# NOAA Invasive Species Research Updates

Ashley Elgin
NOAA GLERL

Dreissenid Mussel Research: Cooperative Science and Monitoring Initiative

- Monitoring invasive dreissenid mussels is a common priority among the Great Lakes Lakewide Action Management Plans

- Between 2016-2023, we assessed mussels at 80 stations, several of which were visited during two cycles
  - Michigan 2015 and 2021; Huron 2017 and 2022; Ontario 2018 and 2023; Erie 2019 (plans for Erie 2024 are underway)
  Data archived with NCEI:
 **https://doi.org/10.25921/16be-d760**
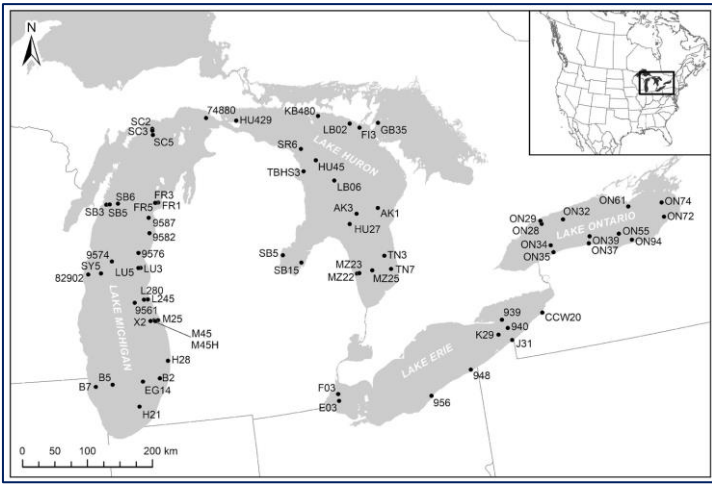
- In general, body condition is highest for shallow mussels and lowest for mid-depth mussels (30-90 m)

- Changes over time are lake-specific

- In Lake Erie, shallow mussels in the central and eastern basin have the highest condition, followed by shallow western mussels, and then deeper eastern mussels

Researchers:
Ashley Elgin
(NOAA GLERL)
Paul Glyshaw
(NOAA GLERL)
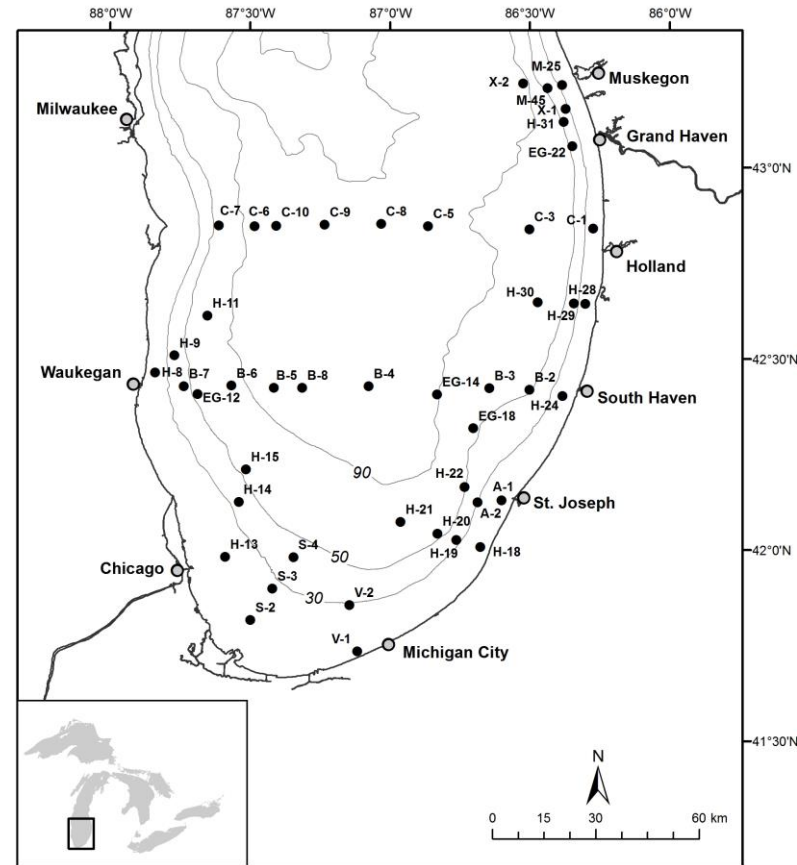Rachel Orzechoswki
(CIGLR/GVSU)

Dreissenid Mussel Research: Annual and Seasonal Surveys

- Annual surveys in Southern Lake Michigan
- Seasonal assessments of body condition and reproduction
- Biweekly to monthly veliger surveys
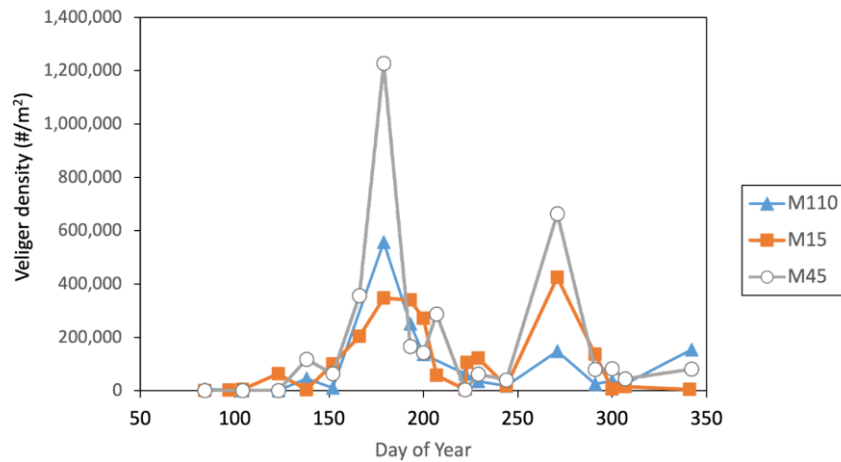
Researchers:
Ashley Elgin, Steve Pothoven (NOAA GLERL)
Rachel Orzechoswki, Aaron Dunnuck (CIGLR/GVSU)

Dreissenid Mussel Research: Developing Technologies to Control and Monitor Populations

- Collaboration with with the University of Wisconsin-Milwaukee to assess local-scale environmental impacts of mussel removal.

  Test removal plot established in 2023, monitoring will continue until at least 2025

- NOAA GLERL is testing the use of underwater vehicles to remove/destroy mussels as well as monitor mussels in control locations.

  Field test planned for Summer 2024

Researchers:
Ashley Elgin and Steve Ruberg (NOAA GLERL)
Harvey Bootsma and Karen Baumann (UW-Milwaukee)
Axim Geospatial, LLC
Hibbard Inshore, LLC
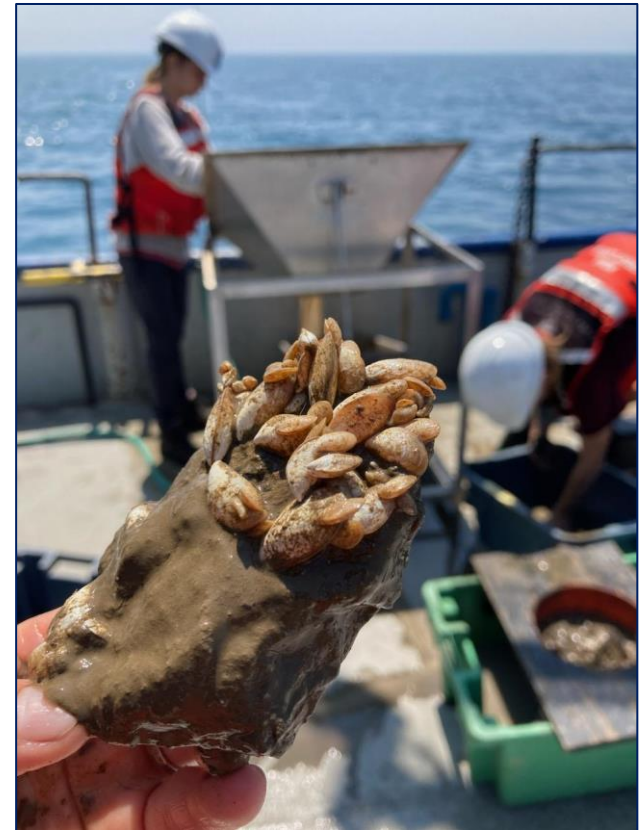
Invasive species models and predictions

Focus: Current and future invasive species impacts on Great Lakes food webs and socio-economics

Interactive effects of other anthropogenic stressors with invasive species:
- Climate
- Eutrophication/hypoxia

Ensemble modeling approach:
- Physiologically-based habitat models
- Bioenergetics models
- Individually-based community models
- Food web models- Ecopath with Ecosim
- Atlantis Ecosystem Model
- Linked ecological models to economics models

Established species of interest:
- Dreissenid mussels (quagga and zebra)

Potential future invaders of interest:
- Invasive carps- silver, bighead, black, grass
- Golden mussel, Killer shrimp

Researchers:
Food web fisheries modelers:
E. Rutherford, D. Mason, M. Rowe (NOAA GLERL); H. Zhang (E.A.R.); Y-C. Kao (FWS); B. Brenton (Brenton Consulting); P. Alsip, N. Boucher, L. Ivan (CIGLR)
Economists: S. Brockmann (Univ NH), J. Apriesnig (MTU), D. Finnoff (Univ WY)
see me for a list of relevant publications

# Projecting invasive species potential effects in the Great Lakes.

Steps to invasion . . .

- Introduction: Is there sufficient habitat for invasive carp in the Great Lakes?

- Establishment: Once in, can they reproduce and reach high biomass?

- Impacts: Once in and established, should we be concerned?
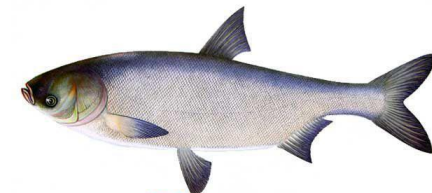
Modeled AIS effects

Researchers:
Ed Rutherford (NOAA GLERL)
Doran Mason (NOAA GLERL)
Hongyan Zhang (E.A.R.)

Introduction

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Establishment

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Spread

⇩

Impact

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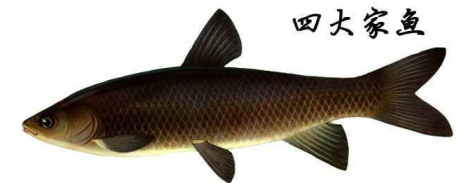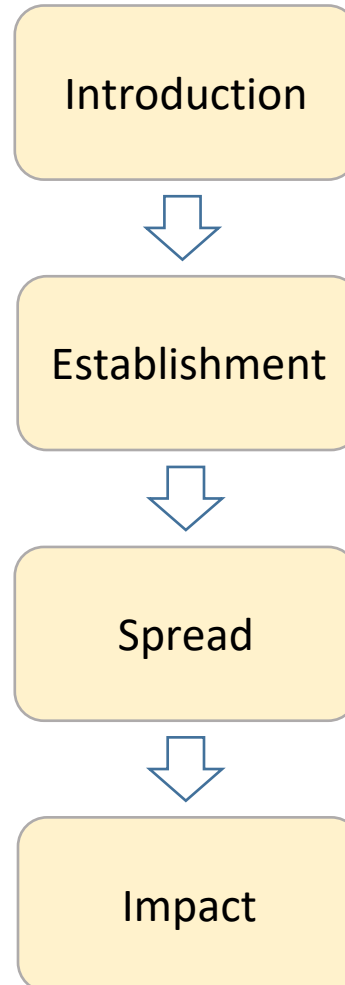
青鱼 *Mylopharyngodon piceus*

草鱼 *Ctenopharyngodon idella*

鲢鱼 *Hypophthalmichthys molitrix*

鳙鱼 *Hypophthalmichthys nobilis*

Habitat suitability: Effects of invasive mussels, nutrient, and climate on invasive carp (IC) establishment in Lake Michigan

- Best IC habitat is in embayments with high nutrient inputs
- Mussels reduce IC habitat quality but do not prevent IC establishment
- A warming climate will improve IC habitat suitability by extending the growing season
- Longer growing season keeps migration corridors available longer, increasing the likelihood of spread, and enhance growth in food-rich habitats like Green Bay
- Nutrient pollution is the most influential form of human activity in determining IC habitat suitability.
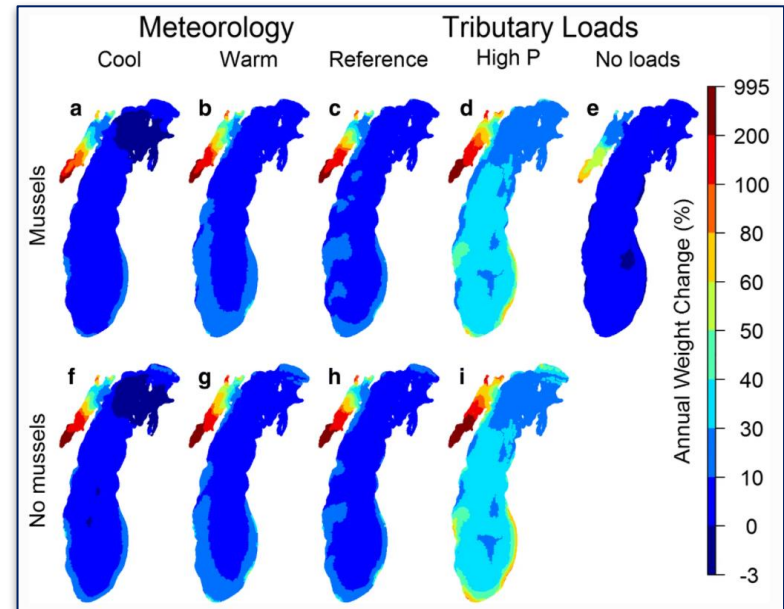
Alsip, Rowe, Rutherford, Mason et al. *Biol. Inv.*, 2020

Researchers:
Peter Alsip (CIGLR)
Mark Rowe, Ed Rutherford, and
Doran Mason (NOAA GLERL)

New Projects- Dreissenids

Mussel Dynamic Energy Budget (DEB) Modeling

(Elgin and Rowe, GLERL; Godwin, Keretz, Pu, CIGLR)

- Develop DEB model for Dreissenids, with a focus on Quagga Mussels
- Conduct lab and field studies to fill knowledge gaps and parameterize the model

Long-term Quagga Mussel Field Growth Study

(Elgin and Glyshaw, GLERL; Orzechowski, CIGLR/GVSU)

- Initiated at three 20-100m sites in Lake Michigan in 2022
- ~10 year study to track quagga mussel growth and mortality
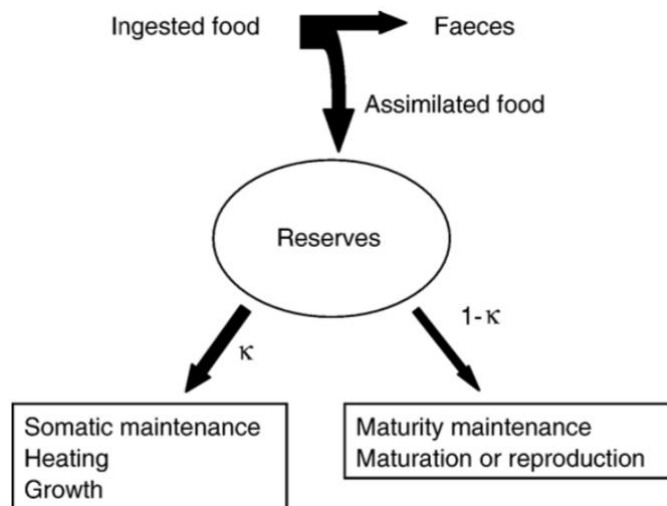
New Projects- eDNA collaboration with USGS

Developing genetic markers for invasive species in the Great Lakes.

Phase 1: Develop qPCR-based high throughput chips for high-priority species. These chips will be capable of detecting all target species simultaneously from a single eDNA sample.

High priority species:

- Fish: Grass carp, Silver carp, Bighead carp, Eurasian ruffe
- Inverts: Red Swamp Crayfish
- Plants: *Hydrilla verticillata*, *Nitellopsis obtusa*, *Hydrocharis morsus-ranae*

Medium and low priority species:

- Fish: Round Goby, Sea Lamprey
- Inverts: Rusty Crayfish (*Faxonius rusticus*), *Leyogonimus polygon*, New Zealand Mudsnail, Spiny water flea
- Plants: Eurasian Watermilfoil
- Pathogen: Bird Botulism (serotypes C, E)

Researchers:
Rao Chaganti (CIGLR)
Muruleedhara Byappanahalli (USGS GLSC)
Adam Sepulveda (USGS NOROCK)
Reagan Errera (NOAA GLERL)
READI-Net Project

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