United States Department of Agriculture
Forest Service

Rocky Mountain Research Station

Wildlife and Terrestrial Ecosystems
and
Air, Water, and Aquatic Environments Programs

Providing scientific knowledge and technology to sustain our nation's forests, rangelands, and grasslands

Science Briefing

DETECTING RARE SPECIES USING ENVIRONMENTAL DNA

ISSUE

Animals in aquatic environments—such as fish, amphibians, crayfish, and mussels—release DNA into the water via their feces, urine, and skin. This external DNA is called environmental DNA (eDNA). By filtering water samples and analyzing them for eDNA, one can determine whether a species is present without actually capturing or seeing an individual. Different species can be identified by using genetic markers that are unique to them.

TECHNOLOGY DEVELOPMENT

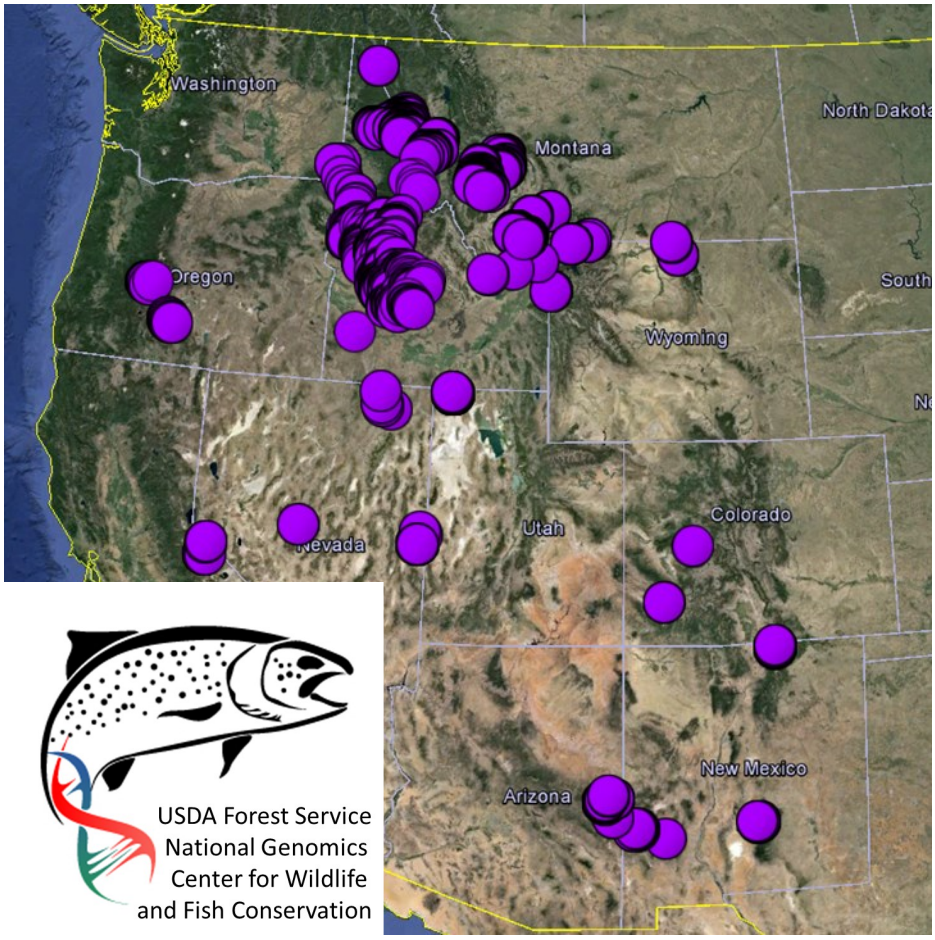
Researchers at the U.S. Forest Service's National Genomics Center for Wildlife and Fish Conservation (NGC) have pioneered developments in this field—including the first reliable eDNA assays for a variety of fishes. NGC scientists developed a rapid, field-proven eDNA sampling protocol that is remarkably sensitive—100% detection efficiency of target species has been attained across order-of-magnitude changes in stream discharge, and detection rates of rare species can be much higher than with traditional sampling methods. Moreover, collected samples are easily stored in the field, can be processed in the lab in under 48 hours, and cost relatively little to analyze.

KEY POINTS

- Aquatic species shed DNA material which disperses throughout the water column. This external DNA is called environmental DNA (eDNA).
- Compared to traditional methods, eDNA sampling is a faster, less expensive, and more sensitive way to assess species presence.
- The detection of eDNA represents a major advance in monitoring species in freshwater environments. Environmental DNA is being rapidly adopted as a tool to detect rare or difficult to detect species.

One person can collect a sample in about 15 minutes, and use that sample to detect many species. Assays are available or being developed for an array of native and nonnative species, such as bull trout, two subspecies of cutthroat trout, brook trout, brown trout, rainbow trout, opossum shrimp, and river otters.

ENVIRONMENTAL DNA SAMPLING IN THE WEST



USDA Forest Service
National Genomics
Center for Wildlife
and Fish Conservation

Scientists at the NGC have collaborated with biologists from agencies across the West to use eDNA sampling for answering questions about the presence of native and nonnative species at over 1,600 sites.

- Arizona Game & Fish Department
- California Department of Fish & Game
- Idaho Department of Fish & Game
- Montana Fish, Wildlife & Parks
- Nevada Department of Wildlife
- Oregon Department of Fish & Wildlife
- Utah Division of Wildlife Resources
- Wyoming Game and Fish Department
- Wild Fish Conservancy
- Wildlife Conservation Society
- Snoqualmie Tribe
- Nez Perce Tribe
- U.S. Forest Service
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

SIGNIFICANCE

Because of its greater efficiency and reduced cost, eDNA sampling may revolutionize the monitoring and assessment of freshwater species. NGC scientists introduced biologists from partner agencies across the West to this approach by providing training and lending equipment from our "tool library." Successful projects have included finding new populations of sensitive species, delineating the boundaries of habitats occupied by fish, and gauging the effectiveness of efforts to remove nonnative species.

MORE INFORMATION

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