



# The Effect Of Pesticides on the Biodiversity of Aquatic Pond Organisms in/near Golf Courses



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## Abstract

People who use pesticides, especially those in golf courses, could potentially affect the biodiversity of living organisms present in the environment around them. The question is whether golf courses that use pesticides affect the biodiversity of aquatic pond organisms in/near golf courses compared to those that do not. The objective for the experiment was to determine if pesticides can influence the biodiversity of organisms. 20 organisms were collected from each area in which four were successful for barcoding. They were later used to gather the genetic sequence through DNA isolation and gel electrophoresis. The DNA isolation of each sample, showed that the organisms collected from Eisenhower Park and those collected from Harbor Links did not vary in base sequence with information provided by the sequence alignment. Thus, supporting the hypothesis that the biodiversity of organisms located in environments that use pesticides decreased which would affect the environment in each location.

## Introduction

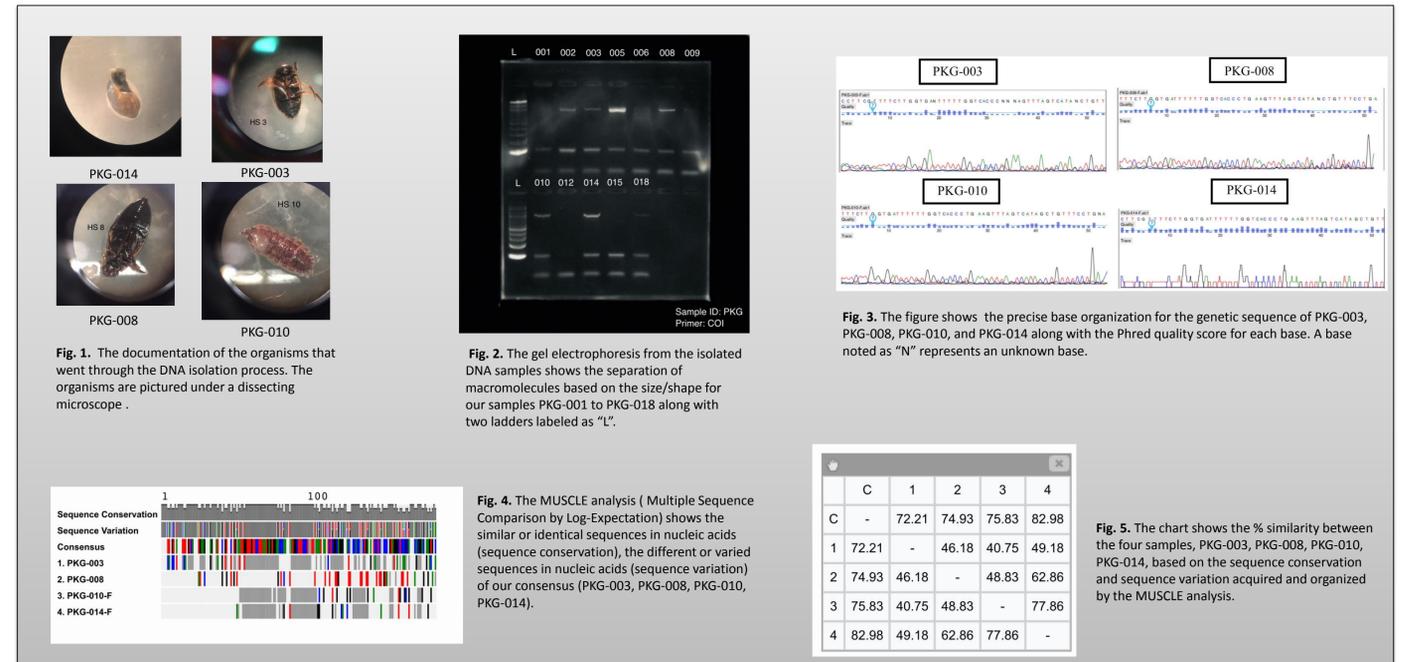
How does the use of pesticides impact the biodiversity of aquatic pond organisms in or near golf courses? Pesticides are a widely used substance used to manage and limit the growth of certain pests and insects. Pesticides can be used by farmers for agricultural purposes to prevent specific, harmful pests that destroy crops. Specific pesticides have shown signs of headaches, eye irritation, asthma, and even cancer in humans. These symptoms are more accessible with pesticides being prone to spread through air, food and water (Ki-Hyun., K. 2016). Barcoding will provide the ability to analyze genetic information and ultimately gather and distinguish this information to identify the biodiversity of these organisms. Studies have shown that water polluted with pesticides have shown an increased level of AChE which is known as acetyl cholinesterase, is an enzyme that breaks down acetylcholine which functions as a neurotransmitter in insects and pests (Nowell.,L. 2014). Once the AChE enzymes break down the neurotransmitters, the insects/pests diaphragms can't contract effectively, can't breathe and end up dying. It can be inferred that pesticides have a negative effect on biodiversity and are directly decreasing the biodiversity of pond organisms (Isenring, 2010). The organisms from the pond can be identified and will distinguish the genetic sequences and bases and ultimately acknowledge how diverse they are using DNA Barcoding. Barcode Long Island is the best resource for this experiment because it will give the ability to explore and track biodiversity of these organisms to find if pesticides used in golf courses near ponds, will decrease the biodiversity of these aquatic pond organisms.

## Materials & Methods

The golf courses collected from the experiment was Eisenhower Park and Harbor Links Golf Courses. The collection date at which organisms were collected from Eisenhower Park was October 27, 2018 and collected from Harbor Links Golf Course on November 2, 2018. Harbors Links Golf Course is known to not use pesticides while Eisenhower Park was known to use pesticides on their land. The organisms were collected by using a fine net. Organisms that were different and unique were found and collected. The total number of organisms collected from both sites was 20, meaning 10 from each site. Then, all organisms went through isolation, amplification, gel electrophoresis, and bioinformatics. However during isolation, when organisms were being ground, 5 microliters of proteinase was added to the lysis solution.

## Results

After receiving the sequences from the samples, there was a limit to only using four sample sequences, PKG-003, PKG-008, PKG-010, PKG-014 because of a failed sequence isolation. As it is seen in figure 3, the sequence analysis of the four samples used show a moderate quality score. Although this moderate quality score, the line representing a quality score of 20, shows that the analysis is predominately 90% confident that the correct base has been assigned (Burke, 2007). Based on the MUSCLE analysis as seen in figure 4. As represented on figure 5, PKG-003 and PKG-008 are 46.18% similar, PKG-003 and PKG-010 are 40.75% similar, PKG-003 and PKG-014 are 49.18% similar, PKG-008 and PKG-010 are 48.83% similar, PKG-008 and PKG-014 are 62.86% similar, and PKG-010 and PKG-014 are 77.86% similar.



## Discussion

Research has shown that there is a correlation between pesticide exposure and a decrease in biodiversity of organisms. Although, there was not enough information or data collected from the research and experiment to prove the hypothesis that if pesticides are used on golf courses and runoff into ponds then there will be a decrease in genetic biodiversity of the organisms in the pond. The gel electrophoresis gels for specific samples collected may have not been approved for sequencing because of insufficient tissue grinding from the organisms or the tissue samples collected from each organism that was used to collect the DNA from, were too small. Though, there were samples that did pass through sequencing, DNA Subway showed the quality of even those sequences were relatively higher, but still contained some unsure base pairs. The results show the advantage of using DNA Barcoding rather than using taxonomic properties because of the difference in identification. With the information gathered in this experiment, it is notable that the sequences had more similarities, showing that with the few organisms used, pesticides did show a decrease in the biodiversity of these organisms. The organisms that did pass through sequencing, PKG-003, PKG-008, and PKG-010, are from Harbor Links, and PKG-014 is from Eisenhower Park. The sequence variation shows that PKG-003 is only 49.18% the similar to PKG-014, PKG-008 is 62.86% similar to PKG-014, and PKG-010 is 77.86% similar to PKG-014. The percent similarity of the DNA sequences show that the organisms from Eisenhower Park and Harbor Links have more similarities than differences to their sequences. Therefore, the hypothesis was proved, that pesticide exposure to aquatic pond organisms in golf courses can potentially decrease the biodiversity of these aquatic pond organisms.

## References

- Burke, R.L., et. al. Vol. 69, No.4 (2007) Pages 229-237
- Isenring, R., Pesticide Action Network (2010) P. 3-11
- Kim,K., et. al. Vol. 575, (2017), pages 525-535
- Nowell,H.L., et. al. Vol. 476-477, (2014), pages 144-157

## Acknowledgements

We would like to thank everyone from Cold Spring Harbor Laboratory , Especially Dr. Megan Wallner. We would also like to thank the managers from Eisenhower Park Golf course and Harbor Links Golf Course. And finally, we would like to thank our mentor, science research teacher and special friend Dr. McGlade-McCulloh.