

The study of salinity, water temperature and soil quality on diversity of fiddler crabs in mangrove saline hot springs, Hat Chao Mai National Park, Trang Province

Students: Hataiphath Kanjanasrimek and Nattagritha Lunda

School: Princess Chulabhorn Science High School Trang, Thailand

Teachers: Mrs. Patchara Pongmanawut and Miss. Neungruethai Chaimanee

Email: ppatt1994@hotmail.com

10 March 2022

Abstract

This research aims to study the salinity, water temperature and soil quality in mangrove forests near saline hot springs on the diversity of fiddler crab. The study site was the area around the saline hot springs in Hatachamai National Park, Trang Province. Data were collected into 6 routes around the hot springs every 1 meter for 15-19 meters. The results showed that the salinity of the water at all distances from the hot springs was not different. The temperature of the water decreases with the distance from the hot springs. There are two types of soil structure, which are massive and granular. Soil adhesion and soil texture are mostly clay loam with different soil minerals. Water salinity did not affect the diversity and density of the fiddler crab, but temperature, pH and soil minerals influenced the density and diversity of the fiddler crab. Mangrove forest routes at a distance 2-7 meters and uncovered ground routes at 8-16 meters from the hot springs, the soil has the same temperature and the most minerals. There are five species of fiddler crab, which is the region with the greatest diversity and density of fiddler crab. It was concluded that the distance from the spring influenced the density of the sword claw crab.

Keywords: Saline, hot springs, fiddler crab, soil quality

Introduction

Fiddler crabs are crabs in the *Uca* Ocypodinae family. Their dominant features are the eye stem and the cylinder of long eye grooves. Male fiddler crabs have one large claw, used for fighting, courtship and dig holes and small claws are used for store food. Female fiddler crabs have small claws on both claws, helping to consumed food. In addition, most fiddler crabs have flashy, eye-catching colors, including red and orange. Most fiddler crabs live in hot and warm weather areas. Along the entire length of the bay, is the path of the river which leaving the mangroves and muddy. At high tide, it is embedded, lurking in the hole. The water recedes when it comes out of their burrow. The fiddler crab foraged not too far from its holes because it must keep moisture in its body, so it periodically runs down the hole to obtain moisture and itself from losing water. Fiddler crabs live in mangroves plays an important role in transforming gross yield into organic matter. Fiddler crabs feed on dead humus and animals. This causes larger organic matter which make smaller changes that are suitable for microbial use. Resulting in the transfer of nutrients back into mangrove ecosystems and marine systems, which other organisms can exploit.

Saline Hot Springs is characterized by a pond that has sprung from the basement naturally. The cause of the salty taste is due to the combination of hot and seawater at deep levels before polling off the ground. Saline hot spring is classified in Salt Hot Springs. The area around saline hot springs or salt hot springs is a natural mangrove. There are saline hot springs scattered around the area, where the salty hot springs are located at the temperature of the water in the pond is appropriate as about 40-49 degrees Celsius.

Mangrove forest in Hat Chao Mai National Park, Trang province is an area of interest because of the area of the saline hot springs and many species of fiddler crabs that have been found, and there are also different densities of fiddler crabs in different distances of the area. As a result of this differences, we are interested in studying the effects of saline hot springs near mangroves at Hat Chao Mai National Park, Trang province on soil quality and diversity of fiddler crabs.

Research Questions

1. Is there any difference between salinity, water temperature and soil quality at different distances from the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province?

2. Does the salinity, water temperature and soil quality in the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province affect the diversity and density of fiddler crabs?

Research hypothesis

1. The salinity, water temperature and soil quality at different distances from the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province were different.

2. The salinity, water temperature and soil quality in the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province, affect the diversity and density of the fiddler crab.

Materials and methods of research

1. Materials and Equipment

- | | |
|-------------------------|-------------------------------|
| 1) Soil color book | 2) Tape measure |
| 3) Plastic rope | 4) Flag |
| 5) Quadrant | 6) Globe Observer Application |
| 7) Thermometer | 8) pH meter |
| 9) Centrifuge | 10) Vernier calipers |
| 11) Soil classification | 12) Digital soil meter |
| 13) Salinity meter | 14) NPK soil tester |

2. Research methodology

2.1 Determining the scope of study site

This research was conducted at the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province. GPS location is latitude 7.55448 °N , longitude 99.31171 ° E, as shown in Figure 1. The researchers collected data (water temperature, water salinity, soil pH, soil temperature, soil structure, soil nutrient, diversity of fiddler crabs) between November 2021 to March 2022.

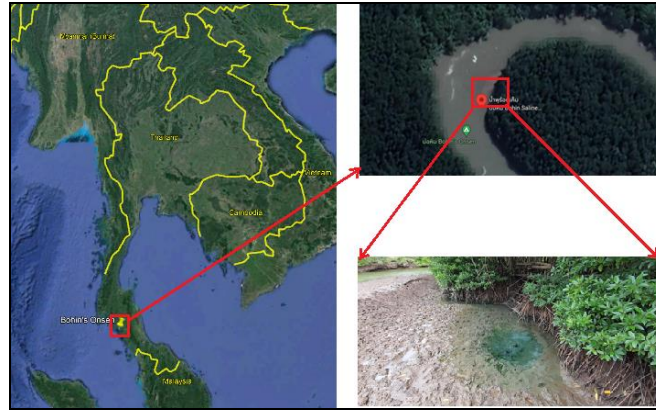


Figure 1 Study area of the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province.

2.2 Data collection methods

Water quality data collection

Water quality was measured according to the GLOBE method by measuring the water temperature and water salinity in the following order :

1) Determine the measurement point by using a waterway that connects the saline hot springs to the canals by measuring every 1 meter away from the edge of the saline hot springs as shown in picture 2.



Figure 2 Waterway that connects the saline hot springs to the canals

2) Measure the water temperature by immersing the thermometer in 10 cm of water for 3 minutes. Read the temperature value on the thermometer at eye level, collect data 3 times.

3) Measure the water salinity by using the Salinity meter collect data 3 times.

4) Record the data and average the data.

5) Send the data to GLOBE Data Entry

Soil quality data collection

Water quality was measured according to the GLOBE method by measuring the soil pH, soil temperature, soil structure, soil nutrient in the following order :

- 1) Determine the measurement point by dividing the educational route into 6 routes, 15-19 study points each, starting at the edge of the saline hot springs and dragging the educational route to the canal. Each route is 60 degrees apart, and sampling points are set every 1 meter in each route, a total of 97 points, as shown in Figure 3.

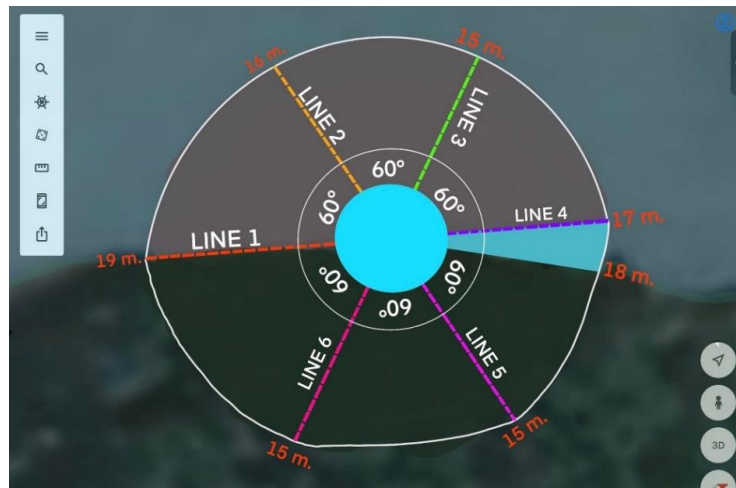


Figure 3 The educational route and the study point at the mangrove saline hot springs, Hat Chao Mai National Park, Trang Province.

- 2) Measure the soil temperature by immersing the thermometer in 10 cm of soil for 3 minutes. Read the temperature value on the thermometer at eye level, collect data 3 times.
- 3) Collect soil samples at every sampling point to study soil properties according to various indices in the laboratory, pH, Nitrogen value, Phosphorus value, and Potassium value were measured. Soil pH was measured using a pH meter and N, P and K values were measured using the NPK soil tester.
- 4) Record the data and average the data.
- 5) Send the data to GLOBE Data Entry

Fiddler crabs data collection

- 1) Determine the measurement point by dividing the educational route into 6 routes as shown in Figure 3

2) Use a quadrant of size 50 X 50 cm, placed every 1 meter distance in every route, quietly observing. Then collect data, number of fiddler crabs, species of fiddler crabs and record the data in the table.

2.3. Data analysis

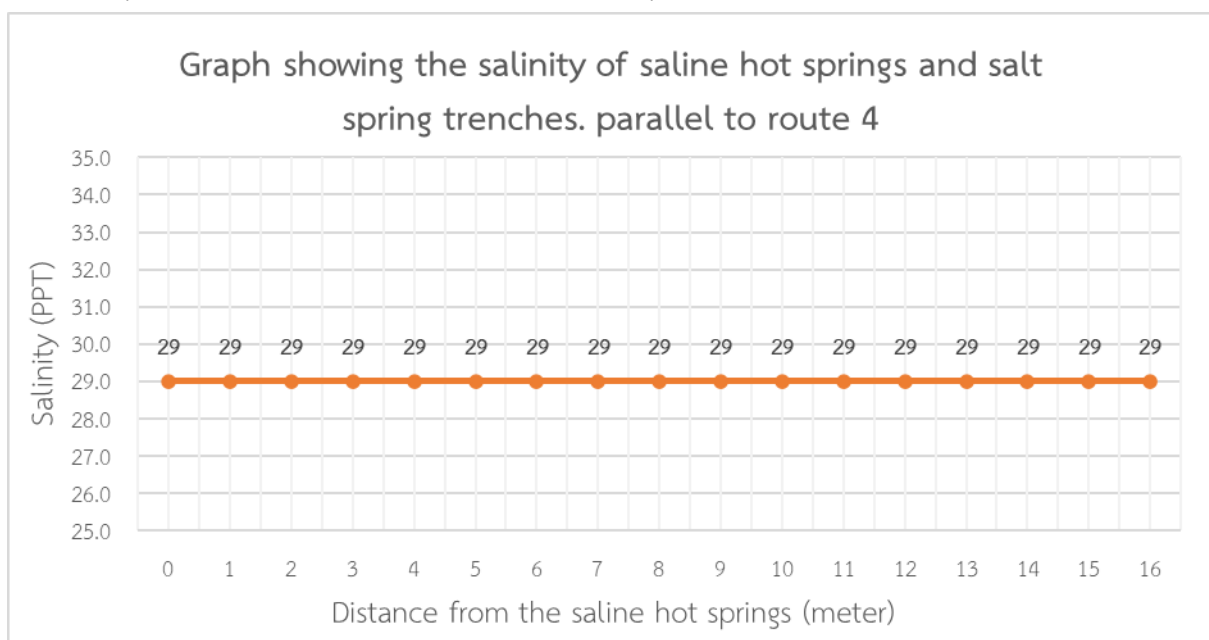
1) Compare the water salinity, water temperature and soil quality at the different routes and different points from the edge of the saline hot springs by using One way ANOVA

Results

The results of the study of salinity, water temperature and soil quality on diversity of fiddler crabs in mangrove saline hot springs, Hat Chao Mai National Park, Trang Province in the following order :

1 The study of salinity and water temperature at different distances at the edge of the saline hot springs.

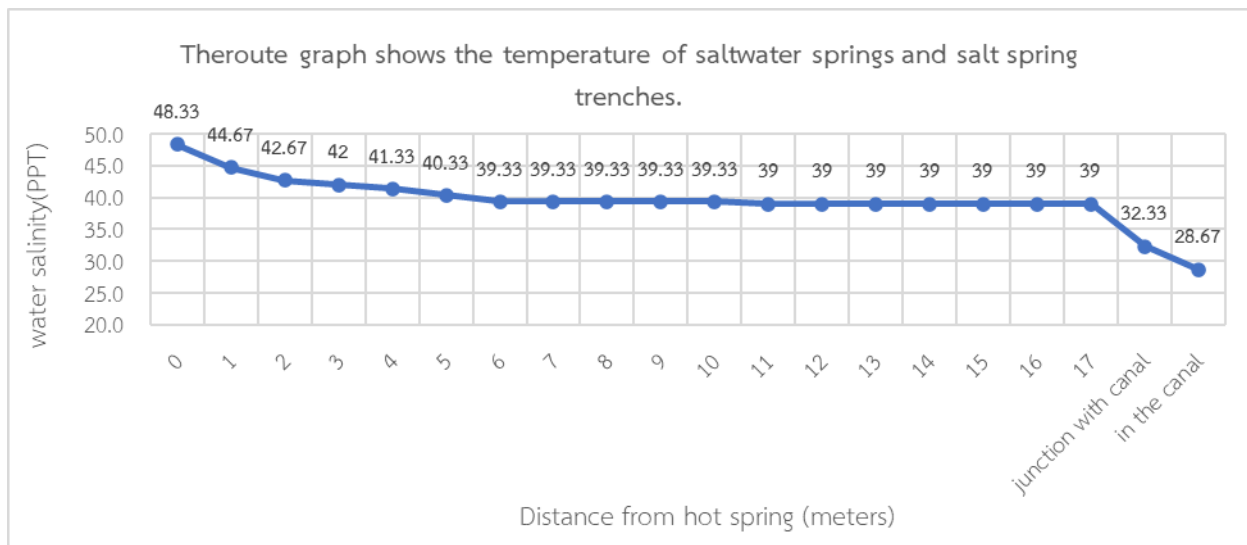
The study of salinity and water temperature at different distances at the edge of the saline hot springs to the canal was found that the salinity of the water at all distances from the hot springs was not different. As shown in Graph 1.



Graph 1 The water salinity and the distance from the saline hot springs.

The study of water temperature at different distances from the edge of the saline hot springs to the canal found that The temperature of the water from the edge of the saline hot springs will gradually decrease to a distance of 10 m. the temperature stabilizes at

7 m. Then decreases suddenly before it enters the canal. The lowest value in the canal at 28.67 ° C, which is the normal temperature of the water in the canal. As shown in Graph 2.



Graph 2 The water temperature and the distance from the saline hot springs.

2.The study of soil structure, soil color and soil texture.

From the study, it was found that route 1, The soil structure is astringent, the soil colors are Light olive Gray, olive Gray and Gray. The soil adhesion is firm and the soil texture is mostly silty loam. As for the route 2-4, which is a sandy route. The soil structure is astringent and the soil color is olive Gray, olive Gray at a distance of 1-4 m and the nodular soil structure. Within a distance of 5-14 meters, the soil color is Brown and Light Brown. The distance from 14 meters to the edge of the canal The soil structure is astringent texture, the soil color is Gray, while route 5-6 the soil color is Brown and Light Brown along the way.

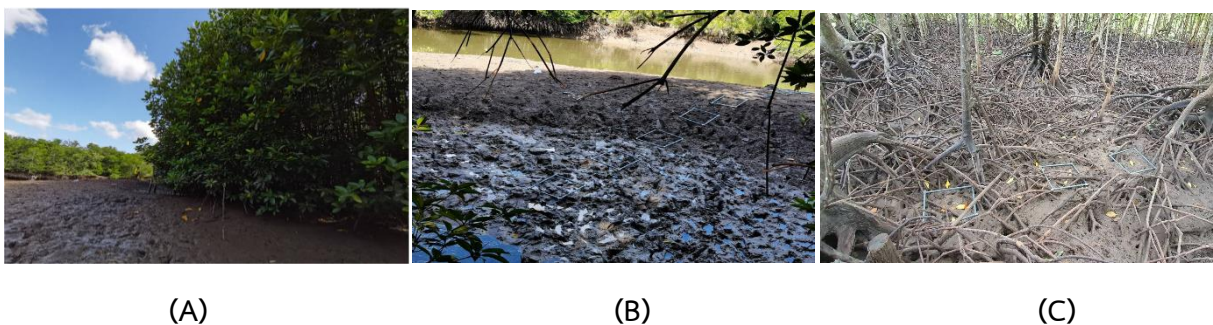
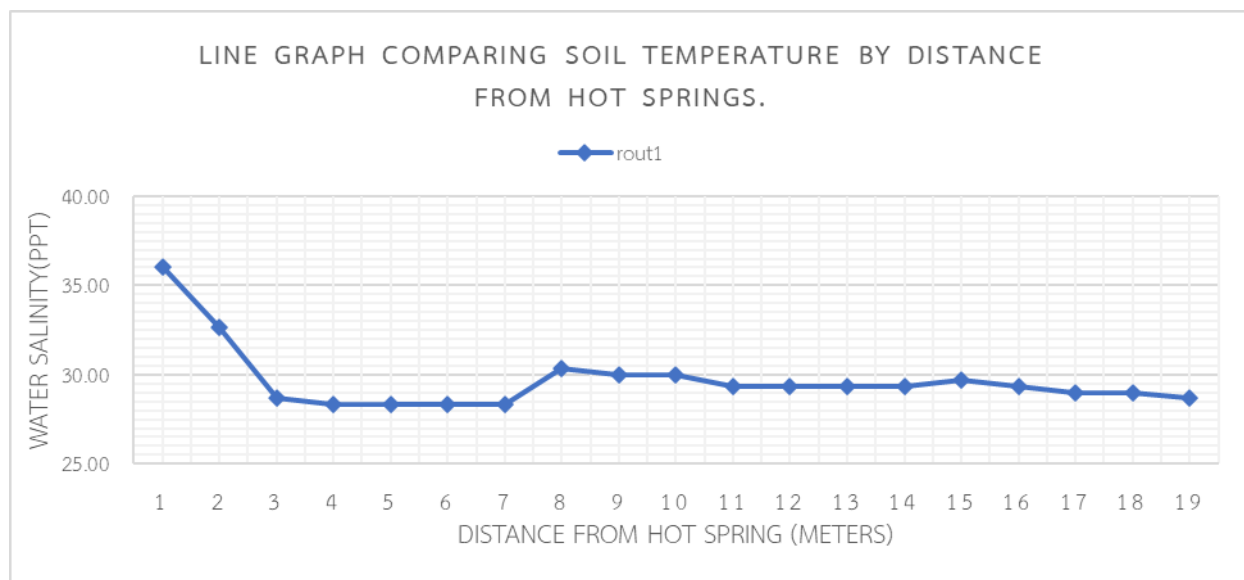


Figure 3 (A)route 1 (B)route 2-4 (C)route 5-6

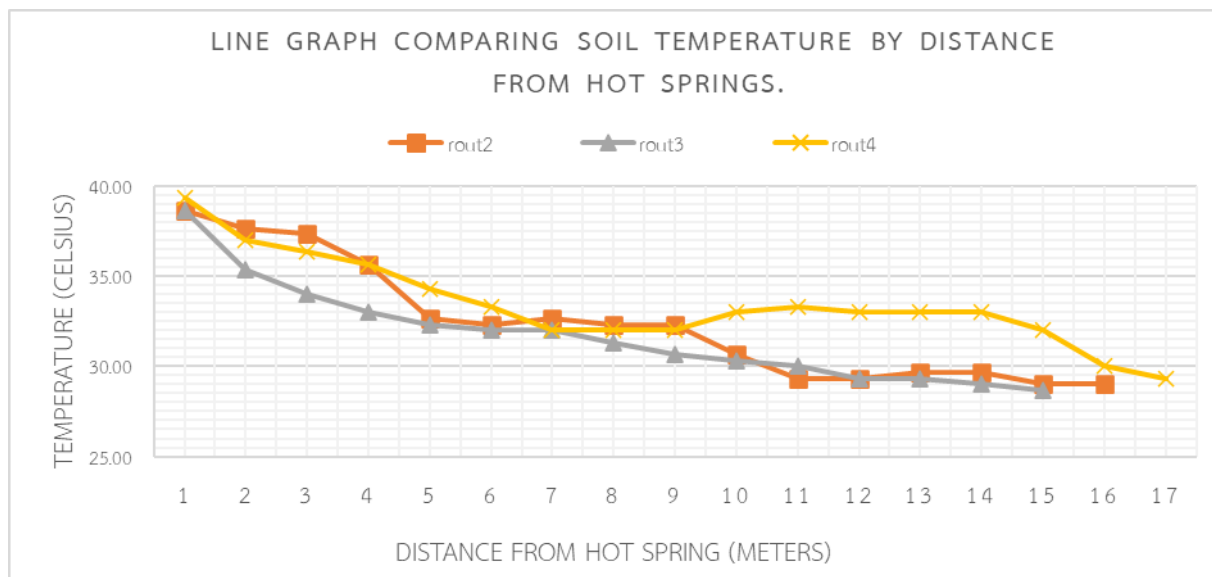
3. The study of soil temperature at different distances at the edge of the saline hot springs.

The study of soil temperature at a distance of every 1 m. from the edge of the saline hot springs in 6 routes, divided into 3 subgroups according to area characteristics, found that in group A (route 1), the soil temperature was reduced in first 3 m. The first meter from the edge of the saline hot springs is relatively stable until 19 meters, which is the end of the canal. From the study of the relationship between temperature and distance from saline hot springs, Route 1 showed a low negative correlation in the mangrove forest area. as in the Graph 3



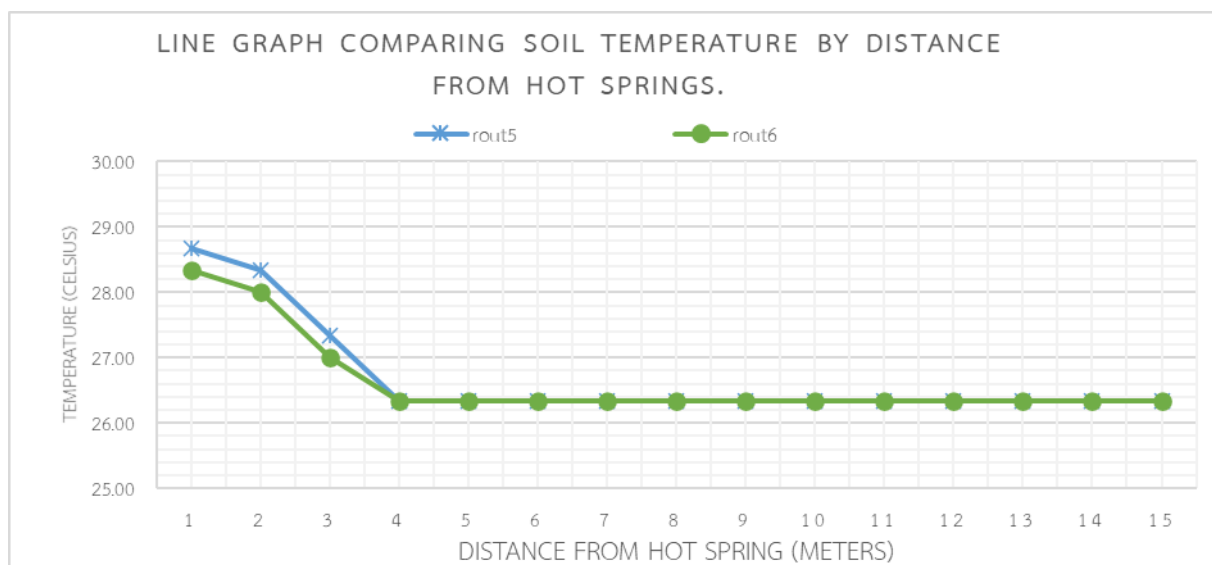
Graph 3 shows the temperature of the soil. route 1 (Mangrove route)

For group B, routes 2 , 3 and 4 (sand sedimentary line), it was found that the temperature and distance from the saline hot springs There was a significantly higher negative correlation at the .01 level, i.e. as the distance increased, the temperature dropped to a high level. as in the Graph 4



Graph 4 shows the temperature of the soil. Route 2-4

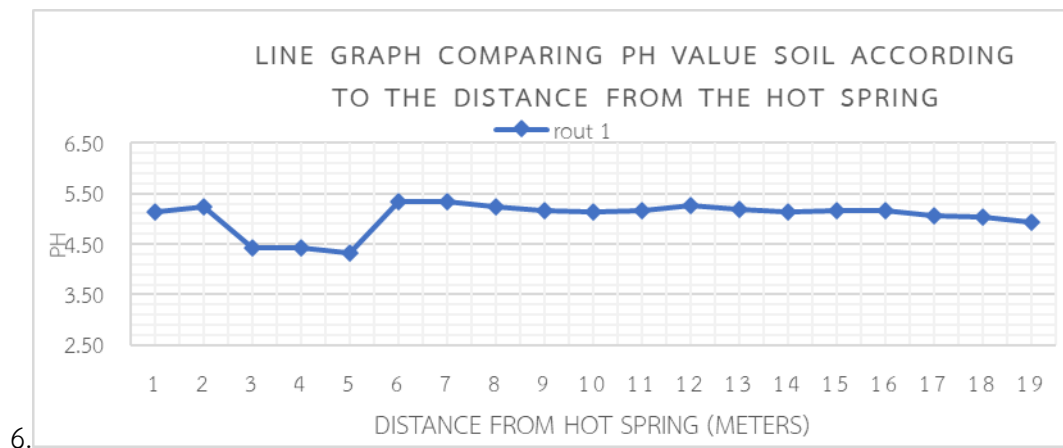
Group C, Route 5-6, mangroves, found that the soil temperature was reduced during the first 4 meters from the mouth of the hot springs and the temperature remained stable until 15 meters at the end of the ground adjacent to the canal. as in the Graph 5



Graph 5 shows the temperature of the soil. Route 5-6 (Mangrove Forest)

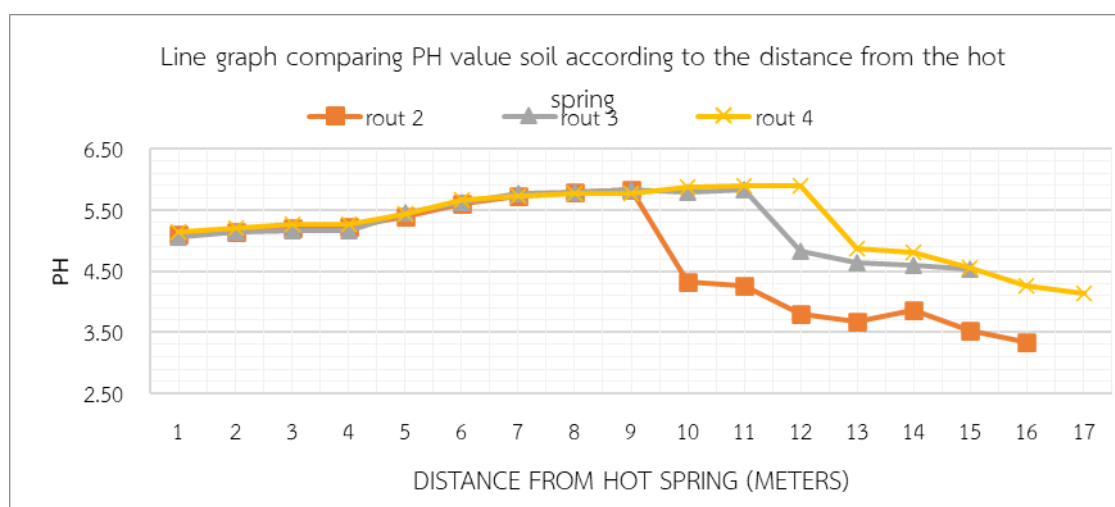
4. The study of soil pH at different distances from the edge of saline hot springs.

Soil pH and distance from saline hot springs in Route 1, mangrove line, soil pH near the hot springs the pH is high, with an average of 5.17, then the pH decreases at a distance of 3-5 m from the spring, with a pH less than 5 and an increase in soil pH. Relatively stable from a distance of 6 meters to the canal, an average of 5.17 as shown in the Graph



Graph 6 shows the pH of the soil. Path 1 (Mangrove Line)

The pH of the soil and the distance from the saline hot springs Route 2-4, which is a sandy line. The pH of the soil gradually increases in the 1-9 meters. In the second line, the pH decreases gradually over a distance of less than 3.5 upon reaching the canal. In route 3 and 4, the pH gradually increases, and Decreased at distances of 11 m and 12 m respectively, the lowest values when reaching the canal were pH 4.5 and 4, respectively, as shown in Graph 7.

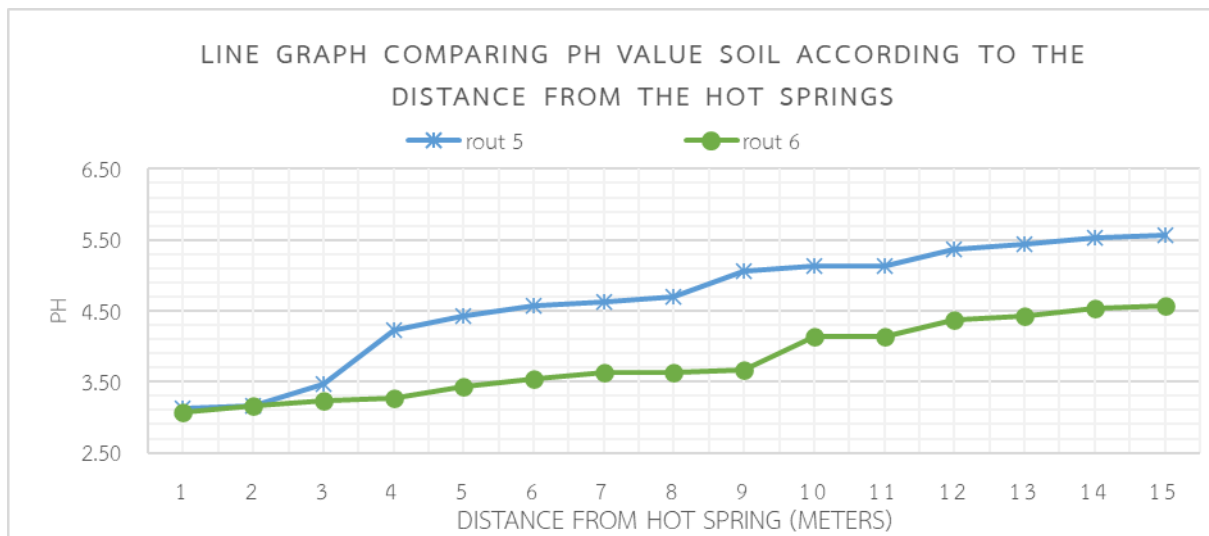


Graph 7 shows pH. Base of soil Paths 2-4 (Sand sedimentary line)

Soil pH and distance from saline hot springs Route 5-6, which is a mangrove line. The pH of the soil is highest in the same way. Soil acidity: within a distance of 1-4 meters from a saline

hot spring, there is a high acidity of 3.07-3.27, which is a flooded area that affects the acidity. It's the way to end in the beach forest, causing the pH to rise. as in the Graph

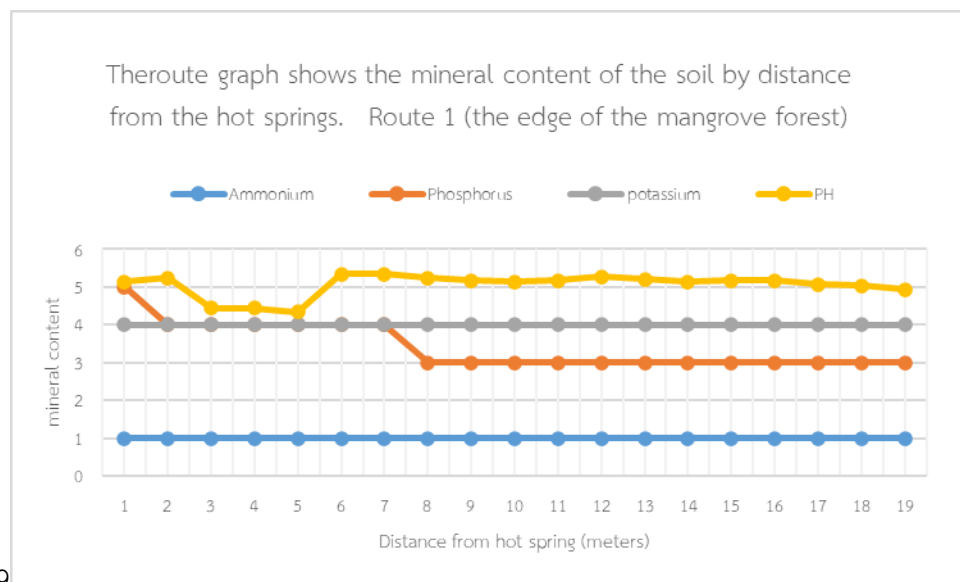
8



Graph 8 shows the pH of soil Path 5-6 (Mangrove Forest)

5. The study of soil mineral content and soil pH.

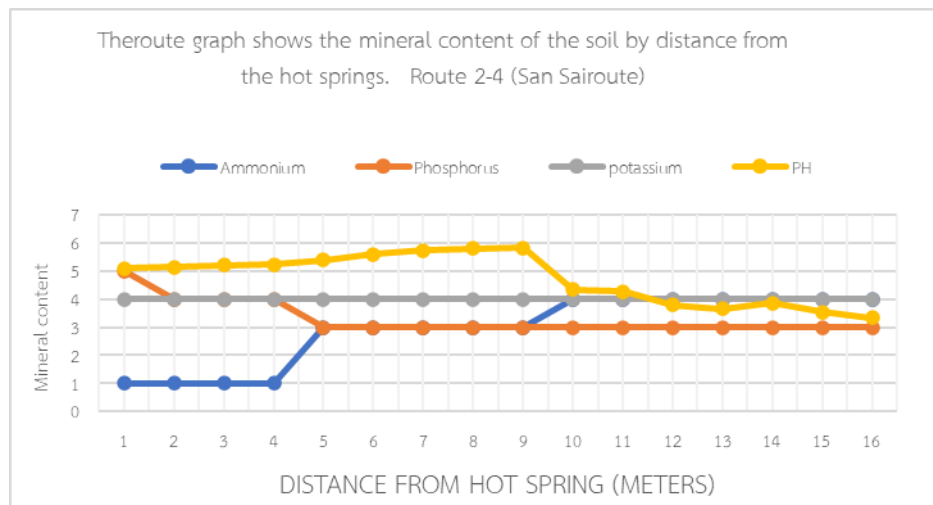
From the study of the relationship between soil mineral content and soil acidity of route 1, there was a similar trend in the graph. There is a constant average over a distance of 8 meters from the spring which is a muddy area. as in the Graph



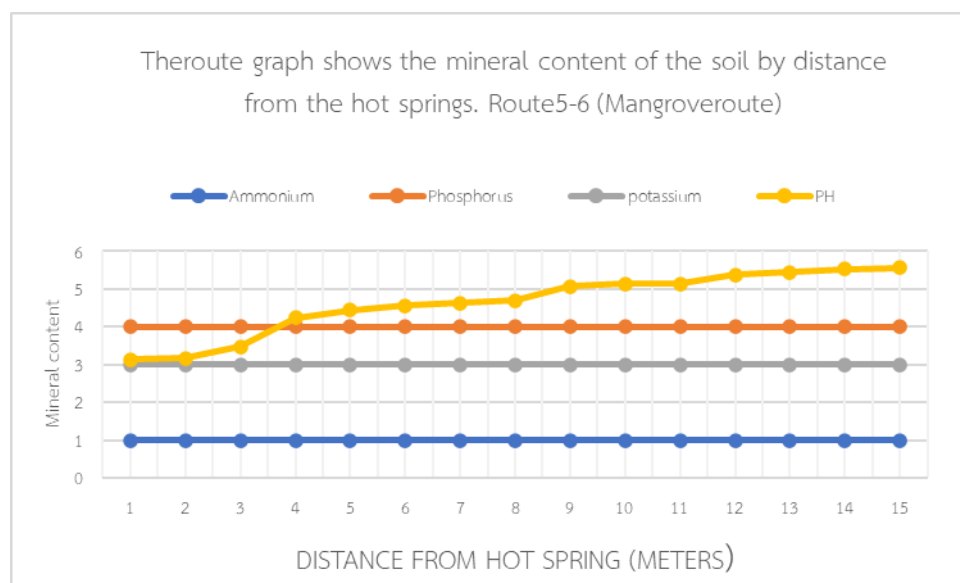
9

Graph 9 shows the relationship of mineral content in the soil to the acidity of the soil base.

From the study of the relationship between soil mineral content and soil pH of routes 2-4, there was a trend in the same graph. There was an increase in the average ammonia. higher acidity as in the Graph 10



Graph 10 shows the relationship of mineral content in the soil to the pH of the soil.
Route 2-4.



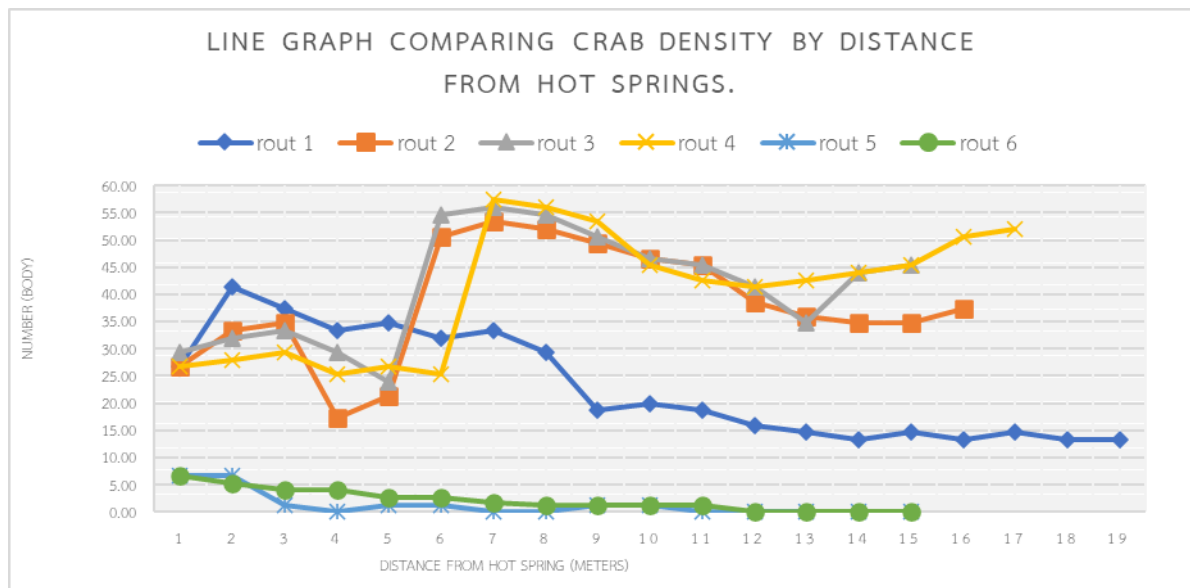
Graph 11 shows the relationship of mineral content in the soil to the pH of the soil .
Route 5-6 Mangrove Forest

6. Results of a study of the diversity of fiddler crabs

Types of fiddler crabs

<i>Austruca annulipes</i>		
<i>Uca tetragonon</i>		
<i>Uca Urvillei</i>		
<i>Uca Rosea</i>		
<i>Uca Bengalai</i>		

From the table, it is found that the distance from the fountain influences the density of the crab. Significantly, the equation for predicting crab density is $y = -0.435x + 5.633$.



Graph 12 shows the relationship between the path from hot springs to crab density.

Summary and discussion of the findings

Summary of findings

Part 1: Salinity, water temperature and soil quality Saline Hot Springs Area Mangrove Forest, Hat Chao Mai National Park Does Sikao District, Trang Province affect soil quality and fiddler crab diversity?

Summary and discussion of the results

Soil structure, soil color Clay and soil fastening Studies have shown that path T1 Mangrove Forest Astringent soil structure The clay color is light olive gray, olive gray and gray, the clay fastening is tight, and the soil texture is mainly loamy, sticky, powdery. Tight clay fastening in Paths 2-4, which are sandy. The soil structure is astringent and the soil color is olive gray at a distance of 1-4 meters, and the clay structure is nodular at 5-14 meters, the soil color is brown and light brown, while the distance from 14 meters to the canal and the soil structure is astringent. The soil color is gray in paths 5-6 which is a mangrove forest route and the color are brown and light brown along the route.

Does salinity and water temperature affect the diversity of fiddler crabs?

A study of salinity in hot springs and trenches flowing from hot springs into the pit of the canal showed that the salinity values in the hot spring area from the table showed that the

distance from the fountain significantly influenced salinity at .01, with the equation for salinity forecasting being $y = 0.30x + 28.828$, and the distance from the fountain significantly influenced water temperature.

Soil temperature

The study was based on the relationship between soil temperature and distance from saline hot springs. The paths from the study can be grouped into three groups: path 1 is a mangrove area. The distance from saline hot springs to soil temperature is in negative correlation low levels as when the distance increases, the soil temperature decreases to a low level.

Group 2: Path 2, 3 and 4, sand sediments At .01, when the distance increases, the temperature decreases at a high level. The second study path containing an equation for soil temperature forecasting: $y = -0.648x + 37$, path 3 is $y = -0.563x + 36.238$, and path 4 is $y = -0.419x + 37.222$, group 3 paths 5-6, mangrove route has significantly moderate negative correlation at .01 level.

pH in soil

Based on studies of relationships between

Acidity, base of soil and distance from saline hot springs. The paths from the study can be grouped into 3 groups: Soil acidity values in close proximity to hot springs, the acidity value is high, with an average of 5.17, and then the acidity value gradually decreases with the distance from the saline fountain from 2-8 meters. The average ranges from 5.23-5.33, which may be the result of a mangrove streak. At a distance of 9-12 meters, the acidity value will increase. The average is 5.17, and the acidity is highest at the canal man area 4.93, group 2 is paths 2-4, which is sandy. The acidity base value of the soil is the same: the acidity of the soil. Within 1-4 meters of saline hot springs, there is a high acidity of 5.10-5.23 at a distance of 5-14 meters, which is a sandbar area, the acidity value decreases by an average of 5.40-5.87 after a distance of 14 meters from the saline hot spring to the canal man. The acidity increases by an average of 5.07-5.1, the third basin is Path 3, which is a mangrove forest route. The acidity base of the soil is highest in the same way as the acidity of the soil. Within 1-4 meters of saline hot springs, there is a high acidity of 3.07-3.27, which is a flooded area, affecting acidosis. Within 5-15 meters, there is less flooding and the way to end the beach forest area, the base acidity is increasing

2 .Does the distance from saline hot spring area Mangrove Forest, Hat Chao Mai National Park Sikao District, Trang Province affect the density and diversity of fiddler crabs?

A study of the diversity of fiddler crabs in mangrove forests near saline hot springs in Chao Mai National Park, Trang Province. Fiddler crabs were found as a diverse by all sword claws. The five types are *Austruca annulipes*, *Uca tetragonon*, *Uca Urvillei*, *Uca Rosea* and *Uca Bengalai*, which each occupies have different spaces and densities. as follows

1. The characteristics of occupying the area of the fiddler crab with the highest temperature are 1 meters away from the fountain at path 1 of the mangrove forest. Path 2 and 3 sandbars within 1-4 meters Path 4, parallel to the trenches of saline hot springs within - meters and 8-14 meters, which is highest temperature area, the highest crab density is mainly found small crabs, and two types of male crabs as *Uca Urville* and *Austruca annulipes*, are not found in this area.

2 Characteristics of occupying the area of the fiddler crab at a distance of 4-6 meters from the saline hot spring. On paths 2-3 and joints with paths 1 and 4, the area is inclined, the paving balls are larger in size than the first area, two types of male crabs, *Uca Urvillei* and *Austruca annulipes*, female crabs are not found in this area.

3. Characteristics of occupying the area of the fiddler crab at a distance from the fountain, distance 6-9 meters. Path 2: Distance 6-8 meters on path 3 and 6-7 meters On path 4, which only find one type of male crab as *Austruca annulipes*.

4. The characteristics of the occupying area of the fiddler crab at the distance from the fountain, the distance from 9 meters, path 2, from 8 meters on path 3 to the canal, and the joint area on paths 1 and 4, which where the sediment and nutrients accumulate in the soil are most abundant. The largest variety of crabs, including male and female crabs, is found with a density of 50.67-37.33 crabs per meter, with five types of male crabs such as *Austruca annulipes*, *Uca tetragonon*, *Uca Urvillei*, *Uca Rosea* and *Uca Bengalai* which is seen as the most diverse and densely found fiddler crab.

5. The occupancy of the fiddler crab at the distance from the fountain, distance from 2-7 meters, path 1 along the edge of the mangrove forest, which is where the average temperature is lower than the area. Many crabs were found here. Three types of male crabs were found as *Austruca annulipes*, *Uca Urvillei* and *Uca Rosea*.

A study of the diversity of fiddler crabs in mangrove forests near saline hot springs in Chao Mai National Park, Trang Province. We totally find 5 types of crabs, with the distance from

the fountain influencing the density of the crabs. Significantly, at .01, the equation for predicting crab density is $y = -0.435x + 5.633$.

Acknowledgements

The study of salinity, water temperature and soil quality on diversity of fiddler crabs in mangrove saline hot springs, Hat Chao Mai National Park, Trang Province has been successfully accomplished with the help and assistance of many parties. We would like to thank. Assoc. Prof. Mullica Jaroensutasinee, a scientist who advises on data collection, suggests the ways to improve the various deficiencies. Dr. Suwanee Uengvarakorn. Director of Princess Chulabhorn Science High School Trang who approved the budget for material procurement. Thank Mrs. Patchara Pongmanawut and Miss Neungruethai Chaimanee, the project advisors. who help and give advice, suggestions that are very useful in doing this research.

References

- Costa, T. and Soares-Gomes, A. (2009). Population structure and reproductive biology of *Uca rapax* (Decapoda:Ocypodidae) in a tropical coastal lagoon, southeast Brazil. *Zoologia*, 26(4),647–657.
- Dai, A. and Yang S. (1991) Crabs of the China Seas. China Ocean Press, Beijing and Springer- Verlag, Berlin
- Milne Edwards, 1837) in Klong Sikao Mangrove Forest, Trang Province. Research Journal of Rajamangala University of Technology Srivijaya,4(2), 10-22. (in Thai).
- White, 1848) and *Uca* (Deltuca) *dussumieri* spinata (H. Milne-Edwards, 1852). Master of Science Thesis, Kasetsart University, 134 pp (in Thai).
- Berlin Milne Edwards(1837). Klong Sikao Mangrove Forest, Trang Province. Research Journal of Rajamangala University of Technology Srivijaya,4(2), 10-22.
- Costa, T. and Soares-Gomes, A. (2009). Population structure and reproductive biology of *Ucarapax* (Decapoda:Ocypodidae) in a tropical coastal lagoon, southeast Brazil. *Zoologia*, 26(4),647–657.
- Chakkrit Chanchanglao.(2015). Mangrove Area Finfu Process for Sustainable Development:Collision Case Study.
- Chulalongkorn University Costa, T. and Soares-Gomes, A. (2009). Population structure and reproductive biology of *Uca rapax*(Decapoda:Ocypodidae) in a tropical coastal lagoon, southeast Brazil..*Zoologia*,26(4),647–657.

Dai, A. and Yang S. (1991) Crabs of the China Seas. China Ocean Press, Beijing and Springer-Verlag,

Ploughsri Wanthongchai and Faculty(2013).Mangrove Knowledge Guide(No.5).Bangkok

:Department of Resources Sea & Coast.

Kittima Pahurat. (1852). Some behavioral and ecological studies of two types of claw crabs

Uca (Deltuca) forcipata.

Khon Kaen University, Khon Kaen Master of Science Thesis, Kasetsart University. Seri

Banpavijit. Taxonomy of Crab Claws in Thailand.,

White (1848) and *Uca (Deltuca) dussumieri spinata* (H. Milne-Edwards, 1852). Master of

Science Thesis, Kasetsart University, 134 pp (in Thai).

Wannida Mangrove Management Resource Management Improvement of Community

Committee. In Bangpoo Subdistrict, Mueang District, Samut Prakan Province(Master of

Thesis).College of Government

International Virtual Science Symposium

Optional Badges

1. I am a Collaborator

We are Collaborator because we work in group every step in the process of collecting information, team members help collect information about soil, water and fiddler crabs as needed. And my project is clearly divided into tasks. But we help each other every time something goes wrong during work.

2. I make an Impact

Our research can use the results to provide community residents with observational **e for the benefit to conservation fiddler crabs**

3. I am a Data Scientist

We are Data Scientist because this research collects various data on saline hot springs and natural diversity of mangrove forests at Hat Chao Mai National Park, Trang Province, such as soil quality, water quality, diversity of fiddler crabs. and use the data to analyze how they affect each other.