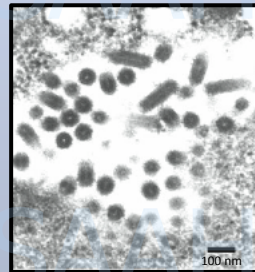


Results of 2009 Surveillance Efforts for Viral Hemorrhagic Septicemia Virus in Lake Ontario and Lake Superior

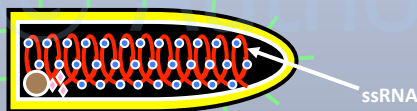
Emily R. Cornwell, Geoffrey E. Eckerlin, Rodman G. Getchell, Geoffrey H. Grocock, Tarin M. Thompson, William N. Batts, Gael Kurath, James R. Winton, Paul R. Bowser, Mark B. Bain and James W. Casey.

An introduction to VHSV

- Family: *Rhabdoviridae* (e.g. rabies)
- Genus: *Novirhabdovirus*
- Bullet shaped, enveloped particle
- Genome: ssRNA, ~ 11 kb



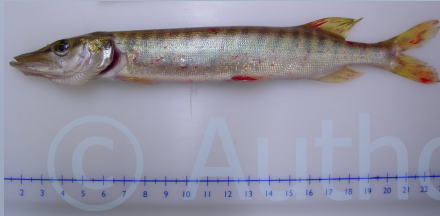
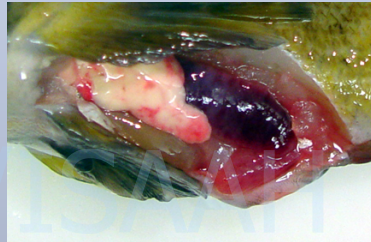
Elsayed et al, 2006



VHSV leads to hemorrhagic disease

Clinical signs :

- Severe hemorrhaging
- Distended visceral cavity
- Exophthalmia
- Erratic swimming behavior



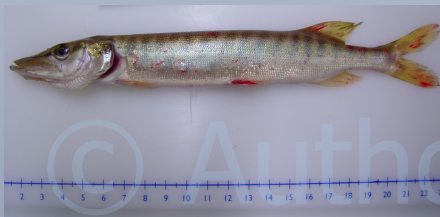
VHSV leads to hemorrhagic disease

Clinical signs:

- Severe hemorrhaging
- Distended visceral cavity
- Exophthalmia
- Erratic swimming behavior

Susceptibility :

- Species susceptibility varies
- Seasonality: March to May
- Broad host range: 28 species according to USDA APHIS





A brief history of VHSV in the Great Lakes



www.coastwatch.msu.edu

A brief history of VHSV in the Great Lakes



A brief history of VHSV in the Great Lakes

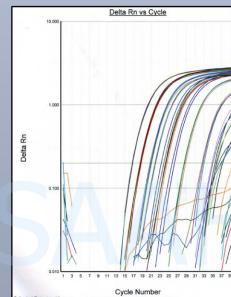
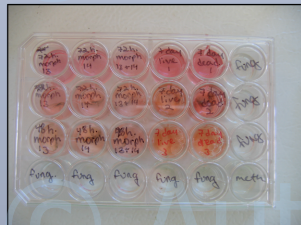


A brief history of VHSV in the Great Lakes



Methods of detecting VHSV

1. Cell culture :
 - Detects **replicating** virus
 - Method approved by OIE
 - Time to results can be long
 - Less sensitive
2. qRT-PCR :
 - Detects **viral RNA**
 - Rapid results
 - Very sensitive
 - No way to tell if detected RNA comes from viable virus



Previous surveillance efforts in NY State

- Detecting apparent prevalence – a snapshot in time
- 2006 “Healthy Fish” survey
 - Sampled healthy fish during a mortality event of round goby
 - Apparent prevalence of 9% (cell culture)
 - Not significantly different by qRT-PCR
- 2008 Eastern Great Lakes survey
 - Sampled healthy fish in the absence of reported mortality events in Lake Ontario, Erie, and Huron
 - Apparent prevalence of 5% (qRT-PCR)

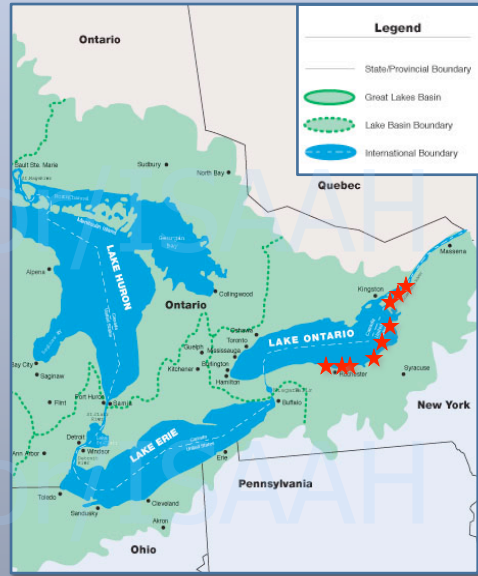
Major questions for Lake Ontario surveillance effort in 2009

1. What is the distribution and prevalence of VHSV in Lake Ontario and the St. Lawrence River
2. Is there a difference in prevalence between yellow perch and round goby?
3. What factors influence disease in yellow perch and round goby?



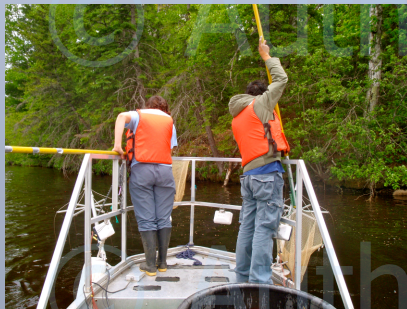
2009 Survey design – Lake Ontario

- 2010 fish sampled
 - Focused on round goby and yellow perch
 - Approx. 60 of each species collected per site
 - Recorded physical characteristics of site, and fish
- 10 L of water from each site tested for VHSV



Major Questions for Lake Superior Sampling

1. Is there evidence for the presence of VHSV in Lake Superior in fish or water?



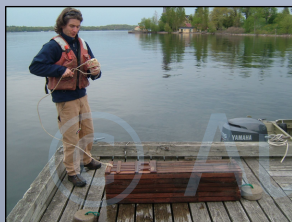
2009 Survey design – Lake Superior

- 847 fish sampled
 - Few round goby and yellow perch
 - Approx. 120 fish per site
 - Recorded physical characteristics of site, and fish
- 10 L of water from each site tested for VHSV

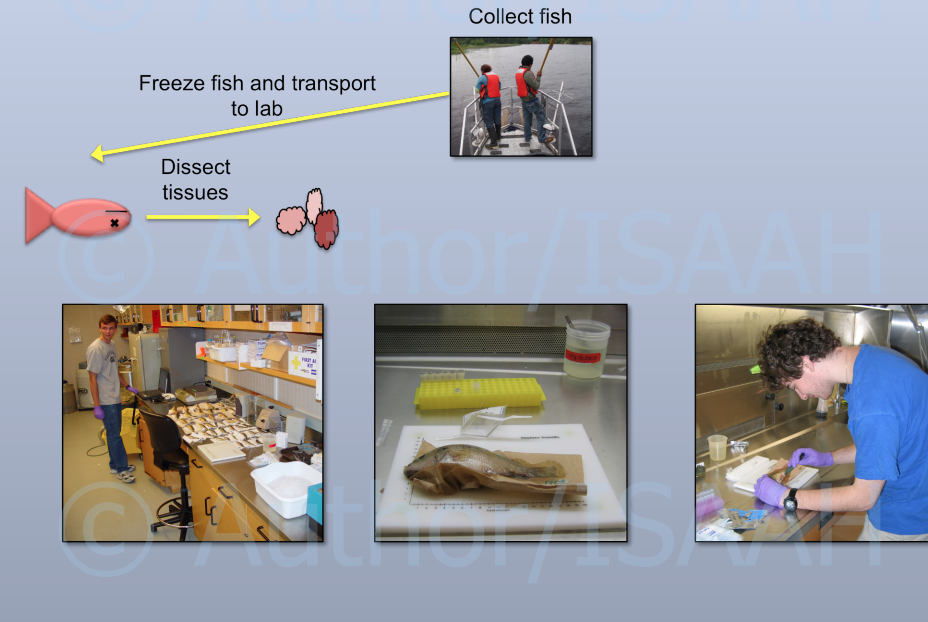


Survey method

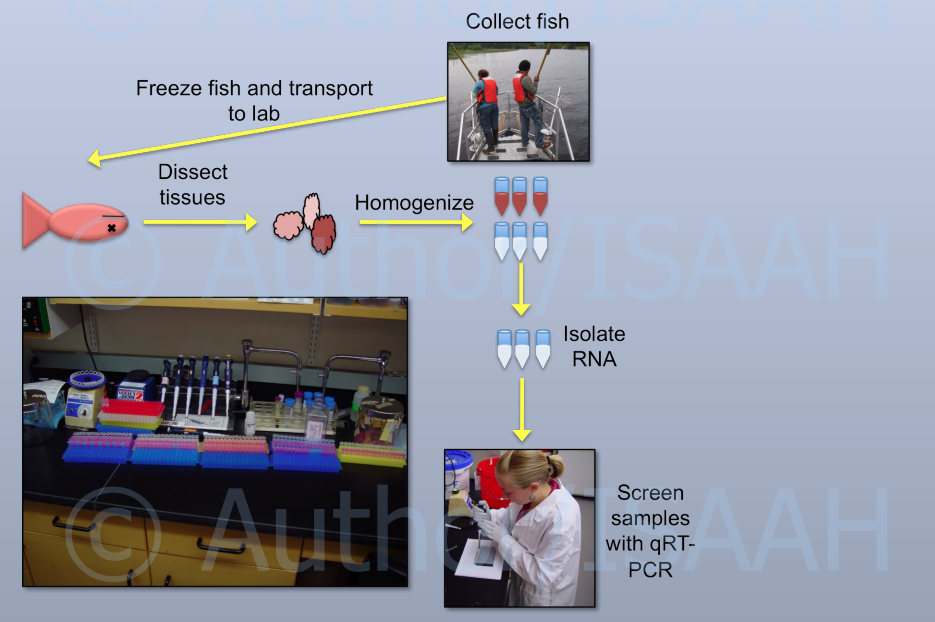
Collect fish



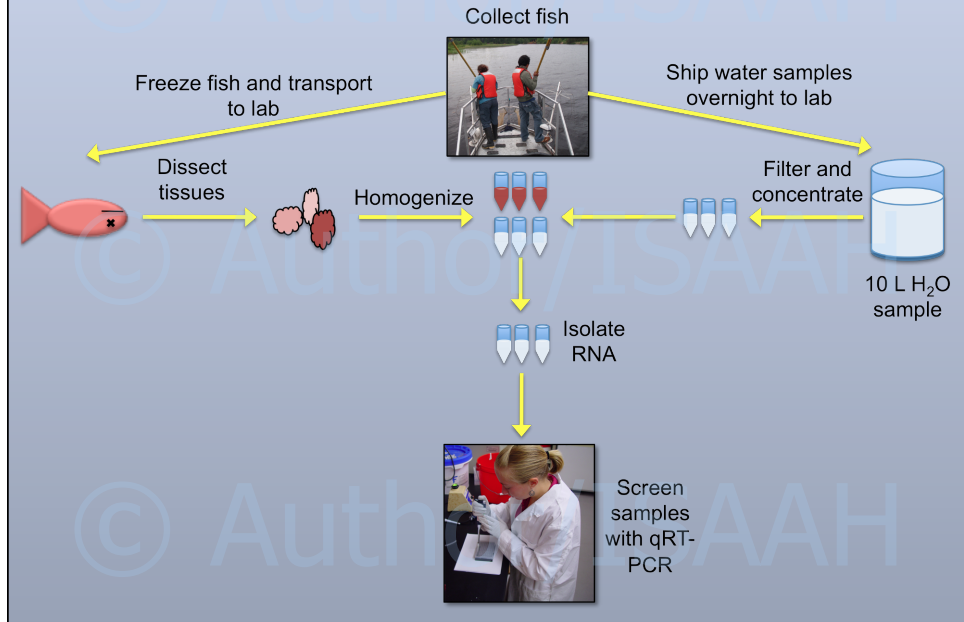
Survey method



Survey Method

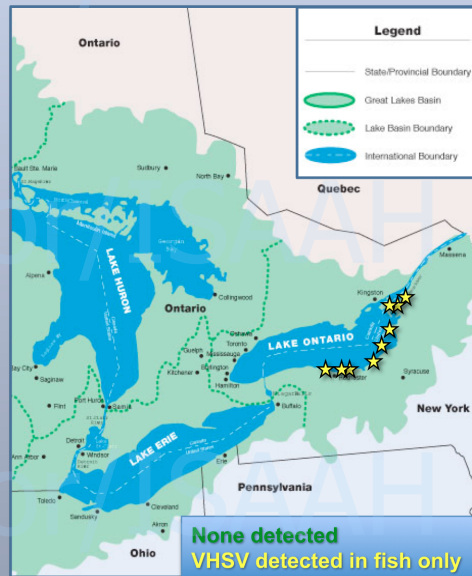


Survey Method



VHSV positive fish found at every site sampled in Lake Ontario and the St. Lawrence

- 382 fish tested positive for VHSV
- Positive fish found at every site
- No virus detected in water samples
- Apparent prevalence 19%



Species collected by site in Lake Ontario

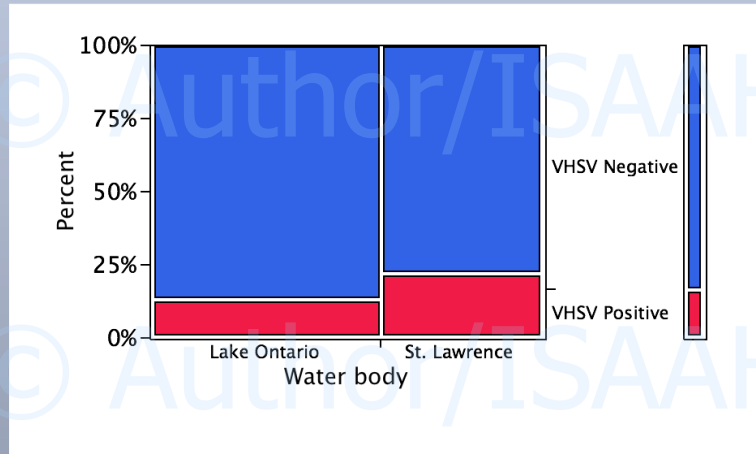
Species	Site									Species total
	1	2	3	4	5	6	7	8	9	
Alewife	0	0	0	0	0	1	0	0	0	1
Bluegill	0	0	0	19	0	19	0	0	0	38
Largemouth bass	0	0	0	0	0	1	0	0	0	1
Pumpkinseed	0	20	0	0	0	44	0	0	0	64
Rock bass	0	0	15	8	0	11	11	0	0	45
Round goby	19	38	13	313	125	62	37	53	80	740
Smallmouth bass	43	0	36	40	41	0	49	29	0	238
Yellow Perch	104	127	154	61	116	38	58	43	182	883
Total	166	185	218	441	282	176	155	125	262	2010

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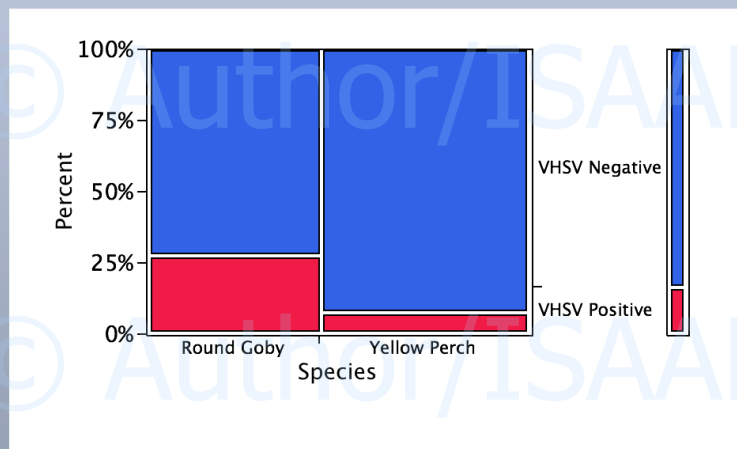
Water body affects disease status in round goby and yellow perch

- Fisher's Exact Test $p < 0.0001$
- Relative Risk: 1.7 (95% CI: 1.4, 2.1)



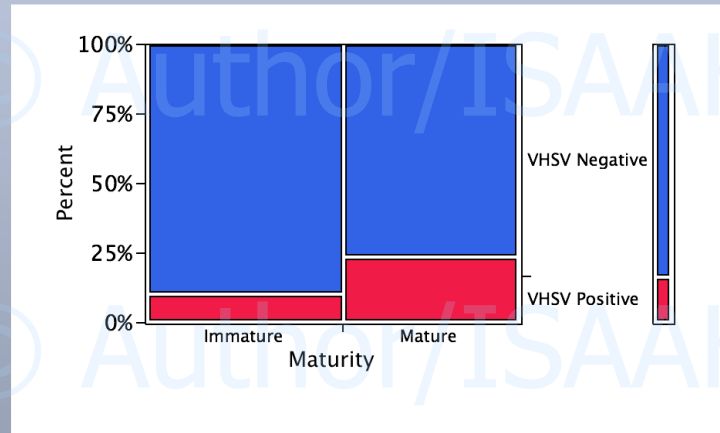
Higher prevalence of VHSV in round gobies compared to yellow perch

- Fisher's exact test $p < 0.001$
- Relative risk: 3.7 (95% CI: 2.9, 4.8)

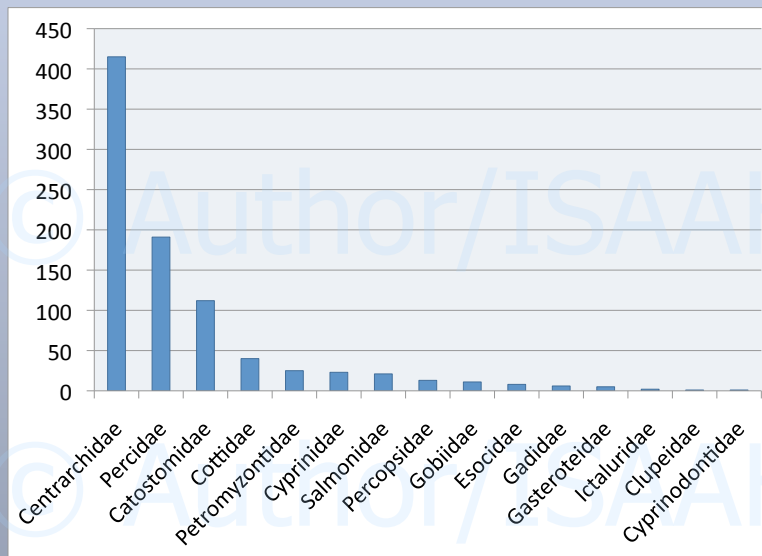


Maturity affects disease status in round goby and yellow perch

- Fisher's exact test: $p < 0.0001$
- Relative risk: 2.4 (95% CI: 1.6, 3.0)



Overview of families collected in Lake Superior

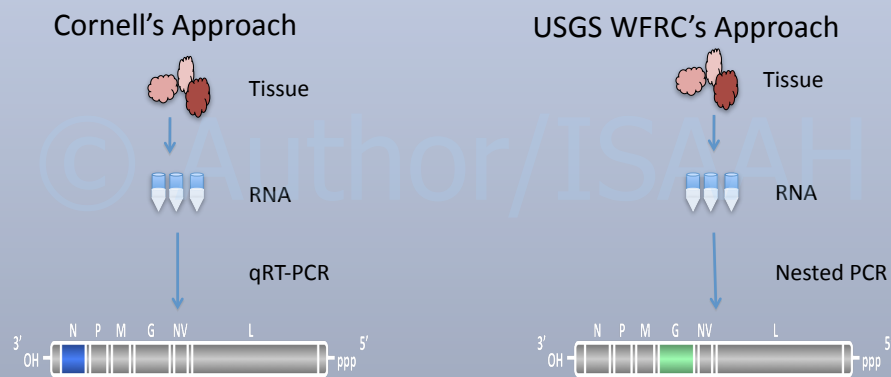


First detection of VHSV in Lake Superior



- Positive fish found in 4 sites
- No virus detected in water samples
- Presence of virus in fish from Paradise, MI independently confirmed by USGS WFRC Seattle.

Independent confirmation of qRT-PCR positive samples



Two separate molecular techniques in a water body connected to a known infected area meets the OIE requirements for confirmation of VHSV as of 2009.

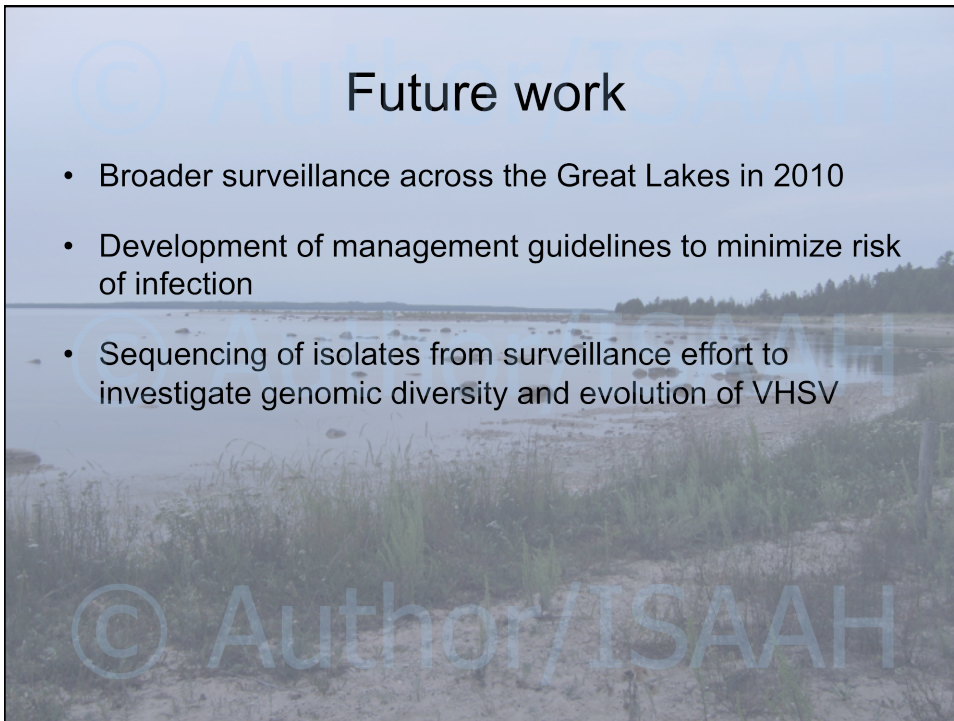
Conclusions from the 2009 VHSV Surveillance

- VHSV is present in Lake Superior
- VHSV is still present in Lake Ontario and the St. Lawrence River, even in the absence of reported mortality events
- Prevalence in round goby is higher than the prevalence in yellow perch
- Maturity and water body affect prevalence in round goby and yellow perch.



Future work

- Broader surveillance across the Great Lakes in 2010
- Development of management guidelines to minimize risk of infection
- Sequencing of isolates from surveillance effort to investigate genomic diversity and evolution of VHSV



Acknowledgements

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USDA APHIS

