# Using Environmental DNA
And Underwater Video
## As Early Detection Tools
## for Aquatic Invasive Species

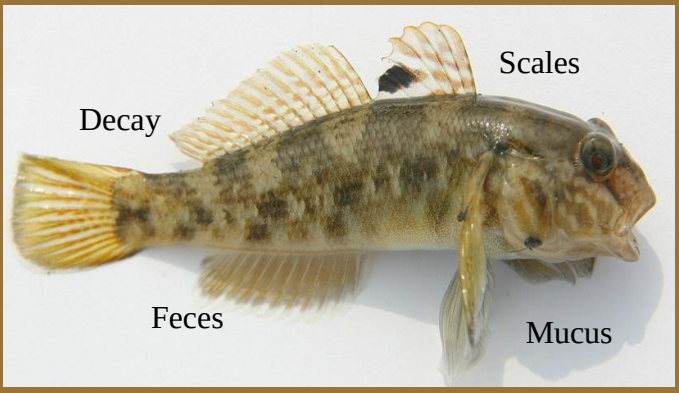
## A Citizen Science
## Reference Guide

*St. Lawrence Eastern Lake Ontario Partnership for Regional Invasive Species Management*
*The Nature Conservancy, Central & Western New York Chapter*

## How Early is Early When It Comes to Detection?

Early detection of aquatic invasive species (AIS) is especially difficult because AIS are hidden beneath the water. If we could detect AIS while in low abundance, prior to becoming established then we would have a strategic advantage in eradicating or suppressing their impacts on the ecology of our water resources and the benefits these resources provide to people and nature.

Aquatic organisms such as fish are constantly shedding material that contains species specific DNA such as scales, mucus and waste. DNA from water samples can be filtered out and processed in such a way as to detect as little as one single cell from that species. This is known as Environmental DNA or (eDNA). This process can be used to identify harmful aquatic species before they become well established.




## Is eDNA Practical ?

Yes, with today's approaches working with eDNA is relatively easy. Collecting and filtering water samples and sending the samples to a lab is straight forward. The laboratory (which you will need) has the task of processing the samples and reporting the results. Costs for laboratories varies, in many cases however, samples can be processed for under $150.00 per sample which includes multiple species.

## Engaging Volunteer Citizen Scientists

The growing interest of public participation in scientific nature-based fieldwork includes a type of volunteerism known as citizen science in which members of the public or students engage in the process of scientific investigations, collecting data, and/or interpreting results. The value of utilizing citizen scientists exceeds scientific posterity and allows for a cost-effective means by which to conduct AIS early detection on a broader level because citizen scientists typically volunteer without compensation.

Volunteer citizen scientists also learn a great deal from volunteering, as well as, contributing to shared knowledge of a subject. In many cases, volunteers can take the information gained, share it and implement similar work in a waterbody or landscape of their choice.

# Getting Started

To conduct eDNA for the early detection of aquatic invasive species on your favorite waterbody, you will need the following:

- A list of several species that you wish to detect. These could be species impacting nearby waterways or just species you are generally concerned about. Your lab costs may vary based on the number of species and samples you wish to include.

- A laboratory that conducts eDNA analyses using a technique known as qPCR. Many local Universities have the capacity to conduct qPCR. In New York Cornell University Dept. Of Immunology and Microbiology and Buffalo State College Dept. of Biology have established eDNA laboratories. Check with your local university as well.

- Field Sampling Kit & Protocol. Several existing university programs can provide field sampling kits which have everything you need to collect samples and can advise on a sampling protocol for your lake or waterbody. This may include number and location of samples to be taken for best results. Keep in mind, even a few samples are better than no samples at all. Samples can be collected and filtered from the shoreline, from docks end, a canoe or a boat.


*Shown: Sampling kit developed by Cornell University Department of Microbiology and Immunology. Funded by USDA HATCH grant 2014-15-242*

- Delivery to Laboratory & Laboratory Response Time. Samples can be dropped off at the lab you are working with or they can be mailed to the lab at flat rate. In order for eDNA to be effectively used as an early detection tool and to allow for an appropriate response to a newly discovered invasive species, the qPCR analysis needs to be completed and the results reported in a timely manner. Three to twenty days would be considered a good turn-around time that should be discussed with your lab of choice.

# What to Expect

Most laboratories will report the eDNA results in two ways. First, is the numeric value of the amount of DNA from your target species found in each water sample. In most cases you just want to know if a particular species is present in the waterbody (presence/absence), so any number (other than zero) would indicate that the species may be present.

Some laboratories will also provide amplification plots. These are graphs that show the presence of a species above a certain threshold. This also indicates a (presence/absence) scenario.

# eDNA as an Indicator Only

It is important to note that eDNA is not finite and is used as an indicator only. A positive test result indicates that a species might be present and that further testing and possible fish/organism sampling may be warranted. There are many resources available in New York State to help determine follow-up measures and possibly a strategic or rapid response to your early detection. Resources may include, but are not limited to:

- PRISM's – Partnerships for Regional Invasive Species Management: www.nyis.info
- New York State Department of Environmental Conservation: http://www.dec.ny.gov/
- New York State Invasive Species Research Institute: http://www.nyisri.org/
- United States Fish & Wildlife Service: https://www.fws.gov/

# Underwater Video Technology

Using underwater video technology can be an exciting way to engage citizen scientists in aquatic invasive species observations. Real time video allows for close observation of aquatic plants and animals. Recorded video can also be a practical means by which to taxonomically determine fish species passing the viewing range of the video camera. This technology offers citizen science teams a (hands-on) means by which to embrace useful technology and to test its usefulness as an aquatic invasive species early detection tool.

High definition underwater, color video cameras range in costs from a few hundred dollars up.

Underwater video from Eastern Lake Ontario showing Smallmouth bass (*Micropterus dolomieu*).

## Acknowledgements


The SLELO PRISM Partners
The Nature Conservancy CWNY
Great Lakes Restoration Initiative – United States Fish & Wildlife Service
New York State DEC Invasive Species Coordination Unit
Finger Lakes, Lake Ontario Watershed Protection Alliance
Nathan Fedrizzi, Zach Bengtsson,The Nature Conservancy
NYS DEC Invasive Species Coordination Unit
Dr. James Casey, Cornell University
Dr. Donna Cassidy-Hanley, Cornell University
Gregg Sargis, The Nature Conservancy, Project Advisor
Darran Crabtree, The Nature Conservancy, Project Advisor
Stevie Adams, The Nature Conservancy

Project Manager: **Rob Williams**, SLELO PRISM / The Nature Conservancy

St. Lawrence Eastern Lake Ontario Partnership for Regional Invasive Species Management

This Citizen Science Reference Guide was prepared through a grant from the **Great Lakes Restoration Initiative** Agreement No. F14AP00482 via The New York State Department of Environmental Conservation, The Finger Lakes Lake Ontario Watershed Protection Alliance and The Oswego County Soil & Water Conservation District