Fisheries Journal, 16 (3), 1693-1702 (2026)
http://doi.org/10.29303/jp.v16i3.2346

OPTIMIZATION OF FEED EFFICIENCY AND GROWTH PERFORMANCE OF ASIAN SEABASS *(Lates calcarifer)* THROUGH A COMBINATION OF COMMERCIAL FEED AND LEMURU FISH IN A FLOATING NET CAGE SYSTEM

Optimasi Efisiensi Pakan dan Pertumbuhan Ikan Kakap Putih (*Lates calcarifer*) Melalui Kombinasi Pakan Komersial dan Ikan Lemuru pada Sistem Keramba Jaring Apung

Diyo Wahyu Ardiansyah*, Gede Ari Yudasmara, Hamdanul Fain

Department of Marine Biology and Fisheries, Faculty of Mathematics and Natural Sciences, Ganesha University of Education

Jalan Udayana No.11 Singaraja - Bali 81116

*Corresponding Author: Diyo@student.undiksha.ac.id

(Received June 1st 2026; Accepted June 30th 2026)

ABSTRACT

High feed costs remain a major constraint in the cultivation of Asian seabass *(Lates calcarifer)* in floating net cages (FNC), necessitating a more efficient feeding strategy without compromising fish growth performance. This study aims to analyze the effect of a combination of commercial feed and lemuru fish *(Sardinella longiceps)* on the feed efficiency and growth of Asian seabass, as well as to determine the most optimal feed combination. The research employed an experimental method utilizing a Randomized Block Design (RBD) consisting of three treatments and three replications: Treatment A (100% commercial feed), Treatment B (75% commercial feed + 25% lemuru fish), and Treatment C (50% commercial feed + 50% lemuru fish). The observed parameters included absolute length growth, absolute weight growth, specific growth rate (SGR), feed conversion ratio (FCR), survival rate (SR), and water quality. Data were analyzed using Analysis of Variance (ANOVA) at a 95% confidence level, followed by the Least Significant Difference (LSD) test. The results indicated that the feed combinations significantly affected growth and feed efficiency ($p < 0.05$). Treatment B yielded the best performance with an absolute length growth of 5.07 cm, an absolute weight growth of 50.5 g, an SGR of 2.225% per day, and the lowest FCR of 1.877 g/g. The fish survival rate ranged from 90% to 93%, while water quality parameters remained within the optimal range throughout the study. Therefore, the combination of 75% commercial feed and 25% lemuru fish is the most effective formulation for improving the feed efficiency and growth of Asian seabass in the floating net cage system.

Keywords: Asian Seabass, Feed Efficiency, Floating Net Cages, Growth, Lemuru Fish

ABSTRAK

Biaya pakan yang tinggi merupakan kendala utama dalam budidaya ikan kakap putih *(Lates calcarifer)* di Keramba Jaring Apung (KJA), sehingga diperlukan strategi pemberian pakan yang lebih efisien tanpa mengurangi performa pertumbuhan ikan. Penelitian ini bertujuan menganalisis pengaruh kombinasi pakan komersial dan ikan lemuru *(Sardinella longiceps)* terhadap efisiensi pakan dan pertumbuhan ikan kakap putih serta menentukan kombinasi pakan yang paling optimal. Penelitian menggunakan metode eksperimen dengan Rancangan Acak Kelompok (RAK) yang terdiri atas tiga perlakuan dan tiga ulangan, yaitu A (100% pakan komersial), B (75% pakan komersial + 25% ikan lemuru), dan C (50% pakan komersial + 50% ikan lemuru). Parameter yang diamati meliputi pertumbuhan panjang mutlak, pertumbuhan berat mutlak, laju pertumbuhan spesifik (Specific Growth Rate/SGR), rasio konversi pakan (Feed Conversion Ratio/FCR), tingkat kelangsungan hidup (Survival Rate/SR), dan kualitas air. Data dianalisis menggunakan uji ANOVA pada taraf kepercayaan 95% yang dilanjutkan dengan uji Least Significant Difference (LSD). Hasil penelitian menunjukkan bahwa kombinasi pakan memberikan pengaruh nyata terhadap pertumbuhan dan efisiensi pakan ($p<0,05$). Perlakuan B menghasilkan performa terbaik dengan pertumbuhan panjang mutlak 5,07 cm, pertumbuhan berat mutlak 50,5 g, nilai SGR 2,225% per hari, dan nilai FCR terendah sebesar 1,877 g/g. Tingkat kelangsungan hidup ikan berkisar 90–93%, sedangkan parameter kualitas air berada dalam kisaran optimal selama penelitian. Dengan demikian, kombinasi 75% pakan komersial dan 25% ikan lemuru merupakan formulasi yang paling efektif untuk meningkatkan efisiensi pakan dan pertumbuhan ikan kakap putih pada sistem Keramba Jaring Apung.

Kata Kunci: Efisiensi Pakan, Ikan Lemuru, Kakap Putih, Keramba Jaring Apung, Pertumbuhan

INTRODUCTION

Asian Seabass (*Lates calcarifer*) cultivation is a growing aquaculture sector in Indonesia due to its high economic value, rapid growth, and stable market demand (Widianti & Ariasari, 2024). One widely used cultivation system is the Floating Net Cage (KJA) system, as it optimally utilizes coastal waters, provides good water circulation, and supports efficient fish growth (Gandhy, 2017). However, the success of Asian Seabass cultivation is strongly influenced by feed management. Feed costs can reportedly reach 70–80% of total operational costs, making it a major factor determining business efficiency and farmer profitability (Payung & Irawati, 2021). One widely used alternative is trash fish, particularly lemuru fish (*Sardinella longiceps*), which contains protein, essential amino acids, and fatty acids needed to support the growth of carnivorous fish. Besides being readily available, the use of lemuru fish as a feed ingredient also has the potential to increase feed efficiency while reducing cultivation operational costs. Nutritional quality determines successful growth because Asian Seabass are carnivorous fish that require high protein content, essential amino acids, and a balanced energy balance to support body tissue synthesis and metabolism (Islam et al., 2023).

Several previous studies have shown that the use of trash feed can produce good results in Asian Seabass cultivation. Ladjaha et al. (2024) reported that the type of trash feed significantly affected the growth and feed efficiency of Asian Seabass in floating net cages. Research by Zulfikar et al. (2024) also showed that providing fresh fish at 5% of the biomass resulted in better growth and feed efficiency compared to pellet feed. Furthermore, Fitrinawati & Utami (2023) reported that Asian Seabass cultivation using trash feed resulted in a high survival rate while maintaining optimal water quality. These research results indicate that natural feed has the potential to improve the performance of Asian Seabass cultivation.

However, research on the combination of commercial feed and lemuru (*Sardinella longiceps*) in varying proportions is still relatively limited, particularly in floating net cage

culture systems in the waters of Sumberkima Village, Buleleng Regency, Bali. Most previous studies have focused on the use of trash feed as the primary feed or compared it with commercial feed, resulting in a paucity of information on the most effective combination proportions for increasing growth and feed efficiency. However, determining the appropriate feed combination is crucial for achieving a balance between nutritional adequacy, feed efficiency, and reduced production costs.

Based on this description, this study aims to analyze the effect of a combination of commercial feed and lemuru (*Sardinella longiceps*) on the growth and feed efficiency of Asian Seabass (*Lates calcarifer*) reared in floating net cage systems, and to determine the feed combination that provides the best performance. The results of this study are expected to provide a basis for developing more efficient and sustainable feeding strategies to support increased productivity in Asian Seabass cultivation.

RESEARCH METHODS

This research was conducted in Floating Net Cages (KJA), Sumberkima Village, Gerokgak District, Buleleng Regency, Bali, for six weeks, namely from March 15–April 30, 2026. The research used an experimental method with a Randomized Block Design (RAK). RAK is a statistical method used to group experimental units into homogeneous groups, then apply randomized treatments within each group (Margaretha et al., 2025). The research design consisted of three treatments and three replications. The treatments given included A (100% commercial feed), B (75% commercial feed + 25% lemuru fish), and C (50% commercial feed + 50% lemuru fish). Each treatment was repeated three times with each container containing 10 Asian Seabass (*Lates calcarifer*), so that a total of 90 test fish were used.

The equipment used included a 100 cm × 50 cm × 50 cm rearing tank, a digital scale, a ruler, a DO meter, a refractometer, a thermometer, a fish scoop, a camera, and stationery. The research materials consisted of Asian Seabass (27–30 g) with a length of 11–12 cm, commercial feed STP KAE with a protein content of 50–52%, and lemuru fish (*Sardinella longiceps*) as a trash feed.

Before the study began, the rearing media was prepared by dividing one 4 m × 4 m × 3 m cage into nine compartments using netting, according to the number of treatments and replications. The test fish were fasted for 24 hours, then weighed and their initial length measured before being randomly distributed into each rearing tank. Rearing was carried out for 42 days, with feeding twice daily at 10:00 and 14:00 WITA using the at-satiation method according to the treatment composition. Fish growth and water quality were observed every two weeks.

The parameters observed included absolute length growth, absolute weight growth, specific growth rate (SGR), feed conversion ratio (FCR), survival rate (SR), and water quality, including temperature, pH, salinity, and dissolved oxygen (DO).

Absolute length growth was calculated using the formula of Zonneveld et al. (1991):

$$P_m = L_t - L_o$$

where P_m= absolute length growth (cm), L_t= final length (cm), and L_o= initial length (cm).

Absolute weight growth was calculated using the formula based on Effendie (1979):

$$W_m = W_t - W_o$$

where W_m= absolute weight growth (g), W_t= final weight (g), and W_o= initial weight (g).

The FCR value calculation refers to Handajani, H., & Wahyu, W. (2010) as follows:

$$FCR = \frac{F}{(Wt + D) - Wo}$$

where F = Total amount of feed given (grams), Wt = Fish weight at the end of the study (grams).

The SGR value calculation refers to Effendie (2002), as follows:

$$SGR = \frac{Wt-Wo}{t} x\ 100\%$$

where Wt = Average final weight (g), Wo = Average initial weight (g), t = Maintenance time (days).

Survival was calculated using Effendie's (1979) formula:

$$SR = \frac{N_t}{N_o} \times 100$$

where SR = survival rate (%), N_t = number of live fish at the end of the study, and N_o = number of fish at the beginning of the study.

Data were analyzed descriptively to illustrate the trend in the results for each treatment. Then, assumption tests were conducted, including a normality test using the Kolmogorov–Smirnov test and a homogeneity test using Levene's Test. Furthermore, the data were analyzed using Analysis of Variance (ANOVA) at a 95% confidence level (α = 0.05). If the ANOVA results show significant differences, the analysis is continued with the Least Significant Difference (LSD) test to determine the differences between treatments.

RESULT

The results obtained included data on absolute length growth, absolute weight growth, specific growth rate (SGR), feed conversion ratio (FCR), survival rate (SR), and water quality. The average absolute length and absolute weight growth of Asian Seabass during the study are presented in the following diagram.

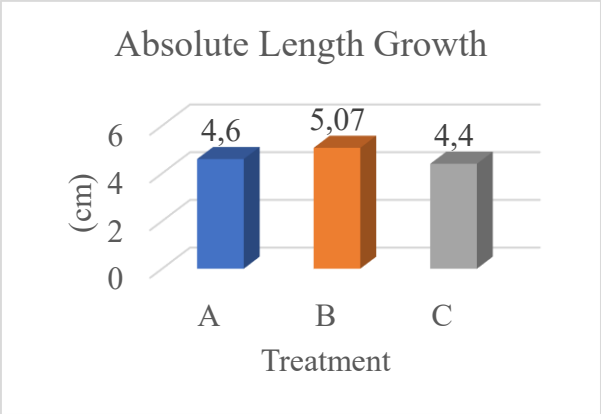

Figure 1. Diagram of Absolute Length Growth of Asian Seabass

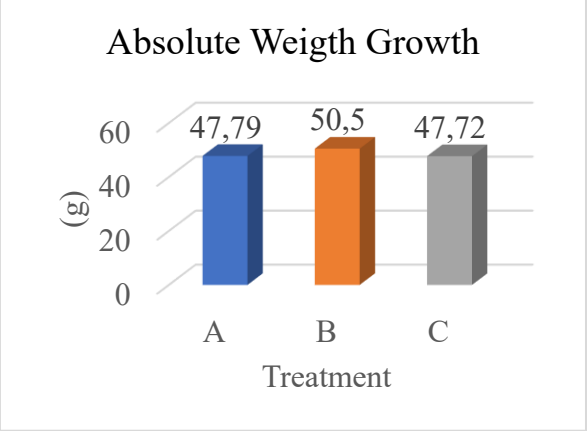

Figure 2. Diagram of Absolute Weight Growth of Asian Seabass

Treatment B (75% commercial feed + 25% lemuru fish) produced the highest absolute length growth of 5.07 cm, followed by treatment A (100% commercial feed) at 4.60 cm, while treatment C (50% commercial feed + 50% lemuru fish) showed the lowest value of 4.40 cm. ANOVA results showed that the feed combination significantly affected absolute length growth ($p = 0.040$). Further LSD testing showed that treatment B was significantly different from treatment C ($p = 0.016$), while treatment A was not significantly different from either treatment B or C.

Treatment B produced the highest absolute weight gain of 50.50 g, while treatments A and C produced 47.79 g and 47.72 g, respectively. ANOVA results indicated a significant effect of feed combination on absolute weight gain ($p = 0.048$). Based on the LSD test, treatment B was significantly different from treatment C ($p = 0.018$), while treatment A was not significantly different from either treatment B or C.

The specific growth rate (SGR) and feed utilization efficiency of Asian Seabass during the study are presented in the following chart.

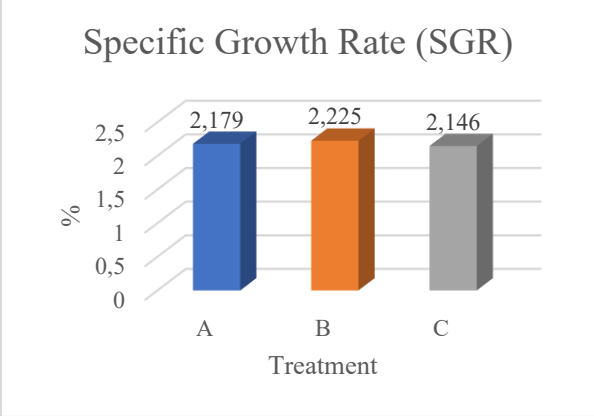

Figure 3. Specific Growth Rate Diagram of Asian Seabass

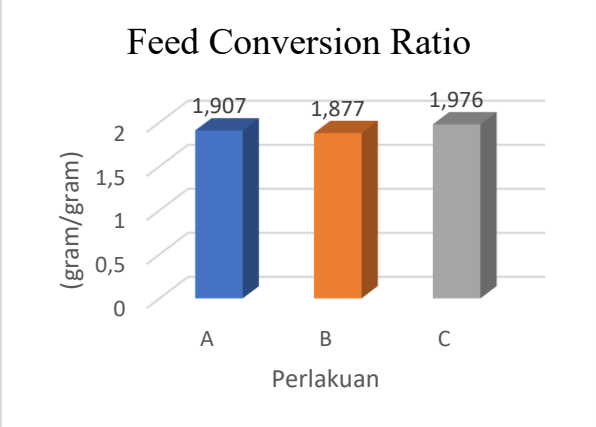

Figure 4. Feed Conversion Ratio Diagram

The highest SGR value was obtained in treatment B at 2.225%/day, followed by treatment C at 2.179%/day, and treatment A at 2.146%/day. ANOVA analysis showed that the feed combination significantly affected the SGR value ($p = 0.048$). The LSD test showed that treatment B was significantly different from treatment C ($p = 0.018$), while treatment A was not significantly different from the other treatments.

The lowest FCR value was obtained in treatment B at 1.877 g/g, while treatments A and C had 1.907 g/g and 1.976 g/g, respectively. The ANOVA results showed that the feed combination significantly affected the FCR value ($p = 0.032$). The LSD test showed that treatment B was significantly different from treatment C ($p = 0.013$), while treatment A was

not significantly different from treatments B or C.

The survival rate of goldfish during the study for each treatment is presented in the following diagram.

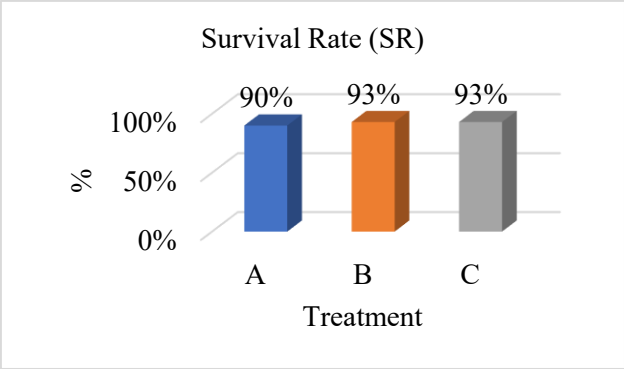

Figure 5. Asian Seabass Survival Rate Diagram

SR values for all treatments were above 90%. Treatments B and C produced a survival rate of 93%, while treatment A achieved a survival rate of 90%.

The results of water quality measurements during the study are presented in the following table.

Table 3. Results of Water Quality Measurements During the Study

Parameter	Measurement Results	Optimal Range (SNI 7677:2018)
Temperature (°C)	28.7–30.4	28–32
pH	7.50–7.82	7–8.5
Salinity (ppt)	31-33	26–35
DO (mg/L)	4.51-6.12	>5

All water quality parameters were within the range that meets the Asian Seabass cultivation standards based on SNI 7677:2018. Water quality conditions during the study were within the range that supports the growth and survival of Asian Seabass.

DISCUSSION

The results showed that the combination of commercial feed and trash fish significantly affected the growth performance of Asian Seabass (*Lates calcarifer*), especially in the parameters of absolute length growth, absolute weight growth, specific growth rate (SGR), and feed conversion ratio (FCR). Treatment B (75% commercial feed + 25% trash feed) consistently produced the best performance compared to other treatments. Absolute length growth reached 5.07 cm, absolute weight growth of 50.5 g, SGR value of 2.225%, and the lowest FCR value of 1.877 g/g. Conversely, increasing the proportion of trash fish to 50% (Treatment C) actually resulted in lower growth performance. ANOVA results showed that the feed combination significantly affected growth in length, weight, SGR, and FCR ($p<0.05$), while further LSD analysis revealed that significant differences occurred primarily between Treatment B and Treatment C.

The superiority of Treatment B indicates that the use of trash fish as an alternative feed is more effective when combined in certain proportions with commercial feed rather than using excessively high amounts. The commercial feed used in this study had a protein content of approximately 50–52% and was supplemented with fat, vitamins, and minerals formulated to meet the nutritional needs of carnivorous marine fish. This high protein content is crucial for supporting protein synthesis, tissue formation, and increasing fish biomass. According to Islam et al. (2023), Asian Seabass is a carnivorous species that requires high-quality protein as a

primary source for tissue formation, metabolism, and growth. The availability of complete nutrients in commercial feed is a key factor supporting efficient feed utilization during rearing.

The addition of 25% of the trash fish, such as *Sardinella* spp., is thought to complement the nutritional profile of commercial feed. *Sardinella* spp. is known to contain approximately 20% protein, fat, essential minerals such as calcium, phosphorus, and iron, vitamins A and B1, and essential amino acids and omega-3 fatty acids, such as EPA and DHA, which play a role in tissue formation and improve fish health (Farida et al., 2024). In addition to being a source of nutrients, trash fish can also improve feed palatability, resulting in higher feed consumption. Sahputra et al. (2017) explained that the use of trash fish can increase the appeal of feed to carnivorous fish, while Ladjaha et al. (2024) reported that the combination of commercial feed and trash fish can increase the efficiency of nutrient utilization in Asian Seabass cultivation in floating net cages. Thus, the proportion of 75% commercial feed and 25% trash fish create a balance between nutritional adequacy and feed consumption levels, resulting in optimal fish growth.

The increase in absolute length and weight growth in Treatment B also indicates that the balance of protein and energy content is a crucial factor in fish biomass formation. Ibrahim et al. (2024) stated that the quality of protein sources is directly related to the growth performance of Asian Seabass because the available nutrients are more easily utilized for body tissue synthesis. This finding is supported by Hardiyanti et al. (2020) who reported that fish-based raw materials can increase the growth of farmed fish because they contain proteins with a high digestibility level. Therefore, the feed combination in this study not only meets protein requirements but also increases the efficiency of nutrient utilization, resulting in better growth in length and weight.

Conversely, increasing the proportion of trash fish to 50% in Treatment C failed to produce optimal growth. This condition is suspected to be caused by an imbalance in nutritional composition due to the reduced proportion of commercial feed with a more stable nutritional formulation. Furthermore, trash fish have a high-water content, resulting in lower dry matter consumption compared to commercial feed. Sahputra et al. (2017) explained that the high-water content of trash fish can affect feed efficiency. Farida et al. (2024) also explained that the nutritional quality of fish as a feed ingredient is influenced by the quality of the ingredients and body parts used, resulting in inconsistent nutrient content.

The highest SGR value was obtained in Treatment B, indicating that this feed combination increased the efficiency of fish in converting nutrients into daily biomass. The SGR value is an indicator of successful nutrient utilization during the rearing period, so a higher SGR value indicates better fish growth performance. These results align with those of Zulfikar et al. (2024), who reported that the feeding ratio is a critical factor in determining the growth performance of Asian Seabass. Research by Ladjaha et al. (2024) also showed that using the right feed combination can increase growth and feed efficiency in Asian Seabass cultivation. Furthermore, P. D. K. Wulandari et al. (2025) reported that the adequacy of certain organic nutrients in feed can increase SGR values while improving fish survival rates. These results indicate that successful growth is determined not only by protein content but also by the balance of nutritional components that support metabolism and energy utilization efficiency.

The lowest FCR value in Treatment B indicates that the combination of 75% commercial feed and 25% trash fish is the most efficient formulation in converting feed into body weight gain. A low FCR value indicates less feed is needed to generate biomass growth. Susanti et al. (2024) explained that proper feeding management directly influences the efficiency of nutrient utilization and growth performance of Asian Seabass. Islam et al. (2023) also emphasized that the high protein requirements of Asian Seabass must be met for optimal metabolism and tissue synthesis. Furthermore, Ibrahim et al. (2024) stated that the quality of protein sources affects feed utilization efficiency, while Hardiyanti et al. (2020) reported that fish-based protein has a

high digestibility rate, thus increasing growth efficiency. The findings of this study also support the results of research by Ladjaha et al. (2024) and Zulfikar et al. (2024) which stated that the combination of fresh feed with commercial feed can produce better feed efficiency than the use of single feed. Conversely, the increased FCR value in Treatment C indicates that the use of trash fish in excessively high proportions reduces nutrient utilization efficiency. This condition is supported by Marantika (2017) who explained that protein substitution without a balanced nutritional formulation can reduce feed utilization efficiency.

In addition to increasing growth, all treatments produced a very high survival rate of 90–93%. The high survival rate indicates that all feed combinations provided were still able to meet the basic nutritional needs of the fish without causing negative impacts on fish health. Ibrahim et al. (2024) stated that a survival rate above 80% indicates successful Asian Seabass cultivation. According to Islam et al. (2023), adequate protein not only functions for growth but also plays a role in the formation of the immune system. Sahputra et al. (2017) added that adequate nutrition can suppress cannibalism, which is common in Asian Seabass. The high survival rate in this study was also supported by stable water quality conditions so that the fish did not experience physiological stress during cultivation. Ramadhani & Lesmana (2025) explained that good water quality management is an important factor in maintaining fish survival, while Insivitawati et al. (2022) showed that appropriate temperature and salinity support the osmoregulation and metabolism processes of fish. A. L. F. Wulandari et al. (2025) also reported that stable environmental conditions contribute to successful fish development from the early stages to growth, while Putri & Kurniawan (2023) emphasized that a stable rearing environment is closely related to high survival rates in cultured fish.

Water quality parameters during the study were within a range appropriate to the physiological needs of Asian Seabass, namely a temperature of 28.7–30.4°C, pH 7.50–7.82, salinity 31–33 ppt, and DO 4.51–6.12 mg/L. This range aligns with cultivation standards and supports growth and efficient feed utilization. Putri and Kurniawan (2023) explained that optimal temperature significantly influences fish metabolic activity and growth. A study by Pebriani et al. (2025) emphasized the importance of pH stability in maintaining physiological function and the quality of the cultivation environment. Meanwhile, Islam et al. (2023) and Insivitawati et al. (2022) explained that stable salinity supports osmoregulation, allowing more energy to be allocated to growth.

In addition to the conditions of the rearing medium, the ecological characteristics of the research location also contribute to successful cultivation. Prasetia et al. (2024) reported that the coastal area of Sumberkima Village has suitable environmental conditions for sustainable aquaculture development based on a coastal resource study. Research by Prasetia et al. (2025) also showed that Sumberkima waters have a good level of biodiversity, reflecting a relatively healthy ecosystem. These conditions provide ecological support for the successful cultivation of Asian Seabass in this study. Furthermore, Pebriani et al. (2025) explained that regular monitoring of water quality and aquaculture waste is a crucial aspect in maintaining stable physicochemical parameters of the waters, ensuring sustainable cultivation productivity.

The results showed that a combination of 75% commercial feed and 25% trash fish was the most effective formulation in increasing growth and feed utilization efficiency in Asian Seabass. This combination achieves a nutritional balance that supports biomass formation, increases feed conversion efficiency, and maintains high survival rates without compromising the quality of the culture environment. These findings provide practical insight that trash fish should not replace commercial feed in large proportions, but rather be used as a supplementary ingredient to improve palatability and supplement the feed's nutritional content. This approach has the potential to increase production efficiency while reducing feed costs without compromising growth performance or the sustainability of Asian Seabass cultivation.

CONCLUSION

The combination of commercial feed and trash fish significantly affected the growth and feed utilization efficiency of Asian Seabass (*Lates calcarifer*). The treatment with a composition of 75% commercial feed and 25% trash fish provided the best performance, as indicated by better absolute length growth, absolute weight growth, specific growth rate (SGR), and feed conversion ratio (FCR) values compared to other treatments.

The high fish survival rate in all treatments, along with water quality conditions that remained within the optimal range, indicated that the feed combination was safe for use during rearing and supported by a suitable culture environment.

ACKNOWLEDGEMENT

The author would like to thank his supervisor for the guidance, direction, and input provided during the research and preparation of this article. He also thanks all those who provided support, assistance with the research, data collection, and research facilities, ensuring the successful completion of the entire research process.

REFERENCES

Farida, I., Samanta, P. N., & Maulana, H. (2024). Evaluasi Mutu Nutrisi dan Organoleptik Tepung Ikan yang Berasal dari Bagian Tubuh dan Kepala Ikan Lemuru. *Jurnal Peternakan*, *21*(1), 38–47. https://doi.org/10.24014/jupet.v21i1:22683

Fitrinawati, H., & Utami, E. S. (2023). Performa Pertumbuhan Kakap Putih *(Lates calcarifer)* dalam Karamba Jaring Apung, Tual, Maluku. *Journal of Fishery Science and Innovation*, *7*(2), 158–165. https://doi.org/10.33772/jsipi.v7i2.430

Gandhy, A. (2017). Analisis Peningkatkan Pendapatan Petani Keramba Jaring Apung Dengan Diversifikasi Spesies Ikan Budidaya Di Waduk Cirata. *Jurnal Ekonomi & Studi Pembangunan*, *18*(1). https://doi.org/10.18196/jesp.18.1.3778

Hardiyanti, T., Yulianto, T., & Miranti, S. (2020). Pengaruh Pemberian Tepung Ikan Lemuru (*Sardinella longiceps*) Terhadap Pertumbuhan Ikan Kerapu Cantang (*Epinephelus fuscoguttatus* >< *Epinephelus lanceolatus*). *Intek Akuakultur*, *4*(1), 1.

Ibrahim, I., Budi, S., & Mulyani, S. (2024). Performa Pertumbuhan dan Sintasan Benih Ikan Kakap Putih *Lates calcarifer* dengan Sumber Protein yang Berbeda. *Journal of Aquaculture and Environment*, *6*(2), 90–95. https://doi.org/10.35965/jae.v6i2.2720

Insivitawati, E., Hakimah, N., & Chudlori, M. S. (2022). Effect of temperature, pH, and salinity on body weight of Asian Seabass (*Lates calcarifer*) at different stockings. *IOP Conference Series: Earth and Environmental Science*, *1036*(1). https://doi.org/10.1088/1755-1315/1036/1/012117

Islam, Md. A., Bosu, A., Hasan, Md. M., Yasmin, F., Khan, A. B. S., Akhter, M., Ullah, Md. R., Karim, E., Rashid, Md. H., & Mahmud, Y. (2023). Culture technique of seabass, *Lates calcarifer* in Asia: A review. *International Journal of Science and Technology Research Archive*, *4*(1), 006–017. https://doi.org/10.53771/ijstra.2023.4.1.0174

Ladjaha, W. O. R., Abidin, J., Muhamad, I. La, & Abdurasid, R. (2024). Pengaruh Pakan Rucah Yang Berbeda Terhadap Pertumbuhan Dan Efisiensi Pakan Ikan Kakap Putih *(Lates calcarifer)* Di Keramba Jaring Apung. *Jurnal Ilmu Perikanan Dan Masyarakat Pesisir*.

Marantika, A. K. (2017). Pengaruh substitusi jeroan ikan tuna terfermentasi dengan tepung ikan dalam formulasi pakan terhadap pertumbuhan benih ikan patin (*Pangasius* sp.). *Jurnal IKA*, *15*(1), 21–36.

Margaretha, E., Yudasmara, G. A., & Fain, H. (2025). Pengaruh Suplementasi Sinbiotik (EM4 X Ipomoea Batatas L) dalam Pakan terhadap Sintasan dan Laju Pertumbuhan Benih Ikan Nila (Oreochromis niloticus). *Wahana Matematika dan Sains: Jurnal Matematika, Sains, dan Pembelajarannya*, *19*(2), 102-111.

Payung, D., & Irawati, I. (2021). Pemanfaatan Ikan Rucah Zero Waste Sebagai Pakan Dalam Pemeliharaan Ikan Kuwe Di Keramba Jaring Apung Dusun Wael Kabupaten Seram Bagian Barat. *TRITON: Jurnal Manajemen Sumberdaya Perairan*, *17*(1), 18–24. https://doi.org/10.30598/tritonvol17issue1page18-24

Pebriani, D. A. A., Julyantoro, P. G. S., Negara, I. K. W., Saraswati, S. A., Sutrisnawati, E. A., & Prasetia, N. D. (2025). Monitoring of Aquaculture Wastewater in Gerokgak Subdistrict, North Bali. *Aquacultura Indonesiana*, *26*(1), 31–35. https://doi.org/10.21534/ai.v26i1.204

Prasetia, I. N. D., Amelia, J. M., Sitepu, G. S. B., Maharani, M. D. K., Wulandari, D., & Ampou, E. E. (2024). Assessment Of Coastal Resources In Sumberkima Village, Buleleng, Bali: A Foundation For Sustainable Aquaculture-Based Minatourism Development. *The Seybold Report*, *19*, 727–749. https://doi.org/10.5281/zenodo.10931944

Prasetia, I. N. D., Amelia, J. M., Sitepu, G. S. B., Maharani, M. D. K., Wulandari, D., Ampou, E. E., Malik, M. D. Al, Nursalim, N., Kholilah, N., & Cahyani, N. K. D. (2025). Applications of environmental DNA for marine biodiversity monitoring in Sumberkima Village, Bali, Indonesia. *Biodiversitas*, *26*(8), 3939–3951. https://doi.org/10.13057/biodiv/d260824

Putri, M. N., & Kurniawan, R. (2023). Kualitas Air pada Media Pemeliharaan Larva Ikan Kakap Putih *(Lates calcarifer)*. *South East Asian Aquaculture*, *1*(1), 1–4. https://journal.stedca.com/index.php/seaqu/

Ramadhani, N., & Lesmana, I. (2025). Kinerja Pendederan Benih Ikan Kakap Putih *(Lates calcarifer)* Menggunakan Sistem Resirkulasi: Pertumbuhan, Kelangsungan Hidup, dan Pengelolaan Kualitas Air. *Jurnal Berkala Perikanan Terubuk*, *53*, 2025.

Sahputra, I., Khalil, M., & Zulfikar, Z. (2017). Pemberian jenis pakan yang berbeda terhadap pertumbuhan dan kelangsungan hidup benih ikan kakap putih *(Lates calcalifer*, Bloch). *Acta Aquatica: Aquatic Sciences Journal*, *4*(2), 68–75.

Susanti, N. M., Roslimah, R., Sari, M. R., Tillah, R., & Laoli, D. (2024). Manajemen Pemberian Pakan Pada Pembesaran Ikan Kakap Putih *(Lates calcarifer)* di UD Marlisdin Desa Suka Jaya Kabupaten Simeulue. *Zoologi: Jurnal Ilmu Peternakan, Ilmu Perikanan, Ilmu Kedokteran Hewan*, *2*(1), 98–111. https://doi.org/10.62951/zoologi.v2i2.81

Widianti, R., & Ariasari, A. (2024). Teknik Pembesaran Ikan Kakap Putih *(Lates calcarifer)* Dengan Metode Keramba Jaring Apung Di Balai Besar Perikanan Budidaya Laut Lampung. *Prosiding Seminar Nasional Tahun 2024 Hasil Penelitian Kelautan Dan Perikanan*.

Wulandari, A. L. F., Marantika, A. K., Wulandari, D., & Fain, H. (2025). Manipulasi Lingkungan Terhadap Tingkat Fertilisasi dan Penetasan Ikan Kakap Putih *(Lates calcarifer)* Strain Lokal dan Strain Australia. *Journal of Aquatropica Asia*, *10*(1), 94–99.

Wulandari, P. D. K., Sitepu, G. S. B., & Amelia, J. M. (2025). Analysis of The Addition of Commercial Organic Sulfur Compounds at Different Doses on The Growth Rate and Survival Rate Of Asian Seabass *(Lates calcarifer)*. *AQUASAINS Jurnal Ilmu Perikanan Dan Sumberdaya Perairan*, *13*(1), 1714–1727.

Zulfikar, Z., Ahmad Zawawi, M., Miranti, S., Raza'i, T. S., Putri, D. S., & Yulianto, T. (2024). Performa Pertumbuhan Ikan Kakap Putih *(Lates calcarifer)* Yang Diberi Pakan Ikan Tamban (*Sardinella abella*) Segar Dengan Rasio Berbeda Terhadap Biomassa. *Jurnal Riset Akuakultur*, *18*(1), 61. https://doi.org/10.15578/jra.18.1.2023.61-70