Using Freshwater Mussels as an Indicator for River Water Quality

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Background Information

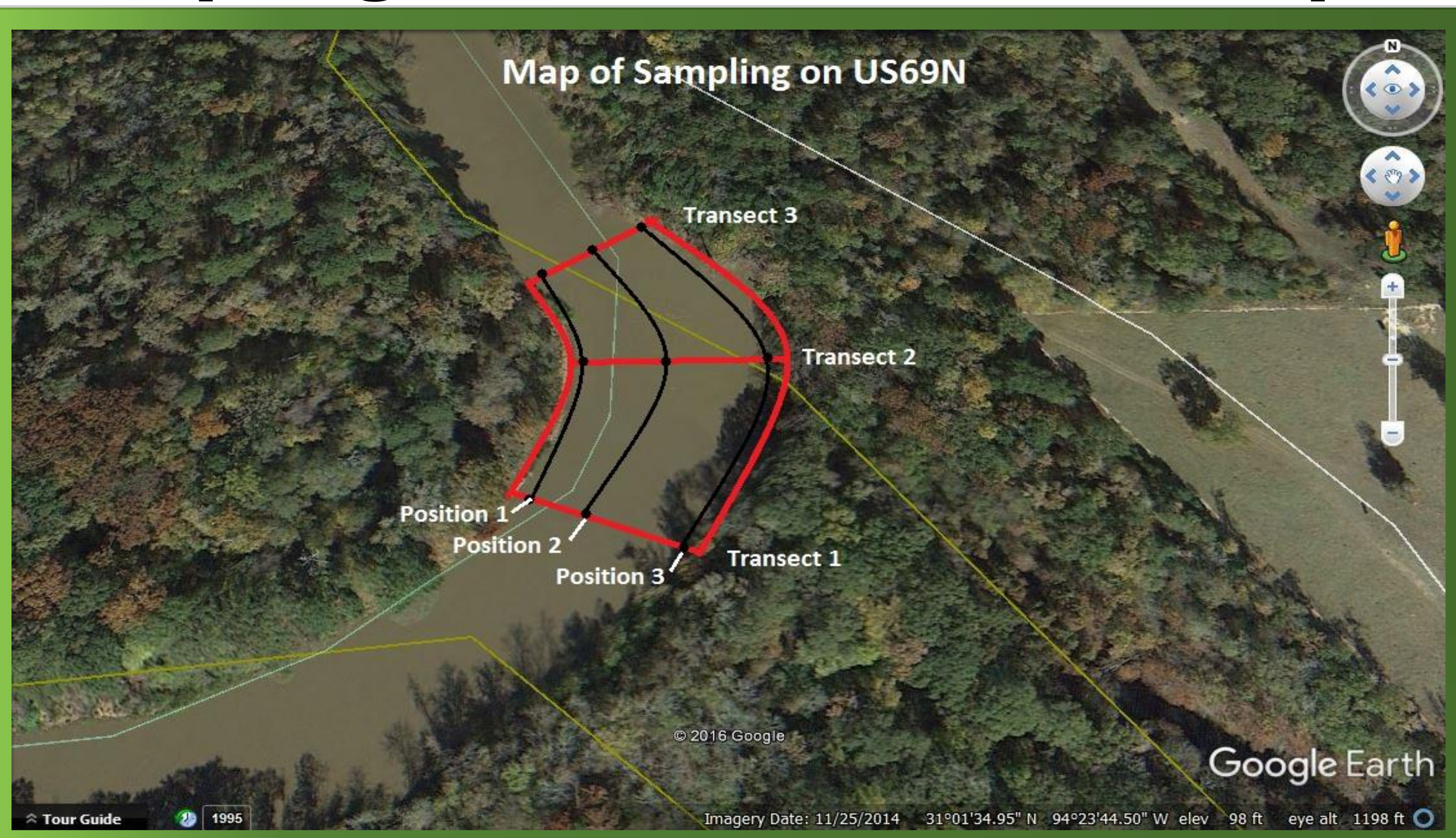
Using the freshwater mussel to monitor water quality is a practical and advantageous way to use nature's indicator species. River water quality is an important measurement that is constantly monitored for many purposes. The sampling involved with monitoring can be very costly and time-consuming. Using mussels as indicator species could save money and time. So, this project has been dedicated to exploring the applications and reality of using freshwater mussels to monitor river quality.

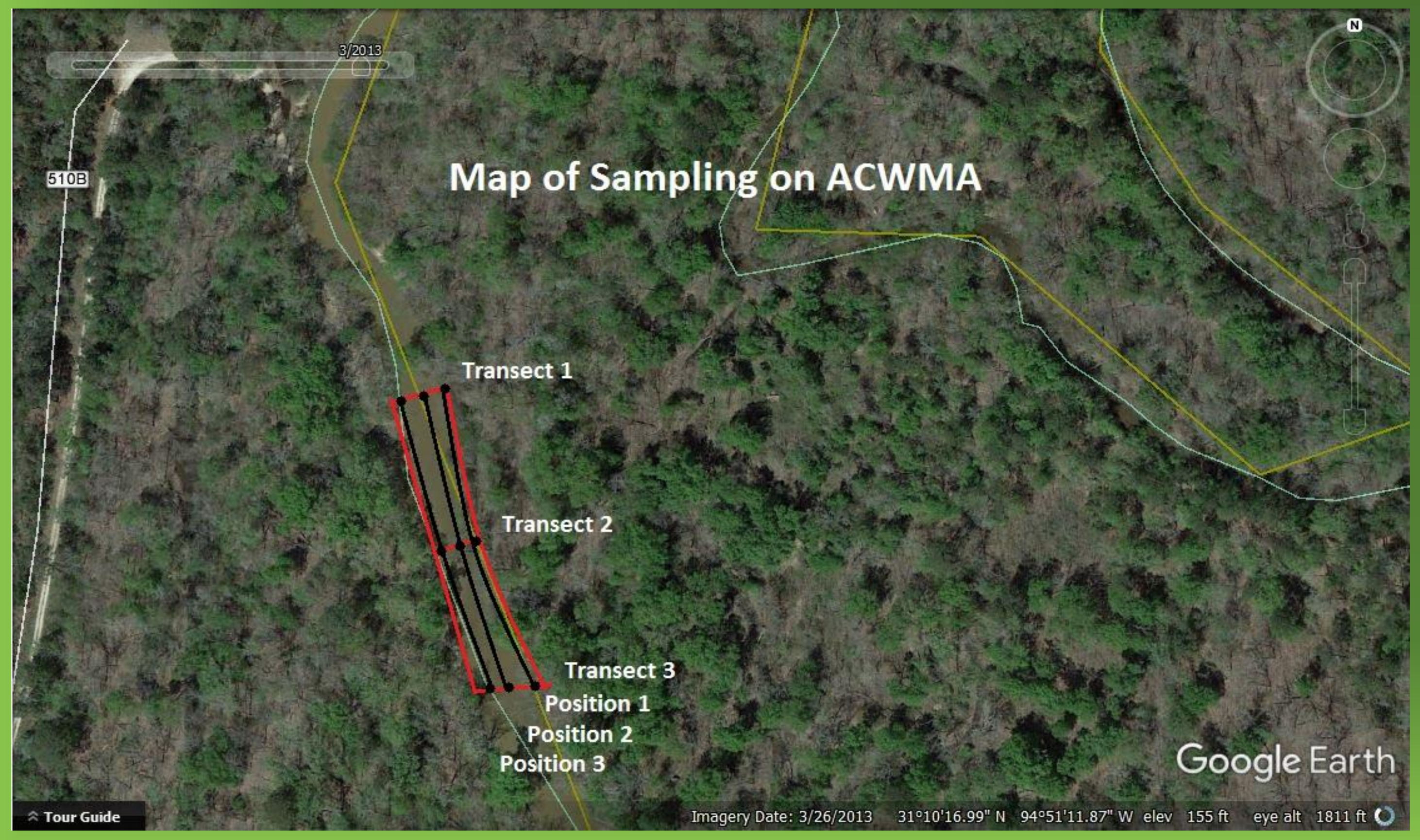
Characteristics of mussel sample data can be correlated to characteristics of water quality sample data taken in the same area. The mussel data available to this project was correlated with different parameters of water quality. . Chosen for this particular study were Dissolved Oxygen, Temperature, pH, and Turbidity. These were taken instantly on-site using a portable multi-parameter meter (Model HQ40d, Hach Company)

Instruments and Supplies

- Hach HQ40d
- Secchi Tube
- Sample Containers
- Google Earth App
- Dissolved Oxygen Probe
- pH Probe
- Kayaks
- Field Research Notebook
- Shovel

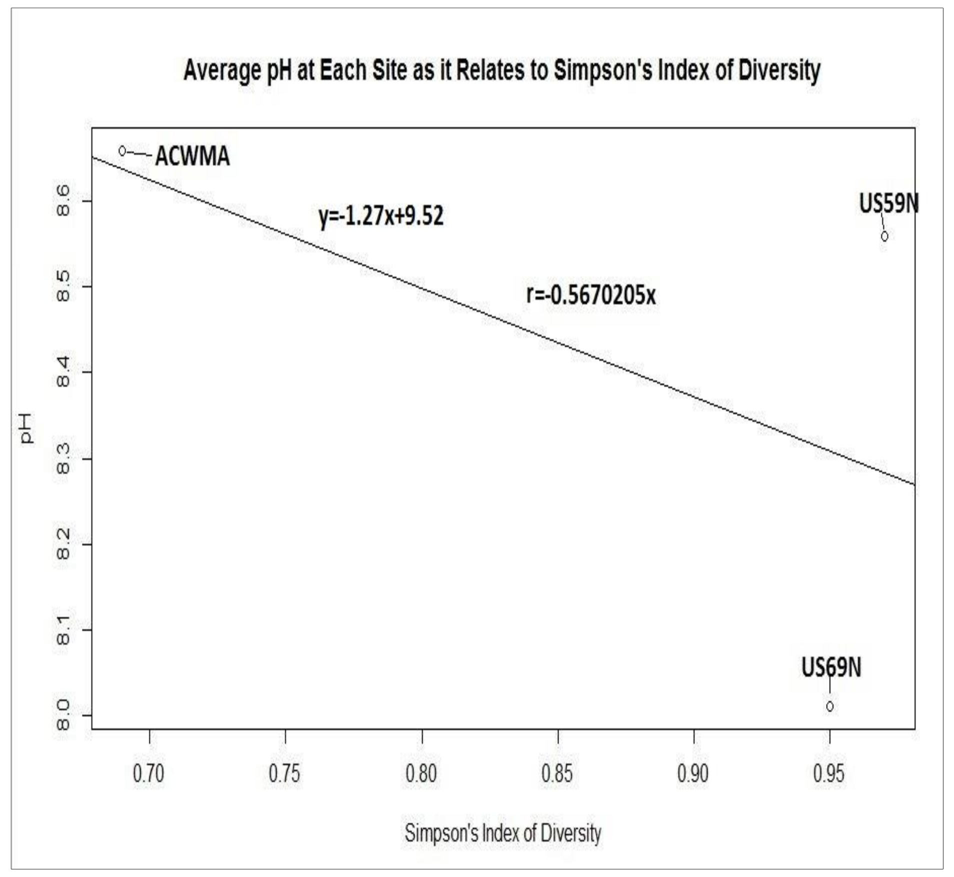
Sampling Location and Techniques

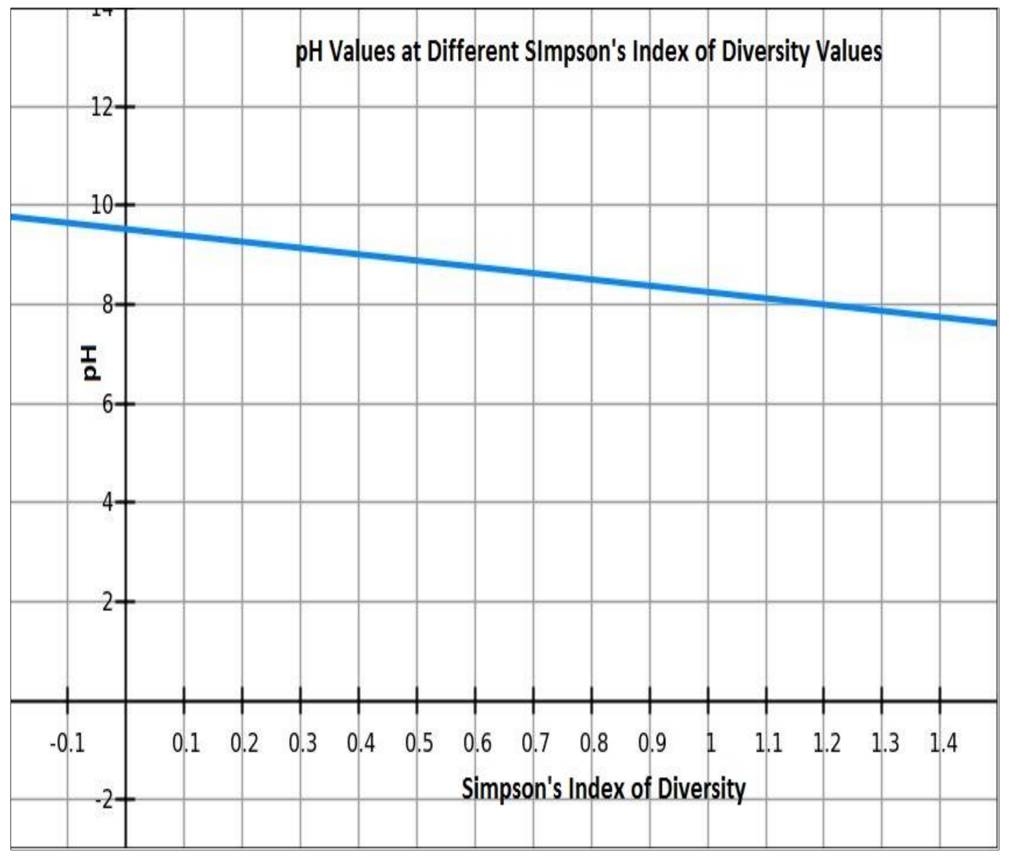




Data Obtained from Sampling

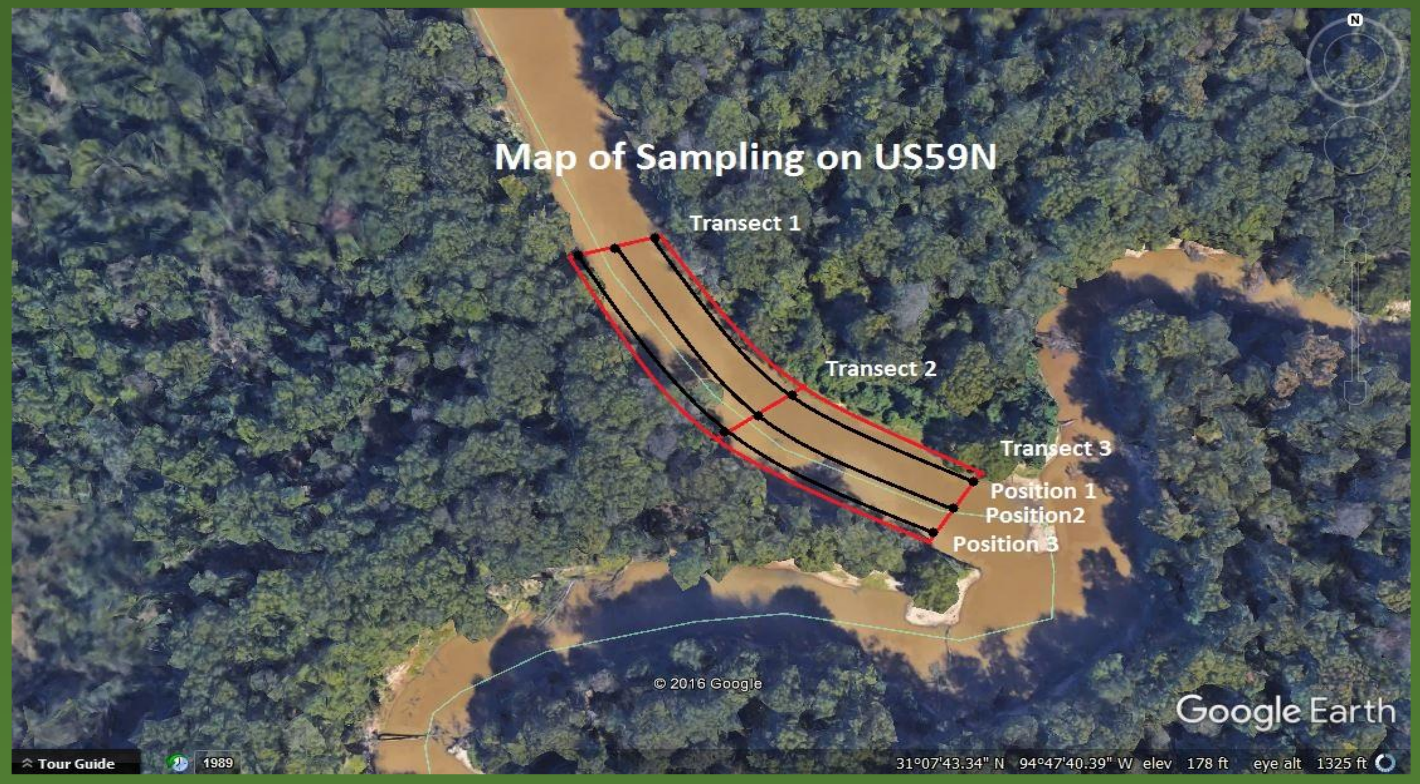
	X1	DO	Temp	pH	Turb	D
1	US69N	7.06	32.37	8.01	25.87	0.95
2	US59N	7.77	21.29	8.56	24.17	0.97
3	ACWMA	0.00	17.50	8.66	21.40	0.69





Methods

To obtain a useable number from mussel population sampling data that is standardized between sites to be able to compare to water quality, Simpson's Index of Diversity was calculated. It can be simply shown by this equation: $1 - D$, where D is calculated by the equation: $D = \frac{\sum n(n-1)}{N(N-1)}$, where n is the number of individuals of a species of mussel found, and N is the sum of total number of mussels found at that site. Once the Index was calculated, water quality data was obtained. These parameters were taken by filling a container with water from the river and then using the appropriate probe attached to the HQ40d to determine the value of the parameter being tested. Turbidity was taken instantly on-site using a secchi tube graded in centimeters. Water quality data was taken from the same site that the mussel data was taken. Then, the average of each water quality parameter was compared to the corresponding location's Simpson's Index of Diversity value.



Acknowledgements

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Data Analysis

To produce a useable and accurate data analysis, correlation between datasets is calculated. The dependent variable is interchanged between the four water quality parameters (dissolved oxygen, pH, temperature, and turbidity/visibility). The independent variable is the calculated Simpson's Diversity Index. A line of best fit was calculated for each dataset as well as the Pearson correlation coefficient (given as r). With the time, budget, and resources of this project, three sites is the maximum that can be sampled. Three sites is only enough to obtain a linear line of best fit. This is enough to show a relationship and make rough estimates of the potential values of a water quality at different diversity levels. This allows an interested party to see at what mussel population diversity does the water become anoxic or hypoxic, too acidic, or too basic for possibly an endangered species or a species targeted for management on a property. The applications for this kind of data are very practical. Being able to check on a river's quality by referencing mussel survey data can be less expensive than checking a parameter of the river constantly. Given more data, a more accurate graph can be calculated. Such a graph could become an easy tool for many agency offices such as the Parks and Wildlife or Forest Service.
Such graph would certainly differ from the ones produced by this project, as several areas of inaccuracy have been identified in the data used for this project. However, this data succeeds in showing the reality of the relation between mussel population diversity and overall water quality.

Conclusions

This project has successfully demonstrated that there are relationships between the Diversity in a freshwater mussel population and water quality parameters. It has demonstrated that such a relationship could be graphed and used as a reference by professionals looking to monitor or manage an area of river. Also, such a system can save money. If professionals consulted mussel population diversity before undergoing a more detailed analyses of river quality, it could save money and limit the need for such large scale operations to be wasted. Treating mussel population diversity graphs as a first phase in river water quality assessment can be practical and advantageous.