The effect of different feed on Ctenopoma (Ctenopoma acutirostre) production through survival rate and growth

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Abstract. This study aimed to determine the effects of different feed on growth rate and survival rate of Ctenopoma (Ctenopoma acutirostre). Ctenopoma used in this study had weight 0.65 grams each from 300 fish and maintained in aquarium with dimension 20 cm x 20 cm x 20 cm used densities 5 fish/litre. This study used Completely Randomized Design with 5 treatments and 3 replications. The treatments were A (silk worms), B (freezed blood worms), C (freezed artemia), D (freezed daphnia), and E (commercial feed). This study conducted for 60 days rearing with observed parameters such as specific growth rate, length, weight, and survival rate. The data were analyze descriptively. Samples data were recorded and conducted on day 0, day 10, day 20, day 30, day 40, day 50, and day 60th. Treatment A were resulted highest growth with weight of 1.94 gram, SGR of 2.28%, and length of 1.38 cm although showed no different on survival rate.

1. Introduction
Freshwater ornamental fish is one of the fishery commodities that can be cultured sustainably. In 2017 the production of aquacultured ornamental fish reached 23.32 million, consisting of 20.61 million freshwater ornamental fish and 2.61 million seawater ornamental fish [1]. Ctenopoma fish (Ctenopoma acutirostre) is one of the popular ornamental fish in the community originated from the Congo region of Central Africa. This ornamental fish has good potential to be developed because it has a domestic market and exports abroad. The production of Ctenopoma fish in 2014 decreased to 11,779,370 fish which in 2013 the production of Ctenopoma fish was 14,586,450 fish, which means that there was a decrease in Ctenopoma fish production of approximately 19.24% [2]. This decrease in production was caused by disease attacks, weather changes, low larval survival rates, and the lack of availability of the right amount of silkworm feed for optimal growth of Ctenopoma fish [3].

The provision of natural feed combined with artificial feed on Ctenopoma fish showed the best growth results in a combination of 75% silk worms and 25% artificial feed with a feeding rate of 8%. Previous research showed that the role of natural food as the main food could not be replaced by artificial feed for the growth of Ctenopoma fish at the fry stage. Good feed for fish is not only seen from the quality but also the feeding rate [4]. Therefore, it is necessary to study different types of feed for the growth and survival of Ctenopoma fish. This study aims to determine the effectiveness of different feeding for growth rate and survival of Ctenopoma fish fry.
2. Material and methods

2.1. Sample preparation

This research was conducted in Bogor, Indonesia. Seeds of 3 cm ctenopoma fish, silk worms, frozen blood worms, frozen artemia, frozen daphnia, and commercial feed were obtained from IPB University. This research was conducted for 60 days using Completely Randomized Series (CRD) with five treatments and three replications. The treatments in this study were A (silk worm feed), B (frozen bloodworm feed), C (frozen artemia feed), D (frozen daphnia feed) and E (Commercial feed PF-500). Each treatment used 20 ctenopoma fish fry. Feeding was done twice a day at 08.00 and 16.00. The amount of feed given was 12% of the fish biomass to feed silk worms, frozen blood worms, frozen artemia, and frozen daphnia, before being weighed the feed was dried using a tissue to reduce the water contained in the feed. The amount of feed given to commercial feed is 3% of the biomass. Manure siphoning and water changes were carried out every morning before feeding. Sampling was carried out every 10 days for 60 days of maintenance. 10 fish samples were used from each experimental container, the sample fish were weighed, measured in length, and calculated the survival rate during maintenance.

2.2. Research parameter calculation

Weighing of the test fish was carried out every 10 days using a measuring instrument in the form of a scale. According to previous study, the formula for calculating the weight gain of the test fish was as follows [5]:

\[ W = W_t - W_0 \]

\( W \): Weight growth (gram)
\( W_t \): Final average weight (gram)
\( W_0 \): Initial average weight (gram)

Specific Growth Rate (SGR) is the change in daily fish growth from the beginning of rearing to the end of fish rearing, calculated by the following formula [6]:

\[ SGR = \frac{LnW_t - LnW_0}{t} \times 100\% \]

\( SGR \): Specific Growth Rate (%/days)
\( t \): Cultured time (days)
\( W_t \): Final average weight (gram)
\( W_0 \): Initial average weight (gram)

Absolute length measurements were carried out every 10 days. The absolute length growth according to previous study formula was as follows [5]:

\[ P = P_t - P_0 \]

\( P \): Absolute length growth (cm)
\( P_t \): Final length (cm)
\( P_0 \): Initial length (cm)

The number of dead fish was counted every day until the end of the study. According to previous study the survival rate of fish was calculated using the formula [5]:

\[ SR = \frac{N_t}{N_0} \times 100\% \]
Water parameters measured in this experiment include DO, pH, temperature, and ammonia. DO parameters were measured using a DO meter, pH was measured using a pH meter, temperature parameters were measured using a thermometer, and ammonia was measured using an ammonia test kit at the time of fish sampling. Data obtained during the study such as specific growth rate, absolute length, absolute weight, and survival rate were then analyzed descriptively.

3. Result and discussion

3.1 Fish Growth

Based on research conducted for 60 days, the absolute weight growth of ctenopoma fish in treatment A was 1.94 grams, treatment B was 1.47 grams, treatment C was 0.85 grams, treatment D was 0.88 grams and treatment E of 0.69 grams. The absolute weight growth data was presented in Figure 1. The specific growth rate of ctenopoma fish in treatment A was 2.28%, treatment B was 1.98%, treatment C was 1.39%, treatment D was 1.46%, and treatment E was 1.20%. The specific growth rate data was presented in Figure 2. The absolute length growth of ctenopoma fish in treatment A was 1.38 cm, treatment B was 1.24 cm, treatment C was 0.98 cm, treatment D was 1.16 cm, and treatment E was 0.90 cm. The absolute length growth was presented in Figure 3.

Silk worm feed showed good results because of its good nutritional content. Silk worms contained up to 57% protein and 13.3% fat [7]. The growth rate in fish is influenced by the absorption of nutrients from the feed provided. The feed consumed by fish contains various substances including protein, fat, carbohydrates, crude fiber, vitamins and minerals. The main function of protein is to form new body tissues and maintain existing tissues [8]. The amount of protein stored in the form of tissue in the fish's body divided by the amount of feed protein consumed is called protein retention. The food eaten by fish will be used for body maintenance, basal metabolism, activity, and growth. Growth occurs when there is excess free energy after the available energy is used for body maintenance, basal metabolism, and activity. The main source of energy used for metabolism is fat. In a state of sufficient energy derived from fat, the energy derived from protein is used to build tissues so that growth occurs [9].
Previous study stated that the physical properties of feed must be in accordance with the eating habits of fish, feed is not easily destroyed in water, has an attractive aroma and stimulates appetite [10]. Ctenopoma fish have the habit of swimming at the bottom and the water column, moving slowly and being active at night. Silk worms are natural food that is widely used as food for ctenopoma fish, this is based on the nature of silk worms that move slowly, sink and size according to the mouth opening of ctenopoma fish. Looking at the physical properties of the feed used, frozen artemia feed has the smallest size, this is thought to be the cause of reduced fish appetite. Low fish appetite also occurs in the treatment of commercial pellet feed. Commercial pellet feed is floating, measuring 0.5-0.7 mm, the floating nature of this pellet feed is thought to be the cause of reduced fish appetite. With a reduced appetite for fish, the nutritional needs of fish are not met. Putra et al [11] stated that growth in the fish body will be influenced by the amount of nutrient content available at the time of fish rearing, the greater the amount of nutrients consumed by the fish, the more energy will be produced for growth and activity by each individual fish. This caused the slowest growth of fish on frozen artemia feed and commercial pellet feed.

3.2 Survival rate
The survival rate of ctenopoma fish ranged from 88% to 87%. Survival rates at different treatments during maintenance showed no significant effect. Survival rates data showed in Figure 4.
Based on the data in Figure 4 shows that the different types of feed given to ctenopoma fish did not produce a difference in the survival rate. This result was due to the fact that the ctenopoma fish seeds were able to live well in the culture containers, conditions that were suitable for the needs of the ctenopoma fish caused the fish to survive. This can occur due to water quality treatment during the maintenance period by siphoning fish feces, changing water, and using aeration. Water quality is an external factor that greatly affects the survival rate of fish, the more optimal the value of water quality in the rearing container will support the survival rate of fish [12]. The results of previous studies showed that ctenopoma fish reared for 28 days using silk worm feed resulted in a 90% survival rate [3].

### 3.3 Water quality parameters

The results of water quality parameter was presented in Table 1.

| Treatment | Parameter | Value         |
|-----------|-----------|---------------|
| A         | pH        | 6.8-7.8       |
|           | Temperature (°C) | 28-30       |
|           | DO (mg/L) | 5.5-7.3       |
|           | Ammonia (mg/L) | 0.02-0.09  |
| B         | pH        | 6.7-7.8       |
|           | Temperature (°C) | 27-30       |
|           | DO (mg/L) | 5.3-7         |
|           | Ammonia (mg/L) | 0.02-0.09  |
| C         | pH        | 6.5-7.8       |
|           | Temperature (°C) | 28-31       |
|           | DO (mg/L) | 5.5-7.2       |
|           | Ammonia (mg/L) | 0.02-0.09  |
| D         | pH        | 6.8-7.8       |
|           | Temperature (°C) | 27-30       |
|           | DO (mg/L) | 5.5-7.3       |
|           | Ammonia (mg/L) | 0.0-0.09    |
| E         | pH        | 6.8-7.8       |
|           | Temperature (°C) | 27-30       |
|           | DO (mg/L) | 5.5-7.3       |
|           | Ammonia (mg/L) | 0.02-0.09  |

Good water quality can support the life of fish. Water quality in each treatment did not show a big difference. The water temperature in the rearing tank ranges from 27-30°C. This result was in accordance with previous study that the optimal water temperature for ctenopoma fish life was 23-28°C [3]. The quality of water pH in the rearing container ranges from 6.5 to 7.8, this was in accordance with previous...
study which stated that freshwater fish would grow optimally in conditions of water pH ranging from 7 to 8.5 [3]. Previous study stated that the solubility of oxygen in water had an important role for fish growth, in the range of 1-4 mg/L fish could live but growth was stunted, while at oxygen solubility of 5 mg/L fish could grow optimally, during the maintenance period of oxygen solubility [5]. The lowest obtained was 5 mg/L so that the oxygen solubility factor has met the needs of fish life. Ammonia content in aquaculture containers would be safe for fish life if it did not exceed 0.5 mg/L, during the maintenance period the highest ammonia content produced was 0.09 mg/L, this made ammonia in water no harm to fish life [13].

4. Conclusion
Feeding silk worms to ctenopoma fish resulted in the highest growth rate although it did not showed a significant difference in survival rates.

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