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Celia Esses High School
Biology Class
Teacher: Mrs. Ashkenazy
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# Lab Report: Invasive Species

## Abstract:

On Wednesday,September 28, 2016, our Biology class went to Gerritsen Creek to do a study on invasive species. We wanted to see the types of fish in the creek, and if any were invasive species threatening the area. Invasive species are bad for water sources because they take over and are a threat to other living organisms. They are a threat because they steal habitats and ruin the food chain by eating the food of native fish, making them threatened species and causing ecological disasters. We took samples from the creek water and filtered it using a flask, a Buchner funnel, a hand held vacuum, and filter paper discs. We handed in the filter paper with the traces of eDNA to Cornell, where they will test our results to see what type of species are in these waters.

## Introduction:

In order to test for DNA, we look at fish cells that have shed in the water. DNA comes in many types like blood, urine, mucus, or flaked off skin cells. DNA released from cells are called environmental DNA or eDNA, because they are released from the environment. Since eDNA is unique, it is possible to test for many different types of invasive species, with one water sample. Testing the eDNA can tell us if a fish is present or was present in the area of water where the sample was collected. By collecting the samples, we helped Cornell University test for three different types of invasive species: sea lamprey, Asian carp, and Round Goby.

GPS coordinates will be used to identify the locations of the sites. GPS coordinates can be found using the Compass app on an Iphone or with Google maps. The coordinates we recorded were 40.5834° N, 73.9093° W. We collected small water samples and filtered it out so that remaining cells stayed on the filter paper. DNA in the water can last up to 6 hours after shedding, so DNA can be collected even hours after the fish shed. The filter paper is placed in a vial containing solution that protects the DNA. Then, it is set to Cornell for testing. If the tests do not come out positive, it may mean that the invasive species are not present. A weak eDNA signal could mean that there are few shed cells in the water, or the fish just entered so there is few cells. A larger population comes out with a stronger signal.

Asian Carp were brought to the US in the 1970's to control Algae growth in Catfish habitats and in Sewage ponds. There were two different types of Asian Carp released into the wild due to flooding in the 1990s. Ever since then, these fish have invaded the Mississippi River and have become the most common fish species, exceeding the native fish species. Asian Carp have also been found in the canals, or man-made bodies of water, connecting the Mississippi River to the Great Lakes. The reason they are spreading like wildfire is because they have no predators in their new environment, are four feet long, and weigh more than 100 pounds. Asian Carp eat about 10% of their body weight in plankton every day. This high consumption rate wipes out the plankton, the main food source, which kills the native fish rapidly and keeps the fish healthy so they can mate and hatch new Asian Carp. To attempt to control these invasive species, they have placed them on the federal list of injurious wildlife. This enforces strict rules

and makes transportation of live Asian Carp and their eggs illegal across country and state borders; educational or zoological purposes allow you to transport them with a special permit.

Round Goby were brought to the Great lakes through ballast water from large ships and were discovered in 1990 as an invasive species. Round Goby have caused serious ecological and economical difficulties and issues. They spread to where the Mississippi river drains, and into smallers streams and creeks that flow into the Great Lakes. They have even been spotted in a New York finger lake, Cayuga lake. Round Goby swim at the bottom of the rivers, and compete with other fish species for egg hatching space, food, habitat, and cause serious significant population decreases to native fish. They also affect the food chain. The Round Goby eat lots of Zebra Mussels, a damaging species, which can be looked at as beneficial. But when you look at the broader picture, it's just another problem. Zebra mussels have a large concentration of toxins that absorb into the tissue of the Round Goby, so when sport fish eat the Round Goby, they absorb plenty of toxins at a higher concentration. Humans eat these sport fish, and in result, we have an increase of health problems to those who consume Sport fish.

Sea lamprey naturally live in the Atlantic Ocean. They have a large sucking disc for a mouth, filled with a sharp teeth and a file like tongue. They are very harmful. Only about 1 out of 7 fish will survive an attack. They are a highly destructive invasive species. This fish invaded the United states and Canada and reduced the amount of lake trout by a significant number. We are looking for all types of fish but specifically ones that are an invasive and can harm our waters and environment.

Invasive fish are a problem because they can arrive into a body of water that they aren't supposed to be in. One way they can end up in a new body of water, is when large ships dump large amounts of ballast water. Ballast water is water carried in ships' ballast tanks to improve stability, balance, and trim. This happens daily all round the world. Millions of tons of ballast water are exchanged daily. These can carry aquatic organisms from microscopic plankton to fish. Another way is when people buy or sell exotic aquarium fish that can sometimes release invasive species into areas that have never been found before. This can happen by accident or sometimes even on purpose. There are people who purposely and illegally release invasive fish into a new environment to start ecological and economical disasters.

Plans to introduce non-native organisms to control biological problems have backfired and resulted serious environmental damage in the past. For example, they had an idea to let out a fish known as the grass carp. Their plan was for it to control the spread of unwanted aquatic plants. Their plan backfired. It leads to the destruction of native plants, species in inland lakes, resulting in damage to lake ecology and the ecosystem. By using bait, boaters and fisherman also add to the problem, resulting in cross contamination to unaffected waters.

The filters containing the samples we took on September 25, 2016, are going to be sent back to Cornell University. There they will check to see if there is or isn't eDNA from Sea Lamprey, Asian carp, and Round Goby. If there is, we will have contributed to the scientific community as citizen scientists.

The results of the tests taken on the water samples, will be sent back to us so we can discuss our results in class. Our samples will be added to our state map, giving our school and class credit for helping the environment in acting as citizen scientists for this project. What we did was very important, and will have an effect on the world, and people. The samples that were

collected are very precious and hold the information to many questions we would like to know the answers to such as which invasive species live in Gerritsen creek.

## Hypothesis:

I think there will be plenty of the Round Goby species in the creek. Round Goby are found in New York lakes. I don't think there will be a huge population of Asian Carp fish in the creek because they were discovered in the Mississippi River and haven't completely reached New York yet. There may be Sea Lamprey in the lake since they are popular in Lake Ontario, the great lake that borders New York.

## Materials and Methods:

Materials you will need to complete this lab:

- Polypropylene suction flasks
- A Buchner funnel
- Rubber stopper adaptor for funnel
- 2 Glass fiber filter discs
- A hand held vacuum pump with tube for assembly
- 2 gallon sized Ziploc bags- one for water collection and one for collection tube storage
- Round toothpicks
- 2 forceps (1 for controlled experiment, other for samples)
- 2 collection tubes with cover for storing filter paper after use
- A pair of gloves
- Water Sample from a river, creek, stream, lake, or pond
- GPS unit
- Black trash bag to hold the materials

Lab Method- Step-by-Step process:

1. Find a location and record the GPS readings for your site. Then go into the body of water and get a water sample in the Ziploc bag. Seal it tightly, put aside, and set up your equipment in a sterile area. Put on your gloves.
2. Take out the flask, funnel, forceps, and vacuum pumps. Then, take out the toothpicks, rubber stopper, collection tubes, and fiber discs (filter paper). So the materials don't contaminate, everything may be kept in a black trash bag.
3. Assemble rubber stopper adaptor on the flask with the flat part on the flask and the other side facing up. Connect the clear tube to the hand pump. Then tightly connect the two parts of the Buchner funnel and attach the tubing to the flask.
4. Place the Buchner funnel into the opening of the rubber stopper on the mouth of the flask. Then using a pair of forceps, place **one** filter paper disc into the funnel.
5. Do a controlled experiment. This is important so you have something to compare your experiment to. Do steps 6-8 using a clean water source, like an untouched closed water bottle, instead of your water sample. Then repeat steps 6-8 using your water sample.
6. Once your flask is set up, take a toothpick and poke a hole in the corner of the ziploc bag holding the water sample. Filter the water through the funnel, and pump with the hand vacuum to let the water down. Be careful not to put too much water at a time or else you can cross-contaminate or overflow the flask.
7. With a team member, continue the process holding down the filter paper with the forceps if desired. If the filter paper isn't flat, it won't pick up any eDNA. Once the water in the flask reaches the 300 mL line, stop pouring water and pump until there is no more water in the funnel. Then using the forceps, remove the filter paper from the funnel and fold into a collection tube, being sure to keep it as straight and clean as possible. **DO NOT**

**DROP OR CROSS CONTAMINATE THE FILTER PAPER DISC.** If you do so, you will have to do this process over again. Cover the top of the tube and secure it tightly.

8. Place the tube into the ziploc bag for collection tube storage and send the results to Cornell University.

## Results:

| Fish that contain eDNA | Sea Lamprey | Asian Carp | Round Goby |
|---|---|---|---|
| Was there DNA found? | | | |
| Is the fish invasive? | | | |
| Was there a lot of DNA or a few traces? | | | |

## Discussion:

I loved the lab it was incredible. I enjoyed the outside weather and a day off. We all need a day off once in awhile to have fun. It was a bit cold and windy. I'm not going to lie next year think we should do it on a nicer, sunnier day. Also we don't necessarily need to go into the water to get samples. Next year the students can tie a string to the bucket and toss the bucket into the water. From there we can wheel in the bucket with the DNA. The whole process of going into the water in my opinion was a bit chaotic. Next year that should definitely run smoother. I felt the whole Cornell idea was left a bit unclear. I would have liked to understand more how Cornell is going to test our samples, and what they will figure out from them. As the year progresses i hope to learn more about Cornell and their project. Overall the beach and rivers were great!! We all really had fun and enjoyed every moment. It was a very interesting and intriguing experiment. I highly recommend next year the 9th graders do it. I learned a lot and found it very enjoyable!

In my opinion, the lab was really amazing. It was really cool to see how we test water for many different types of DNA. Although the lab was fun and educational, it wasn't so enjoyable. The day we went to the creek was a really cold day. Maybe next year you could choose a warmer day. Also, the process was very long, so it was hard for me to stay patient, standing, waiting for other groups to finish. Other than that it was a really amazing lab. It was cool to explore the world outside of our classroom or school labs. We actually got to test something in the real world that would be helpful to scientists. This was one thing that really stood out to me about this experiment. I enjoyed it a lot!

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