Using Macroinvertebrates as Water Quality Indicators in Angelina River

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Abstract

The Angelina River supports a variety of macroinvertebrates, fertilizers, and water-tolerant flora. The goal of this research was to create a complete dataset on water quality that included variables such as pH, dissolved oxygen content, nitrate levels, and temperature. The main objective was to link water contamination indicators with macroinvertebrate diversity to establish an early warning system for ecosystem health by collecting samples at two different locations of the Angelina River.

Analysis using Environmental Protection Agency (EPA) and Lehigh Environmental Initiative guidelines showed that both locations had acceptable dissolved oxygen levels and healthy nitrate levels despite the environmental fluctuation. Using techniques like surface-level container burying and net dragging, macroinvertebrate samples such as stoneflies and Whirligig beetles were collected.

Introduction

Located at the bottom of the Sam Rayburn Reservoir, Angelina River is home to water-tolerant vegetation, varying levels of macroinvertebrates and nutrients. This project aims to provide a comprehensive dataset of water quality, aiding in identifying patterns and variations over time. It also aims to connect macroinvertebrate diversity with water contamination indicators, providing an early warning system for the ecosystem's health. The parameters measured in the Angelina River are the water's temperature, the dissolved oxygen levels, the nitrate levels, as well as the pH levels. The parameters measured outside the water body are the weather forecast and the outside temperature. The project's relevance and timely data will help protect the ecosystem and its population.

Methods

- A field blank was prepared with 10 milliliters of deionized water placed in a labeled glass container that was left open to the elements at the site until the collection was complete.
- For nitrate testing, river water was mixed with a nitrate indication packet, shaken to allow the powder to activate, then analyzed in a colorimeter.
- For the Dissolved Oxygen (DO) test, a water sample was collected in a beaker. A rubber cap was placed in the beaker and the AccuVac Ampul was inserted and broken to fill with river water. After shaking the AccuVac Ampul and letting it settle, the sample was analyzed in a colorimeter.
- For temperature and pH testing, a multi-probe was dipped in a beaker filled with river water.
- For the macroinvertebrate collection, a net was dragged at the bottom of the river. The macroinvertebrates were then transferred to a labeled jar to be researched and identified.
- Each data were recorded in the field journal for further analysis.
- All procedures were repeated at each site location for the next three days.

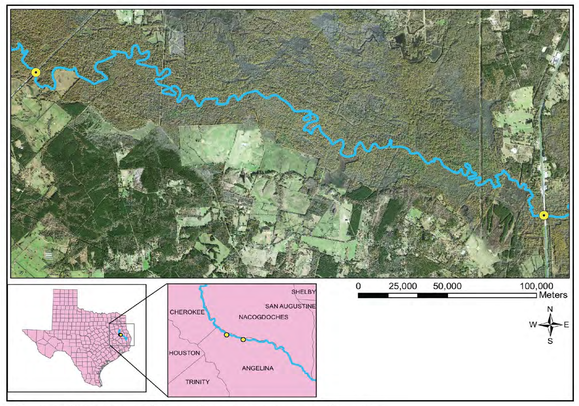

Figure 3: Map of Angelina River sample sites.

Figure 1: Site #1 at Angelina River intersecting Highway 7

Figure 2: Site #2 at Angelina River intersecting Route 59

Figure 4. Fishing spiders, stonefly, and a mosquito

Results & Discussion

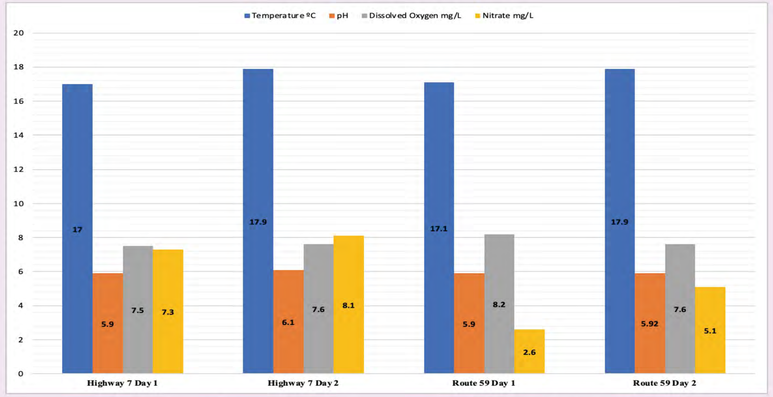

Figure 7: Comparison of water quality measurements from both locations.

The data from the Highway 7 and Route 59 locations revealed varying levels of nitrate and dissolved oxygen in the Angelina River ecosystems. Highway 7 had nitrate levels at 7.3 mg/L and 8.1 mg/L, and dissolved oxygen levels of 7.5 mg/L and 7.6 mg/L, while Route 59 had nitrate levels at 2.6 mg/L and 5.1 mg/L and dissolved oxygen levels at 8.2 mg/L and 7.6 mg/L. The pH of the Angelina River ranged between 5.90 and 6.10, which is more acidic than it should be due to stormwater run-off, fertilizer, or acid rain.

The Lehigh Environmental Initiative at Lehigh University states that nitrate levels in aquatic locations have a range of 0 to 10.0 mg/L, with 1.1 to 3.0 mg/L being considered good, 3.1 to 5.0 being fair, and greater than 5.1 mg/L being poor. The normal range for a river can range between 0.01 to 3.0 mg/L. The data indicates healthier nitrate levels at the Route 59 location.

The Environmental Protection Agency (EPA) requires dissolved oxygen levels below 5 mg/L to harm aquatic life. Both Highway 7 and Route 59 locations showed proper dissolved oxygen levels, with Route 59 showing higher dissolved oxygen rates and lower traces of nitrate. The pH and temperatures were similar at both locations, but slight variations were due to recent rainfall.

The data collection results indicated moderate to healthy dissolved oxygen and nitrate levels. Whirligig beetles indicate tolerable levels of pollutants for insects, while Stoneflies are good water quality indicators. The only data collected for macroinvertebrates were Whirligig beetles, as they would not be present if high pollution levels were found.

Figure 5: Whirligig beetle

Figure 6. Stoneflies

Conclusion

The macroinvertebrate samples collected from both locations, whirligig beetles, indicate moderate water quality. The water sampled from both sites were considerably better for aquatic life due to its more appropriate levels of dissolved oxygen. The water sampled from site #2 at Route 59 on day 1 was considered more tolerable for aquatic life due to its low nitrate level. However, the identification of stoneflies and fishing spiders retrieved from the first location on the banks are good indicators of tolerable levels of pollutants.

The collection methods, the first being the sample containers along the river, and later the net, both suggest similar findings regarding macroinvertebrates. The evidence of the macroinvertebrates being found suggests moderate to healthy aquatic ecosystems located at both sites. The stoneflies are less tolerant to pollution, while the whirligig beetles have a moderate capability of experiencing some pollution. The two different sampling methods allowed for more samples to be collected for examination, which in turn, allowed for a more accurate analysis of the locations.

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