



Western Fisheries Research Center (WFRC)

## Western Fisheries Science News



Wild Pacific herring bait ball, photo taken in front of the Marrowstone Marine Field Station. Photo by USGS.

### Understanding Disease Outbreaks in Populations of Wild Marine Fishes

Pacific herring play an important role in marine ecosystems of the North Pacific Ocean. As a dominant member of the forage fish group, Pacific herring provide an essential source of food for larger fish, seabirds, and marine mammals. However, abundances of herring populations have changed dramatically in recent years, with population declines often occurring for unknown reasons. Many populations have experienced dramatic declines, such as the Cherry Point stock—the once-largest stock of Pacific herring in the Puget Sound—declining by over 90% since 1973. Causes of mortality and population fluctuations have been difficult to study, but direct and indirect death from infectious and parasitic diseases are believed to be important factors in some forage fish population declines.

In a recent [article](#) published in the *Canadian Journal of Fisheries and Aquatic Sciences*, researchers from WFRC's Marrowstone Marine Field Station, Fisheries and Oceans Canada, and WFRC's Seattle laboratory describe the principles underlying the epizootiology—the study and analysis of disease patterns, causes, and effects in animal populations—of a viral disease, viral hemorrhagic septicemia virus (VHSV), found in Pacific herring and other fishes throughout the North Pacific Ocean. Although VHSV, typically occurs at low levels in natural (Continued on page 2)

### Events

**USGS Scientist Travels to Oslo, Norway, to Serve as Outside Examiner to Ph.D. Defense:** On August 31, 2016, WFRC Scientist, Maureen Purcell, served as an outside examiner for a student's Ph.D. defense in Oslo, Norway. The student, from the Norwegian Life Sciences University, defended a dissertation examining infectious pancreatic necrosis virus, an important pathogen of Atlantic salmon. Dr. Purcell is a research microbiologist, and has studied many of the major viral, bacterial and parasitic pathogens of finfish in the western North America. For more information, contact Maureen Purcell, [mpurcell@usgs.gov](mailto:mpurcell@usgs.gov), 206-526-2052.

**USGS WFRC Participates in Feds Feed Families Campaign:** The WFRC recently participated in the 2016 Feds Feed Families Campaign by donating 681.5 pounds of non-perishable food, 8 pounds of perishable food, and \$1,200 dollars (allowing for purchase of 30,000 pounds of food). Donations were made to the Skamania County Food Bank (Stevenson, WA), FISH food bank (Hood River, OR), Port Townsend Food Bank (Port Townsend, WA), Klamath Falls Gospel Mission (Klamath Falls, OR), and Northwest Harvest Foods (Seattle, WA). Food banks across the country are facing severe shortages of food. Through this program we have been providing much-needed food support to neighbors, families, and communities across the nation. For more information, contact Amy Hansen, [achansen@usgs.gov](mailto:achansen@usgs.gov), 509-538-2911.

(Continued on page 2)

populations of Pacific herring and other marine fishes in the region, outbreaks of the resulting disease (VHS) periodically occur, often in association with observed fish kills.

The researchers identify the principles controlling the disease patterns of VHS in the North Pacific by combining the results of previously published field investigations and controlled laboratory studies (primarily involving Pacific herring) with previously unpublished observations of VHS in Pacific herring. A thorough understanding of these principles provides the basis for identifying risk factors that predispose certain marine fish populations to VHS disease outbreaks. These include the lack of population resistance, presence of chronic viral carriers in a population, profuse viral shedding by infected individuals, cool water temperatures, limited water circulation patterns, and social host behavioral patterns. Further, these principles are used to define the stages of the disease in Pacific herring, including the susceptible, enzootic (where infection prevalence and intensity are often below the limits of reasonable laboratory detection), disease amplification (where infection increases rapidly) and outbreak (often accompanied by host mortalities with high virus loads and active shedding). This is followed by recovery (mortality rate and virus load decline owing to an active host immune response), and refractory stages (characterized by little or no susceptibility and where viral clearance occurs in most VHS survivors).

Understanding these complex relationships will be useful for developing disease forecasting tools that assist in future population assessment. In addition to providing a foundation for assessing the potential risks of future VHS epizootics in Pacific herring, these principles provide insights into the disease patterns of VHS in other fish communities where susceptible species exist, such as Pacific sardines, Pacific sandlance, and other forage fishes in the Northeast Pacific.

To learn more about this research, contact Paul Hershberger at [phershberger@usgs.gov](mailto:phershberger@usgs.gov) or 360-385-1007 x225.

## Honors

### International Recognition for Historic Elwha River

**Restoration:** Collaborative work by the U.S. Department of the Interior (DOI) and the Lower Elwha Klallam Tribe to restore the Elwha River of Washington, USA, was honored during the awarding of the 2016 Thiess International Riverprize. The International River Foundation awards the Riverprize annually to support premier examples of river-restoration management. Research geologist Jonathan Warrick (USGS Pacific Coastal and Marine Science Center) and research ecologist Jeff Duda (WFRC) represented the DOI at the 2016 awards ceremony, held September 14, 2016, at the 19th International River Symposium in New Delhi, India. The [Elwha River Restoration Project](#) was recognized for its unprecedented approach to restoring salmon populations and other ecosystem elements through the largest dam removal project in history. The [three finalists](#) the Segura River of Spain, and the Niagara and Elwha Rivers of the USA. The (Continued on page 2)

## Honors (Continued)

Buffalo Niagara Riverkeeper project won the Riverprize. For more information, contact Jeff Duda, [jduda@usgs.gov](mailto:jduda@usgs.gov), 206-526-2532.

## In the News

During the week of September 5, 2016, USGS research by Jim Hatten of the WFRC was featured in numerous news media outlets (in 24 states and internationally) about a report that describes [Southwestern willow flycatcher habitat and the potential effects of an introduced tamarisk leaf beetle in the southwestern United States](#). For more information, contact James Hatten, [jhatten@usgs.gov](mailto:jhatten@usgs.gov), 509-538-2932

## Publications

**Burdick, S.M., C.O. Ostberg, M.E. Hereford, and M.S. Hoy.** 2016. Juvenile sucker cohort tracking data summary and assessment of monitoring program, 2015: [U.S. Geological Survey Open-File Report 2016-1164](#), 30 p., DOI: 10.3133/ofr20161164.

**Morley, S.A., H.J. Coe, J.J. Duda, L.S. Dunphy, M.L. McHenry, B.R. Beckman, M. Elofson, E.M. Sampson, and L. Ward.** 2016. Seasonal variation exceeds effects of salmon carcass additions on benthic food webs in the Elwha River. [Ecosphere 7\(8\): e01422](#), 19 p. DOI: 10.1002/ecs2.1422.

**Sorel, M.H., A.G. Hansen, K.A. Connelly, A.C. Wilson, E.D. Lowery, and D.A. Beauchamp.** 2016. Predation by Northern Pikeminnow and tiger muskellunge on juvenile salmonids in a high-head reservoir: implications for anadromous fish reintroductions. [Trans. Am. Fish. Soc. 145\(3\): 521-536](#).

**Thompson, J.N., and D.A. Beauchamp.** 2016. Growth of juvenile steelhead *Oncorhynchus mykiss* under size-selective pressure limited by seasonal bioenergetic and environmental constraints. [J. Fish. Biol. \(Early View\)](#). DOI: 10.1111/jfb.13078.

USGS Western Fisheries Research Center

6505 N.E. 65th Street

Seattle, Washington 98115

<http://wfrc.usgs.gov/> 206-526-6282