



Viral hemorrhagic septicemia

APPENDIX 6: VIRAL HEMORRHAGIC SEPTICEMIA (VHSV, ONCORHYNCHUS 2 NOVIRHABDOVIRUS): A FISH-KILLING DISEASE CASE IN THE GREAT LAKES

THE DISCOVERY

The first case of viral hemorrhagic septicemia virus (VHSV) in live fish of the Great Lakes was in 2005 in the Bay of Quinte, Ontario. The identification of the disease prompted a retroactive analysis of fish specimens and led to the confirmation of VHSV in Muskellunge retrieved from Lake St. Claire, Michigan in 2003. Scientists conducted a genetic comparison of the Great Lakes strain against the four known genotypes and found that it was most similar to the Genotype IV, whose origin is marine waters of North America, Japan and Korea. However, the analysis revealed significant differences between the two strains, so scientists referred to the Great Lakes/St. Lawrence Seaway strain as Genotype IVb and its marine counterpart as Genotype IVa. The pathway of VHSV introduction into the greater Great Lakes waterways remains a point of debate. While the primary suspect is ballast water, the many alternative hypotheses proposed include overland transport of infected fish via human and non-human pathways, transfer of infected water, transfer via infected equipment, and natural migration of an infected marine fish into freshwater (Bain et al. 2010).

THE DAMAGE

Signs that fishes have contracted VHSV include hemorrhaging, swollen abdomen, and bulging eyes. This disease impacts a variety of important recreational species. The impact of the virus varies depending on the species and conditions—often most lethal in species that are stressed or contained in aquaculture facilities. Since its discovery in 2005, VHSV related fish kills have been noted in species like muskellunge, walleye, and whitefish, among others. Additionally, less severe die offs have also occurred in bluegill and smallmouth bass.

THE POLICY RESPONSE

Following the confirmation of VHSV in Great Lakes waters, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) utilized the authority delegated by the Animal Health Protection Act to issue a federal order prohibiting the importation of VHSV susceptible species fish from Ontario and Quebec. Additionally, the order prohibited the interstate movement of the same species of live fish from the following Great Lakes states: Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin. The order was superseded by an interim rule in 2008, but was repealed in 2014 after an analysis revealed that state level regulations were overlapping with those previously set forth by APHIS. At the state level, Great Lakes agencies responded by eliminating stocking of certain species from specific hatcheries; increasing VHSV testing in aquaculture and freshwater environments; and enacting legislation regarding VHSV testing and movement of baitfish.

ACTION TAKEN

VHSV prevention recommendations for the public were released, which include: draining, thoroughly cleaning, and drying boats, nets, and other equipment when moving between water bodies; disposing of unwanted fish parts or unused baitfish in the trash; and abstaining from moving live fish between water bodies. Aquaculture facilities are recommended to quarantine and disinfect all incoming fish and equipment, make efforts to reduce or eliminate stressful holding conditions, and introduce a Hazard Analysis and Critical Control Point (HAACP) plans. In aquaculture facilities, a VHSV outbreak is addressed with a quarantine, water flows are turned off, all equipment disinfected, and fish eliminated and properly disposed of. Infected water may be treated with UVC irradiation, treated with disinfectants, or given a heat treatment.

CURRENT STATUS

VHSV has been found in all of the Great Lakes and several inland lakes. However, large die offs only occurred in the years immediately following the discovery of VHSV, and the mortality events appear to have minimal long term effects on commercially and recreationally important fish species. VHSV outbreaks are now prevented within the hatchery system.

REFERENCE

Bain, M. B., E. R. Cornwell, K. M. Hope, G. E. Eckerlin, R. N. Casey, G. H. Groocock, R. G. Getchell, P. R. Bowser, J. R. Winton, and W. N. Batts. 2010. Distribution of an invasive aquatic pathogen (viral hemorrhagic septicemia virus) in the Great Lakes and its relationship to shipping. *PLOS ONE* **5**:e10156.

VHSV IVb induced fish. Great Lakes. Photo by USFWS. 2008.

