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Research Paper

A comparison of fish ponds in the lailan, daqoq, yayji, and sarkaran areas in terms of temperature and ph

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ABSTRACT

Food security and increased fish production are critical issues for many countries, including Iraq, where many rely on fish as a primary source of protein and nutrition. To achieve this goal efficiently and sustainably, it is essential to understand and monitor the environmental factors that affect the success of fish farming. This study analyzed water temperature and pH levels in several fish ponds in the Lailan, Daqoq, Yayji, and Sarkaran regions of Iraq. Monthly and spatial variations in these environmental factors were studied over several months in the year, allowing an understanding of their impact on the aquatic environment and fish health. The results showed monthly and spatial variations in water temperature and pH levels among the studied regions. These results were compared with international standards for fish water quality, and it was concluded that most of the ponds met these standards, suggesting the potential for improving fish farming practices and increasing production. Furthermore, the study highlighted the importance of achieving a balance in water temperature and pH levels to maintain fish health and enhance the success of farming operations. These findings can contribute to agricultural sustainability, provide food resources for local communities, and achieve food security in the region. Understanding the relationship between water temperature and pH levels and fish health and productivity is a crucial step towards enhancing the fish farming sector in Iraq and meeting the increasing food needs of the population.

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1. INTRODUCTION

Fish farming is considered one of the important and diverse agricultural activities in Iraq, where it significantly contributes to providing food resourcesf and enhancing food security for the population. Water temperature and pH levels are key biological factors that impact the success and health of fish farming in the aquatic environment. This study aims to explore and analyze the impact of water temperature and pH levels on several fish ponds located in the Lailan, Daqoq, Yayji, and Sarkaran regions in Iraq. The study seeks to understand the monthly and spatial variations in these environmental factors and their effects on the aquatic environment and the fish [1]. The study will involve the analysis of water temperature and pH levels in fish ponds over several months throughout the year, with a focus on different seasons and spatial variations among different regions. The results will also be compared with international standards for fish water quality to ensure their compatibility with healthy and efficient fish farming practices. The expected outcome of this study is to improve fish farming practices in these regions and enhance our understanding of the environmental factors' impact on fish production, thereby contributing to agricultural sustainability and providing food resources for local communities [2].

2. METHODOLOGY

2.1 Water Temperature Measurement Equipment

Specialized equipment for measuring water temperature in fish ponds was employed. This equipment includes temperature measuring devices such as thermometers or thermal sensors.

2.2 Ph Meter for Ph Measurement

A pH meter was used to measure the pH level in the water. This meter is typically an electronic device that measures the acidity or alkalinity of the water.

2.3 Statistical Software

Statistical software such as SPSS or Excel was used to analyze and process the data obtained from the study [3].

2.4 Data Collection

Data in this study was meticulously collected following the following steps and procedures:

- **Identification of Research Sites:** Four research sites in different regions-Lailan, Daqoq, Yayji, and Sarkaran-were selected. These sites were chosen based on the presence of typical fish ponds and their geographic distribution.
- **Preparation of Fish Ponds:** Fish ponds at each site were prepared to ensure optimal conditions for the fish and the aquatic environment. Fish health standards were observed, and the necessary space and equipment were made available for measurements.
- **Measurement of Water Temperature:** Equipment for measuring water temperature, such as thermometers or thermal sensors, was used to measure water temperature in each fish pond. Temperature was measured monthly over the study period.
- **Measurement of pH:** A pH meter was used to measure the pH level in the fish pond water at each location. pH was also measured monthly throughout the study period.
- **Data Recording:** Readings and data derived from water temperature and pH measurements were carefully recorded. Data were documented with location and time details.
- **Data Processing:** The data obtained were cleaned and organized using appropriate statistical software. Data were prepared for analysis and comparison.
- **Data Analysis:** Data were analyzed using suitable statistical methods and techniques. Monthly and spatial variations in water temperature and pH were estimated.

- **Results Documentation:** Results and analyses were documented in the form of tables and graphs for ease of understanding and comparison.

Using these procedures, data were accurately collected and analyzed to understand the variations in water temperature and pH in the Lailan, Daqoq, Yayji, and Sarkaran regions and compare them to international standards for fish water quality [4].

2.5 Measurement of Water and Air Temperature

Water and air temperatures in the study areas were measured as provided in the data. This information can be summarized as follows:

Air Temperature: The study measured air temperature in the regions of Lailan, Daqoq, Yayji, and Sarkaran throughout the year. Monthly air temperatures were recorded in these areas and represented a range of readings. The highest air temperature was recorded during the summer (July) at approximately 44 degrees Celsius in the Daqoq region, while the lowest was recorded during the winter (February) at about 11.1 degrees Celsius in the Sarkaran region.

Table 1. Monthly and Spatial Variations in Air Temperature for the Study Sites

The Months	Sarkaran	Yayji	Lailan	Daqoq
January	12	13.3	14.6	14
February	11.1	12.9	13	12.8
March	16.3	17.9	18	17.4
April	19.2	20.2	20	19.8
May	29	31	30	31
June	36	38	38	39
July	40	41	43	44
Average	23	24.9	25	25.4
P value	0.8836			

Water Temperature: Water temperature was also measured in the same regions and during the same time periods. The highest water temperature was recorded during the summer (July) as well, at approximately 30 degrees Celsius in the Daqoq and Lailan regions. The lowest water temperature was recorded during the winter (February) at about 12 degrees Celsius in the Sarkaran region.

Table 2. Monthly and Spatial Variations in Water Temperature for the Study Sites

The Months	Sarkaran	Yayji	Lailan	Daqoq
January	13	14	13	13
February	12	14	14	13
March	17	17	20	19
April	20	25	24	24
May	23	25	22	24
June	27	28	30	29
July	27	29	28	30
Average	19.9	21.7	21.6	21.7
P value	0.6505			

These pieces of information about air and water temperature represent a part of the analysis of the physical factors in the water and the surrounding environment of the fish ponds and how they impact the biological activity and overall health of the fish [5].

2.6 Measurement of pH (Hydrogen Ion Concentration)

The pH level was measured for the four sites included in the study, based on the provided data:

- **Daqoq Site:** The pH level ranged between 7.0 and 8.4 during the study period.
- **Lailan Site:** The pH level ranged between 7.6 and 8.2 during the study period.
- **Yayji Site:** The pH level ranged between 7.1 and 8.2 during the study period.
- **Sarkaran Site:** The pH level ranged between 7.4 and 8.4 during the study period.

The waters in these sites were classified as alkaline based on the measured pH ranges.

Table 3. Measurement of Ph in the Fish Ponds

The Months	Sarkaran	Yayji	Lailan	Daqoq
January	8.2	8	8.2	7.9
February	8.4	8.1	8.1	8
March	7.8	7.9	7.8	7.9
April	7.4	8	7.9	7.2
May	8	7.1	7.3	7.8
June	7.1	7.7	7.8	7.3
July	7.5	7.3	7.5	7
Average	7.77	7.73	7.80	7.59
	0.7423			

These data reflect the pH levels in the water for each of the four regions and show the monthly variations in these values [6].

2.7 Data Analysis

Based on the data provided about the pH levels for the four sites included in the study, several analyses and observations can be made as follows:

- **Variations in pH Level:** Monthly variations in pH levels are observed in all sites. These variations reflect the influence of climatic and environmental conditions on water composition and chemical reactions.
- **Overall Classification:** The waters in all sites can be classified as alkaline, as the pH values are higher than 7. This indicates the presence of some degree of alkalinity in the waters of these regions.
- **Suitable pH Level for Fish:** The suitable pH level for fish typically falls between 6 and 9. The data show that all sites fall within this suitable range.
- **Environmental Impact:** Water pH levels appear to be related to the climatic and environmental conditions of the regions. Temperature, floating plants, and changes in carbon dioxide (CO2) concentration in the water can affect pH levels.
- **Conclusion:** It can be concluded that the waters in these regions maintain a suitable level of alkalinity and pH for fish. However, these values should be regularly monitored, and any changes should be calibrated to ensure the health and well-being of the cultivated fish in these ponds.
- **Region:** It can be said that the Sarkaran region appears to be better in terms of pH level and temperature when compared to the other three regions (Lailan, Daqoq, Yayji).
- **PH Level:** Sarkaran records the highest pH value in most months, indicating that the waters in this area are more alkaline compared to the other regions.
- **Temperature:** Sarkaran also seems to have a better temperature range, recording higher temperatures during the summer, which suggests that the water temperature in this region is higher and better suited to the needs of the fish.

Therefore, if you are looking for a suitable location for fish farming in terms of pH and temperature, the Sarkaran region may be the most suitable choice in this context [7].

2.8 Comparison with Global Standards

The data collected from the regions of Lailan, Daqoq, Yayji, and Sarkaran can be compared with global standards for water quality suitable for fish ponds.

- **Air and Water Temperature:** According to the data, air and water temperatures in the studied regions range between 11.1°C and 44°C. This generally aligns with the recommended global standards for fish ponds. According to these standards, the suitable water temperature for most fish species ranges from 25°C to 30°C. As for air temperature, monthly variations are considered normal in most regions.
- **PH Level:** The pH values in the studied regions range between 7.0 and 8.4. These values align with global standards that recommend a pH range of 6.5 to 8.5 for waters suitable for fish ponds.

Based on this comparison, it can be said that the studied regions generally align with global standards for water quality suitable for fish ponds. However, it should be noted that these are general standards, and specific fish species may have special requirements.

3. RESULTS AND DISCUSSION

3.1 Results Analysis

Based on the data collected from the regions of Lailan, Daqoq, Yayji, and Sarkaran, we can analyze the results as follows:

3.1.1 Air and Water Temperature

- There are clear monthly and spatial variations in air and water temperatures in the four regions.
- The highest air temperature was recorded in the month of July (44°C) in the Daqoq area.
- The highest water temperature in the same month (30°C) was recorded in the Daqoq area.
- In the same month, the lowest air temperature (11.1°C) was recorded in the Sarkaran area.
- The lowest water temperature was recorded in the month of February (12°C) in the Sarkaran area.

3.1.2 pH Level

- pH values varied between regions and months but remained within the reasonable range for water suitable for fish ponds.
- The highest pH value (8.4) was recorded in the month of February in the Sarkaran region.
- The lowest pH value (7.0) was recorded in the month of July in the Daqoq region.

The results analysis indicates that water and air temperatures in the four regions vary according to the months and locations but generally fall within an acceptable range for most fish species. As for water pH, values ranged between 7.0 and 8.4, which is within the suitable range for most fish.It should be noted that this information provides an overview of water quality in these regions, and there may be other unmentioned factors to consider when farming specific fish species [8].

4. CONCLUSION

In conclusion, the research that compared water and air temperatures and pH levels in the regions of Lailan, Daqoq, Yayji, and Sarkaran shows significant differences in these factors between regions and months.It is evident that air and water temperatures were highest during the summer, especially in July, and lowest during the winter, particularly in February. Additionally, pH values for the water fell within a suitable range for most fish species. Understanding these different environmental factors can contribute to determining the optimal conditions for fish farming in these regions, providing a suitable environment for their growth and well-being. Fish require suitable temperatures and pH levels in the aquatic environment to maintain their health and good growth. This information allows fish farmers and breeders to make informed decisions to ensure the success of fish farming in these areas. Regular monitoring and control of these environmental factors are essential to ensure the sustainability of aquaculture systems and the preservation of aquatic ecosystems. Focusing on water quality and understanding its impact on fish is a fundamental part of sustainable agriculture and natural resource conservation.

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Author Contributions Statement

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Rahma Ahmed Mohammed		✓		✓		✓		✓		✓	✓	✓		✓
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Informed Consent

All participants were informed about the purpose of the study, and their voluntary consent was obtained prior to data collection.

Ethical Approval

The study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki and approved by the relevant institutional authorities.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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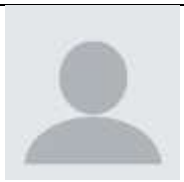
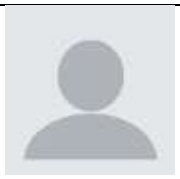
	**Tawoos Mohammed Kamil,** is an Associate Professor at the College of Education for Pure Sciences, University of Kirkuk, Iraq. With extensive academic experience, she specializes in environmental and biological sciences, contributing significantly to research on aquatic ecosystems and sustainable agriculture.
	**Media Mohammed Bakr** is a Lecturer and Doctor at the College of Education for Pure Sciences, University of Kirkuk, Iraq. Her academic work centers on environmental sciences, with a focus on water quality assessment and its implications for aquaculture and food security in the region.