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Shedding Light on Shedded Cells: Using eDNA Sampling for Surveillance of Invasive Species

Invasive species cause billions of dollars of economic losses and other damage every year in the United States. Environmental DNA (eDNA) sampling can help managers determine whether a problem species is present in an area, even when its numbers are low or it is hard to observe. This capability makes it a powerful tool for early detection and monitoring. The [National Invasive Species Council](#) (NISC), recognizing

eDNA sampling as a promising tool for invasive species surveillance and management, began in 2020 to look for ways to make this tool more tangible for managers. Rocky Mountain Research Station (RMRS) researchers who helped build the [National Genomics Center for Wildlife and Fish Conservation](#) (NGC) eDNA Program worked with an interagency team to publish a framework that describes the ins and outs of using eDNA sampling as a tool in invasive species management. The framework is the culmination of the work of nearly 30 Federal scientists and invasive-species specialists.

Managers need detailed information for deciding if, when, and how to use eDNA sampling for invasive species surveillance and management. The first step is to determine whether eDNA sampling is a useful tool given the management objectives. A new paper describes examples where eDNA sampling has been used effectively, such as surveillance for invasive mussels in the Rocky Mountain and Pacific Northwest regions. Jeff Morisette, an RMRS science program manager who helped initiate and led this project while working for NISC, says, “eDNA has proven effectiveness, but there are two significant caveats: It is fairly sophisticated from a technical level and secondly, it is extremely sensitive in detecting evidence of a given species, but such evidence does not necessarily imply that there is a viable population present. Our paper provides guidance on these two issues, as well as other aspects of implementing eDNA for invasive species surveillance.”

The framework stresses the importance of communication to build trust among managers, eDNA



Scientists from the USDA Forest Service Rocky Mountain Research collect an eDNA sample for lake trout (*Salvelinus namaycush*) DNA from Bowman Lake in Montana. USDA Forest Service photo by Thomas Franklin.

practitioners, and stakeholders. As Stas Burgiel, with NISC, explains, “Resource managers interested in using eDNA for invasive species detection and monitoring need to consider how to interpret eDNA sampling results, how to report these results to stakeholders, when to take management action, and who is responsible for each of these steps.” The technical considerations for implementing eDNA-based monitoring or surveillance may seem overwhelming. The paper helps guide managers by providing clear diagrams of the workflow for initial considerations, implementation considerations, and technical considerations. It also points to several detailed reviews and a listing of related Federal and international programs.

“Beyond the use of eDNA in localized circumstances,” Burgiel says, “reporting of sampling results to databases like the [USFS Aquatic eDNAAtlas](#) or [USGS Non-indigenous Aquatic Species database](#) assists broader regional and national analyses using invasive species occurrence data.”

The eDNA Program at the RMRS National Genomics Center has been a leader in the application of eDNA sampling tools to invasive species such as [northern pike](#) and [brook trout](#) for over 10 years. Taylor Wilcox, a researcher at NGC, says, “We hope that this framework and working group organized by NISC can help facilitate further collaboration across agencies seeking to use eDNA sampling tools for invasive species management.”

FURTHER READING

Morisette, J.; Burgiel, S.; Brantley, K.; Daniel, W.M.; Darling, J.; Davis, J.; Franklin, T.; Gaddis, K.; Hunter, M.; Lance, R.; Leskey, T.; Passamaneck, Y.; Piaggio, A.; Rector, B.; Sepulveda, A.; Smith, M.; Stepien, C.A.; Wilcox, T. 2021. [Strategic considerations for invasive species managers in the utilization of environmental DNA \(eDNA\): Steps for incorporating this powerful surveillance tool.](#) *Management of Biological Invasions*. 12(3): 747–775.

Wilcox, T.M.; Carim, K.J.; Young, M.K.; McKelvey, K.S.; Franklin, T.W.; Schwartz, M.K. 2018. [The importance of sound methodology in environmental DNA sampling.](#) *North American Journal of Fisheries Management*. 38: 592–596.

Young, M.K.; Isaak, D.J.; Schwartz, M.K.; McKelvey, K.S.; Nagel, D.E.; Franklin, T.W.; Greaves, S.E.; Dysthe, J.C.; Pilgrim, K.L.; Chandler, G.L.; Wollrab, S.P.; Carim, K.J.; Wilcox, T.M.; Parkes-Payne, S.L.; Horan, D.L. 2018. [Species occurrence data from the aquatic eDNAAtlas database.](#) Fort Collins, CO: Forest Service Research Data Archive. Updated 30 June 2021.

MANAGEMENT IMPLICATIONS

- The [National Invasive Species Council](#) (NISC) and scientists with Rocky Mountain Research Station are helping provide guidance on the use of eDNA sampling as a tool for invasive species management by Federal agencies across many environments.
- A newly published framework can help managers decide if, when, and how to use eDNA sampling technology for invasive species monitoring or surveillance.
- If eDNA sampling is used, the framework provides an approach where managers and stakeholders can accept results with a clear understanding of the strengths and limitations of the method.
- The Rocky Mountain Research Station’s [National Genomics Center for Wildlife and Fish Conservation](#) and the [Aquatic eDNAAtlas database](#) are important components of the U.S. infrastructure for eDNA-based monitoring of invasive species.

Featured Scientists

[Jeffrey Morisette](#) is the director of the Rocky Mountain Research Station Human Dimensions program. His research interests include increasing the benefits of Federal monitoring networks and national assessments and using the best available science to inform climate-smart conservation and land management.

[Stas Burgiel](#) serves as the executive director of the National Invasive Species Council (NISC). He facilitates high-level policy dialogue across Federal departments and White House offices on invasive species and is responsible for overseeing the development and implementation of NISC work plan activities.

[Thomas Franklin](#) is the eDNA program leader at the Rocky Mountain Research Station National Genomics Center for Wildlife and Fish Conservation, a state-of-the art facility for advanced research providing expertise in DNA sequencing and environmental and forensic DNA sampling.

[Taylor Wilcox](#) is a research geneticist at the Rocky Mountain Research Station National Genomics Center for Wildlife and Fish Conservation, a state-of-the art facility for advanced research providing expertise in DNA sequencing and environmental and forensic DNA sampling.

Rocky Mountain Research Station researchers work at the forefront of science to improve the health and use of our Nation’s forests and grasslands. More information about Forest Service research in the Rocky Mountain Region can be found [here](#).

The National Invasive Species Council includes senior-level membership across the Federal government, including 12 departments and 4 White House offices. The overarching duty of the Council is to provide the high-level vision and leadership necessary to sustain and expand Federal efforts to safeguard interests of the United States by preventing, eradicating, and controlling invasive species, and by restoring ecosystems and other assets impacted by invasive species.



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