Peconic River Species Identification Through DNA Barcoding to Determine Biodiversity

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Abstract

The Forge Pond, Peconic River is a vital habitat and breeding ground for many species of fish and organisms. However, Long Island's nitrogen pollution is reaching critical levels, invasive species are driving out native organisms, and fish species are becoming overpopulated. It is important to measure and maintain biodiversity because it will help with the stability of the ecosystem. If biodiversity is maintained, the issues related to pollution and overpopulation can be managed. People can contribute to finding a solution by conducting biodiversity surveys to assess habitat health. From the research as part of this study, several species may be identified using DNA barcoding as that would show that the area has a very high biodiversity. However, if not many species are identified, that could mean that the area currently has a low biodiversity. The hypothesis of this study is that there will be a high biodiversity. There is a chance of finding species that are invasive or are not logged in the DNA barcoding program, which would give vital information on the biodiversity of this habitat and possible future steps for conservation in this area.

Introduction

This project barcoded these organisms to allow for a better understanding of the areas biodiversity. Barcoding can help with research, pest and disease control, food production and safety, resource management, and biodiversity conservation. (Hebert et al., 2003) This research aims to contribute to solving issues specific to the Forge Pond, like invasive species. DNA Barcoding is a method of species identification. (Questal et al., 2024). Just like every human has a fingerprint, every species has its own barcode. The method uses short segments of DNA. These segments can then be compared to a known database of species to find the ID of the species. (Hebert et al., 2003) DNA barcoding can help people study biodiversity by showing what kinds of species inhabit a certain area and whether they are native or invasive. This project studies the Peconic River as part of the program, A Day in the Life of a River, to track the biodiversity of the rivers on Long Island. The Peconic River is also a very significant habitat and breeding ground for many species of marine life and animals, therefore it is important to know what species are abundant in this river. (Suffolk County Department of Health Services Office of Ecology) Some major issues in the Peconic River are that the river contains excessive amounts of nitrogen and other harmful elements. (Blasl, 2016) The river also has many invasive species and pollution. (Peconic Estuary Partnership) These elements impact biodiversity negatively by harming native species to the point where some of them may start to die off; the invasive species also can outcompete the native species for food and grow their numbers while shrinking the native populations.

Materials and Methods

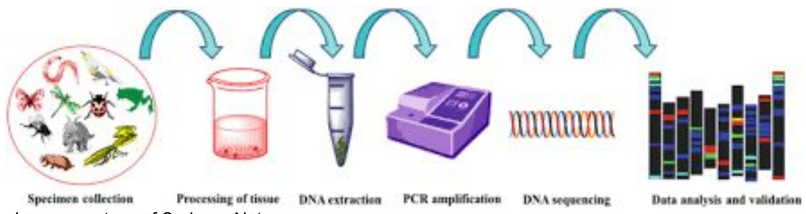
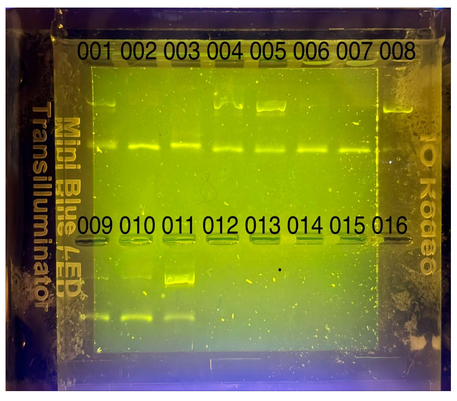


Image courtesy of Springer Nature

Image courtesy of ESPN



Upon arrival at the river seining nets and dip nets were used to scoop alongside the dock and collect specimens. Each of the smaller groups collected the organisms they caught into plastic containers.

Samples were stored in vials and brough back to the classroom. One milliliter of ethanol was added to each vial to humanely euthanize the organisms. They were then frozen in order to preserve the DNA. Silica extraction method was used to extract the DNA from the organisms in order to identify what species they are.

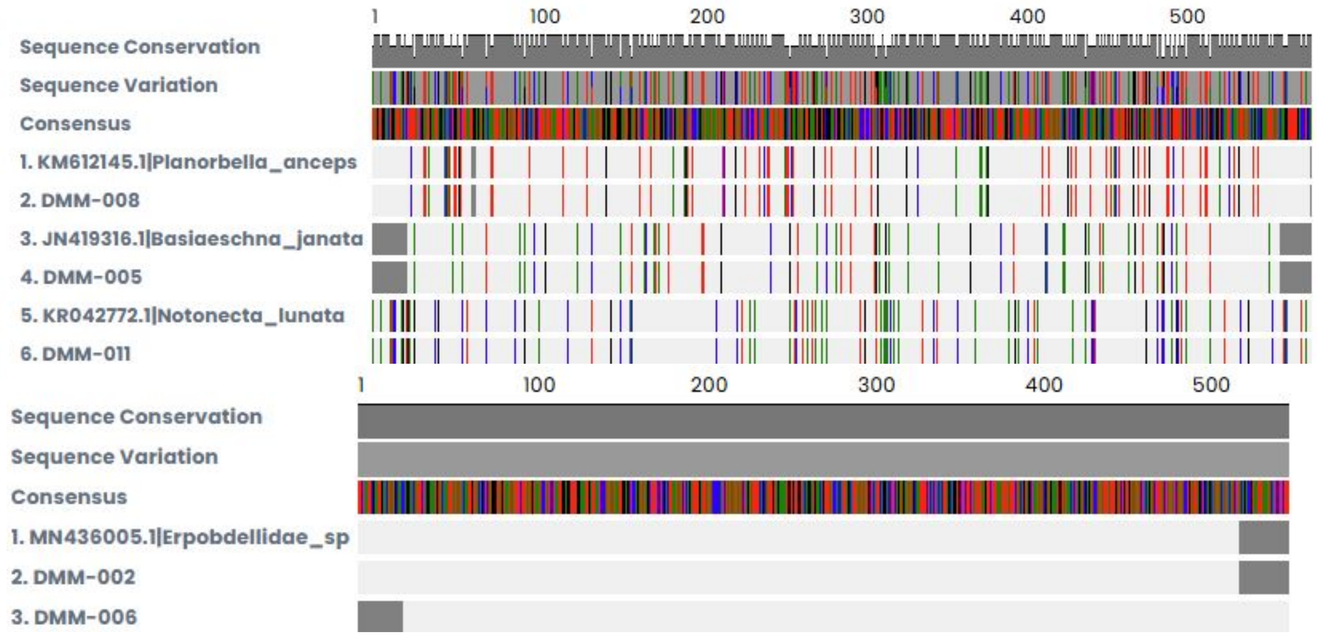
DNA was extracted from the samples and run through gel electrophoresis in order to check to see which samples were successful with DNA extraction. Samples were then sent to the DNA Learning Center to be barcoded. Lastly results were analyzed using DNA Subway to see what species were collected.

References

Results

Images courtesy of DNA Subway

Sample #	Scientific Name	Common Name
DMM-005	*Basiaeschna janata*	Springtime Darner
DMM-008	*Planorbella anceps*	Two-ridge rams-horn snail
DMM-011	*Notonecta lunata*	Backswimmer
DMM-002 and DMM-006	*Erpobdellidae*	Leech



Discussion

The results do not provide enough data to be certain if there are high or low amounts of biodiversity because there were five samples that produced successful DNA barcoding results. However, if one were to assume these results were the best results possible, one would be able to come to the conclusion that there is mild to moderate biodiversity in the Peconic River. The findings can show that the Peconic River is home to multiple marine organisms. Invasive species were not identified, which could suggest that there are not too many invasive species in the river, although the lack of successful results could be affecting this claim. Although this study expected to receive a higher amount of results, fairly accurate conclusions from the limited results could still be drawn. This study was able to inspect native species to the Peconic River and view the biodiversity that supported our outcome.

Future Directions

It is anticipated that this study will expand, with a focus on what the effects this kind of research might be on biodiversity in Long Island rivers. Some important next steps for others would be to consider the results of studies like these and use this information to be more environmentally conscious. People should try to reduce human impact as much as possible to maintain a high biodiversity in ecosystems. This project is continuing and adding to a large-scale long-term study on the biodiversity of the Peconic River that ESM school has been participating in for many years. Additionally, this program is adding more novel species to the database for DNA barcoding in the future.

Acknowledgements

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