Case study

FEEDING MANAGEMENT FOR VANNAMEI SHRIMP GROWTH (*Litopenaeus vannamei*) AT THE BRACKISH WATER AND MARINE FISHERIES TECHNICAL SERVICE UNIT IN THE SOUTHERN REGION OF WEST JAVA, INDONESIA

ABSTRACT

Feed management plays a crucial role in the growth of vannamei shrimp and greatly influences aquaculture activities. The aim of this Field Work Practice is to equip students with practical skills and knowledge in the field of vannamei shrimp production and feed management at the Brackish Water and Southern Marine Fisheries technical service unit. The descriptive method was employed, and data collection involved gathering both primary and secondary data. The results of the feed management practices conducted at the technical service unit for Brackish Water and Marine Fisheries in the Southern Region revealed that feeding was carried out four times a day, using feed sizes 0 and 1. The initial feeding dose provided was 0.4 kg for 120,000 fries, followed by an additional 100 grams of feed per day for shrimp at DOC-30 stage. The determination of feeding parameters followed the index calculation set by the technical service unit.

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Keywords: aquaculture, feed, management, shrimp, vannamei

1. INTRODUCTION

Brackish Water and Southern Marine Fisheries located in Pangandaran, West Java, Indonesia. This gove

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agency serves as one of the technical service units under the Department of Fisheries and Maritime Affairs of West Java Province. It specializes in the production of vannamei shrimp and tiger prawn seeds, while also conducting demonstration activities for vannamei shrimp enlargement at various locations, including the Cibalong Installation in Garut Regency, as well as vannamei shrimp demonstration farm in Tasikmalaya Regency and Garut Regency. The total area of this unit spans approximately 2.5 hectares, with 1 hectare dedicated to office buildings, official housing for staff, and rearing ponds. Situated in close proximity to the estuary on the east, neighboring settlements on the west, and the ocean to the north and south, it also shares boundaries with the tourist area of the east coast of Pangandaran. As a technical service unit for Brackish Water and Marine Fisheries in the Southern Region, its responsibilities encompass the management of Brackish Water and Sea Fisheries in the area, evaluation and reporting of technical service units, and other functions aligned with its core tasks.

Vannamei shrimp is a non-oil and gas export product that has significantly contributed to the country's foreign exchange earnings. Over the years, the market demand for vannamei shrimp has been increasing due to its nutritional value and status as a food source [1].It is highly sought after both domestically and internationally, making it a commodity with high economic value and superior nutritional content, which has led to its rapid cultivation [2]

Vannamei shrimp is a high-value export commodity, particularly in the shrimp industry, and it experiences high demand in both local and international markets [3]. According to [4], vannamei shrimp possesses several advantages, including its disease susceptibility, ease of cultivation, and high productivity, all of which contribute to its popularity and demand. Additionally, vannamei shrimp exhibit fast growth rates even with relatively low feed protein yields and show tolerance to

varying water temperatures, oxygen levels, and salinity in low-intensity farming activities. However, these cultivation practices can have significant environmental impacts, affecting the physical, chemical, and biological factors of the ponds [5]. The lack of environmental stability and the resulting damage to the surrounding ecosystems pose challenges to vannamei shrimp production and make the cultivation vulnerable to diseases [6].

In aquaculture activities, feed plays a crucial role in determining the success of vannamei shrimp farming. It is a vital component that significantly impacts the overall outcome [7]. The use of feed in aquaculture is of utmost importance as it constitutes a significant portion of the production cost. Improving the nutritional composition and employing efficient feeding practices can enhance vannamei shrimp production, reduce feed procurement costs, and minimize waste. Therefore, a comprehensive understanding of feed nutrition, the nutritional requirements of vannamei shrimp, and proper feed management for each growth stage are essential [8].

Feed management holds great significance in aquaculture activities, especially in the cultivation of vannamei shrimp, from larvae to adults. Feeding practices must align with the nutritional content of the feed to ensure optimal growth of *Litopenaeus vannamei*. Furthermore, feed efficiency plays a pivotal role in the overall success of vannamei shrimp cultivation activities. The aim of this paper is to enhance knowledge about vannamei shrimp commodities and gain a deeper understanding of the feed management practices employed in the cultivation of vannamei shrimp by the Brackish Water and Southern Marine Fisheries technical service unit.

2. MATERIAL AND METHODS

This activity was carried out at the technical service unit for Brackish Water and Marine Fisheries in the Southern Region of West Java Province, which is located in Pangandaran Village and District, Pangandaran Regency. The research approach employed in this activity is the descriptive method, which aims to provide a comprehensive description and interpretation of the subject under investigation [9]. Through the descriptive method, systematic, realistic, and accurate descriptions or depictions are created based on sample or population data [10]. Data collection for this activity encompasses the following techniques:

1) Primary Data: This involves gathering data through interviews, observations, and engaging in discussions with leaders, field supervisors, employees, and staff members of the Brackish Water and Marine Fisheries technical service unit in the Southern Region.
2) Secondary Data: This entails utilizing data that has been previously examined and collected by other parties in relation to the research problem, as well as data obtained through library research. The secondary data collected for this activity includes documentation from the conducted activities, data from the Brackish Water and Southern Marine Fisheries technical service unit, recorded information during the activity, and relevant studies conducted by other parties.

The equipment utilized in this activity comprises barrels, dippers, buckets, containers or Styrofoam, stirrers, feed spoons, and analytical scales. These tools were employed to facilitate the various tasks involved. Similarly, a range of materials was utilized during the activity, including molasses, yeast, SP-36 (a substance for producing liquid organic fertilizer), ZA, probiotics, milk, fresh water, feed, vitamin C, herbal powders, amino acids, and Bio-Nutrients. These materials were essential for carrying out the required processes and achieving the intended outcomes.

The activity can be divided into two stages: the production of liquid organic fertilizer and the fermentation of feed. The process of creating Liquid Organic Fertilizer (LOF) involves adding the required amount of water to a vat, dissolving and mixing all the ingredients into the water-filled vat, and stirring the mixture thoroughly. The vat is then tightly sealed with plastic and rubber, left to stand for three days, and the fertilizer is ready for use. In the feed fermentation stage, water is added to a barrel as needed. All the ingredients, except for the feed, are placed into the water-filled barrel and stirred until dissolved, creating a solution ready for use. The feed is measured and placed in a bucket, followed by the addition of the solution in a ratio of 5:1. Thorough stirring is carried out to ensure the success of the fermentation process, and the feed barrel is filled. The barrel is tightly closed and left to stand for 3-5 days, allowing the feed to ferment. After this period, the feed is ready for use.

3. RESULTS AND DISCUSSION

3.1 Vannamei Shrimp Feeding Behavior

Vannamei shrimp are commonly recognized as omnivorous scavengers. However, upon examining the contents of their intestines, research has revealed that vannamei shrimp exhibit carnivorous behavior, consuming various small crustaceans and worms. Their diet includes plankton, both phytoplankton, and zooplankton, as well as benthic algae, detritus, and other organic matter. Contrasting vannamei shrimp with tiger prawns, their food preferences and feeding habits differ. Vannamei shrimp are known for their voracious appetite and require lower protein levels, approximately ranging from 32% to 38%. On the other hand, tiger prawns typically require an average protein level of around 35% to 53% [11]. The protein content plays a significant role in the growth of the cultivated shrimp. Research conducted on white shrimp has indicated that their diet primarily consists of small crustaceans, amphipods, and polychaeta [12]. White shrimp are nocturnal creatures, actively engaging in feeding activities during the night. They are attracted to food sources containing organic compounds such as protein, amino acids, and fatty acids. Using their walking legs, the shrimp grasp the food and bring it into their mouths. If the consumed feed is large, it undergoes chemical digestion facilitated by the

Comment [U3]: If this is a research, materials and methods should be in subsection for ease of understanding. 2.1. Study Area. 2.2 Collection of Expetrimental organisms. 2.3 Feeding regime. 2.4. determing specific growth rate and each management level. 2.5 feed type. Is it formulated or commercial feed. State the nutritional content in each case. This is growth research, shoul show parameters like lenth, weigh gain based on the different feeding management administer. It is expected that recommendations be made which feeding management practice should be adopted for optimal growth.

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maxillipeds in their mouths [13].

3.2 Feed Management

Feed management plays a crucial role in aquaculture activities as it significantly impacts the growth of vannamei shrimp. In fact, feed production alone can account for 50% or more of the operational costs in shrimp farming. To achieve optimal results, implementing an effective feed management program is essential [8]. The primary objective of feed management is to enhance the quality of feed, which is a key factor in supporting shrimp growth. Given that feed constitutes a significant portion of the budget, feed efficiency becomes paramount in determining the success of cultivation.

Successful cultivation heavily relies on feed, which can represent up to 50% of the total costs [14]. Feeding practices can be categorized into three types: underfeeding, optimum feeding, and overfeeding. Underfeeding results in slow growth and high feed conversion rates, although water quality remains unaffected. Overfeeding leads to rapid initial growth, but it negatively impacts water quality, increases feed conversion rates, and makes shrimp more susceptible to disease outbreaks. Optimum feeding, on the other hand, has several positive impacts on shrimp farming, including enhanced growth, maintained water quality, and improved feed efficiency [15].

According to [16], feed management involves providing feed throughout one cultivation cycle. This approach serves as a critical factor in determining the success of shrimp farming, as it is closely tied to overall production costs. [16] also outlines a comprehensive feeding program that includes selecting the appropriate feed type, establishing feeding schedules, and regularly monitoring feed intake.

3.2.1 Feed type and code

The following Table 1 is vannamei shrimp feed based on age according to the Indonesian national standard number 01-7246-2006.

Table 1. Vannamei shrimp feed criteria

Shrimp Age (days)	Shrimp Weight (g)	Feed Form	Feed Number	Feed Dosage (%)	Daily Feed Frequency
<15	0.1-1.0	Powder	0	15-75	3
16-30	1.1-2.5	Crumble	1+2	15-25	4
31-45	2.6-5.0	Crumble	2	10-15	5
46-60	5.1-8.0	Pellet	2+3	7-10	5
61-75	8.1-14.0	Pellet	3	5-7	5
76-90	14.1-18.0	Pellet	3+4	3-5	5
91-105	18.1-20.0	Pellet	4	3-5	5
106-120	21.1-22.5	Pellet	4	2-4	5

Shrimp feed plays a vital role in pond-based aquaculture activities and is specifically tailored based on size and form. The feed comes in the form of powder, crumble, and pellets, with sizes customized to match the shrimp's developmental stages. The variation in feed is closely linked to the shrimp's age, which correlates with the size of their mouths. At the technical service unit, Evergreen shrimp feed, specifically types 9220, 9221, and 9222, is utilized. Feeding takes place four times a day, adhering to a schedule of 07.00, 11.00, 15.00, and 19.00 according to Western Indonesian Time.

3.2.2 Nutritional Content of Feed

The nutritional composition of feed plays a crucial role in meeting the energy requirements of Vannamei shrimp, enabling their growth and reproductive activities. The availability of adequate nutrition in shrimp feed is vital for their overall development. Typically, the feed comprises protein, which accounts for 30% to 50% of the total nutritional content, serves as a significant energy source, and fulfills other essential functions. In comparison to tiger shrimp, the protein content in Vannamei shrimp feed is relatively lower. White shrimp, for instance, necessitate feed with a protein content ranging from 20% to 35% [17].

Table 2. Nutritional content of vannamei shrimp feed

Feed Code	Nutrition Content				
	Protein (min.)	Crude Fiber (max.)	Fat (min.)	Moisture Content (max.)	Ash (max.)
932P	36.0%	4.0%	6.0%	12.0%	15.0%
3223S	>33.0%	<4.0%	>6.0%	<12.0%	<12.0%

3.2.3 Feed Storage Conditions

Proper feed storage is essential to maintaining its shelf life and preserving its nutritional value. Exposure to water can

lead to a reduction in nutritional content, a loss of aroma, and the growth of mold. Additionally, direct sunlight can degrade the vitamin C present in the feed. To ensure optimal storage, it is important to store feed in a dry area with adequate air circulation, protecting it from moisture and sunlight [18]. At the technical service unit, specific requirements are in place for feed storage. These include:

1) The storage area must be dry and well-ventilated to prevent moisture buildup.
2) Ensure the storage area is protected from pests such as poultry, insects, and rodents.
3) Safeguard the feed from exposure to water and direct sunlight.
4) Avoid stacking more than 10 sacks of feed to prevent crushing or damage. By adhering to these guidelines, the technical service unit ensures that the feed remains in optimal condition, maximizing its effectiveness in supporting the growth and health of the shrimp.

Fig. 1. Feed storage warehouse at the Southern Region Brackish Water and Sea Development technical service unit

3.2.4 Feeding

To prevent cannibalism, feeding should be adjusted according to the population's weight in the pond. After each feeding session, the shrimp's appetite and feed consumption are evaluated using an *anco* net control. This helps determine the appropriate amount of feed for the next feeding session, and the results are documented for future reference. Several factors should be considered during feeding, including the quantity of feed used, feeding timing, and frequency. These considerations ensure that the feed is distributed evenly, promoting proportional growth and efficient utilization of feed resources, leading to optimal shrimp production. The steps for feeding vannamei shrimp are as follows:

1) Weigh the feed according to predetermined calculations.
2) Spread the feed evenly throughout the pond. If the feed quantity does not meet the shrimp's needs, add water and homogenize the mixture before distribution. By following these feeding procedures, the UPTD ensures that the vannamei shrimp receive the appropriate amount of feed, supporting their growth and overall health.

The Brackish Water and Marine Fisheries technical service unit in the Southern Region employs the use of liquid organic fertilizer (LOF). This tried-and-tested organic fertilizer has been utilized for several years. The use of LOF offers several advantages, such as facilitating the fermentation of feed, making it more palatable for vannamei shrimp, and providing protection against potential diseases. Moreover, LOF aids in accelerating the growth process of shrimp. Compared to an unprocessed protein found in conventional fertilizers, LOF enables shrimp to rapidly absorb amino acids, resulting in faster growth rates. This technology serves as a beneficial tool for the Southern Territory Brackish Water and Marine Fisheries technical service unit in cultivating vannamei shrimp, exhibiting similar benefits and applications to probiotics. As noted by [19], the inclusion of probiotics helps maintain a balanced distribution of beneficial bacteria, ensuring a 100% success rate in the shrimp's life cycle. Additionally, feed enriched with probiotics contributes to increased shrimp survival rates [20] and strengthens their immune system against bacterial infections [21].

Fig. 2. Shrimp feeding at the Southern Region Brackish Water and Sea Development technical service unit

Before producing LOF, probiotics are prepared as the primary component. These probiotics undergo a minimum storage period of 21 days. Probiotics consist of various strains of bacteria. Once the bacteria are ready, the manufacturing process for liquid organic fertilizer commences, utilizing ingredients such as molasses (7 liters), SP 36 (1.8 kg), ZA (6 kg), starter (3 liters), yeast (12 grains), Yakult (8 bottles), milk (0.7 kg), and freshwater.

Fig. 3. Liquid organic fertilizer production process at the Southern Region Brackish Water and Sea Development technical service unit

Liquid organic fertilizer (LOF) is produced through the fermentation of milk, urea, TSP, molasses, and yeast (Saccharomyces cerevisiae). The utilization of LOF in technical service units serves multiple purposes, including fermenting feed ingredients, stabilizing natural feed (zooplankton), and maintaining optimal water quality. The living yeast present in LOF generates enzymes such as amylase, lipase, and protease, which aid in breaking down complex molecules into simpler ones, facilitating the digestion of food substances in the shrimp's digestive organs [22]. Field data indicates several advantages of using LOF, including accelerated shrimp growth, higher survival rates, improved resilience to environmental conditions, and enhanced resistance against pests and diseases.

The resulting LOF can be utilized as an ingredient in the production of a plankton feed mixture and feed fermentation. The manufacturing process involves combining the ingredients and allowing them to ferment for 3-4 days. Fermented shrimp feed is highly beneficial for shrimp growth and typically comprises the following components: feed (25 kg), molasses (1.25 liters), fresh water (15 liters), LOF (5 liters), Vitamin C (10 g), herbal powder (20 g), amino acids (0.1 liters), and bionutrients (0.033 liters).

Fig. 4. Feed fermentation process at the Southern Region Brackish Water and Sea Development technical service unit

3.2.5 Feeding Program

The *anco* feed stored for vannamei shrimp is maintained at 1.5% of the total feed stocked. The purpose of using *anco* in shrimp farming techniques is solely to determine if the feed has been consumed, rather than as a factor for increasing

the feed dosage. The feeding dosage for Vannamei shrimp is determined using an index range of 0.4 to 0.8. The following formula is utilized to calculate the feeding dosage for vannamei shrimp in the technical service unit:

Feeding Dosage = DOC x Index x Number of Stockings

Explanation:
DOC: Day
Index: Utilize an Index of 0.4
Number of Stockings: Number of fries stocked (120,000)

In this technical service unit, feeding is determined using the above formula with an index of 0.4. This feeding determination method is similar to Blind feeding, which is a program based on estimated feeding for the first month. This program is implemented from DOC-1 to DOC-30, as no sampling has been conducted during this period. The amount of feed utilized based on the DOC index calculation formula from day 1 to day 30 is presented in the Table 3 below.

Table 3. Dosage of vannamei shrimp feeding

Age (days)	Time				Feed/Day	Cumulative Feed
	07.00 AM	11.00 AM	03.00 PM	07.00 PM		
1.	0.1	0.1	0.1	0.1	0.4	0.4
2.	0.2	0.2	0.2	0.2	0.8	1.2
3.	0.3	0.3	0.3	0.3	1.2	2.4
4.	0.4	0.4	0.4	0.4	1.6	4
5.	0.5	0.5	0.5	0.5	2.0	6
6.	0.6	0.6	0.6	0.6	2.4	8.4
7.	0.7	0.7	0.7	0.7	2.8	11.2
8.	0.8	0.8	0.8	0.8	3.2	14.4
9.	0.9	0.9	0.9	0.9	3.6	18
10.	0.10	0.10	0.10	0.10	4.0	22
11.	0.11	0.11	0.11	0.11	4.4	26.4
12.	0.12	0.12	0.12	0.12	4.8	31.2
13.	0.13	0.13	0.13	0.13	5.2	36.4
14.	0.14	0.14	0.14	0.14	5.6	42.2
15.	0.15	0.15	0.15	0.15	6	48.2
16.	0.16	0.16	0.16	0.16	6.4	54.6
17.	0.17	0.17	0.17	0.17	6.8	61.4
18.	0.18	0.18	0.18	0.18	7.2	68.2
19.	0.19	0.19	0.19	0.19	7.6	75.8
20.	0.20	0.20	0.20	0.20	8	83.8
21.	0.21	0.21	0.21	0.21	8.4	92.2
22.	0.22	0.22	0.22	0.22	8.8	101
23.	0.23	0.23	0.23	0.23	9.2	110.2
24.	0.24	0.24	0.24	0.24	9.6	119.8
25.	0.25	0.25	0.25	0.25	10	129.8
26.	0.26	0.26	0.26	0.26	10.4	140.2
27.	0.27	0.27	0.27	0.27	10.8	151
28.	0.28	0.28	0.28	0.28	11.2	162.2
29.	0.29	0.29	0.29	0.29	11.6	173.8
30.	0.30	0.30	0.30	0.30	12	185.8

4. CONCLUSION

Feed management activities at the Brackishwater and Marine Fisheries Technical Service Unit in the Southern Region encompass four feedings per day, utilizing Evergreen feed with sizes 0 and 1. The initial feed dosage provided is 0.4 kg for 120,000 fish fries, with an additional 100 grams of feed per day until reaching DOC-30 for the shrimp. This feeding determination follows the calculation set by the technical service unit. The feed is distributed evenly along the pond's edge during the feeding process. Prior to feeding, the feed undergoes fermentation, and a culture of liquid organic fertilizer and plankton fertilizer is prepared to support vannamei shrimp farming activities. It is crucial to prioritize proper feed storage to ensure its preservation and safeguard it against bacteria and fungi. Additionally, adhering to the feeding schedule and conducting regular siphoning are essential to maintaining water quality in aquaculture activities.

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