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Authors
Pearson, Dr. Walter H.
May, Christopher

Publication Date
2005-08-29
CULVERT TEST BED: FISH-PASSAGE RESEARCH FACILITY

Walter Pearson (Phone: 360-681-3661, Email: walter.pearson@pnl.gov), Associate Director, and Christopher May (Phone: 360-681-4556, Email: christopher.may@pnl.gov), Senior Research Engineer, Marine Sciences Laboratory, 1529 West Sequim Bay Road, Sequim, WA 98382, Fax: 360-681-3661

Abstract

The passage of juvenile salmonids and other fish through culverts is a significant Endangered Species Act (ESA) issue throughout the Pacific Northwest and now in other areas of the nation. Much of recent research and engineering has focused on increased passage of returning adult salmon; however, juvenile-salmonid movement both up and downstream throughout the year is now recognized as substantial and is a key area in which future research promises practical returns. Because a large percentage of the culverts beneath roads in the Pacific Northwest are judged as blocking juvenile salmon from thousands of miles of habitat, determining appropriate hydraulic and fish-passage designs for retrofitted culverts before installation has both substantial cost and environmental implications.

To address these issues, the Washington State Department of Transportation (WSDOT) leads a partnership that includes the Washington Department of Fish and Wildlife (WDFW), Alaska Department of Transportation, Alaska Department of Fish and Game, Oregon Department of Transportation, California Department of Transportation, the Federal Highway Administration, and the Pacific Northwest National Laboratory (PNNL). The partnership has undertaken a phased program conducted by an interdisciplinary team of scientists and engineers from PNNL to address the hydraulic and behavioral issues associated with juvenile-salmonid fish passage through culvert systems. This program addresses the testing and assessment of full-scale physical models of culvert systems deployed in an experimental test bed. Experiments in the test bed have begun and will measure the hydraulic conditions (mean velocity, turbulence, and water depth) associated with various culvert designs under various slopes and flow regimes, and then relate these measures to repeatable, quantitative measures of fish-passage success.

The culvert test-bed program is a one-of-a-kind capability designed to provide scientifically sound information that can be used to develop better designs for retrofitted culvert installations. Compared with field studies or temporary installations, the facility promises fast results, scientific and statistically controlled evaluations, an ability to quickly discern optimum engineering principles, and elimination of expensive trial-and-error approaches of field installations.

Biographical Sketches: Dr. Walter H. Pearson is associate director of the Marine Sciences Laboratory in Sequim, Washington, which is a part of the Pacific Northwest National Laboratory, operated for the U.S. Department of Energy by Battelle Memorial Institute. His bachelor's and master's degrees are in biology from Bates College and the University of Alaska. His doctorate is in oceanography from Oregon State University. Dr. Pearson's primary area of expertise is the study of the effects of pollution and human activities on marine and estuarine environments, especially on the fisheries these environments support. He has expertise in ecotoxicology and the behavioral ecology of fish and shellfish. Working for the Marine Sciences Laboratory for over 20 years, Dr. Pearson has gained extensive experience leading large multidisciplinary, multi-organizational studies to address environmental and fisheries issues. From 1993 through 1997, Dr. Pearson was founding program director of the innovative offsite program of Huxley College of Environmental Studies in Port Angeles, Washington, as part of Western Washington University's extended education program. In 1998, Dr. Pearson joined the newly formed Environmental Research and Wildlife Development Agency (ERWDA) in Abu Dhabi in the United Arab Emirates (UAE). He served as head of the Marine Environmental Research Center (MERC) until August 2000. Dr. Pearson led MERC as its staff developed programs for sea turtles, dugong, sea grasses, fisheries, water quality, oil-spill contingency planning, coastal-sensitivity mapping, and other marine issues. He returned to the Marine Sciences Laboratory in 2006. Dr. Pearson's current research at the Marine Sciences Laboratory addresses the effects of dredging on Dungeness crab, oil-spill impacts on marine fisheries, and juvenile fish-passage through culvert systems.

Dr. Christopher May is a senior research engineer at the Marine Sciences Laboratory in Sequim, Washington, which is a part of the Pacific Northwest National Laboratory, operated for the U.S. Department of Energy by Battelle Memorial Institute. Dr. May works to extend existing ecosystem assessment and restoration capabilities in the marine and near-shore environment into freshwater ecosystems with a focus on watershed analysis, stormwater management, non-point-source pollution issues, and salmonid-habitat assessment. Dr. May has served as a researcher and adjunct faculty member at the University of Washington and Western Washington University, as a private consultant, and as a technical advisor to the U.S. Navy and Department of Defense for stormwater and watershed-management issues. Dr. May has been principal investigator on projects ranging from a study to evaluate the impacts of urbanization on aquatic ecosystems and the effectiveness of stormwater best-management practices for the Watershed Management Institute and Environmental Protection Agency to the Kitsap and Jefferson County Salmonid Refugia Projects to identify and evaluate potential salmonid habitat-conservation areas for endangered salmon. Dr. May holds a Ph.D. in environmental science and engineering from the University of Washington, an M.S. in industrial engineering and management from the University of Minnesota, and a B.S. in marine engineering from the United States Naval Academy.