Effects of different live feed on growth and survival rate of clown loach, *Cromobotia macracantus*

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Abstract. This study aims to investigate the effect of different types of live feed on the growth and survival of clown loach, *Cromobotia macracantus*. We used a completely randomized design with four treatments and five replications. The treatments were A; commercial diet feeding as control, B; silkworm, C; golden snail, D; sea worm. The feeding rate was 5% of body weight and feeding frequency was twice per day fed for thirty days. Tested parameters were weight gain (WG), length gain (LG), specific growth rate (SGR), feed conversion ratio (FCR) and survival rate (SR). The result showed that the administration of different live feed had a significant effect on growth performances (p <0.05) of clown loach fingerlings, but did not significantly affect its survival rate. The optimum weight gain (WG), length gain (LG), specific growth rate (SGR), feed conversion ratio (FCR) were found at treatment B, silkworm feeding with 0.78 ± 0.02 g, 4.33±0.01 cm, 0.47 ± 0.01%/day and 2.44 ± 0.08 respectively. Therefore, we concluded that the silkworm was highly recommended for clown loach, *Cromobotia macracantus* fingerlings feeding.

1. Introduction

Located in equator line, Indonesia has abundant of fish and shrimp biodiversity in the world [1, 2, 3]. Ornamental fish is currently developing in South East Asia [4, 12]. Clown Loach, *Chromobotia macracantus* is one type of ornamental fish originating from Sumatra and Kalimantan and has a high economic value so it has the potential to be developed [5]. Currently, Clown Loach fish hatchery has been developed at the Depok Ornamental Fish Cultivation Research Institute since 2004 and has been produced in the desired amount [6].

The availability of feed in fish farming is the most important factor to be considered. Feed plays an important role in fish cultivation activities and feed requirements can reach ± 60% of production costs [7]. The availability of live feed is a factor that plays an important role in fish farming [4]. Compared to artificial feed, live feed contains relatively higher nutrients, in addition to being easily obtained at relatively low costs, having a size that matches the mouth opening of the fish (especially the size of the fingerling). Thus, live feed is considered to be able to meet the needs of Clown loach for growth and survival of it. The types of live feed used in this study are silk worms (*Tubifex* sp.), Golden snail (*Pomacea canaliculata*), and sea worms (*Nereis* sp.).

The selection of live feed such as silk worms, golden snails and sea worms is due to the high protein content that can meet the needs of the carnivorous Clown loach protein. Based on the description above, the live feed of silk worms, golden snails and sea worms are feed that can be used as a substitute for commercial feed as the main feed for Clown loach with a relatively economical price and high nutrition and are expected to provide good results for growth and survival Clown loach.

2. Research Methode

2.1 Time and place of research

This research was conducted from September to October 2017. Fish maintenance was carried out in Gampong Cot suruy, Ingin Jaya District, Aceh Besar District. The main tools and materials used in this
study were jars, aerators, waring, pH meters, thermometers, botia fish, commercial feed, silk worms, golden snails, sea worms.

2.2 Experimental design
This research was conducted using a completely randomized design trial (CRD) with 4 treatments and 5 replications. The treatments tested in this study were as follows:
- Treatment A = commercial feed (control)
- Treatment B = Silk worm
- Treatment C = golden snail
- Treatment D = Sea worms

2.3 Container preparation and fish and feeding
The container used in this research was a jar with a size of 25 liters as many as 20 units. The containers used were cleaned first and then filled with 10 liters of water / jar. Furthermore, the jar was equipped with aeration to increase the solubility of oxygen in water. The placement of the container in this study was arranged by using a random container layout for each jar. This was done to get optimal research results. The golden snail which was first boiled with salt water for 30 minutes aimed to remove toxins and soften the meat. Next separated between meat and shell by breaking the shell. Then the meat obtained was soaked again for 15 minutes to clean the mucus [4]. As for silk worms and sea worms that had been obtained, it was cleaned with running water so that the mud was attached to the worms. The three types of live feed were cut into small pieces according to the size of the mouth of the fish then put into the freezer to maintain freshness before feeding.

The fish tested in this study were botia fish with a length of 3-4 cm and weight of 0.71 to 0.81 grams. The density of the test fish was 2 ind / liter, so at the beginning of the study there were 20 ind in each aquarium. At first, the weight was weighed and the length was measured. Feed given as much as 5% of the average body weight. The frequency of feeding 2 times a day at 8:00 a.m. and WIB 16.00 WIB. Fish fed at libitum.

2.4 Test parameters
Absolute weight growth
Absolute weight growth (W) was calculated using the [9] formula, as follows: \( W = Wt - Wo \)
Remarks: W: Absolute weight growth of fish that is maintained (gram) Wt: Weight of fish at the end of maintenance (grams) Wo: Weight of fish at the beginning of maintenance (gram).

Absolute length gain
Absolute length gain was calculated using the [9] formula, as little as: \( L = Lt - Lo \)
Remarks: L: Absolute length gain of fish kept (cm) Lt: Length of fish at the end of maintenance (cm) Lo: Length of fish at the beginning of maintenance (cm).

Specific growth rate
Calculation of specific growth rates using the formula [9, 10, 11, 12]:
\[
SGR = \frac{\ln Wt - \ln W0}{t} \times 100
\]
Description: SGR: Specific Growth Rate (% per day) Wt: Average fish weight at the end of the study (g) W0: Average fish weight at the beginning of the study (g) t: Time of study (days)

Survival of fish
The survival rate of fish during maintenance was calculated using [9, 10, 11, 12] formula as follows:
\[
SR = \frac{Nt}{No} \times 100\%
\]
Feed Conversion Ratio (FCR)
Feed conversion ratio during maintenance was calculated using the formula [13] as follows:

\[ \text{FCR} = \frac{F}{W_t - W_0} \]

Description: FCR: Feed conversion ratio F: Total amount of feed consumed (g) Wt: Test fish weight at the end of maintenance (g) Wo: Weight of test fish at the beginning of maintenance (g)

Water quality
Measurements of physics and chemistry parameter of water were carried out at the beginning, middle and end of maintenance. The parameters measured were temperature and pH.

2.5 Data analysis
Observational data in the form of absolute weight gain, absolute length gain, survival rate, Specific growth rate and feed efficiency of Clown loach feed obtained at the end of the study were analyzed using analysis of variance (ANOVA) with a 95% confidence level.

3. Results and Discussions
ANOVA test results of different live feed significantly affected the growth of absolute weight gain, absolute length gain, specific growth rate, and feed conversion ratio (P <0.05), but did not significantly affect survival rate (Table 1). The highest growth of fish weight was found in treatment B (silk worm) with an average value of 0.78 ± 0.02 gr. The lowest weight growth was found in treatment D (sea worms) with an average of 0.26 ± 0.005 gr / week. The highest absolute length gain was found in treatment B (silk worms) with an average of 4.33 ± 0.01 cm. The lowest length was found in treatment D (sea worms) with an average of 4.45 ± 0.02 cm, and the water temperature value during the study ranged from 27.5-27.74 °C, and the value of acidity (pH) ranged from 6.32 - 7.66 (Table 2).

Table 1. Results of treatment of absolute weight gain (g), absolute length gain (cm), specific growth rates (SGR), feed conversion ratios (FCR) and survival rate (SR).

| Treatment | Absolute Weight gain (g) | Absolute Length gain (cm) | Specific growth rate (% / day) | Feed conversion rate | Survival rate (%) |
|-----------|--------------------------|----------------------------|--------------------------------|----------------------|-------------------|
| A         | 0.33 ± 0.05b             | 4.20 ± 0.06b               | 0.13 ± 0.03b                   | 4.96 ± 0.77c         | 94.00 ± 5.47a     |
| B         | 0.78 ± 0.02d             | 4.33 ± 0.01c               | 0.47 ± 0.01d                   | 2.44 ± 0.08a         | 98.00 ± 4.47a     |
| C         | 0.47 ± 0.04c             | 4.21 ± 0.02b               | 0.26 ± 0.02c                   | 3.69 ± 0.33b         | 94.00 ± 8.94a     |
| D         | 0.26 ±0.005a             | 4.15 ± 0.02a               | 0.09 ± 0.06a                   | 6.07 ± 0.10d         | 92.00 ± 8.36a     |

Description: Different superscript letters in the same column show significant different.

Based on the ANOVA test results showed that feeding four different types of live feed significantly affected the growth of Clown loach, Chromobotia macracanthus fingerling. The feeding of silkworm experienced better growth than feeding of snails, commercial and sea worms. Based on the results of Duncan's further test, the highest results on feeding silkworms were significantly different from feeding snails, commercial and sea worms. This was thought to be caused by the fact that these four types of feed have different protein values, silkworms had a higher protein value than commercial feed so that the growth of Clown loach fingerling that are fed silkworms grow faster than the fish fed commercial food. It was stated that the nutritional content of silkworms is quite high, namely protein reaching 57%, fat 13.3%, crude fiber 2.04%, ash content 3.6% and water 87.7% [14].

The administration of silkworms (treatment B) in fish during the study stated the absolute growth value, specific growth rate, feed conversion ratio, and high survival compared to other treatments. This
was influenced by the nutritional value of silk worms by 57%, thus increasing the rate of growth of the juveniles. In addition, silk worms also had a slow motion, small size that matches the opening of the mouth of the fish and was easily digested. According to [15] stated silk worms also contain vitamin B12, calcium, pantothenic, nicotinic acid and B2. Clown loach showed a response to commercial feed and sea worms due to it required adaptation to be able to eat commercial feed and sea worms. In contrast to silk worms, it showed a high response of Clown loach which stated that Clown loach were more dominant in consuming live feed (silk worms). Silk worms had a distinctive aroma while in rice field snails feed tends not to emit fragrance [16]. Based on the composition of ornamental fish pellets used at the time of the study consisted of 48% protein content and 6% fat, while silk worms had a protein content of 57% and 13% fat content. Tubifex worms in addition to including foods that are rich in protein, this worm was also easily digested in the fish's body because it was without a frame.

Based on the results of the specific growth rate test it can be seen that the protein content in silk worms met the needs of fish growth because protein is one of the nutrients needed by fish to form new tissue and replace damaged tissue during growth [17]. However, with a higher protein content contained in feed will provide better growth performance such as growth produced by cork fish fed silk worms because to be converted from feed into body tissues fish requires up to 60% protein content [18]. Feed conversion ratio (FCR) was the ability to change feed into the form of adding body weight. The lower the value of feed conversion proved the better the feed. The highest feed conversion was found in the treatment with the administration of sea worms (treatment D) which was 6.07 ± 0.10% and the lowest was in the administration of sea worms (treatment B) which was 2.44 ± 0.08%, this indicated that the best value for fish is feed in treatment B (silk worms). According to [18], the smaller the value of feed conversion, the better the quality of the feed.

Survival is a factor that greatly determines the success of a fish seed cultivation activity. Clown loach juveniles that were kept for 30 days with a number of 10 ind/container showed results that were not significantly different in each treatment. The highest survival was in the treatment of silk worms (B) = 100% while the lowest survival was in the treatment of sea worms (C) by 91% and other treatments showed similar results. The lowest survival rate in the administration of sea worms (treatment D) which was 6.07 ± 0.10% and the lowest was in the administration of sea worms (treatment B) which was 2.44 ± 0.08%, this indicated that the best value for fish is feed in treatment B (silk worms). According to [20], the factors that influenced the digestion process of fish in feed include the factor of fish size, composition of feed, amount consumed, and physiological conditions of fish. According to [9] growth is defined as a change in the size or number of body cells, either temporal or long-term. Quantification for growth can be in the form of long weights (wet and dry) or body nutrients such as protein, carbohydrates, fats and energy. According to [21], that growth occurs when there is excess energy after being used for standard metabolism, namely digestion and activity.

Table 2. Water quality parameters

| Treatment | Temperature (°C) | pH     |
|-----------|-----------------|--------|
| A         | 27.52-27.62     | 6.32-7.06|
| B         | 27.56-27.62     | 6.32-7.62|
| C         | 27.54-27.74     | 6.33-7.66|
| D         | 27.50-27.60     | 6.32-6.86|

Water quality is important for the survival and growth of fish during maintenance. Poor water quality can affect the fish being tested. The water quality parameters measured included temperature, degree acidity (pH) and dissolved oxygen (DO). The temperature range during the study was 27.5-27.74 °C, and the acidity value (pH) ranged from 6.32 to 7.66 (Table 2). The results of measurements of water parameters during the study were in a range that was suitable for the growth of Clown loach juveniles. [23] stated that the dissolved oxygen content for optimal growth for fish survival must always be more than 5 mg / liter. Meanwhile, according to [24], in this study showed that the temperature of 27.16-27.44
C obtained the highest value of length and weight gain of fish. According to [18], the ideal pH for fish life is 6.5-9.0. PH values below 4 and above 11 cause mortality in fish.

Conclusion
It can be concluded that the administration of different live feed showed a significant effect on the growth of absolute weight gain, absolute length gain, specific growth rate and feed conversion ratio (P <0.05), but did not significantly affect survival. Furthermore, the best growth was found in treatment B (silkworms).

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