

The HACCP Approach to Prevent the Spread of Aquatic Invasive Species by Aquaculture and Baitfish Operations

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Problems

1. **AIS can invade and disrupt baitfish and aquaculture operations**
2. **Baitfish and aquaculture operations have been identified as a pathway for the spread of AIS**
 - Close areas to harvest/culture
 - Impose regulations that may be disruptive to the industry

Impacts

- **Many states and provinces have banned importation, banned fish and bait harvest from infested waters, or required exotics-free certification**
- **Unnecessary, poorly designed, or unenforceable regulations are costly to government and the industry**

Economic Value of Baitfish Industry Including Wild Harvest

Baitfish industry

Value in 6 NCR states	\$162 million ¹
Value US and Canada	\$1 billion ²

¹ Meronek *et al.* 1997

² Litvak and Mandrak 1993

How Can Aquaculture Be Characterized by AIS Risk?

- **Extremely diverse and complex as is Agriculture**
- **Characterized by:**
 - Production systems
 - Product types
 - Water Source
 - Species
- **Each of these components pose different risks for spreading AIS**



Product Types

➤ Food



➤ Fish for stocking

- stocking public/private waters
- stocking aquaculture systems

➤ Fee Fishing



➤ Aquarium fish



➤ Decorative ponds



➤ Baitfish



Baitfish

➤ Wild harvest

- shiners, suckers, chubs, dace

➤ Semi aquaculture

- suckers, fatheads, softshell crayfish

➤ Aquaculture

- golden shiners, fatheads, rosy reds, goldfish



Water Sources

- **Springs**
- **Well water**
- **Surface water**

ANS Risks and Aquaculture

- **Vast majority of aquaculture poses very little risk for spread of AIS because they:**
 - raise fish for the food market (dead fish)
 - use well or spring water
 - don't harvest fish from infested waters
 - use closed systems
- **Higher risk is from:**
 - baitfish harvested from AIS infested waters
 - fish for stocking taken from AIS infested waters
 - AIS cultured for live sale
 - AIS grown where they can escape into the wild
 - surface water used or transferred with live fish

Regarding Aquaculture: What do we want?

- **Prevent AIS from establishing reproducing populations**
- **Balance resource protection with potential negative economic impacts**

So, how do you allay concerns that aquaculture might spread AIS

- ① Must have a policy and procedures in place to deal with concerns**
- ② The procedures must be robust enough to work for a wide variety of aquaculture and baitfish operations**
- ③ Must have records that will show that the policies and procedures are being followed**
- ④ Must verify that policies and procedures work**

But, the procedures should be as unobtrusive as possible

Kinnunen & Gunderson



"We'd like to try out a few procedures on your department before we use them to mess up the entire company."

HACCP Approach

Hazard Analysis and Critical Control Point

- HACCP is preventive, not reactive
- Concentrates on the points in the process that are critical to the safety of the product
- Stresses communication between the regulator and industry

Seven Principles of HACCP

- ① **Conduct hazard analysis**
- ✍️ **Identify critical control points (CCP)**
- ③ **Establish control measures**
- ④ **Monitor each CCP**
- ⑤ **Establish corrective action to be taken when a problem occurs**
- ⑥ **Establish a record-keeping system**
- ⑦ **Verify that the HACCP plan and control measures work**

AIS-HACCP

Potential Hazards

1. AIS **Fish and other Vertebrates**- round goby, ruffe, white perch, Asian carp, amphibians, etc.



Hazards for Seafood Safety

1. Biological
2. Chemical
3. Physical

AIS-HACCP

Potential Hazards

1. AIS **Fish and other Vertebrates**- round goby, ruffe, white perch, Asian carp, amphibians, etc.
2. AIS **Invertebrates** - zebra mussels, spiny and fish hook waterflea, rusty crayfish, etc.



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AIS-HACCP

Potential Hazards

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2. AIS **Invertebrates** - zebra mussels, spiny and fish hook waterflea, rusty crayfish, etc.
3. AIS **Plants** - Eurasian watermilfoil, hydrilla, water chestnut, giant salvinia, etc.
4. Diseases – WD, BKD, VHS.



Hazards for Seafood Safety

1. Biological
2. Chemical
3. Physical



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Baitfish HACCP Project

Approach - Part 1 of 3: Establish HACCP Program

- Apply a *Hazard Analysis and Critical Control Points (HACCP)*, approach. Successfully used by seafood industries to ensure a safe product
- Identify critical control points (CCPs) in the baitfish “chain of commerce.”
- Discover ways to reduce risk of moving AIS
- Harvest to hook review

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Baitfish HACCP Project

- Identify critical control points (CCP) and points of risk throughout the “chain of commerce”
- Establish critical limits (e.g. by-catch percent)
- Draft monitoring strategies needed to keep an eye on success over time
- Conduct workshops with baitfish harvesters, wholesalers and dealers so they understand the risks and the safety steps to take

Baitfish HACCP

Emphasis of Minnesota Project

- ✓ Worked with private and public sector stocking operations
- ✓ Began writing draft HACCP plan
- ✓ Most operators are taking some actions to prevent contamination

Minnesota Sea Grant

Working on Commercial Fish Farm

Guidelines to Reduce Risk of Infestation or Spread

SAFER FISH FARM PRACTICES

- Use ground or spring water, or sand filters
- Use clean brood fish sources
- Routinely inspect for AIS
- Clean and dry all equipment
- Isolate equipment used in infested waters
- Do not take water from unknown sources (e.g. bait trucks)

Baitfish HACCP

Michigan Sea Grant Emphasis

- **Wild baitfish harvest**
 - » How many commercial harvesters?
 - » How many types of harvest?
 - » What are the critical control points?
 - » How can we best reach bait harvesters with an education program once the HACCP plan is complete?

Baitfish HACCP

Michigan Sea Grant Emphasis

- **Trying to identify Critical Control Points in the wild baitfish “chain of commerce” to reduce risk of moving AIS to uninfested waters**



Baitfish HACCP

Sea Grant Field Work



**Understanding the
process of wild baitfish
harvest**



Sea Grant Field Work

Understanding the Process of Wild Baitfish Harvest



Sea Grant Field Work

Understanding the Process of Wild Baitfish Harvest



**Transfer points provide
a closer look at the
harvest**



Sea Grant Field Work

Discovering Critical Control Points



Separate Boats and Equipment



Some Boats Dedicated for Specific Waters



Pressure Washing Traps



Traps



Drying Nets



Separate Waders for Some Ponds



Keeping Harvest and Transaction Records



Holding Tanks



Grading



Hazard Analysis Worksheet

1. Activity	2. Hazards	3. Are AIS Hazards Significant? (Yes / No)	4. Justification	5. Control	6. CCP
Activity, Harvest or Aquaculture Step (from flow diagram)	Potential AIS Hazards introduced or controlled at this step (from potential Hazards worksheet)	Hazards Significant? (Yes / No)	Justify your decisions for column 3.	What control measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes / No)
Week Flow Step 1 Disinfect live haul truck and equipment before leaving facility. Live haul tank filled with well water.	Fish/Other Vert: None	No	AIS Fish not present at holding facility	None	No
	Invertebrate: None	No	AIS Invertebrates not present at holding facility	None	No
	Plant: None	No	AIS Plants not present at holding facility	None	No
	Pathogens: None	No	AIS Pathogens not present at holding facility	None	No
Week Flow Step 2 Seining near shore areas of Lake Huron or any other VHSV Positive Management Area.	Fish/Other Vert: -Gobies -Eurasian Ruffe -White perch	Yes	Present in area of harvest	Control applied at later step	No
	Invertebrate: -Zebra Mussels -Quagga mussels -Spiny waterflea -Fish hook waterflea	Yes	Present in area of harvest	Control applied at later step	No
	Plant: -Eurasian watermilfoil -Purple loosestrife	Yes	Present in area of harvest	Control applied at later step	No
	Pathogens: -VHSV	Yes	Present in area of harvest	Control applied at later step	No
Week Flow Step 3 Observe targeted baitfish for any external signs of disease and check for other AIS	Fish/Other Vert: -Gobies -Eurasian Ruffe -White Perch	Yes	Present in area of harvest	If present in large quantities will avoid seining	Yes
	Invertebrate: -Zebra mussels -Quagga mussels -Spiny waterflea -Fish hook waterflea	Yes	Present in area of harvest	Control applied at later step	No
	Plant: -Eurasian watermilfoil -Purple loosestrife	Yes	Present in area of harvest	Control applied at later step	No
	Pathogens: VHSV	Yes	Present in area of harvest	Avoid seining if fish appear diseased	Yes

AIS - HACCP Plan Form

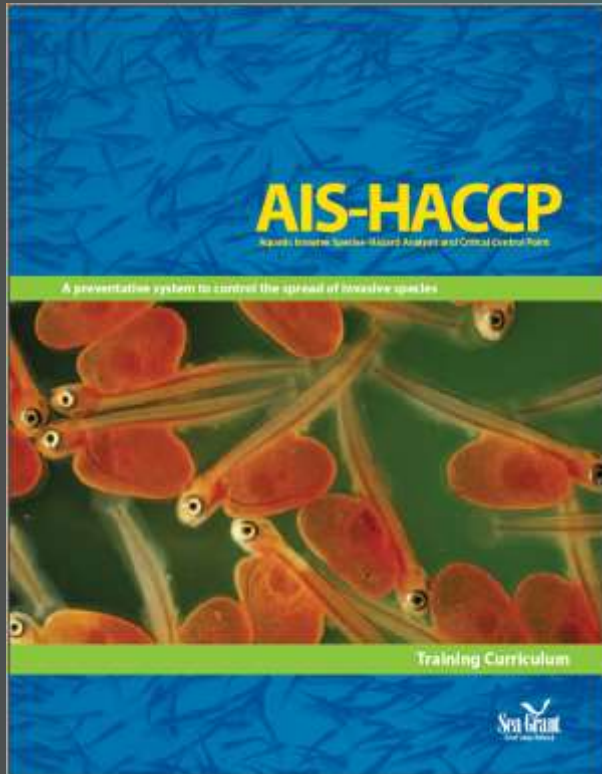
Critical Control Point <small>Each row answered "yes" in column 6 on the Hazard Analysis Form</small>	1	Observe targeted baitfish for any external signs of disease and check for other AIS.	If targeted <u>baitfish appear</u> normal begin seining.
Significant Hazards <small>As determined in column 3 of the Hazard Analysis Form</small>	2	Gobies, Eurasian ruffe, white perch, and VHSV	VHSV
Limits for each control measure	3	- If AIS fish present in large quantities avoid seining. - If targeted <u>baitfish appear</u> diseased avoid seining.	Seine only targeted <u>baitfish that appear</u> disease free.
Monitoring <small>Describe what is being monitored</small>	4	Presence of AIS fish or diseased baitfish	Presence of disease free targeted baitfish.
<small>Explain how the monitoring will take place</small>	5	Visual observation from shore, dock and/or boat.	Visual observation from shore, dock, and/or boat.
<small>Frequency of monitoring</small>	6	Each seining site.	Each seining site.
<small>Persons responsible for monitoring</small>	7	Crew chief	Crew chief
Corrective Actions <small>Actions taken when limits of control measures are not met</small>	8	Additional controls taken at seining step.	Additional controls taken at harvest step.
Verification <small>Method of Verification</small>	9	Record review by supervisor.	Record review by supervisor.
Records <small>List what is recorded at each critical control point</small>	10	Record of seining for MDNR fish report.	Record of seining for MDNR fish report.

Page Break

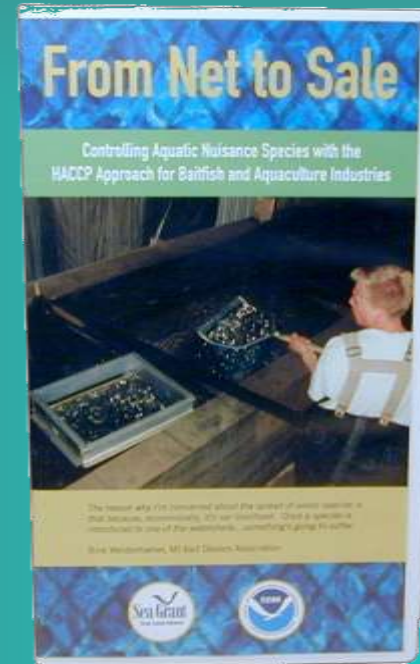
AIS-HACCP Training Materials

Curriculum

CD with
resources



Supporting
training video
(22 min)

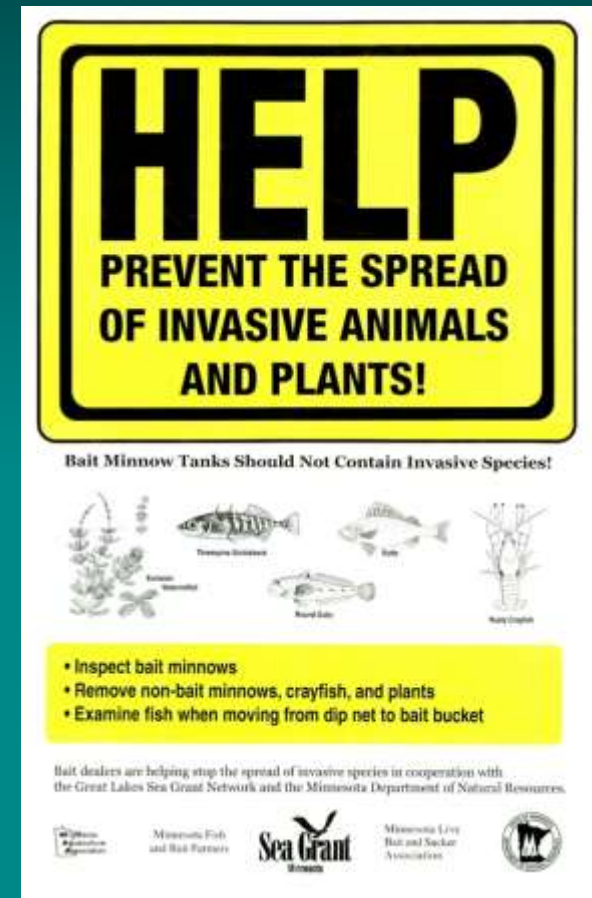


AIS-HACCP Outreach Materials



Stickers for
bait buckets
and tackle
boxes

Posters for
bait shops



★ Regional
2002

★ Regional
2002/03

★ State 2002

★ State 2003



Outcomes

- ✓ Co-hosted four regional workshops: Alexandria, SLC, Portland, Bozeman with major support from USFWS
- ✓ 125 hatchery, resource management, research and aquaculture industry managers

Sea Grant Baitfish HACCP Project

Approach - Part 2 of 3:

- Assess the level of AIS contamination at retail outlets in Great Lakes region
- Purchase and analyze bait for AIS (plants, fish and macroinvertebrates)



The Great Lakes Sea Grant Network purchased minnow samples from retail outlets in Minnesota, Illinois, Indiana, Michigan and Ohio, covering the Great Lakes, Hudson and Mississippi Basin watersheds during 1998-2000.



At least three dozen baitfish of each species carried by a store were purchased and identified to species. Samples were inspected for fish, plants, invertebrates, both AIS and non-target species.



Holding tanks were observed for any visible AIS.

AIS and non-target species found in samples were retained for reference.



Primary baitfish species purchased

- Fathead minnow - all states
- Golden shiner - all states
- Emerald shiner - IL/IN, MI, OH
- White sucker - OH, MN
- Common Shiner - MN
- Red tail chub - MN
- N. redbelly dace – MN
- Willow cats – MN

Among these baitfish species the golden shiner usually comes from aquaculture operations.



The others most frequently are wild-harvested.

No samples purchased in any state contained AIS fishes, although alewife were observed in a tank in one Ohio shop.



No samples were found to contain nuisance plants, such as Eurasian watermilfoil.



Sea Grant Baitfish HACCP Project

Approach - Part 3 of 3: Angler Surveys

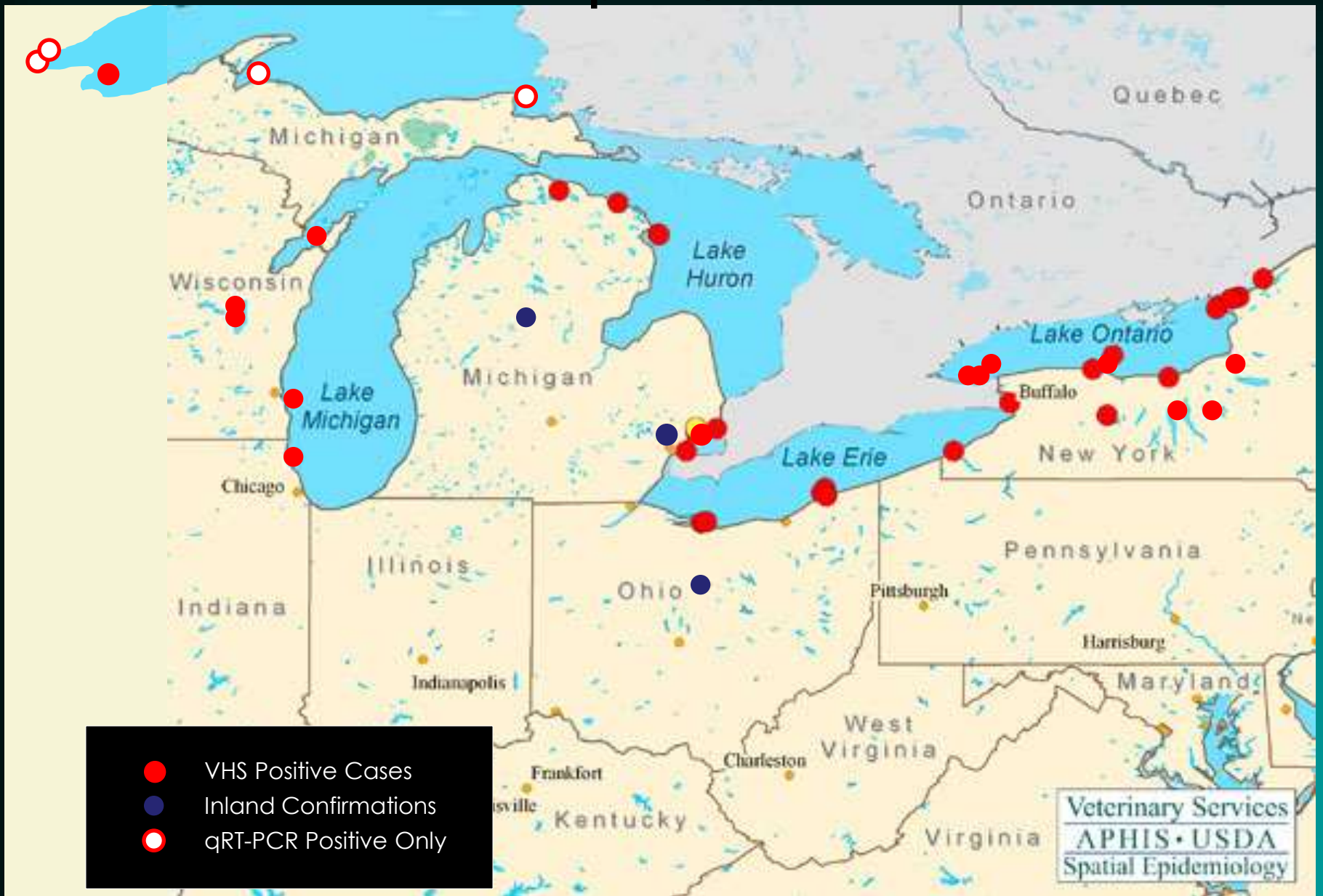
- Assess angler attitudes toward AIS and exotics-free bait
- Assess risk of spread posed by anglers
- Conduct face-to-face angler surveys around Basin



Recent Michigan Department of Natural Resources Baitfish Inspections

- 36 out of 37 wholesale minnow dealers
- 60 of 88 minnow catchers
- 152 out of 675 minnow retailers
- Two non-resident wholesaler trucks
- Did not observe any aquatic invasive species







Fish Disease Control Orders

VHS Management Example

➤ VHS Management Areas



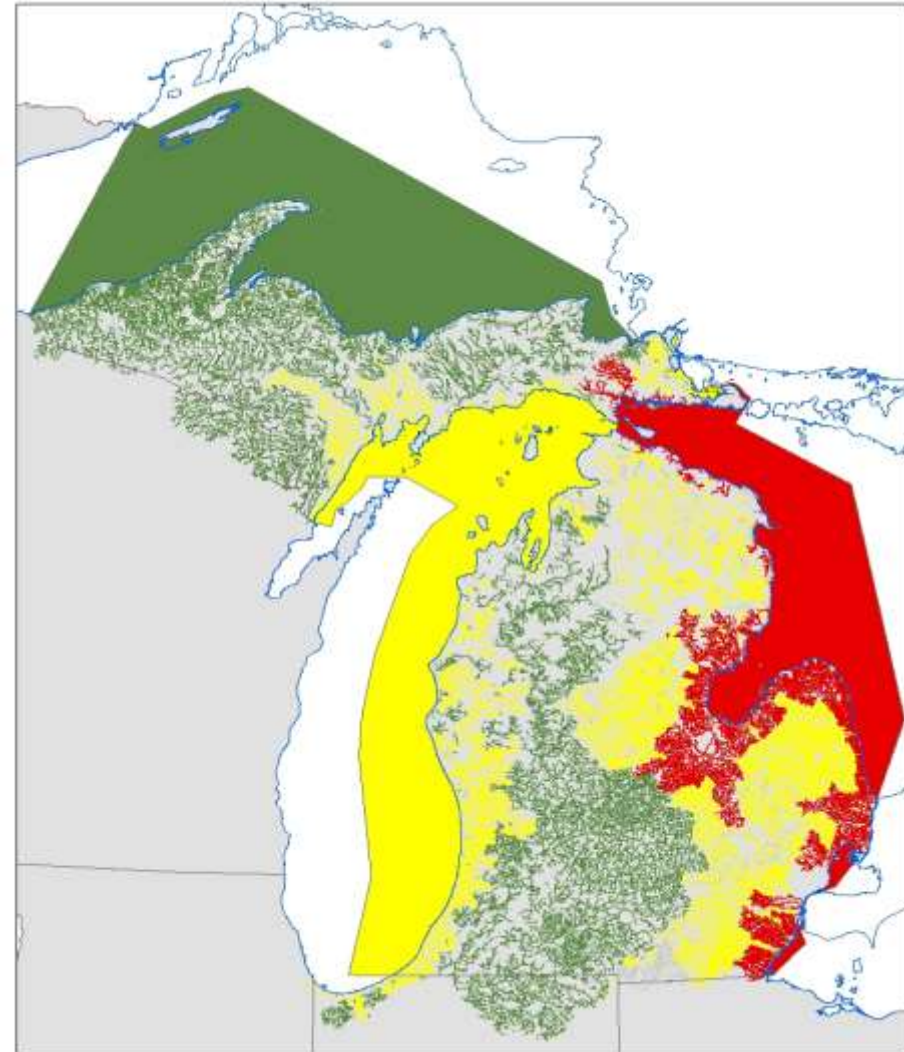
- VHS Positive Area



- VHS Surveillance Area



- VHS Free Area



Baitfish Required Testing for VHS

- **White suckers**
- **Bluntnose shiners**
- **Spottail shiners**
- **Emerald Shiners**

Third Party Verification Program for AIS-HAAP

- **Develop review teams consisting of representatives from aquaculture/baitfish industry, aquaculture extension, and regulatory agencies**
- **Review AIS-HACCP programs at aquaculture/baitfish operations**
- **Pilot programs in Michigan and Minnesota**

CONCLUSIONS

- **The HACCP approach can work as long as there are commitments from personnel in the field as well as management**
- **We think that the HACCP approach can replace more intrusive impacts that may result from unnecessary, ineffective, or unenforceable regulations**
- **Control measures and corrective actions must be developed and they must be AIS specific**
- **It is in the best interest of the public hatchery manager, fish farmer, bait harvester, resource manager, researcher, and enforcement officer to prevent the spread of AIS**