Aquatic Invasive Species (AIS) in Ohio and Lake Erie:

Taking Action as a Boater

THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Eugene Braig, Extension Program Director, Aquatic Ecosystems

First Ohio Boating Summit,
4 May 2015

AIS defined

- **Executive Order 13112** (1999): "…an alien (or non-native) species whose introduction does, or is likely to cause economic or environmental harm or harm to human health." Only a small proportion of non-native species are considered "invasive."
- However, definitions of "invasive" vary; for our purposes, we'll only apply the term to non-native organisms.

AIS defined

- Depending upon who's estimating and how, approx. **185** AIS have been observed in the Great Lakes (194 if you count North American range expansions),
- **136** to Lake Erie alone, and (NOAA 2015)...
- **145** to the state of Ohio (Windle et al. 2008).

For a non-native organism to become invasive, it must…

- Arrive,
- Survive,
- Reproduce, and
- *Have undesirable effects*.

(Chapman 2013)

Invading isn't necessarily easy

Traits usually considered to facilitate invasion:

- Fast growth,
- Rapid reproduction,
- Capacity for dispersal/spread,
- Plasticity of form (especially regarding plants),
- Tolerance of a wide range of environmental conditions,
- General/Plastic diet,
- Association with humans, and
- Often indicated by a history of successful invasions elsewhere.

An aquatic species capable of invading isn't likely to be easily removed once established.

History of North American introductions

1800–1950: Era of indiscriminate stocking and careless releases.

- First documented established aquatic non-native?
  - Goldfish, first reported released to the Hudson River in the 1600s.
- Early US Fish Commission 1871: massive, national efforts.
  - Early efforts to evaluate undervalued native fisheries for supplemental stocking by European spp. and…
  - moving desirable spp. from one US coast to other.
- Canal era of the 1800s connected many waterways allowing freer migration by organisms themselves.

(Kolar et al. 2010)

History of North American introductions

US Fish Commission fish car: last one wasn't decommissioned until 1947!

(National Archives 22-FFB-1000)

History of North American introductions

1950–ca. 1975: era of improved transport shipping and aquaculture escapes.

- Technologies developed in WWII trickled into shipping and fishing industries.
- Escapes of so-called Asian carps: hatchery escapes beginning in the 1970s.
- Recognized/Documented incidental spread of fish-borne parasites and disease, some affecting native relatives of introduced animals.

(Kolar et al. 2010)

History of North American introductions

Ca. 1975–present: era of unauthorized introductions and increased shipping volume.

- Stocking of sport fish by management agencies continues, but with already-established species and on a more limited, state-/jurisdictional-based scale than previous nationwide efforts.
- Escapes of cultured fish continue, but **release/escapes of pets and ornamental plants have become more prevalent.**
- Increase of transoceanic shipping volume and organisms in ballast water discharges.
- Increase in live food fish shipments to ethnic markets.

(Kolar et al. 2010)

A history of Great Lakes invasions

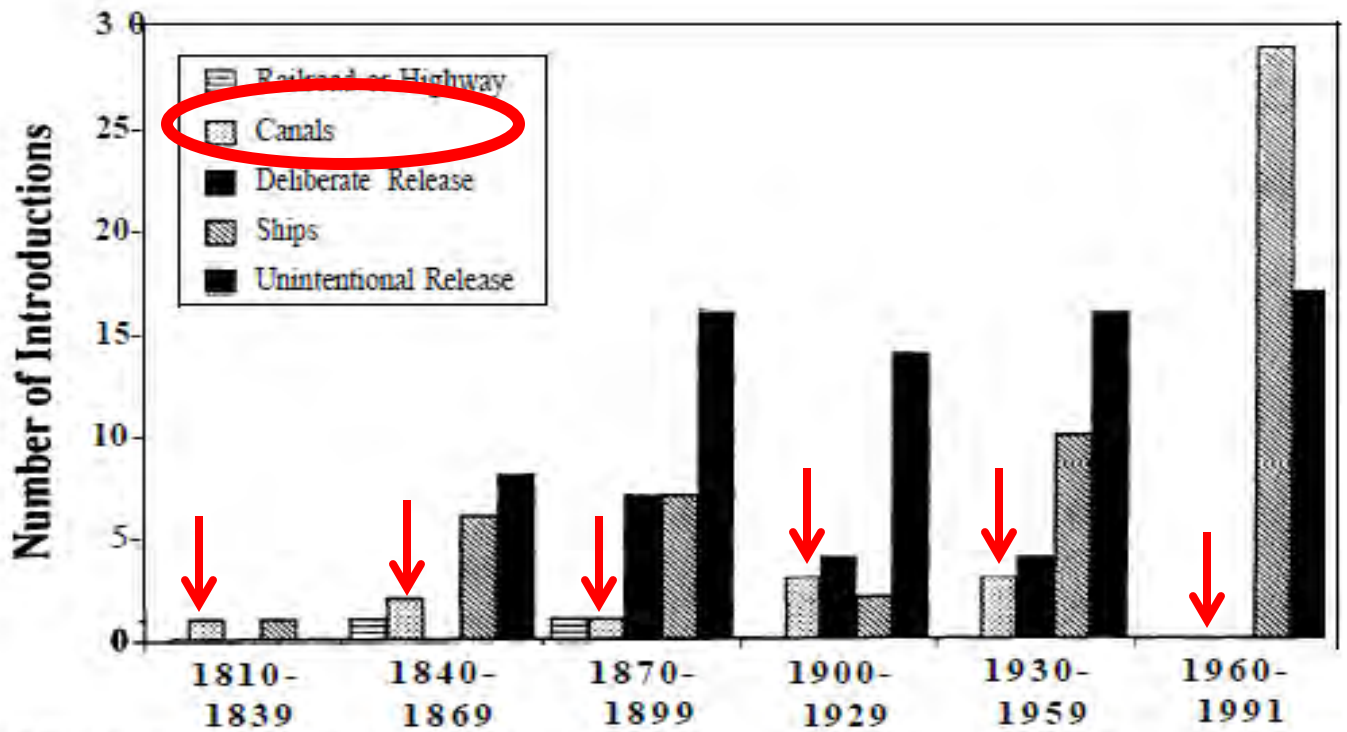


FIG. 4. A timeline of entry mechanisms for aquatic species introduced to the Great Lakes. Data includes sum of mechanisms from Figure 2 and the multiple mechanism category and dates from Figure 3.

(Mills et al. 1993)

A history of Great Lakes invasions

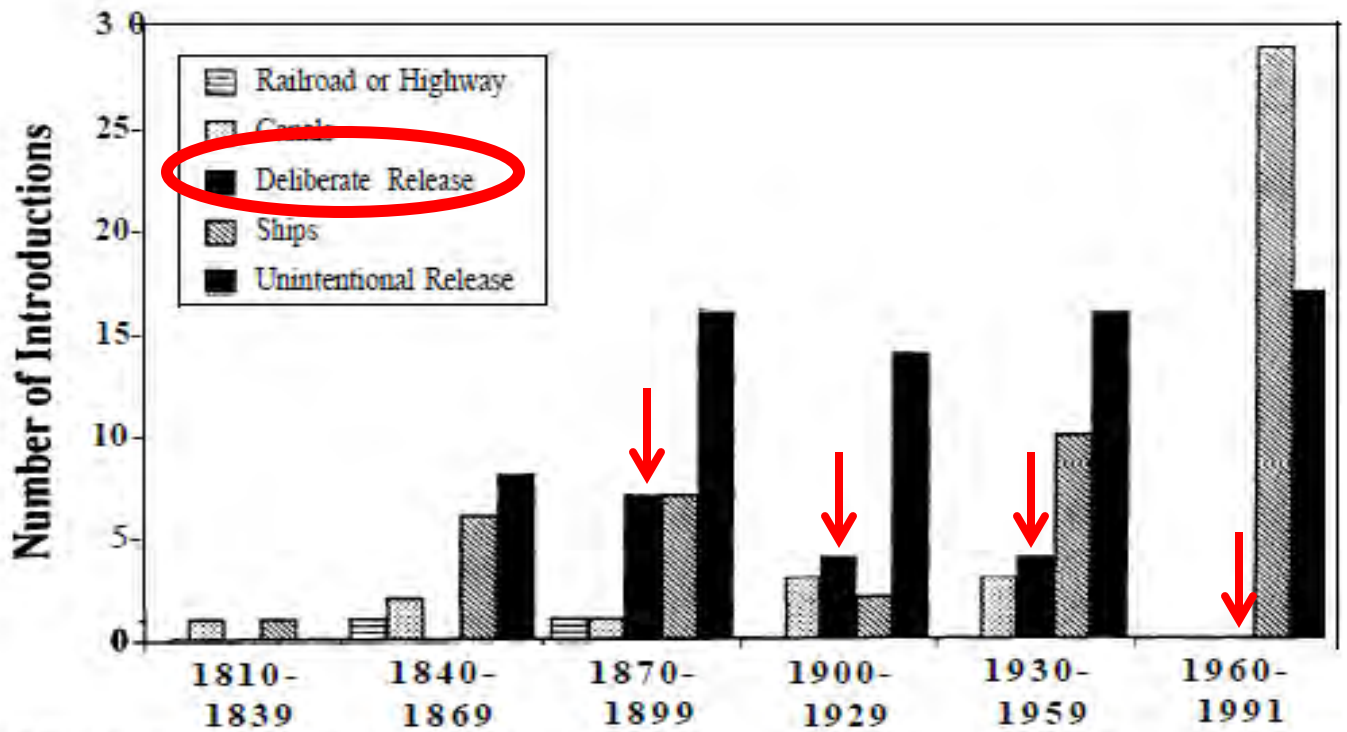


FIG. 4. A timeline of entry mechanisms for aquatic species introduced to the Great Lakes. Data includes sum of mechanisms from Figure 2 and the multiple mechanism category and dates from Figure 3.

(Mills et al. 1993)

A history of Great Lakes invasions

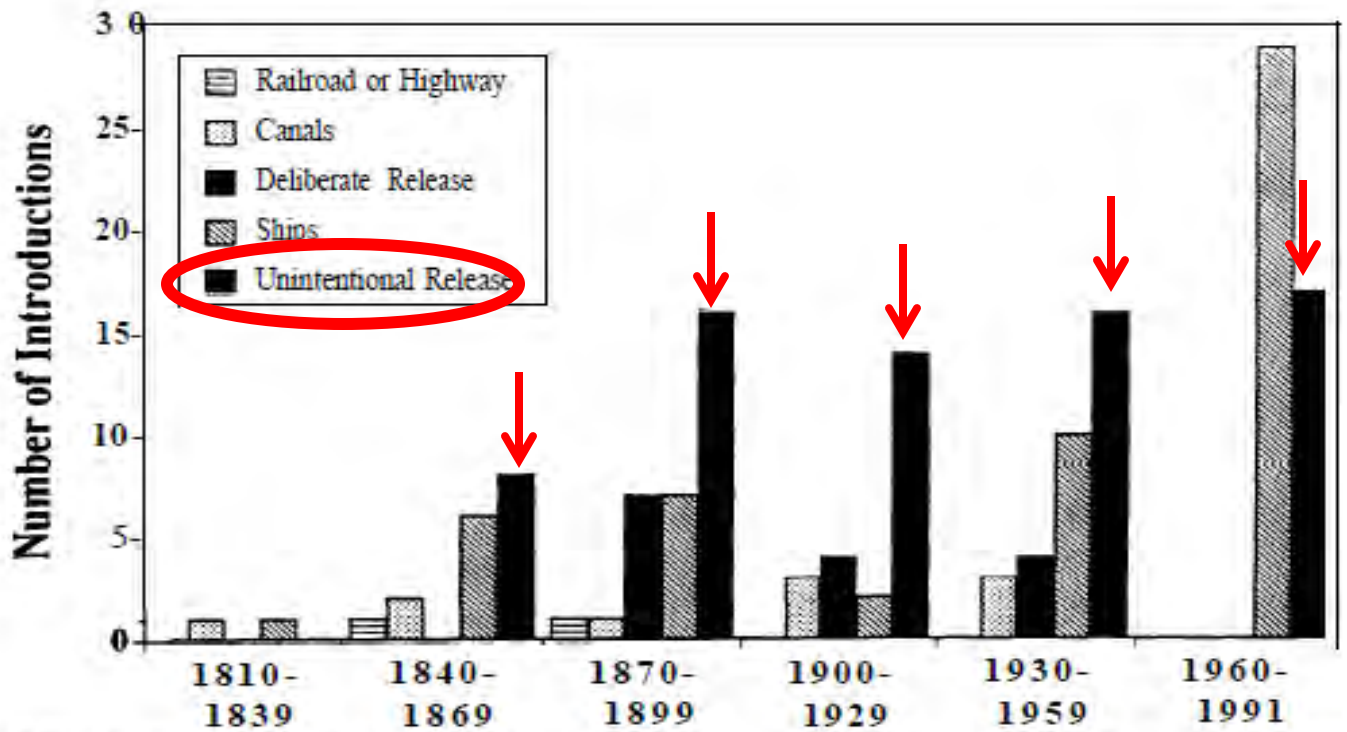


FIG. 4. A timeline of entry mechanisms for aquatic species introduced to the Great Lakes. Data includes sum of mechanisms from Figure 2 and the multiple mechanism category and dates from Figure 3.

(Mills et al. 1993)

A history of Great Lakes invasions

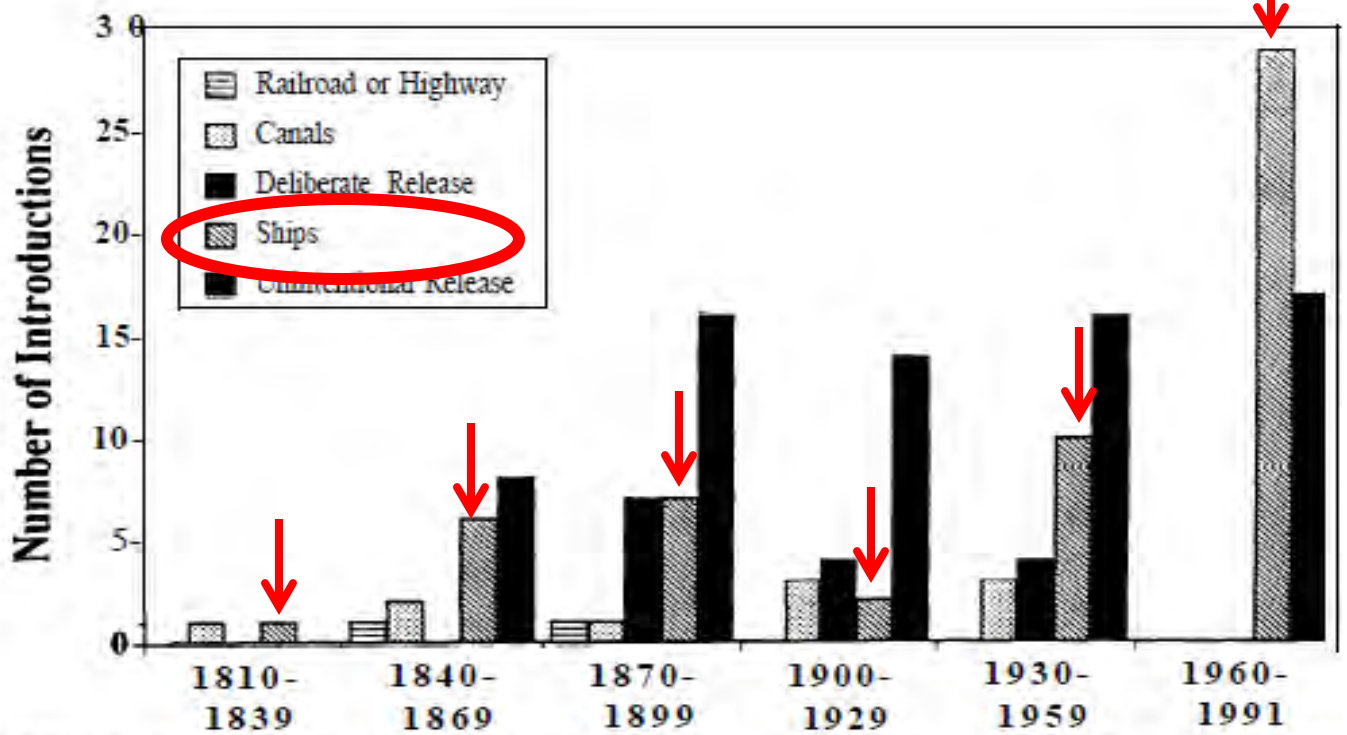


FIG. 4. A timeline of entry mechanisms for aquatic species introduced to the Great Lakes. Data includes sum of mechanisms from Figure 2 and the multiple mechanism category and dates from Figure 3.

(Mills et al. 1993)

US regulatory authority

More than 20 US agencies with diverse and often specific authorities. Highlights:

- Nonindigenous Aquatic Nuisance Prevention and Control Act (1990), amended and expanded as the **National Invasive Species Act** (NISA: 1996): http://anstaskforce.gov/.
- National Invasive Species Council: established by **Executive Order 13112** (1999): http://www.invasivespecies.gov/.
- **Lacey Act** (1900): http://www.fws.gov/injuriouswildlife/.
- **Plant Protection Act** (2000): http://www.aphis.usda.gov/regulations/index.shtml.

State of Ohio regulatory authority

- Largely falls to Ohio Department of Natural Resources, Division of Wildlife (ODW) with some related roles to a few other agencies (e.g., Ohio Dept. of Agriculture).
  - Maintenance of an AIS management plan by ODW qualifies state programs for federal funding via NISA and the Aquatic Nuisance Species Task Force (ANSTF).

Common pathways of AIS introduction

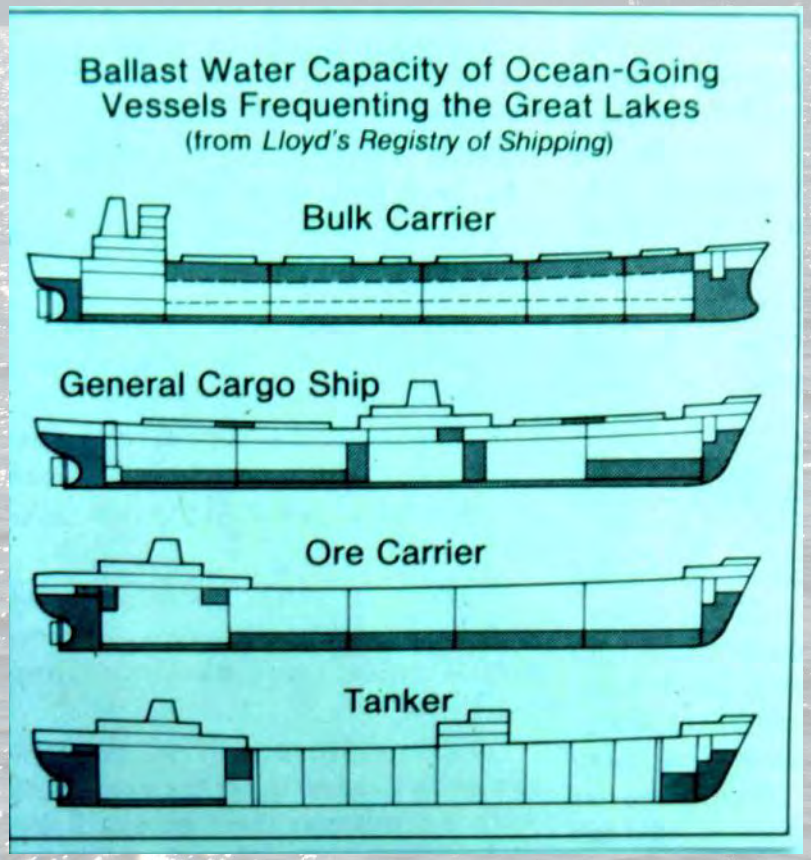
A few highlights of regional importance:

- Ballast water
- Barrier removal
- Intentional stocking to introduce desired species
- Aquaculture escapes
- The aquarium/ornamental trade
- Accidental stocking

A much more comprehensive list:

http://water.epa.gov/type/oceb/habitat/pathways.cfm

Pathways: ballast water



- Ships take on local ballast water to increase stability when not carrying cargo.
- Organisms entrained in ballast water can be pumped out into other bodies of water.
- Approx. 525–550 overseas "salties" enter the great lakes annually.

Ballast water: regulations

Beginning 2012, US Coast Guard implemented UN International Maritime Organization's Ballast Water Performance Standards (2004) for all ocean-going vessels (US is enforcing, but has not yet ratified as of 28 April 2015).

- Phase I (until January 2016), ballast of qualifying vessels must discharge < 10 organisms that are > 50 µm in length per m^3 of ballast water.
  - Permits the discharge of up to 50,000–200,000 organisms (potentially whales) for typical large freight vessels.
- Phase II (as of January 2016), < 1 organism per 100 m^3 of ballast water.
  - Would still allow the discharge of 50–200 organisms.

https://homeport.uscg.mil/

Ballast water: regulations

US Environmental Protection Agency.

- Vessel General Permit: based on water quality standards.
- Covers large, non-recreational transportation vessels as well as smaller vessels with dedicated ballast tanks.
  - **Requires ballast water exchange before entry into the Great Lakes (no documented ballast water invasions since implementation).**
  - Gives individual Great Lakes states a voice through ratification of Clean Water Act permitting process.
- SB 2094 (introduced March 2014): Would move all ballast-water enforcement to US Coast Guard implementing IMO standards.

http://water.epa.gov/polwaste/npdes/vessels/Vessel-General-Permit.cfm

Ballast water: regulations

- "Current regulations do not apply to ships operating exclusively in the Great Lakes, which account for 95% of the volume of all ballast water discharges and may facilitate secondary transport of species that have already been introduced" (Rup et al. 2010).

Pathways: ballast water

Great Lakes examples:

- Zebra and quagga mussels.
- Round and Tubenose gobies.
- Spiny and fish-hook water fleas.

Pathways: barrier removal

A Great Lakes example: canal systems bypassed Niagara Falls.

- 1825: Erie Canal connects Albany to Buffalo.
- 1829: Welland Canal connects Lake Ontario to Lake Erie.
- 1959: The modern St. Lawrence Seaway opened Great Lakes to large vessels.

Also, the ecological downside of dam removal.

Pathways: barrier removal

Great Lakes examples:

- Sea Lamprey.
- Alewife.
- White Perch.

Pathways: intentional stocking

Deliberate, legal introduction of then-desired species by managers.

- However, cultural values do not always persist.

Pathways: intentional stocking

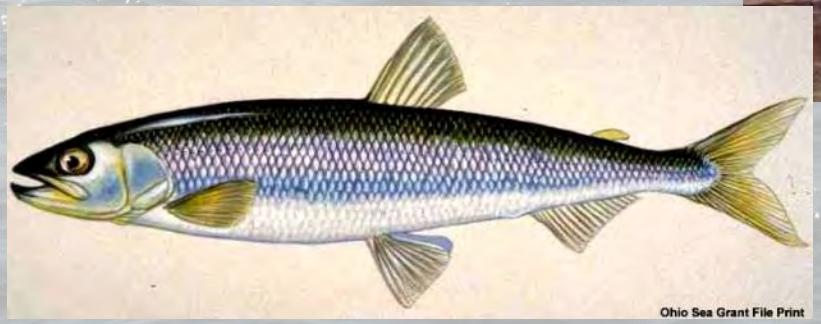
The poster child for bad stocking decisions?

- That's right, kids, it's the Common Carp.

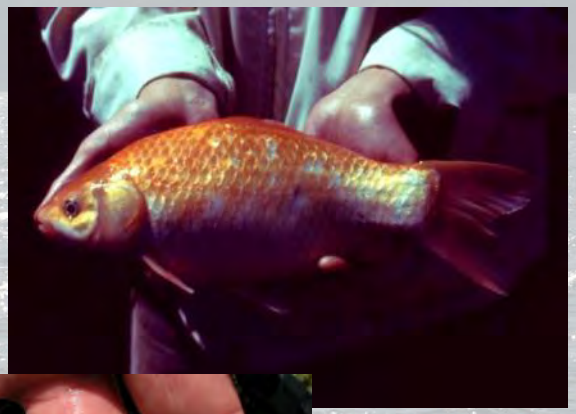
Pathways: aquaculture escapes

Examples:

- Silver and Bighead carps (the so-called Asian carps).
- Rainbow Smelt.



Pathways: aquarium/ornamental releases



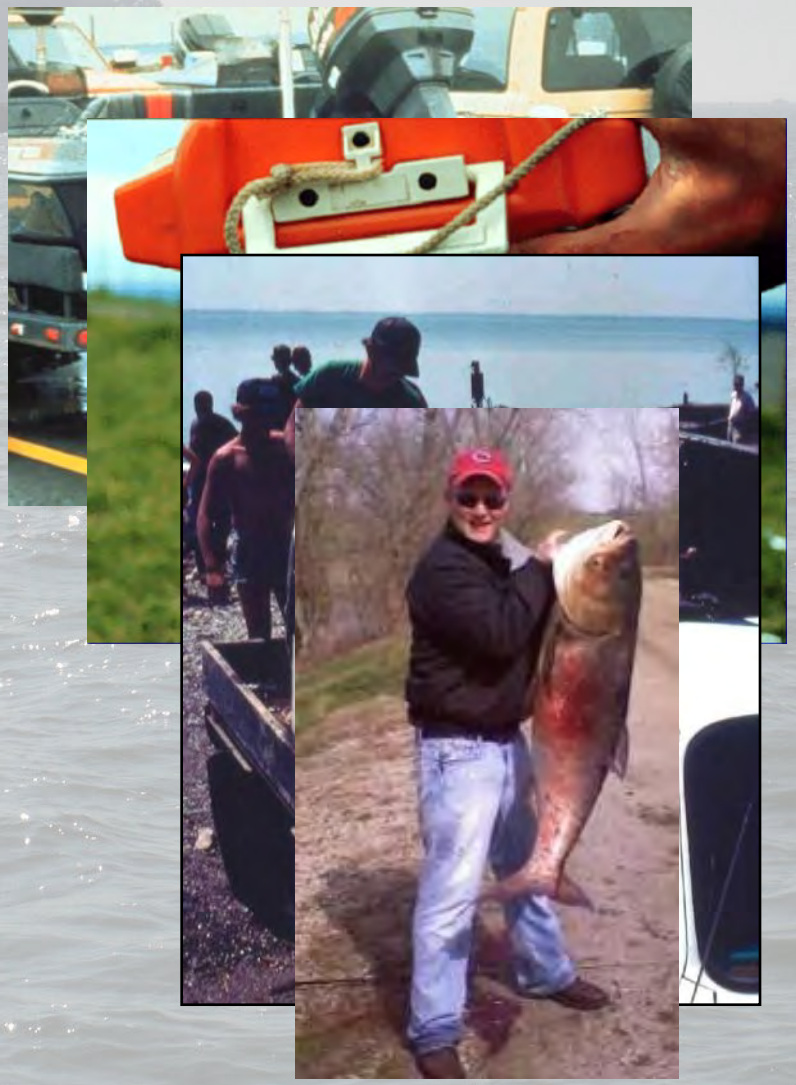
Regional examples:

- Goldfish.
- Northern Studfish.
- Many plant species: e.g., *Hydrilla*.

Pathways: accidental stocking

Can include:

- Plants and other organisms attached to boats and trailers and moved between water bodies,
- Release of unused live bait (rather than disposal), and
- Live fish shipments that also include:
  - potential invasives mixed with target organisms.
  - Fish diseases or pathogens.



Effects of AIS

Types of Aquatic-Nuisance-Species Impacts		
Environmental Effects	**Economic Effects**	**Public Health Effects**
Predation	Industrial Water Users	Disease Epidemics
Parasitism	Municipal Water Supplies	West Nile Virus
Competition	Nuclear Power Plants	Cholera Risks
Introduction of new pathogens	Commercial Fisheries	Parasites
Genetic	Recreational Fishing	
Habitat Alterations	Shipping	

http://anstaskforce.gov/ans.php

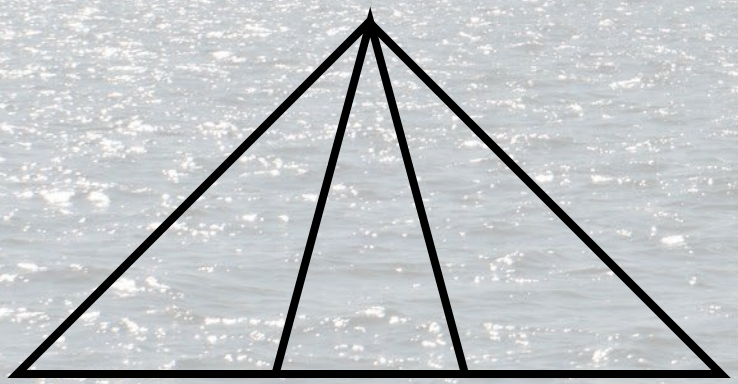
Economic effects

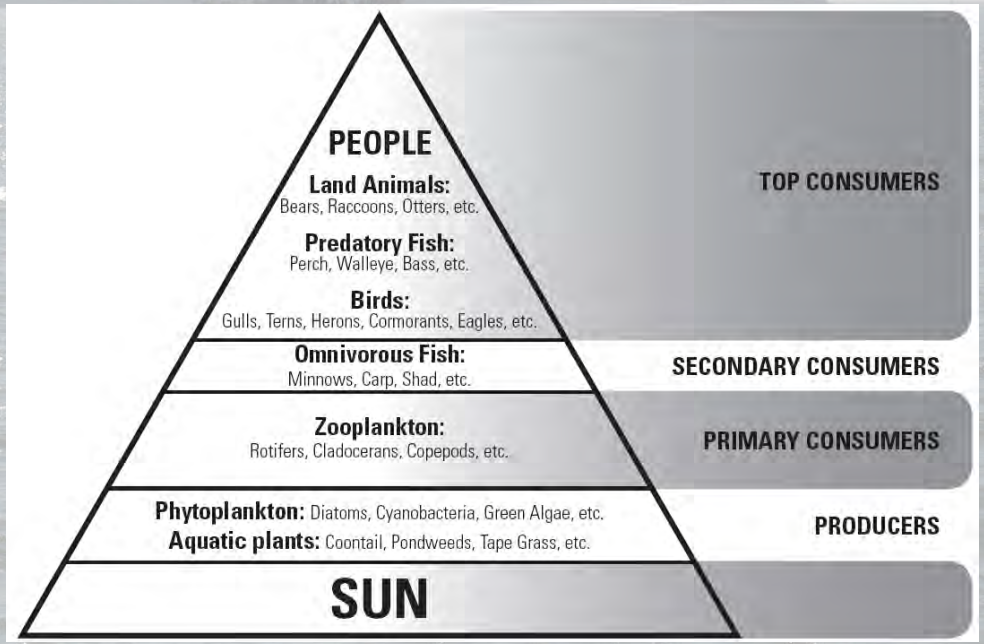
- Great Lakes region-wide, estimated at "significantly over $100 million annually" (Anderson Economic Group, LLC 2012).
- Cumulative zebra/ quagga mussel damage alone estimated as high as $5 billion by 2005 (Lovell & Stone 2005).

Environmental effects

- **Predation on or parasitism/infection of native species**.
- **Competition with native species**.
- **Serve as food source for native species**.
- **Disrupting habitat function**.
- **Genetic**.
- **Trophic cascade effects**:
  - **Mobilizing historic contaminants**: e.g., bioaccumulation of PCBs.
  - **Shifting bioenergetic flow** (the **big** game changer).

Environmental effects: Shifting bioenergetic flow





(from Fortner et al. 2009)

Getting involved: Prevention via stakeholder engagement

Great Lakes Early Detection Network (GLEDN).

- Partnership with Center for Invasive Species and Ecosystem Health (U. Georgia and EDD Maps), Wisconsin Dept. of Natural Resources, and National Park Service:
  - Empower stakeholders via smartphone app.
  - Use to identify, photograph, and directly report invasive species.
  - Professionals verify report to update range maps.
  - Enhances management efforts.

go.osu.edu/GLEDN

Getting involved: Prevention via stakeholder engagement

- **Stop Aquatic Hitchhikers!** Campaign:
  - Consistent message for boating and angling public: **Clean, drain, dry!**

STOP AQUATIC HITCHHIKERS!™

http://www.protectyourwaters.net/

…And partnership programs!

Best management practices (BMP) overview

Good

- Inspect – Remove – Drain & Dry

+

Better

- "Good" + Cold rinse + Decontaminate
- Use mild bleach or salt solution on bilge, bait, and live wells

+

Best

- "Good" + High-pressure rinse + Decontaminate

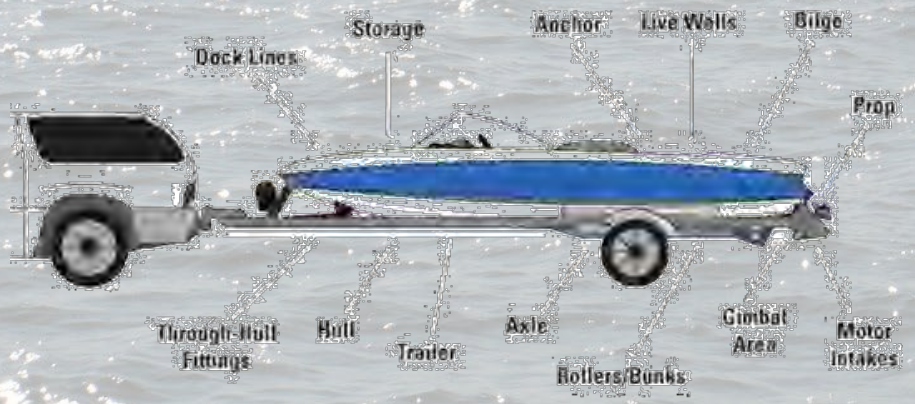
+

Exceptional

- "Good" + Hot high-pressure rinse + Decontaminate

BMP: Good

- **Inspect** boats, trailers, and all equipment.
- **Remove** any vegetation, debris, or animals.
- **Drain** water from motor, bilge, livewells, etc.
- **Dry** for five days before launching on another water body.



THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Sea Grant
Great Lakes Network

NOAA

Great Lakes RESTORATION

FISH & WILDLIFE SERVICE

BMP: Better

- Inspect – Remove – Drain & Dry.
- **Cold Rinse** boats, trailers, and equipment with garden hose.
- **Disinfect** with a mild bleach (0.5 oz per quart of water) or salt solution (2/3 cup per five gallons of water) on all equipment.

BMP: Best

- Inspect – Remove – Drain – Decontaminate.
- **High-pressure rinse** with a pressure washer.

BMP: Exceptional (evidently better than “best”)

- Inspect – Remove – Drain – Decontaminate
- **Hot high-pressure rinse** with pressure washer and water above 104°F.

Getting involved: Resources

Comprehensive "State Management Plan for Aquatic Invasive Species" newly revised (ODNR 2013).

- Keeps Ohio eligible for select federal funding.
- Includes extensive reference to Ohio law (revised and updated as of autumn 2012…by me).
- Formal input by stakeholders via state advisory committee.

Getting involved: Ohio AIS Committee

- Advisory group to the AIS policies of the Ohio Department of Natural Resources, Division of Wildlife (ODW):
  - Coordinated by ODW and OSU Extension (i.e., me)/the Ohio Sea Grant College Program.
  - Ohio representatives sit on both the Great Lakes and the Mississippi River Basin Panels of the **National Aquatic Nuisance Species Task Force.**

Getting involved: Ohio AIS Committee

John Navarro, Chair
Ohio Department of Natural Resources
Division of Wildlife
2045 Morse Rd, G-3
Columbus, Ohio 43229

john.navarro@dnr.state.oh.us

…Or me.

Aquatic Invasive Species (AIS) in Ohio and Lake Erie

Eugene Braig
The Ohio State University
School of Environment & Natural Resources
2021 Coffey Rd.
Columbus, OH 43210
614-292-3823

braig.1@osu.edu

First Ohio Boating Summit,
Nationwide and Ohio Farm Bureau 4-H Center, OSU Campus, Columbus, OH,
4 May 2015

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

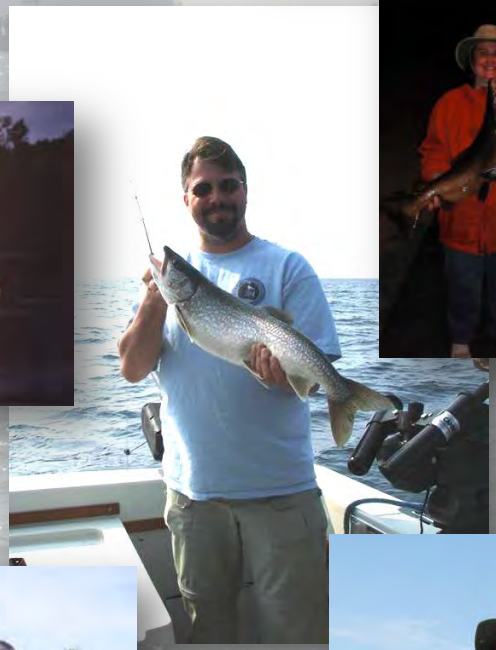
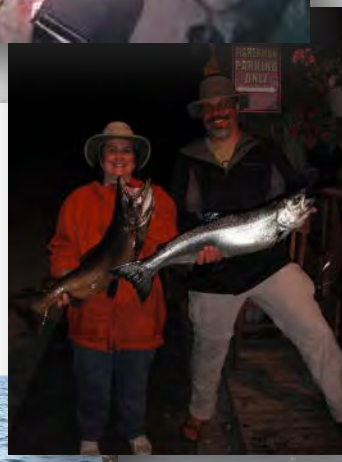
Sea Grant Great Lakes Network

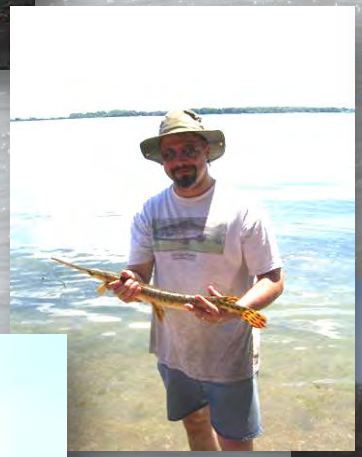
NOAA

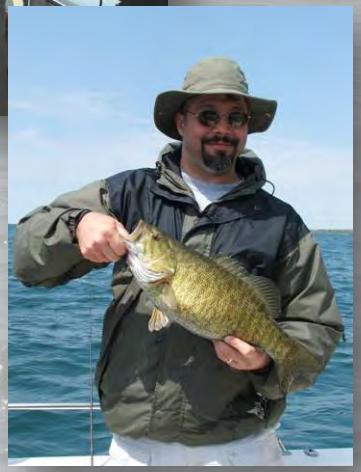
Great Lakes RESTORATION

U.S. FISH & WILDLIFE SERVICE

Questions?





NIVERSITY

ULTURAL,
AND ENVIRONMENTAL SCIENCES