

## FEEDING MANAGEMENT AND BROODSTOCK PERFORMANCE OF BARRAMUNDI (*Lates calcarifer*): A CASE STUDY FROM TELUK BUO HATCHERY, INDONESIA

### Manajemen Pemberian Pakan dan Performa Induk Ikan Kakap Putih (*Lates calcarifer*): Studi Kasus di Hatchery Teluk Buo, Indonesia

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#### ABSTRACT

Barramundi (*Lates calcarifer*) is a high-value aquaculture species whose productivity strongly depends on the quality of broodstock management. In many government-operated hatcheries in Indonesia, feeding practices rely heavily on locally available trash fish without standardized supplementation, potentially affecting broodstock performance and water quality. This study aimed to document and evaluate feeding management practices for barramundi broodstock at the Teluk Buo Hatchery, West Sumatra, Indonesia. A descriptive case study was conducted over a one-month period through direct observation of feeding schedules, broodstock biometric data, and water quality monitoring. Broodstock were fed trash fish and squid at 3% biomass twice daily, supplemented with vitamins C, B-complex, and E on a scheduled basis. The broodstock ranged from 1.5–1.8 kg (males) and 5.7–6.5 kg (*females*), meeting recommended criteria for reproductive readiness. Water quality remained within optimal ranges (temperature 30.2–31.8 °C, salinity 30–33 ppt, pH 7–8, dissolved oxygen 5.5–6.3 mg/L), in compliance with national standards. These results indicate that structured feeding management contributes to broodstock health, gonadal maturation, and environmental stability. The findings provide a practical, replicable model for coastal hatcheries operating under resource-limited conditions and highlight the need for future studies addressing reproductive performance, economic feasibility, and sustainable feed alternatives.

**Keywords:** Barramundi, broodstock management, feeding strategy, trash fish, hatchery sustainability

#### ABSTRAK

Ikan kakap putih (*Lates calcarifer*) merupakan komoditas akuakultur bernilai tinggi yang produktivitasnya sangat bergantung pada kualitas manajemen induk. Di banyak hatchery pemerintah di Indonesia, praktik pemberian pakan masih mengandalkan ikan rucah lokal tanpa standar suplementasi yang jelas, sehingga berpotensi memengaruhi performa induk dan kualitas air. Penelitian ini bertujuan untuk mendokumentasikan dan mengevaluasi praktik manajemen pakan induk kakap putih di Hatchery Teluk Buo, Sumatera Barat, Indonesia. Studi kasus deskriptif dilakukan selama satu bulan melalui observasi langsung terhadap jadwal

pemberian pakan, data biometrik induk, dan pemantauan kualitas air. Induk diberi pakan ikan rucah dan cumi-cumi sebanyak 3% biomassa dua kali sehari, serta disuplementasi dengan vitamin C, B kompleks, dan E sesuai jadwal rutin. Induk jantan memiliki bobot 1,5–1,8 kg dan betina 5,7–6,5 kg, sesuai kriteria kesiapan reproduksi. Kualitas air tetap berada dalam kisaran optimal (suhu 30,2–31,8 °C; salinitas 30–33 ppt; pH 7–8; DO 5,5–6,3 mg/L), sesuai standar nasional. Hasil penelitian menunjukkan bahwa manajemen pakan terstruktur mendukung kesehatan induk, kematangan gonad, dan stabilitas lingkungan. Temuan ini menawarkan model praktis yang dapat direplikasi pada hatchery pesisir dengan keterbatasan sumber daya, serta menekankan pentingnya penelitian lanjutan mengenai performa reproduksi, kelayakan ekonomi, dan alternatif pakan berkelanjutan.

**Kata Kunci:** kakap putih, manajemen induk, strategi pakan, ikan rucah, keberlanjutan hatchery

## INTRODUCTION

Aquaculture has emerged as one of the fastest-growing food production sectors globally, playing a crucial role in sustaining food security, economic growth, and the livelihoods of coastal communities. In Indonesia, marine aquaculture is recognized as a strategic industry with considerable potential, given the country's extensive coastal waters and biodiversity. Among the high-value marine species, barramundi (*Lates calcarifer*), also known as Asian seabass, has received significant attention due to its rapid growth, wide salinity tolerance (euryhaline), and catadromous life cycle, which allow flexible farming in marine, brackish, and freshwater environments (Windarto *et al.*, 2019; Lesmana *et al.*, 2025). This species not only contributes substantially to domestic markets but is also an important commodity for international trade. Ensuring the sustainability and productivity of barramundi aquaculture relies heavily on the availability of high-quality broodstock, as the performance of broodstock directly affects the production of viable eggs, larvae, and ultimately, the success of hatchery operations. Within this context, feeding management has been widely recognized as a critical factor influencing broodstock health, gonadal maturation, and reproductive performance, underscoring the importance of developing efficient and sustainable feeding strategies in hatchery systems (Boyd *et al.*, 2020; Pandey, 2022; Bella & Lesmana, 2025).

Despite its economic importance, the effective management of barramundi broodstock remains a persistent challenge in hatchery operations across Indonesia. In many government-operated hatcheries, broodstock are primarily fed on locally available trash fish, often without standardized feeding protocols or adequate supplementation strategies. Such practices can lead to inconsistent nutrient intake, poor gonadal development, and increased susceptibility to stress and disease (Migaud *et al.*, 2013). Moreover, inefficient feeding management contributes to uneaten feed accumulation, which in turn deteriorates water quality—an essential factor for maintaining broodstock health and reproductive performance (Rahman, 2017; Khan *et al.*, 2019). While commercial aquaculture systems have increasingly emphasized formulated diets and advanced nutritional approaches, there is still a lack of systematically documented evidence on how feeding practices are implemented in regional hatcheries, particularly those managed at the provincial level. This lack of empirical data not only limits the optimization of broodstock performance but also hampers the development of replicable models for sustainable hatchery management in Indonesia.

This study aims to systematically document and evaluate the feeding management practices applied to barramundi (*Lates calcarifer*) broodstock at the Teluk Buo Hatchery in West Sumatra, Indonesia. Specifically, it seeks to describe the feeding regimen involving trash fish and squid as the primary dietary sources, alongside scheduled supplementation with vitamins C, B-complex, and E, which are routinely applied to enhance broodstock health and reproductive readiness. Furthermore, the study intends to assess how these feeding practices

align with recommended biomass-based feeding rates and how they influence the maintenance of water quality within broodstock holding systems. By presenting a comprehensive case study, this research is expected to generate practical insights into broodstock performance under existing hatchery conditions and provide evidence-based recommendations that could strengthen the sustainability and efficiency of barramundi hatchery operations in similar coastal environments.

Although a growing body of literature has addressed various aspects of barramundi aquaculture, most studies have concentrated on larval rearing techniques, grow-out performance, or the application of formulated feeds in intensive production systems. In contrast, the nutritional management of broodstock, particularly under conditions typical of government-operated hatcheries in Indonesia, has received comparatively little scholarly attention. Existing reports rarely provide systematic documentation of how trash fish and supplemental vitamins are applied in practice, nor do they explore the implications of such feeding regimes for gonadal maturation, broodstock health, and water quality maintenance. Moreover, published studies are often based on controlled experimental trials, leaving a gap in empirical evidence derived from real-world hatchery settings where resource availability, management capacity, and local ecological conditions may significantly influence outcomes. This lack of applied, context-specific knowledge creates a critical gap that hinders the development of standardized and replicable feeding strategies for broodstock management in coastal hatcheries across Southeast Asia.

This study contributes to filling the identified knowledge gap by presenting a detailed case study on broodstock feeding management of barramundi (*Lates calcarifer*) in a government-operated hatchery located in Teluk Buo, West Sumatra, Indonesia. Unlike previous research that has largely emphasized experimental trials or grow-out systems, this work documents real-world feeding practices that integrate locally available trash fish and squid with scheduled vitamin supplementation (C, B-complex, and E) to support broodstock health and reproductive performance. By linking feeding strategies with water quality maintenance—demonstrated through parameters such as dissolved oxygen (5.5–6.3 mg/L), salinity (30–33 ppt), and pH (7–8), all within the range of national standards—this research highlights the dual role of feeding management in promoting both gonadal maturation and environmental sustainability. The novelty of this study lies in its empirical evidence from a coastal hatchery setting, offering a practical, replicable model for optimizing broodstock management under resource-limited conditions. These insights are expected to inform not only local hatchery operations but also broader regional strategies for strengthening the sustainability and competitiveness of barramundi aquaculture across Southeast Asia.

## RESEARCH METHOD

### Study Site and Duration

The study was conducted over a four-week period, from January to February 2024, at the UPTD Balai Perikanan Budidaya Air Laut dan Payau (BPBALP) Teluk Buo, Padang, West Sumatra, Indonesia. The hatchery is a government-operated facility that specializes in the breeding and culture of marine and brackishwater species, including barramundi (*Lates calcarifer*). The facility is equipped with broodstock holding tanks, water reservoir systems, aeration units, and supporting infrastructure necessary for broodstock management.

### Research Approach

The study employed a descriptive case study approach, aimed at documenting and evaluating existing feeding management practices and their implications for broodstock performance and water quality. The approach combined direct observation, structured

documentation of hatchery protocols, and secondary data review to capture both technical and practical aspects of broodstock management.

### **Experimental Procedures**

Broodstock were maintained in circular concrete tanks with a capacity of approximately 85 tons and a depth of 3 meters, equipped with aeration systems to maintain dissolved oxygen levels. Prior to stocking, tanks were cleaned and disinfected using chlorine (150 ppm) to reduce pathogen load. **Broodstock Selection:** Male broodstock ranged from 1.5–1.8 kg in weight and 45–60 cm in length, while female broodstock ranged from 5.7–6.5 kg and 100–120 cm in length. Selection was based on gonadal maturity indicators, such as abdominal swelling and genital coloration in females, and milt release upon gentle abdominal pressure in males. **Feeding Management:** Broodstock were fed twice daily (morning and afternoon) with a diet consisting of fresh trash fish (kuniran and tongkol) and squid at a feeding rate of 3% of total biomass. To enhance reproductive performance, vitamin supplementation was provided following a routine schedule: Vitamin E once every seven days, Vitamin C once every six days, and Vitamin B-complex once every five days. Feed was prepared by cutting trash fish into portions, rinsing with seawater, and storing in a freezer prior to feeding to preserve freshness. **Water Quality Management:** Water was replaced every two days to prevent feed residues and metabolic waste accumulation. Continuous aeration was supplied to maintain dissolved oxygen levels.

### **Data Collection**

Data were collected through a combination of: **Direct observation** of feeding practices, broodstock behavior, and hatchery protocols; **Measurement of broodstock biometric parameters**, including body weight and length, recorded during routine handling and selection; **Water quality monitoring**, including temperature, salinity, dissolved oxygen, and pH, measured using standard hatchery equipment (DO meter, refractometer, thermometer, and pH test kits). Recorded water quality values ranged between 30.2–31.8 °C (temperature), 30–33 ppt (salinity), 7–8 (pH), and 5.5–6.3 mg/L (DO), all within the acceptable range of national standards (SNI 6145.4-2014).

### **Data Analysis**

All data were tabulated and analyzed using descriptive statistics. Feeding schedules, feed types, and supplementation regimes were compared against standard broodstock management practices reported in the literature. Water quality data were evaluated in relation to established thresholds for barramundi culture to determine whether the hatchery environment supported broodstock health and gonadal maturation. The results were then synthesized to provide insights into the effectiveness and sustainability of the feeding management practices at the Teluk Buo Hatchery.

## **RESULT**

The feeding management of barramundi (*Lates calcarifer*) broodstock at the Teluk Buo Hatchery followed a structured routine combining fresh trash fish, squid, and scheduled vitamin supplementation. Trash fish, primarily kuniran and tongkol, were provided twice daily at a feeding rate equivalent to 3% of total biomass. Squid was offered as a supplemental feed every third day, enhancing dietary diversity and protein quality. Vitamin supplementation was administered according to a fixed schedule: Vitamin E once every seven days, Vitamin C once every six days, and Vitamin B-complex once every five days. Figure 1 illustrates the regularity and distribution of the feeding and supplementation events throughout the observation period.

Broodstock biometric data indicated that selected males ranged between 1.5–1.8 kg in body weight and 45–60 cm in length, while females ranged between 5.7–6.5 kg in body weight and 100–120 cm in length. These values are consistent with established criteria for broodstock selection, suggesting that feeding and supplementation strategies effectively supported gonadal development. Water quality parameters remained within optimal ranges throughout the study period, with temperature between 30.2–31.8 °C, salinity between 30–33 ppt, pH between 7–8, and dissolved oxygen between 5.5–6.3 mg/L, all of which complied with the Indonesian National Standard (SNI 6145.4-2014). The maintenance of stable water quality was largely attributed to careful feeding management that minimized feed waste and regular water exchange conducted every two days.

These results highlight that broodstock at the Teluk Buo Hatchery were maintained under conditions that not only adhered to recommended biomass-based feeding practices but also incorporated nutritional supplementation designed to enhance reproductive readiness. The consistency of feeding, coupled with effective environmental management, provided a foundation for sustaining broodstock health and performance.

Table 1. Feeding management schedule for barramundi (*Lates calcarifer*) broodstock at Teluk Buo Hatchery (January–February 2024), showing regular feeding with trash fish and squid, along with scheduled supplementation of vitamins E, C, and B complex.

Feed Type	Frequency	Feeding Rate
Trash fish	2× daily	3% biomass
Squid	Every 3 days	Supplement (10 times giving)
Vitamins	Scheduled	Supplement
• Vitamin E	Every 7 days	Supplement (7 times giving)
• Vitamin C	Every 6 days	Supplement (6 times giving)
• Vitamin B complex	Every 5 days	Supplement (5 times giving)

## DISCUSSION

The results of this study demonstrate that the feeding management practices implemented at the Teluk Buo Hatchery were consistent with established principles of broodstock nutrition and contributed to maintaining stable broodstock performance. The routine provision of trash fish at 3% of total biomass, supplemented periodically with squid, ensured a balanced protein intake that supported both somatic maintenance and gonadal maturation. The integration of vitamin supplementation—Vitamin E, C, and B-complex—provided additional reproductive and immunological benefits, reinforcing findings from previous studies that emphasize the importance of micronutrients in enhancing broodstock fecundity and resilience (Tahapari *et al.*, 2019; Setiadharna *et al.*, 2016). Moreover, the maintenance of water quality within optimal ranges throughout the study period reflects the effectiveness of feeding management in minimizing feed waste and preventing nutrient loading in the rearing environment. These observations align with prior reports that highlight the strong relationship between feed utilization efficiency and water quality stability in broodstock culture systems (Cahyani & Hafiludin, 2022; Aga, 2016). Collectively, these findings confirm that carefully structured feeding routines can serve as a cornerstone for successful barramundi broodstock management, even under the resource constraints typical of government-operated hatcheries.

The findings from this case study also provide valuable insights into both theoretical and practical dimensions of barramundi broodstock management. From a theoretical perspective, the results reinforce the established understanding that biomass-based feeding rates are critical in optimizing nutrient utilization and minimizing environmental impacts in broodstock culture (Harris, 2010). The observed alignment between feeding practices and stable water quality

conditions lends further empirical support to models that link feed efficiency with ecological sustainability in hatchery systems. From a practical standpoint, the study highlights that the integration of locally available trash fish with targeted vitamin supplementation represents a feasible and cost-effective strategy for government-operated hatcheries, where financial and technological resources are often limited. This approach not only sustains broodstock health and reproductive readiness but also offers a replicable model that can be adopted by other coastal hatcheries across Indonesia and Southeast Asia (Pandey, 2022; Rahman *et al.*, 2016; Aji, 2012). Thus, the outcomes of this research extend beyond site-specific implications and contribute to broader efforts aimed at improving the sustainability and competitiveness of barramundi aquaculture in the region.

While the study provides meaningful insights into the feeding management of barramundi broodstock, several limitations should be acknowledged when interpreting the findings. First, the research design was descriptive rather than experimental, and therefore lacked control treatments that would allow for direct comparisons between different feeding regimes or supplementation strategies. Second, the parameters measured were largely restricted to broodstock biometric data, feeding routines, and water quality indicators; reproductive outputs such as fecundity, fertilization rate, and larval survival were not assessed, which limits the ability to fully evaluate the reproductive effectiveness of the feeding strategy. Third, the observation period was relatively short—approximately one month—and thus may not capture seasonal variations in broodstock performance or environmental conditions. Finally, as the data were derived from routine hatchery practices, external variables such as broodstock origin, prior nutritional history, and environmental fluctuations were not fully controlled (Ross & Zaidi, 2019). These limitations suggest that while the results provide a valuable case study, they should be considered as preliminary evidence requiring further validation through controlled, long-term investigations (Pandey, 2022)

Building on these findings, future research should adopt more rigorous experimental designs to compare the effects of different feeding strategies, such as trash fish, formulated diets, or their combinations with specific vitamin or micronutrient supplementation, on broodstock reproductive performance (Zuo *et al.*, 2022). Longitudinal studies extending across multiple spawning seasons are also recommended to capture temporal variability and to evaluate the consistency of feeding outcomes under varying environmental conditions (McBride *et al.*, 2015). Moreover, incorporating reproductive performance metrics such as fecundity, fertilization rates, egg viability, and larval survival would provide a more comprehensive assessment of the effectiveness of feeding practices (Zadmajid & Butts, 2018). Advances in nutritional physiology and molecular biology could also be integrated, including the monitoring of hormonal profiles or gonadal histology, to better understand the mechanistic pathways through which diet influences broodstock maturation (Torsabo *et al.*, 2022). Finally, future investigations may consider including cost-benefit analyses to evaluate the economic feasibility of different feeding regimes, which would enhance the practical applicability of research outcomes to hatchery managers and policymakers.

Beyond technical considerations, the findings of this study carry important social and ethical implications for sustainable aquaculture development. The reliance on locally available trash fish as the primary feed resource highlights the potential of integrating community-based fisheries with hatchery operations, thereby creating economic opportunities for small-scale fishers while reducing feed costs in government-operated facilities (Ateweberhan *et al.*, 2018). However, the continuous use of wild-caught trash fish raises concerns regarding the sustainability of bycatch fisheries and their long-term ecological impacts. Ethical responsibility thus requires that feeding strategies balance the immediate benefits of cost-effective nutrition with the conservation of marine resources. Furthermore, the incorporation of structured feeding

schedules and supplementation protocols underscores the importance of data-driven management practices in hatcheries (Gephart & Golden, 2022). The potential adoption of digital tools for recording feeding events and monitoring water quality could enhance transparency, accountability, and knowledge transfer across hatcheries, but would also necessitate careful attention to issues of data privacy and equitable access to technology (Troell *et al.*, 2023). Taken together, these considerations illustrate that feeding management practices extend beyond biological outcomes to influence broader social, economic, and ethical dimensions of aquaculture sustainability.

### CONCLUSION

This study documented the feeding management practices applied to barramundi (*Lates calcarifer*) broodstock at the Teluk Buo Hatchery, Indonesia, and demonstrated that a structured regimen consisting of trash fish and squid, supplemented with vitamins C, B-complex, and E, effectively supported broodstock performance under government-operated hatchery conditions. Feeding at 3% of biomass twice daily, combined with scheduled supplementation, not only maintained optimal broodstock biometric profiles but also contributed to the stability of key water quality parameters, all of which remained within the thresholds set by national standards. These findings underscore the critical role of carefully managed feeding strategies in enhancing broodstock health, reproductive readiness, and environmental sustainability in hatchery systems.

While the results confirm the effectiveness of the current feeding regime, the study also highlights the need for more comprehensive evaluations of reproductive outcomes, including fecundity, fertilization success, and larval survival. Future research should incorporate controlled experiments and longer observation periods across spawning seasons, as well as advanced analyses of reproductive physiology, to validate and refine broodstock feeding strategies. Economic assessments comparing trash fish-based diets with formulated feeds would further strengthen the practical applicability of the findings.

From a practical perspective, the current feeding model provides a replicable framework for coastal hatcheries operating under resource-limited conditions, offering a balance between cost-effectiveness and broodstock performance. However, the reliance on trash fish also raises questions of ecological sustainability, calling for the integration of alternative feed resources and responsible sourcing practices. To strengthen long-term sustainability, the adoption of digital monitoring tools for feeding and water quality management is recommended, as these could enhance transparency, accountability, and knowledge transfer across hatchery systems. Collectively, these recommendations highlight the importance of aligning broodstock feeding management not only with biological and technical goals but also with broader social, economic, and environmental priorities in aquaculture development.

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