Dissolved oxygen content and fish populations in water

Literature, Russian Literature

Dissolved Oxygen Content and Fish Populations in Water

Lab 1 – Introduction to Science

Exercise 1: The Scientific Method

Dissolved oxygen is oxygen that is trapped in a fluid, such as water. Since many living organism requires oxygen to survive, it is a necessary component of water systems such as streams, lakes and rivers in order to support aquatic life. The dissolved oxygen is measured in units of parts per million (ppm). Examine the data in Table 4 showing the amount of dissolved oxygen present and the number of fish observed in the body of water the sample was taken from; finally, answer the questions below.

QUESTIONS

1. Make an observation – Based on the data in Table 4, discuss what patterns you observe in regards to dissolved oxygen content and fish populations in the body of water?

Based on the data above, the population of fish increases as the volume of dissolved oxygen is increased to a certain optimal level of 12 ppm. Beyond that, the number of fish appears to drop slightly and stabilize as the volume of dissolved oxygen is increased.

2. Do background research – Utilizing at least one scholarly source, describe how the dissolved oxygen content in a body of water can effect fish populations.

Research has shown that reduced volumes of dissolved oxygen content can greatly reduce the number of fish in the affected water bodies. For example, in a study conducted by Denise Breitburg (2002), the researcher observed that reduced levels of dissolved oxygen causes hypoxia and this leads to

reduced growth rates and altered behaviors in fishes. As a result, this may cause fish die or to migrate to areas where oxygen levels are sufficient. Denise Breitburg, Leif Pihl and Sarah Kolesar (2001) further suggest that low dissolved oxygen levels cause adult fishes to avoid laying eggs in affected areas, and this greatly impacts the population of fish in such areas.

3. Construct a hypothesis – Based on your observation in question 1 and your background research in question 2, develop a hypothesis relating to the amount of dissolved oxygen measured in the water sample and the number of fish observed in the body of water?

Fish populations drop significantly in water bodies with dissolved oxygen levels of less than 12ppm

4. Test with an experiment – Describe an experiment that would allow you to test your hypothesis from question 3. This description must provide ample detail to show knowledge of experimental design and should list the independent and dependent variables, as well as your control.

In order to test the hypothesis above, two large fish tanks each with an equal number of fish will be used. In the first tank, the oxygen concentration is kept at a constant level of less than 12ppm. This will act as the control. In the second tank, the oxygen will be increased steadily to from 10ppm to over 15ppm (10ppm, 11ppm, 12ppm, 13ppm, 14ppm, 15ppm). At each interval, the number of fish will be taken. The oxygen levels in the water will be increased by using an oxygen tank connected to the fish tank. In this case, the independent variable is the oxygen volume and the dependent variable is the fish.

5. Analyze results – Assume that your experiment produces results identical

to those seen in Table 4, what type of graph would be appropriate for displaying the data and why?

The best type of graph to be used will be a line graph. This type of graph best illustrates trends or behavior of the dependent variable (fish) against varying oxygen levels. The line graph helps the researcher easily monitor increases and declines in the variable over time.

6. Analyze results - Graph the data from Table 4 and describe what your graph looks like (you do not have to submit a picture of the actual graph!).

For oxygen levels of between 0 and 4 ppm, the graph rises steadily but for values between 4 and 12 ppm, there is a sharp rise. However, there is a significant drop between levels of 12 and 14ppm, before again showing a steady rise between levels of 14 and 18ppm.

7. Draw conclusions - Interpret the data from the graph made in Question 7. What conclusions can you make based on the results of this graph?

Based on the results, fish thrive well in water with dissolved oxygen concentrations of about 12ppm. However, when the oxygen level is raised above this level, there is no significant increase in the number of fish but instead; a drop in fish populations may be witnessed. Therefore, 12ppm is the optimal level of dissolved oxygen for fish survival.

8. Draw conclusions – Assuming that your experiment produced results identical to those seen in Table 4, would you reject or accept the hypothesis that you produced in question 3? Explain how you determined this.

If my experimental results were to be identical to the above, I would accept my hypothesis. This is because the highest population of fish is witnessed at 12ppm dissolved oxygen level. This means that any values below the 12ppm

will lead to a reduced number of fish, and this supports my hypothesis.

References

Breitburg, D (2002). Effects of Hypoxia, and the Balance between Hypoxia and Enrichment, on Coastal Fishes and Fisheries. Estuaries, 25(4b), pp. 767–781

Breitburg, Pihl & Kolesar (2001). Effects of Low Dissolved Oxygen on the Behavior, Ecology and Harvest of Fishes: A Comparison of the Chesapeake Bay and Baltic-Kattegat Systems. In Coastal Hypoxia: Consequences for Living Resources and Ecosystems: Coastal and Estuarine Studies, pp. 241-268.