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RESPONSE OF VANAME SHRIMP (*Penaeus vannamei*) POND WATER QUALITY TO THE TRANSITION FROM BLIND FEEDING TO POST-BLIND FEEDING UP TO DOC 60

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ABSTRACT

Vaname shrimp (*Penaeus vannamei*) aquaculture is highly influenced by water quality dynamics during the rearing cycle, particularly during the transition phase from blind feeding to post-blind feeding. The study aimed to describe the response of water quality in vaname shrimp ponds to changes in feeding management from the blind feeding phase through the post-blind feeding phase until DOC 60. The study was conducted at the intensive pond of CV. Mytra Pratama, Batang Regency, over one rearing cycle. Observations were made during two rearing phases: the blind-feeding phase (DOC 1–30) and the post-blind-feeding phase (DOC 31–60). The water quality parameters observed included total organic matter (TOM), ammonia (NH_3), ammonium (NH_4^+), total ammonia nitrogen (TAN), nitrite (NO_2^-), alkalinity, hardness, plankton abundance, total bacterial count (TBC), and total Vibrio count (TVC). Data analysis was performed descriptively based on the temporal dynamics of each parameter. The results showed that during the blind feeding phase, water quality was relatively stable, with total organic matter (TOM) ranging from 81–122 mg/L, total ammonia nitrogen (TAN) from 0.024–0.385 mg/L, and nitrite (NO_2^-) from 0.017–0.147 mg/L. Conversely, during the post-blind feeding phase, there was a significant increase, with TOM reaching 205 mg/L, TAN reaching 2.985 mg/L, and nitrite rising sharply to 2.736 mg/L at DOC 60, accompanied by high fluctuations in aquatic biological parameters due to increased shrimp biomass and feeding intensity. The transition from the blind feeding phase to the post-blind feeding phase places greater ecological stress on the pond water system. Therefore, adaptive water-quality management is necessary to maintain environmental stability and support the sustainability of *Penaeus vannamei* culture at DOC 60.

Keywords: Blind Feeding; DOC 60; Water Quality; Post-Blind Feeding; *Penaeus vannamei*

INTRODUCTION

Aquaculture products have been recognized as a central sector in supporting global food security by driving the blue food system (Alsaleh, 2023). One of the leading aquaculture products today is crustaceans. Vaname shrimp (*Penaeus vannamei*) have become the most widely cultivated product in Indonesia, replacing black tiger shrimp (*Penaeus monodon*) due to their high tolerance to high stocking density and shorter production cycles (Yahya *et al.,* 2025).

Vaname shrimp (*Penaeus vannamei*) aquaculture is significantly influenced by dynamic water quality conditions throughout the rearing cycle (Ariadi *et al.,* 2021). These dynamics are primarily determined by feed management, as feed serves as the primary source of nutrient inputs into the pond system. During the 90–120-day rearing cycle, from pond preparation to harvest, inefficient feeding increases the accumulation of organic matter and nitrogen compounds such as ammonia and nitrite, which directly affect water quality stability and shrimp health. Therefore, every stage of cultivation including water quality management, pest and disease control, and partial and total harvests is essentially a response to changes in water conditions triggered by feeding activities. Thus, optimizing each phase of the cultivation cycle depends not only on the implementation of technical steps but also on the ability to maintain a balance between feed input and the water body's capacity to assimilate metabolic waste, which ultimately determines cultivation productivity (Madusari *et al.,* 2024).

One crucial phase in pond management is feed management, particularly the transition from blind feeding to post-blind feeding. Blind feeding is an initial feeding method based on estimates of age and density, without accounting for actual shrimp consumption. During this phase, the accuracy of daily sampling remains low due to the small size of the shrimp (DOC 1–30/35), leading to imprecise estimates of feed requirements. This situation often delays the transition to the post-blind feeding phase in aquaculture practice, leading to overfeeding toward the end of the blind feeding phase. This delay poses a major risk because the accumulation of unused feed increases the organic load and accelerates the accumulation of nitrogen compounds such as ammonia and nitrite in the pond water.

Upon entering the post-blind feeding phase, feed administration is adjusted based on biomass sampling results using anco at >DOC 30 (Fahrur *et al.,* 2023). This difference in approach has direct implications for water quality dynamics, particularly regarding increases in organic matter and nitrogen transformation processes. Commercially, the timing of the transition is a key factor in preventing overfeeding and maintaining feed efficiency. Preventing overfeeding is a

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strategic step in avoiding water quality deterioration that could disrupt the physiological functions and growth of shrimp (Liang *et al.,* 2025). In line with Ariadi *et al.* (2019), water quality stability in the early phase occurs because biomass and metabolic activity are still low, resulting in relatively small loads of organic waste and nitrogen compounds; however, this condition can change drastically if feed accumulation occurs due to delayed feed management transitions.

However, as shrimp age and the amount of feed provided increases, the pond ecosystem undergoes more complex changes due to the accumulation of uneaten feed and feces, and increased microbial activity (El-Saadony *et al*., 2022). Given that vaname shrimp are ectothermic animals that breathe directly from the water, these organisms are highly sensitive to changes in environmental quality and have a molting process that depends on water conditions; therefore, the dynamics of rearing water quality must be maintained, particularly parameters such as alkalinity which buffers pH and serves as a carbon source for phytoplankton development in the pond. Additionally, the accumulation of potentially toxic waste materials, such as organic matter from uneaten feed, feces, and dead plankton, can increase concentrations of ammonia, nitrite, and nitrate (Kunjiraman *et al.,* 2024). This poses a critical threat to the rearing environment, leading to a surge in bacteria that accumulate in the water during rearing.

The transition from blind feeding to post-blind feeding is a critical phase in the vaname shrimp cultivation cycle, as it marks a fundamental shift in feeding management that directly affects water quality dynamics. During this phase, increased shrimp biomass is accompanied by increased feed input, which has the potential to accelerate the accumulation of organic matter and nitrogen compounds in pond waters. The observation period up to DOC 60 was selected because this phase marks the midpoint of the rearing cycle, when feeding intensity and shrimp metabolic activity begin to increase significantly, allowing the water-quality response to ecological stress to be observed more clearly. Additionally, DOC 60 is a critical point before entering the final rearing phase, as undetected water-quality imbalances from the outset can directly impact growth performance and harvest success. Water quality dynamics during this phase need to be observed descriptively to understand the patterns of change occurring alongside the increase in shrimp biomass. DOC (Day of Culture) itself is a unit of time used to indicate the duration of shrimp cultivation from stocking to harvest. Therefore, a study of water quality responses during the blind feeding phase through the post-blind feeding phase to DOC 60 is crucial as a basis for initial evaluation in water quality management and for refining feeding management strategies in vaname shrimp farming. This study aims to describe the response of water quality in vaname shrimp ponds to changes in feeding management from the blind feeding phase through the post-blind feeding phase up to DOC 60.

RESEARCH METHODOLOGY

Time and Location of the Study

The study was conducted at a vaname shrimp (*Penaeus vannamei*) farm owned by CV. Mytra Pratama in Batang Regency over one rearing cycle until the shrimp reached 60 days post-hatch (DOC 60). The study focused on observing water quality dynamics during the blind-feeding and post-blind-feeding phases as a case study of vaname shrimp farming. Cultivation was carried out at a stocking density of 150 shrimp/m² in HDPE (High-Density Polyethylene) ponds. The aeration system used water wheels at a density of 1 unit per 25,000 postlarvae to maintain dissolved oxygen levels and support water quality stability. Observations were conducted in a 1,600 m² cultivation pond. The water quality data obtained were from a single pond to illustrate the cultivation system's response under the operational conditions used.

Maintenance and Feed Management

Maintenance was divided into two phases: the blind-feeding phase from DOC 1–30 and the post-blind-feeding phase from DOC 31–60. During the blind feeding phase*,* a blind feeding program was used from DOC 1–30 days; subsequently, during the post-blind feeding phase, the feeding program was adjusted based on the feeding rate (FR) from sampling results and the target average daily growth (ADG).

Water Sampling

Water quality data is collected periodically at each corner of the pond during the rearing period, taken in the morning from 05:00–06:00 AM and in the afternoon from 12:00–2:00 PM(Halim *et al.,* 2022). Sampling was performed by inserting a sample bottle to a depth of 30–40 cm below the water surface.

Analysis of Water Quality Parameters

The parameters observed included ammonia (NH_3), ammonium (NH_4^+), total ammonia nitrogen (TAN), and nitrite (NO_2), which were analyzed using a UV-Vis spectrophotometer. Total organic matter (TOM) was analyzed by taking a 50 mL water sample to which 10 mL each of concentrated sulfuric acid (H_2SO_4) and $KMnO_4$ (0.01 N), each 10 mL, boiled for 5–10 minutes, and calculated using the formula (Yoswaty *et al.,* 2021):

$$\text{TOM (mg/L)} = \frac{\text{mL KMnO4 x N KMnO4 x 31.6 x 1000}}{\text{mL sampel}} \quad \text{......... (1)}$$

Alkalinity was analyzed using water samples to which 0.02 N H_2SO_4 was added and calculated using the formula (Dhoke, 2023):

$$\text{Alkalinitas (mg/L)} = \frac{\text{mL titran x N } H_2SO_4 \text{ x 50.000}}{\text{mL sampel}} \quad \text{...... (2)}$$

Hardness was analyzed by mixing the water sample with 0.01 M EDTA reagent, pH 10 buffer, and EBT indicator and calculated using the formula by Ingin *et al.,* (2024):

$$\text{Hardness (mg/L)} = \frac{\text{mL EDTA x M EDTA x 100.000}}{\text{mL sampel}} \quad \text{...... (3)}$$

Plankton abundance was analyzed using pond water samples filtered through a plankton net and placed into a Sedgwick rafter counting cell (SRC) and observed under a microscope. The results were calculated using the formula (Febrianti *et al.,* 2022):

$$N = \frac{n \times Vr}{V0 \times Vs} \quad \text{...} (4)$$

Notes: N: plankton abundance (cells/L); n: number of counted plankton; V_r: volume of concentrated sample (mL); V_0: volume of filtered water (mL); V_s: volume of SRC (m^3)

Total bacterial count (TBC) and total Vibrio count (TVC) were analyzed using the Total Plate Count (TPC) method, with samples spread onto Tryptic Soy Agar (TSA) for TBC and Thiosulfate Citrate Bile Salt Sucrose (TCBS) for TVC. These were incubated for 24 hours in an incubator at 37 °C and calculated using the formula (Yahya *et al.,* 2025):

$$CFU/mL = \sum \text{bakteri tumbuh} \times \sum \text{sampel (ml)} \times \text{tingkat pengencer} \quad \text{..........} (5)$$

Data Analysis

The data are presented as time-series tables to illustrate changes in water quality during each maintenance phase. Data analysis was conducted descriptively by comparing patterns of change in water quality parameters between the *blind-feeding* and *post-blind-feeding* phases. The comparison focused on trends in fluctuations and on the response of water quality to the transition between maintenance phases up to DOC 60. The analysis results were used to evaluate water quality dynamics as a basis for improving vaname shrimp farming management.

RESULTS AND DISCUSSION

Water Quality Response During the Blind Feeding Phase (DOC 4–24)

The dynamics of the physical, chemical, and biological water quality parameters in vaname shrimp ponds during the blind feeding phase (DOC 4–24), observed periodically throughout the rearing period, are presented in Table 1.

Table 1. Water Quality Response During the Blind Feeding Phase

Parameter	DOC					
	4	7	11	14	18	24
Alkalinity (mg/L)	112	112	118	126	122	96
Hardness (mg/L)	5702	5750	5431	5055	5487	4395
TOM (mg/L)	92	122	97	112	107	81
NH_3 (mg/L)	0.004	0.001	0.012	0.009	0.029	0.006
NH_4^+ (mg/L)	0.068	0.023	0.333	0.069	0.356	0.059
TAN (mg/L)	0.072	0.024	0.345	0.078	0.385	0.065
NO_2(mg/L)	0.044	0.059	0.017	0.037	0.044	0.147
Plankton (cells/L)	1,482,500	1,510,000	415,000	283,500	1,517,500	200,000
TB (CFU/mL)	58,000	10,000	110,000	125,000	140,000	16,000
TVC (CFU/mL)	4,200	600	120	450	9,510	1,400

Based on the data in Table 1, water quality responses during the blind feeding phase (DOC 4–24) showed relatively stable conditions. Alkalinity values ranged from 96 to 126 mg/L (Figure 1), while hardness was in the range of 4395–5750 ppm (Figure 2), which is above the SNI 8037:2014 standard; however, the results of the study by Srinivasan *et al.* (2025) showed hardness values ranging from 5196 to 6947 ppm, indicating that these values are still considered safe for intensive shrimp farming systems. Fluctuations in these two parameters remain relatively low, indicating that the water body's buffering capacity is still capable of maintaining system stability during the early maintenance phase, when shrimp biomass is still low.

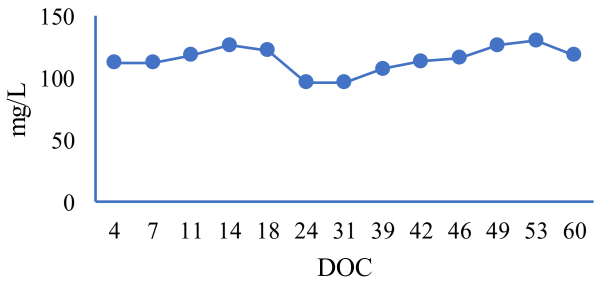

Figure1 . Alkalinity Dynamics at DOC 4–60

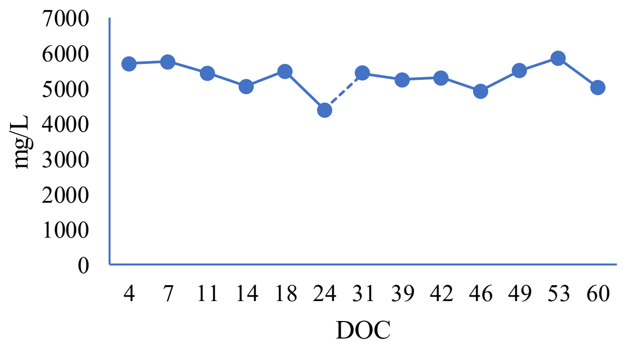

Figure2 . Hardness Dynamics at DOC 4–60

Organic matter and nitrogen compound parameters during the blind feeding phase also showed a response that remained under control. Total organic matter (TOM) values ranged from 81–122 mg/L (Figure 3), consistent with findings (Kurniawan *et al.,* 2025) reporting a TOM range of 80–120 mg/L in *Penaeus vannamei* shrimp ponds during the blind feeding phase. NH_3 concentrations were recorded as very low (0.001–0.029 mg/L). At the same time, NH_4^+ and TAN remained in the low to moderate range, with a maximum TAN value of

0.385 mg/L at DOC 18 (Figure 5), similar to the results of Ariadi *et al.* (2023), which showed TAN below 0.5 mg/L during the early stages of cultivation. Nitrite (NO_2) concentrations were relatively low in most observations, although an increase to 0.147 mg/L began to be observed at DOC 24. This condition indicates that the accumulation of metabolic waste and nitrogen transformation processes continues to a limited extent during the blind feeding phase (Ren *et al.*, 2019).

The biological response of the water column during this phase is indicated by fairly sharp fluctuations in plankton abundance, ranging from 200,000 to 1,517,500 cells/L. These fluctuations reflect the plankton community's initial adaptation to nutrient availability, as explained by Ariadi *et al.* (2019), who noted that during the blind feeding phase, plankton community dynamics are influenced by bacterial activity and changes in water quality. Total bacterial count (TBC) ranged from 10,000 to 140,000 CFU/mL (Figure 4), while total Vibrio count (TVC) was relatively low to moderate. Similar conditions were reported by Mandele *et al.* (2024), who found that bacterial and Vibrio abundance in vaname shrimp ponds showed a close relationship with phytoplankton density and water quality stability. Overall, the water quality response during the blind feeding phase still indicates relatively stable water conditions that support the early growth of vaname shrimp (Kurniawinata *et al.,* 2021).

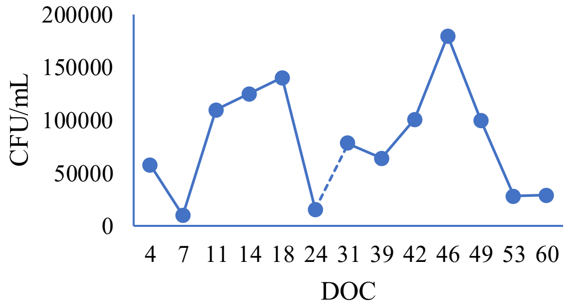

Figure 4 . TBC dynamics during DOC 4–60

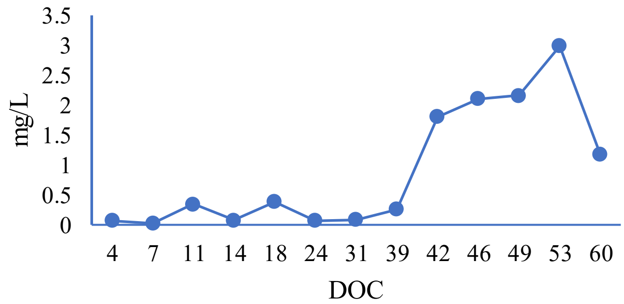

Figure 5 . TAN dynamics in DOC 4–60

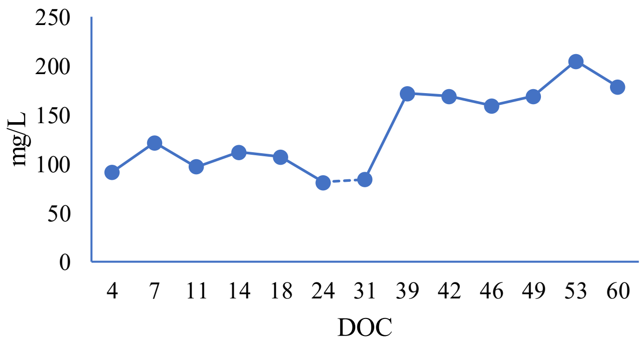

Figure 3 . TOM dynamics during DOC 4–60

Water Quality Response During the Post-Blind Feeding Phase (DOC 31–60)

The dynamics of physical, chemical, and biological water quality parameters in vaname shrimp ponds during the post-blind feeding phase (DOC 31–60), observed periodically throughout the rearing period, are presented in Table 2.

Entering the post-blind feeding phase (DOC 31–60), the data in Table 2 show a more dynamic response in water quality compared to the previous phase. Alkalinity values increased to reach 130 mg/L at DOC 53, while hardness showed a fairly sharp increase to 5857 mg/L. The increase and fluctuations in these two parameters indicate the accumulation of dissolved ions and increased biogeochemical activity in the pond water as shrimp biomass increases (Ariadi *et al.,* 2021).

Table 2. Water Quality Response in the Post-Blind Feeding Phase

Parameter	DOC						
	31	39	42	46	49	53	60
Alkalinity (mg/L)	96	107	113	116	126	130	118
Hardness (mg/L)	5421	5237	5300	4918	5500	5857	5034
TOM (mg/L)	84	172	169	159	169	205	179
NH_3 (mg/L)	0.008	0.02	0.32	0.16	0.34	0.39	0.19
NH_4^+ (mg/L)	0.075	0.240	1.483	1.942	1.827	2.597	1,521
TAN (mg/L)	0.083	0.26	1.806	2.102	2.163	2.985	1.711
NO_2(mg/L)	0.379	0.153	0.263	0.972	1.396	1.918	2.736
Plankton (cells/L)	150,000	4,192,500	3,215,000	2,292,500	3,415,000	1,902,500	1,330,000
TB (CFU/mL)	78,000	64,000	101,000	180,000	100,000	28,000	29,000
TVC (CFU/mL)	6,190	19,070	19,200	19,400	3,500	1910	2340

The biological response of the water during this phase is characterized by extremely high fluctuations in plankton abundance, with a maximum value reaching 4,192,500 cells/L at DOC 39 (Figure 6). The surge in plankton indicates high nutrient availability in the pond water, driven by increased organic matter. A similar phenomenon was reported by Mandele *et al.* (2024), who found a close relationship between phytoplankton density and increased organic matter content in intensive *Penaeus vannamei* shrimp ponds. TBC values also increased to 180,000 CFU/mL (Figure 4), while TVC showed significant fluctuations, with a maximum of 19,400 CFU/mL. This aligns with the study by Kurniawinata *et al.* (2021), which reported increases in total bacterial counts and Vibrio levels as dissolved nutrients and the feed decomposition phase progressed. These conditions reflect heightened microbial activity in response to the accumulation of organic matter and dissolved nutrients during the post-blind feeding phase (Huang *et al.,* 2024). Additionally, bottom sediment quality acts as a mediator for organic substances involved in various aquaculture activities, significantly influencing shrimp growth, water quality, and pathogen concentrations in the pond (Boyd & Phu, 2018; Chainark *et al.,* 2024).

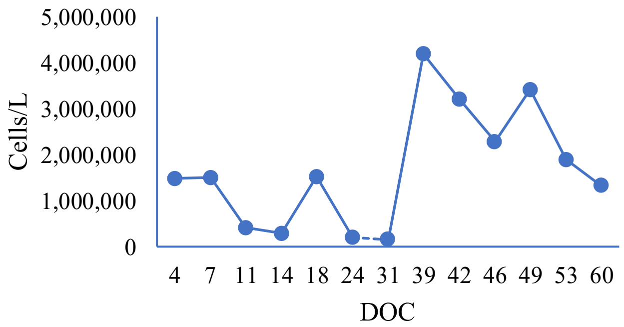

Figure 6 . Plankton dynamics at DOC 4–60

Water Quality Response to the Transition from Blind Feeding to Post-Blind Feeding

A comparison of water quality data between the blind feeding and post-blind feeding phases reveals a clear response to the transition in feeding management. During the blind feeding phase, most water quality parameters exhibit relatively small fluctuations and remain stable. Conversely, during the post-blind feeding phase, there is an increase in values and fluctuations of organic matter parameters, nitrogen compounds, and biological components of the water.

This water-quality response to the transition indicates that increased shrimp biomass and feeding intensity place greater ecological pressure on the pond's water system. Presenting the data in tabular form effectively illustrates temporal fluctuations in water quality, thereby serving as a basis for evaluating water quality management and adjusting vaname shrimp cultivation practices up to the DOC 60 stage.

Implications for Water Quality Management

Increases in organic matter and nitrogen compounds during the post-blind feeding phase indicate the need for adaptive adjustments to water quality management. Rising TOM levels exceeding 200 mg/L, along with spikes in TAN and nitrite, indicate high organic loading and unbalanced nitrification activity. These conditions can cause physiological stress in shrimp if not managed through feed management, aeration, and bioremediation (Mardiana *et al.,* 2024).

Regulating the C/N ratio through the addition of carbon sources, optimizing aeration to enhance ammonia oxidation, and appropriately applying probiotics can serve as mitigation strategies to suppress the accumulation of TAN and nitrite. Additionally, plankton management should be directed at maintaining stability and preventing excessive blooms, as extreme plankton fluctuations are associated with increased total bacteria and Vibrio (Ariadi *et al.,* 2024).

CONCLUSION

Based on the research results and discussion, it can be concluded that water quality responses in vaname shrimp ponds show clear differences between the blind-feeding phase and the post-blind-feeding phase. During the blind-feeding phase, water quality tends to be stable, with relatively low fluctuations in physicochemical and biological parameters, consistent with the small shrimp biomass and limited feeding intensity.

Upon entering the post-blind feeding phase, there is a significant increase in the accumulation of organic matter and nitrogen compounds, as indicated by rising TOM, TAN, and nitrite levels, as well as increased abundances of plankton, total bacteria, and Vibrio. This increase reflects greater ecological pressure from growing shrimp biomass and higher feeding intensity.

The transition from the blind feeding phase to the post-blind feeding phase is a critical period that significantly influences pond water quality dynamics. Therefore, adaptive water quality management is required, particularly through feed control, aeration optimization, and microbiological management, to maintain aquatic environmental stability and support the success of vaname shrimp cultivation up to DOC 60.

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