Research Title

Analysis of water properties in a reservoir for use as a fish breeding ground, Somdetpittayakom School, Somdet District, Kalasin Province.

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ABSTRACT

The objective of this research was to **analyze the water quality of Waree Pond** at Somdetpittayakom School to determine its suitability for fish breeding. The study area covers **14 rai** with a water storage capacity of **40,000 cubic meters**. Data were collected over **six consecutive weeks** using the **GLOBE Protocol** to measure parameters including water transparency, temperature, dissolved oxygen (DO), electrical conductivity (EC), salinity, pH level, alkalinity, and nitrate content.

The research results revealed the following average values: **water transparency** was **145 cm at the surface** and **34 cm at depth**; the **water temperature** was **25.5 °C**; **electrical conductivity** was **272 μS/cm**; **salinity** was **0.5 ppt**; **pH level** was **6.8**; **alkalinity** was **116 mg/l**; **nitrate content** was **0.02 ppm**; and **dissolved oxygen** was **8.12 mg/l**. Analysis of these properties over the 6-week period indicates that **Waree Pond shows no signs of wastewater or pollution**. All measured values, including nitrate levels, temperature, pH, alkalinity, and salinity, are within the **optimal ranges for freshwater aquaculture**. Therefore, it is concluded that the pond is **highly suitable to be utilized as a fish breeding source** and for **agricultural purposes** within Somdet pittayakom School.

Keywords: Water, Water Properties

Rationale and Background

Somdetpittayakom School, located in Somdet District, Kalasin Province, is a large secondary school situated in a semi-urban and rural community where most residents are engaged in agriculture. The school is adjacent to **Waree Pond**, a public reservoir that originated as a natural waterway. Over the years, this pond has been expanded to serve the community's needs, most recently in 2021, when it was dredged to cover an area of **14 rai** with a storage capacity of **40,000 cubic meters**.

The school has actively integrated Waree Pond into its educational curriculum. For instance, in 2022, soil from the pond was used for a demonstration rice field in agricultural classes. However, the rice yield was lower than expected, producing only 144 kilograms compared to the projected 200–250 kilograms for the given area. For the **2024 academic year**, the school has planned a new project to utilize Waree Pond as a **source for fish breeding** for upper secondary agricultural courses.

Given the historical use of the pond and the upcoming fish breeding initiative, it is crucial to understand the current state of the water. The researchers are interested in analyzing the water quality of Waree Pond using the **GLOBE Protocol** to provide **essential baseline data**,. This study aims to determine whether the physical and chemical properties of the water are suitable for aquatic life and agricultural purposes, ultimately establishing the pond as a sustainable **learning resource** for both the school and the local community,.

Research Question:

Is the water in the reservoir suitable for fish breeding?

Research Hypothesis:

The water in the reservoir has suitable properties for use as a fish breeding ground and as an agricultural water source for Somdetpittayakom School.

Research Objective:

To analyze the properties of the water in the reservoir at Somdetpittayakom School, Somdet District, Kalasin Province.

Research Methodology

The study was conducted at **Waree Pond**, Somdetpittayakom School, which has an area of **14 rai** and a capacity of **40,000 cubic meters**. The research followed the **GLOBE Protocol** for water quality analysis, conducted every Saturday for **six consecutive weeks**. The methodology is divided into the following steps:

1. Site Survey and Mapping

Surveying the area: A general survey of Waree Pond was conducted to identify the study site.

- **Creating a Study Site Map:**
  - ° A **50-meter straight line** was defined along the pond bank, with flags placed every **3 meters** as reference points.
  - ° A map was drawn showing the shoreline, the direction of water flow, and significant features such as trees, water inlets, and outlets.
  - ° The map included the site name, north arrow, date, scale, and symbols.

2. Water Quality Analysis Procedures

The researchers analyzed eight key parameters using specific instruments and methods:

- **Water Transparency:** Measured using a **Secchi Disk** and a measuring tape. The disk was lowered into the water until it became invisible, then raised until visible again to record the average depth. This process was repeated **three times** by different observers to ensure accuracy.
- **Water Temperature:** A bulb thermometer was dipped **10 cm deep** for 3–5 minutes. Readings were taken at eye level while the thermometer remained in the water, with **three repetitions**.
- **Dissolved Oxygen (DO):** Water samples were collected underwater to avoid air bubbles and tested within **2 hours** using a DO test kit.
- **Electrical Conductivity (EC):** Samples at room temperature (20–30°C) were measured using a **Conductivity Meter**. The electrode was cleaned with distilled water between readings, and the process was repeated **three times**.
- **Salinity:** A **hydrometer** and thermometer were used to measure the specific gravity and temperature of a 500 ml water sample. These values were then compared in a standard table to determine salinity in **ppt**.
- **pH Level:** The acidity or alkalinity was measured using **pH paper** and compared against a standard color chart.
- **Alkalinity:** Measured using the **HANNA alkalinity test kit**. A 5 ml sample was treated with Bromophenol blue indicator and titrated with HI3811-0 titrant. The result was calculated by multiplying the amount of titrant used by 300 (mg/l $CaCO_3$).
- **Nitrate Content:** Measured using a **Nitrate Test kit**. Reagents were added to the sample to induce a color change, which was then compared to a color comparison chart.

3. Data Recording and Comparison

- All collected data were recorded in the **GLOBE Data Entry system**.
- The results were averaged and compared against **standard water quality criteria for freshwater aquaculture** to determine suitability for fish breeding.

Research Results

The study area was Ang Waree, a public reservoir located within the grounds of Somdetpittayakom School in Somdet District, Kalasin Province. The reservoir covers an area of 14 rai and has a water capacity of 40,000 cubic meters.

Part 1: Drawing a Map of Study Sites
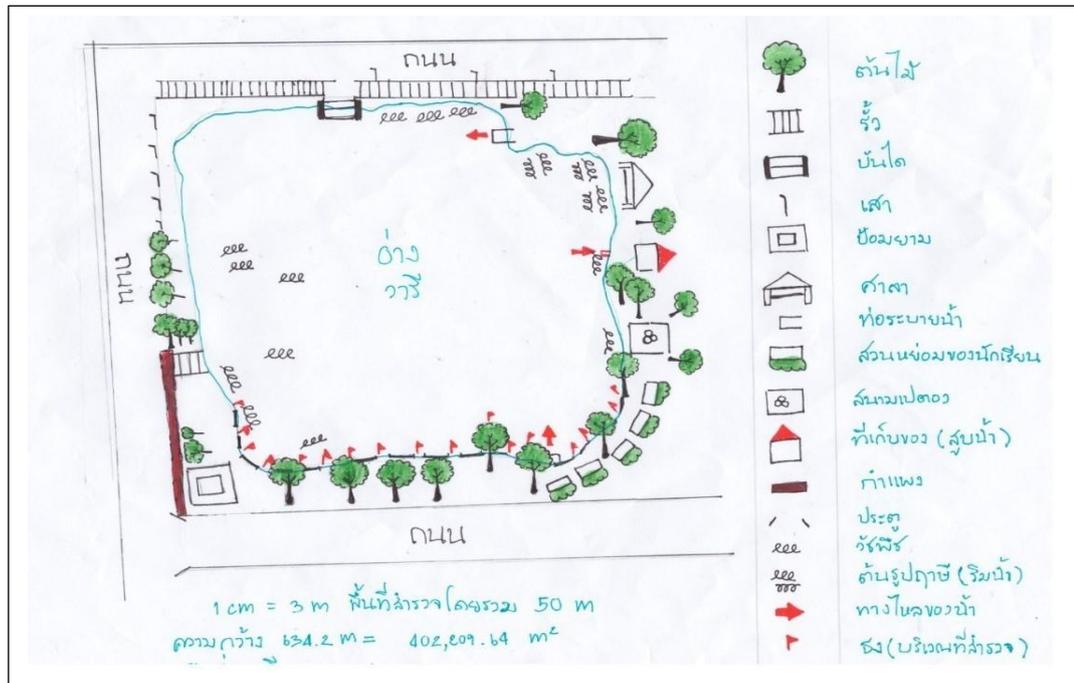
Part 2: Results of the Study on Water Properties in the Water Reservoir, Somdetpittayakom School

Research Results

The study analyzed the water quality of **Waree Pond** at Somdetpittayakom School, which covers an area of **14 rai** and has a storage capacity of **40,000 cubic meters**. Based on the data collected over **6 consecutive weeks** following the **GLOBE Protocol**, the research results are as follows:

1. Physical and Chemical Properties of Water (Average Values):

• **Water Transparency:** Measured at **145 cm** at the surface and **34 cm** at the depth level.

• **Water Temperature:** The average temperature was **25.5 °C**.

• **Electrical Conductivity (EC):** The average value was **272 µS/cm**.

• **Salinity:** The salinity level was recorded at **0.5 ppt**.

• **pH Level (Acidity-Alkalinity):** The average pH was **6.8**.

• **Alkalinity:** Measured at **116 mg/l**.

• **Nitrate Content:** The nitrate level was very low at **0.02 ppm**.

• **Dissolved Oxygen (DO):** The average amount of dissolved oxygen was **8.12 mg/l**.

2. **Comparison with Standard Criteria:** When comparing these results with the standard water quality for freshwater aquaculture, the findings indicate:

• **Suitability for Aquatic Life:** All measured parameters, including temperature, pH, alkalinity, and salinity, are within the **optimal ranges** for the growth and reproduction of aquatic animals.

• **Water Quality:** The water in Waree Pond shows **no signs of wastewater or pollution**. The nitrate levels are appropriate and not contaminated.

• **Agricultural and Educational Use:** The transparency level is within a normal range that allows light penetration for biological growth. Therefore, the pond is **highly suitable for use as a fish breeding source** and for **agricultural purposes** within the school.

Conclusion and Discussion
Conclusion

The analysis of water quality in **Waree Pond** at Somdetpittayakom School, conducted over **six consecutive weeks** following the **GLOBE Protocol**, concludes that the water is of high quality,. The average measured values include a **transparency level of 145 cm** at the surface (34 cm at depth), a **temperature of 25.5 °C, electrical conductivity of 272 µS/cm, salinity of 0.5 ppt, pH of 6.8, alkalinity of 116 mg/l, nitrate content of 0.02 ppm**, and **dissolved oxygen (DO) of 8.12 mg/l**,. These findings

indicate that the pond contains **no significant pollution or wastewater** and possesses physical and chemical properties highly **suitable for fish breeding** and **agricultural use** within the school and community,.

Discussion

The research results can be discussed across several key parameters as follows:

• **Water Transparency:** The measured transparency at depth was **34 cm**, which falls within the standard range of **30–60 cm** recommended for aquatic life. According to research by Maitree Duangsawat, this level is ideal; transparency lower than 30 cm indicates excessive turbidity or plankton (leading to oxygen depletion), while transparency above 60 cm suggests a lack of biological productivity.

• **Temperature:** The average temperature of **25.5 °C** is within the **optimal range of 25–32 °C** for tropical fish in Thailand. Water temperature is a critical factor influencing the life cycles and growth of aquatic animals.

• **Electrical Conductivity (EC) and Salinity:** The EC value of **272 μS/cm** is well within the standard freshwater range of **100–2,000 μS/cm**. Similarly, the salinity of **0.5 ppt** is appropriate for freshwater environments, which typically range between 0 and 0.5 ppt.

• **pH Level:** The average **pH of 6.8** is highly suitable for aquaculture. Standard criteria suggest that a **pH range of 6.5–9.0** is ideal for growth and reproduction, whereas levels below 4.0 are hazardous to fish.

• **Alkalinity:** The measured alkalinity of **116 mg/l** aligns perfectly with the recommended range of **100–120 mg/l** for maintaining a healthy aquatic ecosystem.

• **Nitrate Content:** The nitrate level was recorded at **0.02 ppm**, which is significantly lower than the safety threshold of **0.5 mg/l**. This confirms that the water in Waree Pond is **not contaminated** with excessive nutrients or pollutants,.

• **Dissolved Oxygen (DO):** The DO level of **8.12 mg/l** is considered excellent, as it exceeds the minimum requirement of **5 mg/l** necessary for the respiration and growth of most aquatic organisms.

In summary, the environmental conditions of Waree Pond are **optimally balanced**, confirming the research hypothesis that the pond is fit to serve as a **productive fish breeding site** and a **sustainable agricultural resource**

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Reference documents

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Appendix