



### Abstract

Our research was done to test if surface dissolved oxygen had a stronger correlation to the surface temperature or the depth beneath the sample location. We also aimed to create a basin profile of Sand Lake at Chain O' Lakes State Park in northeast Indiana (See Figure 1) using 8 sample waypoints along a transect of the lake. Dissolved oxygen is an important factor in establishing the health of a lacustrine environment and finding a correlation between surface temperature and depth may allow for fast, less expensive indirect measurements. Our study showed there was a stronger correlation between surface temperature and dissolved oxygen.

## **Question/Hypothesis**

Dissolved oxygen concentration is a key indicator in evaluating the health of the aquatic ecosystem. Our investigation aimed to determine if there were correlations between surface temperature and dissolved oxygen, and if there were correlations between depth and dissolved oxygen measured at the surface. We believe there is a stronger correlation between the surface temperature and dissolved oxygen concentrations at the surface than the depth of water beneath the sample location.



Sand Lake Transect WP2 Sand Lake Transect WP3 Sand Lake Transect WP4 Figure 2

Sand Lake Waypoint Transect

Location of Chain O'Lakes State Park n northeast Indiana

Fiaure 1

### Introduction

As part of this experiment, we wanted to create a profile of basin of Sand Lake using a depth finder. To do this, we used the Garmin BaseCamp software to draw a transect line with eight waypoints along the line. We used a LuckyLaker portable depth finder (model Lucky FF1108-1CT) to measure the depth at each waypoint and then used this data to create a profile of the lake basin. We also measure surface temperature and dissolved oxygen using a Vernier GoDirect Optical Dissolved Oxygen sensor. Data was collected twice a month in September and October 2020. Our data suggests there was little to no correlation between surface dissolved oxygen concentration and the depth of water at that waypoint. There is a strong correlation (r = 0.786) between surface temperature and dissolved oxygen when analyzed across entire data set.

# A Comparison of Surface Temperature and Dissolved Oxygen when **Cross-Referenced with Water Depth** Brayden Baker, Cody Bickley, Sarah Cooper, Jack O'Connor Garrett High School

### **Research Methods**

Our plan to collect data was to use the GLOBE Protocol for dissolved oxygen testing. We used the protocol to analyze the dissolved oxygen levels in Sand Lake at Chain O'Lakes State Park. The protocols gave us the necessary data to determine whether there is a correlation between surface temperature and dissolved oxygen, or if there is a stronger correlation between surface dissolved oxygen and the depth beneath the surface. We used the Vernier GoDirect Dissolved Oxygen sensor to measure the dissolved oxygen concentration at the surface at each of the eight waypoints along the transect (See Figure 2). This sensor also allowed us to measure water surface temperature. We used a LuckyLake portable depth finder to measure the depth at each of the eight waypoints

Our research was over the significance of depth and surface temperature to dissolved oxygen over a string of waypoints across Sand Lake at Chain O' Lakes State Park. We accessed the eight waypoints using a single user kayak, and a GPS unit to find the locations of each waypoint. At each waypoint, the depth finder was used to measured the depth, then we used the Dissolved Oxygen sensor for three readings over three periods of thirty seconds to measure the dissolved oxygen concentration in the surface water at each waypoint. The average of those three readings were recorded as the dissolved oxygen concentration for each way point. The Dissolved Oxygen sensor was also used to find the surface temperature of the water at each waypoint. We collected data four times over a period of eight weeks to verify if the correlations were consistent.



Check out our drone footage and data tables by scanning the QR code above







Sand Lake basin profile based on waypoint depth measurements



## THE GLOBE PROGRAM

Global Learning and Observations to Benefit the Environment

### Discussion **Interpreting Data**

After conducting our research we established there was very little fluctuation in the D.O. levels throughout the lake. We found that often as the temperature increases the dissolved oxygen levels would begin to rise. The surface temperature (See Surface Temp vs Depth graph) shows a slight dip in the surface temperature based on depth. The vertical change in the surface temperature is based on the four days with different temperatures. However, the dip is parallel across all four test dates. We also found very little correlation between the surface dissolved oxygen when compared to the depth below the surface. We found that there were a few outliers through our research though. These occurrences usually appeared at our final waypoint of the lake, WP8. At this way point we would often find a large spike in dissolved oxygen higher then the entire increase throughout the entire lake. These spikes occurred in areas with large amounts of vegetation, specifically vegetation close to the surface of the water. Through this we concluded that the spikes were the cause of photosynthesis occurring i these plants leading to a spike in oxygen levels in said areas.

### Conclusions

Our conclusion is that there is a stronger correlation between the surface temperature, than the depth of the water. We found that there was little to no correlation between surface dissolved oxygen and the depth beneath the surface. Our also demonstrated that aquatic flora contributes heavily to the dissolved oxygen concentration. We plan to expand on this project in the future by investigating dissolved oxygen at various depths, comparing dissolved oxygen concentrations over a longer time period, and comparing the dissolved oxygen content of Sand Lake to other nearby lakes such as Sylvan Lake (Rome City, IN) and Story Lake (Ashley, IN).

## Bibliography

Macuch, C. & Klug, J. (2020). High Frequency Data for Temperature and Oxygen Reveal the Potential for Stressful Conditions for Fish in a Southern New England Impoundment. Northeastern Naturalist. 27(3). p 520 - 533

Zahraeifard, V. & Deng, Z. (2012). VART Model-Based Method for Estimation of Instream Dissolved Oxygen and Reaeration Coefficient. Journal of Environmental Engineering. p 518 - 524