

Standardizing Sampling Techniques for *Potamopyrgus antipodarum* (NZMS) to Establish Early Detection, Monitoring and Outreach Programs for the NZMS and other Invasive Species

Jill M. Hardiman, Timothy D. Counihan, Christopher E. Walker, and Amy L. Puls,
U. S. Geological Survey, Western Fisheries Research Center;
Adrienne Zuckerman and Tova Cochrane, Underwood Conservation District

Invasive species comprise one of the most significant alterations of native ecosystems for fish, wildlife, and plants, and are rapidly becoming a dominant component of aquatic ecosystems within the Columbia River Basin. Early detection, prevention, and eradication are the keys to reducing the effects of invasive species; however, eradication can be extremely difficult and costly once a species is established. The *Potamopyrgus antipodarum* (New Zealand mudsnail) is an invasive non-indigenous species which has been spreading rapidly in the last 20 years throughout the western United States and British Columbia and has reached population densities as high as 300,000 snails/m². The New Zealand mudsnail (NZMS) has significant potential to alter benthic ecosystem functions in rivers such as food web structure by competing with native macroinvertebrate fauna. Their potential to alter the Columbia River Basin's benthic ecosystem is high due to their ability to spread through human activities, reproduce parthenogenetically, and rapidly colonize and occupy substrates at high densities. New Zealand mudsnails are readily transported from infested waters inadvertently through gear, boats, and other human activities. Options for controlling established populations of NZMS are very limited. The best management method for most invasive species is early detection and prevention of spreading after initial colonization.

We developed and implemented an outreach program focusing on awareness, identification, and prevention of spreading in conjunction with early detection and monitoring surveys. We believe a strategy to focus on early detection and prevention of colonization in un-infested waterways through scientific surveys, monitoring, and increased public awareness can limit the spread of invasive species.

During 2007 and 2008, we developed and implemented standardized survey techniques for early detection, monitoring, and baseline surveys to determine the presence or absence of adult NZMS in the Klickitat River, Washington in conjunction with an outreach and awareness program. We present standardized survey techniques and results for early detection of NZMS at very low densities ($\leq 0.1/m^2$) in a wadeable river. We evaluated various levels of sampling intensity through plot size (0.25 m² and 0.5 m²), plot numbers, species density (0.05 or 0.1/m²) and search efficiency (0.6, 0.8, and 0.95) to detect populations at varying densities and habitats at 9 popular access points on the Klickitat River. We determined our probability of detecting a NZMS at a density of 0.1/m² and an estimated search efficiency of 0.95 was 0.61 at an individual site. The desired power of detection, monetary cost per sample, detection at density levels for eradication, and search efficiency will determine the appropriate study design. These quantitative sample designs can be used for early detection of invasive species including NZMS and to monitor for population changes in the native and non-native community structure. We will also present the methods and results of our outreach program. Outreach is a critical component of any invasive species program, and the pairing of outreach with the field surveys arouses curiosity in the public, increases exposure time, awareness, and raises interest levels in the outcomes of the field work.

Jill Hardiman

Jill Hardiman has worked in the field of fisheries since 1993. She has worked in Alaska as a fisheries observer onboard trawlers and long liners. In 1996 she started with the U.S. Geological Survey at the Columbia River Research Laboratory, studying survival and behavior of juvenile salmonids at hydroelectric projects. She obtained her Master's degree in Fishery and Wildlife Biology from Colorado State University in 2003, and she is currently working for the USGS at the Western Fisheries Research Center. Her primary research interests include salmon ecology, mark/recapture survival studies, invasive species, GIS, bio-genetics, and climate change.

Amy Puls

Amy Puls is a fishery biologist for the U.S. Geological Survey, Columbia River Research Laboratory. During her seven years with USGS she has been involved in a diverse array of research projects ranging from investigating the survival and egress of juvenile salmonids during hydroelectric dam passage on the Columbia and Snake rivers using radio and acoustic telemetry, to more recently developing early detection programs for invasive species and assessing their potential effects. Amy has a M.S. in Marine Biology from the University of Oregon, where her research focused on invertebrate larval ecology.