Belgium

Project title: The effects of water temperature on a freshwater pond

College Hagelstein Sint-Katelijne-Waver Belgium

Research question

How does water temperature affect water quality in the pond at our school?

Summary of the project

Mankind has been emitting gasses which affect our climate for a long time, and we are finally seeing and feeling the consequences of these emissions. As temperatures rise, our world also changes, including plant growth, extreme weather conditions and more. We aim to clarify the impact on ponds and other freshwater bodies of water caused by these temperature changes. Good water quality is essential for the health of nature, and by extension, mankind. This is a project we chose because we have a pond at school, and we wanted to know if climate change would have an effect on the wildlife in the pond.

We investigated the effects of the water temperature on water quality in the pond at our school. We investigated the concentrations of phosphates, nitrates, ammonium, oxygen, pH, total hardness and temperature. Our project aims to visualize the impact of water temperature on the aforementioned concentrations. For this experiment, we chose three locations in the pond to measure the temperature and calculate the average of those three temperatures. We then take a scoop of water using a beaker and use the Macherey-Nagel Visocolor ECO test kit to measure the concentrations of these substances. The pH is measured twice, once using a test strip, and once using a digital meter, we then calculate the average of these two values. These measurements were taken every two weeks, apart from holidays and weeks when we could not get time to work on this project. These concentrations are gathered in an Excel file and put in a line graph, making the changes visible and comparable to the temperature.

Main results and Conclusions

How does water temperature affect water quality in the pond at our school?

We have compared the results of the different parameters with the temperature. Our first parameter is the phosphate concentration In the water. We have observed that the concentration simultaneously dropped when the temperature rises (fig.1). The highest concentration was 0.5 mg/l and the lowest was 0 mg/l. An optimal phosphate concentration is between 0.1 and 0.3 mg/l. The second concentration is ammonium. When we look at our graphs we can see that the temperature does not affect the ammonium concentration (fig.2). The third concentration is nitrate. The link between the temperature and nitrate is not clear but the concentration was higher when it was colder and lower when it was warmer (fig.3). The value of the total hardness in the water rises together with the temperature but the value dropped significantly between 7-8°C and higher (fig.4). The

acidity of the water rises together with the temperature until it reaches a pH of 8 and after balances between 7 and 8 (fig. 5).

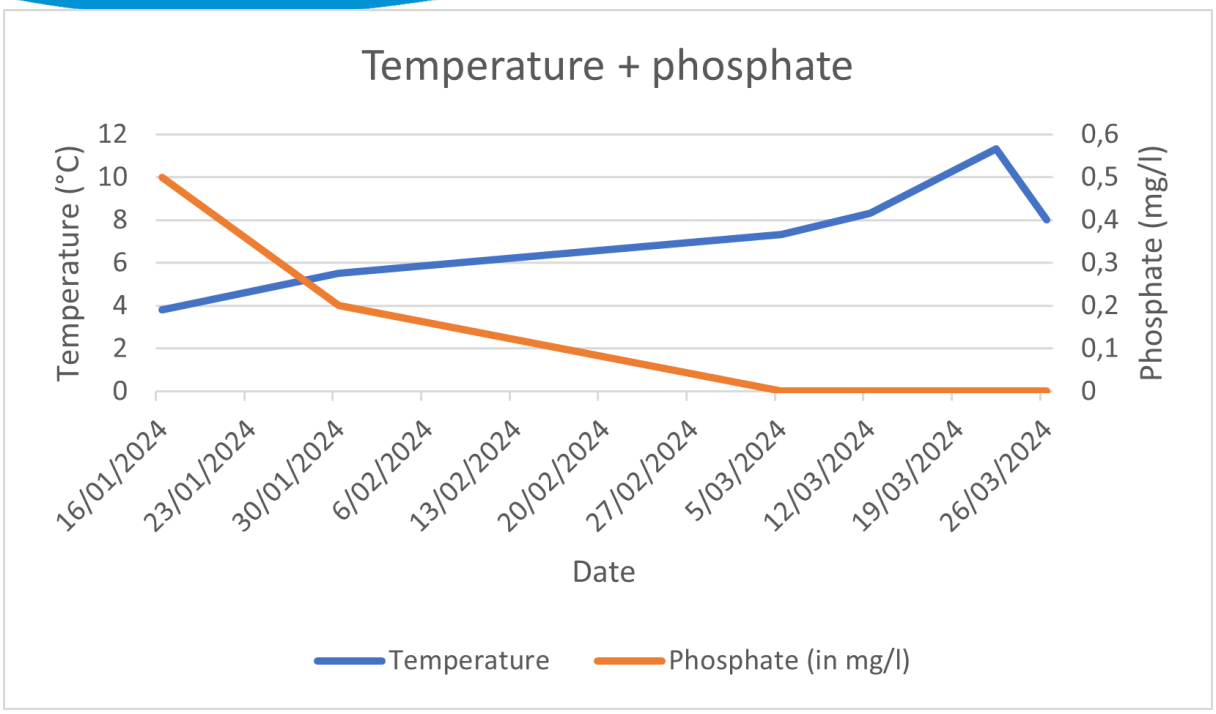
The temperature has no impact on the oxygen content of the pond water. The oxygen content also remains stable and the same. This value is somewhat on the high side but is still optimal for the pond (fig. 6).

Other studies show that our results are partly the same as theirs, but there are some differences. The nitrate levels, for example, did not follow the expected increase, but this can be due to a change in test kits because of a shortage in this test. (fig. 3) The oxygen concentration was too high to be accurately measured, according to our tests. (fig. 6) This caused our test to constantly top out on the maximum level it can be. The effect on acidity was also unexpected, this should have lowered according to other studies, which it didn't do (fig. 5).

What's Next? Actions to make a difference and help lessen the problem

The most important part of solving this problem is reducing emissions, which is a global problem. This isn't an issue one person can solve, it requires a global effort by billions of people. The biggest impact is by very industrialized countries, like the USA, China or India. These countries provide half of the world's emissions.

Things like adding plants or animals can often have a good impact on a pond. You should also avoid using insecticides near the pond. Another important step in maintaining a healthy pond is doing check-ups regularly, this way you can solve any problems before they grow bigger and cause any harm by adding supplements. Other actions are reducing the plastic waste which is thrown into the pond.


Temperature + phosphate
Temperature (°C)
Phosphate (mg/l)
12
10
8
6
4
2
0
0,6
0,5
0,4
0,3
0,2
0,1
0
16/01/2024
23/01/2024
30/01/2024
6/02/2024
13/02/2024
20/02/2024
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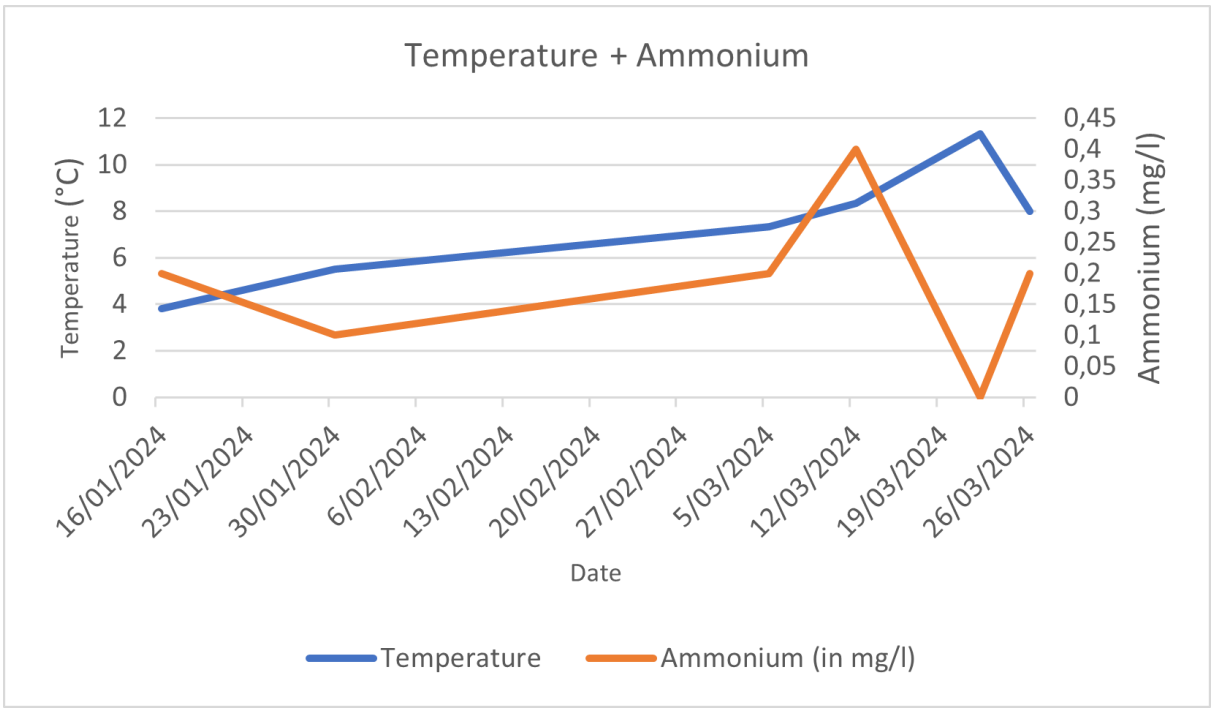
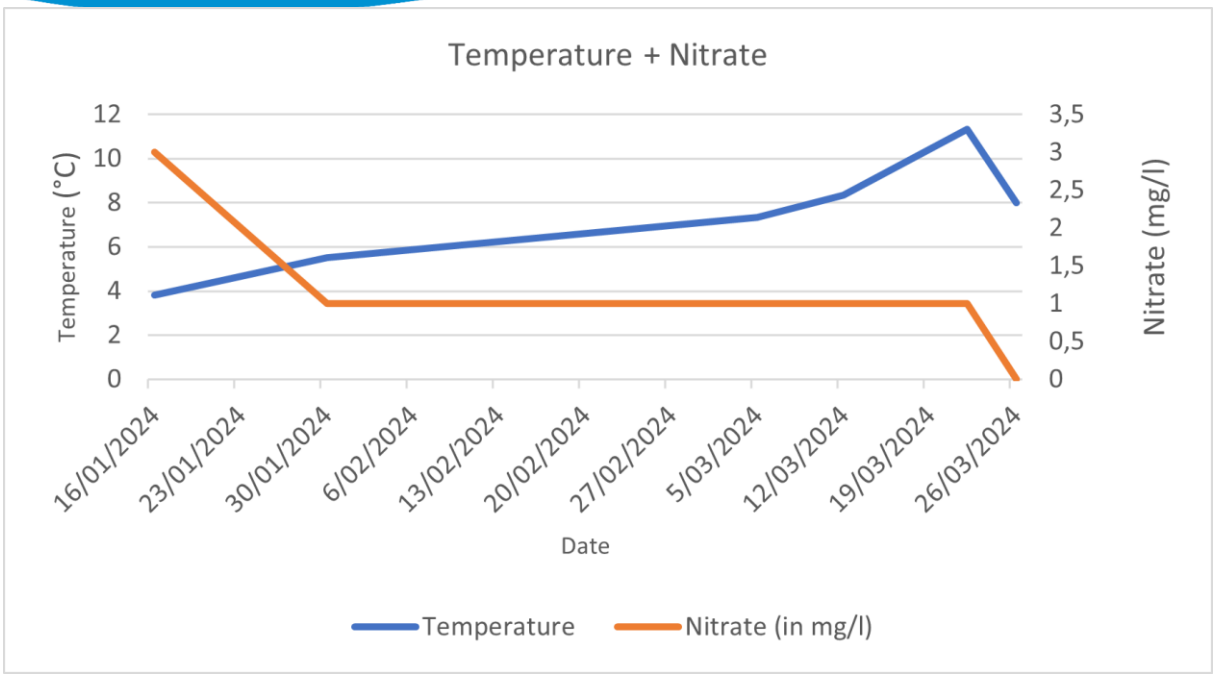
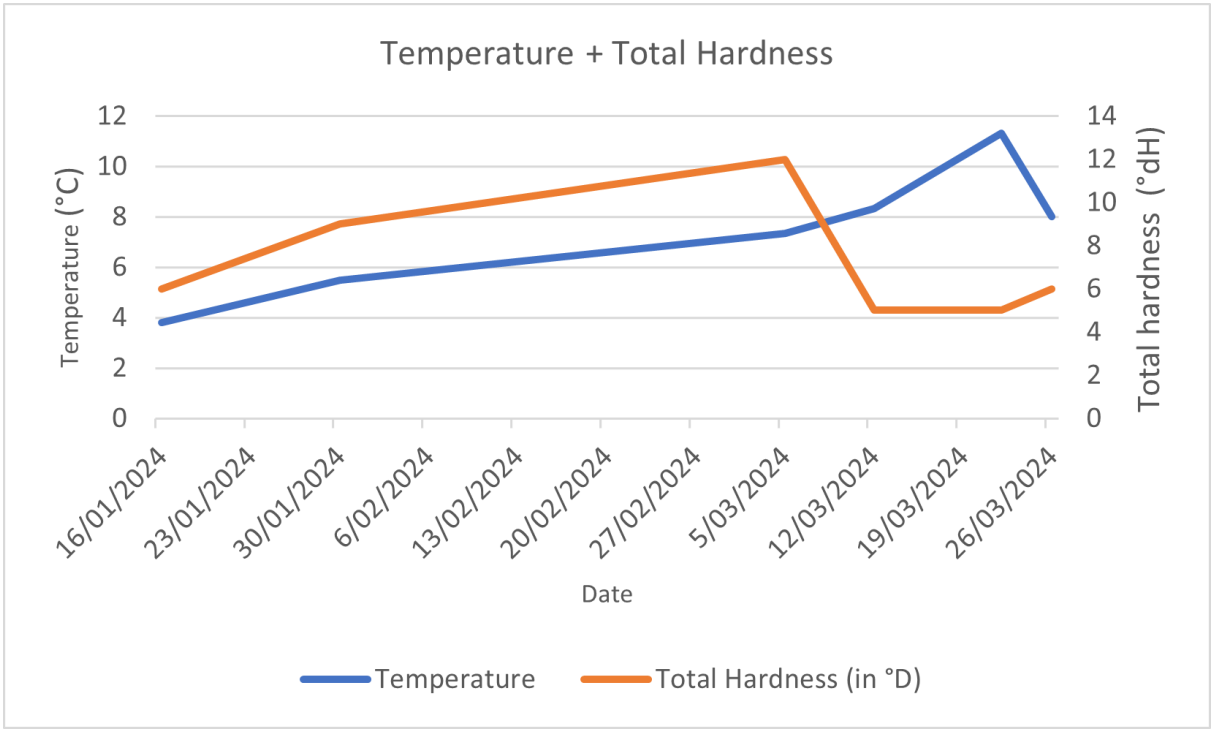
12/03/2024
19/03/2024
26/03/2024
Date
Temperature
Phosphate (in mg/l)


Temperature + Ammonium
Temperature (°C)
Ammonium (mg/l)
12
10
8
6
4
2
0
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
16/01/2024
23/01/2024
30/01/2024
6/02/2024
13/02/2024
20/02/2024
27/02/2024
5/03/2024
12/03/2024
19/03/2024
26/03/2024
Date
Temperature
Ammonium (in mg/l)


Temperature + Nitrate
Temperature (°C)
Nitrate (mg/l)
Date
16/01/2024
23/01/2024
30/01/2024
6/02/2024
13/02/2024
20/02/2024
27/02/2024
5/03/2024
12/03/2024
19/03/2024
26/03/2024
Temperature
Nitrate (in mg/l)


Temperature + Total Hardness
Temperature (°C)
Total hardness (°dH)
Date
16/01/2024
23/01/2024
30/01/2024
6/02/2024
13/02/2024
20/02/2024
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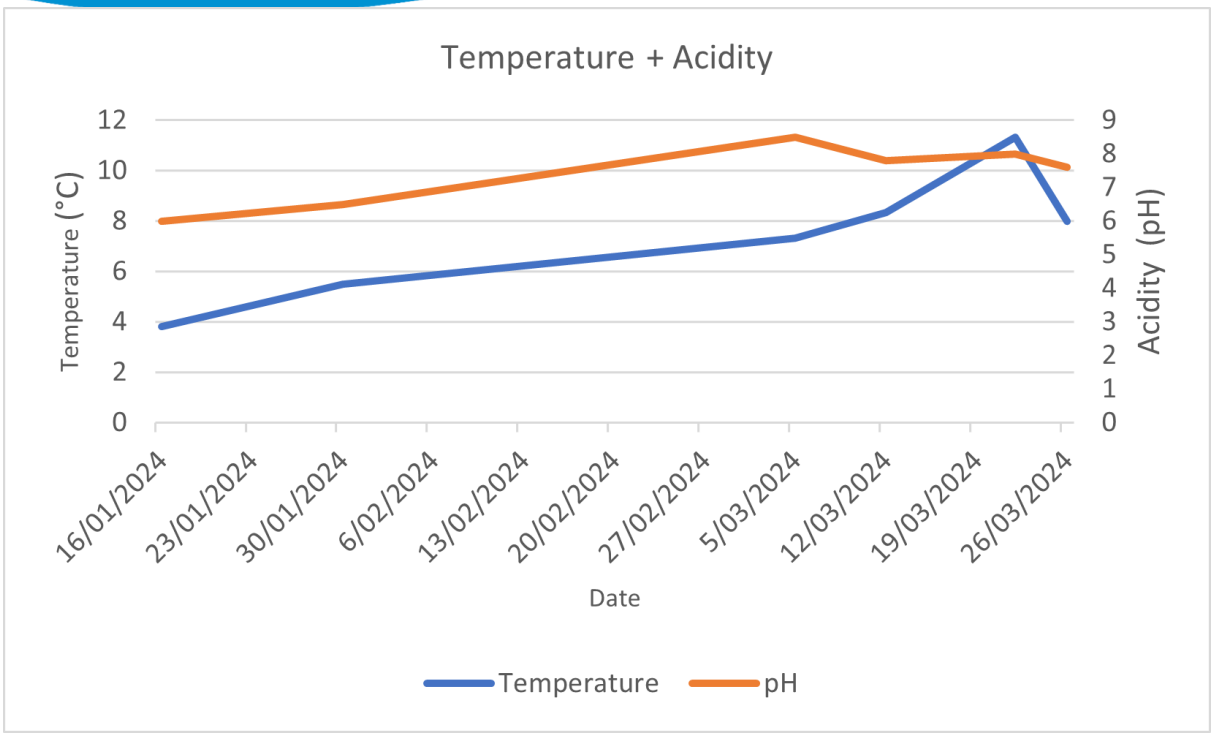
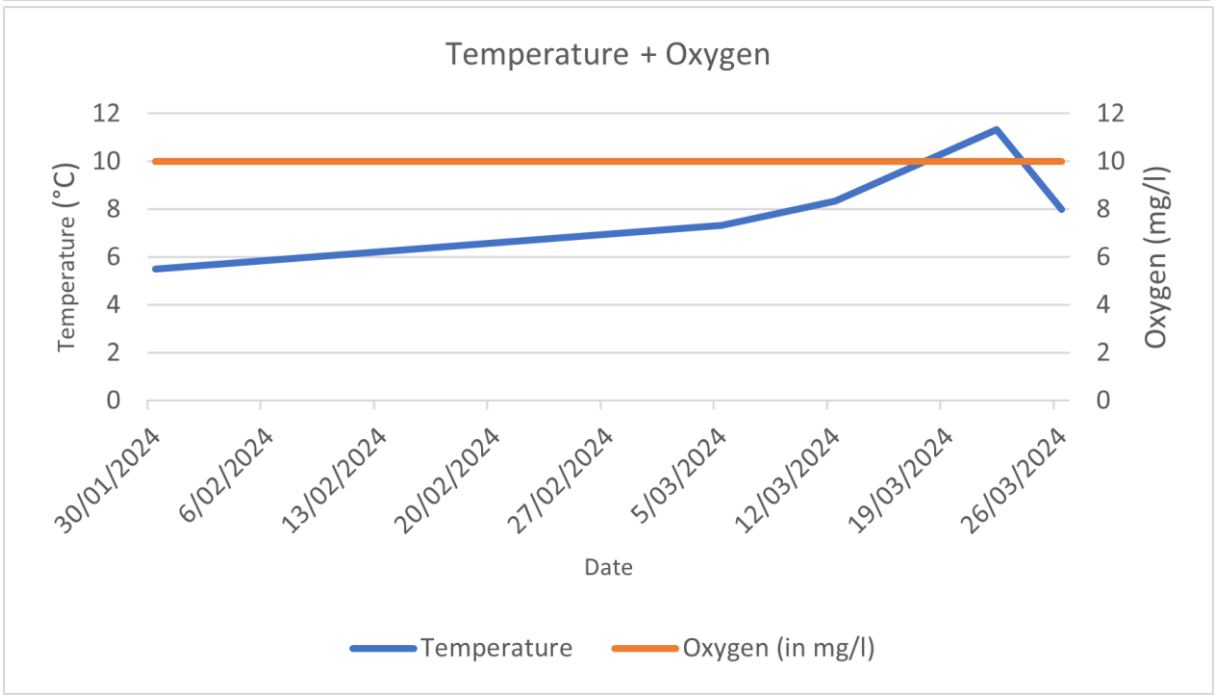
19/03/2024
26/03/2024
Temperature
Total Hardness (in °D)


Temperature + Acidity
Temperature (°C)
Acidity (pH)
0
2
4
6
8
10
12
0
1
2
3
4
5
6
7
8
9
16/01/2024
23/01/2024
30/01/2024
6/02/2024
13/02/2024
20/02/2024
27/02/2024
5/03/2024
12/03/2024
19/03/2024
26/03/2024
Date
Temperature
pH


Temperature + Oxygen
Temperature (°C)
Oxygen (mg/l)
0
2
4
6
8
10
12
0
2
4
6
8
10
12
30/01/2024
6/02/2024
13/02/2024
20/02/2024
27/02/2024
5/03/2024
12/03/2024
19/03/2024
26/03/2024
Date
Temperature
Oxygen (in mg/l)