Monitoring of water quality in the catfish (*Clarias sp.*) farming in Tuban Regency

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Abstract. Fish need a decent environment for their life and livelihood. Types of fish that have different respiratory organs such as catfish can survive in extreme water conditions. However, in order to grow and develop naturally in a cultivated environment, they need optimum water quality. This study aimed was to determine the quality of water in catfish aquaculture ponds in three partner locations for Community Service activities in Tuban Regency, East Java. The method used in this research is descriptive, with 3 points of location for water sampling, namely, in Jenggolo Village (A), Tegalagung Village (B), and Campurejo Village (C), Tuban Regency. The results of the study showed that the highest temperature in the pond in Campurejo Village was 30.2 ºC. The highest pH in the pond in Tegalagung Village is 7.59. The highest dissolved oxygen in the pond in Jenggolo Village was 13.4 mg L⁻¹. The highest nitrate level was in the pond in Tegalagung Village, namely, 25 mg L⁻¹. The highest phosphate content in the pond in Tegalagung Village. Furthermore, the highest Total Ammonia Nitrogen (TAN) levels are in the pond in Tegalagung Village, which is 16.6 mg L⁻¹. Based on the results, the water quality parameters were classified as great. However, some parameters are less than optimal at different locations. Water quality management needs to be developed to optimize the growth of catfish.

1. Introduction
The basic principle of the aquaculture business is to produce high production at low costs to create the highest profit. The success of the production process can be in the form of a high survival value or fast growth for fish rearing. Things that can support the success of the catfish production process include Water quality, healthy seeds, efficient use of feed [1]. The optimum conditions for cultivation media are crucially needed, even though the cultivated cultivates that have high resistance. Areas that are difficult to get clean water require innovation to be able to maintain or improve the condition of the cultivation media.

Fish need a decent environment for their living and living. Types of fish species that have additional organs as a means of breathing such as catfish (*Clarias* sp.), so that this type of fish is resistant to fairly extreme water conditions, but in order to develop naturally in a sophisticated environment, they need an optimum amount and quality of water. Decreasing water quality will disrupt growth and disease infections that grow and develop in low-quality waters. Ayuniar and
Hidaya [2], suggest that aquaculture production will be successful if we can manage the water quality of the cultivation media, seeds, and feed provided. Feed quality can also affect water conditions. Water with good quality has a good effect on cultivated fish, while water with low quality will affect fish growth so that the fish is not optimal.

Water quality deserves special attention in fish farming activities. Catfish can survive in unfavorable environmental conditions for themselves. According to [3] stated that the water quality parameters that will be used as cultivation media must be following the conditions that can support growth well. Physical parameters that need to be considered are temperature, pool water depth, turbidity level, TSS, or the presence of dissolved solids. Chemical parameters that also need to be controlled are DO, carbon dioxide, water pH value, the amount of Nitrate, Phosphate, and ammonia presence [4].

Good water quality in fish ponds benefits fish to increase the quality of plankton as food, a buffer for harmful things, and low water quality quickly results in decreased fish yields and lower production quality. Balancing water quality is a technical skill in aquaculture, and monitoring water quality parameters can be the first step [5]. In this study, water quality parameters such as temperature, pH, DO (dissolved oxygen), Nitrate, Phosphate, and total ammonia nitrogen (TAN) from catfish (Clarias sp.) Ponds were measured and tested with literature data. Water quality variables were selected to assess the quality of fish pond water.

2. Material and methods
This study was descriptive exploratory research which is presented descriptively through water quality monitoring in catfish (Clarias sp.) Ponds as a form of water quality management. Water samples were obtained from 3 locations in Tuban Regency, namely, Tegalagung Village (a); Jenggolo Village (b); and Campurejo Village (c). Measurement of water quality consisting of parameters Temperature, pH, DO (dissolved oxygen), Nitrate, Phosphate, and Total Ammonia Nitrogen (TAN). Water quality data analysis was carried out by comparing the examined water quality data using optimal water quality parameter values with catfish farming. Water sampling was carried out at one point of observation. Water samples were taken using 3 600 ml bottles with three repetitions to measure nitrate, Phosphate, and Total Ammonia Nitrogen (TAN) to be analyzed in the laboratory. As for the measurement of water quality parameters directly (in site) such as temperature, pH, and dissolved oxygen (DO).

3. Result and discussion
The results of measuring water quality parameters such as temperature, pH, DO (dissolved oxygen), Nitrate, Phosphate, and Total Ammonia Nitrogen (TAN) from catfish (Clarias sp.) Ponds in Tegalagung Village (a); Jenggolo Village (b); and Campurejo Village (c) can be seen in Table 1. below.

| Parameters | TegalAgung Village | Jenggolo Village | Campurejo Village |
|------------|--------------------|-----------------|-------------------|
| Temperature | 28.5 °C            | 29.7 °C         | 30.2 °C           |
| pH         | 7.59               | 6.90            | 6.99              |
| DO         | 3.3 mg L⁻¹         | 13.4 mg L⁻¹     | 2.8 mg L⁻¹        |
| Nitrate    | 25 mg L⁻¹          | 10 mg L⁻¹       | 10 mg L⁻¹         |
| TAN        | 16.62 mg L⁻¹       | 0.05 mg L⁻¹     | 1.53 mg L⁻¹       |
| PO4        | 4 mg L⁻¹           | 1.5 mg L⁻¹      | 2 mg L⁻¹          |

Table 1. Results of monitoring of water quality in catfish (Clarias sp.) ponds.
3.1. Temperature
Based on the results of water temperature measurements during the study, the results were relatively constant and following the quality standards so that the water temperature was very suitable for catfish life. The results of water temperature measurements in Tegalagung Village were around 28.5 ºC, in Jenggolo, it was 9.7 ºC, and in Campurejo, it was 30.2 ºC. According to Hermawan et al. [6], stated that the suitable temperature range for catfish farming is in the temperature range of 23-30 ºC. So, based on research that has been carried out, the temperature range during the administration of coenzymes in catfish farming still meets the feasibility and is good enough for catfish farming. Too high a temperature will damage the process by preventing enzyme activity in cells— one Celsius increase. Temperatures less than the ideal range can cause a decrease in processing efficiency, increasing the toxicity of an aquatic organism pollutant [7]. Temperature parameters at the three research locations are still classified as supporting the growth rate of cultivated catfish and do not have any effect or influence on other parameters.

3.2. pH
The results of pH measurements at three locations of catfish farming ponds, namely in the village of Tegalagung, amounted to 7.59; in Jenggolo Village, 6.90; and in Campurejo Village, as much as 6.99. The pH range measured in this study is still classified as the optimum pH to support catfish life. According to Trisnawati [8], a suitable pH for catfish farming ranges from 6.5 to 8.5. pH, which is high or above 8.5, can cause increased toxicity in the waters, but if the pH is low or below 6.5, it can inhibit the growth rate of Sangkuriang catfish. [9] stated that microorganisms generally have growth conditions with a pH of 4-9.5. Ammonium compounds that can be ionized are found in waters that have a low ph. Ammonium is toxic, but at high pH conditions, there is more ammonia that is not ionized and is toxic. So, based on research that has been carried out, the pH range during research on catfish maintenance in three locations in Tuban Regency still meets the feasibility and is good enough for catfish farming.

3.3. DO (Dissolved Oxygen)
Based on the research conducted, DO measurements have been carried out at three locations show that in the village of Tegalagung the amount of 3.3 mg L⁻¹; in Jenggolo Village, as much as 13.4 mg L⁻¹; and in Campurejo Village as much as 2.8 mg L⁻¹. The oxygen levels in the ponds in Tegalagung and Campurejo villages showed low yields, below the threshold for catfish oxygen demand. According to Rachmawati et al. [9], the right oxygen concentration for catfish should not be less than 3 mg L⁻¹. Low oxygen is generally followed by an increase in ammonia and carbon dioxide in the water, which causes the nitrification process to be inhibited so that it interferes with the livelihood of the fish. Oxygen is needed for Sangkuriang catfish for metabolic processes such as respiration or overhauling food that produces energy. Suppose oxygen in low waters can disrupt the increase in catfish [10]. Aquatic organisms need oxygen for burning their fuel (food) to produce activities, such as swimming, growth, reproduction, and vice versa. Therefore, the availability of oxygen for aquatic organisms determines the cycle of activity, feed conversion, and growth rate [7].

3.4. Nitrate
Based on the results of nitrate measurements in this study in three locations, namely the village of Tegalagung at 25 mg L⁻¹, Jenggolo Village is 10 mg L⁻¹, and Campurejo Village is 10 mg L⁻¹. These results, when compared with water quality standards, the nitrate content can still be tolerated by catfish because it is still classified in normal conditions. Ideally, the nitrate content in the water is <100 mg L⁻¹ [11]. Nitrate is the main form of nitrogen in water and is the primary nutrient for plant and algae growth. Nitrites are very soluble in water and are stable [12]. Nitrate levels in waters are closely related to water phosphate levels. Nitrate can be obtained from the nitrogen cycle and the nitrification process by autotrophic bacteria by the conversion of ammonia-nitrite-nitrate.
3.5. Phosphate
The results measured phosphate levels in catfish farming ponds in three locations, namely Tegalagung Village at 4 mg L\(^{-1}\), Jenggolo Village at 1.5 mg L\(^{-1}\) and Campurejo Village at 2 mg L\(^{-1}\). These results indicate that the levels of Phosphate in the three research locations are above the phosphate quality standard for catfish farming. This condition disrupts water quality conditions and inhibits the growth of catfish. The increase in leftover feed and accumulated metabolite waste can cause an increase in Phosphate so that water quality becomes low, namely a decrease in dissolved oxygen levels in the waters. High phosphate concentrations will interfere with metabolic processes and can even lead to fish mortality [13]. The presence of various phosphates is controlled by biological and physical processes, including absorption by phytoplankton in the photosynthesis process, used by bacteria, and absorption by sludge. The increase in t-phosphate is proportional to the rise in sediment concentration, and suspended material can also carry the absorbed Phosphate in it [12].

3.6. Total Ammonia Nitrogen (TAN)
The results measured the concentration of Total Ammonia Nitrogen (TAN) in catfish ponds in three locations, namely Tegalagung Village at 16.62 mg L\(^{-1}\), Jenggolo Village at 0.05 mg L\(^{-1}\), and Campurejo Village at 1.53 mg L\(^{-1}\). The TAN content obtained in the pond in Tegalagung Village is very high; this result exceeds the recommended TAN quality standard for catfish farming ponds. This phenomenon will affect other water quality parameters. The quality standard for water TAN content is 0.4 - 3.1 [14]. According to Tucker et al., [15], the source of ammonia in waters is the decomposition of organic nitrogen (protein and urea) and organic nitrogen contained in the soil, which comes from the decomposition of organic matter (dead plants and aquatic biota), by microbes known as the ammonification process. Ammonia accumulation in culture media is one of the causes of water quality degradation, failing in fish culture production [16].

4. Conclusion
Based on the results of research that has been done, it is found that the overall water quality condition is still classified as useful. However, some parameters exceed the established water quality standards. Like TAN in Tegalagung Village, which is very high, Phosphate in three locations still exceeds the water quality standard. Water quality is essential for the growth rate of catfish.

5. References
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