

VHS Disease: Understanding its Biology and Implications for the Future

John Dettmers
Great Lakes Fishery Commission

**Joint Meeting of the Great Lakes and
Mississippi River Basin Panels
on Aquatic Nuisance Species
June 17, 2008**

Road Map for Today's Talk

- A. What is VHS?**
- B. VHS, an invasive virus
- C. Impacts and spread
- D. Summary

Viral Hemorrhagic Septicemia (VHS)

VHS is a fish virus

VHS does NOT harm humans

It is safe to touch and eat fish with VHS



What does VHS look like in fish?

Looks very much like other fish diseases

- fish get pop-eye
- gills very pale
- body very dark
- bleeding at base of fins and in organs
- may swim in corkscrew behavior
- may behave abnormally



What does VHS look like in fish?

Not all infected fish show signs of disease

- **may appear healthy**
- **swim normally**

VHS was found in both of these fish:



Great Lakes VHS infects many species

yellow perch
muskellunge
freshwater drum
round goby
suckers
walleye
whitefish

emerald shiner
gizzard shad
bluegill
rock bass
smallmouth bass
Chinook salmon
spottail shiner



What is known about VHS

- **Virus is spread by infected fish**
 - in close proximity to another fish
 - through feeding
 - in body fluids: urine, reproductive fluids
 - in water
- **Most active at water temperatures < 15 °C**
- **Mortality is associated with stressors:**
 - Temperature changes
 - Spawning
 - High population density



Road Map for Today's Talk

A. What is VHS?

B. VHS, an invasive virus

C. Impacts and spread

D. Summary

VHS strains

3 European strains

- fresh and marine waters
- found primarily in cage culture operations
- disease outbreaks have resulted in large die-offs of cultured trout, salmon (rainbow trout)
 - as many as 80% of caged fish may die
- must be reported to World Animal Health Organization (OIE)
- Explains regulatory concern by states and feds

VHS strains

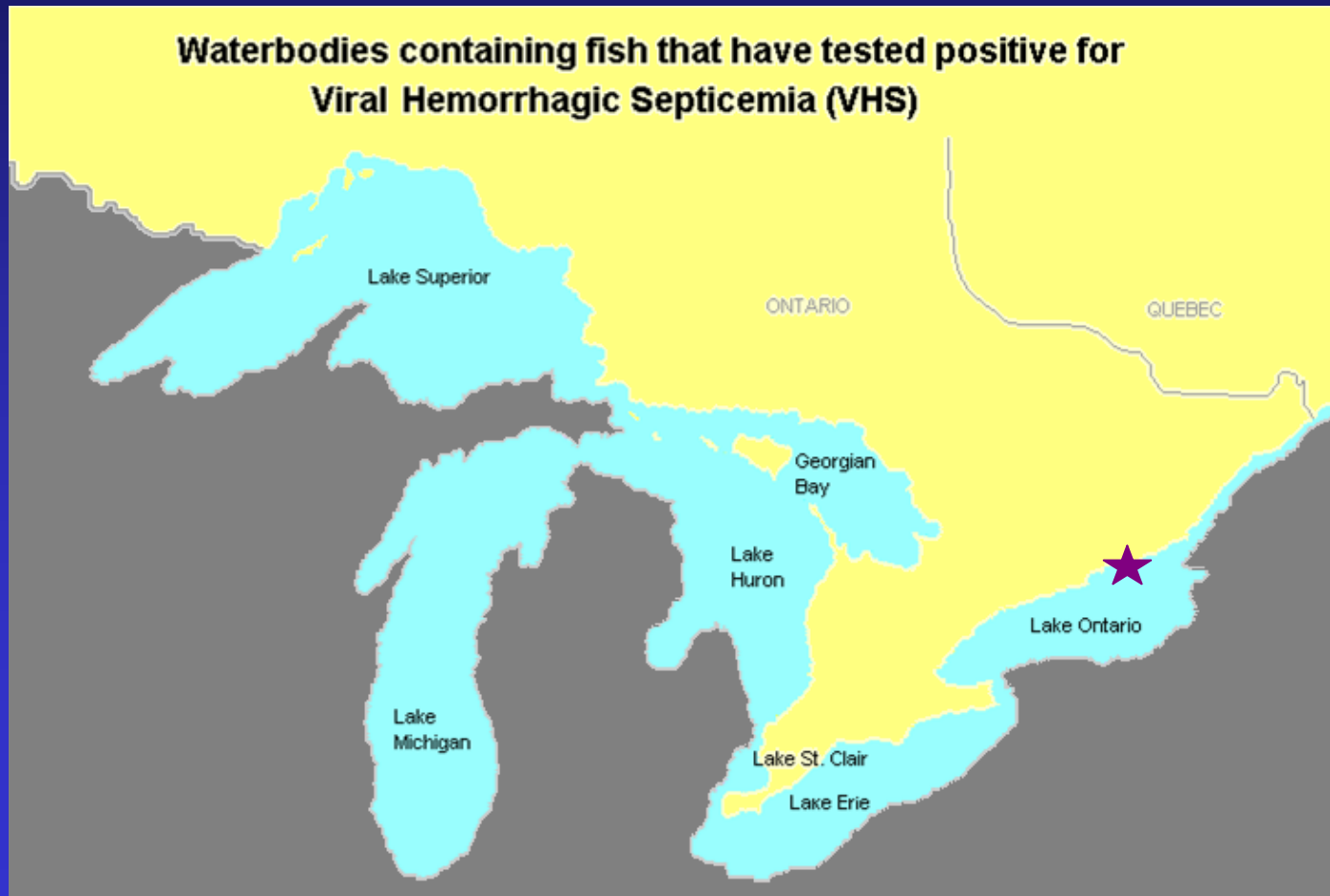
1 North American strain

- estuarine and marine waters on both coasts
 - infects Atlantic salmon, and other species
 - infects Pacific herring on west coast
 - thought to regulate population
- abundance in wild herring

VHS strains

First reported in Great Lakes in 2005

- large die-off of freshwater drum (sheepshead)

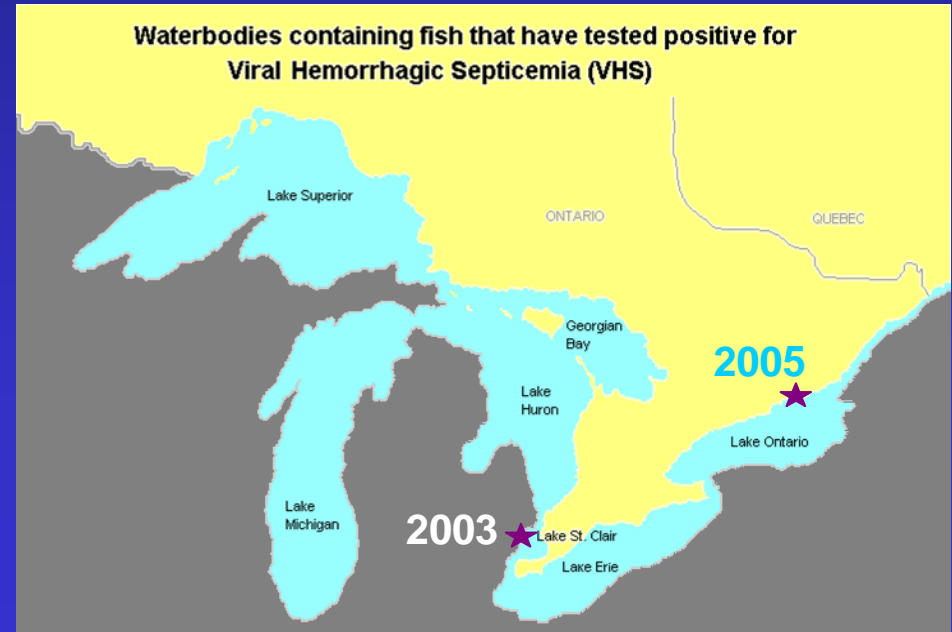


Road Map for Today's Talk

- A. What is VHS?
- B. VHS, an invasive virus
- C. Impacts and spread**
- D. Summary

Spread of VHS in the Great Lakes

- **Initial colonization?**
 - **unknown virus collected in 2003**
 - was Great Lakes strain of VHS
 - **Great Lakes strain similar to Atlantic strain**
 - **How, when VHS got to Great Lakes is unknown**



Spread of VHS in the Great Lakes

- **Initial disease outbreak**

- reports of die-offs in several species

2005 - Lake Ontario freshwater drum: spring

2006 - Lake Erie freshwater drum: April

- Lake St. Clair muskellunge, gizzard shad: April

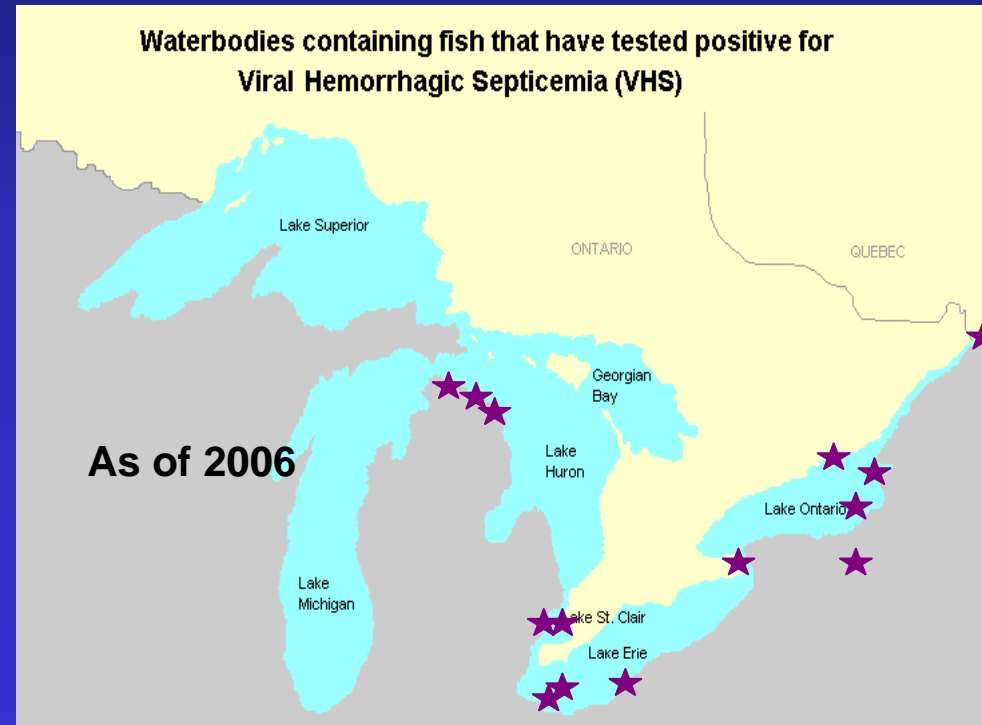
- St. Lawrence River round goby: May

- Lake Ontario/St. Lawrence River round goby,
freshwater drum: May

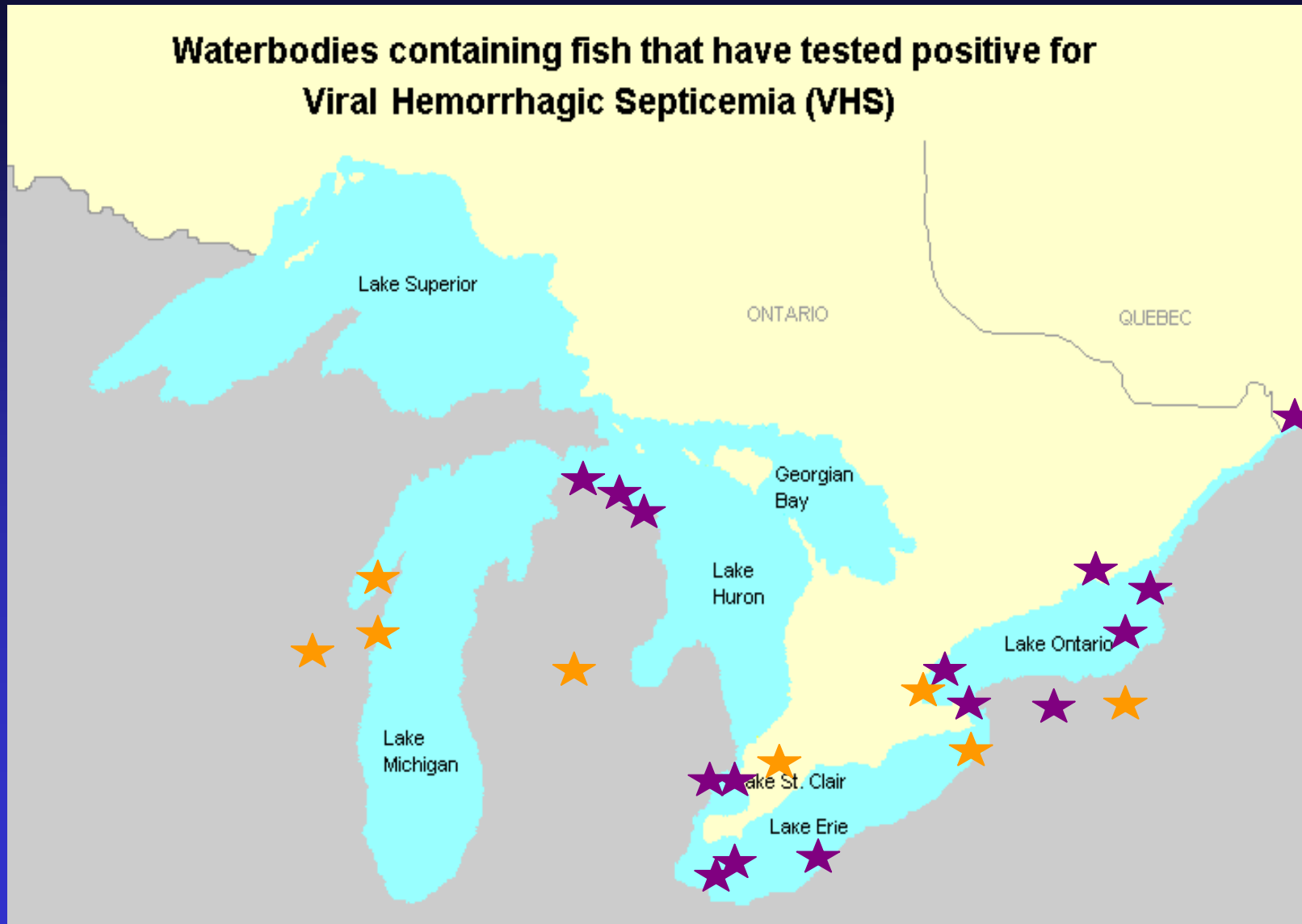
- Lake Erie freshwater drum, yellow perch: June

Impacts of VHS in the Great Lakes

- **Population adjustment?**
 - too soon to know
 - large visible die-offs can occur but impact on abundance is not well known
 - Some species serve as carriers
 - annual die-offs ?



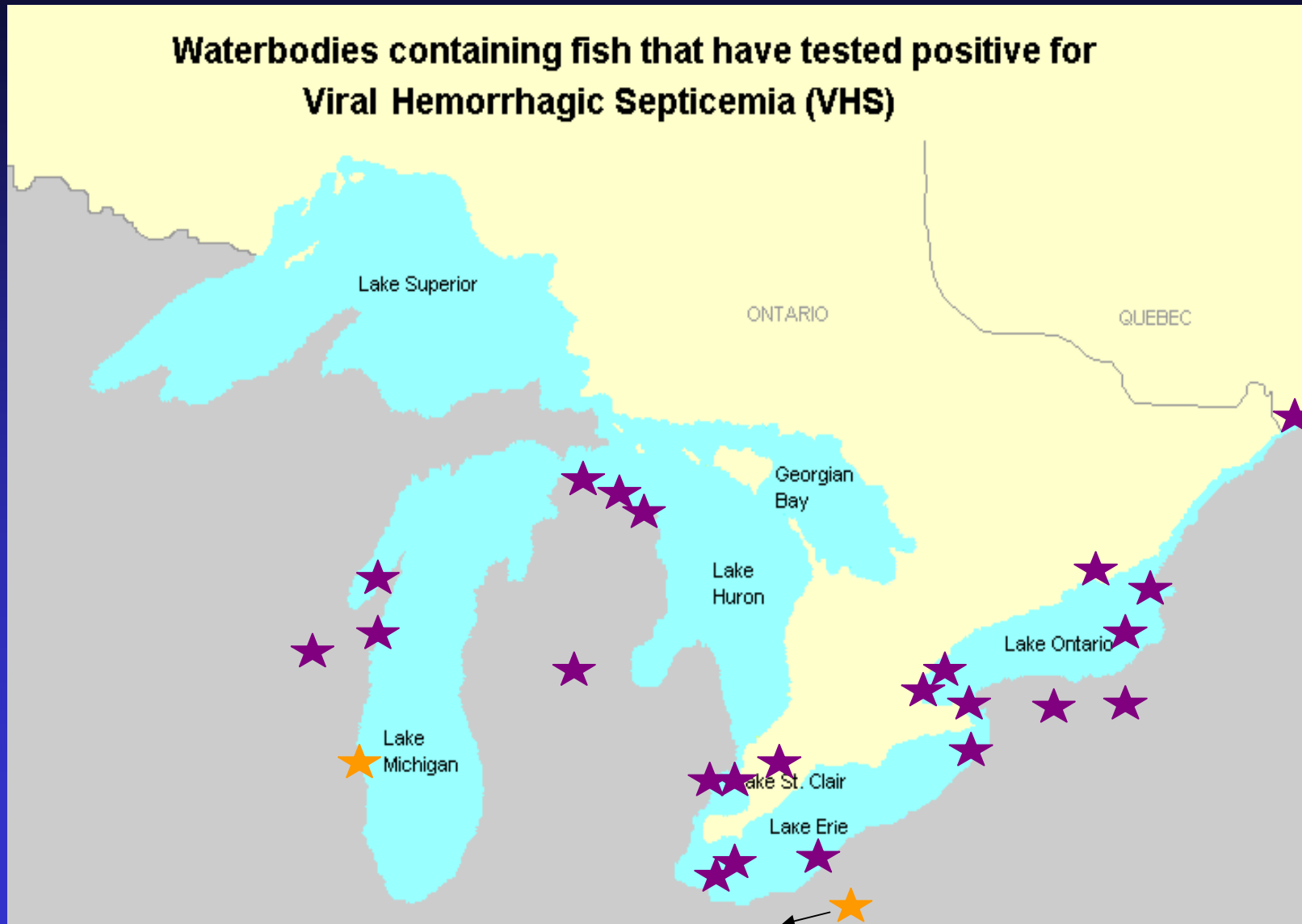
VHS Detections through 2007



Appearances of VHS in 2008

- **Lake Michigan (MKE), round goby: May**
- **Lake Michigan (MKE), yellow perch: June**
- **Clear Fork Reservoir, OH, muskellunge: April**
 - **First report outside of the Great Lakes Basin**

VHS Detections to Date



Road Map for Today's Talk

- A. What is VHS?
- B. VHS, an invasive virus
- C. Impacts and spread
- D. Summary**

Current Status of VHS

- **Present in the Great Lakes since at least 2003**
- **Discovered in Lake Michigan in 2007**
 - **Major die-offs of round goby in 2008**
- **Discovered beyond the Great Lakes in 2007**
 - **e.g., Lake Winnebago, WI; Budd Lake, MI**
- **Discovered beyond Great Lakes Basin in 2008**
 - **e.g., Clear Fork Reservoir, OH**

AIS AND VHS

ISSUE	NEED	AIS	VHS
Multiple Vectors for introduction/transportation	Must address all	✓	✓
Impact—economic, ecological, disruption of normal activities	Wide-reaching	✓	✓
Consistent and Enforceable Regulations	Badly needed	✓	✓
Prevention	Paramount	✓	✓
Stakeholders	Very important at all levels	✓	✓

Regulation of Activities: Asian Carp (OLD)

	SILVER	BLACK	BIGHEAD	GRASS	
				DIPLOID	TRIPLOID
ILLINOIS	All activities permitted except for aquaculture purposes	All activities permitted except for aquaculture purposes	All activities permitted except for aquaculture purposes	All activities permitted except for aquaculture purposes	All activities permitted except for aquaculture purposes
INDIANA	All activities banned	All activities banned	All activities banned	All activities banned	may be cultured & sold with permit & reporting requirements
MICHIGAN	All activities banned	All activities banned	All activities banned	All activities banned	All activities banned
MINNESOTA	All activities banned	All activities banned	All activities banned	All activities banned	All activities banned
OHIO	All activities banned	All activities banned	All activities banned	All activities banned	May be imported and sold with permit from Chief, Ohio Div of Wildlife
PENNSYLVANIA	All activities permitted except importation	All activities permitted except importation	All activities permitted except importation	All activities permitted except importation	All activities permitted except importation
NEW YORK	All activities permitted	All activities permitted	All activities permitted	All activities banned	certified triploid can be cultured in waters (permit req'd) no lgr than 5 acres with no in- or outlet
WISCONSIN	All activities permitted except possession*, importation regulated**	All activities permitted except possession*, importation regulated**	All activities permitted except possession*, importation regulated**	All activities permitted except possession*, importation regulated**	All activities permitted except possession*, importation regulated**
ONTARIO	All activities permitted except culture	All activities permitted except culture	All activities permitted except culture	All activities permitted except culture	All activities permitted except culture

Listed as a game fish, therefore possession is prohibited

**Importation of ANY fish requires a permit from the Dept. of Agriculture; importation of any NONNATIVE fish requires an additional permit from the DNR

Regulation of Activities: Asian Carp (CURRENT)

	SILVER	BLACK	BIGHEAD	GRASS	
				DIPLOID	TRIPLOID
ILLINOIS	All activities banned	All activities banned	All activities banned	All activities permitted except for aquaculture purposes	All activities permitted except for aquaculture purposes
INDIANA	All activities banned	All activities banned	All activities banned	All activities banned	may be cultured and sold with permit and reporting reqs
MICHIGAN	All activities banned	All activities banned	All activities banned	All activities banned	All activities banned
MINNESOTA	All activities banned	All activities banned	All activities banned	All activities banned	All activities banned
OHIO	All activities banned	All activities banned	All activities banned	All activities banned	may be imported and sold with permit from Chief, Ohio Div of Wildlife
PENNSYLVANIA	All activities banned	All activities banned	All activities banned	All activities permitted except importation	All activities permitted except importation
NEW YORK	All activities banned	All activities banned	All activities banned except in 5 boroughs of NYC; must be killed upon point of sale	All activities banned	certified triploid can be cultured in waters (permit req'd) no lgr than 5 acres with no in- or outlet
WISCONSIN	possession ¹ prohibited, transportation ² and importation ³ regulated	possession ¹ prohibited, transportation ² and importation ³ regulated	possession ¹ prohibited, transportation ² and importation ³ regulated	possession ¹ prohibited, transportation ² and importation ³ regulated	possession ¹ prohibited, transportation ² and importation ³ regulated
ONTARIO	Live sale, culture and possession banned	Live sale, culture and possession banned	Live sale, culture and possession banned	Live sale, culture and possession banned	Live sale, culture and possession banned

¹Listed as a game fish, therefore possession is prohibited; ²No live rough fish except goldfish, dace and suckers may be transported into or within the state without a permit from the department (29.407(4)); ³Importation of ANY fish requires a permit from the Dept. of Agriculture, Importation of a nonnative fish species requires an additional permit from the DNR.

Implications for the Future

- **Humans facilitate movement of VHS**
 - **Baitfish movement, recreational boating, and ballast water are possible vectors**
- **Precautions are needed**
 - **Education and outreach**
 - **Develop consistent regulatory framework**
 - **Communication among groups**
- **Must develop comprehensive legislation to stop future invaders**