Research Report

Study of the Relationship Between Freshwater Algae and Water

A Case Study at Thung Kai Botanical Garden, Trang Province

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Research Title: Study of the Relationship Between Freshwater Algae and Water Quality in a Pond: A Case Study at Thung Kai Botanical Garden, Trang Province
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Abstract

This research aims to (1) study the relationship between freshwater algae species and water quality in ponds within Thung Kai Botanical Garden, Trang Province, (2) analyze the factors affecting the occurrence of different freshwater algae, including temperature, pH, water transparency, and dissolved oxygen levels, and (3) classify the algae species found, study their morphological characteristics, and the characteristics of the water source to use as a bioindicator for water quality assessment. Water and algae samples were collected from three survey points over a 3-week period to analyze water quality parameters. The results showed that water quality varied at each point. Points 1 and 2 had higher pH and temperature values, with Spirogyra (green filamentous algae) found, while point 3 had higher water transparency and lower pH, with Fragilaria (yellow-brown filamentous algae) found. The study indicates that water quality directly affects the distribution of algae, with Spirogyra being found in water with higher pH and temperature, and Fragilaria found in water with higher transparency and lower pH. Additionally, algae can serve as a bioindicator for water quality assessment, providing important information for managing and conserving water sources to maintain ecological balance in the long term.

Keywords: Freshwater algae, water quality, bioindicator, Thung Kai Botanical Garden

Introduction

Background and Significance

Water quality is a crucial factor that affects the balance of aquatic ecosystems in Trang Province, which is rich in biodiversity. Water determines the structure and function of ecosystems, impacting living organisms at all levels. Changes in pH, oxygen levels, and water transparency can affect the food chain and aquatic animal populations.

Algae are both primary producers and bioindicators that are sensitive to changes in water quality. The types and quantities of algae reflect the environmental conditions and the balance of ecosystems. Trang Province relies on water resources for tourism activities such as diving, rafting, and ecotourism. Changes in water quality directly impact both ecosystems and the local economy. Studying the relationship between algae species and water quality helps assess the impact of human activities and provides a guide for managing water sources to maintain ecological balance alongside sustainable development.

Research Objectives

1. To study the relationship between freshwater algae species and water quality in ponds within Thung Kai Botanical Garden, Trang Province.
2. To analyze the factors affecting the presence of different types of freshwater algae, including temperature, pH, water transparency, and dissolved oxygen levels.
3. To classify the algae species found in the study area, examine their morphological characteristics, and assess the water source characteristics as biological indicators for evaluating water quality.

Research Questions

1. How are freshwater algae species related to water quality in ponds within Thung Kai Botanical Garden, Trang Province?
2. Do physical and chemical factors such as temperature, pH, water transparency, and dissolved oxygen levels influence the presence of different types of algae in the water source?
3. How can the types of freshwater algae found in the study area be used as biological indicators to assess water quality in natural water sources?

Research Hypotheses

1. The species of freshwater algae are related to water quality in ponds within Thung Kai Botanical Garden, Trang Province, with algae species changing according to physical and chemical parameters such as pH, transparency, and dissolved oxygen levels.
2. Temperature, pH, water transparency, and dissolved oxygen levels are important factors influencing the presence of different types of freshwater algae in water sources.
3. The species of freshwater algae found in the ponds can effectively be used as biological indicators for assessing water quality in natural water sources.

GLOBE Measurement Methodology

Hydrosphere Measurement Methodolog

Materials and Equipment

1. Oxygen test kit
2. Thermometer
3. Litmus paper
4. Tongs
5. Turbidity meter
6. Smart lens, 20x magnification
7. Water scooping bucket

Study Site Determination : the area of 135 Thung Kai Subdistrict ,Yan Ta Khao District ,Trang Province92140.

Research Methodology

Step 1: Water Sampling

1. Define the sampling points for water collection in the ponds at Thung Kai Botanical Garden, Trang Province. Water samples will be collected from the ponds in the Thung Kai Botanical Garden.
2. Collect samples once a week for a total of 3 times from the area, with 3 sampling points. Water will be collected using appropriate equipment and stored in bottles, ensuring that it is kept away from light.
3. Measure the water temperature using a thermometer at a depth of 10 cm. Wait for 5 minutes, then record the value.
4. Measure the pH level of the water using litmus paper. Dip it into the water sample, compare with an indicator, then record the value.
5. Measure the oxygen level in the water using a test kit for oxygen concentration. Record the value after testing.
6. Measure the water turbidity using a turbidity cylinder. Fill the cylinder with the water sample until the base is no longer visible, then record the value.

Step 2: Freshwater Algae Sampling and Identification

1. Define the sampling points for freshwater algae collection in the ponds at Thung Kai Botanical Garden, Trang Province. Freshwater algae will be collected from the ponds at the Thung Kai Botanical Garden.

2. Collect freshwater algae samples using a net to collect algae from the surface of the pond at various designated points. Samples will be stored in clean containers, with collection once a week for a total of 3 times from the area, using 3 sampling points.
3. Identify the algae species: Use a smart lens with 20x magnification to observe the morphological characteristics of the freshwater algae. Classify the algae species based on characteristics such as shape and color. Observe and record the results.

Table 1: Classification Criteria for Freshwater Algae

No.	Classification Criteria for Freshwater Algae		
	Color	**Scientific Name**	**Basic Shape**
1	Green	*Spirogyra*	Filamentous
2		*Chlorella*	Unicellular
3		*Volvox*	Colonial
4	Blue-green	*Microcystis*	Colonial
5		*Oscillatoria*	Filamentous
6	Yellow-brown	*Navicula*	Unicellular, Diatom
7		*Fragilaria*	Filamentous, Diatom

Step 3: Analyzing the Relationship Between Algae Species and Water Quality

1. Create a comparison sheet of indicators: Prepare a comparison sheet (or indicator sheet) by listing the species of algae found at each sampling point and comparing the results of the algae species found with the water quality values measured at each point.

Research Results

Table 2: Geographic Coordinates

Zone	Geographic Coordinates	
	Latitude (N)	Longitude (E)
Pond in Thung Kai Botanical Garden, Trang Province	7.466024	99.638253

The geographic coordinates for the study area are located in zone 135, Thung Kai Subdistrict, Yan Ta Khao District, Trang 92140.

Table 3: Oxygen Levels in Water Sources

Survey No.	Oxygen Levels in Water (mg/L)		
	Point 1	**Point 2**	**Point 3**
1	15.0	15.0	11.5
2	8.0	10.5	4.5
3	7.5	11.5	12.5
Average	10.17	12.33	9.5

Table 4: pH Levels in Water

Survey No.	pH Levels in Water		
	Point 1	**Point 2**	**Point 3**
1	7	6	6
2	7	7	6
3	6	5	5
Average	6.67	6	5.67

From the study results Oxygen Levels in Water Sources,

In Survey 1, Point 1 had 15.0 mg/L, Point 2 had 15.0 mg/L, and Point 3 had 11.5 mg/L.

In Survey 2, Point 1 had 8.0 mg/L, Point 2 had 10.5 mg/L, and Point 3 had 4.5 mg/L.

In Survey 3, Point 1 had 7.5 mg/L, Point 2 had 11.5 mg/L, and Point 3 had 12.5 mg/L.
The average oxygen levels were 10.17 mg/L for Point 1, 12.33 mg/L for Point 2, and 9.5 mg/L for Point 3.

From the study results pH Levels Water ,
In Survey 1, Point 1 had pH 7, Point 2 had pH 6, and Point 3 had pH 6.
In Survey 2, Point 1 had pH 7, Point 2 had pH 7, and Point 3 had pH 6.
In Survey 3, Point 1 had pH 6, Point 2 had pH 5, and Point 3 had pH 5.
The average pH levels were 6.67 for Point 1, 6 for Point 2, and 5.67 for Point 3.

Table 5: Water Temperature

Survey No.	Water Temperature (°C)		
	Point 1	Point 2	Point 3
1	30	30	29
2	23	21	23
3	25	23	25
Average	26	24.67	25.67

Table 6: Water Transparency

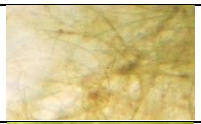
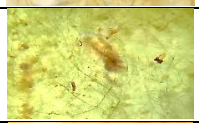
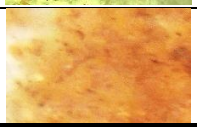
Survey No.	Water Transparency (cm)		
	Point 1	Point 2	Point 3
1	77.7	>100	100
2	65.8	>100	90.5
3	67.5	>100	86.9
Average	70.33	>100	92.33

From the study results Water Temperature,
In Survey 1, Point 1 had 30°C, Point 2 had 30°C, and Point 3 had 29°C.
In Survey 2, Point 1 had 23°C, Point 2 had 21°C, and Point 3 had 23°C.
In Survey 3, Point 1 had 25°C, Point 2 had 23°C, and Point 3 had 25°C.
The average temperatures were 26°C for Point 1, 24.67°C for Point 2, and 25.67°C for Point 3.

From the study results Water Transparency,

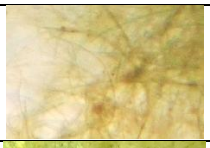
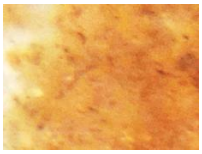
In Survey 1, Point 1 had 77.7 cm, Point 2 had >100 cm, and Point 3 had 100 cm.
In Survey 2, Point 1 had 65.8 cm, Point 2 had >100 cm, and Point 3 had 90.5 cm.
In Survey 3, Point 1 had 64.5 cm, Point 2 had >100 cm, and Point 3 had 86.9 cm.
The average transparency levels were 70.33 cm for Point 1, >100 cm for Point 2, and 92.33 cm for Point 3.

Table 7: Types of Freshwater Algae Found

Survey Point	The types of freshwater algae found in water sources.			
	Freshwater Algae	Characteristics of Freshwater Algae	Image from Smart Lens (20x Magnification)	Image of the Found Location
1	*Spirogyra*	Filamentous, Green		
2	*Spirogyra*	Filamentous, Green		
3	*Fragilaria*	Filamentous, Yellow-Brown		

From the study, in points 1 and 2, Spirogyra (green filamentous algae) was found, and in point 3, Fragilaria (yellow-brown filamentous algae) was found.

Table 8: The Relationship Between Freshwater Algae and Water Quality.

Survey Point	The relationship between algae and water quality.		
	Freshwater Algae	Image from Smart Lens (20x Magnification)	Water Quality
1	*Spirogyra*		Average Oxygen Level: 10.17 mg/l pH: 6.67 Average Temperature: 26°C Water Transparency: 70.33 cm
2	*Spirogyra*		Average Oxygen Level: 12.33 mg/l pH: 6.0 Average Temperature: 24.67°C Water Transparency: >100 cm
3	*Fragilaria*		Average Oxygen Level: 9.5mg/l pH: 5.67 Average Temperature: 25.67°C Water Transparency: 92.33 cm

From the study, the observations are as follows:

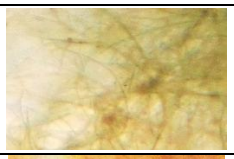
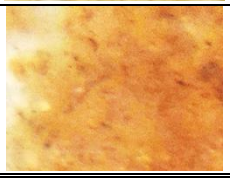
In **Point 1**, **Spirogyra** (green filamentous algae) was found with an average oxygen level of 10.17 mg/l, pH of 6.67, an average temperature of 26°C, and water transparency of 70.33 cm.

In **Point 2**, **Spirogyra** (green filamentous algae) was found with an average oxygen level of 12.33 mg/l, pH of 6.0, an average temperature of 24.67°C, and water transparency >100 cm.

In **Point 3**, **Fragilaria** (yellow-brown filamentous algae) was found with an average oxygen level of 9.5 mg/l, pH of 5.67, an average temperature of 25.67°C, and water transparency of 92.33 cm.

Algae Species and Water Quality Indicators.

Table 9: Biological Index of Freshwater Algae and Water Quality

Freshwater Algae	Image from Smart Lens (20x Magnification)	Characteristics	Water Quality Relationship	Pollution Level Indicator
Spirogyra		Filamentous, Green	High pH, Moderate Oxygen Levels	Clean Water
Fragilaria		Filamentous, Yellow-Brown	Clear Water, Low Oxygen Levels	Water Starting to Degrade

How to Use the Comparison Sheet:

1. Collect water and algae samples from the study site.
2. Measure water quality parameters, including dissolved oxygen, pH, temperature, and turbidity.
3. Classify the types of algae and assess water quality

Research Results

The study on the relationship between the types of freshwater algae and water quality in the Thung Khae Botanical Garden pond, Trang Province, revealed that water quality directly influences the types of algae present. The main factors that affect algae growth include pH, dissolved oxygen, temperature, and water transparency. In water with a high pH and high temperature, the algae *Spirogyra*, which thrives in nutrient-rich water with adequate sunlight, was observed. In contrast, water with low pH and high transparency showed the presence of *Fragilaria*, a diatom that grows well in clear water with low dissolved oxygen.

This study demonstrates that algae can be used as a biological indicator to assess water quality. Changes in the types and quantities of algae reflect alterations in water quality. *Spirogyra* was found in high-quality, clean water, indicating water with a high pH and moderate dissolved oxygen levels. Meanwhile, *Fragilaria* was found in deteriorating water, indicating water with low oxygen levels and high transparency. The use of algae as a biological indicator effectively tracks water quality changes and can highlight shifts in pollution levels.

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Classification of Algae

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Kingdom of Life

Source: https://www.scimath.org/lesson-biology/item/7043-2017-05-22-15-0534?fbclid=IwZXh0bgNhZW0CMTEAAR3pFD_NnY50zNlDDOHILIq9-xPiB7eUx-RedvJ9olNCfg63uRydW8QxM6s_aem_lw8GHohhbKyEBa8HQaMpSA

Appendix