Research Title: A Study of Water Quality Affecting the Distribution of Moss (*Fissidens anomalus* Mont.) in Ban Sri Dao Ruang, Palian District, Trang Province .

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Abstract

This study investigated the water quality affecting the distribution of the moss species Fissidens anomalus Mont. in Ban Sri Dao Ruang, Palian District, Trang Province. The primary objective was to examine the water quality in the upstream areas at three specific study sites, following the GLOBE protocols.The research findings indicated that the water quality is highly suitable for the growth and distribution of Fissidens anomalus Mont. The average water temperature was recorded at 25.91°C, with an average pH value of 6.67, indicating a slightly acidic to near-neutral state. Furthermore, the average dissolved oxygen (DO) was as high as 6.48 mg/L. According to the Pollution Control Department's standards for surface water quality and utilization, this classifies the sites as very clean water sources.The distribution of Fissidens anomalus Mont. was found to be most dense on rocks along the stream banks, characterized by high humidity and consistent water flow, which aligns with the excellent water quality measurements. The results of this study confirm that water quality is a crucial factor directly influencing moss distribution. Moreover, it reflects that this moss species serves as an effective bioindicator of local ecosystem health, providing essential data for the sustainable management of natural resources.

Keywords: Water Quality, Dissolved Oxygen (DO), Water Temperature, pH Value, Moss

Introduction

Lotic ecosystems, characterized by continuously flowing water systems, are vital natural resources responsible for the essential cycling of minerals and energy across varying elevations. In the modern era, rapid global environmental changes, coupled with expanding human activities and land-use shifts, have directly impacted water quality in both physical and chemical dimensions. According to the Department of Water Resources (2022), monitoring these changes is crucial, especially in the West Coast Southern Basin of Trang Province, where water quality directly supports local livelihoods and biodiversity. These environmental alterations trigger a complex chain reaction affecting aquatic organisms that are highly sensitive to subtle shifts in their habitat (Pollution Control Department, 2024).

Mosses, or bryophytes, serve as highly efficient and cost-effective biological indicators. Due to their unique physiological structure—lacking a complex vascular system and possessing leaf layers often only one cell thick—their cells can directly absorb nutrients and pollutants from the water (Glime, 2017). This anatomical simplicity allows mosses to respond rapidly to fluctuations in water quality parameters, such as pH levels, dissolved oxygen (DO), and temperature. These factors directly govern their metabolic rates, growth, and distribution (Witthaya Treelokes, 2018). Specifically, Fissidens anomalus Mont. is a specialized species typically found in high-humidity areas with pristine water quality. Within the Thai moss flora, the genus Fissidens is recognized for its diversity and specific ecological requirements, making it an ideal subject for assessing ecosystem integrity (Narin Printarakul, 2020; Printarakul et al., 2013).

Located in Ban Si Dao Rueang, Palian District, Trang Province, the study area is a biodiversity hotspot characterized by natural stream networks. The research team recognizes the importance of studying the relationship between water quality and the distribution of Fissidens anomalus Mont. as a "long-term health record" for water sources (Montri Phasuk, 2019). By strictly employing The Institute for the Promotion of Teaching Science and Technology (IPST) (2017) and GLOBE Thailand (2019) protocols for environmental monitoring, this study aims to establish a crucial database for assessing ecological health. Furthermore, it seeks to provide sustainable guidelines for the conservation of water resources and the local environment in Southern Thailand

Research Objectives

1.To investigate the water quality in the area of Ban Si Dao Rueang, Palian District, Trang Province.

2.To study the distribution patterns of the moss species *Fissidens anomalus* Mont. within the Ban Si Dao Rueang area, Palian District, Trang Province.

Research Question

1.Does high water quality significantly affect the distribution of the moss species *Fissidens anomalus* Mont.?

Research Hypothesis

High water quality has a positive and significant effect on the distribution of *Fissidens anomalus* Mont.

Materials and Equipment

1. Thermometer (for water temperature measurement)
2. pH Indicator Paper (Litmus/pH strips)
3. Dissolved Oxygen (DO) Test Kit
4. Water Sampling Bottles
5. Specimen Containers (for moss samples)
6. Field Notebook and Stationery
7. Macro Lens Attachment (for smartphone/camera to capture specimen details)

GLOBE Protocols Applied

The study strictly adheres to the GLOBE (Global Learning and Observations to Benefit the Environment) protocols, focusing on:

Hydrosphere Protocols: Specifically for measuring physical and chemical water parameters.

Site Definition: Selection of study sites based on standard environmental monitoring criteria.

Study Site and Sampling Design

The study was conducted at Ban Si Dao Rueang, Palian District, Trang Province.

Sampling Method: Systematic Random Sampling.

Sampling Points: 3 specific study points were established along the upstream area.

Transect: Data was collected at 100-meter intervals over a total distance of 300 meters to ensure a representative dataset of the stream's gradient.

Research Methodology

1. Preparation PhaseIdentify Research Topic

1.1Select and define the core subject of the study.

1.2Literature Review: Gather relevant theories, existing research, and background knowledge.

1.3Establish Objectives: Clearly define the goals and scope of the study.

1.4Sampling Design: Determine the random sampling points within the designated study area.

2. Operational PhaseAction Planning

2.1Create a detailed timeline and operational workflow.

2.2Site Survey: Conduct a preliminary exploration of the physical study area.

2.3Water Quality Measurement (GLOBE Protocols): Measure water temperature, pH, and Dissolved Oxygen (DO) using the following procedures

2.3.1 pH Measurement: Fill a container with a water sample. Immerse the pH indicator paper. Compare the resulting color with the standard reference chart. Perform in triplicate (3 times) to ensure accuracy.

2.3.2 Temperature Measurement: Submerge the thermometer probe into the water. Wait for the reading to stabilize before recording the value. Perform in triplicate (3 times).

2.3.3 Dissolved Oxygen (DO) Measurement (Winkler Method/Test Kit):Collect water in a BOD bottle until full, ensuring no air bubbles are trapped.

- Add 3 drops of Reagent #1 and 3 drops of Reagent #2. Seal and shake until a brown precipitate forms. Let it settle for 2 minutes.

- Add 3 drops of Reagent #3, seal, and shake until the precipitate dissolves and the solution turns yellow.Divide the solution equally into two bottles.

- Titration: Titrate the solution by adding Reagent #T drop by drop while gently swirling until the yellow color turns clear/colorless. Record the total number of drops used (Value A).Calculation: Dissolved Oxygen (mg/L) is calculated based on Value A (Number of drops).Data Management: Submit the collected data to the GLOBE Data Entry system.

3. Data Analysis and ConclusionData Analysis

Conduct a correlation analysis between environmental factors and moss distribution. Statistical tools are used to calculate the mean (average) for:Water TemperaturepH levelsWater Transparency (Turbidity)Dissolved Oxygen (DO)Conclusion: Synthesize the analyzed data to answer the research questions and verify the hypothesisData Analysis and ConclusionData Analysis

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Research Results

esearch ResultsTable 1: Geographic Coordinates of the Study

AreaStudy	Location	
	Latitude(N)	Longitude(E)
Ban Si Dao Rueang	7.28350	99.83944

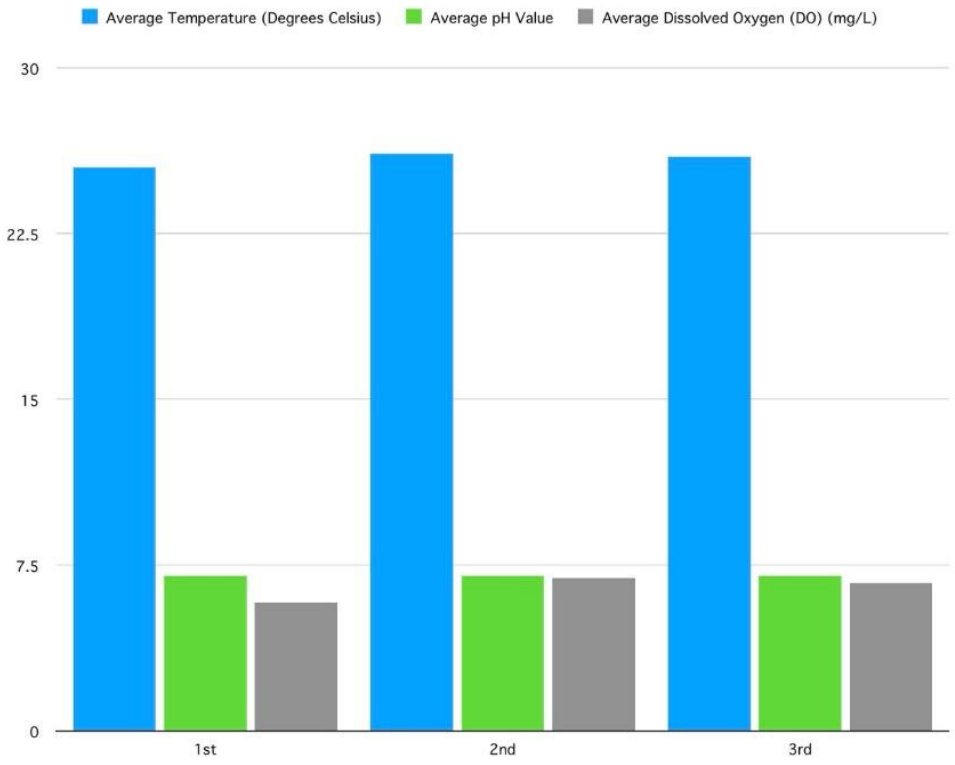
Table 1: AreaStudy LocationLatitude (N)Longitude (E)Ban Si Dao Rueang7.2835099.83944Table 1 presents the geographic coordinates for the study conducted at Ban Si Dao Rueang, Palian District, Trang Province. The study focused on a natural stream where the moss species was observed. The data was collected across three specific sites within this area, all situated around the coordinates 7.28350° N and 99.83944° E.

Table 2: Average Water Quality Parameters at Study Sites for *Fissidens anomalus* Mont.

No	Average Temperature (°C)	Average pH	Average Dissolved Oxygen (mg/L)
1	25.9	7	5.8
2	26.1	7	6.9
3	26	7	6.7

Table 2 illustrates the physical and chemical water properties across three sampling points. The findings indicate that:Water Temperature: The values remained stable, ranging from 25.9°C to 26.1°C, with an overall average of 26.0°C.pH Levels: All three sites recorded a neutral pH of 7.0, providing an ideal chemical balance for aquatic life.Dissolved Oxygen (DO): The DO levels varied between 5.8 and 6.9 mg/L, with a high average of 6.47 mg/L (rounded to 6.48 in the summary), reflecting well-oxygenated and clean water conditions.

Chart comparing water quality at each sampling point



According to the bar chart comparing water quality at each location, Site 2 recorded the highest average temperature at 26.1°C. The average pH level remained constant at 7 across all locations, while Site 2 also showed the highest average dissolved oxygen (DO) at 6.9 mg/L.

Figure 1: Distribution of *Fissidens anomalus* Mont.

Source: Mr. Yasintorn Tengchoo

The ground surface is covered with a lush green, dense carpet of moss, particularly in shaded areas with consistent moisture near flowing water. These conditions are critical factors for the growth and expansion of this species. The moss identified here is *Fissidens anomalus* Mont., a member of the genus Fissidens. Its distinguishing morphological feature is the neat, pinnate (herringbone-like) leaf arrangement, which anchors firmly to moist soil or substrates.

The distribution of this species occurs via spores, which are dispersed by wind and water. When spores land in optimal environments—such as shaded, damp areas with sufficient organic matter—they germinate and expand into continuous moss mats as shown in the figure. The prevalence of *Fissidens anomalus* Mont. in this area clearly reflects a highly intact ecosystem characterized by high humidity, stable temperatures, and minimal anthropogenic disturbance, making it an ideal habitat for this species.

Discussion

The study of water quality factors affecting the distribution of the moss species *Fissidens anomalous* Mont. in Ban Sri Dao Rueang, Palian District, Trang Province, identifies three primary determinants: water temperature, pH levels, and dissolved oxygen (DO).

The findings reveal an average water temperature of 25.91°C, which is considered optimal for maintaining moisture within the moss tissue and facilitating efficient photosynthesis without heat stress. This is complemented by a pH value of 6.67 (slightly acidic to near-neutral), a condition that promotes the solubility and absorption of essential minerals without damaging delicate cellular structures. Furthermore, the high dissolved oxygen level of 6.48 mg/L indicates a clean environment with good water circulation, directly supporting the respiration and anchorage of the moss in flowing water.

This research highlights that superior water quality significantly influences the growth and reproduction of *Fissidens anomalous* Mont. Although the value of bryophytes is often overlooked in Thailand, international research recognizes this moss species as a precision biological indicator (Bioindicator) of ecological health. This study serves as a vital knowledge base to foster community awareness regarding the importance of small forest flora, encouraging their use in monitoring water quality to ensure the long-term sustainability of natural resources in Ban Sri Dao Rueang.

Conclusion

The water quality in the Ban Sri Dao Rueang area is exceptionally pristine and fertile. With an average temperature of 25.91°C, the water remains optimally cool, while the high dissolved oxygen (DO) level of 6.48 mg/L indicates superior water cleanliness. Additionally, the pH level of 6.67—representing a slightly acidic to near-neutral state—provides an ideal environment for aquatic life. These excellent water quality factors support the dense distribution and colonization of the moss species *Fissidens anomalous* Mont., particularly on boulders along the stream banks where there is a consistent and steady water flow.

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1. I am a Data Scientist

I don't just process data; I go where the data is. I conducted extensive field research to collect water samples and environmental insights.

Methodology: I utilized the global GLOBE Program standards to ensure high-quality data collection for water quality analysis.

Analytical Precision: Using specialized instruments, I measured critical parameters including pH levels, Temperature, and Dissolved Oxygen (DO).

Correlation Analysis: My role is to decode the complex relationship between physical variables and biological indicators, turning raw environmental observations into scientific evidence.

2. I am Make an Impact

My work goes beyond statistics; it creates a ripple effect for the community and the planet.

Environmental Stewardship: Through rigorous monitoring, I help preserve water quality and protect the delicate balance of our local ecosystems.

Eco-Tourism Development: By ensuring a thriving and pristine environment, I help transform local sites into high-value eco-tourism destinations.

Economic Growth: My data proves the health of our nature, building trust and attracting more tourists to the area, which directly boosts the local economy.

3. I am a Collaborative

I believe that data is most powerful when it is shared and integrated with diverse perspectives.

Team & Mentorship: I thrive on working closely with my teammates and advisors, ensuring our research meets the highest academic and practical standards.

Community Integration: I don't work in a vacuum; I actively engage with the local residents of Ban Si Dao Rueang. By integrating local wisdom with scientific data, I ensure that our conservation efforts are both accurate and culturally sustainable.