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## Research Article

# Water Quality Dynamics of the Karang Mumus River and its Suitability for Tiger Prawn (*Penaeus monodon*) Farming

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## Abstract

**Background and Objective:** *Penaeus monodon* is a robust shrimp species capable of surviving under varying water conditions and seasons. Despite its size and potential socio-economic benefits, it has not been cultivated in the Karang Mumus River due to concerns about water pollution. This study aimed to assess the water quality characteristics of the Karang Mumus River as a potential culture medium for *P. monodon* during both the rainy and summer seasons. **Materials and Methods:** An analytical observational study with a cross-sectional design was conducted. Data were collected twice, in July and October 2023. Shrimp body weight was measured weekly, and water quality parameters, including Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Suspended Solids (TSS) were analyzed at multiple river locations. The survival rate data were arcsine-transformed before analysis, and all data were analyzed using SPSS, with significance determined at  $p < 0.05$  using Chi-square tests for categorical variables. **Results:** Significant differences were observed in TSS and COD between seasons, while BOD and COD values remained within standard threshold limits. Weekly measurements showed progressive increases in shrimp body weight, with the third sampling location demonstrating significantly higher growth compared to other sites. **Conclusion:** The findings indicate that *P. monodon* can be successfully cultured in the Karang Mumus River. Seasonal variations in TSS and COD exist but remain within acceptable water quality standards, confirming the river's potential as a shrimp culture medium.

**Key words:** Climate change, habitat, Karang Mumus River, *Penaeus monodon*, water quality

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**Competing Interest:** The authors have declared that no competing interest exists.

**Data Availability:** All relevant data are within the paper and its supporting information files.

## INTRODUCTION

*Penaeus monodon* are a type of aquatic biota that can inhabit both rivers and oceans. People refer to this kind of fauna as tiger shrimp because of its black and white striped skin. Among the several shrimp species, this one is the largest. Its ability to consume everything, including smaller shrimp, allows it to rapidly increase its body size in its growing environment. Despite its potential as a natural habitat for aquatic biota, the Karang Mumus River in Samarinda, Indonesia, has never successfully cultivated *P. monodon*<sup>1</sup>.

Different circumstances can lead to a variety of variances in the effectiveness of the nursery at the site or under various conditions. Rivers, brackish or saltwater, mangrove, or palm fiber shelters, labs utilizing varying salinity concentrations of water, and seawater can all be used as the nursery land culture pond location. Factors such as temperature, pH, salinity, dissolved oxygen, ammonia, and others can significantly influence the success of *P. monodon* cultivation. The lower middle-class residents of the surrounding area use this river's water for daily needs, such as washing, bathing, fishing, and making a living. However, not everyone in the area knows how important it is to protect the quality of the river, which could make it harder to grow *P. monodon* in this area<sup>2</sup>.

The Karang Mumus River in Samarinda, Indonesia, is a good contender for inclusion in this study's list of habitats for *P. monodon* because lower-middle-class<sup>1</sup> residents of the surrounding area use this river's water for daily needs, such as washing, bathing, fishing, and making a living<sup>3</sup>. Even though their survival depends on the river's water, not all of the local population recognizes the significance of preserving the river's quality<sup>4</sup>. Although this river serves as a natural habitat for aquatic biota<sup>5</sup>, *P. monodon* shrimp have never been successfully cultivated there; *P. monodon* is one of the organisms capable of thriving in aquatic environments characterized by a diverse array of water quality conditions<sup>6</sup>. We will address this final justification as the current study's goal, and we assert this as a novelty.

Upon observing the Karang Mumus River, we notice black waste puddles on the water's surface, accompanied by a foul odor reminiscent of decaying rubbish, which explains the reported quality issues in the river. Removal of home waste from residents activities, as well as from a range of small businesses, hotels, marketplaces, farms, and agricultural areas, some of which are still undeveloped land, is usually linked to the alleged issue, and it will be difficult to be executed<sup>7</sup>.

Until now, we have directly evaluated common water quality characteristics such as pH, temperature, brightness, and dissolved oxygen to determine the presence of water

contamination<sup>8</sup>. Other researchers have conducted a wide range of experiments, including measuring the concentrations of heavy metals. The high concentration of heavy metals in waters pollutes, accumulates in, and even contaminates the ecosystem, which includes biota, sediment, water, and other elements, and has the potential to kill aquatic biota and damage their liver and gills. Given the current situation, it is possible that problems related to the use of water in certain contexts, with specific consequences for human health, may emerge in the future<sup>9</sup>.

Studies using *P. monodon* recognize that various materials, whether carcinogenic or not, have implications for the health of the biota<sup>10</sup>. We choose the problem's occurrence based on the outcomes presented in the operational variables. The two most commonly utilized *P. monodon* metrics are body weight and its development rate, as well as body weight. Two additional extremely precise metrics are the blood cell profile of this shrimp and the osmotic work rate of the shrimp<sup>11,12</sup>.

To address this gap, the current study aims to explore the potential of *P. monodon* cultivation in the Karang Mumus River, Samarinda, Indonesia. The novel aspect of this study lies in its focus on a habitat that has yet to yield successful cultivation of this shrimp species.

## MATERIALS AND METHODS

**Study area and duration:** Karang Mumus is the name of the river that divides the city of Samarinda, East Kalimantan. The Karang Mumus River is a tributary of the Mahakam River, with a flow length of 34.7 kilometers in the city of Samarinda. Geographically, the Karang Mumus River is situated between 0°19'28.93" South Latitude and 0°26'54.72" South Latitude, as well as between 117°12'06.24" East Longitude and 117°15'41.27" East Longitude.

This observational analytical research is designed using a cross-sectional approach. In July and October of 2023, we collected water sources at three locations beneath and around the Lambung Mangkurat Bridge. These locations were displayed in the Google Earth application as 117°09' 10.1457" E 0°29' 27.6665" S, 117°09' 21.6432" E 0°29' 31.4340" S, and 117°09' 31.1835" E 0° 30' 10.6989" S (see Fig. 1). In order to fill the aquarium for *Penaeus monodon* breeding, water is extracted from the river between 8 and 9 AM every week until the end of the 4th week.

**Shrimp samples collection:** The tiger shrimp utilized in this investigation were sourced from a hatchery located in Muara Badak Ilir Village, Kutai Kartanegara, East Kalimantan. The

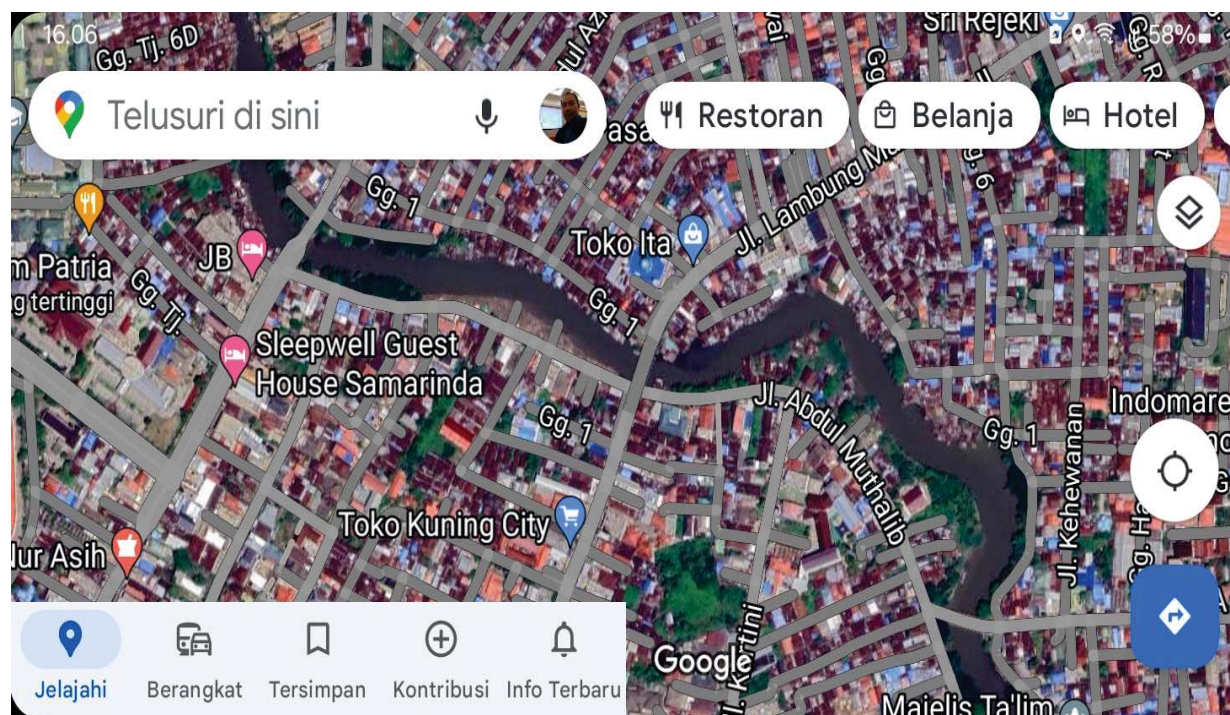


Fig. 1: Map of Sampling Location: Locations 1, 2, and 3 represent upstream, midstream, and downstream, respectively

subjects utilized in the study were juvenile shrimp (PL10) exhibiting an average body weight of  $0.29 \pm 0.006$  g per individual. In this study, 40 larvae per group were utilized with three replications, resulting in a total of 360 juvenile shrimp larvae that were acclimated in the laboratory for 7 days before the experiment.

**Feed and feeding management:** This study involved the provision of commercial pelleted feed to prawns throughout the culture period. The prawns received artemia as a feed, tailored to their body weight. The feed was administered at 5% of the total body weight of the prawn throughout the culture period. The feed was administered to the pond's surface five times daily, with allocations of 10% at 6:00 AM, 10% at 12:00 PM, 20% at 4:00 PM, 30% at 6:00 PM, and 30% at 11:00 PM of the total feed designated for the prawn.

**Karang mumus water samples:** The Karang Mumus River was collected during the summer and rainy seasons, as reflected in the water sample that was taken in July and October of 2023. During those months, the first sampling was conducted at 9:00 Central Indonesia Time. A water sample was collected from three locations of the Karang Mumus River in the application Google Earth (Fig. 1).

- **Location 1:** Coordinates of 117°09' 10.1457" E, 0°29' 27.6665" S
- **Location 2:** Coordinates 117°09' 21.6432" E, 0°29' 31.4340" S
- **Location 3:** Coordinates 117°09' 31.1835" E, 0°30' 10.6989" LS

Water samples were collected on eight occasions during the months of July and October 2023. July 2023 signifies the peak of summer; samples were collected during weeks 1, 2, 3, and 4. Additionally, in October 2023, which marked the onset of the rainy season, samples were gathered weekly until week 4. The collected water samples will serve to assess water quality and will additionally support the maintenance of tiger shrimp in the laboratory setting.

For water analysis, the Mulawarman University, Faculty of Fisheries and Marine Sciences has the Water Laboratory and Microbiology Laboratory, where water samples will be analyzed. The Water Laboratory checked for BOD (APHA 5210-B, 22nd year, 2012), COD (SNI 6989.2:2019), TSS (SNI 6989.3:2019), Fe (SNI 6989.4-2009), and Cr (VI) (SNI 6989.53-2005). The Microbiology Laboratory looked at coliform bacteria.

**Experimental design:** This study used a completely randomized design with three groups with different water sample locations:

- **Group 1:** *Penaeus monodon* culture using Karang Mumus water from location 1
- **Group 2:** *Penaeus monodon* culture using Karang Mumus water from location 2
- **Group 3:** *Penaeus monodon* culture using Karang Mumus water from location 3

Each group consisted of three replications, 40 juveniles of *P. monodon*, and a four-week culture period. Shrimps are kept using water sourced from the Karang Mumus River with 4.5% NaCl every week, continuing this practice for a duration of 4 weeks. The initial week of July marks the onset of summer; air samples are collected to support the maintenance of tiger shrimp in an aquarium with a density of 20 fish per liter. The second week involves water purification utilizing the new Karang Mumus River, which is sourced during this period, continuing until water sampling occurs in the fourth week of July, ensuring that shrimp are maintained through the fifth week. Similarly, collecting samples during the rainy season.

**Data collection:** One of the shrimp growth criteria involved indirectly measuring the body weight with a digital micrometer/caliper. The study measures the shrimp's weight and survival rate by placing them in a container filled with river water. The hatchery distributor in Muara Badak Ilir Village, Kutai Kartanegara, East Kalimantan, Indonesia, provided the shrimp population.

The survival rate (SR), weight gain (WG), and survival rate (SR) were determined using the standard method of AftabUddin *et al.*<sup>13</sup>:

$$\text{Survival rate (SR\%)} = \frac{\text{Number of live shrimps}}{\text{Initial number of total shrimps}} \times 100$$

$$\text{Weight gain (WG\%)} = \frac{\text{Final weight (g)} - \text{Initial weight (g)}}{\text{Initial weight}} \times 100$$

**Data analysis:** The survival rate data was transformed to arcsin before analysis. The data on tiger shrimp's weight gain and survival rate were analyzed using SPSS version 20 (SPSS Inc., Chicago, IL). A Chi-square was performed to test for differences in proportions of categorical variables between two or more groups. The level  $p < 0.05$  was considered as the cutoff value or significance.

Research permits and ethics were submitted to the Ethics Committee of the Faculty of Medicine, Mulawarman University, on September 20, 2023, within Surat Persetujuan Kelayakan Etik 187/KEPK-FK/IX/2023.

## RESULTS AND DISCUSSION

Water quality is critical as a medium in shrimp culture. In shrimp farming, the remainder of the feed, excretion, and dead organisms will decompose into organic waste, potentially contaminating the cultivated water<sup>14,15</sup>. The average BOD concentration in the Karang Mumus River ranged from 1.22 to 2.48 mg/L across all seasons, which was not optimal for the growth and survival of tiger shrimps. Some research declares that tiger shrimp need 5 mg/L of BOD, but in the traditional pond, usually the BOD averages 2-3 mg/L. In this study, we are using a recirculation system and an aerator to increase the BOD. The solubility of oxygen in water decreases as the water temperature rises. Conversely, the higher the level of oxygen consumption, the lower the dissolved oxygen level, affecting the life of tiger shrimps.

The research shows BOD, COD, and TSS test outcomes that demonstrate that there isn't a single increasing value that surpasses the water quality standard threshold value (Table 1). This suggests that the Karang Mumus River has demonstrated its capacity to replenish pollutants that were last reported a few years ago. Except the second location, Table 1 shows a significant change in the results between the rainy and summer seasons.

According to the Indonesian government regulations, the water quality of the Karang Mumus River in Samarinda, Indonesia, as measured in July and October, showed no increasing values of BOD, COD, and TSS above their standard levels. These results, however, were only included in class II, indicating that the river has the potential to be used as a medium for breeding aquatic biota. Pantjara *et al.*<sup>14</sup> state that the high presence of fish in the area suggests that people commonly fish from the riverbank or the bridge<sup>15-18</sup>.

To maintain the sustainability of the ecosystem in these waters, the Samarinda city government actively contributes to the preservation of the Karang Mumus River by sending a team to explore the river and remove trash from its surface on a daily basis. Additionally, the government grants communities adjacent to the river the authority to recognize the value of open spaces along river borders, which aids creatures whose survival depends on the river's presence.

While the TSS and COD of the Karang Mumus River water have been found to be in excellent condition and suitable for *P. monodon* culture, the increase in TSS during rainy seasons

Table 1: Average water quality parameters of the Karang Mumus River across various seasons.

| Parameters | SNI Standards (mg/L) | Location | July 2023 Summer  | October 2023 rainy |
|------------|----------------------|----------|-------------------|--------------------|
| TSS        | 50                   | 1        | 31 <sup>a</sup>   | 38 <sup>b</sup>    |
|            |                      | 2        | 34 <sup>a</sup>   | 47 <sup>b</sup>    |
|            |                      | 3        | 11 <sup>a</sup>   | 20 <sup>b</sup>    |
| BOD        | 3                    | 1        | 2.16 <sup>a</sup> | 2.18 <sup>a</sup>  |
|            |                      | 2        | 1.48 <sup>a</sup> | 2.40 <sup>a</sup>  |
|            |                      | 3        | 1.22 <sup>a</sup> | 1.68 <sup>a</sup>  |
| COD        | 25                   | 1        | 6.67 <sup>a</sup> | 11.72 <sup>b</sup> |
|            |                      | 2        | 4.62 <sup>a</sup> | 7.83 <sup>b</sup>  |
|            |                      | 3        | 3.51 <sup>a</sup> | 5.76 <sup>b</sup>  |

Values are presented as mean values. Different superscript letters (a-b) within the same row indicate significant differences between seasons at  $p < 0.05$ . TSS: Total suspended solids, BOD: Biological oxygen demand, COD: Chemical oxygen demand and SNI: Indonesian national standard

Table 2: Body weight in gram of *Penaeus monodon* culture using the Karang Mumus River water

| Location | Week 1 |         |       | Week 2 |         |       | Week 3 |         |       | Week 4 |         |       |
|----------|--------|---------|-------|--------|---------|-------|--------|---------|-------|--------|---------|-------|
|          | July   | October | Sig.  | July   | October | Sig.  | July   | October | Sig.  | July   | October | Sig.  |
| 1        | 0.012  | 0.013   | 0.027 | 0.018  | 0.018   | 0.956 | 0.025  | 0.025   | 0.956 | 0.030  | 0.031   | 0.441 |
| 2        | 0.012  | 0.013   | 0.652 | 0.016  | 0.016   | 0.734 | 0.020  | 0.020   | 0.965 | 0.025  | 0.026   | 0.887 |
| 3        | 0.011  | 0.012   | 0.799 | 0.015  | 0.015   | 0.663 | 0.021  | 0.021   | 0.794 | 0.030  | 0.030   | 0.280 |

often necessitates the use of filtration<sup>15</sup>. The increase in TSS and COD during the rainy season is a concern, as it can negatively impact the river's water quality and the suitability for aquaculture activities<sup>18</sup>.

The water quality of rivers is affected by various factors, including industrial and domestic waste, land use changes, and seasonal variations. To ensure the long-term sustainability of the Karang Mumus River ecosystem and its suitability for aquaculture, it is crucial to address these underlying issues and implement comprehensive water management strategies. This may involve improving wastewater infrastructure, monitoring land use changes, and strengthening institutional and regulatory aspects, as seen in the case of the Cisadane River in Tangerang, Indonesia. Additionally, regular water quality assessments and the development of policies to manage the river as a raw water source can contribute to the preservation of the Karang Mumus River and its valuable aquatic resources.

Table 2 presents the body weight of *Penaeus monodon* cultured using Karang Mumus River water at three different locations during July and October over four weeks. In Week 1, the body weight ranged from 0.011-0.012 g in July and 0.012-0.013 g in October across all locations. By Week 2, the body weight increased to 0.015-0.018 g in both sampling periods. A further increase was observed in Week 3, where body weight ranged from 0.020-0.025 g in July and remained nearly similar in October. At Week 4, the highest body weight values were recorded, ranging from 0.025-0.030 g in July and 0.026-0.031 g in October. Statistical analysis showed no significant differences ( $p > 0.05$ ) between July and October at all locations and weeks, indicating relatively similar growth performance of shrimp cultured in Karang Mumus River water during both sampling periods.

Measurements of the body weight of shrimp were performed twice, in July and October 2023, to correspond with various seasons (Table 2). The shrimp's growth indicates that nutrients are being effectively used for the development of its body anatomy, and expansion will undoubtedly continue to trend positively as long as there are sufficient nutrients to support this process. The body's capacity to break down and assimilate food into basic building blocks is what supports nutritional sufficiency. For this reason, the study's water quality test results are crucial in guaranteeing the best conditions for life and development<sup>19</sup>.

The study of shrimp growth and its correlation with water quality is a crucial aspect of aquaculture research, as it provides valuable insights into the factors that contribute to the overall health and development of these economically important crustaceans. The present study aimed to investigate the growth patterns of shrimp in relation to water quality parameters during the months of July and October 2023. The results indicate that the shrimp's body weight measurements showed a positive trend, suggesting that the available nutrients were effectively utilized for the development of their anatomical structure<sup>20</sup>. This is in line with previous findings that have highlighted the importance of nutritional sufficiency in supporting the growth and well-being of shrimp populations<sup>21</sup>. Water quality is a vital factor in ensuring the optimal conditions for shrimp life and development. The study's water quality test results are crucial in guaranteeing the best possible environment for the shrimp to thrive. As noted by Sombatjinda *et al.*<sup>22</sup>, changes in microbial community dynamics during the shrimp growing period may be correlated with water quality parameters, such as the gradual decrease in total ammonia nitrogen and the increase in nitrate concentrations. This suggests that the monitoring of



Fig. 2: Condition of the water in the Karang Mumus River, polluted and brown

Table 3: Survival rates (%) of *Penaeus monodon* culture using the Karang Mumus River water

| Location | July   |        |        |        | October |        |        |        |
|----------|--------|--------|--------|--------|---------|--------|--------|--------|
|          | Week 1 | Week 2 | Week 3 | Week 4 | Week 1  | Week 2 | Week 3 | Week 4 |
| 1        | 100    | 97.5   | 82.5   | 62.5   | 100     | 100    | 97.5   | 87.5   |
| 2        | 100    | 100    | 90.0   | 77.5   | 100     | 100    | 100    | 97.5   |
| 3        | 100    | 100    | 92.5   | 72.5   | 100     | 100    | 100    | 97.5   |

water quality and its associated microbial communities can provide valuable insights into the overall health and performance of the shrimp culture system<sup>22</sup>. Furthermore, studies have shown that differences in cultivation models, such as indoor versus outdoor systems, can have a significant impact on water quality parameters, including temperature, pH, dissolved oxygen, and nitrate levels<sup>23</sup>. These findings underscore the importance of carefully managing and monitoring water quality in shrimp aquaculture to ensure optimal growth and development.

The growth (Table 2) results in this study revealed a difference between July and October, with an average weight range (mean) of 0.011475-0.030875 mg in July and 0.01155-0.0307 mg in October. Several investigators continue to view fluctuations in outcomes over different months or seasons as natural<sup>24</sup>. These outcomes are comparable to those of earlier studies that carried out nursery on open fields with more abundant and free food supplies<sup>25,26</sup>. Since this is a novel research project with no prior data, no data can be compared to the current results. However, our team has gathered information from the distributor of *P. monodon* in Muara Badak Ilir Village, Kutai Kartanegara Regency, who informed us that during nursery maintenance, 20% of the water volume had been reduced to be replaced with river water of an equivalent quantity within a week of the nurseries, to further reduce salinity. Whenever those shrimp are maintained as research subjects, stress caused by altering conditions may result in faster growth, which increases the possibility that

there is a growth hormone that is promoted to be released earlier and will accelerate growth as long as there is sufficient nutrition. In order to support these phenomena, we put data about *P. monodon* survival rate in Table 3.

Table 3 shows the survival rates of *Penaeus monodon* cultured using Karang Mumus River water during July and October at three different locations over a four-week culture period. In Week 1, the survival rate was 100% at all locations during both months. During Week 2, survival rates remained high, ranging from 97.5-100% in July and maintaining 100% in October across all locations. By Week 3, survival rates declined to 82.5-92.5% in July, whereas October maintained higher values of 97.5-100%. In Week 4, the lowest survival rates were observed in July, ranging from 62.5-77.5%, while October recorded comparatively higher survival rates of 87.5-97.5%. Overall, the results indicate better survival performance of shrimp cultured during October compared to July, particularly during the later weeks of the culture period.

Table 3 provides proof that *P. monodon* can also survive inside the Karang Mumus River. In this experiment, we isolate them, so there aren't predators that can harm their lives. In order to support their survival ability, we feed them enough to make sure that their nutrition will be enough to live and grow. The Karang Mumus River has a reputation for being dirty, as seen in Fig. 2, yet how did those shrimps manage to survive until after the last research phase ended? The environmental carrying capacity of the river plays a crucial role in keeping the standard water quality threshold

value from being exceeded. The amount of rainfall, which influences concentration or wind activity<sup>27,28</sup>, which impacts river waves, dictates the magnitude of this environmental carrying capacity.

The success of this river in preventing the exceedance of the standard water quality threshold value cannot be separated from the role of environmental carrying capacity. The greatness of this environmental carrying capacity is determined by the conditions of rainfall that affect the concentration or wind activity that affects the waves of the river. It is important to raise the possibility that seasonal variations could be responsible for the previously mentioned fluctuations. The researcher would like to highlight that the examination of parameters in July 2023, which represents the summer season, and October 2023, which reflects the rainy season, actually showed a difference in results, where in 3 different locations, there was always an increase over the standard water quality threshold value. Because no data on citizen activities or government performance were published at the time, scholars have been unable to explain this phenomenon and support this hypothesis clearly<sup>15</sup>.

The Karang Mumus River in Indonesia is known for its reputation as a dirty waterway, yet recent studies have shown that the shrimp species *P. monodon* can thrive within this environment<sup>29,30</sup>. In a controlled experiment, researchers found that *P. monodon* can survive and grow when isolated from predators and provided with adequate nutrition<sup>31</sup>. The success of *P. monodon* in the Karang Mumus River can be attributed to the environmental carrying capacity of the river. The concentration of the water, influenced by rainfall patterns, and the river waves, affected by wind activity, play a crucial role in maintaining the water quality within acceptable thresholds<sup>29,31</sup>. Researchers have found that seasonal variations, such as the difference in water quality parameters between the summer and rainy seasons, can impact the environmental carrying capacity of the river<sup>32</sup>. Previous studies have examined the distribution and abundance of *Penaeus* shrimp species in other mangrove ecosystems in Indonesia, highlighting the need for conservation efforts to protect their critical habitats<sup>29</sup>. Additionally, research on shrimp cultivation has revealed the importance of understanding the dynamics of water quality and its impact on plankton communities, which serve as indicators of environmental health<sup>31,32</sup>.

The results of water's parameter examination may be different from what happened in 2017<sup>17</sup> or 2020<sup>16</sup>, who reported that at this sampling location, it turned out that there was a red color on the spatial map, which showed that it was considered a critical point (Fig. 2). Reports of pollution in this

river can be physically seen with a cloudy brownish color, so the Samarinda Municipality Government participates in socialization to maintain the balance of the river ecosystem<sup>33</sup>. Researchers assess the significant steps taken by the Samarinda Municipality Government to restore the provision of green open space on the border of the Karang Mumus River, which has a positive impact on reducing population density<sup>3</sup>. The other secret behind the success of the Samarinda Municipality Government in reaping this glorious result is through the garbage collection movement, which has been carried out regularly since 2019, so that contrasting conditions like those that occur in other rivers, for example, the Citarum River, which is filled with a lot of garbage piles on the river surface, can be prevented<sup>34</sup>.

Normally, *P. monodon* can consume plankton, moss, and even the remains of animals and plants that have rotted in order to fulfill their demand to grow and live<sup>35</sup>. Finding food shouldn't be an urgent challenge for the nature of Indonesia's rivers, which support various kinds of aquatic biota. Nutrients are easily accessible in natural rivers; however, this circumstance is unavailable in aquariums, so we must actively feed them. Following this event, we believe that an appropriate habitat is the primary prerequisite for the emergence of a species, so we are pleased to report that our shrimps can overcome the challenges posed by being moved from their natural mating grounds into aquariums for scientific study. Additionally, we propose that individuals should investigate this river in order to raise *P. monodon*, or tiger shrimp, and earn additional revenue from scientific study. Additionally, we propose that individuals should investigate this river in order to raise *P. monodon*, or tiger shrimp, and earn additional revenue. we propose that individuals should investigate this river in order to raise *P. monodon*, or tiger shrimp, and earn additional revenue.

## CONCLUSION

The study indicates that the dynamics of water quality in the Karang Mumus River experience notable alterations during the summer and rainy seasons, especially concerning TSS and COD levels, whereas BOD values remain relatively stable despite seasonal fluctuations. The cultivation of *P. monodon* shrimp can be effectively conducted during both the summer season in July and the rainy season in October. However, to optimize growth and improve survival rates, it is essential to increase oxygen levels. This study's findings suggest that community activities and seasonal changes significantly impact the condition of the Karang Mumus River.

## SIGNIFICANCE STATEMENT

This study provides important evidence that the Karang Mumus River possesses suitable water quality conditions for the culture of *Penaeus monodon* under different seasonal conditions. The findings support the potential utilization of polluted river systems for sustainable shrimp aquaculture, contributing to local food production, economic development, and improved management of freshwater aquaculture resources.

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