Report Template

Title of Project: How Temperature and Wind Affect River pH: A Study on Water Chemistry

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Abstract

This project looks at how water temperature and wind speed affect the pH levels of a river. We think that as the water gets colder, the pH will go up because colder water can hold more carbon dioxide, which makes the water more acidic. We also think that higher wind speeds might lower the pH by mixing more gases into the water. We measured water temperature, pH, outdoor temperature, wind speed, and precipitation on different days. Our results showed that when the water was colder, the pH went up, which matches the idea that colder water holds more carbon dioxide. However, wind speed didn't seem to change the pH very much. This means that water temperature has a bigger effect on pH than wind speed, and it helps us understand how weather changes could affect rivers.

Intro

Research Question

How does water temperature and wind speed affect the pH level of a river?

Hypothesis

When water temperature drops then the pH level of the body of water will go up because colder water can have more carbon dioxide. Which will make the water more acidic. Continuing, if the wind speed goes up then the pH level might go down slightly because strong winds help mix gases into the water, which changes the level of pH.

Why This Research Matters?

Bodies of water are important for animals, people, and plants. The pH level of a body of water affects what is able to live in it and large changes in pH can harm the fish and other creatures living in the water. It is important to know how things like the temperature and wind can affect the pH level so we can understand how weather and climate changes might impact rivers in the future. Understanding this better can help protect water sources and keep bodies of water healthy. Background Information

What Is pH?

pH is a way to measure how acidic or basic something is. The scale goes from 0 to 14. If

the pH is below 7, the water is acidic. If it's above 7, it's basic. Many rivers have a pH between 6.5 and 8.5. If the pH changes too much, it can make it hard for fish and other animals to survive (Wetzel, 2001).

How Temperature Affects pH

Water temperature can change pH because colder water can hold more gases like carbon dioxide. When CO_2 mixes with water, it creates carbonic acid, which can lower the pH. Warmer water releases CO_2 into the air, which can make the pH go up (Stumm & Morgan, 2012).

How Wind Affects pH

Wind could also be a factor in pH level because it mixes up water and the gases into it. When there is a lot of wind more CO_2 might get into water, which makes the pH go down. On the other hand, wind can also help with adding oxygen to the water which would raise the pH(Falkowski & Raven, 2007).

Other Factors That Can Change pH

Pollution, rain, and soil can also have an impact on pH levels. Acid rain can make the water more acidic, while the pollution from factories and farms could raise or lower the pH. During our data collection we had very little rain, so we are mainly focusing on the temperature and wind (Smith et al., 2019). When rivers have more plants and algae they can have higher pH levels because they remove CO_2 from the water during photosynthesis(Johnson & Peterson, 2016).

In this research, we will look at how water temperature and wind speed affect pH. This is important because it helps us understand how nature works and how changes in weather could affect rivers in the future.

Methods and Materials

Methods: When we did data collection we began with using a thermometer to measure the temperature of the water. We made sure the thermometer was in the water for at least 15 seconds to obtain an accurate reading. Once the water temperature was recorded, we used a pH strip to test the water's pH level. The pH strip was dipped into the water and allowed to sit for a little. Afterward, we compared the color of the strip to the color chart on the pH strip bottle, which showed the pH value. Additionally, we recorded the outdoor temperature by consulting the weather station in the room.

After talking with Sara, we used the measurement of wind speed into our process. The scientist directed us to a website (name to be included later)(I forget it) that provided the wind speed data from the days we did the pH and temp of water. This allowed us to gather wind speed data corresponding to each day we had previously collected water samples.

Throughout the experiment, we recorded the data on the days we had lunch in the lab. We performed the pH and temperature readings each time, ensuring that all data was correctly logged and had the right date.

Risks and Safety Precautions: The primary risks associated with this experiment involved working with water sources and the use of the thermometer. To minimize risks, we made sure all

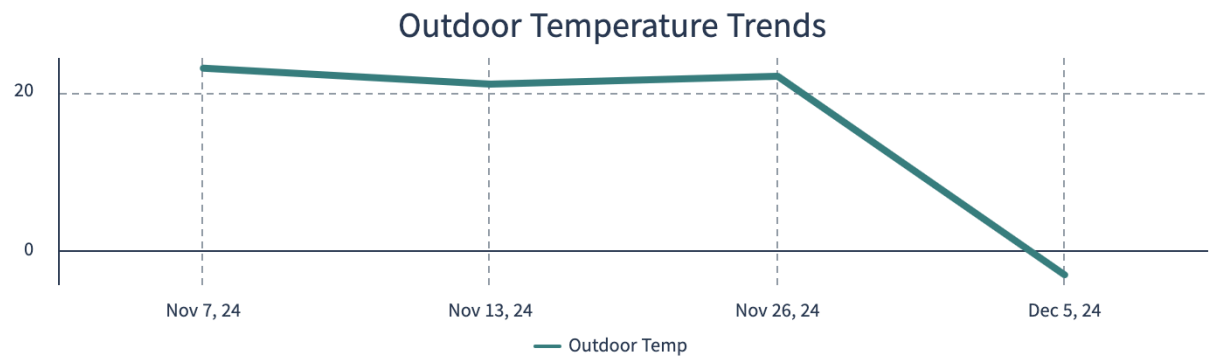
equipment was dry and correctly set up before use. We also followed proper procedures when handling the pH strips to avoid contact with any substances.

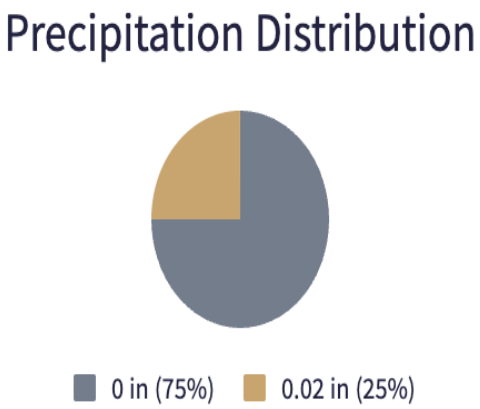
Statistical Analysis: To analyze the data, we will calculate the average for both water temperature and pH levels. We will also try to gather a correlation between outdoor temperature, water temperature, wind speed, amount of rain and pH levels.

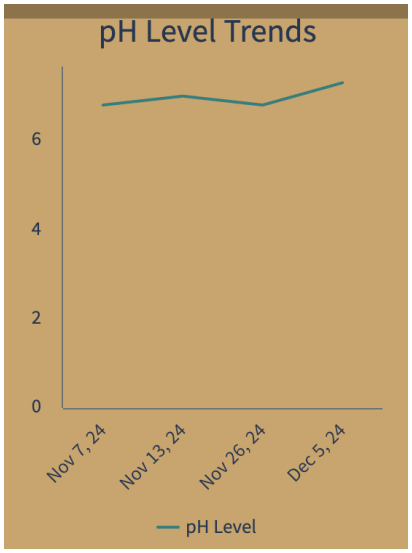
Presentation of Data and Results

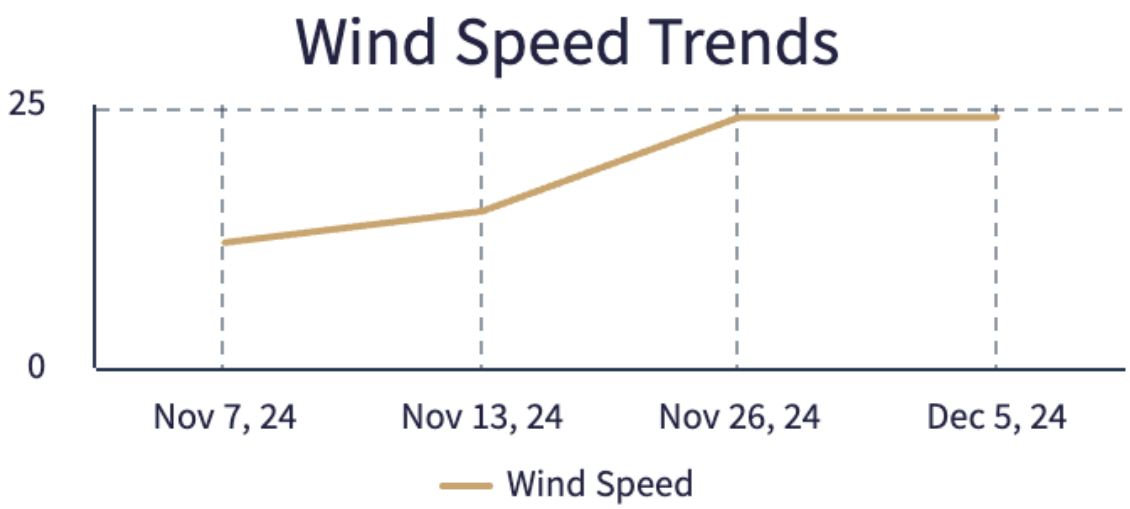
	pH Level	Water temp (c)	Outdoor Temp (c)	Precipitation	Wind
Nov 7, 24	6.8	14.4 c	23 c	0 in	12mph
Nov 13, 24	7.0	10 c	21 c	0 in	15mph
Nov 26, 24	6.8	13.6 c	22 c	0.02 in	24mph
Dec 5, 24	7.3	1.1 c	-3 c	0 in	24mph

Graphs/Charts:









Based on our data it shows that the pH levels went up when the water got colder. On November 7, the water was 14.4°C, and the pH was 6.8. But by December 5, the water was much colder at 1.1°C, and the pH had gone up to 7.3. This supports that colder water holds more carbon dioxide, which can alter the pH levels. The pH stayed the same 6.8 on November 7 and November 26, even though the water temperature was a little different. But when the water got really cold on December 5, the pH went up more. This could potentially mean that pH changes more when the water gets really cold. The wind speed did not seem to make a huge difference in the pH levels. For example, on November 26 and December 5, the wind speed was the same at 24 mph, but the pH was different. This means temperature probably had a larger effect than the wind. One unusual result occurred on November 13, when the pH was 7.0 even though the water was 10°C. This could have been because of little changes within the water that we didn't get results from. Overall, the results show that water temperature affects pH more than wind speed. The colder the water, the higher the pH.

Analysis and Results

Our findings suggest that water temperature affects pH levels, while wind speed does not have a clear impact. The data shows that when the water temperature decreased, the pH level increased. For example, on December 5, the water was the coldest at 1.1°C, and the pH was the highest at 7.3. This supports our hypothesis that colder water holds more carbon dioxide, which changes the pH. To analyze our data, we could calculate a correlation between temperature and pH. We did not use any large equations to conduct our experiments but there are a couple different ones we could look into further if we were to continue with this. When looking at wind speed, our results did not show a clear connection to pH changes. On both November 26 and December 5, the wind speed was 24 mph, but the pH levels were different. If wind had a strong effect, we would expect pH to follow a pattern based on wind speed, but that did not happen. This suggests that wind may not be a major factor in changing pH. Our hypothesis said that colder water would raise the pH and that stronger winds might lower it. The first part of our hypothesis was supported by the data, but the second part was not proven. Some other studies also show that temperature affects pH. According to our research, colder water holds more carbon dioxide, which reacts with water molecules to form carbonic acid. This can make water more acidic, but in natural bodies of water, buffering systems (like dissolved minerals) may cause the pH to rise instead. This helps confirm why we saw the pH increase as temperatures dropped. Wind might not have had an effect because the changes in speed were too little, or other factors, like water mixing, played a bigger role.There were some possible errors in our experiment. One issue was using pH strips, which can be hard to read and may not give the most accurate results. A digital pH meter would provide more accurate measurements. Another thing

is that we did not measure the amount of carbon dioxide in the water, which would help explain why pH changed. Other outside factors, like pollution or sunlight, may have also affected the pH without us noticing it. To better this experiment, we could use more accurate tools, take more measurements over time, and test different water sources. We could also measure how much carbon dioxide is in the water to see if that explains the pH changes. These changes would give us a better picture of how temperature and wind speed affect pH and help us understand the results even better.

Conclusion

Our experiment shows that water temperature affects the pH level of a river. When the water was colder, the pH was higher, which supports our idea that colder water holds more carbon dioxide, making the water more acidic. But wind speed didn't have much effect on the pH, which suggests that other things, like how the water mixes, might be more important than wind alone. Some problems with the experiment, like using pH strips that might not be very accurate, could be fixed by using better tools. Overall, this research helps us learn how temperature can change river water, and it could be useful for understanding how weather and climate changes affect rivers in the future.

Discussion

The results of this experiment show that water temperature has a clear effect on the pH level of the river, while wind speed does not seem to make much of a difference. When the water was colder, the pH was higher, which supports the idea that colder water can hold more carbon dioxide, making the water more acidic. Wind speed didn't show a clear pattern in the data, so it might not be a big factor in changing the pH. If we were to repeat the experiment, we could make a few improvements. First, using more accurate tools, like a digital pH meter, would give us better results than pH strips. It would also help if we measured the amount of carbon dioxide in the water because that could explain why the pH changed when the temperature did. To get more accurate results, we could test more rivers and take measurements at different times of the year. This experiment helps us understand how temperature affects river water and could be

important for predicting how changes in climate will affect rivers in the future. If the temperature of rivers changes, it could affect the creatures that live there. Future research could also look at how other things, like pollution or the amount of plants in the water, might change the pH level.

Acknowledgments

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