Confirmation of Dreissenid Mussel Detection using eDNA

A USGS authored paper describes an investigation into the use of eDNA at streamgages to detect dreissenid mussel DNA. The study, which focused on sampling at streamgages in the Columbia River Basin in the Northwest U.S., details field and laboratory procedures to confirm and verify the results are valid detections.

An eDNA early warning system can help avoid economic impacts to areas where these mussels or other types of aquatic invasive species have yet to establish. Their economic impact is well-documented in the Great Lakes Region and they are estimated to have a $730 million impact to the Columbia River Basin, should they get established there. Yet, there is concern that an incorrect positive early detection of dreissenid mussel DNA could also trigger an ecologically and economically costly containment and control plan.

The study used a conservative approach to detect and report positive detection of dreissenid mussel DNA in waters not known to harbor the invasive mussels. Field sampling protocols included the collection of field blanks – field negative controls - and replicate samples. Laboratory protocols included replicated analysis and both positive and negative laboratory controls. A report of a positive dreissenid DNA detection would only result from the completion of a multi-phase analysis and validation approach. This approach requires DNA amplification from multiple sites on the genome, DNA sequence confirmation, and complete re-sampling verification to ensure that results are reproducible. All field and laboratory samples and controls followed this multi-phase approach.

None of the samples collected in the Columbia River Basin met the multi-phase criteria to be considered a positive detection of dreissenid mussel DNA. Dreissenid DNA was detected in field blanks associated with two sampling events. All field samples associated with these contaminated field blanks were considered compromised and the results were disregarded. Subsequent field samples and controls resulted in no dreissenid mussel DNA detection, leading the researchers to believe the field blank contamination did not come from living mussels in the sampled waterbodies.

The researchers also provide recommendations to enhance field and laboratory procedures. They include improvements to field blank collection and processing workflow, inclusion of a travel blank, and additional laboratory positive control procedures. These additional safeguards will help to identify and isolate potential sources of contamination, and minimize the likelihood of compromised sampling events.

Management Implications

- A positive dreissenid mussel DNA detection report requires field and laboratory verification through a multi-phase protocol that includes multiple DNA detection and identification steps and a re-sampling of the site.
- Multiple field and laboratory samples and controls are used to ensure positive detections are not due to contamination during field or laboratory procedures.
- eDNA can be used to identify waters that need additional scrutiny rather than to designate them as positive or infested with a target species.

THIS BRIEF REFERS TO:

Sepulveda, A.J., Schmidt, C.G., Amberg, J.J., Hutchins, P.R., Stratton, C., Mebane, C.A., Laramie, M.B., Pilliod, D.S., 2019, Adding invasive species biosurveillance to the U.S. Geological Survey streamgage network: Ecosphere, p. e02843, https://doi.org/10.1002/ecs2.2843.

Photos by USGS

Contacts

Adam Sepulveda, Biologist
Northern Rocky Mountain Science Center
(406) 994-7975
asepulveda@usgs.gov

David Pilliod, Supervisory Research Ecologist
Forest and Rangeland Ecosystem Science Center
(208) 426-5202
dpilliod@usgs.gov