Assessment and Comparison of Invertebrate Biodiversity and Water Quality in Huai Yang, and Huai Wa, Ban Phak Mai Yai

Research Team

Ms. Warattaya Sopha
Ms. Marisa Phukamnoi
Ms. Pannara Naknuan
Mr. Athit Seewiiyat

Research Advisors

Mrs. Darunee Samerpak
Mr. Samruan Samerpak
Ms. Sasiwimon Pangma

Phak Mai Wittayanukul School, Sisaket, Thailand

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Research Team Ms. Waratthaya Sopha
Ms. Marisa Phukamnoi
Ms. Pannara Naknuan
Mr. Athit Seewiiyat
Grade Level Grade 12
Research Advisor Mrs. Darunee Samerpak, Mr. Samruan Samerpak
Ms. Sasiwimon Pangma
School Phak Mai Wittayanukul School
Huai Thap Than District, Sisaket Province

Abstract

This research aimed to study the biodiversity and abundance of freshwater invertebrates, as well as water quality, in Huai Yang and Huai Wa streams at Ban Phak Mai Yai, Huai Thap Than District, Sisaket Province. Invertebrates and water samples were collected from two sampling sites. The species and number of invertebrates were analyzed, and water quality parameters were measured, including pH, water temperature, and dissolved oxygen (DO).

The results showed that at Site 1, five species of invertebrates were found, namely freshwater shrimp, snails, leeches, water spiders, and water striders, with a total of seven individuals, indicating relatively high biodiversity. In contrast, Site 2 had three species of invertebrates—freshwater shrimp, water spiders, and water striders—with a total of 22 individuals, of which freshwater shrimp was the most abundant species. Water quality analysis revealed that the pH values at both sites were similar, ranging from 6.18 to 6.25, indicating slightly acidic conditions. Water temperature ranged from 33.4 to 33.6 degrees Celsius. Dissolved oxygen levels at Site 2 were clearly higher than those at Site 1, with values of 8.5 and 6.0 milligrams per liter, respectively.

When compared with standard criteria, the water quality at both sites was classified as fair to good. Dissolved oxygen levels were suitable for aquatic organism conservation and fisheries; however, the pH values were slightly lower than the optimal range for aquaculture. The findings indicate that water quality and biodiversity are interrelated. Sites with higher dissolved oxygen levels supported greater abundance of certain organisms. Nevertheless, biodiversity was not dependent solely on dissolved oxygen but was also influenced by habitat structure, food availability, and environmental stability. This study provides baseline information that can be used for planning appropriate and sustainable local water resource management and conservation.

Keywords: Biodiversity, Freshwater Invertebrates, Water Quality

Introduction

1. Background and Significance

The biodiversity of freshwater invertebrates is an essential component of aquatic ecosystems. These organisms play various important roles, including maintaining ecosystem balance, regulating populations of other organisms, and serving as a major food source for aquatic animals. In addition, freshwater invertebrates are widely recognized as effective biological indicators for assessing water quality and the overall health of aquatic ecosystems, as they respond rapidly to environmental changes such as variations in dissolved oxygen, pH, and water temperature. These factors directly influence the growth, survival, and distribution of organisms within aquatic ecosystems.

Water quality is therefore a crucial variable that directly affects the diversity and integrity of freshwater invertebrate communities. Changes in the chemical and physical properties of water, such as a decrease in dissolved oxygen levels or sudden fluctuations in pH, can have severe impacts on biodiversity and may lead to ecosystem degradation. Consequently, the study of water quality in conjunction with freshwater invertebrate diversity provides an effective approach for analyzing and evaluating the condition of aquatic environments.

Huai Yang and Huai Wa streams in Ban Phak Mai Yai, Sisaket Province, are important freshwater resources for the local community, as they are used for agriculture, fisheries, and domestic purposes. The geographical characteristics and environmental conditions of these two water bodies differ in certain aspects, such as water flow and surrounding habitat structure, which may influence water quality and the diversity of freshwater invertebrates in each area. Investigating these differences can enhance understanding of the factors affecting biodiversity and ecosystem health at the local level.

Therefore, this study aims to investigate and compare the biodiversity and abundance of freshwater invertebrates, along with water quality, in Huai Yang and Huai Wa streams at Ban Phak Mai Yai. The findings are expected to provide baseline information on the health of local freshwater ecosystems and can be applied to the planning of appropriate and sustainable water resource management and conservation. Moreover, this study supports the conservation of freshwater ecosystems with high biodiversity, which is essential for long-term environmental sustainability and the quality of life of local communities.

2. Research Questions

1. How does the water quality of Huai Yang Stream differ from that of Huai Wa Stream at Ban Phak Mai Yai?

2. What is the relationship between the biodiversity and abundance of freshwater invertebrates and water quality in each study area?

3. Research Hypotheses

1.The water quality of Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai is different.

2.The biodiversity of freshwater invertebrates is related to water quality in each water body.

4. Research Objectives

1.To study the water quality of Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai.

2.To analyze the relationship between freshwater invertebrate biodiversity and water quality
in Huai Yang and Huai Wa streams at Ban Phak Mai Yai.

3.To provide guidelines for improving and developing water quality in Huai Yang and Huai Wa streams at Ban Phak Mai Yai.

5. Expected Outcomes of the Research

1.Information on the water quality of Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai was obtained.

2.The results indicated that freshwater invertebrate biodiversity is related to water quality. Water bodies with better water quality tend to support higher invertebrate diversity, and freshwater invertebrates can be used as indicators of water quality status.

3.The findings can be applied to planning appropriate water quality improvement and development in the study area, such as pollution source control, promotion of community participation, and conservation of biodiversity in natural water bodies.

6.Variables Involved

6.1.Independent Variables

Sampling sites / Study areas
(Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai)

6.2 Dependent Variables

Freshwater invertebrate biodiversity and abundance Water quality (pH, water temperature, and dissolved oxygen)

6.3 Controlled Variables

The sampling method, sampling period, sampling time, measurement instruments, measurement procedures, and units of measurement were kept constant at all sampling sites.

Research Methodology

1.Scope of the Research

1.1 Scope of Content

The study examined physical water quality parameters, namely water temperature, and chemical water quality parameters, including pH and dissolved oxygen (DO).

1.2 Scope of Study Area

Two study sites were selected: Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai, Huai Thap Than District, Sisaket Province.

1.3 Scope of Time

Water and freshwater invertebrate samples were collected on 16 June 2025.

2. Materials, Equipment, and Chemicals

1 Alcohol bulb thermometer

2. pH meter

3.Dissolved Oxygen (DO) test kit

4.Aquatic net

5.Water sampling bottles 6.Beaker 7.Tray 8.Mobile phone
9.Camera 10. Pencil / Pen 11.Notebook

3.Research Method

3.1Selection of Study Sites

Two study sites were selected: Huai Yang Stream and Huai Wa Stream at Ban Phak Mai Yai.

Site 1: Huai Wa Stream at Ban Phak Mai Yai

Site 2: Huai Yang Stream

3.2 Field Survey of the Study Sites

A field survey was conducted at both study sites to observe the water conditions and the surrounding environmental characteristics of the study areas.

3.3Water Sampling and Water Quality Analysis

Water samples were collected from both study sites to analyze water quality following the GLOBE protocols. The analysis focused on two aspects:
(1) physical characteristics, specifically water temperature; and
(2) chemical characteristics, including pH and dissolved oxygen (DO).

The results of water quality analysis were used to evaluate the effects of physical and chemical factors on the aquatic environment and to support planning for water resource management and conservation.

3.4 Identification and Counting of Freshwater Invertebrates

1. The hand net was submerged into the water and swept in areas with aquatic plants or submerged wood, ensuring that the net reached the bottom.

2.The net was moved back and forth twice in areas with accumulated sediment.

3.The net was lifted out of the water.

4.The contents of the net were poured into a tray, and the invertebrates found were identified and counted.

3.5 Comparing Measured Water Quality with Standard Criteria

1. pH Standard

The pH values were compared with the National Freshwater Fisheries Institute standard, which indicates that a pH range of 6.5–9.0 is suitable for aquatic animal culture.

2. Dissolved Oxygen (DO) Standard

The dissolved oxygen (DO) levels were evaluated using the Department of Environmental Quality Promotion criteria, where a DO ≥ 6.0 mg/L is considered Class 2water quality, suitable for aquatic conservation, fisheries, recreation, and safe water use after disinfection.

3.Water Temperature Standard

The water temperature was assessed according to the Pollution Control Department guideline, which states that water temperature should not exceed the natural temperature by more than 3°C.

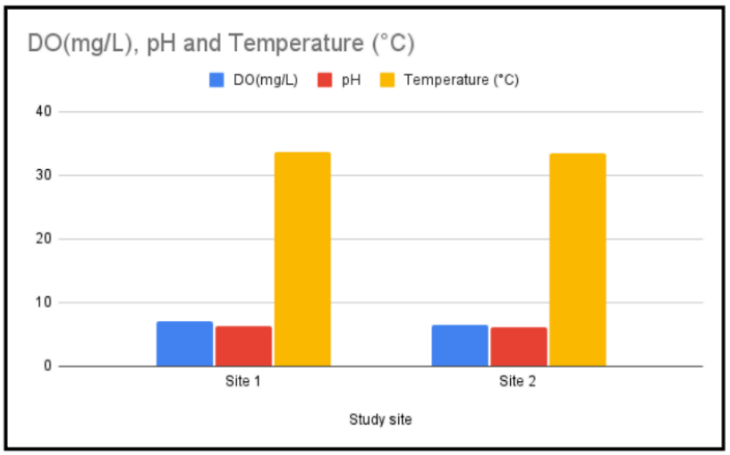
Research Results

From the collection of water samples and analysis of water quality at both study sites on 16 June 2025, the results were compared as follows

Table 1 shows the water quality at the two study sites, Huai Wa Stream at Ban Phak Mai Yai and Huai Yang Stream, Huai Thap Than District, Sisaket Province.

Study site	Water quality table		
	DO(mg/L)	pH	Temperature
Site1	7.5	6.25	33.6
Site2	7	6.18	33.4

Figure 1 shows the water quality at the two study sites, Huai Wa Stream at Ban Phak Mai Yai and Huai Yang Stream, Huai Thap Than District, Sisaket Province.



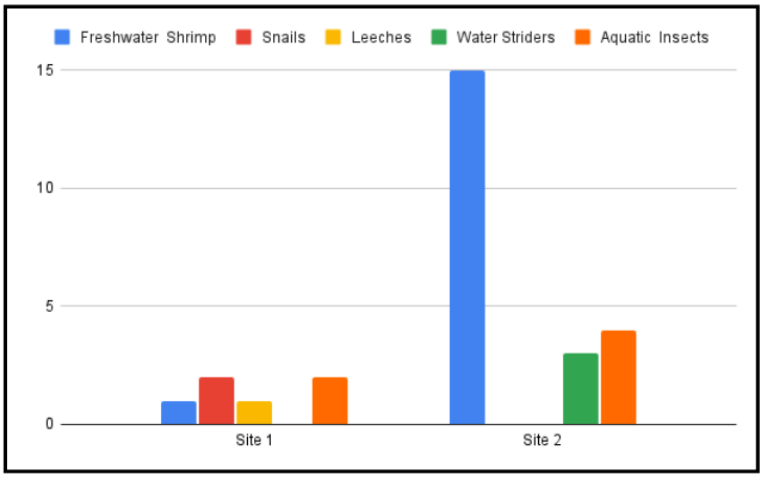
From Table 1, it was found that the water quality at the two study sites, Huai Wa Stream at Ban Phak Mai Yai and Huai Yang Stream in Huai Thap Than District, Sisaket Province, showed both similarities and differences. Water samples collected from the two sites indicated that the pH values were similar, ranging from approximately 6.18 to 6.25, which falls within a slightly acidic condition. The water temperatures at both sites were also similar, ranging from 33.4 to 33.6 °C, suggesting a stable environmental condition.

However, differences were observed in dissolved oxygen (DO) levels. Site 2 recorded a higher DO value of 8.5 mg/L, compared to Site 1, which had a DO value of 6.0 mg/L, indicating that the water quality at Site 2 was relatively better. Therefore, it can be concluded that the water quality in the study area varied between the two sites, particularly in terms of dissolved oxygen levels, which is an important indicator of the suitability of the water environment for aquatic life.

Table 2 shows the types and numbers of freshwater invertebrates at the two study sites, Huai Wa Stream at Ban Phak Mai Yai and Huai Yang Stream, Huai Thap Than, Sisaket

Study site	Types and Abundance of Invertebrates at Each Study Site				
	Freshwater Shrimp	Snails	Leeches	Water Striders	Aquatic Insects
Site1	1	2	1	-	2
Site2	15	-	-	3	4

Figure 2. Bar chart showing the number of freshwater invertebrate species and individuals at the two study sites.



From the study of freshwater invertebrate species and their abundance at Huai Wa Stream at Ban Phak Mai Yai and Huai Yang Stream in Huai Thap Than District, Sisaket Province, samples were collected from two sites. At Site 1, five invertebrate species were identified: freshwater shrimp, snails, leeches, water spiders, and water striders, with a total of 7 individuals, indicating relatively high biodiversity. At Site 2, three invertebrate species were observed: freshwater shrimp, water spiders, and water striders, with a total of 22 individuals. Freshwater shrimp was the most abundant species at Site 2, with 15 individuals recorded.

From the results of the study, it can be concluded that Site 1 had greater species diversity of freshwater invertebrates but a lower total number of individuals. In contrast, Site 2 had a higher total number of invertebrates but lower species diversity, with freshwater shrimp being the most abundant species. These differences reflect the distinct environmental conditions and habitat suitability at each site.

When the water quality at both study sites was compared with established standard criteria, the dissolved oxygen (DO) levels at both locations were found to meet the criteria for good water quality, which is suitable for aquatic organism conservation and fisheries use. However, the pH values at both sites were slightly below the optimal range for aquaculture, indicating a slightly acidic condition that may adversely affect aquatic organisms if sustained over time. The water temperature at both sites did not exceed the prescribed standard limits.

In summary, the overall water quality in the study area can be classified as fair to good. Nevertheless, regular monitoring of pH levels is recommended to prevent long-term negative impacts on the aquatic ecosystem.

Summary and Discussion of Research Results

The research findings indicate that water quality and biodiversity are related. Site 2 exhibited higher dissolved oxygen levels, which supported greater abundance of aquatic organisms, particularly freshwater shrimp. Although Site 2 had a higher number of individuals, it showed lower species diversity, possibly because the environmental conditions at this site favored the growth of certain species only.

In contrast, Site 1, despite having lower water quality than Site 2, had greater species diversity. This suggests that Site 1 may possess a more heterogeneous and suitable environment for a variety of aquatic organisms, even though its dissolved oxygen levels were not as high. Therefore, the abundance of organisms in a water

body is not determined by dissolved oxygen levels alone. Other factors, such as habitat structure, food availability, and environmental stability, also play significant roles in influencing the number and diversity of aquatic organisms in each area.

From the study of freshwater invertebrate species and abundance in Phak Mai and Huai Yang subdistricts, Huai Thap Than District, Sisaket Province, samples were collected from two sites. At Site 1, five freshwater invertebrate species were found: freshwater shrimp, snails, leeches, water spiders, and water striders, with a total of 7 individuals, indicating relatively high biodiversity. At Site 2, three invertebrate species were observed: freshwater shrimp, water spiders, and water striders, with a total of 22 individuals. Among these, freshwater shrimp was the most abundant species, with 15 individuals recorded.

From the study of water quality at the two study sites in Ban Phak Mai Yai and Huai Yang, Huai Thap Than District, Sisaket Province, water samples were collected from both locations. The pH values at both sites were similar, ranging from approximately 6.18 to 6.25, indicating a slightly acidic condition. Water temperatures at both sites were also similar, ranging from 33.4 to 33.6 °C, suggesting stable environmental conditions. However, dissolved oxygen (DO) levels differed between the sites, with Site 2 recording a DO value of 8.5 mg/L compared to 6.0 mg/L at Site 1. Therefore, it can be concluded that water quality in the study area varied, particularly in terms of dissolved oxygen, which is an important indicator of the suitability of the environment for aquatic life. Site 2 demonstrated better water quality than Site 1.

The evaluation of water quality at the two study sites, when compared with established standard criteria, showed that the dissolved oxygen (DO) levels at both locations were within the range of good water quality, suitable for aquatic organism conservation and fisheries use. The pH values at both sites were slightly below the optimal range for aquaculture, indicating a somewhat acidic condition, which may negatively affect aquatic organisms if it persists over time. Meanwhile, the water temperatures at both sites did not exceed the prescribed standard limits.

In summary, the water quality in the study area can be classified as fair to good; however, regular monitoring of pH levels is recommended to prevent long-term impacts on the aquatic ecosystem.

Acknowledgements

We would like to express our sincere gratitude to the Director of Phak Mai Witthayanukul School for providing the opportunity to conduct this environmental science research. Our heartfelt thanks go to Mrs. Darunee Samerpak for her valuable knowledge, technical guidance, and continuous support throughout the research process.

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Appendices

Flowchart of the Procedures for Assessing Water Quality and Freshwater Invertebrates at the Study Sites, as follows:

1. Conduct a field survey and collect water samples



2. Measure the water temperature at the study site using a thermometer and record the measured temperature.



3. Measure the pH of the water at the study site using a pH meter and record the measured values.



4. Bring the water samples from the study sites to the laboratory, measure the dissolved oxygen (DO) levels, and record the results.



5. Identify and count the freshwater invertebrates in the water samples.




6. Submit the environmental measurement data to the GLOBE database

ออกซิเจนที่ละลายน้ำ	
วันที่วัด:	5 กรกฎาคม 2568
ชื่อองค์กร:	โรงเรียนกัดมัยวิทยานุกูล
รหัสไซต์:	394755
ชื่อไซต์:	หัวยวะผักไหมใหญ่
ละติจูด:	14.94018
ลองจิจูด:	104.05029
ระดับความสูง:	131.6 เมตร
วัดได้ที่:	2025-07-05T08:11:00
สถานะของแหล่งน้ำ:	ปกติ
ออกซิเจนที่ละลายผ่านชุด:	7 มก./ล.
ทีม GLOBE:	GlobeSciUBU,GLOB Thailand,THDataEn

ค่า pH	
วันที่วัด:	5 กรกฎาคม 2568
ชื่อองค์กร:	โรงเรียนกัดมัยวิทยานุกูล
รหัสไซต์:	394755
ชื่อไซต์:	หัวยวะผักไหมใหญ่
ละติจูด:	14.94018
ลองจิจูด:	104.05029
ระดับความสูง:	131.6 เมตร
วัดได้ที่:	2025-07-05T08:11:00
ค่า pH ของน้ำ:	6.5 หน่วย pH
สถานะของแหล่งน้ำ:	ปกติ
วิธี pH:	เมตร
ทีม GLOBE:	GlobeSciUBU,GLOB

อุณหภูมิของน้ำ	
วันที่วัด:	5 กรกฎาคม 2568
ชื่อองค์กร:	โรงเรียนกัดมัยวิทยานุกูล
รหัสไซต์:	394755
ชื่อไซต์:	หัวยวะผักไหมใหญ่
ละติจูด:	14.94018
ลองจิจูด:	104.05029
ระดับความสูง:	131.6 เมตร
วัดได้ที่:	2025-07-05T08:11:00
อุณหภูมิของน้ำ:	33.4 องศาเซลเซียส
สถานะของแหล่งน้ำ:	ปกติ
วิธีการอุณหภูมิ:	เทอร์โมมิเตอร์แบบบรรจ

Badge

1) I WORK WITH A STEM PROFESSIONAL

This research aligns with the “I Work with a STEM Professional” badge through close collaboration with an expert who provided guidance on experimental design, sampling, data analysis, and interpretation. This support improved the quality of the research and strengthened the team’s understanding and application of scientific methods in studying aquatic ecosystems.

2) I AM A DATA SCIENTIST

Our research focuses on analyzing data related to the biodiversity of freshwater invertebrates, which serve as biological indicators of water quality. We measured both chemical and physical water quality parameters and compared them with standard criteria to examine the relationship between invertebrate biodiversity and water quality. The data were presented using graphs and tables to clearly illustrate the comparisons of water quality and freshwater invertebrate diversity.

3) I AM A COLLABORATOR

This research compared the biodiversity of freshwater invertebrates and water quality at Huai Yang and Huai Wa in Ban Phak Mai Yai. The study required collaboration among all team members in designing the experiment, collecting water samples, recording data, and analyzing results. Team discussions helped identify effective methods for assessing water quality and biodiversity, while guidance from the research advisor enhanced understanding of environmental factors and supported practical application in the future.