Title

Physical factors affecting plankton diversity in wastewater from whiteleg shrimp farming ponds in Trang, Thailand

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Abstract: This study on the physical factors affecting plankton diversity in wastewater receiving ponds from whiteleg shrimp farming in Bo Hin Subdistrict, Sikao District, Trang Province, aimed to: 1) study the water quality in the wastewater receiving ponds from whiteleg shrimp farming in Bo Hin Subdistrict, Sikao District; and 2) study the plankton diversity in the wastewater receiving ponds from whiteleg shrimp farming in Bo Hin Subdistrict, Sikao District at each sampling point. Three plankton sampling points were selected between November 2025 and January 2026. Water quality data was also collected from the wastewater receiving ponds in Bo Hin Subdistrict, Sikao District, Trang Province. The results showed that the average water temperature was 28.3 °C , the average pH was 8 , the average transparency was visible at 29 centimeters and obscured at 35 centimeters, the average salinity was 0.6 ppt, and the average dissolved oxygen was The average concentration was 4.5 mg/l , and the total number of plankton found consisted of 7 divisions, divided into 4 divisions of phytoplankton : Division Chlorophyta (green algae) Volvox sp., Tetraedron sp., Eudorina sp., Division Euglenophyta, Euglena sp., and Division Bacillariophyta (diatoms). Navicula sp., Cymbella sp., Division Dinophyta (dinoflagellates) , Ceratium sp. , and zooplankton are found in three divisions : Division Rotifera (Rotifer sp., Brachionus sp., Brachionus quadridentata) and Division Arthropoda (Crustacea) (Crustacea), Cyclops sp .

Keywords: Plankton ; Water quality ; Shrimp pond

Research Question: Water quality in the wastewater receiving ponds for whiteleg shrimp farming. Does it affect planktonic diversity?

Hypothesis: The water quality in the wastewater receiving ponds for whiteleg shrimp farming affects plankton diversity.

Introduction and Review of Literature: Shrimp farming is one of the important agricultural activities in Thailand, especially in coastal areas such as Bo Hin Subdistrict, Sikao District, Trang Province, of an environment to be suitable for aquaculture, such as shrimp farming. Shrimp farming requires a large amount of water, from pond preparation and shrimp cultivation to water quality management throughout the production cycle. This results in "shrimp pond wastewater," which is water that has been used for shrimp farming. This wastewater typically has high levels of salinity, organic matter, suspended solids, and nutrients such as nitrogen and phosphorus. And it affects the quality of natural water. This leads to the degradation of natural areas and water sources, as well as the accumulation of silt and sediment within shrimp farming ponds due to waste and leftover food scraps. Therefore, the research team is interested in studying the diversity of water quality and plankton in wastewater treatment ponds from shrimp farms in Bo Hin Subdistrict, Sikao District, Trang Province, as well as the relationship between water quality and plankton. This research would likely be beneficial to students, researchers, and those interested in natural resources in Thailand.

Research Methods: 1. Research preparation phase.

1) Identify the research question; choose a topic you wish to study.

2) Study, research, and gather knowledge and theories related to the research.

3) Define the educational objectives.

4) Determine sampling points within the study area.

2. Procedures for operating and collecting data according to GLOBE principles.

Part 1: Collecting water samples for measurement according to the GLOBE principle.

1) Survey and determine sampling points in the wastewater receiving ponds from whiteleg shrimp farming ponds in Bo Hin Subdistrict, Sikao District, Trang Province. Three sampling points were determined.

2) Measure the water temperature using a thermometer at a depth of 10 centimeters. Wait 5 minutes, read the value, and record the result.

3) Measure the pH of the water using pH paper. Read the value and record the result.

4) Measure the transparency of the water by immersing the Secchi disk in the water at three different points, three times at each point. Read the values and record the results.

5) Measure the dissolved oxygen (DO) content of the water. Take a water sample, test it using an oxygen test kit, read the value, and record the result.

6) Measure the salinity. Drop the water sample into the device. Pour 3 drops of salinity meter onto the device and read the value, then record the result.

Part 2 : Collecting water samples to check for plankton.

1) Collect plankton samples for study of plankton species.

2) Collect plankton samples using a plankton-hauling bag and water sampling bottles, while observing and recording cloud cover.

3) Study plankton species by using a microscope to classify them.

Part 3 : Weather Measurement

1) Cloud cover
2) Measure relative humidity.
3) Air temperature

Analysis and summary of research findings.

1) Analyze and compare the relationships between the obtained data using statistical methods, including pH values , dissolved oxygen levels, and water transparency. And the salinity of the water.

2) Create a graph showing the average values of the comparative data.

3) Summarize the experimental results.

Materials *(Including GLOBE Data!)*:

1. Microscope
2. Beaker
3. Universal paper
4. Digital thermohygrometer
5. Plankton scoop
6. Dropper
7. Transparency measuring plate
8. Water oxygen test kit
9. Sample water bottle
10. Salinity measuring instrument

11. Water temperature thermometer. 12. Measuring tape (DO) test kit

Results: Table 1: Geographic coordinates

Nature trail	Geographic coordinates	
	Latitude (N)	Longitude (E)
Wastewater receiving pond from shrimp farms.	7.580935	99.316865

From Table 1, the geographical coordinates were used to study the wastewater receiving pond from shrimp farms, Bo Hin Subdistrict, Sikao District, Trang Province. The geographical coordinates are Latitude (N) 7.580935 and Longitude (E) 99.316865.

Table 7. Physical water quality analysis.

print	Area 1	Area 2	Area 3	Average ($\bar{x}$) ± Standard deviation
Water temperature (°C)	28.3	28.3	28.3	28.3
pH value	8	8	8	8
Transparency value (cm^3)	29	35	35	33
Oxygen content in water (mg/l)	3.5	4.5	5.5	4.5
Salinity (ppt)	0.6	0.6	0.6	0.6

Table 7, a physical analysis of water quality, revealed that the wastewater receiving pond area had an average pH of 8, considered within the standard range. The average water

temperature was 28.3°C, and the average water transparency was 33 cm, indicating high turbidity. The average dissolved oxygen (DO) level was 4.5 mg/l , suggesting a moderate level of oxygen in the water. and the average salinity is 0.6 ppt.

Table 8 shows the types of plankton.

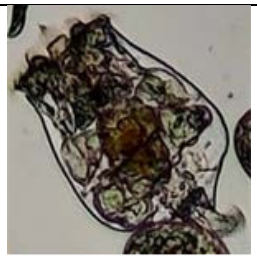
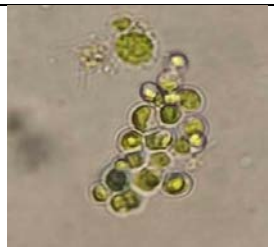
 *Cyclops* sp.	 *Brachionus* quadridentata	 *Rotifer* sp.	 *Brachionus* sp.
 *Cymbella* sp.	 *Eudorina* sp.	 *Volvox* sp.	 *Lepocinclis* oxyuris
 *Phacus* sp.	 *Navicula* sp.	 *Tetraedron* sp.	 *Euglena* sp.
 *Volvox* sp.	 *Ceratium* sp.		

Table 8 shows the types of plankton. The sampled water sources were found to contain a diverse range of plankton, including both phytoplankton and zooplankton. Phytoplankton were found in four divisions : Chlorophyta (*Volvox* sp., *Eudorina* sp., *Tetraedron* sp.), Euglenophyta (*Euglena* sp., *Phacus* sp., *Lepocinclis* sp.), Bacillariophyta (*Navicula* sp., *Cymbella* sp.) , and Dinophyta (*Ceratium* sp.) , which function as primary producers in the aquatic ecosystem. Zooplankton were found in three divisions : Rotifera (Rotifer sp., *Brachionus* sp., *Brachionus* quadridentata), Arthropoda (*Cyclops* sp.) , and Amoebozoa (*Amoeba* sp.) , which function as consumers in the food chain .

Table 9 shows the amount of cloud cover.

Types of clouds	Area 1			Area 2			Area 3			average
	1st time	2nd time	Third time	1st time	2nd time	Third time	1st time	2nd time	Third time	
Cirrus	50%	25%	10%	20%	25%	10%	50%	50%	50%	32.22%
Cirrocumulus	70%	75%	60%	75%	70%	70%	90%	65%	65%	71.11%
Cumulus	25%	0%	20%	10%	20%	25%	20%	10%	25%	17.22%

Table 9 shows the cloud cover, revealing that the sky conditions during the study period were primarily influenced by low-level stratocumulus clouds , which accounted for more than 70% of the total sky area. High-level cirrus and cumulus clouds accounted for smaller proportions, respectively.

Table 10 shows the relative humidity values of the air.

Area where found	1st time	2nd time	Third time	average
Area 1	68%	46%	43%	52.33%
Area 2	45%	45%	43%	44.33%
Area 3	43%	43%	46%	44.00%

Table 10 shows the relative humidity values of the air. for the area 1 to have the highest relative humidity, while areas 2 and 3 had similar or lower humidity than area 1.

Table 11 shows the air temperature.

Area where found	1st time	2nd time	Third time	average
Area 1	28℃	32℃	31℃	30.3 ° C
Area 2	32℃	32℃	32℃	32.0 ° C
Area 3	32℃	31℃	32℃	31.7℃

Table 11 shows the air temperature . Area 2 The highest average temperature was 32.0℃. The next best area is the third area. The average temperature is 31.67℃. and the area where 1 The lowest average temperature was 30.33℃. This shows that the temperature varies slightly from area to area.

Discussion: This study investigated the physical factors affecting plankton diversity in wastewater discharged from whiteleg shrimp (Litopenaeus vannamei) ponds in Bo Hin Subdistrict, Sikao District, Trang Province. Thailand

Part 1 Water quality monitoring

Geographic coordinates: The study was conducted at a wastewater receiving pond from shrimp farms, Bo Hin Subdistrict, Sikao District, Trang Province. Geographic coordinates: Latitude (N) 7.580935, Longitude (E) 99.316865. The water temperature in the studied area was found to be uniform at an average of 28.3 degrees Celsius. The water temperature exhibited high stability and only slight variations between 28.0 and 29.0 degrees Celsius, indicating a consistent

physical environment throughout the study area. pH values of the water in the studied areas were found to be 8 in all three locations, indicating that the water is slightly alkaline and has a consistent pH across all studied areas. The transparency of the water in the studied areas was found to be highest in area 3, followed by area 2, and lowest in area 1. The dissolved oxygen levels in the water were found to vary in each area. Area 1 had a dissolved oxygen level of 3.5 mg/L, Area 2 had 4.5 mg/L , and Area 3 had 5.5 mg/L. The measured values were consistent across all areas, resulting in an average value equal to the measured value for each area. This indicates a tendency for dissolved oxygen levels to increase from Area 1 to Area 3, suggesting differences in water quality between areas. The salinity of the water in the studied areas was found to be the same across all three locations, at 0.6 ppt each time it was measured, with an average of 0.6 ppt. This concludes that the salinity of the water in the study area is consistent, with no significant difference in salinity for areas and indicating that the overall water salinity is stable. Physical water quality analysis revealed that the average pH of the wastewater receiving pond area was 8, considered within standard limits. The average water temperature was 28.3° C , and the average water transparency was 33 cm, indicating high turbidity. The average dissolved oxygen (DO) level was 4.5 , indicating a moderate level of oxygen content, and the average salinity was 0.6.

Part 2 **: Collecting water samples to check for plankton** for the study a total of 14 species of plankton. They are divided into phytoplankton and zooplankton, as follows:

Phytoplankton (9 species)

1) *Volvox* sp. 2)*Eudorina* sp. 3)*Tetraedron* sp. 4)*Euglena* sp. 5)*Phacus* sp. 6)*Lepocinclis* sp. 7)*Navicula* sp. 8)*Cymbella* sp. 9)*Ceratium* sp.

Zooplankton (5 species)

1)Rotifer sp. 2)*Brachionus* sp. 3)*Brachionus quadridentata* 4)*Cyclops* sp. 5)*Amoeba* sp.

Episode 3. Weather monitoring .

Cloud cover analysis revealed that the sky conditions during the study period were primarily influenced by low-level clouds . Plate type (Stratocumulus) These clouds cover more than 70 percent of the total sky area, while high-level clouds (Cirrus) are also present. And cumulus clouds . They have smaller proportions in that order. The relative humidity values shown are as follows: Area 1 The second area had the highest relative humidity. and The

humidity level is similar and lower than in the area where 1 The air temperature is displayed in area 2. The highest average temperature was 32.0°C. The next area is 3 The average temperature is 31.67°C. And area 1. The lowest average temperature, at 30.33°C , indicates that temperatures vary only slightly for areas

Conclusion: The study results showed that the wastewater receiving pond had an average water temperature of 28.3 °C, an average pH of 8 (considered within standard limits) and an average water transparency of 33 cm. The water was found to be very turbid for The average dissolved oxygen (DO) level was 4.5 mg/l , indicating a moderate level of oxygen in the water. The average salinity was 0.6 ppt. The experimental water samples showed a diversity of plankton, including both phytoplankton and zooplankton. Phytoplankton were found in four divisions , including Chlorophyta. These include *Volvox* sp., *Eudorina* sp., *Tetraedron* sp. , and Euglenophyta (*Euglena* sp., *Phacus* sp., *Lepocinclis* sp.) , and Bacillariophyta (*Navicula* sp., *Cymbella* sp.). Dinophyta , including Ceratium *sp* . , acts as primary producers in aquatic ecosystems. Zooplankton are found in three divisions : Rotifera (*Rotifer* sp., *Brachionus* sp., Brachionus quadridentata), Arthropoda (*Cyclops* sp.) , and Amoebozoa (*Amoeba* sp.) , which function as consumers in the food chain .

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(Optional) Badge Descriptions/Justifications:

1. I am a collaborator.

This research was conducted using a scientific team approach, comprising collaborative planning, fieldwork for data collection, and incorporating team members' feedback to improve the research methodology, enhance its reliability and promote effective teamwork for achieving better results.

2. I am a Data Scientist.

This research involved collecting data on pH, transparency, water temperature, dissolved oxygen, air temperature, relative humidity, and cloud cover. These values then used to calculate averages in various tables, and the results were subsequently compared.

3.I am an earth system scientist

This research was conducted to examine the balance of aquatic ecosystems. The study examined wastewater samples from shrimp ponds and plankton within shrimp, reflecting the abundance and biodiversity of the ecosystem.