Research Name: Study of water and soil factors affecting crab density in Khlong Plak Ben, Hat Samran, Trang

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Abstrac

This research aimed to study the environmental factors (salinity and temperature of the seawater at the surface) that affected the density of crabs in Khlong Plak Ben, Ban Khok Ok, Tambon Hat Samran, Amphoe Hat Samran, Trang Province. Samples were collected to analyze the relationship between environmental factors and the density of crabs. The results showed that the crabs had the lowest density of 24 crabs per square meter, while the crabs had the highest density of 32 crabs per square meter. The area with the highest density of crabs was found to have soil with an average pH value of 7.67 indicating high soil fertility. The soil in this area had a low salinity level, averaging 4.91 ppt, which was significantly different from the area with lower crab density. The average water temperature was 27.5±0.5°C, the dissolved oxygen level was 6.75±0.25 mg/L, the pH was 6.25±0.25, the salinity was 23.76±2.4 ppt, and the hardness was 137.5±7.5 mg/L. These conditions were in the optimum range for crab survival. It was found that changes in soil salinity significantly affected the crab density in the study area.

Keywords: Soil quality, Water quality, Mangroves

Introduction

Ecosystem and Living Organisms in the Area, Especially in Communities Dependent on Natural Resources for Livelihoods Khlong Plak Ben, Ban Khok Ok, Hat Samran Subdistrict, Hat Samran District, Trang Province, is an area with high biodiversity. The local population relies on water and soil resources for fishing and the livelihoods of aquatic animals and other living organisms. However, changes in water and soil quality may affect the survival of organisms in the ecosystem.

Crabs are invertebrates that play an important role in aquatic ecosystems, including freshwater, brackish water and saltwater habitats. The density of crabs in each area may vary depending on environmental factors suitable for their survival such as water temperature, dissolved oxygen levels, substrate type and the abundance of food. Suitable habitats support high crab population density while environmental changes such as pollution or habitat destruction may lead to a decline in crab populations Therefore studying the relationship between crab density and habitats is crucial for the conservation and sustainable management of aquatic resources.

Mangrove forests are vital ecosystems found along coastal areas and river estuaries. They play a significant role in preventing coastal erosion, absorbing carbon and serving as habitats for various species of living organisms. The soil in mangrove forests has unique characteristics often acidic or saline, depending on sea level and tidal fluctuations. The salinity of water in mangrove forests varies according to seasons and location affecting the diversity of plants and animals in the ecosystem.

Changes in soil and water quality in mangrove forests are often influenced by both natural processes and human activities. Studying the factors of water and soil affecting crab density in Khlong Plak Ben, Ban Khok Ok, Hat Samran Subdistrict, Hat Samran District, Trang Province, is essential for the conservation and restoration of this ecosystem to ensure its long-term sustainability.

Research objectives

1. To study the relationship between water quality and crab density.
2. To study the relationship between soil quality and crab density.
3. To compare soil and water properties between areas with high and low crab densities

Research questions:

1. Is there a correlation between water quality and crab density?
2. Is there a correlation between soil quality and crab density?
3. Do soil and water properties differ between areas with high and low crab densities?

Research hypotheses

1. Water properties such as pH, dissolved oxygen, salinity, and temperature affect crab survival.
2. Soil properties such as salinity, temperature, and nutrient content (N, P, K) impact crab survival.
3. Soil and water properties differ between high and low crab-density areas, with high-density areas having more favorable conditions for crabs.

Materials and equipment and research methodology

1 Thermometer
2. pH meter
3. Dissolved oxygen test kit
4. Salinity Meter
5. Water hardness test kit
6. Soil thermometer
7. Soil fertility test kit (N, P, K)
8. Soil organic matter test kit

GLOBE Measurement Methods

Soil Measurement Methods (Pedosphere)

Water Measurement Methods (Hydrosphere)

1. Research Preparation Steps

1) Identify the research topic and select the subject of study.
2) Conduct a literature review and gather relevant knowledge and theories.
3) Define the research objectives.
4) Determine sampling locations within the study area.

2. Research Implementation Steps

1) Develop an operational plan.
2) Conduct a survey of the study site.
3) Assess water quality based on GLOBE measurement methods :

1) Determine the sampling points by separating the samples based on crab density. This includes 6 locations in areas with high crab density and 6 locations in areas with low crab density, at a depth of 10-15 centimeters.

2) Determine the water sampling points in water sources where crabs inhabit during high tide, collecting water samples twice.

3) Water Temperature Measurement (Using a Thermometer)

1. Submerge the thermometer about 10 cm into the water for 3-5 minutes
2. Read the thermometer at eye level while it is still submerged.
3. Repeat the measurement after 1 minute, using a different person to read the results.
4. Record the temperature in degrees Celsius (°C), performing two measurements.

4) Dissolved Oxygen and Water Salinity Measurement

1. Rinse the sampling container three times before collecting water samples.
2. Fill the container completely and seal it. If air bubbles form, discard and collect a new sample.
3. Immediately preserve the water and conduct the test within two hours.
4. Perform the examination twice, ensuring that the average value falls within the range specified by the test kit.

5) Water Salinity Measurement (Using a Salinity Meter)

1. Collect water from all designated measurement points and pour it into the test container.
2. Submerge the Salinity Meter to measure the salinity of the water.
3. Wait for the reading to stabilize, then record the results.

6) Water Hardness Test

1. Rinse a 10 mL beaker with the water sample before analysis.
2. Pour 5 mL of the water sample into the beaker, ensuring accuracy by checking the volume markings on the side, then close the lid.3. Add 5 drops of Hardness Buffer Solution into the beaker and gently swirl to mix.
4. Add 1 drop of Calmagite Indicator Solution, then shake until the sample turns reddish-purple.

5. Use a plastic straw to draw up the EDTA H3812-0 solution to the 0.0 mark on the pipette.

6. Slowly add HI 3812-0 EDTA Solution drop by drop into the water sample while shaking the beaker to ensure thorough mixing until the solution turns blue.

7. Read the level of HI 3812-0 EDTA Solution that has decreased from the initial mark on the plastic pipette (representing the amount used).

8. Multiply the value obtained by 300 to determine the water hardness in mg/L as $CaCO_3$.

7) Measuring pH of Water Using a pH Mete

1. Prepare the pH meter, turn it on, and calibrate it using pH 7.0 buffer solution and pH 4.0 or pH 10.0

2. Rinse the electrode with distilled water to remove any residue.

3. Rinse the container with the water sample twice.

4. Pour a sufficient amount of the water sample into the container.

5. Measure the pH by immersing the electrode of the pH meter into the prepared soil solution.

6. Wait approximately 30-60 seconds until the reading stabilizes.

7. Read and record the pH value displayed on the meter screen.

8) Measuring Soil Temperature

1. Calibrate the thermometer to ensure accurate readings.

2. Determine the specific points where the soil temperature will be measured.

3. Use a soil probe to create a guide hole.

4. Insert the soil thermometer into the pre-made hole.

5. Wait 2 minutes, then record the first temperature reading. Repeat the measurement twice and log the results.

9) Measuring Soil pH Using a pH Meter

1. Use a soil probe to create a hole 14 cm deep, ensuring multiple measurement points within the area.

2. Insert the pH meter into the hole made by the soil probe.

10) Measuring Soil N-P-K Levels

1. Collect 20 grams of dried and sieved soil.

2. Perform the test using an N-P-K soil test kit to assess soil fertility.

11) Measuring Soil Organic Matter Content

1. Place one spoonful of sieved soil into a reaction bottle.

2. Add one vial of testing reagent (potassium permanganate solution).

3. Shake the mixture for about 5 minutes to allow the reaction to occur.

4. Add 30 mL of water.

5. Shake the mixture again and let it settle for 5-10 minutes until the soil sediment forms at the bottom.

6. Compare the color of the solution with the color chart, which indicates the level of soil organic matter from very low to moderately high.

12) Record the results and document the findings in a graph.

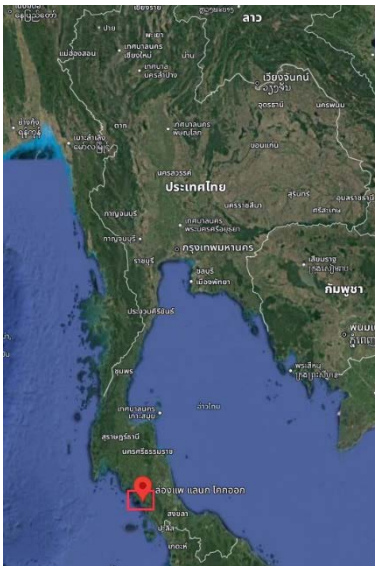
13) Submit the data to GLOBE Data Entry

Submit the data to GLOBE Data Entry.

The study area was determined by systematic soil sampling and stratified by crab density. The study was conducted at Ban Khok Ok, Village No. 8 Hat Samran Subdistrict, Hat Samran District, Trang Province, Thailand, and divided into high-density areas 6 sites and low-density areas 6 sites. The geographic coordinates of the study area are shown in Table 1 below

Table 1 Geographic Coordinates

Area	Geographic Coordinates	
	Latitude (N)	Longitude (E)
High-density area	7.2206°N	99.5961°E
Low-density area	7.2203°N	99.5964°E



3 . Experimental Results

3.1 Crab Density in High-Density and Low-Density Areas

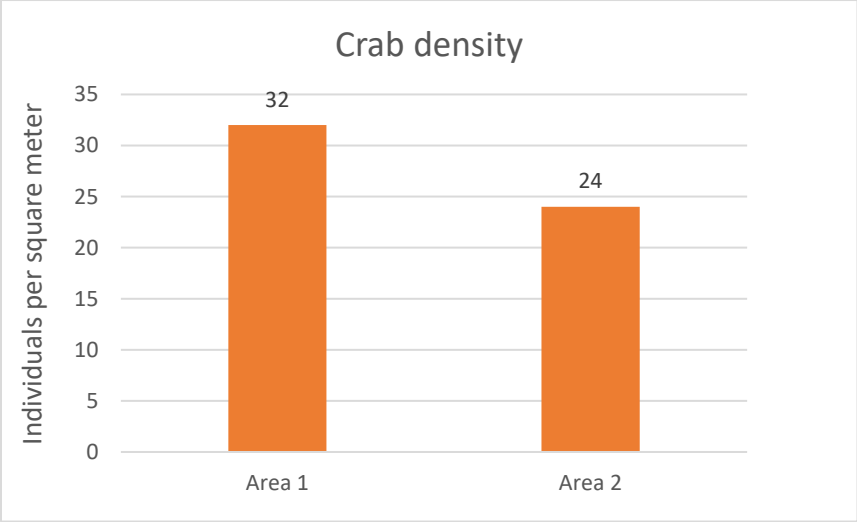


Chart 1 shows the crab population density

The study found that Area 1 had a crab density of 32 crabs per square meter, while Area 2 had 24 crabs per square meter. Therefore, Area 1 was classified as a high-density area, whereas Area 2 was classified as a low-density area.

3.2 Soil Study Results in High-Density and Low-Density Crab Areas

Table 2 shows the results of the soil quality study

Property / Area		Area with a high density of crabs	Area with a low density of crabs	The obtained value (average)
Temperature (°C)		28.17	26.54	27.36
pH value		7.67	7.32	7.45
Organic matter content in soil		≥ 3.5	≥ 3.5	≥ 3.5
Salinity (ppt)		4.91	5.83	5.37
Organic matter content in soil N P K (mg/L)	N	280.92	206.34	243.63
	P	236.64	174.35	205.49
	K	769.70	528.75	676.2

The study found that:

1. Soil temperature in the area with high crab density was 28.17°C, which was higher than the area with low crab density, to be 26.54°C.
2. pH in the area with high crab density was 7.67, which was higher than the area with low crab density, to be 7.32.
3. The amount of organic matter in both areas was similar with a value of ≥ 3.5.
4. Soil salinity was 4.91 ppt which was lower than the area with low crab density to be 5.83 ppt.
5. The amount of primary nutrients (N, P, K) was higher in the area with high crab density, with increased levels of nitrogen (N), phosphorus (P) and potassium (K) compared to the area with low crab density.

- Soil temperature study results

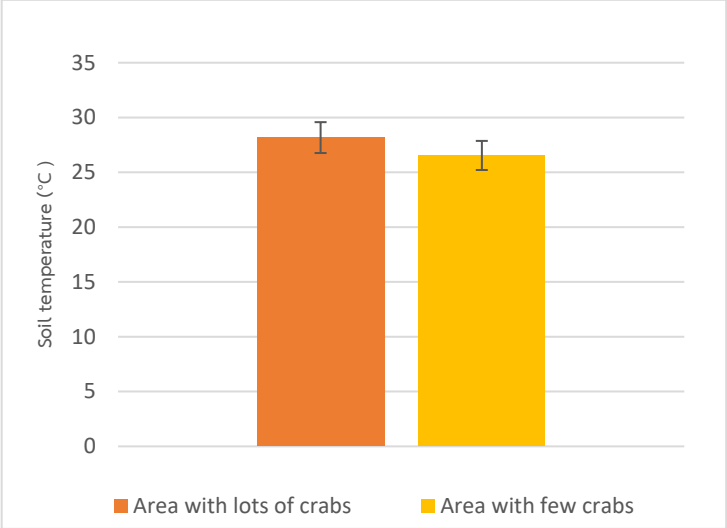


Chart 2 shows the soil temperature

Based on the study, on average, areas with a high crab density have an average temperature of approximately 28.17°C, which is higher than areas with a low crab density, where the average temperature is around 26.54°C. The temperature difference of these two areas is approximately 1.63°C

- Study Results on Essential Soil Nutrients (NPK)

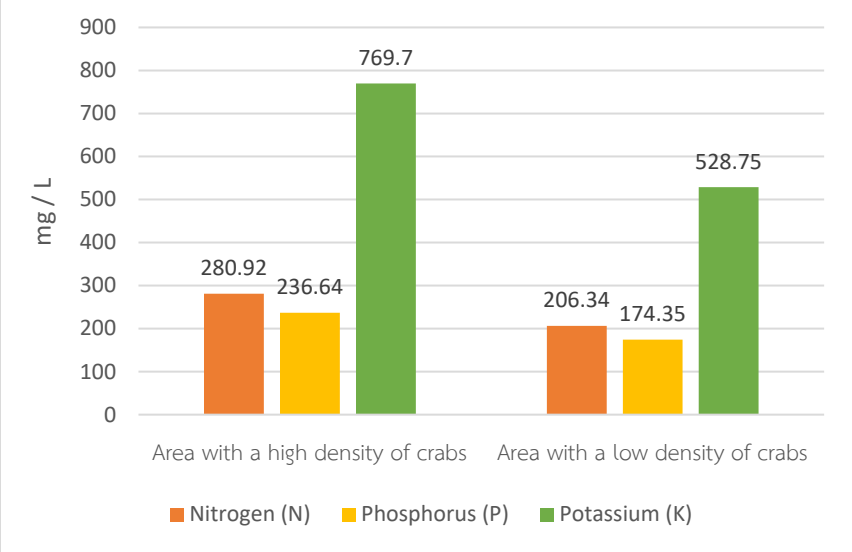


Chart 3 presents the study results on the essential soil nutrients (N P K).

The study found that the concentration of essential nutrients in soil was higher in areas with high crab density than in areas with low crab density for all three components—nitrogen, phosphorus, and potassium. This suggests that areas with a high crab density may have more fertile soil, which is more conducive to plant growth than areas with a low crab density.

3.3 Study Results on Water Quality in Crab Habitats During High Tide

Table 3 presents the properties of water in crab habitats.

Properties	Average Value (± Standard Deviation)
Water Temperature (℃)	27.5 ±0.5
Dissolved Oxygen (mg Oxygen/L)	6.75 ±0.25
pH Level	6.25 ±0.25
Total Dissolved Solids (ppt)	23.76 ±2.4
Water Hardness (mg/L)	137.5 ±7.5

The study found that

1. Water temperature was 27.5℃ ± 0.5, which falls within the optimal range for aquatic life.
2. Dissolved oxygen had an average value of 6.75 mg/L ± 0.25, which is sufficient for aquatic organisms to survive.
3. pH levels were 6.25 ± 0.25, indicating a neutral to slightly acidic environment.
4. Total Dissolved Solids was 23.76 ppt ± 2.4, reflecting the level of dissolved minerals in the water.
5. Water hardness was 137.5 mg/L ± 7.5, indicating the concentration of dissolved calcium and magnesium, which can affect aquatic life.

4. Conclusion and Discussion

This study aims to examine the relationship between soil and water properties and crab density in Khlong Plak Ben, Trang Province. The physical and chemical factors of soil and water were analyzed in areas with high and low crab densities. The findings revealed as follows

1) Soil Properties

Soil pH: The average pH in areas with high crab density was 7.67, which was higher than in areas with low crab density 7.32 However, both values fell within the range of neutral to slightly alkaline soil.

Soil Temperature: The temperature in areas with high crab density was 28.17°C higher than in areas with low crab density 26.54°C.

Essential Nutrients (N, P, K): The soil in areas with high crab density contained higher nutrient levels than in areas with low crab density, indicating greater soil fertility.

Organic Matter Content: Both areas had organic matter content ≥ 3.5, indicating high organic matter levels in the soil.

Soil Salinity: Areas with low crab density had higher soil salinity 5.83 ppt than areas with high crab density 4.91 ppt.

2) Water Properties

The study found the following water quality parameters Water Temperature 27.5 ± 0.5°C Dissolved Oxygen: 6.75 ± 0.25 mg/L Water pH: 6.25 ± 0.25 Water Salinity: 23.76 ± 2.4 ppt Water Hardness: 137.5 ± 7.5 mg/L

Acknowledgements

This research project “The Study of Water and Soil Factors Affecting the Survival of Crabs in Plak Ben Canal, Ban Khok Ok, Had Samran Subdistrict, Had Samran District, Trang Province” that has been successfully completed due to the collaboration and dedication of many individuals. Their commitment and perseverance have ensured a smooth research process and the achievement of our objectives.

We would like to express our deepest gratitude to Mr. Sakda Phaisomboon, the Director of Wichienmatu School, and the Wichienmatu Special Program for approving the budget for this research.

A special thanks to Ms. Jiraporn Sirirat, our project advisor, for her valuable guidance, insightful suggestions and continuous support in overcoming challenges throughout the research process, enabling us to accomplish our goals. We are also grateful to the teachers and staff of Wichienmatu School for providing essential equipment, facilities, and access to the science laboratory, which were crucial for conducting this research. Furthermore, we extend our heartfelt appreciation to our families for their unwavering emotional and moral support, which played a vital role in keeping us motivated and helping us overcome difficulties.

Lastly, we would like to thank all sources of information and experts who provided us with essential knowledge and data. Their contributions were invaluable in ensuring the successful completion of this research project.

Project Team

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OPTIONAL BADGES

1. I AM A STUDENT RESEARCHER

I chose this badge because my research follows a systematic scientific approach, which includes formulating research questions, planning studies, designing experiments, collecting data, analyzing results, and drawing conclusions logically. My study is based on academic references and presents research findings that can be practically applied.

2. I AM A COLLABORATOR

I chose this badge because my research is a collaborative effort among team members, with clearly defined roles. The team members work together to analyze data, verify accuracy, and coordinate continuously. Working together allows us to develop ideas and effectively solve emerging problems.

3. I AM A DATA SCIENTIST

I chose this badge because my research utilizes both quantitative and qualitative data to process systematically. We analyze the data logically and evaluate the reliability of the information. Additionally, I use the data to answer research questions, solve problems, and propose practical applications.

Appendix

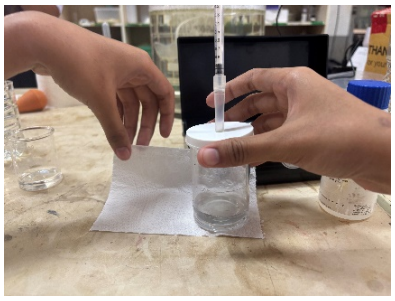
Site survey before the experiment

Soil sample collection

Soil sample collection

Weighing soil samples

Measuring water temperature



Measuring water hardness

Measuring salinity and pH levels

Measuring soil temperature