

Research Title A Comparative Study of Water Quality and the Correlation Between Physical and Chemical Characteristics of Lentic and Lotic Ecosystems Affecting Aquatic Organisms at Khao Lak Waterfall, Trang Province Nam Phut Subdistrict, Mueang District, Trang Province

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Abstract

This study aimed to compare water quality and investigate the relationship between physical and chemical characteristics of different water bodies and their effects on aquatic life at Khao Lak Waterfall, Trang Province. The objectives were: 1) to examine the physical properties (e.g., color, temperature) and chemical properties (e.g., pH levels) of lentic (standing) and lotic (flowing) water; and 2) to survey the biodiversity of organisms in these habitats. Data collection was conducted between December 13–21, 2025.

The results revealed that lotic (flowing) water exhibited superior quality compared to lentic water, characterized by high transparency, an average temperature of 25°C, and a neutral pH of 7.0. The substrate primarily consisted of boulders, pebbles, and coarse sand. Organisms identified in lotic areas included water striders, ricefish, freshwater shrimp, mayfly nymphs, and tiger barbs.

In contrast, lentic (standing) water had an average temperature of 27–28°C and was slightly acidic (pH 5.5–6.5) due to the decomposition of organic matter. The water appeared yellowish with higher turbidity, and the substrate was covered with mud, silt, and decaying leaves. Organisms found in these areas included water scorpions, marsh snails, pond snails, and snakehead fish. The study concludes that physical and chemical factors, particularly water flow and oxygenation, are primary determinants of biodiversity and species distribution in waterfall ecosystems.

Keywords: Water quality, Khao Lak Waterfall, Lentic water, Lotic water

Introduction

Water resources are fundamental to the survival of all living organisms, particularly within freshwater ecosystems which serve as habitats for diverse aquatic plants, animals, and insects. Variations in physical and chemical environmental factors, such as temperature and pH, are key determinants of the types and diversity of life in a given area. In waterfall ecosystems, habitats are categorized into lotic (flowing) and lentic (standing) systems, each possessing distinct characteristics. Lotic systems benefit from water circulation which increases dissolved oxygen and regulates temperature, whereas lentic systems often accumulate sediment and organic matter, leading to higher temperatures and altered pH levels. This research seeks to establish baseline data for assessing water resource status and promoting local ecological conservation.

Research Questions

1. How do the physical and chemical water qualities (temperature and pH) differ between lentic and lotic areas at Khao Lak Waterfall?
2. How do these physical and chemical characteristics influence the distribution and species composition of organisms in the area?

Hypotheses

1. Lotic areas will exhibit higher water quality (lower temperature and neutral pH) than lentic areas due to better circulation and oxygenation.
2. Physical and chemical factors (temperature and pH) significantly influence the habitat selection of aquatic organisms.

Methodology

1. Study Site

Khao Lak Waterfall, Nam Phut Subdistrict, Mueang District, Trang Province (Latitude 7.703630 N, Longitude 99.729242 E).

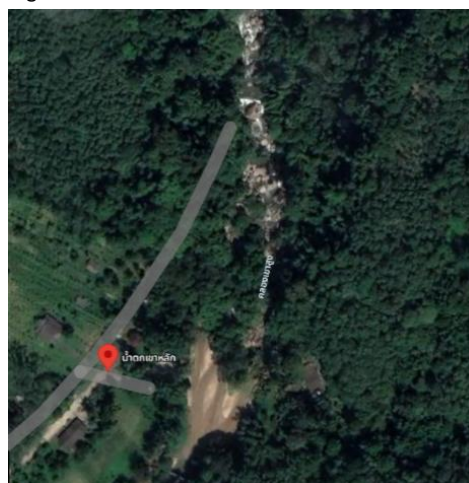


Figure 1: Study sites at Khao Lak Waterfall, Nam Phut Subdistrict, Mueang District, Trang Province.

Retrieved from Google Maps.

2. Sampling Procedures

In this study, the research team conducted data and specimen collection at Khao Lak Waterfall, Nam Phut Subdistrict, Mueang District, Trang Province, which was organized into three sequential stages as follows:

1. Site Selection: The researchers categorized the survey points into two distinct types: stagnant water areas, defined as pools with minimal or no water circulation and an accumulation of sediment and leaf litter; and flowing water areas, characterized by continuous currents and substrates consisting of boulders or gravelly sand.

2. Physical and Chemical Water Quality Measurement: At each survey point, standard water quality parameters were measured, including water temperature using a thermometer and pH levels using a pH test kit. Additionally, observations were recorded regarding water color, clarity, and the characteristics of the underwater substrate.

3. Biodiversity Survey and Assessment: The researchers employed random sampling with hand nets in flowing water zones. In stagnant water zones, the methodology focused on visual observation and manual sampling of organisms at the water surface and shoreline, as well as the use of nets in areas covered by aquatic plants. All specimens were classified, photographed, and recorded before being released back into their natural habitat.

3. Measurement of Parameters:

3.1 Temperature: Measured using a thermometer submerged 10–15 cm below the surface for 2-3 minutes

3.2 Transparency/Turbidity: Assessed through visual observation of substrate visibility and sediment characteristics.



Figure 2: Water temperature measurement and biodiversity survey in lentic and lotic water areas at Khao Lak Waterfall, Nam Phut Subdistrict, Mueang District, Trang Province.

4. Biological Survey

4.1 pH Level: Determined using a universal indicator test kit and compared against a standard color chart.

Materials and Equipment

1. Aquatic hand-held dip net (1 unit)
2. Thermometer (0–100°C) (1 unit)
3. Vunique pH indicator test kit (pH range 4.5–9.0) (1 set)
4. Specimen observation basin (1 unit)

Research results

Table 1 Physical and Chemical Characteristics of Water at Each Sampling Site

Site	Characteristics of the surveyed area	Temp (°C)	pH	Water Color	Transparency	Substrate
1	Lentic (Mud/Accumulated leaves)	26.5	6.5	Clear	High	Boulders with minor algae
2	Lentic (Boulders/Sand)	26	7.0	Clear	Moderate	Boulders with minor algae
3	Lentic (Pool by the bank)	27	6.0	Pale yellow	Low	Sand, mud, and algae
4	Lentic (Coarse sand/Brown sediment)	28	5.5	Pale yellow	Moderate	Sandy with high sediment
5	Lotic (Boulders/Gravel sand)	25	7.0	Clear	High	Sand and leaves
6	Lotic (Boulders/Sand)	25	7.0	Clear	High	Sand with minor algae on rocks
7	Lotic (Stream margin)	25.5	7.0	Clear	High	Coarse sand
8	Lotic (Headwater/Strong current)	25	7.0	Clear	High	Boulders and gravel sand

• The data were collected during the period of December 13–21, 2025.

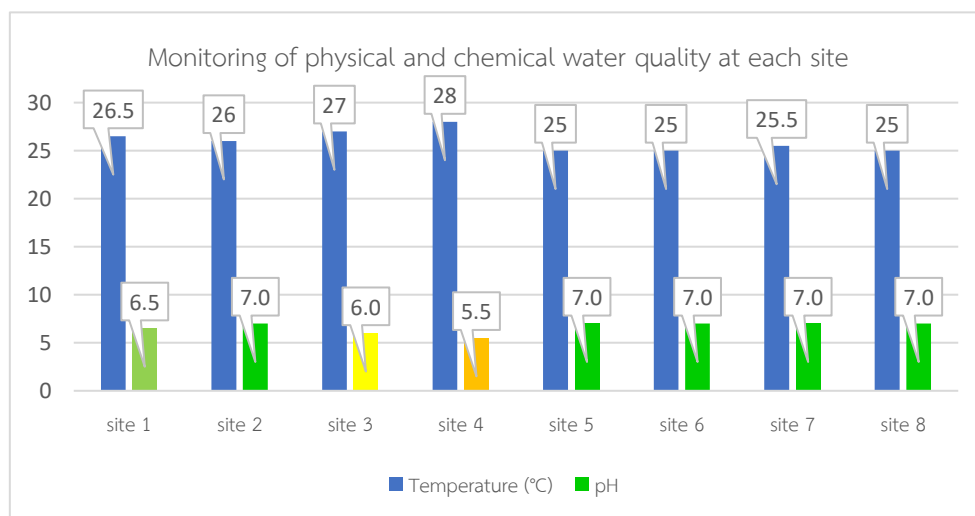


Figure 3: Graph showing a comparison of the physical and chemical characteristics of water at each point in the Khao Lak Waterfall area, Nam Phut Subdistrict, Mueang District, Trang Province

Table 2: Survey of Aquatic Organisms at Each Sampling Site

Species Found	S1 (Lentic)	S2 (Lentic)	S3 (Lentic)	S4 (Lentic)	S5 (Lotic)	S6 (Lotic)	S7 (Lotic)	S8 (Lotic)	Observed Behavior
Mayfly nymphs							/		Attached to rocks
Tiger barbs						/			Schooling
Ricefish		/				/			In clear water areas
Freshwater shrimp							/		In rock crevices/aquatic plants
Water scorpions			/						In lentic areas
Marsh snails				/					On muddy substrate
Freshwater limpets						/			Firmly attached to objects
Snakehead fish	/								Burrowed in mud
Water striders		/			/	/			On slow-flowing surface
Frog eggs			/						On stagnant water surface

• The data were collected during the period of December 13–21, 2025.

Table 4: Summary of Aquatic Biodiversity by Habitat Type

Habitat Type	Species Found	Observed Behavior and Habitat
Lentic Areas	1. Water scorpion	Often attached to accumulated leaf litter or inhabiting muddy substrates in stagnant, calm water.
	2. Ricefish	
	3. Marsh snail	
	4. Snakehead fish	
	5. Frog eggs	
	6. Water strider	
Lotic Areas	1. Water strider	Distributed in areas with active currents and rock crevices; exhibits high swimming agility or adheres to boulders in slow to moderate flows.
	2. Mayfly nymph	
	3. Freshwater shrimp	
	4. Tiger barb	
	5. Ricefish	
	6. Freshwater limpet	

Research findings

The comparative study of water quality and its impact on aquatic organisms in lentic (standing) and lotic (flowing) water environments at Khao Lak Waterfall, Nam Phut Subdistrict, Mueang District, Trang Province, conducted between December 13–21, 2025, yields the following conclusions

Part 1: Physical and Chemical Water Quality

The investigation revealed distinct environmental conditions between the two types of water bodies. Lotic (flowing) water areas exhibited superior water quality compared to lentic areas, characterized by an average temperature of 25°C and a neutral pH of 7.0. The waterway was clear and colorless. In contrast, lentic (standing) water areas recorded higher temperatures, averaging 27°C, and were slightly acidic (pH 6.3). The water appeared clear but with a pale yellow tint, which is a result of organic matter decomposition. The substrate in these areas was predominantly covered with mud and accumulated leaf litter and the underwater substrate primarily consisted of boulders and gravel with minimal algae.

Part 2: Biodiversity of Aquatic Organisms

Lentic Environments: Inhabited by aquatic species tolerant to low oxygen levels or those that utilize organic matter as a primary food source, such as water scorpions (*Laccotrephes* sp.), marsh snails, ricefish, frog eggs, and snakehead fish.

Lotic Environments: Supported species requiring high dissolved oxygen and clean water, including water striders, ricefish, freshwater shrimp, tiger barbs, freshwater limpets, and mayfly nymphs.

Part 3: Correlation between Water Quality and Aquatic Life

Water quality serves as a direct determinant of organism distribution

Lotic environments facilitate heat exchange and oxygen dissolution through constant water circulation, creating conditions more conducive to freshwater biodiversity. Conversely, lentic environments are prone to thermal accumulation and the buildup of organic acids, which limits the variety of species to only those capable of adapting to such conditions.

Discussion

The study indicates that the water quality in running water (lotic) zones is markedly superior to that in still water (lentic) zones. These areas exhibit a lower mean temperature (25 °C) and a neutral pH (7.0). This is attributed to the constant movement of the water current, which facilitates heat exchange and enhances the solubility of dissolved oxygen. Such environmental conditions are conducive to pollution-sensitive organisms requiring high oxygen levels, such as mayfly larvae and tiger barbs.

In contrast, still water zones demonstrate a higher average temperature (27 °C) and slight acidity (pH 6.3). This variation results from water stagnation and the decomposition of submerged leaf litter, which liberates organic acids. Consequently, these areas are inhabited only by species well-adapted to high organic matter and low oxygen conditions, such as river snails and water scorpions. These organisms utilize camouflage for predation and breathe through respiratory siphons at the water surface. In conclusion, the physicochemical characteristics of the water source are the primary factors clearly determining the type and diversity of biological life in the Khao Lak Waterfall area

Recommendations

1. Further studies should be conducted across different seasons, particularly the rainy season, to compare variations in pH levels and shifts in biological communities that may migrate or change in response to fluctuating water volumes.

2. Additional measurements of Dissolved Oxygen (DO) should be implemented to empirically confirm the correlation between water current velocity and oxygen concentration, which directly impacts the habitat suitability for aquatic insect larvae

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Appendices

Category 1: Physical and Chemical Characteristics of Each Site



Site 1: A stagnant water area characterized by an accumulation of leaf litter and sediment. The water exhibits high transparency, and the recorded water temperature is 26.5 °C



Site 2: A stagnant water area characterized by moderate transparency. The underwater substrate consists of sandy soil with an accumulation of sediment and algae, while the water temperature remains constant at 26 °C



Site 3: A stagnant water area and shoreline pool. The water is characterized by a pale yellow color with low to moderate transparency. The underwater substrate consists of fine sand with minor silt and a high abundance of brown algae. The water temperature is recorded at a constant 27 °C



Site 4: A stagnant water area and a pool near boulders. The water is characterized by a pale yellow color with low to moderate transparency. The underwater substrate consists of coarse sand with a high abundance of brown sediment, and the water temperature remains constant at 28 °C.



Site 5: A flowing water area characterized by clear water and high transparency. The primary substrate consists of boulders and gravelly sand, with brown algae observed on the rock surfaces. The water temperature remains constant at 25 °C



Site 6: A flowing water area characterized by moderate transparency. The primary substrate consists of boulders and sand, with brown algae observed on rock surfaces and the presence of minor air bubbles. The water temperature remains constant at 25 °C














Site 7: A shoreline area characterized by flowing water with high transparency and good water quality. The water temperature remains constant at 25.5 °C



Site 8: A headwater area characterized by a rapid flow and high transparency. The underwater substrate is composed of gravelly sand, and the water temperature remains constant at 28 °C

Section 3: Surveyed Organisms and Biodiversity

Study Area	Scientific Name	Photographs of Organisms
Lentic	1. Water Scorpion	
	2. Ricefish	
	3. Freshwater Snail	
	4. Snakehead fish	
	5. Frog eggs	
	6. Water strider	

Lotic	1. Water Strider	
	2. Swimming Mayfly Nymph	
	3. Freshwater Shrimp	
	4. Partridge Barb	
	5. Ricefish	
	6. Freshwater Limpet	