Growth performance and survival rate of Boeseman's rainbowfish (*Melanotaenia boesemani*) in natural spawning technique at Depok, West Java, Indonesia

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Abstract. Boeseman's rainbowfish is an endemic ornamental fish from Papua. This fish is popular because of its beauty and uniqueness. Problems that occur in rainbow fish farming are low growth rates and high mortality rates in the larvae stage. The purpose of this research is to analyze the growth performance and survival rate of Boeseman's rainbowfish. This research was conducted at BRBIH Depok, West Java, on December 17, 2018, until January 17, 2019. The technique is used was natural spawning technique. In this technique used aquarium containers and fiberglass tanks. Maintenance of the parent is done by feeding *Chironomus* sp. twice a day. The parent selection is carried out before the spawning process. The results of spawning for 20 days had a fertilization rate of 91.47 % and a hatching rate of 86.12 %. Growth monitoring results of the average growth rate were 0.0031 g/day, the specific growth rate was 0.013 – 0.095 %bb/day and the survival rate of larvae was 47.24 %.

1. Introduction

Ornamental fish is one of the fisheries commodities that have high economic value as an export commodity, so it is very promising to be developed. Indonesia made sales worth USD 24 million in 2014 [1]. Rainbowfish (*Melanotaenia* sp.) is one type of ornamental fish that very popular among aquarium ornamental fish lovers [2]. Rainbowfish is one of the endemic ornamental fish from Papua, which is on Lake Ajamaru and several tributaries around it [3].

Boeseman’s rainbowfish (*Melanotaenia boesemani*) is an ornamental fish that has a different color than most other rainbow species, the coloration marked by a brilliant blue anterior and bright yellow to orange-red posterior [4]. The number of requests for rainbowfish can be seen from the large number of catches carried out in its natural habitat. Besides, the problems that occur in rainbowfish farming are low growth rates and high mortality rates in the larval stage [5]. Therefore, improvements are needed in the rainbowfish farming system.

Efforts to meet the demand for rainbowfish include applying good rainbowfish farming techniques. By applying good rainbowfish farming techniques, it is expected to help meet the high market demand for rainbowfish, so that suppliers of rainbowfish do not damage the original habitat of rainbowfish [3].
The purpose of this research is to find out the techniques for spawning rainbowfish, knowing the obstacles, problems and success factors in spawning rainbowfish (Melanotaenia boesemani) in BRBIH Depok. The benefits of this research can improve and apply the knowledge and skills in spawning techniques of Boeseman’s rainbowfish (Melanotaenia boesemani). Knowing the obstacles, problems, and determinants of success in the spawning technique of Boeseman’s rainbowfish.

2. Materials and methods

2.1. Place and time
This research was conducted at the Research Institute for Ornamental Fish Culture (BRBIH), Depok, West Java on December 17, 2018, until January 17, 2019.

2.2. Preparation of containers for maintenance and spawning
The container used in the maintenance of rainbowfish is a fiberglass tank with a size of 85 x 80 x 60 cm. The container used for spawning Boeseman’s rainbowfish (Melanotaenia boesemani) is using a glass aquarium with a size of 60 x 40 x 30 cm. The first step in preparing a rainbowfish care container is to clean the care container to remove dirt and moss that sticks to the fiber tub or aquarium. then rinsed using clean water and dried in the sun to dry. then filled with well water that has been deposited in the reservoir and added aeration to supply dissolved oxygen.

2.3. Parent maintenance
Parent maintenance is carried out before the main selection process and the spawning process. The parent of Boeseman’s rainbowfish is maintained in a fiberglass tank measuring 85 x 80 x 60 cm with a water height of 50 cm and a density of 100 tails. feed given to the parent of rainbowfish is blood worms (larvae of Chironomus sp.) by feeding twice a day at satiation. Feeding blood worms or larvae of Chironomus sp. performed on the parent of rainbowfish due to Chironomus sp. has a high enough protein content that is equal to 55.62% which serves to accelerate the gonadal maturation process and accelerate the growth process [6].

2.4. Preparation of spawning media
The place for spawning Boeseman’s rainbowfish (Melanotaenia boesemani) is carried out in an aquarium measuring 60 x 40 x 35 cm with a water level of 25 cm. Rainbowfish has an adhesive type of egg which is after the hardening of the shell, the egg is sticky so that it attaches to objects or substrate around it. The substrate used in the spawning of rainbowfish is raffia, the substrate of the raffia rope has the advantage that it is not easy to rot and has good adhesion to the egg.[7].

2.5. Parent selection
The parent used in spawning rainbowfish must be gonadal mature and more than seven months old. Herman dkk. [8] statement, which states that the parent used in spawning must be more than seven months old with an average length of 5-7 cm. The difference between a male and a female parent that has matured gonads can be seen from the size and color of his body. The male parent has a larger body shape, brighter body color, longer dorsal fin, large head, and slender body. While the female parent has a fatter body shape, more faded colors, shorter fins, and a pointed head and has a bulging stomach [9,12]. The male parent and female parent can be seen (Figure 1).
2.6. Water quality measuring
The parameter that measured are for water quality which includes measuring dissolved oxygen using DO meter, pH using pH meter, temperature using thermometer and ammonia using an ammonia test kit.

2.7. Data analysis
Growth parameters measured are weight and length. Fish body weight measured using analytic scales with a precision level of 0,001 gr or 0,1 mg and fish body length measured using a microscope equipped with a meter scale with a precision level of 0,001 mm. Other growth parameters calculated include:

a. Hatching rate (HR), to determine Hatching Rate uses a formula [10].
\[
HR(\%) = \frac{\text{The number of eggs hatched}}{\text{several sample eggs}} \times 100\%
\]

b. Fertilisation Rate (FR), to determine the Fertilisation Rate use formula [10].
\[
FR = \frac{Qt}{Qo} \times 100\%
\]

c. Survival Rate (SR), to determine Survival Rate use a formula [11].
\[
SR(\%) = \frac{Nt}{No} \times 100\%
\]

d. Growth Rate (GR), to determine Growth Rate use a formula [11].
\[
GR (\text{g/day}) = \frac{Wt - Wo}{t}
\]

e. Specific Growth Rate (SGR), to determine Specific Growth Rate uses a formula [12].
\[
SGR(\%) = \frac{\ln(Wt) - \ln(Wo)}{(t_2 - t_1)} \times 100\%
\]

Where:
- \(Wt\) = Fish weight on the day (gr)
- \(Wo\) = Fish weight at the beginning of the study (gr)
- \(t\) = Maintenance Time (day)
- \(Nt\) = The amount of fish harvested
- \(No\) = The number of fish stocked
Qt = The number of eggs fertile
Qo = The number of eggs hatched

3. Result and discussion

3.1. Spawning process
The process of spawning Boeseman’s rainbowfish (Melanotaenia boesemani) at the Depok Ornamental Fish Research Center is done naturally, with a ratio of 1:1, namely two males and two females in one aquarium, according to the statement of Tappin [13], which states spawning rainbowfish usually done in groups with more than one male and female in a aquarium, because it can reduce stress on fish. rainbowfish can spawn every day of the year [14], with the peak spawning of Boeseman’s rainbowfish (Melanotaenia boesemani) occurring in August [15].

3.2. Hatching eggs
Hatching egg is done by moving the substrate that has been plastered with eggs into the egg hatching container. The hatching container used in this research is a plastic basin with a diameter of 25 cm and a height of 10 cm, which is filled with reservoir water with a water level of 6 cm. During the egg incubation process, the fertilization rate (FR) and the hatching rate (HR) are calculated. Fertilization rate of rainbow fish accompanied for 20 days the spawning process showed fertilization of 91.47%. This is higher than the results of the Tappin [16] which state the degree of fertilization of rainbow fish ranges from 70 - 80%. Calculation of hatching rate on rainbow fish is carried out starting from 6 days after fertilization until the 10 days after fertilization. This is following the opinion Tappin [16] which states that rainbow fish eggs will hatch at 6-10 days after the egg incubation process. The results of the observation during egg incubation showed that the percentage of eggs that hatched during the spawning process of boesemani rainbow was 86.12%.

Figure 2. Egg of Boseman’s rainbowfish.

3.3. Maintenance of Boeseman’s rainbowfish larvae
Rainbowfish larvae in this study mentened in a fiberglass tank with a size of 43.5 x 43.5 x 30 cm with a water height of 10 cm and given weak aeration. Boeseman rainbowfish larvae are very small with a length of about 3-4 mm, as well as the opening of the mouth, this will be related to the right feed to be given during the larval rearing period [17]. Rainbowfish larvae will run out of the yolk sac at the age of 3-4 days after hatching. The feed used during larval rearing is natural feed infusion and Rotifera sp. by ad libitum.
3.4. Water quality measurement

The water quality in containers for the maintenance of a rainbow or other fish must be maintained properly. Therefore, it is necessary to siphon and replace the water in the rainbowfish care container. Siphon and water replacement is done every morning to clean water in the culture media from dirt and food scraps that are not consumed by fish. The results of water quality measurements at the Boeseman rainbow hatchery can be seen in Table 1.

Table 1. Water quality parameters in Boeseman’s rainbowfish hatchery.

|                  | Larvae | Fingerling | Parent | Optimum [16] |
|------------------|--------|------------|--------|--------------|
| DO (mg/l)        | 5.90   | 5.75       | 5.92   | 6 – 8        |
| Temperature (°C) | 27.0   | 27.1       | 27.0   | 24 – 29      |
| pH               | 7.05   | 7.00       | 6.98   | 6.92 – 7.70  |
| Ammonia (mg/l)   | No Detected | No Detected | 0.02   | < 2.0        |

The results of measurements of dissolved oxygen, temperature, pH, and ammonia on larvae maintenance media, fingerling, and parent of rainbowfish in the BRBHI Depok showed that they were still in good condition or within the tolerance limit of the needs of rainbowfish.

3.5. Growth monitoring

Monitoring the growth of Boeseman’s rainbowfish larvae can be done by routine sampling of rainbowfish larvae. In the activities of spawning rainbowfish in this research, sampling is done once a week on the rainbowfish larvae that we maintain. The graph of the length of the rainbow fish and the growth of the length of the rainbowfish.
Monitoring the growth of Boeseman's rainbowfish can be done by routine sampling of larvae rainbowfish. In this research, sampling is done once a week. The results showed that during the maintenance of rainbow fish grew 0.1309 grams or a growth rate of 0.0031 gram/day with a weight starting at 0.0009 grams and a final weight of 0.1318 grams, the specific growth rate of 0.013 - 0.095% BB/day. Average growth of length was 0.818 mm, at the age of 8-14 days growth of 5.291 mm, at the age of 15-28 days growth of 6.87 mm, aged 29-35 day growth of 3.02 mm and at 36-42 days of growth, the length is 2.03 mm. Fish growth will vary in level, where it depends on the ability of fish to digest and utilize the feed provided as optimal as possible [18].

Rainbowfish growth at the beginning of maintenance has increased and when the seeds are more than one month old the growth begins to decline, this is in accordance with the statement of Dhamaraj and Dhevendaran [19] which states that ornamental fish at the beginning of growth focuses on nutrients obtained for growth while ornamental fish larger-sized nutrients obtained are focused on growth and to improve the quality of skin tone.
3.6. Pests and diseases
The pest found in the maintenance of Boeseman rainbow larvae during research at BRBIH Depok was the larvae of Cybister sp. or who have the local name ucrit and larvae of the Odonata dragonfly or who have local names kini-kini. In the maintenance of larvae, Boeseman rainbowfish found 9 Cybister sp. and 21 larvae of Odonata dragonfly. The parasite found in Boesemani rainbowfish is White Spot Disease. This disease is caused by protozoa *Ichthyophthirius multifilis* [20].

Efforts were made to deal with dragonfly larvae and larvae Cybister sp. is filtering the feed before given and monitoring the maintenance tank every day. and the effort to overcome the disease caused by Ichthyophthirius multifilis is to dry the care tank that was attacked until it is clean and then the fish are moved in a special quarantine aquarium. The aquarium is filled with water with a height of 15 cm, then salt is added at a dose of 5 g / L and 2 heaters are added to stabilize the temperature of the maintenance media and to inhibit the growth of parasites [21].

3.7. Survival rate
Survival rate is a percentage of larvae that live from several eggs that hatch until the end of the maintenance period. In the rainbow larvae maintenance during the research in BRBIH Depok, it was found that the survival rate of 47.24% was relatively low compared to the results of Kadarini et al. [22] which succeeded in obtaining the survival rate value of 80%. Subandiyah and Kadarini[7] adding that the value of the low fish survival rate is influenced by environmental factors, frequency of feeding and pest disease.

4. Conclusion
The growth performance of Boeseman’s rainbowfish is relatively low because in ornamental fish nutrients that are obtained are focused on growth and to improve the quality of skin color. While the survival rate of larvae Boeseman’s rainbowfish is low because of their very small size and the presence of pests in larvae rearing tanks that come with the natural feed given.

5. References
[1] KKP 2014. *Direktur Pengembangan Produk Nonkonsumsi Pengolahahan dan Pemasaran Hasil Perikanan* (Jakarta: P2HP)
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