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Cornell experts: Virus flows into Lake Superior



Recently completed testing has identified the presence of Viral Hemorrhagic Septicemia Virus (VHSV) in fish that were taken from Lake Superior. The findings were made by collaborating laboratories at Cornell University's College of Veterinary Medicine and the USGS Western Fisheries Research Center, Seattle, Washington. The Cornell investigators involved in survey design, collections and evaluation of the samples using a highly sensitive technique, referred to as qRT-PCR, are graduate student Emily Cornwell and collaborating graduate student Geof Eckerlin, Drs. Mark Bain, Paul R. Bowser and James W. Casey. Investigators at USGS Western Fisheries Research Center, Seattle, Washington, who confirmed the presence of the virus by testing of the same samples with a different method and for genetic typing of the virus are Drs. Gael Kurath and James R. Winton.

Cornell investigators tested 874 fish collected from seven sites in Lake Superior. The 2009 work was funded with grants from the Cornell Agriculture Experiment Station (USDA Hatch funds) and USDA APHIS. Fish from four of seven sites; Paradise, MI; Skanee, MI; St. Louis, Bay, WI and Superior Bay, WI were found positive. To confirm the identification of VHSV by Cornell researchers who detected the presence of the viral N gene, tissue samples from the Paradise, MI site in Lake Superior were sent to the USGS Western Fisheries Research Center, in Seattle, WA, where an attempt to independently detect a different VHSV gene, the viral G gene, was successful. Tissues have also been sent to the USDA APHIS Veterinary Service's National Veterinary Service Laboratories, in Ames, IA. The 2009 work was an extension of 2007 and 2008 efforts with support from the Great Lakes Protection Fund in which Cornell investigators developed a surveillance protocol to detect VHSV in water and fish in Lake Ontario, Erie and Huron.

"The USDA APHIS Veterinary Service's National Veterinary Service Laboratories continues to test samples collected by Cornell University, but has not yet confirmed the findings," said Madelaine Fletcher, USDA/APHIS Public Affairs Specialist. "While USDA APHIS considers these findings evidence that VHS virus has been found in samples taken from wild fish populations in Lake Superior, the gold standard of virus isolation in cell culture has not been met, and thus we have not confirmed the findings. These findings will not lead to regulatory actions by USDA APHIS since the States bordering Lake Superior are already under the provisions of the VHS Federal Order, and these findings were from fish species already known to be susceptible to VHS. USDA APHIS recommends that susceptible wild fish populations from Lake Superior be considered in the same risk category for harboring VHS virus as those fish from the other Great Lakes."

VHSV is a significant emerging fish pathogen in the Great Lakes and neighboring waterways that, according to Dr. Paul Bowser, Professor of Aquatic Animal Medicine at Cornell, has reached epidemic proportions. VHSV causes hemorrhage and anemia (as well as other varied disease signs) in fish, has been identified in 28 freshwater fish species, and poses a potential threat to New York's sport-fishing industry, which has been estimated by the US Census Bureau to contribute \$1.4 billion annually to the economy of New York State.

"People come from all over the eastern United States to fish the Great Lakes," said Bowser, noting that the virus has also been found in a few inland waters, including lakes, streams, and a family-owned earthen pond. "The economy of many of these areas ebbs and flows based on the season and the perceived value of outdoor recreational opportunities. The value of these opportunities is dependent on how successful we are at managing the health of wild fish. On a world-wide basis, VHSV is considered one of the most serious pathogens of fish, because it kills so many fish, is not treatable, and infects a broad range of fish species."

The presence of VHSV in the Great Lakes basin was first reported in fish from Lake St. Clair, MI, and Lake Ontario, Canada, in 2005. Through the following years up to 2008, the virus had been documented in all of the Great Lakes with the exception of Lake Superior. In response to the identified VHSV invasion, USDA issued a federal order (USDA 2008) preventing transport of 28 species of susceptible fish within the Great Lakes watershed to limit the spread of this viral pathogen. Lake Superior was included in the federal order, even though no fish infected with the virus had been found and the Lake was thought to be disease-free. The possibility of spread of VHSV to Lake Superior was a valid concern due to the movement of both commercial ships and recreational boats from the lower Great Lakes – areas known to be VHSV positive.

So while no significant fish mortality events due to VHSV were observed in 2008 and 2009, the virus is still present in Great Lakes fish. "It is important to note that fish harboring VHSV sequences, showed no clinical signs of disease; essentially the infection was proceeding but no mortalities were observed," said Bowser. "This is important because it suggests that these infected fish may serve as a reservoir for the virus in the Great Lakes ecosystem. While we don't fully understand the reasons for the lack of recent mortality events, the potential presence or absence of concurrent stressors on the fish may be playing a role. Further, VHSV was isolated by cell culture in a few fish collected in 2008 where levels of VHSV sequences were high, attesting to the accuracy and sensitivity of current testing used at Cornell and the USGS Western Fisheries Research Center. In our 2009 work, VHSV sequences for two viral genes have been independently detected by two collaborating laboratories – Cornell and USGS. This strongly suggests that this virus has invaded Lake Superior."