

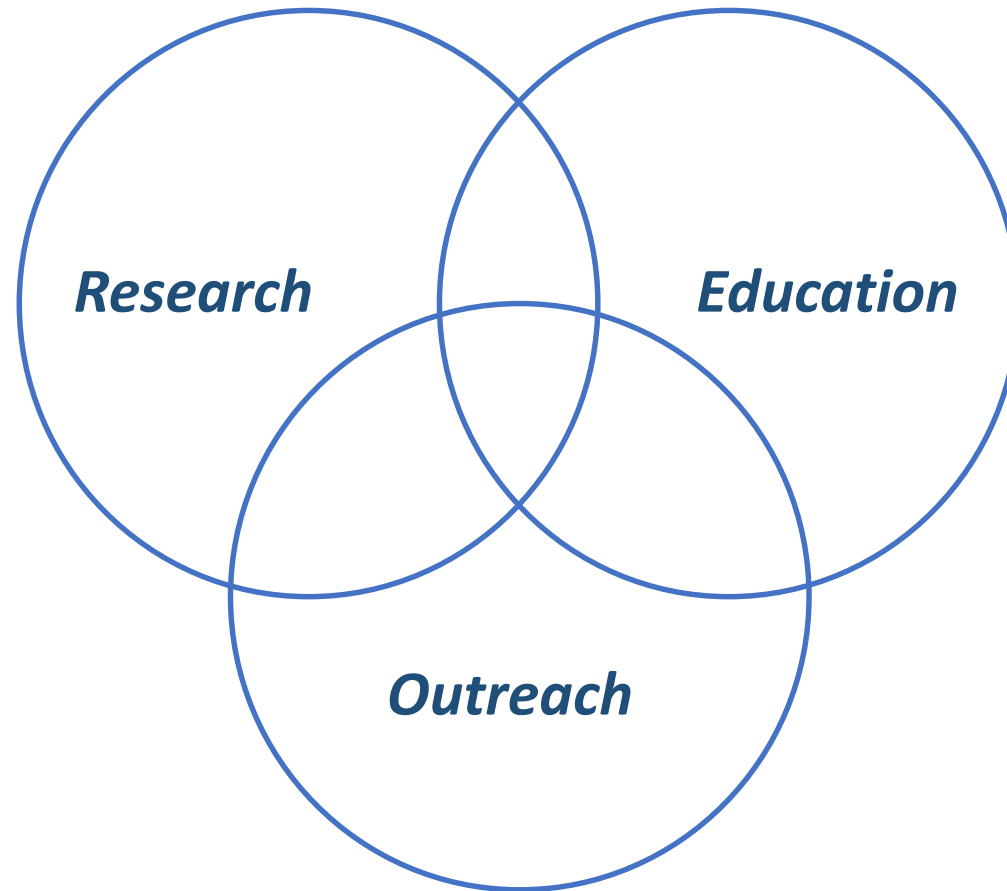
FishTracker: Students, Scientists, and eDNA



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FishTracker

A Collaborative Citizen Science Effort to Address the Spread of Invasive Fish



Research

Research Infrastructure



Research Facilities



Cornell Aquatic Health Program



Scientific Expertise



Outreach

Infrastructure

ASSET program has impacted >400 teachers and >15,000 students nationwide



Teacher Contacts



Outreach Experience



Education - Teachers and Students

Teachers

Provide

Experience

Expertise

Critical feedback



Students

Participate

Learn

Engage

Provide Feedback



What Does FishTracker Do?

FishTracker provides an economical and effective way to address two key aspects of any successful Invasive Fish Management Plan

Prevention

FishTracker educational material increases public awareness of causes and effects of increasing invasive fish populations, and engages the next generation in issues related to invasive species.

Early detection and Monitoring

FishTracker provides an expandable, effective and economical approach to widespread monitoring of invasive fish species to facilitate identification of new or low-level infestations.

What Fish Species are Monitored?

Invasive species currently monitored

Round goby (Neogobius melanostomus)

Asian carp - 4 species detectable with a single set of primers and probes (Ctenopharyngodon idella, Hypophthalmichthys molitrix, Hypophthalmichthys nobilis, Mylopharyngodon piceus)

Northern snakehead (Channa argus)

Sea lamprey (Petromyzon marinus)

Invasive species to be added

White perch (Morone americana)

Asian swamp eel (Monopterus albus)

Endangered species to be added

Lake Herring or deep water cisco (Coregonus artedii)

American eel (Anguilla rostrata)

Challenges to Citizen Science and eDNA

Scientific

Outreach

Education

The Scientific Challenge

An Example of the Science Behind FishTracker



Specificity:

Develop a qPCR assay that will detect only Asian carp in the background of 160 -200 resident fish in the Great Lakes watershed.

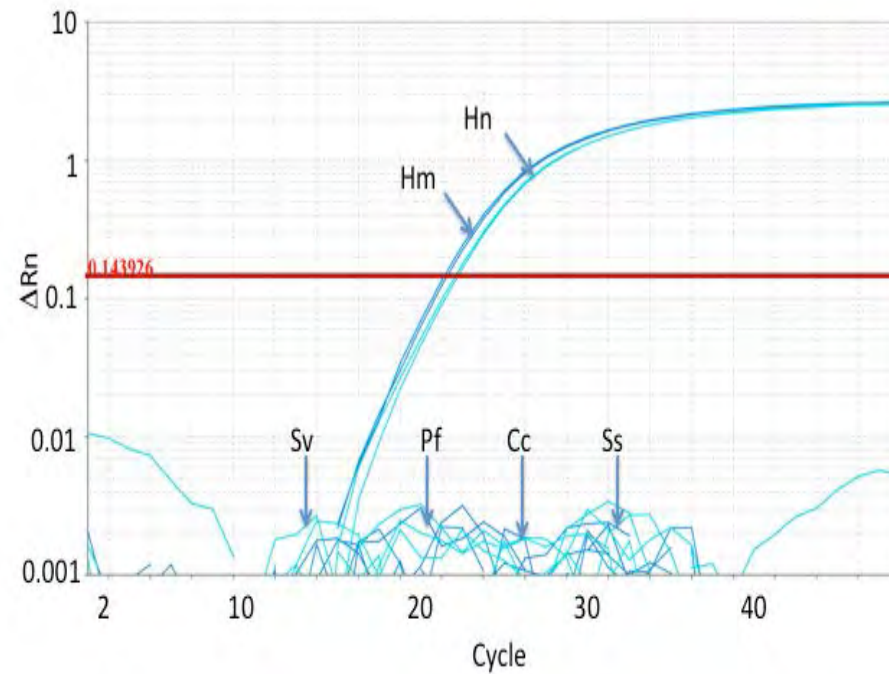
Sensitivity:

Develop a qPCR assay that displays greater than 99% efficiency and a single copy analytical sensitivity.

Species Abundance:

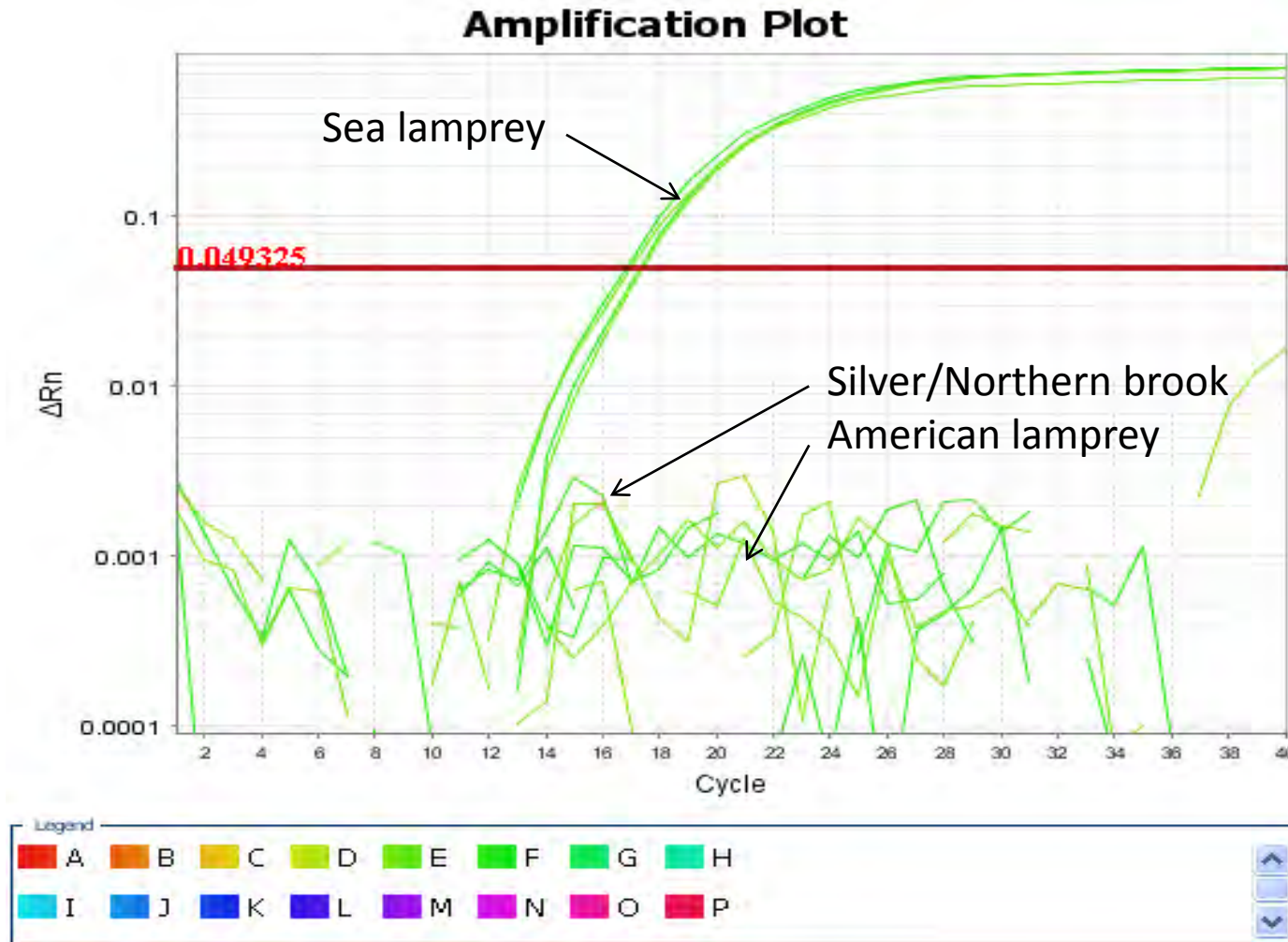
Develop a qPCR assay where the copy number of the eDNA target relates to the Asian carp numbers.

Specificity of the Pan Asian qPCR Assay

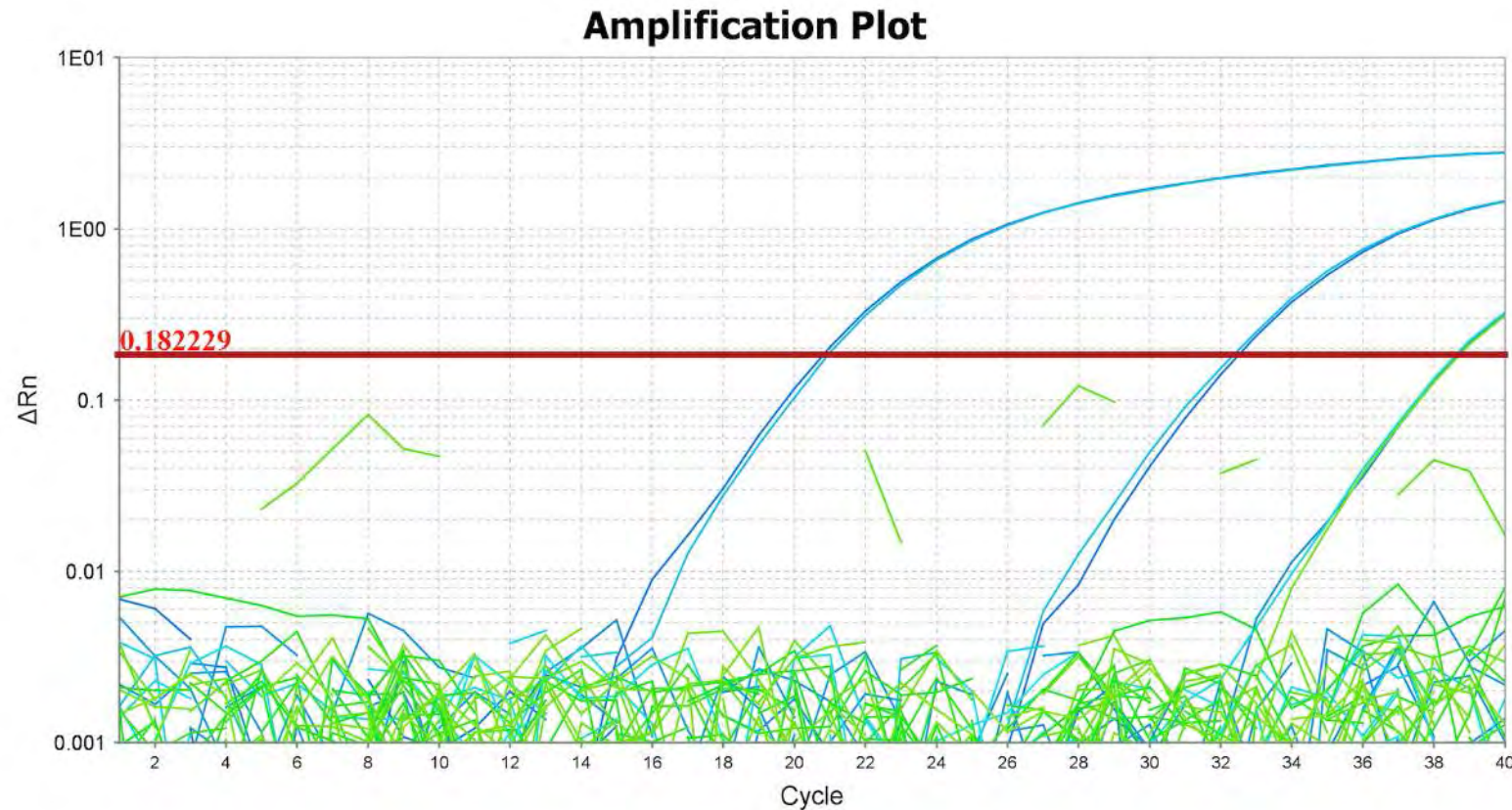


Sv: Walleye, Pf: Perch, Cc: Common carp, Ss: Salmon, Hn: Bighead carp, Hm: Silver carp

Lamprey Test Amplification



Specificity of Pan Asian Primers and Probes

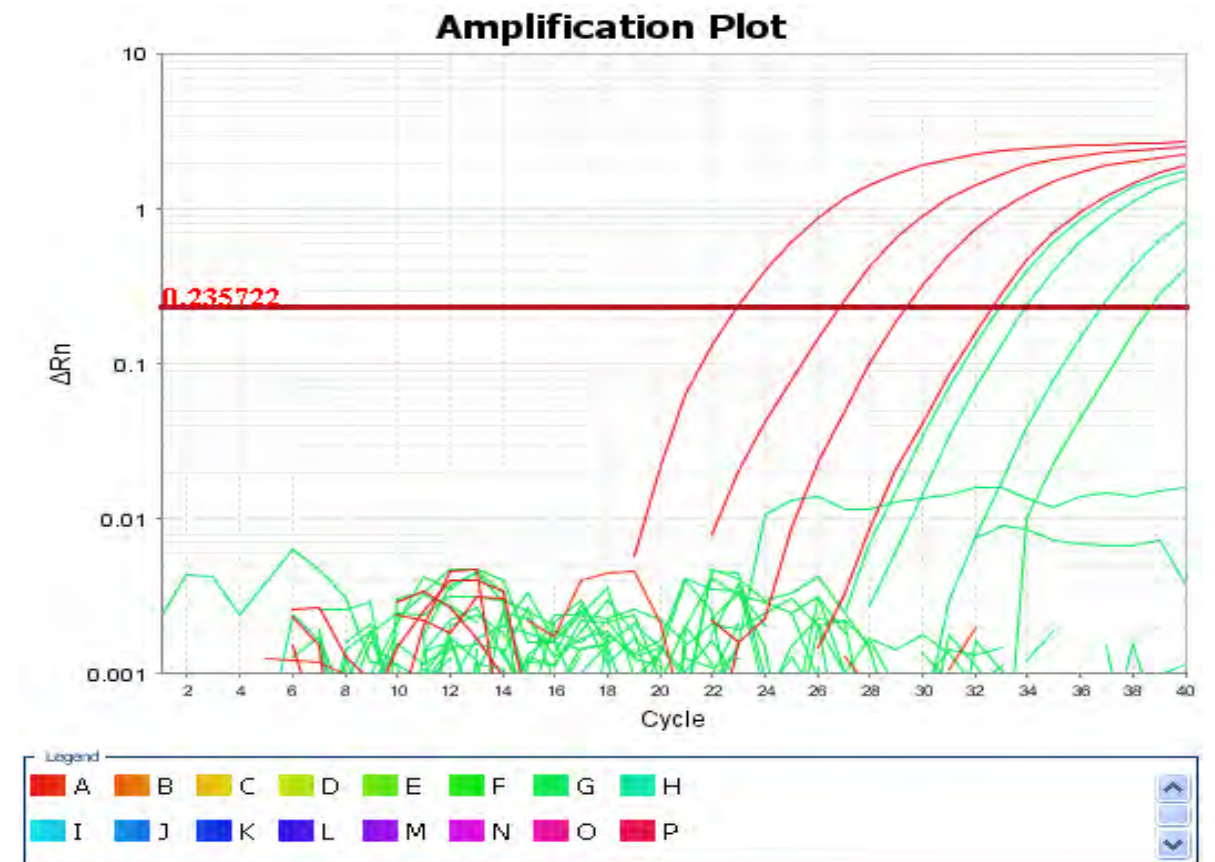


Forty near shore Great Lakes fish species collected in 2010-2011 as part of a VHSV surveillance program were assessed for cross reaction with Pan Asian reagents. The three positive amplifications were spiked Asian carp positive controls.

qPCR Analysis



qPCR



The Outreach Challenge



TRACKING FISH WITH E-DNA

A Citizen Science Project at Cornell University

[Our program](#)

[Latest news](#)

[Protocols & documentation](#)

[e-DNA testing results](#)

[Reserve a testing kit](#)



[News from schools](#)

[Photo credits](#)

How FishTracker Works

Teachers

Request kit(s) for specific dates online

Utilize material on the website to provide background and context before collection

Review collection protocol (on the website) with students before using the kit

Students

Collect and process samples

Return kit and samples to Cornell

Cornell

Process and analyze samples by qPCR

Archive samples in Freezer

Return results to teachers and students

Display results on website, acknowledging teachers and schools participating

Teachers and Students

Discuss results, impacts of invasive fish. Students share results with family and friends.

The Educational Challenge

FishTracker Kit

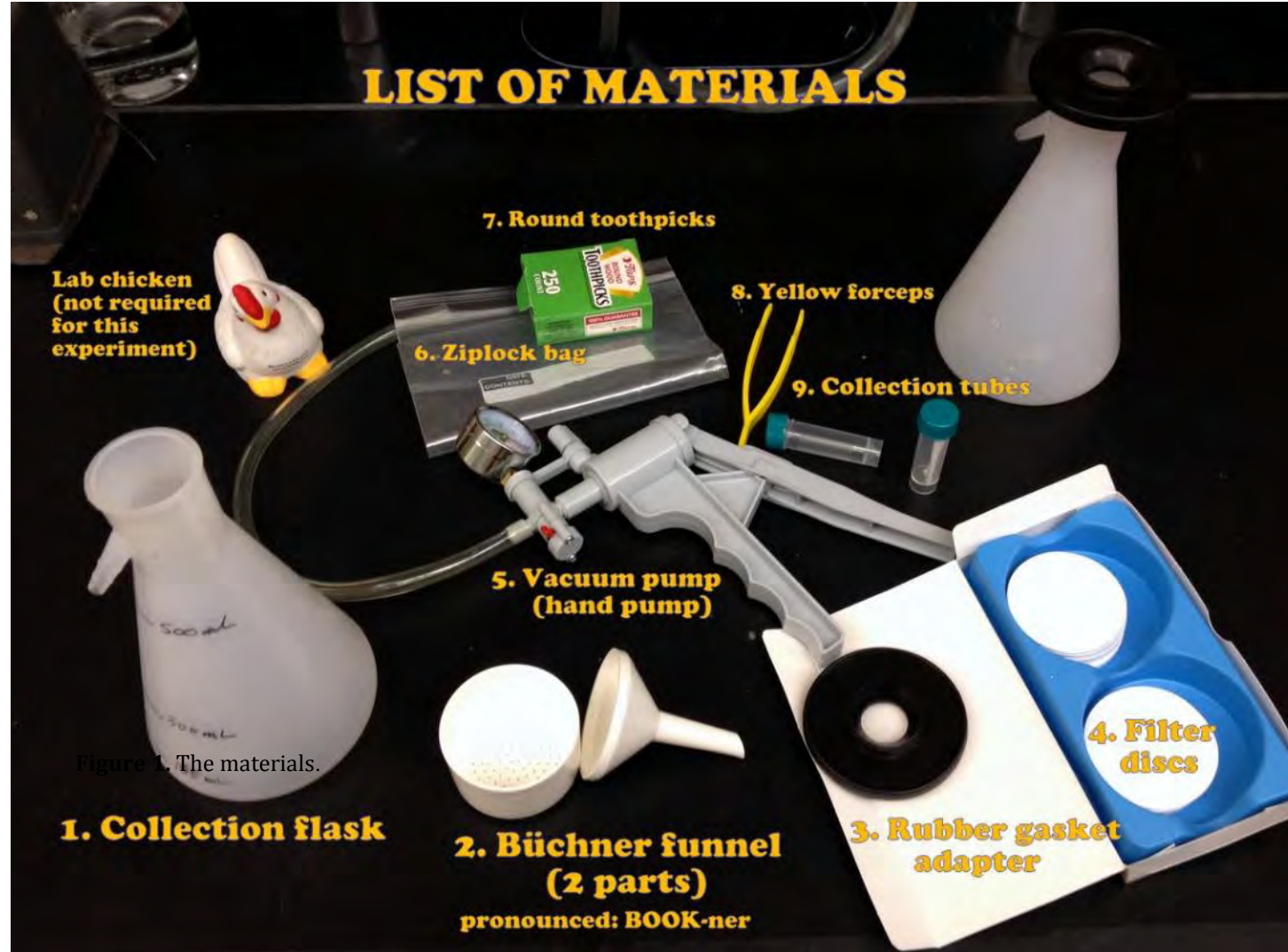


Figure 1. The materials.

Detailed protocols, background information, all materials are provided

Can K – 12 Students do Good Science?

Yes!

If the program provides needed support and controls...

Primary Concern - Minimizing Cross-Contamination

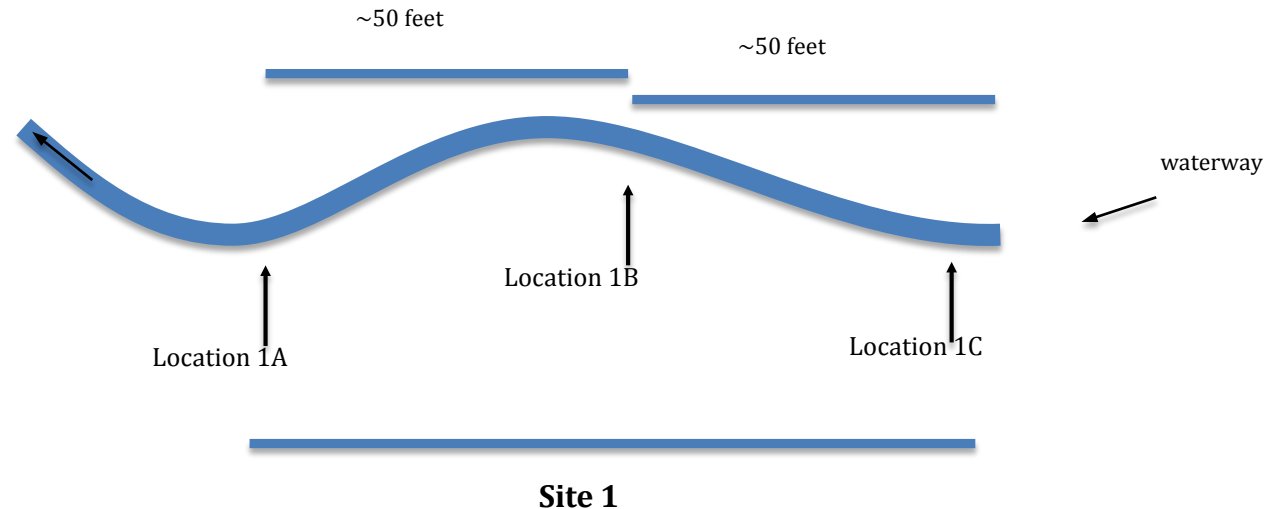
- **Complete materials for each site packaged separately in a white bag and opened immediately before use.**
- **After collection, used equipment immediately sealed in black return bag. No sharing of equipment between sites.**
- **Between uses returned equipment decontaminated in 10% bleach.**

Sample Collection

Sample Preservation: Buffer short term, freezer for long term archiving.

Accurate identification of sites and samples: GPS coordinates

Repeatability: 3 samples collected at each site plus 3 negative controls



Organization

Sample Collection

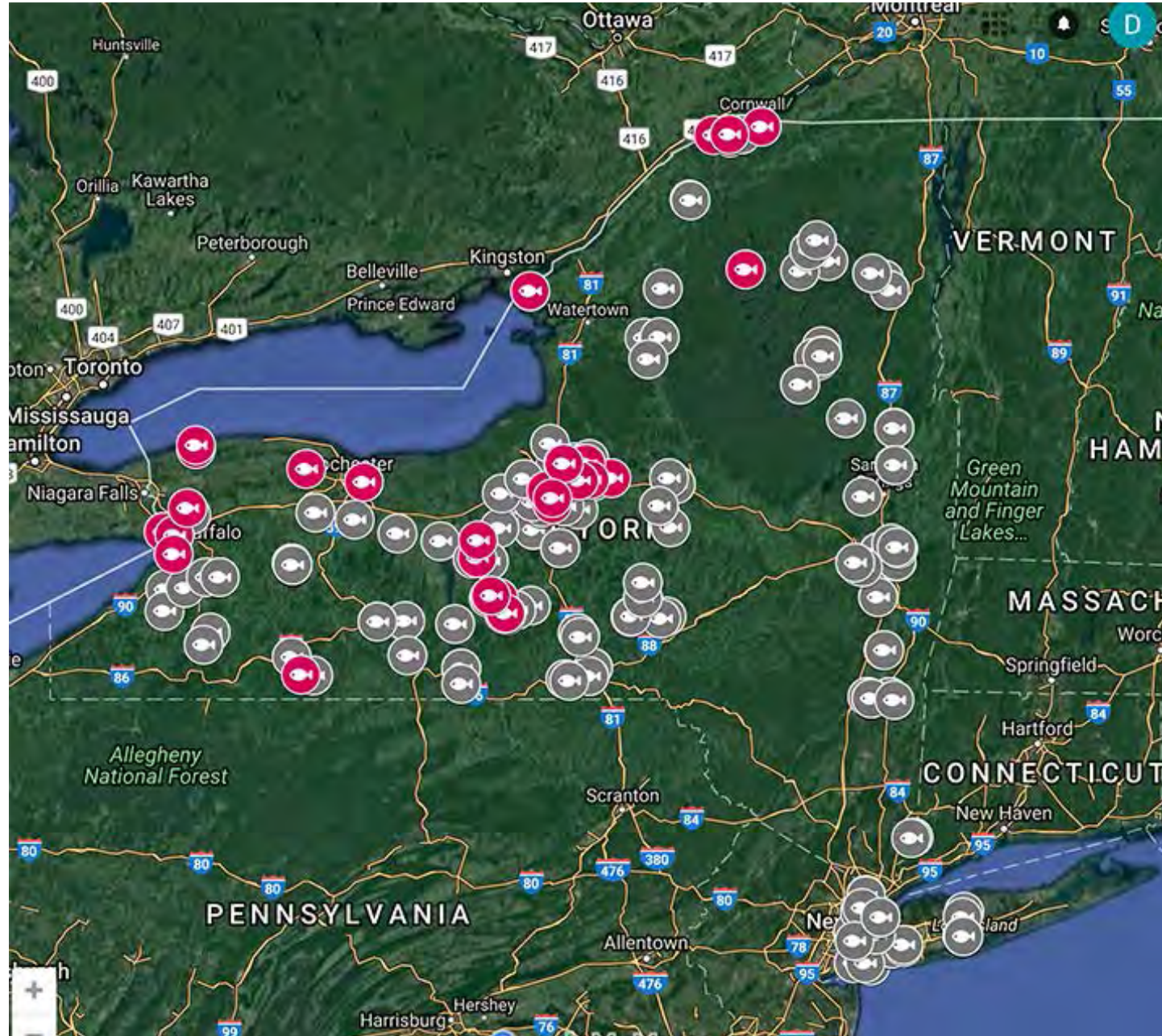


Results

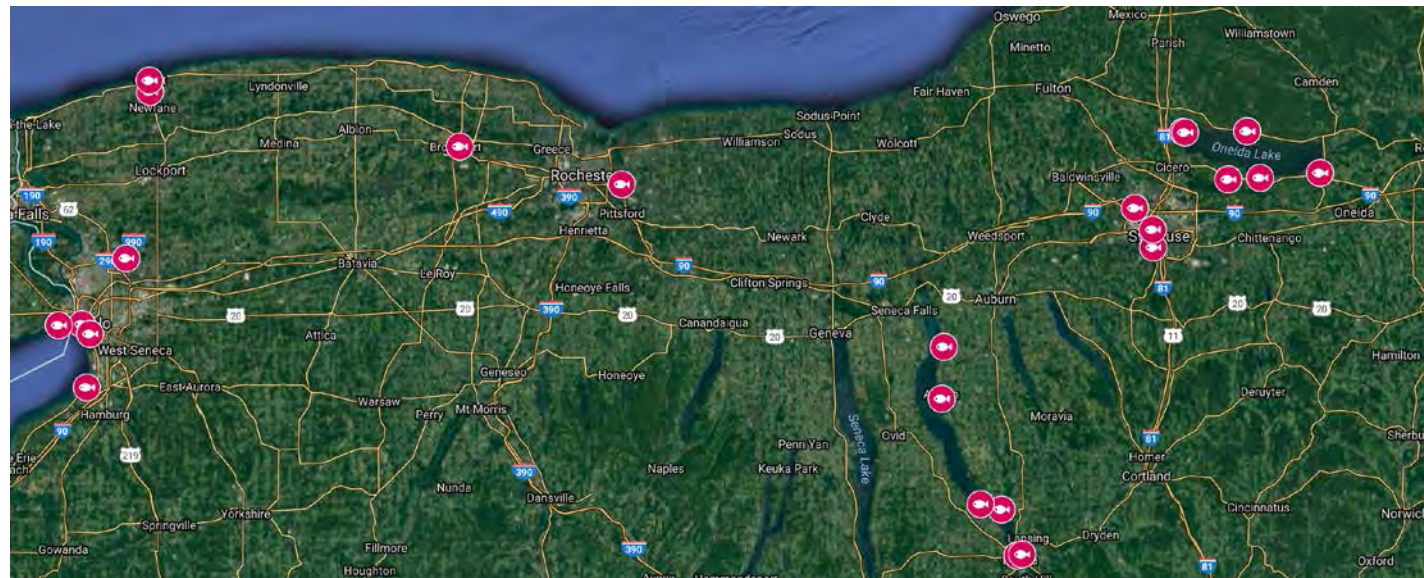
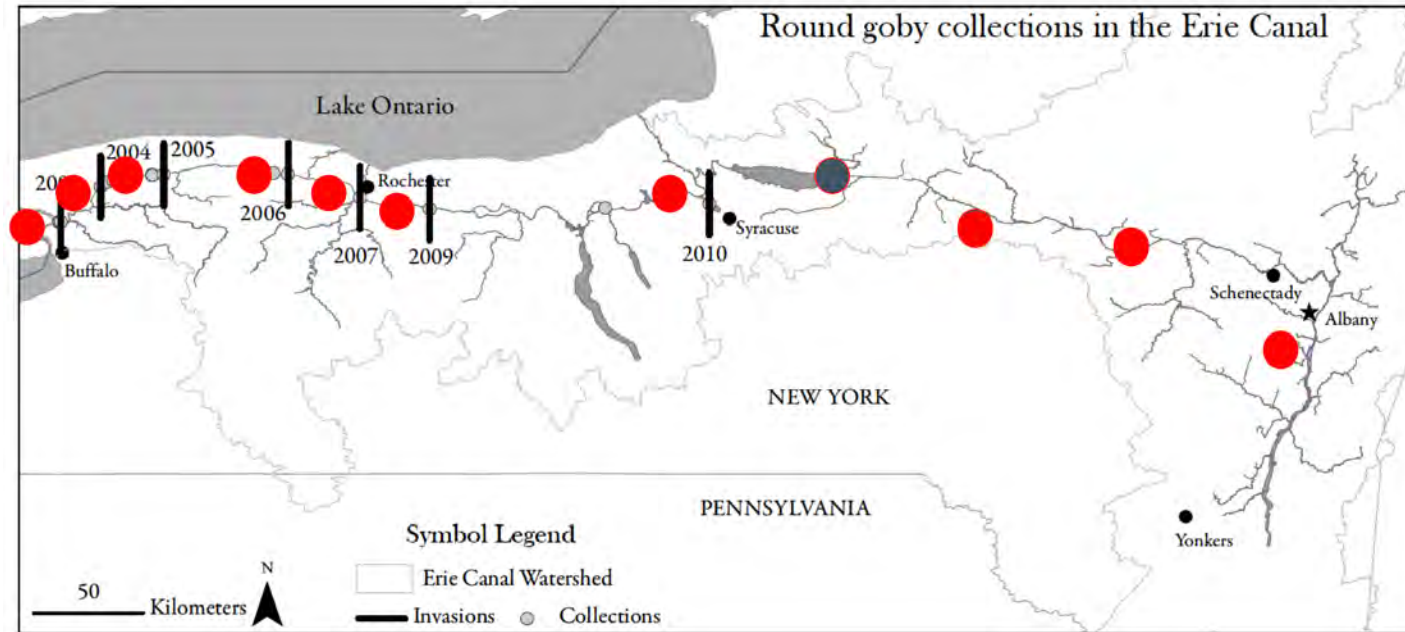
Teachers and Students make Great Citizen Scientists!!

Just ask the >70 teachers and >1500 students who have participated in the FishTracker program so far!

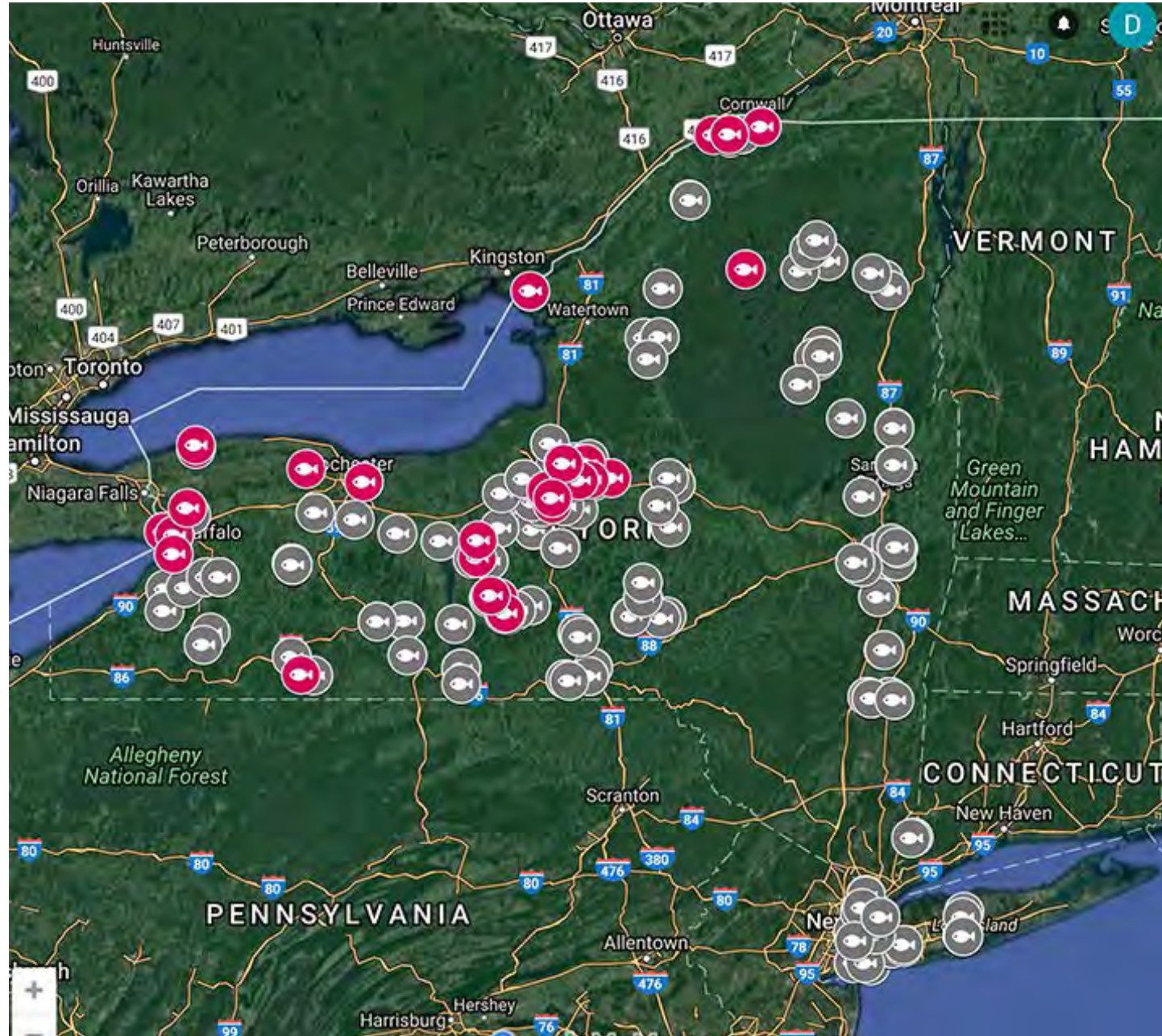
Round Goby



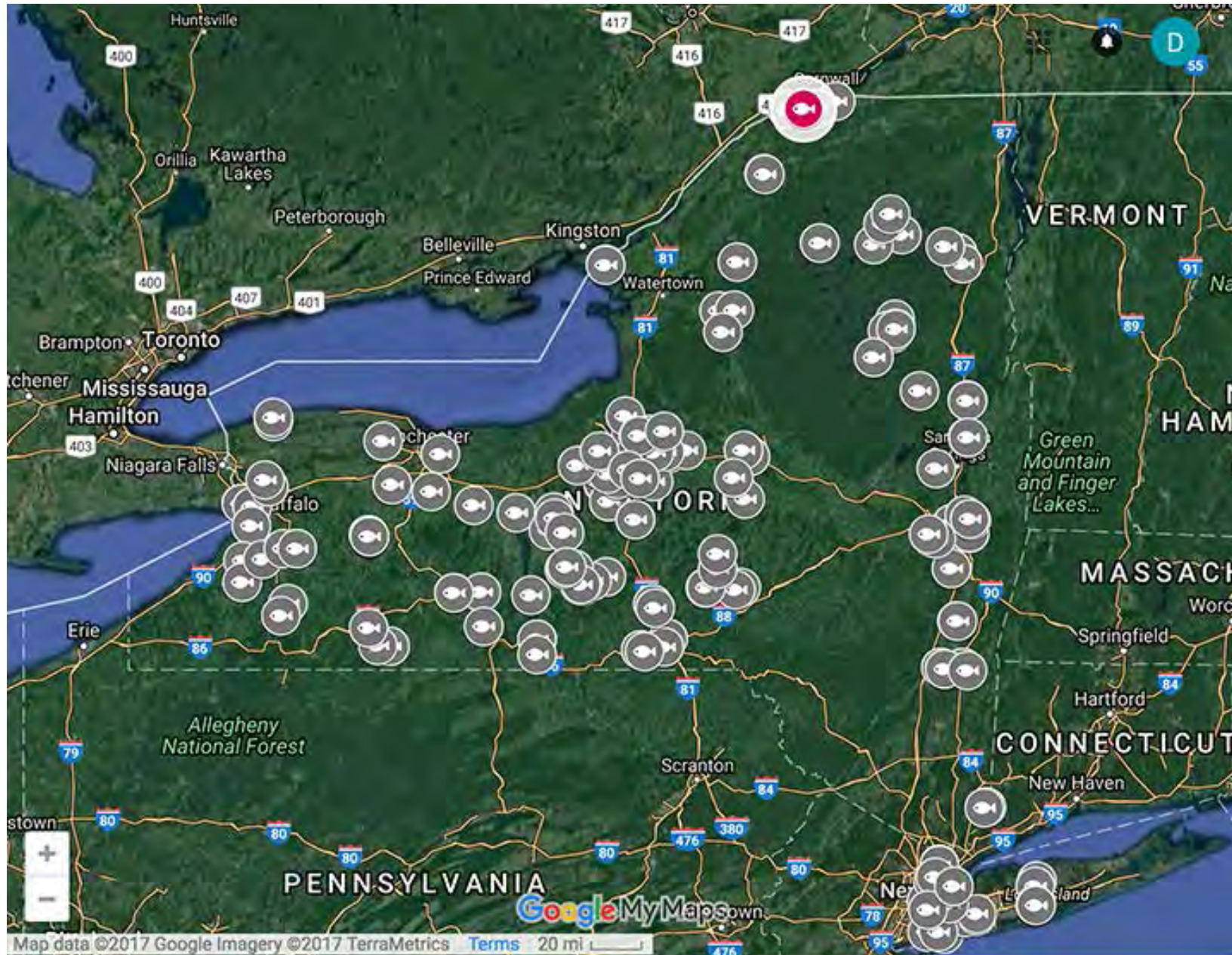
Spread of round goby



Round Goby



Asian Carp



Snakehead

