

VHS (Viral Hemorrhagic Septicemia): A Threat to Sustainable Fisheries and NY Sea Grant's Research/Extension Responses

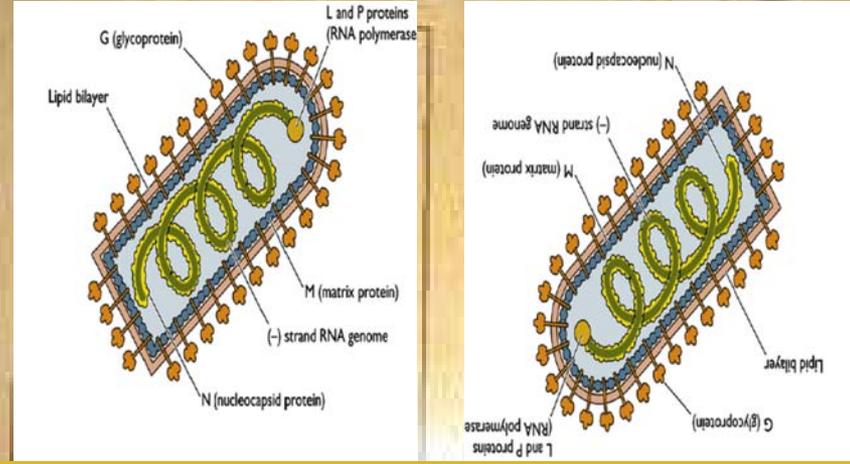


Dave MacNeill, New York Sea Grant
Dr. Paul Bowser, Cornell University
Dr James Casey, Cornell University

Great Lakes Ecosystem Management: 101



WANTED IN 5 STATES



VHS Virus type IVb

PUBLIC ENEMY NUMBER ONE!

The Attorney General of the U.S. has authorized a
\$20,000 REWARD!

For information leading to the arrest of VHSV type IVb

VHS: why is it an issue ?

- **VHS: the disease**

- “The most serious fish health threat in North America”
- Species and range expansion.
- Fish mortalities: GL Basin & globally (4 genotype groups)
- Economic / fisheries impacts?
- Policy implications: polarizing
- Media: “**Ebola virus of fish**” – Anonymous

VHSv: the virus (genotype IV)

- Type IVb: new fresh water genotype in GL.
- Type IVa: mortalities in Pacific NW, now in NW Atlantic.
- Dynamics of marine/freshwater forms not well-understood.

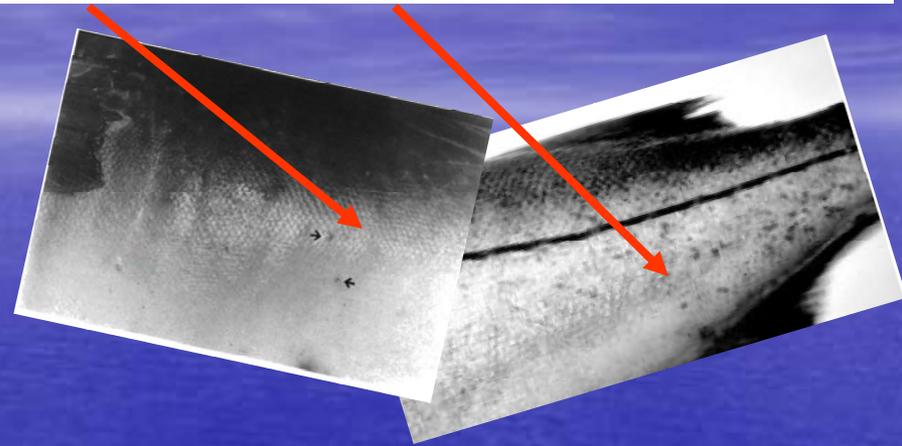


VHS: why is it an issue ?



Pacific "herrings" mortalities Type IVa

European Cod & Haddock lesions Type III?



2 NW Atlantic species: Tested Type IVa positive:



Striped Bass



Atlantic herring

Research and Extension Expertise

- **Cornell University**
- **Department of Veterinary Medicine**
- **Fish Health Laboratory**
 - **Fish pathology**
 - **Disease diagnostics**
- **New York Sea Grant:**
 - **GL fisheries sustainability.**
 - **Food web/ecosystem dynamics.**
 - **Ecosystem uncertainties.**
 - **Conflict management.**
 - **Sponsored research.**



Dr. Paul Bowser

Dr. Jim Casey

Red Sox cap.



Dave MacNeill

Viral Hemorrhagic Septicemia

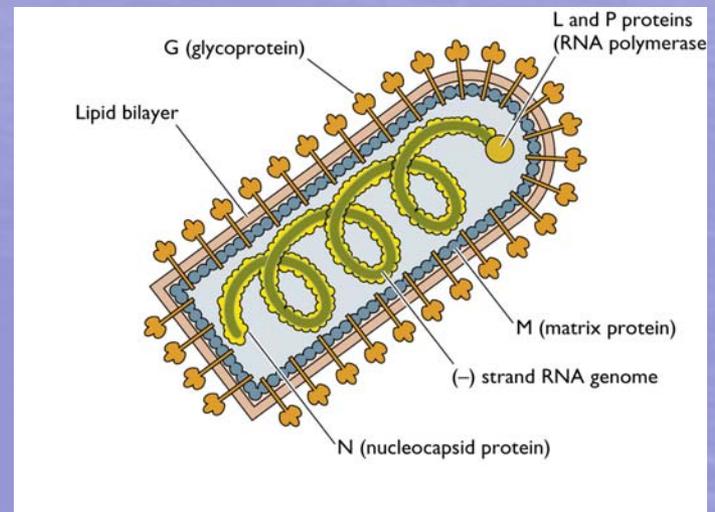


Photo: USFWS

Viral Hemorrhagic Septicemia

- **What is it?**

- The most serious fish disease world-wide
- OIE reportable pathogen
- Caused by a virus
- No treatment
- Rhabdovirus (RNA virus)
- Broad host (fish) range



History

- 1988-89
- Returning chinook and coho salmon found to harbor VHSV
- PANIC!
- Subsequent finding in marine fish species



Columbia River goes to the Hagerman Valley of Idaho where 80% of commercially reared rainbow trout are located in the US.

www.mstp.washington.edu

History

- Known in Europe since the 1930's
 - Most serious disease of fw reared rainbow trout
 - Viral etiology proven in 1960's
-
- VHSV now thought to historically be a disease of marine fish
 - Entered the fw culture environment



VHSV Genotypes

- **Genotype I**
 - Europe
- **Genotype II**
 - Europe
- **Genotype III**
 - Europe
- **Genotype IV**
 - North America, Japan, Korea (marine fish) (IVa)
 - North America – Great Lakes (freshwater) (IVb)

Why is this Important?



**Economic
Value of Sport
Fishing in the
Great Lakes
Basin:
\$4.2 Billion/yr**

What can we do now?

- **Understand the pathogen**
 - Host fish range
 - Variability in ability to infect and cause disease by species
 - Vertical transmission
- **Surveillance**
 - Where it is
- **Prevention**
 - Effective means of control

The Current Federal List of Regulated Fish Species

September 9, 2008

Species regulated by title 9 CFR Parts 83.1 through 83.7, 93.900 and 93.910 through 93.916 (the Viral Hemorrhagic Septicemia (VHS) Interim Rule)

The United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS) has identified the following species as having originated in freshwater locations in the United States and/or Canada, and as having been infected by VHS virus under natural (i.e. non-experimental) conditions of exposure; and from which VHS virus has been isolated by cell culture, with confirmation of strain identity through molecular detection. Anadromous fish species that have migrated into freshwater and from which VHS strain type IV(a) is isolated are excluded from this definition.

For regulatory purposes, presence of the viral pathogen and clinical expression of disease caused by the virus are considered synonymous.

Black crappie	<i>Pomoxis nigromaculatus</i>
Bluegill	<i>Lepomis macrochirus</i>
Bluntnose minnow	<i>Pimephales notatus</i>
Brown bullhead	<i>Amieurus nebulosus</i>
Brown trout	<i>Salmo trutta</i>
Burbot	<i>Lota lota</i>
Channel catfish	<i>Ictalurus punctatus</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Emerald shiner	<i>Notropis atherinoides</i>
Freshwater drum	<i>Aplodinotus grunniens</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Lake whitefish	<i>Coregonus clupeaformis</i>
Largemouth bass	<i>Micropterus salmoides</i>
Muskellunge	<i>Esox masquinongy</i>
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>
Northern Pike	<i>Esox lucius</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Rock bass	<i>Ambloplites rupestris</i>
Round goby	<i>Neogobius melanostomus</i>
Silver redhorse	<i>Moxostoma anisurum</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Spottail shiner	<i>Notropis hudsonius</i>
Trout-Perch	<i>Percopsis omiscomaycus</i>
Walleye	<i>Sander vitreus</i>
White bass	<i>Morone chrysops</i>
White perch	<i>Morone americana</i>
Yellow perch	<i>Perca flavescens</i>

N = 28

VHSV Cell Culture Isolation and Confirmation

Bluegill	Chinook Salmon	Redhorse Sucker
Rockbass	Brown Trout	White Sucker
Black Crappie	Rainbow Trout	
Pumpkinseed		Freshwater Drum
Smallmouth Bass	Channel Catfish	
Largemouth Bass	Brown Bullhead	Round Goby
Muskellunge	White Perch	Lake Whitefish
Northern Pike	White Bass	
		Gizzard Shad
Walleye	Emerald Shiner	
Yellow Perch	Bluntnose Minnow	Burbot
	Spottail Shiner	
Trout-Perch		N = 28 species
		(9 Sept 2008)

VHSV – 2005, 2006, 2007, 2008



Source: www.coastwatch.msu.edu

Seasonality

- NY Sea Grant – Funded Project
- Cornell and Thousand Island Biological Station (SUNY ESF)

Smallmouth Bass – St Lawrence River
Virus most prevalent in the spring

Critical Finding:

Surveillance in the Spring

Egg Disinfection -- VSHV

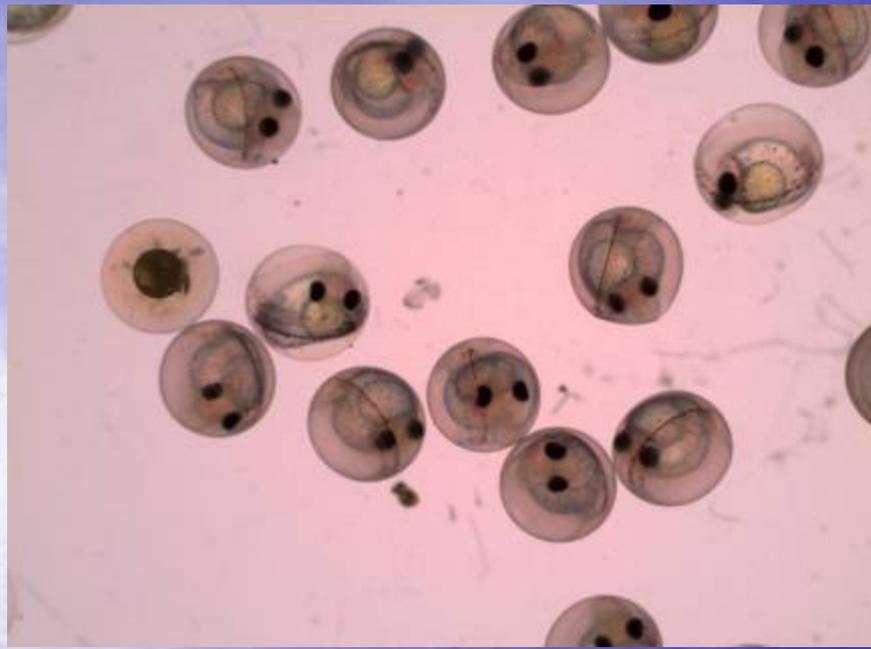
- **Current NY Sea Grant – Funded Project**
- **Implications for fish culture**
- **Does disinfection with Iodophore really work**
- **European Literature**
- **We propose to use the qRT-PCR as the assay**

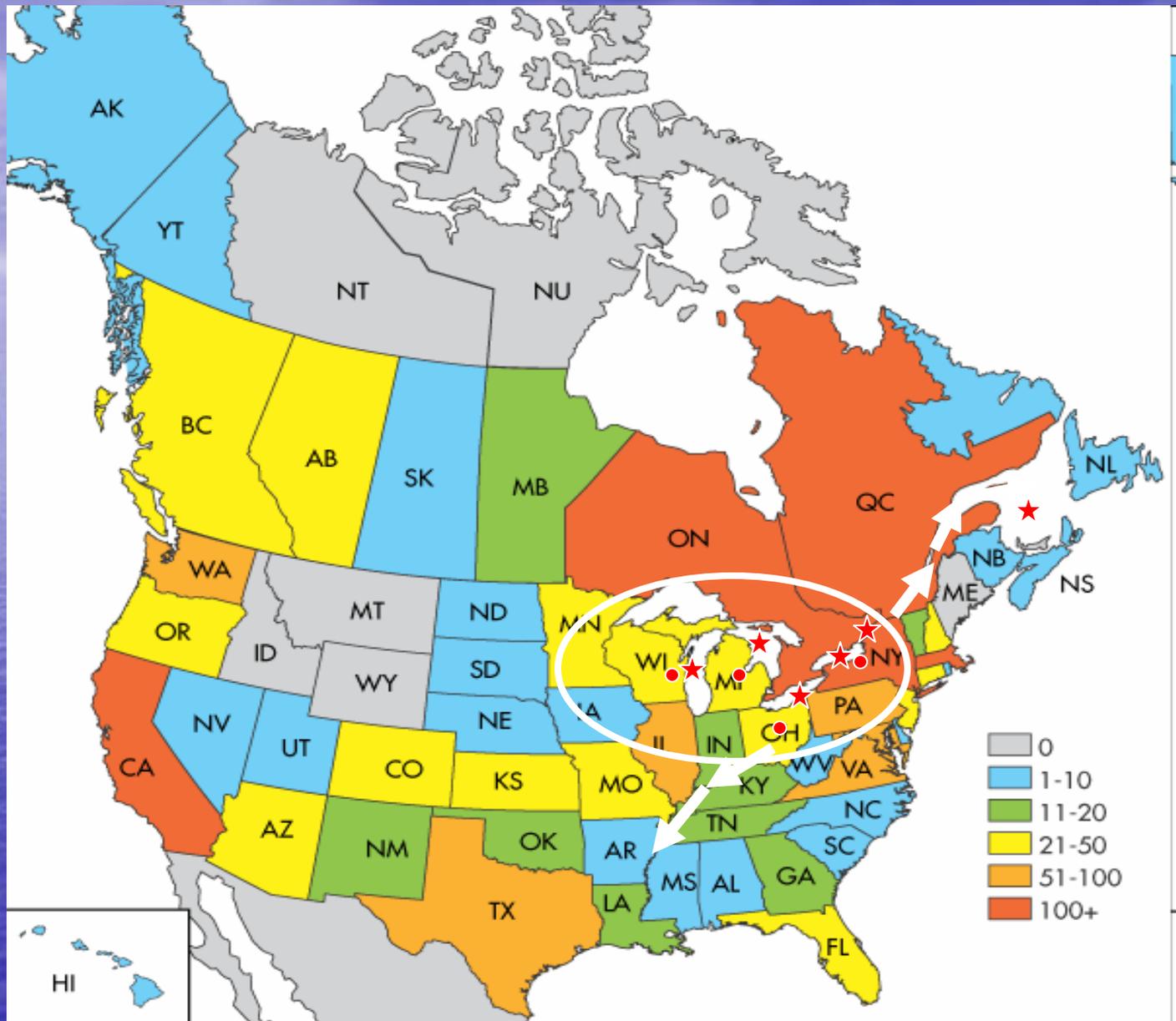


Experimental Egg Hatching Jar System



Eggs Hatching – 8 May 2009





QUESTIONS



Dunkirk Harbor, NY – Lake Erie

Photo: A. Noyes, NYS DEC

NY Sea Grant's Extension Responses to VHS

- 1. *Technical information source:*** user groups, extension professionals and elected officials. CD of 300+ international papers
- 2. *Intermediary:*** policy issues between APHIS USDA, elected officials and the public.
- 3. *Advisor/participant:*** 2008-09 APHIS National VHS Outreach Committee , outreach co-adviser (National Educational Alliance)
- 4. *Public Hearings:*** sponsored by NYS Assembly AIS and Fish Pathogens with Cornell University
- 5. *Organizer:*** Joint RI (Dave Beutel)/NY Sea Grant/Cornell VHS Workshop for Atlantic State audiences.
- 6. *Facilitator: Cornell Study: stakeholder perceptions, knowledge and behaviors.***
- 7. *Outreach coordinator :*** NRAC Applied Research and Outreach Project with Dr. Paul Bowser and Dr. Jim Casey (**in progress**) .



And now, the punch line(s).....

- **VHS: a serious, contentious and unique issue:**
 - Fisheries sustainability and uncertainty
 - Bridges Marine and Great Lakes Sea Grant Networks.
 - Necessitates multiregional research/extension collaborations.
 - Important human dimensions/policy implications.
- **Effectively demonstrates “the Sea Grant Model”:**
 - Timely, objective, research-based information to user groups.
 - Effective collaboration between research and extension.
 - Importance/efficacy of Sea Grant’s role in coastal issues.
 - Importance of proactive (vs. reactive) research & extension.

The Next Steps.....

- **Sea Grant Information Workshops:**
 - Fish diseases 101
 - VHS and other pathogens of concern
- **Research:**
 - ID transmission vectors.
 - Vulnerability/potential impacts:
 - Atlantic herring
 - striped bass
 - “river herring” (alewife, blueback)
 - Atlantic salmon, hake, haddock, cod in NW Atlantic.
 - Food web effects:
 - pinnepeds,
 - cetaceans,
 - sea birds,
 - predatory fish.



Thank you, any questions??