The effect of giving commercial feed, beloso trash fish (Saurida tumbil), kurisi trash fish (Nemipterus nematophorus), and mixed trash fish on growth of cantang grouper (Epinephelus fuscoguttatus-lanceolatus) in floating net cage

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Abstract. An experiment was conducted to observe the effect of commercial feeding, and trash fish feed supplement on cantang grouper fish growth in floating net cages at Situbondo, Indonesia. The method used in this experiment was designed with 4 treatments and 3 replications. Samples (26.49 ± 0.81 cm) were a stocking density of 400 fish/cage and maintenance for 30 days. The treatments used were P0; commercial pellets, P1; 100% beloso trash fish (Saurida tumbil), P2; 100% kurisi trash fish (Nemipterus nematophorus) and P3; mixed wasted fish; 50% beloso trash fish + 50% kurisi trash fish, with four replicates. The best treatment result is that P0 quantitatively has significant effect on feed growth, survival, and efficiency compared to other treatments; SGR (0.5618%), SR (85%), FCR (3.69), and EPP (27.08%) compared to other treatments.

1. Introduction
Cantang grouper fish (Epinephelus fuscoguttatus-lanceolatus) belongs to a group of fish that have high prices and are of export value. Cantang grouper is the result of crossing of tiger grouper fish (E. fuscoguttatus) and kertang grouper (E. lanceolatus) [1]. The growth of grouper fish is one of the main problems faced by grouper farmers, which require large costs for grouper feed needs [1]. The high price of commercial feed results in high cost of feed production [2]. Nutritional needs of grouper feed must have a high protein content of 47.8% to 60% [3]; this is due to belonging to carnivorous animals [4].

Cantang grouper is a cross between tiger grouper (E. fuscoguttatus) as female and kertang (E. lanceolatus) as male fish. Cantang grouper has best performance, growth, disease resistance and tolerance to environmental factors compared to other grouper species. Cultivation grouper has several problems, one of which is feed. The price of artificial feed is higher than the cost of feed production [2]. This can be overcome by using alternative feeds of beloso fish (Saurida tumbil) and kurisi fish (N. nematophorus). Trash fish has lower economic value, may help problem from production costs in grouper feed [2]. Therefore, research on the effect of alternative feeding of beloso fish (S. tumbil) and kurisi fish (N. nematophorus) on the growth of catfish (E. fuscoguttatus-lanceolatus) groups in floating karma (Net Cage).
2. Materials and methods

2.1 Sampling fish
The fish used in this experiment were grouper fish (*E. Fuscoguttatus-Lanceolatus*) with 26.49 ± 0.81 cm and 374.27 ±10.93 g in size with a total of 400 fish/m². The research was conducted in the research station at Situbondo, Indonesia for 30 days.

2.2 Floating net cages
Twelve cages were used in this research and the dimension was 3 m³ and net cages used high-density polyethylene (HDPE) (Aquatec, Indonesia) with a net size was 1-inch mesh (Figure 1).

![Figure 1](image1.jpg)

**Figure 1.** The process of preparing and installing a net in a floating net cage with used high-density polyethylene (HDPE) (a), the process of feeding trash fish feed supplement to cultured cantang grouper growth in floating net cages at Situbondo, Indonesia (b).

2.3 Treatment method
Treatment (P0): Commercial feed (Matahari Sakti, Indonesia) given during maintenance is pellet granules with a content of 10% moisture content, 13% ash content, 46% protein content and 10% fat content (Table 1). Treatment (P1): beloso fish (*S. tumbil*) with a moisture content of 77.75%, 0.40% ash content, 46% protein content and 5.6% fat content [6]. Treatment (P2): kurisi fish (*N. nematophorus*) with a moisture content of 79.55%, 0.97% ash content, 16.85% protein content and 2.2% fat content (Table 1) and Treatment (P3): mixed wasted fish with the water content 59.57%, ash content 4.82%, protein content 28.26% and fat content 1.49% (Table 1). Beloso fish, kurisi fish and mixed wasted fish will be cut into pieces before being given as a grouper feed. The treatments used were P0: commercial pellets, P1: 100% beloso trash fish (*S.tumbil*), P2: 100% kurisi trash fish (*N. nematophorus*) and P3: mixed wasted fish; 50% beloso trash fish + 50% kurisi trash fish, with four replicates. The frequency of feeding is 2 times a day (8:00 and 16:00) with a feeding rate of 3% from the grouper biomass in ad libitum.

2.4 Analysis Data
Variance Analysis was applied to evaluate which probiotic was different from feed conversion ratio (FCR). Specific growth rate (SGR), Efficiency of feed utilization (EPP), Survival rate (SR), Absolute length, Absolute growth, and Daily Weight Gain (DWG) were analyzed using Analysis of Variance (ANOVA) with a confidence interval of 95% (p <0.05). If there is a difference, the analysis is then continued to Duncan’s Multiple Range Test (DMRT).
Table 1. Proximate analysis of each treatment.

| Component analysis          | Commercial artificial feed (P0) | Beloso fish (P1) | Kurisi fish (P2) |
|-----------------------------|---------------------------------|------------------|------------------|
| Water content               | 10%                             | 77.75%           | 79.55%           |
| Ash content                 | 13%                             | 0.4%             | 0.97%            |
| Protein content             | 46%                             | 15.44%           | 16.85%           |
| Crude Fat level             | 10%                             | 5.6%             | 2.2%             |

References [5, 6, 7]

3. Results and discussion

This study showed that the administration of pellets (P0) had a positive effect on the performance of growth, survival, feed efficiency and water quality in the grouper (E. fuscoguttatus-lanceolatus) (P < 0.05) (Table 2, and 3). Beloso fish (S. tumbil), Kurisi fish (N. nematophorus) and mixed wasted fish can be used as alternative feed because the prices are relatively affordable, but the two feeds do not make the growth of grouper fish faster. Water quality in maintenance media is in a reasonable range for the maintenance of the grouper fish (Table 4).

Table 2. The average growth in terms of Length (a) and Weight (b) in cantang grouper (E. fuscoguttatus-lanceolatus) in different feed treatments after 30 days of floating net cage culture. Mean of values in the same row followed by a different superscript that is significantly different (p< 0.05).

| Treatment | Average of weight (g) | Average of length (cm) |
|-----------|-----------------------|------------------------|
|           | W0 | Wt  | Wm  | L0  | L1  | Lm  |
| P0        | 390.5±2.64a | 462.2±2.84a | 71.7±0.20b | 26.5±1.5d | 30.55±2.60b | 4.04±1.19a |
| P1        | 366.6±5.29c | 422.5±4.83c | 55.9±0.45c | 25.79±0.42c | 28.79±0.52c | 3.00±0.10c |
| P2        | 369.6±1.87d | 402.4±2.12d | 32.8±0.25d | 26.20±1.28d | 30.06±1.17d | 3.61±0.11d |
| P3        | 370.4±2.41b | 431.8±3.28b | 49.4±0.87b | 26.32±1.31b | 30.12±1.83b | 3.80±0.52b |

Based on Table 1, it can be seen that the average final weight of the grouper in the treatment P0 (462.2 + 2.84) was significantly (P < 0.05) better than the three other treatments with absolute weighting averaging 71.7 + 0.20. Based on the calculations that have been made, the highest average final length value obtained in treatment P3 (30.55 + 2.69) and at the absolute length value of an average of 4.04 + 1.19.

Table 2 shows a significant difference in treatment parameters P0 compared to treatment P1, P2, and P3 including SR, FCR, and EPP (P < 0.05), while SGR was not significantly different (P > 0.05). P0 has the best SGR value of 0.5618%. According to Haryanto [8], SGR of groupers is in the range of 0.46-1.3% / day. The difference in results obtained is influenced by the condition of the aquatic environment. According to Davis [9], oxygen plays a role in increasing metabolic activity. Temperature and salinity also play a role in increasing metabolic activity [10].

Table 3. Mean and standard deviations of feed conversion ratio (FCR), specific growth rate (SGR), efficiency of feed utilization (EPP), survival rate (SR) of E. fuscoguttatus-lanceolatus different feedstreatments after 30 days of floating net cage culture.

| Parameter | P0            | P1            | P2            | P3            |
|-----------|---------------|---------------|---------------|---------------|
| SGR       | 0.56±0.23a    | 0.47±0.05b    | 0.28±0.01c    | 0.51±0.16d    |
| SR        | 85±1.75a      | 75±2.05c      | 78±1.19b      | 70±1.29d      |
| FCR       | 3.69±0.03a    | 3.83±0.07c    | 4.05±0.04c    | 3.73±0.04b    |
| EPP       | 27.08±1.77a   | 26.08±2.14c   | 24.65±1.89d   | 26.74±2.53b   |

Note: Average values with letter (a, b, c) show significant difference on Duncan’s Multiple Range Test (DMR) with confidence level of 5% (p<0.5). Average values with the same letter show insignificant difference, while the values with different letter show significant difference.
P0 has the best SR percentage of 85%. According to [11], the survival value of bushy grouper with a density of 250 tails is 84.9%. Mixed wasted fish that is wasted during the feeding process become rotten at the base of the cage so that it can cause pollution and decrease in water quality [12]. Cannibalism is a serious problem in cultivation that can reduce the production produced so that it can affect survival values [13].

P0 has the best FCR value of 3.69. Based on [11] argue that feed conversion in bushy grouper is 1.4. According to [14], several factors that can influence feed conversion rates include fish density, individual weight, age level of fish, fish health status, water quality, and feeding methods. The FCR values generated depend on the type of feed, species, size of fish and water temperature [4].

P0 has the best EPP value of 27.08%. This is in accordance with [15], who stated that the EPP value in challenging groupers ranged from 7.41% to 24.69%. Feed efficiency shows the percentage of feed that is converted to the meat or weight gain [4]. Feed efficiency is influenced by the dosage given, the greater the dose given, the feed given is inefficient because excessive feeding and not used by fish will produce leftovers that are not eaten by fish and can affect fish metabolism [8].

Water quality is useful to determine the condition of the waters and the environment that are good for the life and growth of the grouper. Water quality parameters observed included temperature, pH, cross-section and dissolved oxygen (DO). Water quality in maintenance media is in a reasonable range for the maintenance of the grouper fish, both P0, P1, P2 and P3, which are temperatures 30-32°C, pH 8.04 – 8.11 and DO 6.07 – 6.17 mg / L (Table 4). Salinity found in maintenance media showed results that were not in accordance with the literature. The range of salinity for groupers is 30-33 ppt [16]. According to [17] argues that the range of salinity for grouper cultivation ranges from 31.30-31.91 ppt. Salinity changes do not directly affect fish behavior or fish distribution but on changes in the chemical properties of seawater [18].

Table 4. The result of water quality observation during grouper fish (E. Fuscoguttatus-lanceolatus) enlargement cultivation period.

| Parameter      | P0   | P1   | P2   | P3   | References |
|----------------|------|------|------|------|------------|
| Temperature (°C) | 30   | 32.1 | 31.3 | 30.2 | 24-31 [16] |
| pH             | 8.10 | 8.09 | 8.04 | 8.11 | 8.0-8.2 [4]|
| Salinity (ppt) | 35   | 36   | 35   | 36   | 30-33 [16] |
| DO (mg/L)      | 6.17 | 6.10 | 6.07 | 6.10 | >3.5 [16]  |

4. Conclusion
The best treatment result is that P0 quantitatively has significant effect feed on growth, survival, and efficiency feed utilization of cantang grouper (E. fuscoguttatus-lanceolatus) compared to other treatments over 30 days in floating net cages at Situbondo, Indonesia.

5. References
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