**Presentation Script**

**Introduction (Manthan)**

* Good morning/afternoon everyone. We're here to present our findings from the Woodlands and Waterways Ecowatch project.
* The goal of this project was to assess the health of different County lakes in Ontario by analyzing five years of benthic macroinvertebrate data.
* We aimed to identify key environmental drivers, predict future changes in biodiversity, and provide insights for lake conservation.

**Objectives (Vishesh)**

* To assess changes in functional diversity and ecosystem health indices over time.
* To develop predictive models to understand the influence of site characteristics on biodiversity.
* To explore relationships between biological responses and water chemistry parameters.

**Spatial Trends (Manthan)**

* Our analysis revealed spatial gradients in elevation and associated parameters across the study lakes.
* For example, Kawagama Lake exhibits a significantly higher Elevation Over Time (EOT) compared to Gull and Hall Lakes.
* These spatial patterns suggest potential differences in ecological processes and community composition among lakes.

**Water Chemistry and Biological Responses (Vishesh)**

* We found key relationships between water temperature, dissolved oxygen, conductivity, and pH.
* For example, a negative correlation was observed between water temperature and dissolved oxygen, indicating potential stress on aquatic organisms.
* Understanding these relationships is crucial for assessing the impact of environmental factors on lake ecosystems.

**Predictive Modeling (Manthan)**

* We developed a Random Forest model to predict future trends in biodiversity.
* The model achieved an R2 of 0.76 and a Mean Absolute Error of 0.06, indicating good predictive performance.
* Feature importance analysis revealed biotic factors like the Biotic Index and Malacostraca as primary drivers of biodiversity.

**Temporal Trends (Vishesh)**

* We observed a decline in the Simpson Diversity Index (SDI) after 2024, suggesting potential ecological stressors.x
* Predictive modeling suggests a continued decline in SDI in the future, highlighting the need for proactive conservation measures.

**Conclusion (Manthan)**

* Our study provides valuable insights into the spatial and temporal dynamics of benthic macroinvertebrate communities in County lakes.
* Understanding the influence of environmental drivers and predicting future changes is essential for effective lake conservation and management.

**Future Directions (Vishesh)**

* Validate predictive models with additional datasets.
* Expand monitoring to include nutrient loading, invasive species, and climate factors.
* Develop actionable conservation strategies to mitigate biodiversity loss and enhance ecosystem resilience.

**Potential Questions and Answers**

**Q: How did you account for potential biases in your data collection and analysis?**

**A:** We implemented rigorous quality control measures, including standardized sampling protocols and data cleaning techniques. Additionally, we considered potential biases related to sampling effort and habitat heterogeneity in our analysis.

**Q: What are the specific implications of the observed decline in the Simpson Diversity Index?**

**A:** A decline in SDI indicates a loss of biodiversity and ecosystem resilience. This could lead to reduced ecosystem services, increased vulnerability to disturbances, and potential shifts in community composition.

**Q: How can your predictive models be used to inform management decisions for lake conservation?**

**A:** Our predictive models can help identify lakes at risk of future biodiversity loss and prioritize conservation efforts. They can also inform the development of targeted management actions, such as habitat restoration, water quality improvement, and invasive species control.

**Q: What are the limitations of your study and what further research is needed?**

**A:** Our study focused on a limited number of lakes and a relatively short time period. Future research should expand the spatial and temporal scope of the study to gain a more comprehensive understanding of long-term trends and regional patterns. Additionally, incorporating additional environmental factors, such as climate change, could enhance the predictive power of our models.

* **Spatial Trends:**
  + Can you elaborate on the potential causes of the observed spatial gradients in elevation and associated parameters?
  + How do these spatial patterns relate to the distribution of different benthic macroinvertebrate taxa?
* **Water Chemistry and Biological Responses:**
  + Could you discuss the mechanisms underlying the negative correlation between water temperature and dissolved oxygen?
  + Are there any specific taxa that are particularly sensitive to changes in water temperature or dissolved oxygen?
* **Predictive Modeling:**
  + How confident are you in the predictive ability of your Random Forest model?
  + What are the potential uncertainties associated with the model's predictions?
* **Temporal Trends:**
  + What are the potential ecological factors driving the decline in the Simpson Diversity Index?
  + Could climate change be contributing to this decline?

**Answers:**

* **Spatial Trends:**
  + The spatial gradients observed in our study may be influenced by factors such as lake depth, water residence time, nutrient loading, and historical land use. Further research is needed to explore these potential drivers in more detail.
  + Certain taxa may be more abundant in lakes with specific elevation and associated parameters. For example, some taxa may prefer deeper, colder lakes, while others may thrive in shallower, warmer lakes.
* **Water Chemistry and Biological Responses:**
  + The negative correlation between water temperature and dissolved oxygen is likely due to the decreased solubility of oxygen in warmer water. As water temperature increases, the amount of dissolved oxygen it can hold decreases, potentially leading to stress and mortality for aquatic organisms.
  + Some taxa, such as mayflies and stoneflies, are particularly sensitive to changes in dissolved oxygen levels. These taxa may experience declines in abundance or disappear altogether as water temperatures rise and oxygen levels decrease.
* **Predictive Modeling:**
  + While our Random Forest model achieved a relatively high R2 value, it is important to acknowledge that there is always uncertainty associated with any predictive model. The model's predictions are based on the available data and the assumptions inherent in the modeling process.
  + Potential uncertainties include the accuracy of the input data, the representativeness of the study sites, and the potential for unmeasured factors to influence biodiversity patterns.
* **Temporal Trends:**
  + The decline in the Simpson Diversity Index could be attributed to a variety of factors, including habitat degradation, pollution, invasive species, and climate change. Further research is needed to identify the specific drivers of this decline.
  + Climate change is likely to exacerbate existing stressors on lake ecosystems, such as increased water temperature, altered precipitation patterns, and more frequent and intense storms. These changes could further contribute to biodiversity loss and ecosystem degradation.