Transportation of Invasive Species via Boat Traffic in Cold Spring Harbor and Its Effect on Biodiversity

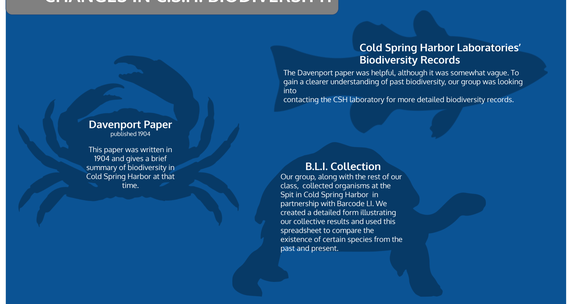
Abstract

The biodiversity of certain areas can be negatively affected by human influence in the environment - this includes the introduction of invasive species (Day, 2016). Our group has chosen to study the effect of boat traffic on biodiversity in Cold Spring Harbor. We hypothesized that the introduction of invasive species via boat traffic has negatively impacted Cold Spring Harbor wildlife by harming organisms native to the area. To test our hypothesis we collected information concerning the regularity of recreational and commercial boating throughout the past century (starting with the publication of the Davenport paper in 1904). We arranged to obtain this information from various sources including: an interview from the staff of the the Cold Spring Harbor Whaling Museum, public records, the Davenport paper, and scientists from the Cold Spring Harbor Laboratories. However we were not able to collect this information from these sources due to the recent outbreak of Covid - 19. Despite the fact that we were unable to collect data from outside sources, we were able to use our own data we collected earlier this year to create a partial conclusion of our research. However, we were not able to determine any correlation between boat traffic and the biodiversity of Cold Spring Harbor. Our data measures the current biodiversity of the area by collecting and documenting organisms found in Cold Spring Harbor and barcoding their DNA. Barcoding the DNA of the collected organisms would have allowed us to accurately identify them and compare the most prevalent organisms of the area currently to the most prevalent species during the time of the Davenport study. However we were unable to visit the DNA Learning Center to do this due to recent social distancing regulations. By doing this we would have been able to determine if there have been any significant increases or decreases in biodiversity in Cold Spring Harbor.

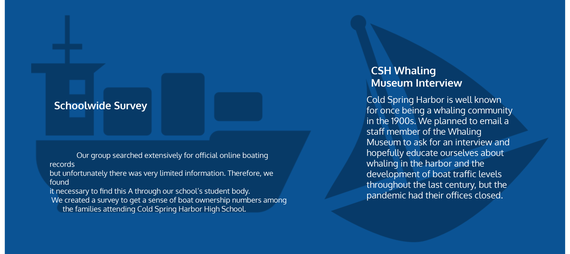
Research

In order to prove that a direct correlation exists between boat traffic and biodiversity, our team had to research and compare the trend in Cold Spring Harbor boat traffic to the trend in biodiversity. This information was not easily accessible online- we had to conduct our own outside research to try to gain a better understanding of our topic.

CHANGES IN C.S.H. BIODIVERSITY:

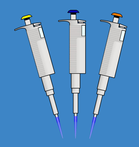


CHANGES IN C.S.H. BOATING:



Materials

The Davenport Paper, published in 1904, was needed to compare our experiment results. We also used various tools to collect our species such as filters for sand and dirt, and shovels.



Tools Used to Prepare Organisms for Barcoding

- Micropipettes
- 6 beakers
- 12 test tubes
- Ethanol
- 1 microscope camera

Methodology

For our biodiversity study we went to the southeastern side of the spit at low tide. Using shovels, buckets, strainers and nets in groups of 3, accompanied by a scientist from the Cold Spring Harbor Laboratories, our group searched for organisms in our designated area. When we found an organism, we recorded its location and habitat, the time we found it, and the name of its species(this was determined with the help of the knowledgeable scientists that accompanied us in our collection). We also took notes of certain species that appeared to be particularly abundant, as well as the environment in which the organism was found. To find the organisms, we searched in the mud with the shovel to look for oysters and clams, turned over large pieces of driftwood or rocks to uncover crabs and looked around on the ground for other organisms. During our collection, we also gathered data on the quality of the water. We measured the pH (using pH strips), turbidity (using a turbidity tube), temperature (using digital thermometers in degrees Celsius) and filter samples of the water we collected back at the DNALC. After our collection, we went to the DNA lab and documented our samples and photographed them. They then were placed in ethanol to preserve them so we could barcode them later on. As a class, we shared all of our results via a Google spreadsheet to consolidate the data we collected. This made one complete data set and made barcoding our collected samples easier and more organized.

Results

Group 4	G4-001		Mollusca	Atlantic oyster drill	Urosalpinx sp	40.86721 N	73.46692 W
Group 4	G4-002		Crustacea	Blue crab	Callinectes sapidus	40.86721 N	73.46692 W
Group 4	G4-003		Mollusca	Ribbed mussel	Geukensia demissa	40.86703 N	73.46402 W
Group 4	G4-004		Mollusca	Mud snail	Lyanassa obsoleta	40.86712 N	73.46395 W
Group 4	G4-005		Platyhelminthes	Ragworm	Nereis sp	40.86811 N	73.46162 W
Group 4	G4-006		Mollusca	Oyster	Crassatrea virginice	40.86813 N	73.46260 W
Group 4	G4-007		Crustacea	Barnacles	Balanidae sp	40.86912 N	73.46301 W
Group 4	G4-008		Mollusca	Jingle shell	Anomia simplex	40.86912 N	73.46301 W
Group 4	G4-009		Crustacea	Fiddler Crab	Uca sp	40.86912 N	73.46301 W
Group 4	G4-010		Platyhelminthes	Small worm	Cerebratulus lactus	40.86912 N	73.46301 W
Group 4	G4-011		Crustacea	Mud crab	Dyspanpeus sayi	40.86912 N	73.46301 W
Group 4	G4-012		Mollusca	Soft shell clam	Mya sp	40.86912 N	73.46301 W

Figure 1

The scientific and common names of the organisms found by our group during our biodiversity collection are shown in the table above (Figure 1).

Due to the recent outbreak of Covid - 19, we were unable to obtain the results from the second portion of our experiment, therefore we can only present the data we collected during the sample collection. This data includes what organisms were found as well as their location and time of collection. Unfortunately this does not supply us with enough information to formulate a complete conclusion, however we did our best to summarize whatever data we collected hitherto.

Sea Stars: The Importance of DNA Barcoding

After combining and analyzing the results of our class' data collections, we found that a different group, Group #2, had discovered a starfish, scientifically identified as *asterias forbesi*. However, upon researching the organism, we found that several sites seem to think that *asterias forbesi* is actually extinct. Having access to DNA barcoding is so important because it can solve these issues and prove that *asterias forbesi* is still in existence and can be found throughout the northwest Atlantic coast.

Mollusca: The Phylum That Continued to Thrive

Our research found that one particular phylum of organisms studied in our collection seemed to be particularly successful: *mollusca*. Our group believes this is because the increasing boat traffic did not have a detrimental effect on these organisms- in fact, certain organisms like mussels or barnacles even find shelter on these boats.

Conclusion

Unfortunately, due to the ongoing pandemic, we were forced to discontinue our research. Although the data we had at that time was not yet enough to be able to form a conclusion relevant to our experiment, we shifted our focus towards the limited information that we did have. Using the Davenport paper and our class collection spreadsheets, we meticulously compared the mentioned species and researched the organisms we found. We did find some proof of decreasing biodiversity- *asterias forbesi*, an organism collected by our research class(Group #2), was described as "very abundant" in the Davenport Paper, but our group's online research shows that they are in limited numbers and some sites even say that they are extinct. However, not all species have been rapidly decreasing since the Davenport Paper's publication: in both the Davenport Paper and our collection records, a myriad of species belonging to the phylum *mollusca* have been recorded as abundant. Our group has very little quantitative information regarding the increasing boat traffic in Cold Spring Harbor, so we cannot connect this information to the changes in biodiversity. However, it is helpful to note that increased boating would likely result in these effects- organisms like barnacles and mussels, that are especially abundant in the harbor today, grow well on boats. The increase in boating in the harbor could explain why they are so successful.

Recommendations

1) **Educate Boaters on Spread of AIS**
   a) host an informational seminar presenting our study & sharing our results on the effect of boating on the environment
2) **Restrict Boating in Designated Nature Areas**
   a) areas with a rich variety of wildlife should be kept safe from boats.
   b) Sea stars are a very endangered species that could die out if new AIS were to be introduced. Areas with higher concentrations of sea stars should be restricted to boaters to protect the species.
3) **Boats must be checked for wildlife/foreign material before re-entering the Long Island Sound.**
   a) Our group suggests the establishment of a checkpoint station where boats entering the Long Island sound are required to be checked for foreign material and wildlife that could potentially introduce new AIS and threaten native species.
4) **Long-distance travel must be reported to the county before departure.**
   a) this applies to travels over 200 miles.

Acknowledgements

1) Barcode L.I. & Cold Spring Harbor DNA Learning Center
   a) Our project was done in coordination with the Barcode L.I. program.
2) Cold Spring Harbor DNA Lab
   a) The instructors at the DNA Lab taught our groups to isolate DNA and how to barcode organisms. This experiment would not have been possible without their help.