

*Meeting the Challenges of
Organisms in Trade in the
Prevention of Aquatic
Invasions*



**Kathe Glassner-Shwayder
Senior Project Manager
Great Lakes Commission**



Meeting the Challenges of Organisms in Trade in the Prevention of Aquatic Invasions

The purpose of my presentation today:

- Paint a picture with a broad brush on the problem of aquatic invasive species (AIS) and the impacts on the Great Lakes ecosystem
- Discuss what we mean by organisms in trade (OIT) as a vector of AIS and the role of OIT in Great Lakes aquatic invasions

Meeting the Challenges of Organisms in Trade in the Prevention of Aquatic Invasions

- Additional information available in Great Lakes Commission's publication, *Great Lakes Aquatic Invasions: AIS Prevention and Control: Outreach Research, Management and Policy*



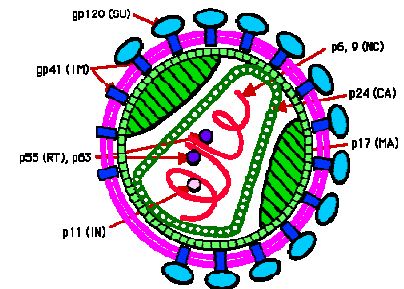


Meeting the Challenges of Organisms in Trade in the Prevention of Aquatic Invasions

- Lessons learned by the Great Lakes Commission in their conduct of a planning grant focused on OIT this past year
 - Problems caused by OIT and progress that is being achieved to address these problems
 - Proposed project ideas to reduce AIS risks posed by OIT through prevention efforts
- My interest in hearing your thoughts regarding aquaculture operations and potential AIS risks

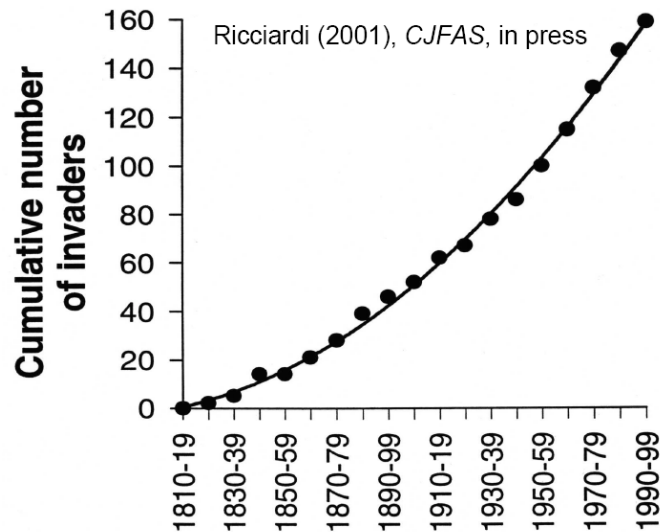
Great Lakes Aquatic Invasions: The Problem

- Aquatic Invasive Species: Non-native plants, animals and pathogens that cause or potentially cause economic loss, environmental damage or harm to human health



Great Lakes Aquatic Invasions: The Problem

- The integrity of the Great Lakes ecosystem is threatened by the presence of more than 180 nonindigenous aquatic species brought into the region carried by vectors from sources across the globe





Great Lakes Aquatic Invasions: The Problem

- Primary vectors identified as contributing to Great Lakes aquatic invasions as identified by the Great Lakes Regional Collaboration (GLRC), Aquatic Invasive Species (AIS) Strategy Team (2005)
 - Maritime commerce (ballast water discharges)
 - Canals and waterways (Chicago Sanitary and Ship Canal)
 - Recreational activities (boating and angling)
 - Organisms in Trade
 - Aquaculture



Live Organisms In Trade: A Priority Vector for Great Lakes Aquatic Invasions



VECTOR

Live Organisms in Trade (OIT)



PATHWAYS

Aquarium

Bait

Horticulture / Water Garden

Food Fish

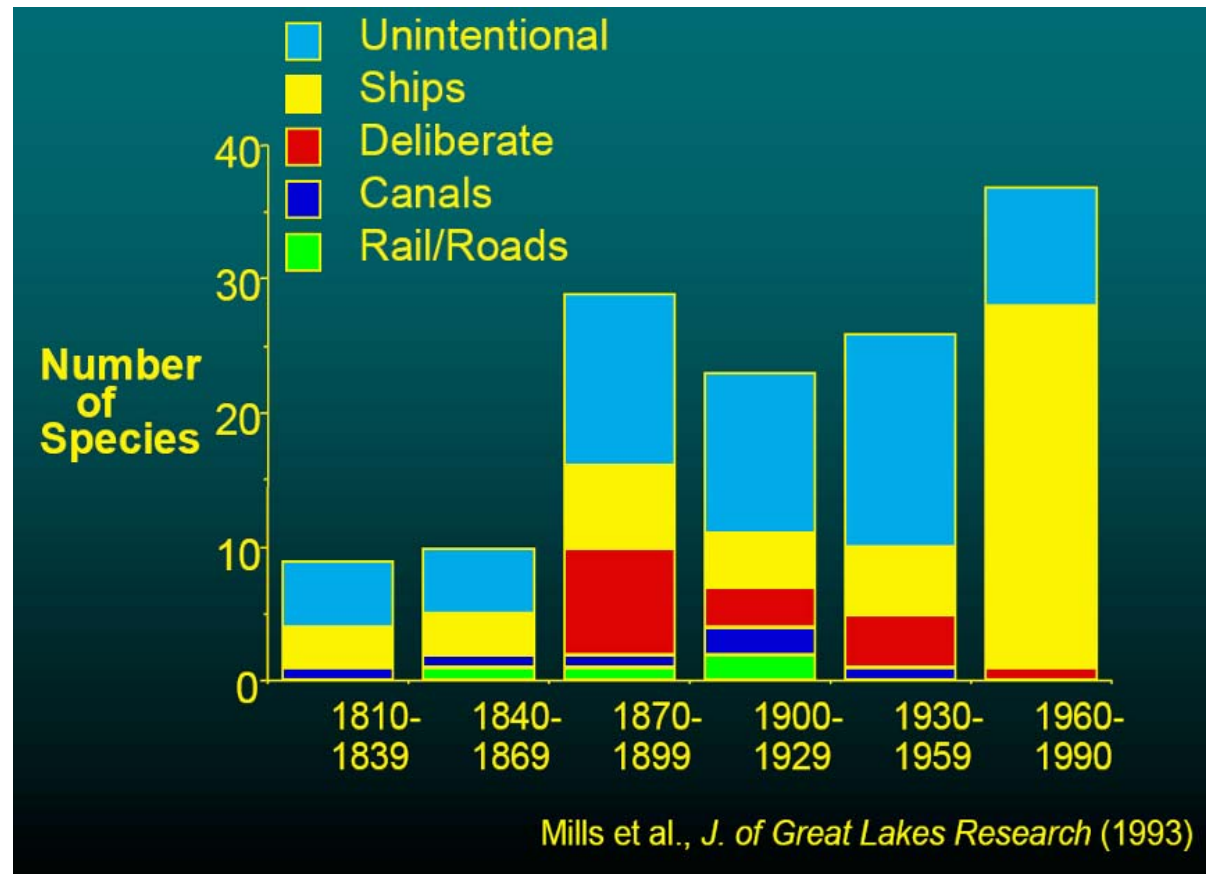
Aquaculture

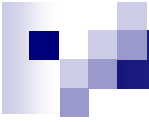
Others

Live Organisms In Trade: A Priority Vector for Great Lakes Aquatic Invasions

Pathways

- Aquarium
- Live Bait
- Horticulture/
Water Garden
- Food Fish
- Aquaculture





Live Organisms In Trade: A Priority Vector for Great Lakes Aquatic Invasions

Why the trade of live aquatic organisms is an escalating problem in the Great Lakes?

- Increases in the rate of invasion have been directly tied to an expansion and globalization of trade.
- The trade of live organisms across geographic regions creates opportunities for biotic interchange, both intentional and unintentional on regional to global scales.
- Trade through human activities provides a diverse supply of organisms to new geographic regions, creating the first critical phase in a sequence of events that result in invasions and related impacts.

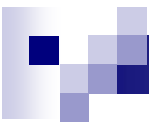
(Greg Ruiz and James Carlton 2003)



Live Organisms in Trade: A Priority Vector for Great Lakes Aquatic Invasions

- With globalization of trade, there is mounting concern in the Great Lakes over invasion risks posed by the OIT vector
- Multiple OIT pathways:
 - aquarium and pet trade, nursery and water garden outlets, live bait, live food fish, aquaculture, etc.
- Multiple management approaches:
 - Education/outreach (Habitattitude™)
 - Voluntary management practices (AIS-HACCP)
 - Federal & state management plans & regulations

→ **Multiple challenges/complexities**



Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

- **Planning Grant:** Led by the Great Lakes Commission
- **Goal:** To help reduce the risks of aquatic invasions through the OIT vector
 - Identify new management, information technology and policy tools
 - Extend existing efforts.
- **Project Participants**
 - Industry
 - NGOs
 - Agency Experts
- **Funder:** Great Lakes Protection Fund
- **Timeframe:** January – December 2008

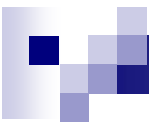


Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

■ Purpose of project activities

- Characterize OIT problems
- Assess progress in addressing each OIT pathway
- Scope out viable solutions to OIT problems through the development of project proposals

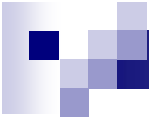
Enhance the capacity of the region to reduce the invasion risks of organisms in trade based on a cooperative effort between the public and private sector



Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

Project Components

- Advisory Committee providing overall guidance and direction on the project
 - 13 members
 - State and Federal Agencies, industry, NGOs
- OIT Pathway Expert Teams
 - Live Bait Fish
 - Live Food Fish
 - Aquaculture
 - Aquarium/Pet Pathway
 - Horticulture and Water Garden Pathway



Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

Project Components

- Pathway summaries being developed by expert teams using the following guidelines:
 - Characterize the pathway in the Great Lakes region, including the types/volume of species being sold and their economic value
 - Points of AIS risks in the pathway, such as choice of organism, sales, transport, end use, consumer behavior



Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

Project Components

- Pathway summaries being developed by expert teams using the following guidelines
 - Progress in mitigating the AIS risk for OIT pathways
 - education, outreach, best management practices, information technology, regulation, enforcement
 - Gaps and unmet needs that need to be addressed
 - additional knowledge, information technology, authority, collaboration, or other resource



Building a Framework to Advance Aquatic Invasive Species Management of Organisms in Trade into the Great Lakes Region

Project Components (continued)

■ Workshops (2)

- Exploring the Organisms in Trade Vector*
- Proposed Projects to Advance Management of Organisms in Trade*

■ Outcomes: Proposal ideas developed in the following areas:

- Risk Assessment for Potential AIS in the Great Lakes
- Internet Monitoring for the Sale of AIS
- Advancing Efforts to Reduce Risks for Aquatic Invasions in Private and Public Aquaculture



Live Bait Pathway Expert Team

Members

- Jeff Gunderson (Minnesota Sea Grant)
- Beth Brownson (Ontario Ministry of Natural Resources)
- Phil Moy (Wisconsin Sea Grant)
- Ron Kinnunen (Michigan Sea Grant)
- Nick Mandrak (Department of Fisheries & Oceans Canada)
- Gary Whelan (Michigan DNR Fisheries Division)
- Andy Goodwin (Aquaculture/Fisheries Center, University of Arkansas)

Staff

- Kathe Glassner-Shwayder, Great Lakes Commission
- Maite Chavez, GLC Quebec Intern



Live Bait Pathway Defining the Trade

- Sale of small fishes, crayfishes, leeches, worms and other terrestrial and aquatic invertebrates
- Use in recreational fishing by anglers who prefer live bait over artificial lures or attractants
- Use as “feeders” that are live fishes fed to piscivorous ornamental animals.



Live Bait Pathway Species Traded

- Fathead Minnow (*Pimephales promelas*) can be called:
 - fatheads, tuffy minnows, blackhead minnows, chubs, blacks, rosy reds, crappie minnows, and just plain “minnows.”
- “Chub” can refer to:
 - fathead minnow, creek chub (*Semotilus atromaculatus*), hornyhead chub (*Nocomis biguttatus*), finescale dace (*Phoxinus neogaeus*), white sucker (*Catostomus commersonii*), or just about any other small fishes.
- “Shiner” can refer to:
 - spottail shiner (*Notropis hudsonius*), common shiner (*Luxilus cornutis*), emerald shiner (*N. atherinoides*), river shiner (*N. blennioides*), sand shiner (*N. stramineus*), golden shiner (*Notemigonus crysoleucas*), or other small silvery fishes.

***Live Bait Pathway
High Value Baitfish in Great Lakes Region***



Emerald Shiner



Live Bait Pathway Economic Value in 6 State Area

- Baitfish wholesale – Meronek 1994
 - Total Value \$14,176,000
 - Cultured \$ 4,721,000
- Baitfish retail – Meronek 1994
 - Total Value \$150,446,000
 - Cultured \$ 50,099,000



Live Bait Pathway Production Methods

■ **Wild harvest**

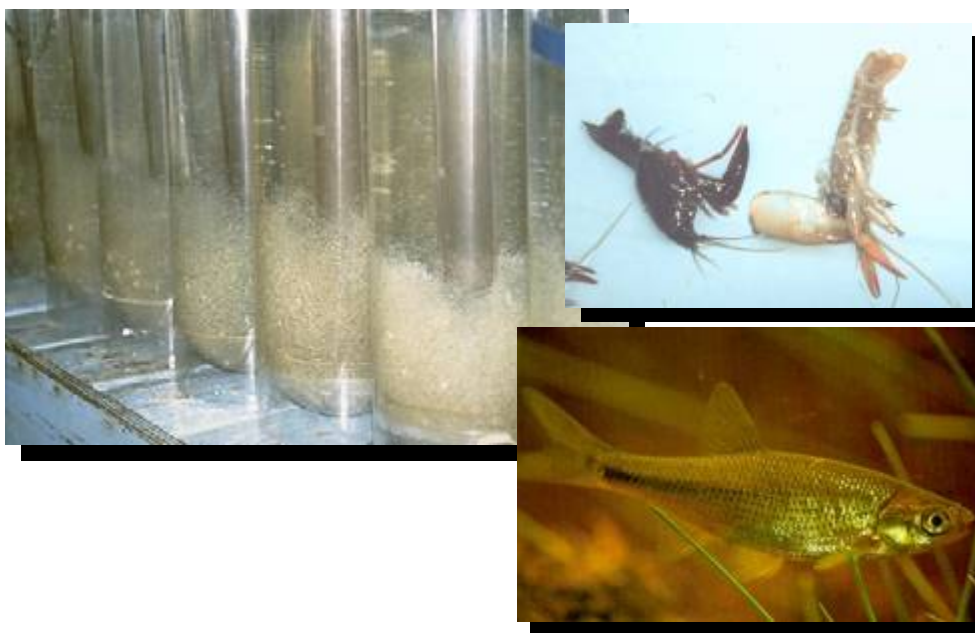
- shiners, suckers and chubs



Live Bait Pathway Production Methods

■ Semi aquaculture

- suckers, golden shiners, fatheads



Live Bait Pathway Production Methods



■ Aquaculture

- Golden shiners, fatheads, rosy reds, goldfish.





Live Bait Pathway Production Methods

- **Safer end:** Levy ponds, protected water supply, semi-farm level disease testing to OIE standard, no import of fish of lesser inspection status, third party verification with on-site inspection.
- **Riskier end:** Fish harvested from stocks present in public waterbodies known to harbor AIS and/or pathogen, and then moved to market without inspection.



Live Bait Pathway

AIS Risks Associated Operational Activities

ACTIVITIES	PLAYERS	RISKS
Harvesting	Commercial harvester Angler (recreational harvest)	Collection and keeping of AIS and non-target species. Moving contaminated water or equipment. Moving diseased fishes.
Stocking	Harvest/Wholesaler/Farmer	Presence of AIS, non-target and diseased fishes. Escape of AIS, non-target and diseased fishes. (Since stocking in public waters require permitting with fish health certification, these risks are greater for private waters)
Shipment	Harvest/Farmer/Wholesaler/ Retailer	Presence of AIS, non-target and diseased fishes. Contamination of hauling trucks and associated equipment. Accidental release.
Transfer	Wholesaler/Retailer	Presence of AIS, non-target; Release of AIS, non-target species and diseased fishes
Final Sale	Retailer/Angler	Presence of AIS, non-target in retail holding facilities
Consumer behavior	Angler	Release of unused/leftover bait that are AIS, non-target species or diseased fishes. Moving contaminated water or equipment.

Live Bait Pathway Risks Posed



- AIS and pathogens can be transferred in bait



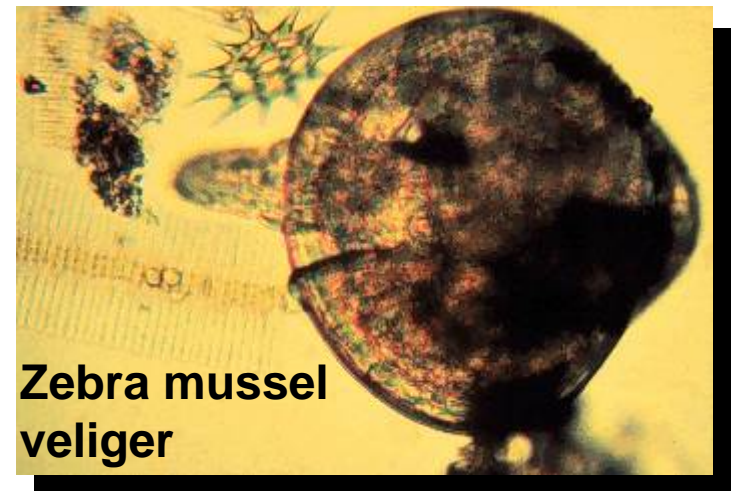
Threespine stickleback



Spiny waterflea



VHS virus

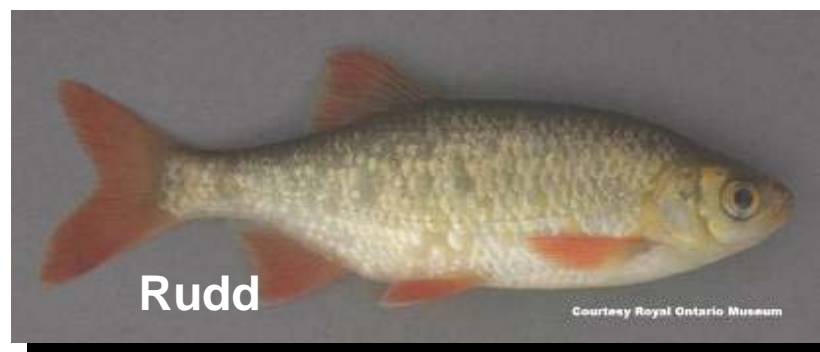


Zebra mussel
veliger

Live Bait Pathway Risks Posed



- AIS may be the bait



Live Bait Pathway Risks Posed

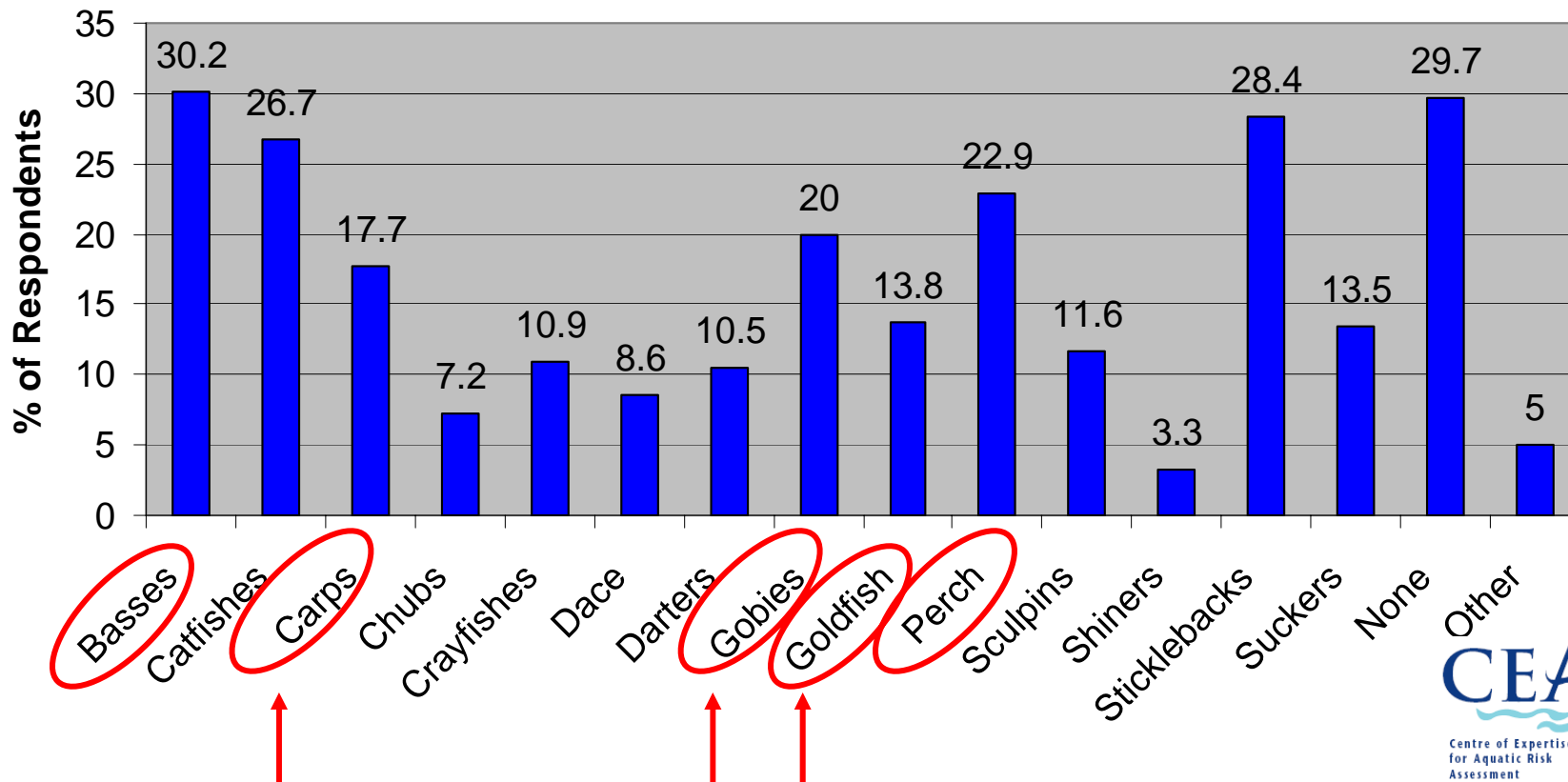
- Angler Behavior: When anglers dump the contents of bait buckets into water bodies other than the original source of bait, AIS and/or pathogens can be spread into new water bodies



Live Bait Pathway Risks Posed



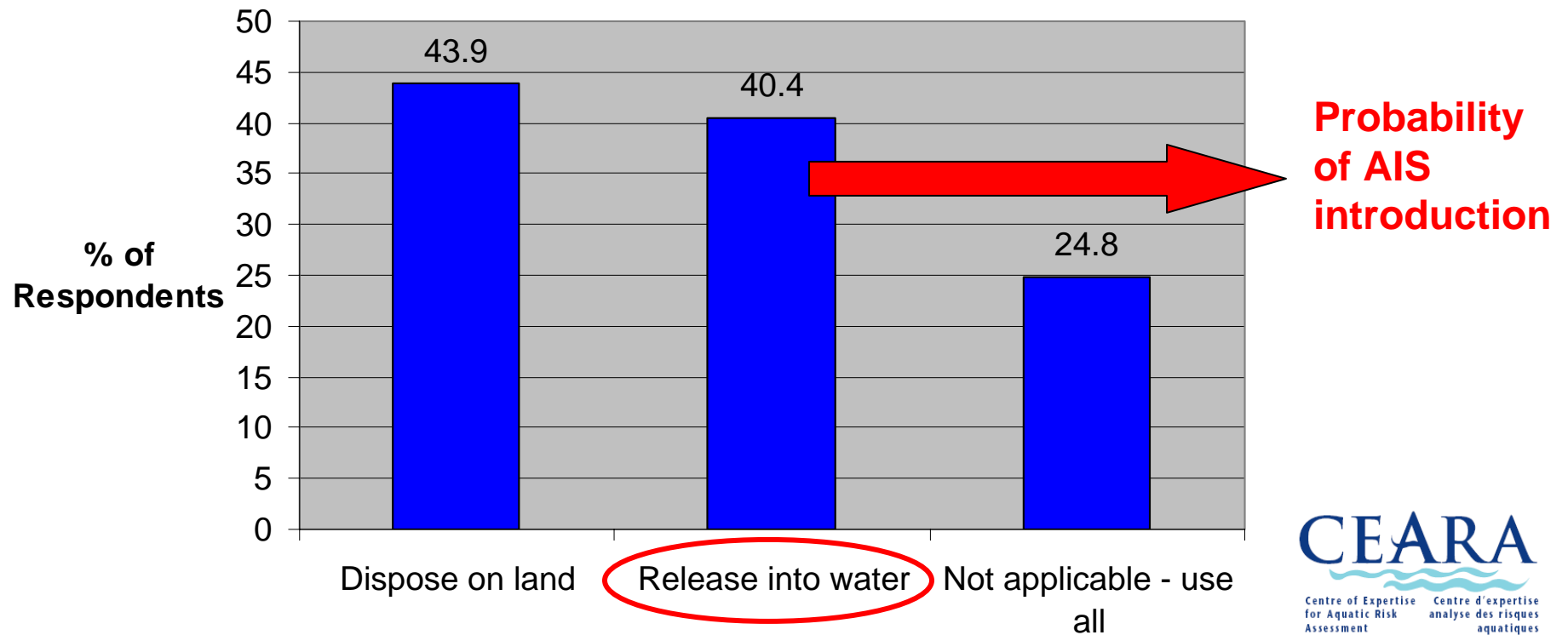
- Q13: What fish do you sometimes find in your purchased bait that you don't like to use? Choose all that apply.



Live Bait Pathway Risks Posed



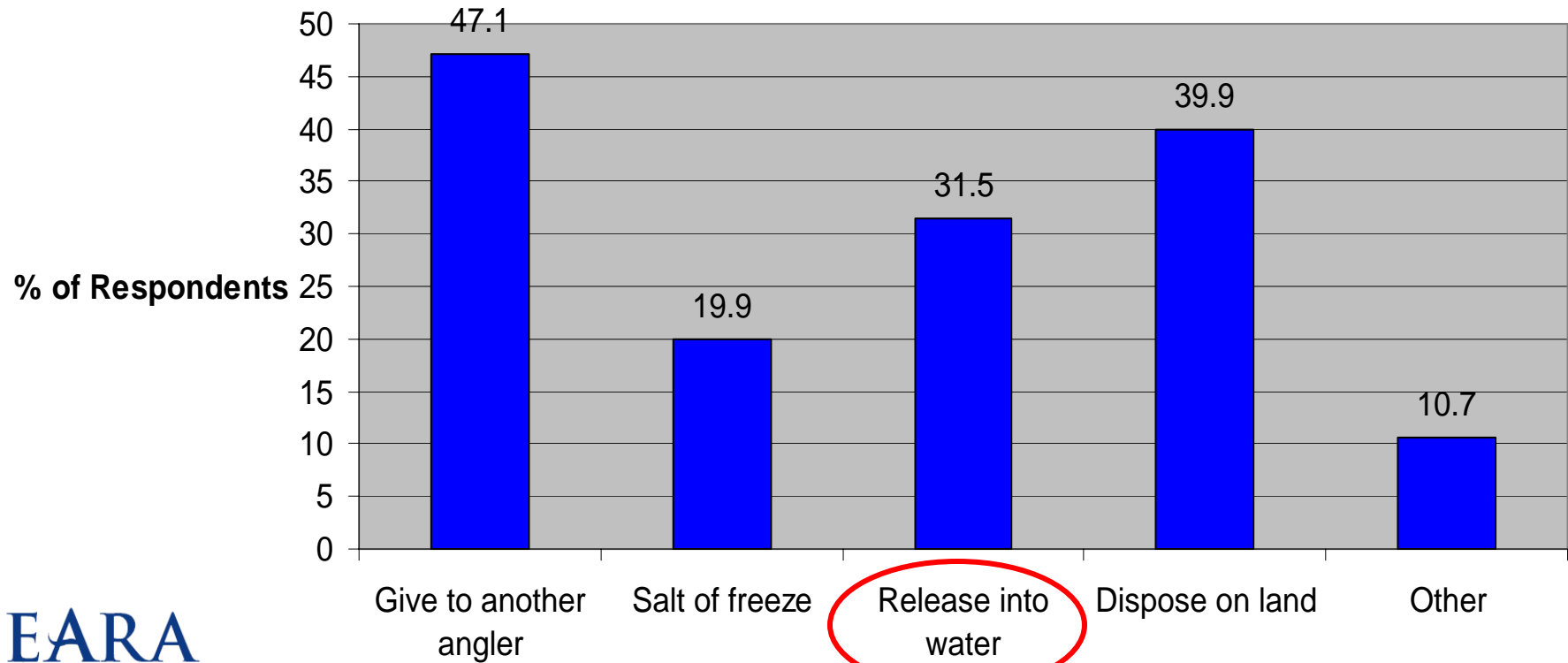
- Q14: What do you do with baitfish that you don't want to use? Choose all that apply.



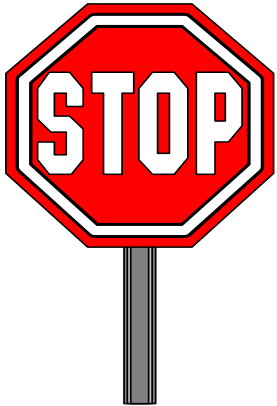
Live Bait Pathway Risks Posed



- Q15: What do you do with your left-over baitfish?
Choose all that apply.



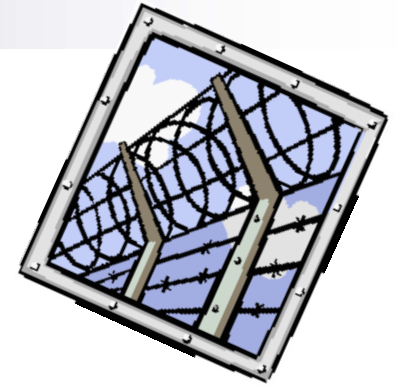
Live Bait Pathway Risk Mitigation



STEPS TO PROTECT YOUR FARM

- Avoid bringing outside fish onto your farm
- Avoid returns or isolate fish
- No new exotics or “experimental” species, especially on a baitfish farm
- Sanitize seine & equipment (waders, buckets, dipnets, boat, motor) in between ponds, blocks of ponds, or farms
- Use a HAACP plan to document that you follow safe practices.

Live Bait Pathway Risk Mitigation

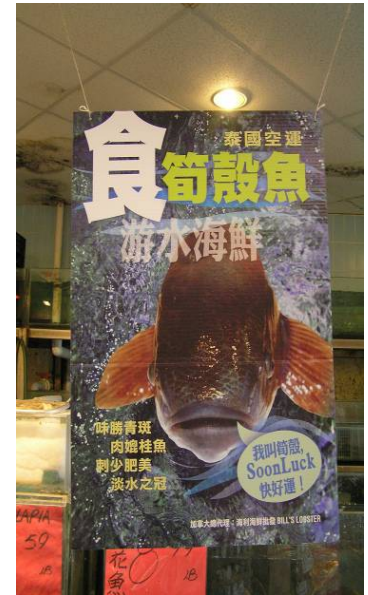


Biosecurity to prevent introduction of AIS and pathogens →

- Facility operation and maintenance
 - Use ground water vs. levee ponds and surface water
 - Clean, Clean, Clean
 - Monitor life support systems: water, dissolved oxygen, temperature
 - No introductions of animals or water from uncertified sources
- Disinfection of people and equipment entering the farm and trucks transporting fish

Live Food Fish Pathway Expert Team

Soon luck goby
(*Dormitator maculatus*)



Team Members

- Becky Cudmore, Fisheries and Oceans Canada
- Jill Wingfield, Great Lakes Fishery Commission
- Ruben Keller, University of Notre Dame
- Judith Pederson, MIT Sea Grant
- Beth Brownson, Ontario Ministry of Natural Resources

Staff

- Kathe Glassner-Shwayder, Great Lakes Commission
- Maite Chavez, Great Lakes Commission-Quebec Intern



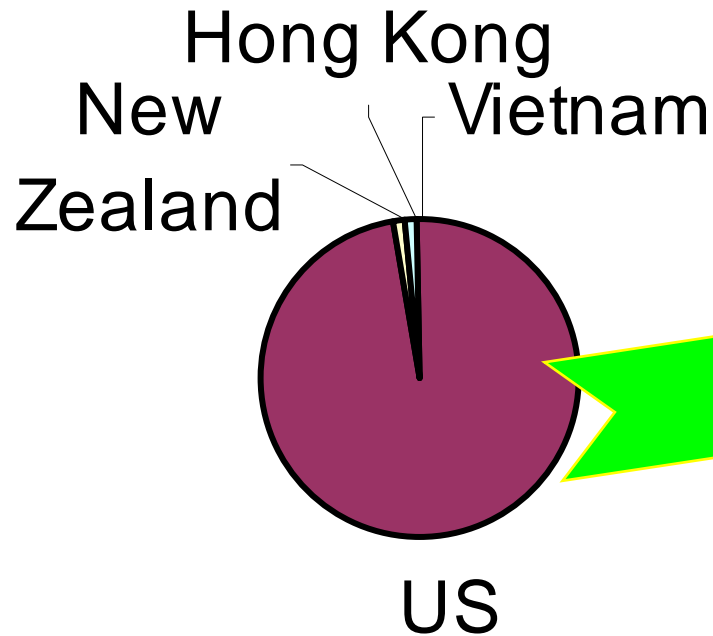
Live Food Fish Pathway Defining the Trade

- The sale of live aquatic species for human consumption is considered a pathway with the potential for nonindigenous species introduction into the Great Lakes (*Rixon et al. 2005*).
- The live food pathway refers to any fishes or other aquatic organisms imported or transferred alive specifically for the purpose of human consumption.

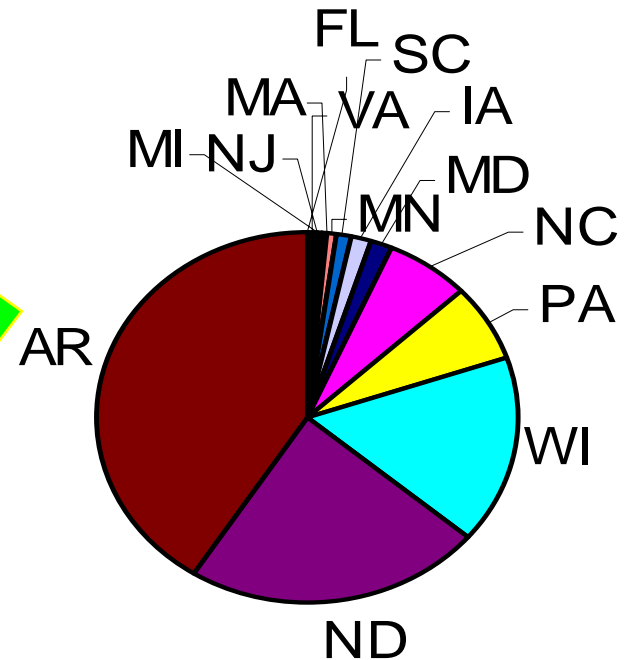
Live Food Fish Pathway

Where in the world are these species coming from?

COUNTRY OF ORGIN



US States



Live Food Fish...Transported Alive To Market



Live Food Fish Pathway

Defining Pathway

- Live food species are being sold to predominantly Asian markets primarily in larger cities such as Chicago and Toronto as well as New York.
- However...not just Asian Market communities



Live Food Fish Pathway Risks Posed

- It is suspected that the live food industry could be a potential pathway for the introduction of Asian carps into the Great Lakes waters... a significant threat to the Great Lakes because they are large, extremely prolific, consuming vast amounts of food.



Live Food Fish Pathway Risks Posed

- Since 2002, snakeheads have been found in lakes and rivers along the east coast and the Midwest, including New York, Chicago and Michigan. Snakeheads have altered species compositions, decreasing population sizes of prized recreational fishes.



Live Food Fish Pathway Risks Posed

Human-mediated release

Ceremonial

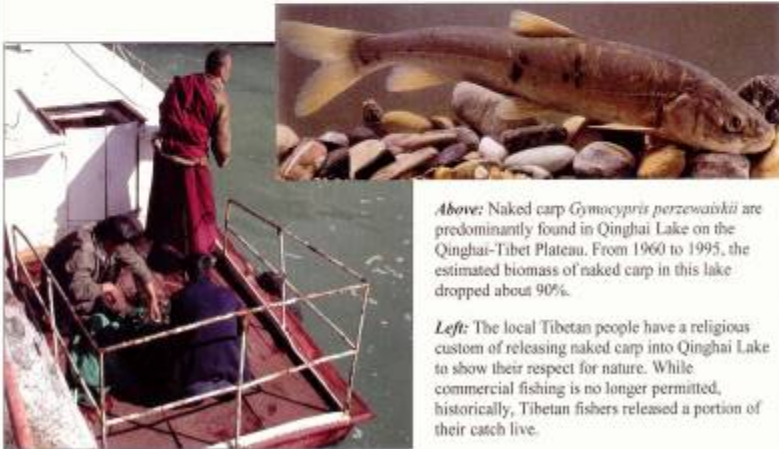
Holy Carp

Naked carp were once plentiful in Qinghai Lake but virtually disappeared when dams blocked spawning habitat. These fish provided food for people and migrating birds as well as being an important part of religious ceremony. The Chinese government recognized the ecological and cultural significance of this fish and is taking action to restore them to their original levels.

In 2003, biologists from Northwest Marine Technology assisted scientists from the Qinghai Fishery Department with coded wire tagging 16,500 hatchery produced naked carp for release into Qinghai Lake.

Two sizes classes of fish were tagged in the nape musculature: small (averaging 50 mm TL) and large (from 100 mm to 250 mm TL). Small fish were held in the hatchery for further grow-out while the large fish were released into the Shaliu River which feeds into Qinghai Lake. Both groups had good tag retention and negligible mortality.

This was the first of many releases of naked carp into Qinghai Lake. As the released fish mature and return to the remaining spawning streams that feed into the lake, the effectiveness of the stocking program will be evaluated.



Above: Naked carp *Gymocypris przewalskii* are predominantly found in Qinghai Lake on the Qinghai-Tibet Plateau. From 1960 to 1995, the estimated biomass of naked carp in this lake dropped about 90%.

Left: The local Tibetan people have a religious custom of releasing naked carp into Qinghai Lake to show their respect for nature. While commercial fishing is no longer permitted, historically, Tibetan fishers released a portion of their catch live.

Activism



Fishery

Live Food Fish Pathway Risks Posed

Hitchhikers
with cultured
or wild-caught
individuals
and in grey
water,
parasites,
disease, other
species



Photograph by Phil Moy, 10/07/04

Live Food Fish Pathway Risks Posed

Live seafood can carry harmful diseases which can be transmitted to other aquatic animals and sometimes people.

Viral Hemorrhagic Septicemia



Spring Viremia of Carp





Aquaculture Pathway Expert Team

Members

- Paul Zajicek (National Association of State Aquaculture, FL Dept. of Agr.)
- Dave Smith (Freshwater Farms of Ohio)
- Gary Whelan (Michigan DNR Fisheries Division)
- Ron Johnson (University of Wisconsin, Extension, UW-Superior Northern Aquaculture Demonstration Facility)
- Ted Batterson (North Central Regional Aquaculture Center, MSU)

Staff

- Kathe Glassner-Shwayder, Senior Project Manager
- Maite Chavez, Quebec Intern



Aquaculture Pathway

Defining Aquaculture Industry

- Aquaculture is the husbandry of aquatic organisms and implies the purposeful intent to nurture or promote the growth and survival of the targeted organism, including
 - state, federal, provincial, and tribal fish hatcheries
 - the aquarium or ornamental fish industry
 - water gardening suppliers
 - private, commercial fish farms
 - baitfish operations dealing with both cultured and wild caught organisms



Aquaculture Project Idea: Advancing Efforts to Reduce AIS Risks

■ Project Rational

- Evidence for progress in the operation of private and public aquaculture in addressing AIS risks
 - Establishment of regulatory programs and polices
 - Implementation of best management practices (BMPs)
 - Conduct of educational outreach
 - Voluntary participation in AIS Hazard Analysis and Critical Control Points (HACCP), led by Sea Grant
- Uncertainty exists as to whether risks from aquaculture are being fully addressed through these programs and practices



Aquaculture Project Idea: Advancing Efforts to Reduce AIS Risks

- Project Rational
 - Need for comprehensive assessment of regulatory and voluntary programs to determine if there are gaps and unmet needs in addressing AIS risks in private and public aquaculture operations
 - Maximize efforts to reduce AIS risks
 - Improve regional consistency
 - Target resources where most needed to reduce AIS risks
 - Find areas where existing efforts can be strengthened



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

- Project Goal: Advance existing efforts to ensure that the aquaculture industry in the Great Lakes is AIS free and biosecure from pathogens and disease
- Objectives/Project Components
 - Conduct a regulatory analysis of private and public aquaculture programs including facilities and species regulations as well as stocking policies



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

- Objectives/Project Components
 - Use results from regulatory analysis to guide an assessment of AIS related BMPs for both private and public aquaculture (on a separate basis) to get a handle on status (what, why and where) of practices utilized for AIS risk reduction
 - Assess implementation of AIS HACCP programs for status to further strengthen AIS risk reduction efforts
 - Develop recommendations based on findings to strengthen capacity for AIS risk reduction for aquaculture industry in the Great Lakes region



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

■ Questions

- In the conduct of the regulatory analysis, how can we ensure that the exercise will set the stage to advance efforts for AIS risk reduction
- How can we best assess the extent of implementation of AIS BMPs, AIS HACCP, outreach programs?
 - Survey?
 - On site visits?
 - Other?



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

- Questions

- What topical areas should be considered in the assessment?
 - Type of facility operation? Location ? species? end use?
 - Best Management Practices to address AIS risks
 - Level of awareness and extent of implementation
 - AIS HACCP
 - Level of participation
 - How are pathogens and viruses addressed?
 - Environmental Technologies: Innovative approaches to reducing risks from AIS and pathogens



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

■ Questions

- Do barriers exist that impede facilities from implementing BMPs the maximum extent?
- If so, how can we reduce barriers and work with aquaculture operators to improve risk reduction efforts through BMPs and HACCP?
- What types of outreach strategies can be most effective in disseminating project findings to achieve project goal of ensuring that private and public aquaculture operations are AIS free and bio-secure?



Aquaculture Project Idea Advancing Efforts to Reduce AIS Risks

- Potential Partners:
 - Great Lakes Fishery Commission
 - North Central Regional Aquaculture Center
 - State/provincial agency representatives, with particular focus on those states with HACCP Plans
 - Aquaculture Associations (U.S. and Canada)
 - Private and Public Aquaculture Operators
 - Tribal Authorities (e.g., Great Lakes Indian Fish and Wildlife Commission and Chippewa Ottawa Resource Authority)
 - Great Lakes Sea Grant Network

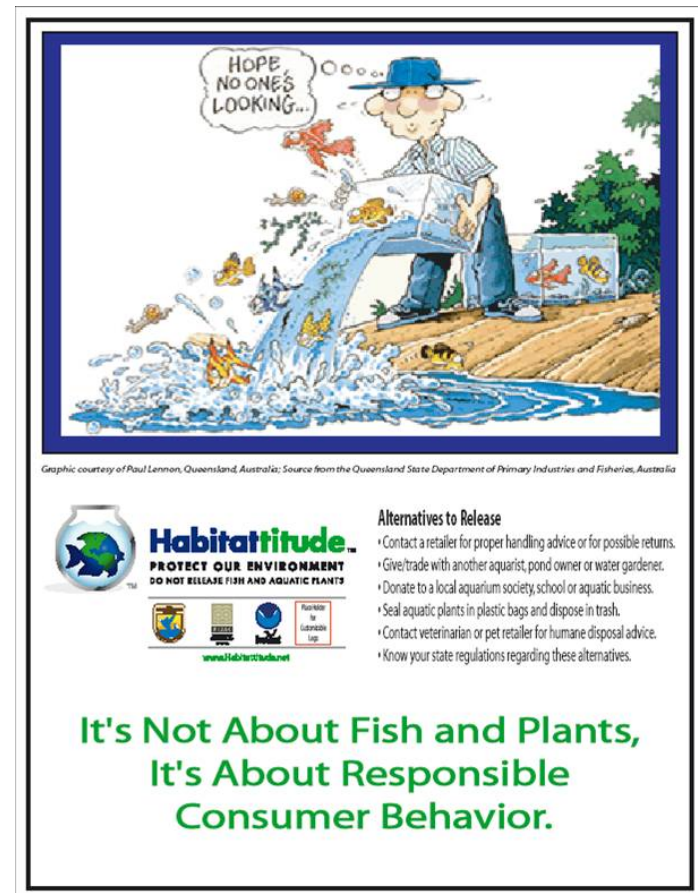


***In Conclusion:
Overall Challenges Posed by the OIT Vector***

- Find solutions to mitigate the risks associated with the trade of live organisms while maintaining economic viability of the industry
- Sales (availability in retail market)
 - Inconsistent regulations between states
 - Limited understanding or awareness of regulations or potential impacts
 - Inaccurate identification or hitchhikers
 - Address the issue of increasing availability of species through non-regulated sales (e.g. internet)

In Conclusion: Overall Challenges Posed by the OIT Vector

- Consumer Behavior: End Use / Disposal
 - Primary mechanism for introductions of non-native species from the aquarium trade is owner release of unwanted pets
 - Strengthen our understanding of how to influence the behavior of consumers



That's all for now...stay tuned!

Kathe Glassner Shwayder (shwayder@glc.org)

OIT Project Website: <http://www.glc.org/ans/initiatives.html#oit>

