

Jun 22nd, 11:40 AM - 11:55 AM

Session D1: Towards Effective, Bi-Directional Selective Fish Passage

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Pratt, Thomas; McLaughlin, Rob; and Muir, Andrew, "Session D1: Towards Effective, Bi-Directional Selective Fish Passage" (2015).
International Conference on Engineering and Ecohydrology for Fish Passage. 41.
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Bi-directional, Selective Fish Passage: The Complications of Fish Passage in the Laurentian Great Lakes



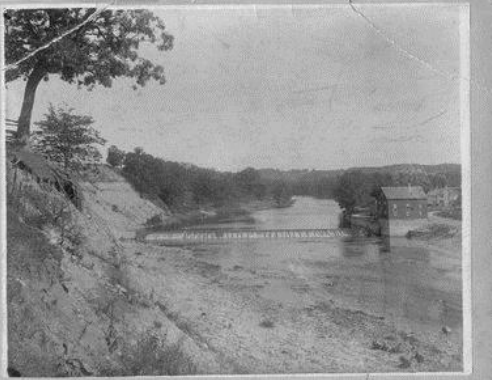
Tom Pratt, Fisheries and Oceans Canada

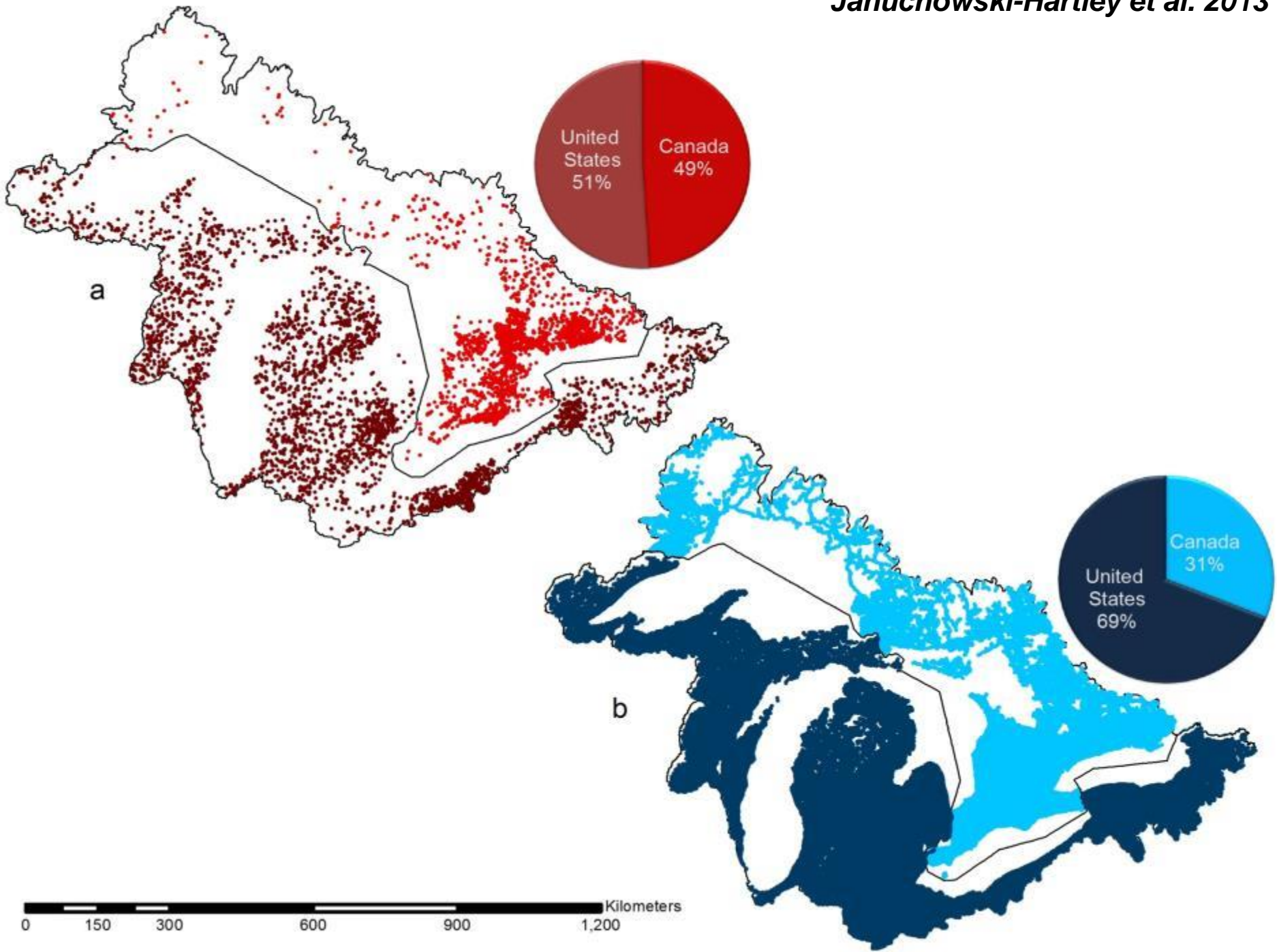
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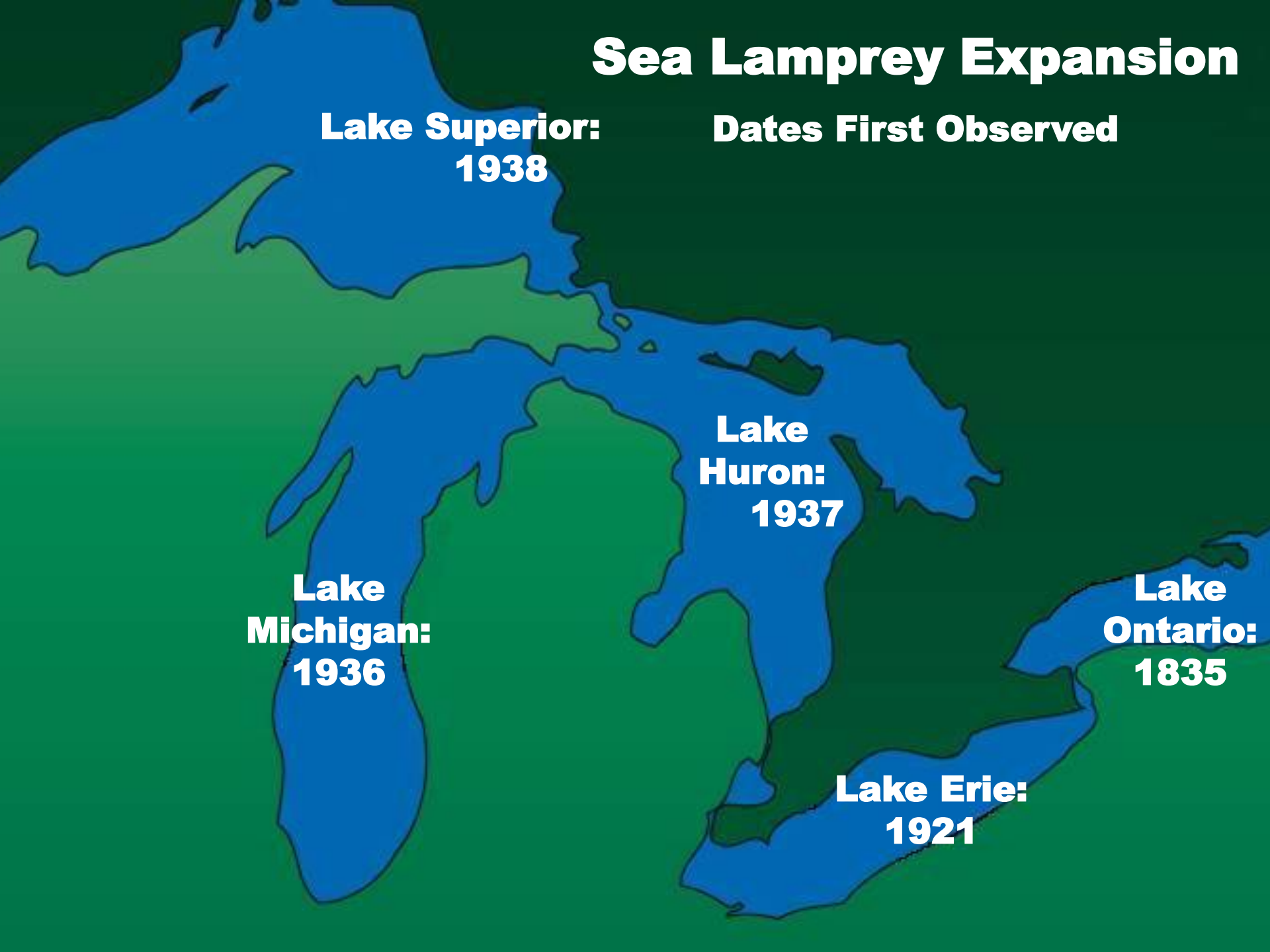
A Brief History of Barriers

- Milling, mining and forestry
- Water regulation, recreation and hydroelectric power generation
- Control of invasive species





Sea Lamprey Expansion



**Lake Superior:
1938**

Dates First Observed

**Lake
Huron:
1937**

**Lake
Michigan:
1936**

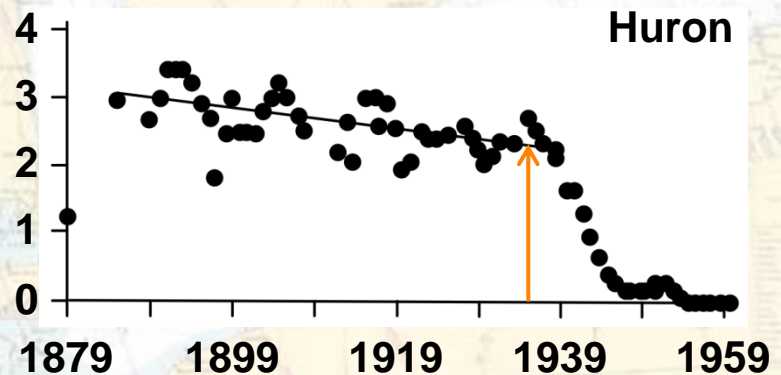
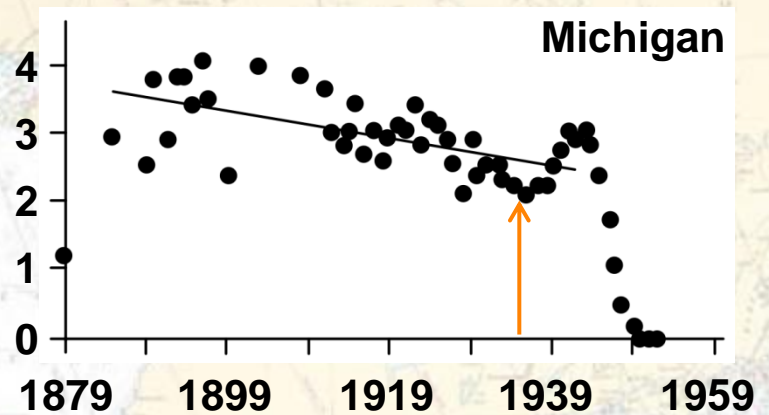
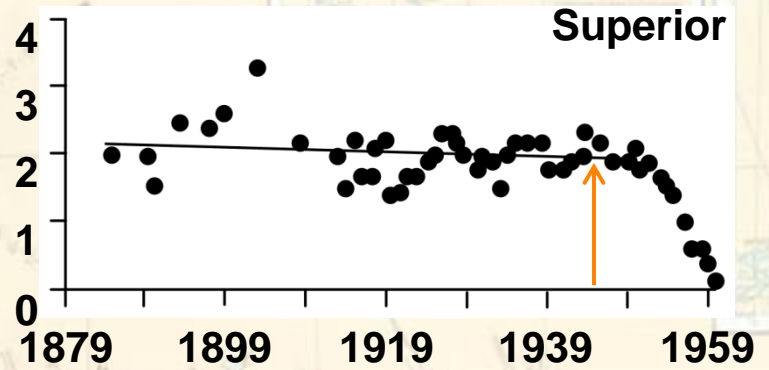
**Lake
Ontario:
1835**

**Lake Erie:
1921**



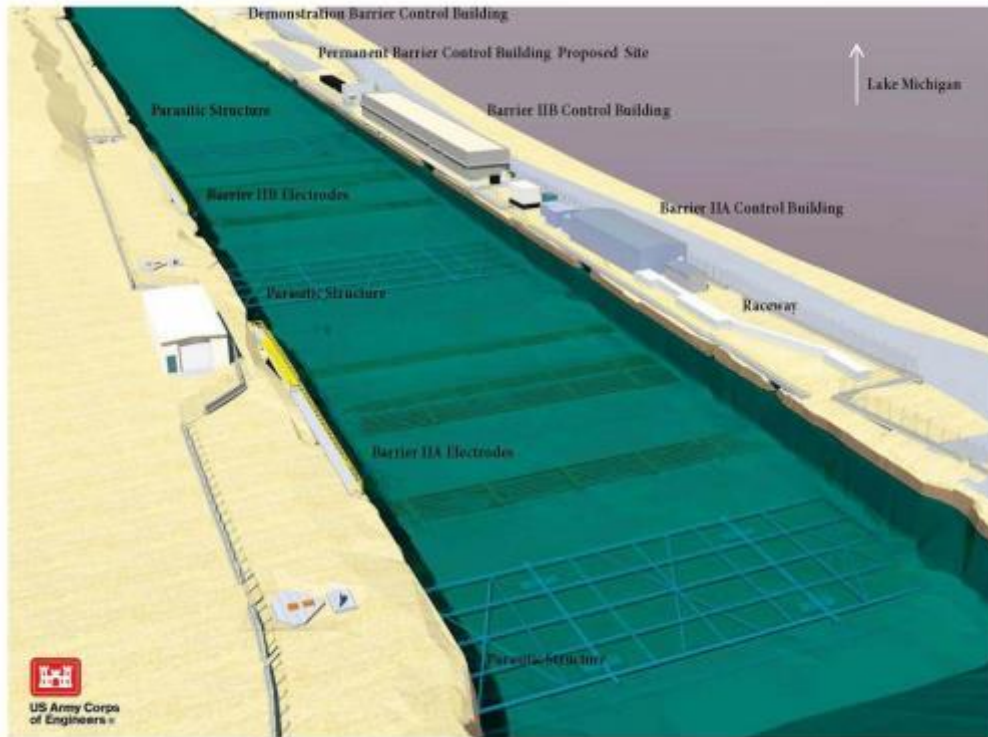
- Sea lampreys helped decimate Great Lakes fish populations
- Barriers are an integral component of a \$21MM annual binational sea lamprey control effort

commercial catch of lake trout
(millions of kg)



Hansen, M.J. 1999. Great Lakes Fishery Policy and Management - a Binational Perspective.

Asian Carp on the Horizon



- Electrical barrier keeping Asian carp out of the Great Lakes



Black Sturgeon

\$1.6M

Increasing Pressure for Dam Removals

Manistique

\$0.8M

\$1.0M

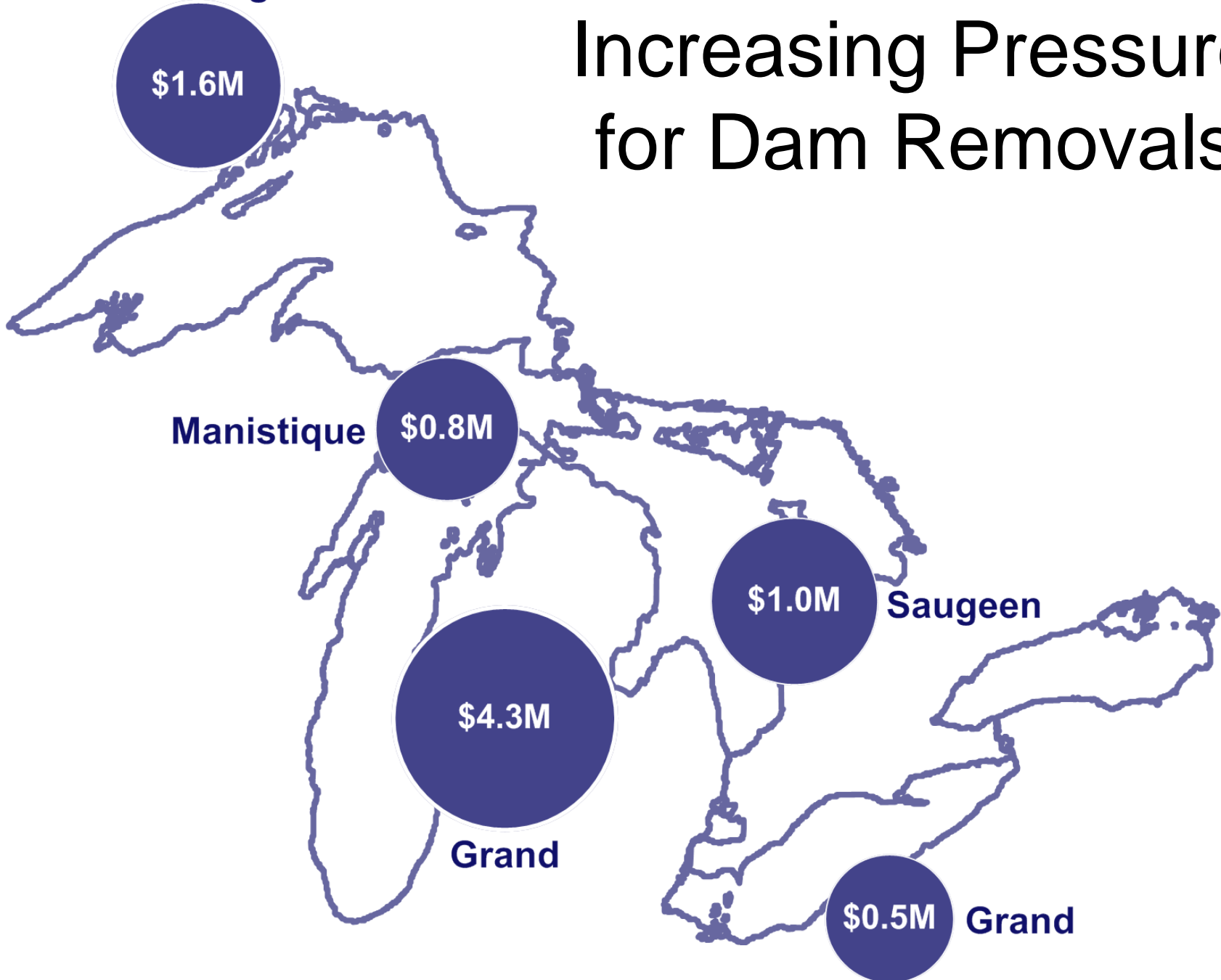
Saugeen

\$4.3M

Grand

\$0.5M

Grand



Management Challenge

INVASIVE CONTROL vs RESTORATION



FRAGMENTATION vs CONNECTIVITY



GENERAL CHART
OF THE
GREAT LAKES

Project Objectives

1. Develop selective bi-directional fish sorting technology as an adaptive management experiment
2. Determine protocols for implementing bi-directional selective fish passage throughout the Great Lakes Basin
3. Set solutions in a global context

How to sort an assortment of things?

HOW IT WORKS

STORY BY KATIE PEER ILLUSTRATION BY GRAHAM MURDOCH

SINGLE-STREAM RECYCLING

The most annoying aspect of recycling—and one of the biggest hurdles to its widespread adoption—is having to separate paper, glass, and plastic before they hit the curb. New recycling machines are changing that. With single-stream recycling, recyclables go into one bin, which a truck delivers to a materials-recovery facility, such as Willimantic Waste

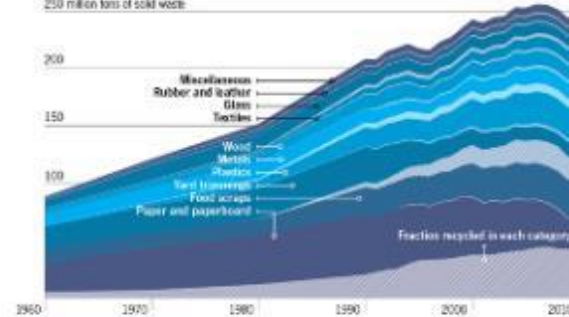
Paper in Willimantic, Connecticut. There, a largely automated system of conveyor belts, screens, magnets, and lasers separates materials so that they can be sold to metal and plastic recyclers and paper mills.

Of the 570 recycling facilities in the U.S., 240 now have single-stream operations, according to Eileen Beery, of the solid-waste research and consulting firm Governmental

Advisory Associates. While the system isn't perfect—its high-speed operation can lead to contamination from broken glass—the simplicity of it means households actually recycle more. "If people want a higher recycling rate, it has to be convenient," says Chaz Miller, of the National Solid Wastes Management Association. "And I think the technology is only going to improve."

Recycling Rates in the U.S.

250 million tons of solid waste



STATS

2.4

Tons of carbon dioxide left out of the atmosphere per ton of solid waste recycled, whether by single-stream or otherwise.

One third

Fraction of municipal solid waste in the U.S. that's currently recycled.

100 million

Number of U.S. residents served by single-stream recycling programs.

92

Percentage recycling rates increased when Florida's Miami-Dade County implemented single-stream recycling in 2008.



Integrating Technologies

Electr



Chemical repellants

P

Integrating Technologies



U.S. Fish & Wildlife Service

Yukon River Video Project

Fairbanks Fish & Wildlife Field Office

Fish wheels are commonly used as a capture method to determine relative abundance and run timing of Yukon River salmon. These "test wheel" catch rates are used by fishery managers to assess the in-season salmon runs on a daily basis. The wheels use live boxes to store fish until they are counted by dip netting. Recent studies on Yukon River fall chum salmon suggest that holding time and crowding in live boxes may affect the ability of fish to travel upstream to spawning streams. This is of particular concern during years of low salmon abundance.

A remote video system was developed to obtain salmon passage rates without the use of fish wheel live boxes, eliminating fish handling and crowding concerns. After fish wheel capture, fish travel down a chute, are video recorded, and then re-enter the river. The system consists of a color CCD camera mounted above the fish wheel chute and connected



This video system continuously records fish passing through the fishwheel and captures the information on a laptop for later analysis.

to a laptop computer through a video capture card. A time-lapse VCR is linked into the system for back-up. The system is powered by 12 volt batteries. During daytime operation, a water-wheel generator charges the batteries. At night, lights necessitate the use of a small gasoline generator.

Video capture software allows the recording of only video frames containing fish images. These images are stored in computer video files. Video capture can be triggered using various methods i.e. magnetic switch door, motion sensor, and image recognition. Frame rate and number of frames captured before or after a triggering event are controlled by the software. The resulting files are reviewed and tallied using video reviewing software specifically de-

signed for generating fisheries Catch Per Unit Effort data. The time-savings using this method over traditional viewing of time-lapse VCR tapes can be substantial.

Presently, three Yukon River fish wheels are equipped with this video system. Accurate daily counts of four salmon species, sheefish, whitefish, and various resident fish species are obtained using the video system. The benefits of video counting are a lowering of fish stress, 24 hour sampling, reduced data recording errors, and lower operational costs. Other applications of this technology include monitoring fish passage at dams and weirs, identification of marked/unmarked fish in tagging studies, and remote monitoring of animal behavior.



The video capture program allows easy identification of the species of fish and whether or not it is tagged.

U.S. Fish & Wildlife Service
1 800/344 WILD
www.fws.gov

For more information, contact:
U.S. Fish & Wildlife Service
Dave Daum
101 12th. Ave., Room 110, Fairbanks, Alaska 99701
907/450/0280

Visit the Fisheries & Habitat home page:
<http://alaska.fws.gov/fisheries/fieldoffice/http://fairbanks/monitoring.htm>

- Shape recognition
- Behavioral recognition
- Color identification
- Enumeration

Conceptual Approach Integrating Technologies

Upstream Electrical Guidance

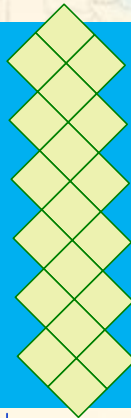


Life History

- Seasonal
- Diel

Conceptual Approach Integrating Technologies

Upstream Electrical Guidance



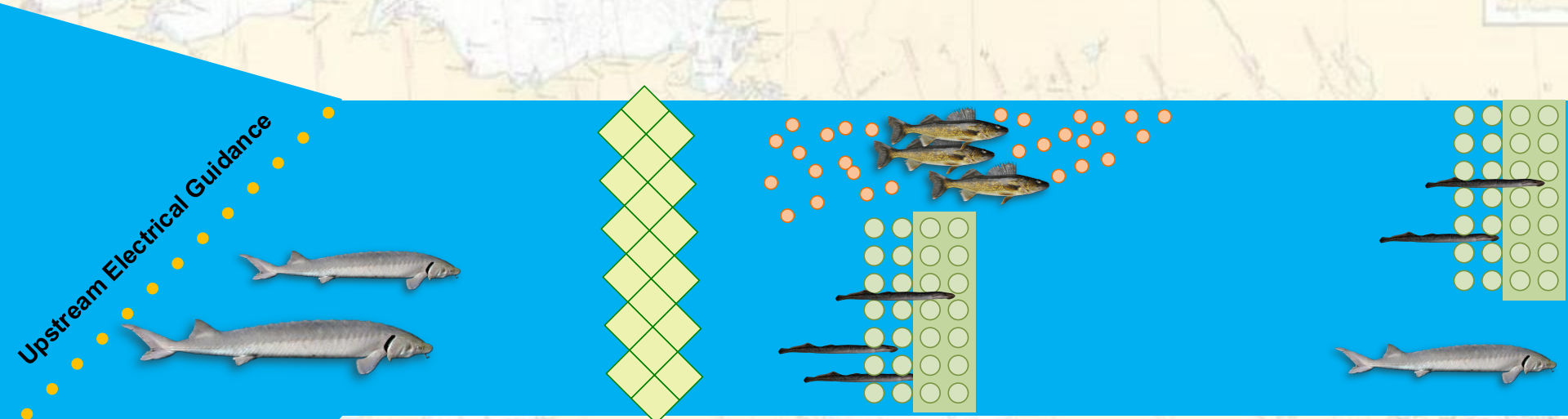
Life History

- Seasonal
- Diel

Morphology

- Video shape recognition
- Elevators
- Screens
- Ladders

Conceptual Approach Integrating Technologies



Life History

- Seasonal
- Diel

Morphology

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Behaviour

- ELST
- Funnel
- Novel
- Pheromones
- Alarm cues
- Co₂ curtain

- If you have any experience in this area (or ideas) we would love to hear from you:

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Andrew Muir:

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KEEP CALM

BECAUSE

WE NEED

YOUR

HELP!