

**A study of the relationship between environmental factors and the abundance and diversity of *Acetes* shrimp in mangrove forests in Pak Phun Subdistrict, Meung Nakhon Si Thammarat District, Nakhon Si Thammarat Province, Thailand.**

Researchers: Supanat Kampapan and Chayapat Kruthnim

Advisor: Thapanawat Chooklin

Princess Chulabhorn Science High School Nakhon Si Thammarat, Thailand

E-mail: p.supanat2547@gmail.com

10 March 2023

**Abstract**

*Acetes* shrimp is one of the key zooplankton that have considerable impact on mangrove ecosystems. They serve as a source of food and a nursery for aquatic creatures. They are also crucial for economy and fisheries. The *Acetes* shrimp were employed as biological monitoring organisms to reveal environmental abundance and balance. When measuring the salinity of the Pak Pha Ying estuary and Kao canal in Pak Phun subdistrict, Meung Nakhon Si Thammarat district, Nakhon Si Thammarat province, Thailand, it can be seen that the *Acetes* genus of shrimp can survive in a variety of salinities. They are alive in the area that have 7-8 thousandth, even can breed in 15-30 thousandth salinity level (Nongnooch). The data suggests that the population density of the *Acetes* shrimp was essentially unaffected by variations in salinity of only a thousandth. However, the monsoon season and the current's speed are the variables that have the most effects on them since their eggs can be blown out directly to the sea. From November to May, fisherman typically set out about 5 or 6 a.m. There were other aquatic species present at the time, including shell, fingerlings, etc. The water did not flow which made the *Acetes* visible and grouped in clusters. In order to protect *Acetes shrimp* habitats and breeding grounds, natural breakwaters like mangroves and other plants that grow along beaches and in mangrove forests are crucial natural resources. This helps to conserve a variety of marine species.

**Keywords:** *Acetes* shrimp, mangrove forest, aquatic animal nurseries

## Introduction

Nakhon Si Thammarat province is one of many provinces in Thailand that have lots of areas next to the sea hence there are abundant areas such as mangroves, mudflat, and open water. Mangrove areas in Nakhon Si Thammarat are approximately 129,475,856 m<sup>2</sup>, distributed in 4 districts: Mueang Nakhon Si Thammarat District, Khanom District, Tha Sala District and Pak Phanang District. These mangroves are nurseries for aquatic animals and mangroves also are food resources for a variety of fish and marine animals. One of the groups of organisms that play an essential part in the ecosystem, especially the food chain, is the *Acetes* shrimp because it serves as food for a wide range of aquatic creatures. *Acetes* shrimp were once used as biological monitoring organisms. Simultaneous study of biodiversity Therefore, it is an index that indicates the abundance and balance of that ecosystem. *Acetes* shrimp can the environment or can live in optimal conditions different for each species. This fundamental knowledge is a crucial component that will influence how the environment develops both now and in the future. We should therefore study the different types and varieties of *Acetes* shrimp for gathering information and performing analyses to support the management of coastal biological resources so that they are more numerous and sustainable by looking at the ideal environment for *Acetes* shrimp, including factors impacting diversity and abundance.

## Research questions

1. What are factors that affect population density and variety of *Acetes* shrimps in mangrove in Nakhon Si Thammarat?
2. How *Acetes* shrimps indicate and improve the abundance of the ecosystem?

## The Objectives

1. To measure pH and salinity of water in mangrove in Pak Pha Ying, Nakhon Si Thammarat province.
2. To study and collect *Acetes* shrimp in different environment to analyze related factors.
3. To study the environment of *Acetes* shrimp's habitat and predators.

## Research Methods

### 1. Study Sites

A study of the relationship between environmental factors and the abundance and diversity of *Acetes* shrimp in mangrove forests in Pak Phun Subdistrict, Meung Nakhon Si Thammarat District, Nakhon Si Thammarat Province, Thailand Collecting data from 2 stations consisting of an estuary; one has flowing water and is called "station 1," and the other has no flow and is called "station 2." Both stations are located at the following coordinates:

Table 1. Location where *Acetes* shrimps were collected in Pak Phun Subdistrict, Meung Nakhon Si Thammarat District, Nakhon Si Thammarat Province

Station	Location	Latitude (N)	Longitude (E)
1	Pak Pha Ying estuary	8°35'16.5"	99°58'44.8"
2	Kao canal	8°34'01.2"	99°59'18.3"

## 2. Sample Collection

### 2.1 Collecting *Acetes* shrimp samplings

Collecting *Acetes* shrimp in still water by using a long-arm colander because *Acetes* shrimp were seen clearly in still water at a depth of about 1 meter. For flow water, using a huge shrimp hooker net at the estuary would be better because of the speed and depth of the water. Moreover, we're also collecting data from fishermen and communities near the mangrove about the *Acetes* shrimp's behaviour, habitat, and favourite environment.

### 2.2 Collecting water samplings

250 mL of water samples were taken from the surface of the water at each station by using plastic bottles. These samples were taken twice each.

## 3. Collecting data from *Acetes* shrimp

- (1) Immersing the *Acetes* shrimp samplings in formalin at the concentrate 10 per cent volume by volume.
- (2) The samples were observed and examined using a compound light microscope at a 4x magnification of objective lens.
- (3) The *Acetes* shrimps were taken a picture for observing their attributes and features.
- (4) Identifying genus of the samplings.

## 4. Testing the water quality

- (1) Using a filter cloth to filter the water samplings for removing the sediments.
- (2) Measuring the pH of the water with a universal indicator.
- (3) Measuring the salinity of the water with a RHNS-10ATC salinity refractometer.

## Result

Factors affecting population density v of *Acetes* shrimp

### 1. Water quality

As surveying fishermen in local area, the difference of water quality between two stations in mangrove forests was negligible. To prove and conclude the factors, we used salinity refractometer model RHNS-10ATC which has  $\pm 0.1$  % measurement error to measure salinity in the water samplings and universal indicator to examine the pH. The results are in accordance with the following table.

Table 1: pH of the water samplings

Sites	pH of water		
	1 <sup>st</sup> trial	2 <sup>nd</sup> trial	Avg.
Station 1	7	7	7
Station 2	7	7	7

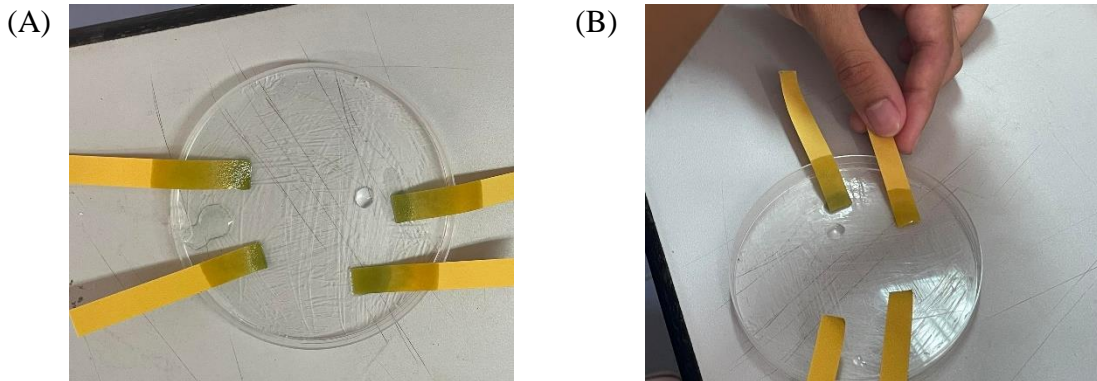


Figure 1. Water samplings pH testing with universal indicator

Table 2: salinity of the water samplings

Sites	Salinity of water (%)			
	1 <sup>st</sup> trial	2 <sup>nd</sup> trial	3 <sup>rd</sup> trial	Avg.
Station 1	0.75	0.75	0.8	0.767
Station 2	0.7	0.7	0.75	0.717

## 2. Water velocity

### 2.1 Station 1

According to the above, station 1 is an estuary before the Pak Pha Ying canal, which has a wide of canal more than 50 meters and thus has a constant flow. The flow was clearly visible and can be observed by the motion on the surface of the water.



Figure 1. the environment of station 1

### 2.2 Station 2

This station's location in a narrow canal which had a width of between 7 and 10 meters made it simpler to explore the surrounding area. As a following pictures, there wasn't any flow here.



Figure 2. the environment of station 2

## The appearance of *Acetes* shrimp

The samplings were examined and detected to be in *Acetes* genus. Normally, the genus is characterised by the loss of the fourth and fifth pairs of pereopods. They are small prawns, 1–4 centimetre (0.39–1.57 in) long, translucent, but with a pair of black eyes, and a number of red spots of pigment on the uropods.

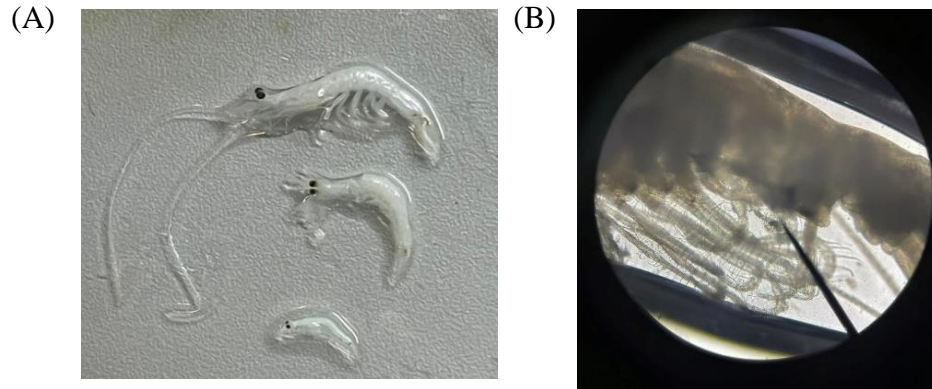


Figure 3. *Acetes* shrimp samplings (samplings in different sizes (A), picture of pereopods of the samplings were taken by a 4x magnification light compound microscope (B))

We were only able to locate members of the *Acetes* genus in the area because the distance between the two stations was too close.

### Population density of *Acetes* shrimp

*Acetes* shrimp are typically found from November to May, but due to the monsoons, they were not taken over that entire period (Daycho et al., 2021). As the *Acetes* shrimp reproduce in February, when we conducted our investigation, they were hardly visible above the water's surface. The fishermen were interviewed about the behavior of the *Acetes* shrimp at different times so we can draw a data conclusion in the following paragraph.

The *Acetes* shrimp naturally congregate in quiet water during the breeding season since the current can blow the eggs away. As a result, we discovered that station 1 had fewer shrimp than station 2, which is evident from the following table:

Table 3: The number of caught *Acetes* shrimp.

Sites	Tool	The number of <i>Acetes</i> shrimp
station 1	fishing net	4
station 2	spoon net	20

According to information gathered from fishermen, if we explore the mangrove coast after their mating season, we would find several groups of *Acetes* shrimp, even in the flowing water. So, it may be concluded that the season and current speed have a bigger impact than seawater salinity.

## Screenshot of data submission

pH	
Measured Date:	2023-02-14
Organization Name:	Princess Chulabhorn Science High School Nakhon Si Thammarat
Site ID:	306396
Site Name:	Pak Phun
Latitude:	8.586625
Longitude:	99.980137
Elevation:	2.9m
Measured At:	2023-02-14T07:15:00
Water Body pH:	7 pH units
Water Body State:	normal
pH Method:	paper

pH	
Measured Date:	2023-02-14
Organization Name:	Princess Chulabhorn Science High School Nakhon Si Thammarat
Site ID:	306397
Site Name:	Kao canal
Latitude:	8.572991
Longitude:	99.989705
Elevation:	5.7m
Measured At:	2023-02-14T07:25:00
Water Body pH:	7 pH units
Water Body State:	normal
pH Method:	paper

Figure 4. Screenshot of water pH measurement result submissions

Salinity	
Measured Date:	2023-02-14
Organization Name:	Princess Chulabhorn Science High School Nakhon Si Thammarat
Site ID:	306396
Site Name:	Pak Phun
Latitude:	8.586625
Longitude:	99.980137
Elevation:	2.9m
Measured At:	2023-02-14T07:15:00
Water Body State:	normal
Tide Longitude:	99.980137
Tide Latitude:	8.586625
Salinity via Hydrometer:	7.7 ppt
Salinity Kit Mfg:	other
Salinity Kit Model:	RHNS-10ATC

Salinity	
Measured Date:	2023-02-14
Organization Name:	Princess Chulabhorn Science High School Nakhon Si Thammarat
Site ID:	306397
Site Name:	Kao canal
Latitude:	8.572991
Longitude:	99.989705
Elevation:	5.7m
Measured At:	2023-02-14T07:25:00
Water Body State:	normal
Tide Longitude:	99.989705
Tide Latitude:	8.572991
Salinity via Hydrometer:	7.2 ppt
Salinity Kit Mfg:	other
Salinity Kit Model:	RHNS-10ATC

Figure 5. Screenshot of water salinity measurement result submissions

## Discussion

According to the survey's findings, the general properties of the water that was sampled from both sites and assessed for quality were comparable. The pH of the water from both sites was determined to be 7 using a universal indicator, indicating that they were neutral. Another factor that was included in the experiment was the salinity of the water. The water quality was measured with a salinity refractometer model RHNS-10ATC, which had an error of 0.1%. From Station 1, the salinity value was 0.77% while Station 2 was 0.72%. We know that the salinity value in Station 2 was lower than Station 1 because the distance between the investigated area and the sea. Furthermore, the speed of the water in each station were different because Station 1 was located in an estuary which will have flowing water. But in Station 2, there was still water because of the wide and the depth of the canal.

The sampling of shrimp from both stations showed that the shrimp samples gathered from the survey were shrimp of the genus *Acetes*, which is a common genus in Nakhon Si Thammarat Province. The population densities of the *Acetes* shrimp in the two stations vary substantially, as evidenced by the quantity of *Acetes* shrimp counted in each catch. It was discovered that Station 2 was more convenient than Station 1 for locating and gathering *Acetes* shrimp samples. The volume of prawn sampling equipment at Station 2 was considerably smaller, but there were significantly more *Acetes* shrimp counted there. due to a variety of circumstances, including the stream's speed, the ecosystem supports, the water's quality, etc. Also, it was discovered that there were other aquatic species nearby when collecting *Acetes* shrimp samples from both locations. After pulled the fishing net up from water in station 1, several immature aquatic organisms were found such as jellyfish, puffer fish, sea eels and fingerlings. In station 2, we found groups of oysters were stucked at roots and mussels that attached on the log in the forest. Our observations of the environment as a whole lead us to the conclusion that aquatic animals consume *Acetes* shrimp as a source of food and use their habitats for nurseries.

According to a survey of local fishermen, the season and monsoon were shown to be significant influences on how *Acetes* shrimp behaved when choosing a habitat, in addition to characteristics relating to water and the ecosystem's social structure. *Acetes* shrimp is typically captured between November and May, starting at about 5 or 6 o'clock in the morning. However, capturing them is not possible year-round since the wind and the flow of water will occasionally push them out to sea. (Daycho et al., 2021)

## Conclusion

The experimental and survey results show that natural factors affect the habitat selection behavior of the *Acetes* shrimp. It was found that the differences in salinity of only a thousandth had almost no effect on the population density of the *Acetes* shrimp. The monsoon season and the current's speed are the variables that have the biggest effects. From November through May, when shrimp can be easily discovered on the water's surface until there is almost no difference in the water, fisherman will typically go out looking for shrimp in the morning starting at 5 or 6 a.m. The *Acetes* shrimp can be caught in every part of the mangrove forest. There will be a clear variation in the density of the *Acetes* shrimp populations if it occurs at different times, such as midday during the breeding season. The study discovered that *Acetes* shrimp can be easily spotted in locations with still water and other marine life, such as shellfish or small fish that were found in Station 2.



Because the mangrove forest is similar to the above, it is an area that should be preserved and under surveillance, so it is not destroyed or too disturbed because it is not only a breeding and residential area of shrimp. It is also a nursery for aquatic animals as well as a food source for many aquatic animals.

They are crucial for fishing as well. because humans and many other animals depend on their larvae when they mature into adults. Mangrove forests are another aquatic environment that is home to many zooplankton species. It is recognized as a foraging-friendly habitat. The spawning area is marked by growth. provides a breeding ground for a variety of aquatic animals, including juvenile fish that have economic value. (Angsupanich, 1994: 78-91)

## Reference

- Arvai, J.L., Leving, C.D., Harrison, P.J. and Neill, W.E. 2002. Improvement of the sediment ecosystem following diversion of an intertidal sewage outfall at the Fraser river estuary, Canada, with emphasis on *Corophium salmonis* (Amphipoda), Mar. Pollut. Bull., 44 : 511-519.
- Dalpadado, P., Borkner, N., Bogstad, B. and Mehl, S. 2001. Distribution of *Themisto* (Amphipod) spp. in the Barents Sea and predator-prey interactions. ICES J. Mar. Sci., 58 : 876-895.
- De Broyer, C., Chapelle G., Duchesne P.-A., R. Munn, F. Nyssen, Y. Scailteur, F. Van Roozendael & P. Dauby, 2003. Structural and ecofunctional biodiversity of the amphipod crustacean benthic taxocoenoses in the Southern Ocean. In : Scientific Support Plan for a Sustainable Development Policy SPSD 1: Belgian Scientific Research Programme on the Antarctic, Phase 4 (1997-2001). Scientific Results Vol. 1: Marine biota and Global Change, pp. 1-58.
- Kaestner, A. 1970. Invertebrate Zoology Vol. 3 Crustacea, Interscience Publishers, New York.
- MacNeil, C., Elwood, R.W. and Dick, J.T.A. 2001. Persistence times of four amphipod species in the stomachs of brown trout. J. Fish Biol., 159 : 1401-1404.
- Daycho K, . (2021). Privatization Of Shrimp Paste to Promote Community Economy A Case Study of Ban Phang Pling Moo 1 Klay Sub-district Tha Sala District Nakhon Si Thammarat Province Thailand. Journal Of MCU Phetchaburi Review, Vol.4 No.2 : 54 – 68.
- Datsri, U. (2012). Species Composition, Habitat Uses of *Acetes* Shrimps at Talet Yai Bay, Nakhon Si Thammarat and The Influence of Predator (*Secutor insidiator*) on Habitat Selection of *Acetes japonicus*. Master' s thesis, Science Program, Walailak University.
- Nongnud T, Alongkorn P, Kritsanai C, and Karnjana H. (2019). Species of *Acetes* Shrimps (Decapoda : Sergestidae) along the Coast of Rayong Province. Burapha University Journal, Vol.24 No.2 : 568 – 580.

## **Optional Badges**

### **1. I make an impact**

Mangrove forest is one of important ecosystems in the world. It's not only being a natural seawall which keep decreasing the coastal erosion rate but also being an aquatic creature habitat and breeding source. Research and knowledge of them, *Acetes* shrimp, an indicator of ecosystem abundance, will help everyone to conserve and assign food resources area and biodiversity area. This will be part of leading to retrieve mangrove areas in the future.

### **2. I am a data scientist**

We considered and selected the scientific tools that suit for sampling collection and examination. Moreover, we have analyzed our data in conjunction with the information that we have got from fishermen who were interviewed by us. In addition, we defined the problems and found the solutions with our data which we got from the experiments. Also, we tried to fine more information from another research reports to prove our hypothesis. Therefore, every data which was assigned in this report is sensible and reliable.

### **3. I am a stem storyteller**

Our presentation has quite lots of animation because we try to decrease the number of alphabets in unnecessary part for making our presentation looks more interesting. Also, it would be easier for audiences to understand the point and the conclusion of this research.