



# Genetic Identification of Leech Species as an Indicator of Ecosystem Health in a Freshwater Pond



Ryan Nowak, Sofia Stirpe, and Vanessa Turecamo  
Shoreham-Wading River High School

## Abstract

Leech species were collected and DNA was extracted to help evaluate the health of a small freshwater pond located on the campus of Shoreham-Wading River High School. Using taxonomic identification leeches were identified by physical characteristics. To confirm the taxonomic identification, Barcode Long Island procedures and methods were used to extract DNA, amplify by PCR, and visualize by gel electrophoresis. The two specimens that were amplified were identified as a member of the *Arhynchobdella* genus (PKZ-006) and less conclusively, sample PKZ-008 was identified as *Motobdella montezuma*.



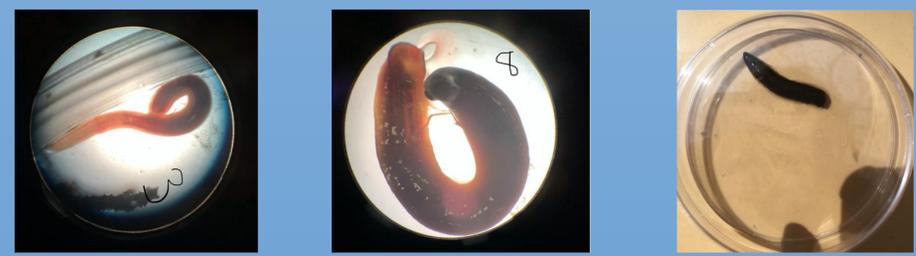
The freshwater pond on the Shoreham-Wading River High School campus

## Introduction

Leeches are carnivorous, segmented worms that are important to both forest and freshwater food chains. They prey on other worms and aquatic invertebrates, and are the prey of fish, birds, turtles and larger aquatic invertebrates (<https://www.des.nh.gov>). Leeches are also important because they are an indicator species, and as such can provide information on the overall health of the pond ecosystem. A high biodiversity of leech species, or an abundance of leeches compared to other macroinvertebrate species, can be an indicator of poor water quality in the aquatic ecosystem (Chernaya and Koval'chuk 2007).

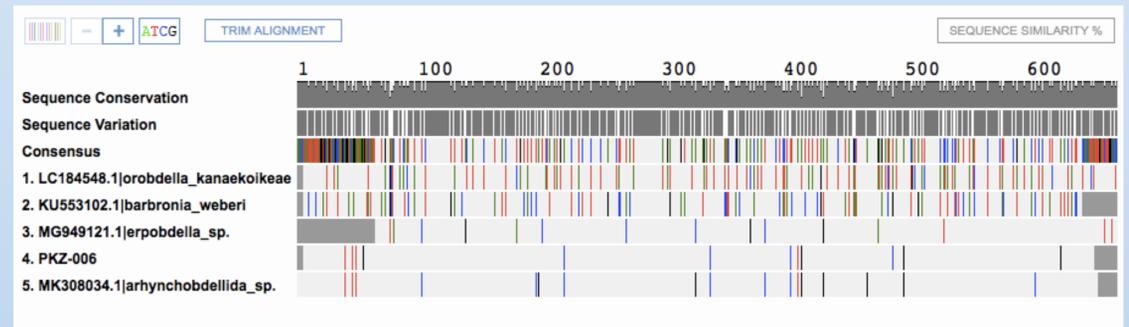
Being that ponds are naturally isolated systems, they require a frequent exchange of members of their ecological community to keep the overall biological workings of the ecosystem in check. Pollution, such as runoff from roadways and rooftops of buildings can affect the composition of biological communities within an aquatic ecosystem and potentially reduce the species richness of native species (Thornhill et al 2016). Leech species, however, are tolerant of poor water quality conditions and will be present in high numbers in spite of potential pollutants.

The goal of this project, in addition to the genetic identification of the leech species, is to determine how the relative abundance of leeches compared to other macroinvertebrates in our pond ecosystem, and to identify the species of leeches present in the pond, to determine how those species may be influencing other populations within the pond community.

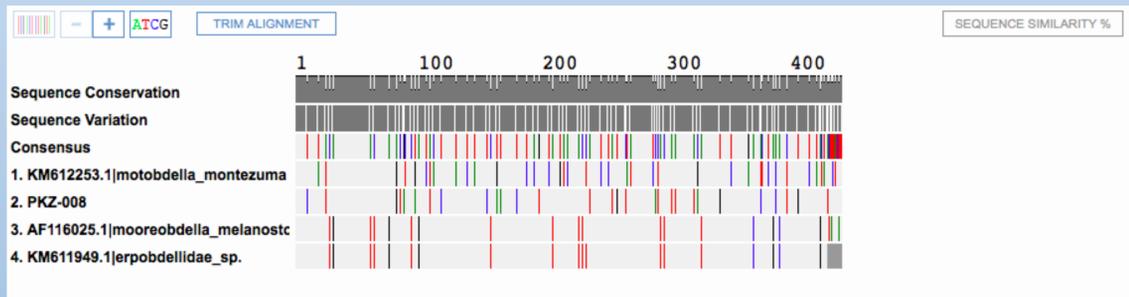


Leech specimens collected from the SWR pond

## Results



PKZ-006 – *Arhynchobdella* sp.



PKZ-008 – *Motobdella montezuma*?

## Materials and Methods

Species were collected from the freshwater pond on our school's campus. Several methods were employed: shovels were used to remove sediment from below the leaf litter on the pond floor (Fig. 2), then transferred to a shallow dissection tray, and sifted through to locate potential sample species. Leaf litter was transferred to a shallow dissection tray, and sifted through carefully to locate individual macroinvertebrate species (Fig. 4). In addition, leech traps were set utilizing old coffee cans and baited with fresh liver. Samples were then removed from the tray or trap using forceps, photographed individually, and placed in a numbered tube. Upon completion of collection, samples were stored in the freezer until additional examination by microscopy and close up photography could be obtained. Genetic identification was obtained following the Barcode Long Island DNA extraction protocol using silica resin, followed by PCR of the COI gene and amplification confirmed by gel electrophoresis.



Coffee can leech trap



Gel electrophoresis to confirm presence of DNA after PCR

## Discussion

The presence of certain species of macroinvertebrates in our pond indicate a healthy pond ecosystem overall, especially if there is a high biodiversity of macroinvertebrates relative to leech species (Carlsen et al 2004 Watershed Dynamics, published by the NSTA). Leeches are residential species, meaning that they spend their lifespan within the same location, which will be a good indicator of the health of the sediment and water in that location (Macova 2009). In addition, leech species have been shown to indicate the presence of cryptic species that may not be seen by the naked eye, but could also add to the understanding of the health of our pond ecosystem (Law 2018). A greater biodiversity of leech species relative to other macroinvertebrates will indicate an ecosystem concern for the Shoreham-Wading River pond, and identification of those species could better inform us of additional species that may be living within the pond as well.

Few samples were obtained, despite multiple methods of collection, which could be an indication that the population of leeches is not plentiful in the pond. Of those samples that were collected, only three species were identified by taxonomic identification, with four of the six samples matching the same species identification. For this reason we tentatively draw the conclusion that the biodiversity of leech species in our pond is low, and may indicate a healthier pond ecosystem as a result.

## References

Carlsen, William S. and Nancy M. Trautmann. "Protocol 5. Collecting Aquatic Invertebrates." *Watershed Dynamics (Student Edition)*. USA: NSTA Press, 2004. Pages 78-84. Print.  
Chernaya, L.V. And L.A. Koval'chuk. "Distribution of Leeches in Aquatic Ecosystems of the city of Yekaterinburg and its vicinity". *Russian Journal of Ecology*, 2009, Vol. 40, No. 2, pp. 111-115.  
Cold Spring Harbor Laboratory DNA Learning Center. "Using DNA Barcodes to Identify and Classify Living Things." 2014. Web. Date of access 2 October 2017.  
Thornhill, Ian, Lesley Batty, Russel G. Death, Nikolai R. Friberg and Mark E. Ledger. "Local and landscape scale determinants of macroinvertebrate assemblages and their conservation value in ponds across an urban land-use gradient". *Biodivers Conserv* (2017) 26: 1065-1086.  
Stroud Water Research Center, Macroinvertebrate Identification key. <https://stroudcenter.org/macros/key/>

## Acknowledgements

We would like to thank Dr. Sharon Pepenella and Megan Capobianco from Barcode Long Island for all of their assistance and patience on this project.