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Growth and Color Brightness of Glofish Fed Natural and Artificial Diets In Cianjur District, West Java Province

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KEYWORDS
glofish, natural feed, artificial feed, growth, color brightness

ABSTRACT

It is known that natural feed, in addition to being preferred because it moves, also has dyes that make the color of ornamental fish more contrasting than artificial feed. The purpose of this study is to find out which type of natural feed (Silk Worm (Tubifex sp.), Daphnia sp., Frozen Blood Worm) and artificial feed, which is more effective against the growth and brightness of the color of Glofish Starfire Red, which will be carried out in August 2024-October 2024 in Cianjur Regency, West Java Province. The study was conducted using an experimental method using a Complete Random Design (RAL) with 4 treatments and 3 replicates. The treatment given is as follows: A (Research using natural feed Daphnia sp, B (Research using natural feed Bloodwarm/Chironomidae, C (Research using natural feed Tubifex sp), D (Research using artificial feed). The parameters observed were Absolute Length Growth, Absolute Weight Growth, Specific Growth Rate and Color Brightness, to analyze the color brightness of Starfire Red fish using https://redketchup.io color comparison.

INTRODUCTION

Ornamental fish are fish that are kept to enjoy their beauty and are intended for hobby fulfillment. Usually ornamental fish are placed in a location that can be seen by the public such as in the lobby or living room, this is in line with the statement from the National Export Development Agency (1994) that ornamental fish generally have a distinctive shape, color and character so that they are able to create an aquarium atmosphere that supports the spatial layout and is able to provide a peaceful atmosphere. According to (Ziemann et al., 2001) Ornamental fish are a group of fish that are very popular because they have a very unique morphology, attractive colors and are very suitable for keeping in aquariums.

Glofish are an eye-catching type of ornamental fish and are usually placed in aquascapes because of their bright and vibrant colors. This type of fish is produced through the development process of combining genetic/GMO changes, from this process fish are produced that have bright and attractive colors. Glofish was originally introduced in 2003, and it still has a lot of fans of ornamental fish from many places around the world.

One of the factors that affect the rapid growth rate of fish is by providing quality feed and in accordance with the needs of fish (Bokings, 2017). Feed is one of the important aspects that must be considered in cultivation activities, because feed is a source of energy to support growth. A good feed is one that is in accordance with the physiological needs and the species of fish being cultivated. In addition to being able to meet the nutritional needs of these fish, providing feed with good quality and quantity can optimize the fish farming business. Feed

must be available in sufficient quantities, continuously, and have the nutritional content needed for fish growth (Maskur et al., 2021).

Glofish are ornamental fish known for their bright and attractive colors. Optimal color brightness and growth are essential in ornamental fish farming to increase selling value and visual appeal.

In 2022, GloFish fish in Indonesia have developed into seven colors, namely Starfire Red (Red), Sunburst Orange (Yellow), Electric Green (Green), Cosmic Blue (Blue), Moonrise Pink (Pink), Galatric Purple (Purple) and Apple Green (Highlighter Green). In this study, only one type of fish color was used (Figure 1), namely Glofish Tetra Starfire Red (Red).

Figure 1. Glofish Tetra Starfire Red (Red).

In ornamental fish farming, the thing that needs to be considered is the brightness of the color of the fish. Therefore, it is necessary to have feed that can increase the brightness of the color of cultivated ornamental fish such as GloFish fish.

The color brightness of GloFish fish is the result of genetic engineering that allows them to produce bright colors. One of the genetic engineering that needs to be considered is nutrition and feed. Nutrients contained in Tubifex sp. namely protein 57%, fat 13.30%, and carbohydrates 2.04% (Madinawati et al., 2011). Daphnia sp. It consists of 95% water, 4% protein, 0.54% fat, 0.67% carbohydrates and 0.15% ash (Purwakusuma, 2007) According to Smith et al. (2018), bloodworms have a high protein content (about 50-60% of dry weight), as well as fats, carbohydrates, vitamins, and minerals that are important for fish growth.

Natural feed plays an important role in fish farming by providing essential nutrients necessary for fish growth and health. Despite the challenges in availability and production, the benefits of natural feed make it a valuable component in fish farming practices. The development of efficient and sustainable natural feed cultivation methods will help in optimizing the use of these resources.

Silkworms, also known as Tubifex spp., are a group of small worms that live in freshwater sediments. Research by (Mi'raizki & Chilmawati, 2015) stated that the organic C-element in silkworm rearing media plays a role as an energy source. These worms are often used as natural feed in fish farming due to their high nutrient content and ability to accelerate fish growth. Research by Rachmawati, A. (2013) stated that silkworm feeding has a faster growth rate compared to commercial feeding. Then the research of (Kurniawan et al., 2022) showed that silkworms contain natural pigments such as carotenoids that help improve the color of ornamental fish.

Figure 2A. Silk Worm (*Tubifex* sp)

Figure 2B. *Daphnia* sp

Figure 2C. Frozen Blood Worm

Figure 2D. Akari Premium Red Pellet

Fig. 2 A. Silk Worm (Tubifex sp.), 2B Daphnia sp., 2C. Frozen Blood Worm. 2D. Akari Premium Red Pellet

Daphnia sp. is the main component of freshwater zooplankton with a body length between 0.2 - 3.2 mm (Pennak, 1953). Daphnia sp. has a bilateral flattened body shape. The body is covered by a shell from the cuticle that contains a transparent khitin called carapaces (Djarijah, 1995). The division of body segments of Daphnia sp. almost invisible. Daphnia sp. has a transparent body so that the internal organs are clearly visible. On the head there are compound eyes, ocellus, and two pairs of antennae, namely the first antenna and the second antennae which branch to half or more of the length of the body which functions for swimming, maxilla, and mandible (Ebert, 2005). Rahmadani, A., & Setiawan, H. (2022) found that betta ornamental fish fed Daphnia showed a faster growth rate compared to fish fed artificial feed. Furthermore, Wulandari, D., & Pratama, A. (2021) stated that Daphnia contains natural pigments that help improve the color of ornamental fish, making them more visually appealing.

Bloodworms (Chironomidae) are a popular natural feed source in fish farming because of their high nutrient content and ease of obtainment. In addition to natural feed, the feed used for fish farming also has artificial feed. Artificial feed is a feed made for farmed fish and must meet the nutritional needs of fish. Research by (Junaidi & Kartiko, 2020) showed that fish fed bloodworms showed a significant increase in growth compared to fish fed commercial feed. The brightness of the color in Glofish fish is greatly influenced by the type of feed given. A study by [Susanti and Harsono (2019)] found that Glofish fed bloodworms had a brighter and more intense color compared to those fed artificially. The carotenoid content in bloodworms contributes directly to the increase in color pigments in fish, which makes their colors more vivid and attractive.

RESEARCH METHOD

This study was conducted using an experimental method using a Complete Random Design (RAL) with 4 treatments and 3 replicates. The treatment provided is:

Treatment 1 = Artificial Feed
Treatment 2 = Daphnia sp
Treatment 3 = Bloodwarm/Chironomidae
Treatment 4 = Tubifex sp
Parameters used:

1. Growth of absolute length;
   PP = Pt – Po
   Where, PP = Growth length (cm), Pt = Length of individual fish time tth time (cm), Po = Length of individual fish time 0th time (cm).
2. Absolute Weight Growth
   W = Wt – Wo
   Where, W = Growth in the absolute weight of the fish raised (gr), Wt = Weight of the fish at the end of maintenance (gr), Wo = Weight of the fish at the beginning of maintenance (gr).
3. Specific Growth Rate
   The specific growth rate is the % of the difference between the final weight and the initial weight, divided by the length of maintenance time. According to Zonneveld et al. (1991) the formula for calculating the specific growth rate is:
   SGR = wt - wo : t x 100%
   Information:
   SGR = Specific growth rate
   Wt = weight of fish biomass at the end of the study (g)
   Wo = weight of fish biomass at the beginning of the study (g)
   t = maintenance time (days)
4. Color brightness
   Analyze the color brightness of Starfire Red fish using a color comparison with that on the website redketchup/https://redketchup.io

RESULTS AND DISCUSSION

Glofish Weight

The weight of glofish after being cultivated for 60 days tends to increase from an average of 0.5 grams to an average of 2.75 cm (Table 1). It appears that B and D treatments, namely glofish given Daphnia and Tubifex, provide a significant growth response compared to the other 2. This can be explained by the possibility of the nutritional content of Daphnia and Tubifex according to the needs of glofish. Rahmadani, A., & Setiawan, H. (2022) found that betta ornamental fish fed Daphnia showed a faster growth rate compared to fish fed artificial feed. Furthermore, (Wulandari & Sutarjo, 2021) stated that *Daphnia* contains natural pigments that help improve the color of ornamental fish, making them more visually appealing.

Table 1. Glofish weight during the 60-day study

Period	Treatment A	Treatment B	Treatment C	Treatment D
1st	0,5	0,5	0,5	0,5
2nd	1,1	1,3	1,2	1,4
3rd	1,5	1,6	1,3	1,6
4th	1,7	1,8	1,7	2,1
5th	1,9	2,1	1,9	2,8
6th	2,1	2,9	2,5	3,5
delta	1,6c*	2,4a*	2,0b*	3,0a*

*The same letter after delta indicates no significant difference in glofish weight response

If the data in Table 1 is made a bar diagram, it can be seen in Figure 4 below.

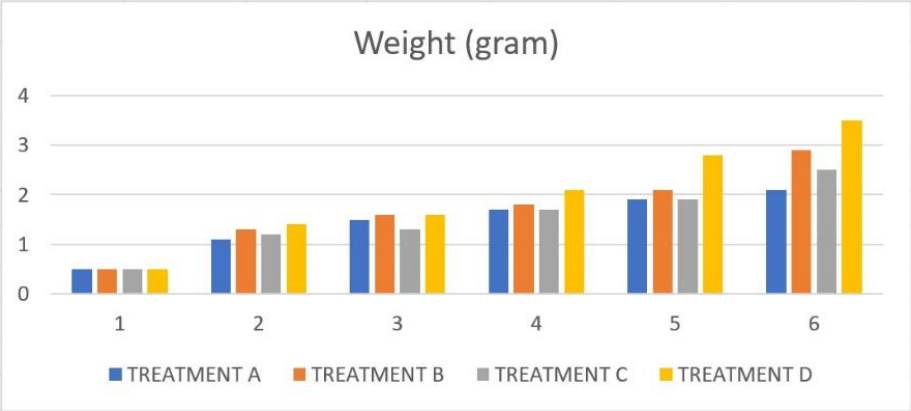

Figure 3 Glofish Weight Bar Diagram for 60 days

According to (Mulqan et al., 2017) fish growth is influenced by the quality and quantity of feed, age, and water quality. Fish growth is highly dependent on the energy available in the feed and energy expenditure, the energy needs for maintenance must be met first and if there is excess, it will be used for growth (Lovell 1988 in (Fitriliyani, 2018). Fish growth is influenced by two factors, namely internal factors and external factors, including: a) Internal factors which include genetics and physiological conditions of fish. b) External factors related to the environment which include the composition of chemical quality and water physics, metabolic waste, availability of feed, and disease.

Glofish Length

Observation of the length of glofish during the study can be seen in the following Table 2.

Table 2. Length of glofish during the study for 60 days

Period	Treatment A	Treatment B	Treatment C	Treatment D
1st	3	3	3	3
2nd	3,5	3,6	3,5	3,6
3rd	3,7	3,9	3,9	3,9
4th	4,2	4,1	4,1	4,3
5th	4,5	4,5	4,5	4,9
6th	4,7	5,5	4,8	5,3
Delta	1.7b*	2,5a*	1.8b*	2,3a*

*The same letter after delta indicates no significant difference in glofish weight response

In stadia of calves and adolescents, body length growth occurs faster so that it results in a larger and faster increase in length. According to (Pouyaud et al., 2003)that ornamental fish still continue to grow and develop until they are 3 years old and it is necessary to carry out further research on the growth and development limits of ornamental fish with a wider lifespan. According to M. Ghufron (2004) that feeding factors containing 40% - 50% protein will provide maximum growth for the development of fish life. Figure 5 shows the length of the observed glofish over 60 days.

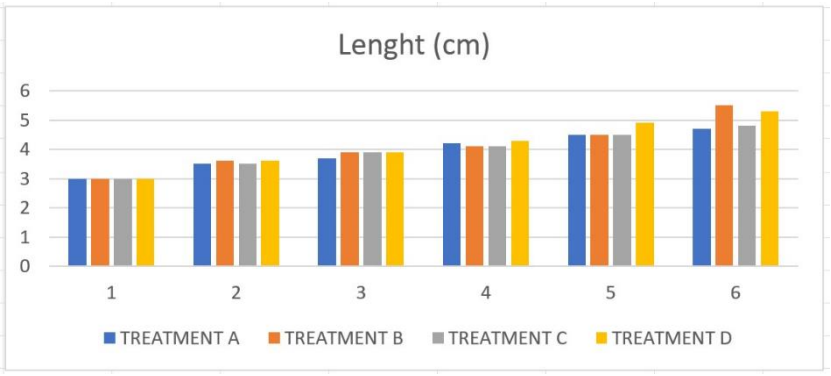

Figure 4 Glofish Length Diagram for 60 days

Glofish Colors

According to Irianto (2005) color is an indicator of beauty in ornamental fish, the brighter the color of the fish, the more attractive it will be and the higher the selling price will be. Discoloration in fish is caused by environmental stresses such as sunlight, water quality and pigment content on the skin or scales of fish. Natural fish color changes can also occur based on genetic, feed and environmental factors. Ornamental fish that have brightness and beauty in color determine the selling value of the fish.

Analyzing the brightness of the color of Starfire Red fish using a color comparison with that on the AI website redketchup/https://redketchup.io provides red and other colors, namely blue and green. Tables 3, 4 and 5 and Figures 6, 7 and 7 show the red, green and blue color points to measure the color at the base of the glofish tail at each treatment and over a 60-day measurement period.

In stadia of calves and adolescents, body length growth occurs faster so that it results in a larger and faster increase in length. According to Laurent et al. (2016) that ornamental fish still continue to grow and develop until they are 3 years old and it is necessary to carry out further research on the growth and development limits of ornamental fish with a wider lifespan. According to M. Ghufron (2004) that feeding factors containing 40% - 50% protein will provide maximum growth for the development of fish life.

Table 3 Showing a red point on the base of the glofish's tail at each treatment and over a 60-day measurement period.

Period	Treatment A	Treatment B	Treatment C	Treatment D
1st	172	172	172	172
2nd	195	196	197	198
3rd	190	198	208	192
4th	207	205	207	201
5th	208	214	216	204
6th	210	217	222	209

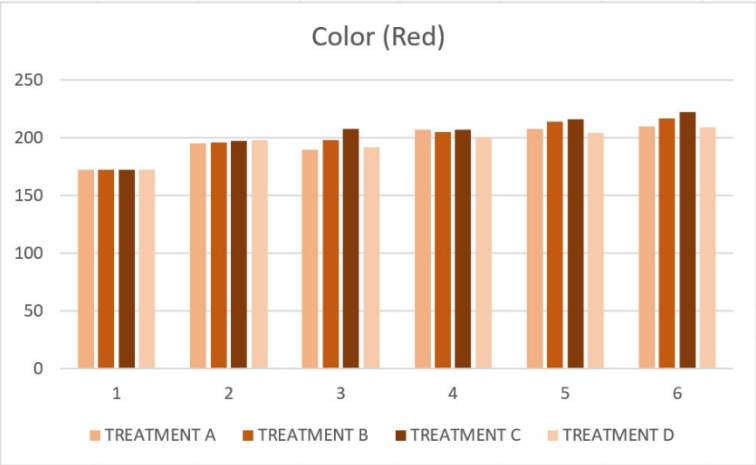

Figure 5 Point of the Red Color Value at the Base of the Glofish's Tail for Each Treatment, Each Measurement Period

The following table, Table 4 and Figure 5 show the green point at the base of the glofish tail at each treatment and over a 60-day measurement period.

Table 4 Showing a green point at the base of the glofish tail at each treatment and over a 60-day measurement period.

Period	Treatment A	Treatment B	Treatment C	Treatment D
1st	48	48	48	48
2nd	50	54	50	53
3rd	53	35	35	50
4th	44	24	31	46
5th	32	33	25	33
6th	37	25	21	39

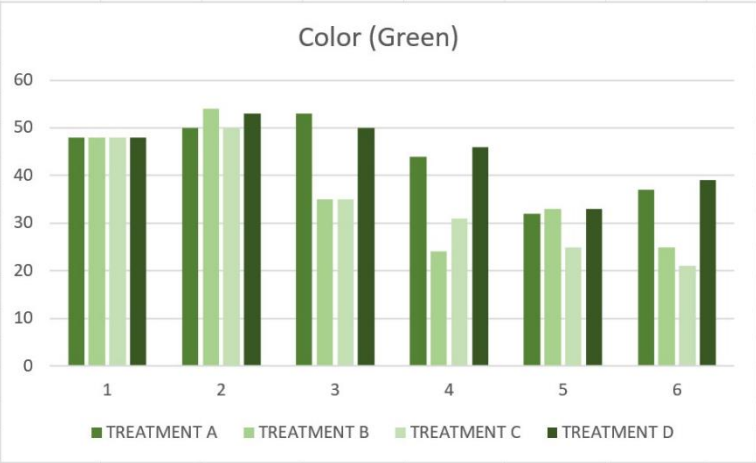

Figure 6. Green Color Value Point at the Base of Glofish's Tail Every Treatment, Each Measurement Period

The following Table 5 and Figure 6 show the blue point at the base of the glofish tail at each treatment and over a 60-day measurement period.

Table 5 Blue points on the base of the glofish's tail at each treatment and over a 60-day measurement period.

Period	Treatment A	Treatment B	Treatment C	Treatment D
1st	62	62	62	62
2nd	58	54	50	53
3rd	60	39	39	50
4th	53	35	35	46
5th	44	31	30	33
6th	32	14	10	35

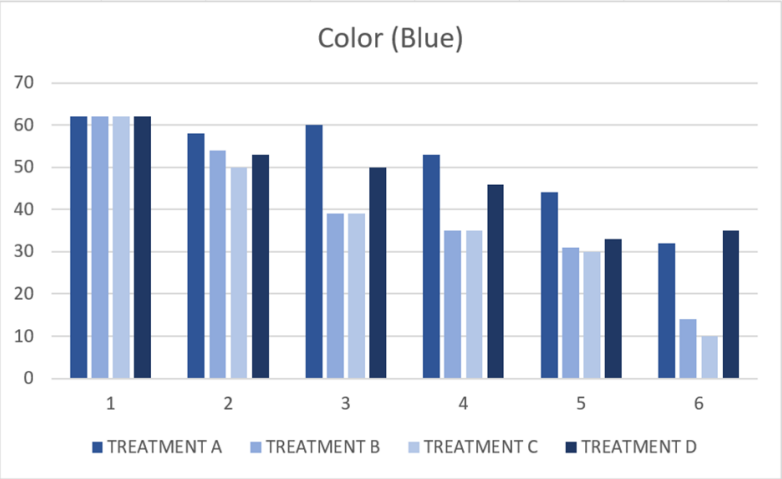

Figure 7. Blue Point Value on the Base of Glofish's Tail Every Treatment, Each Measurement Period

Based on observations, there was a change in the red color point of the glofish during the 60-day treatment which was a response from the treatment. The natural feed *of Chironomidae* gives a color point of 222, higher than the naturally fed glofish (210), *Daphnia* sp (217) and *Tubifex* sp (209).

CONCLUSION

Natural feeding of Daphnia sp and Tubifex sp provided a significant increase in glofish weight, namely 2.4 grams and 3.0 grams compared to others. Natural feeding of Daphnia sp and Tubifex sp provides a significant increase in the length of glofish, namely 2.5 cm and 2.3 cm compared to others.

The red point at the base of the glofish's tail in the measurement period for 60 days for each treatment, showed the administration of bloodworms (chironomidae) of 222 points, compared to the treatment of artificial feeding, Daphnia sp and Tubifex sp of 210, 217 and 209.

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