The growth and survival rate of the larvae of the sunu grouper (Plectropomus leopardus) in different temperatures

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Abstract. The sunu grouper, known as the starch grouper, is one of Indonesia's leading export commodities of marine culture. Temperature is an environmental factor that directly affects fish life. Temperature fluctuations affect the hatchability of the eggs. Water temperatures in the often-changing cultivation medium can produce egg hatching rates ranging from 60 - 70%. The growth stage where the sunu grouper fish larvae become seeds lasts for 45 - 55 days at a water temperature of 27 - 29°C. This study was conducted with the aim of determining the optimum temperature of the development of the early stages of larvae (D0 - D7) for sunu. This research was conducted at Universitas Airlangga Laboratory PSDKU Banyuwangi between May and October 2017. The test material consisted of the eggs of sunu grouper obtained from Balai Besar Riset Budidaya Laut dan Penyuluhan Perikanan Bali. The method used in the implementation of this research was an experimental design that was Randomized Completely (RAL). The treatment consisted of one factor, temperature, and 4 treatments (26, 28, 30, 32°C) repeated 5 times. The results showed that the optimum temperature for the larvae of sunu was in at 30°C with a HR value of 99%, a growth length of 0.96 mm and an SR of 23%.

1. Introduction

Groupers are a type of fish from the Serranidae family that has a high value and that is widely developed in countries throughout Asia, such as Hong Kong, China, Taiwan, Singapore and Malaysia. The sunu grouper fish is an important economic demersal fish that has a good chance of being cultivated because it is supported by considerable potential. Temperature greatly affects the physiological processes of fish, which includes respiration, metabolism, growth and reproduction. The growth of sunu grouper larvae into seeds lasts for 45 - 55 days at a water temperature of 27 - 29°C. The temperature and initial size of the fish are the two most important factors for growth and food consumption [1,2,3,4,5]. Considering that there is not yet a lot of information related to the optimum temperature for embryogenesis processes and the development of sunu grouper larvae in particular, research related to this matter is important. This study was conducted with the aim of determining the optimum temperature for the development of the early stages of the larvae (D0 - D7) of the sunu grouper.

2. Materials and method

The research material was in the form of sunu grouper fish eggs, sea water and fresh water. Sunu grouper eggs were obtained from the Hatchery Balai Besar Pengembangan Budidaya Laut Bali. The research tools were in the form of an aquarium that was 60 x 30 x 30 cm in size, an aerator and an aeration pipe. The method used in the implementation of this study was an experiment using a
Complete Random Design (RAL). The treatment consisted of one factor, temperature, and consisted of 4 treatments (26, 28, 30, 32°C) which were repeated 5 times. The research activities begin with preparation, the acclimatization of the eggs, the stocking and hatching of the eggs and larval maintenance. The observation data for the egg hatching time was shown descriptively, while the data from the observation of the Hatching Rate (HR), Survival Rate (SR) and Long Growth rate were tabulated and processed using analysis of variance (ANOVA).

3. Result and discussion

3.1. Hatching time

The sunu grouper eggs began to hatch partially at 11 hours after fertilization, found in the eggs incubated at 30 and 32°C. For the eggs incubated at 26°C and 28°C, they just hatched after 15 hours post-fertilization. All of the eggs hatched as a whole 20 hours after fertilization.

3.2. Hatching rate (HR) larvae

| Treatment | HR(%) ± SD |
|-----------|------------|
| 26°C      | 88.8 ± 1.3 |
| 28°C      | 91.2 ± 0.8 |
| 30°C      | 99.0 ± 0.8 |
| 32°C      | 97.8 ± 0.8 |

Based on Table 1, it can be seen that the highest percentage of the HR values found in the eggs incubated at 30°C was 99% and the lowest percentage was at the incubation treatment temperature of 26°C, at 88.8%. The ANOVA test results show that the HR value for each treatment was significantly different.

3.3 Length and growth of the larvae

| Treatment | Length growth (mm) ± SD |
|-----------|-------------------------|
| 26°C      | 0.28 ± 0.02             |
| 28°C      | 0.26 ± 0.04             |
| 30°C      | 0.96 ± 0.05             |
| 32°C      | 0.77 ± 0.30             |

Based on Table 2, it can be seen that the fastest growth was found in the treatment temperature of 30°C, equal to 0.96 mm, and the lowest length of growth was at the treatment temperature of 28°C, equal to 0.26 mm. The ANOVA test results showed that the treatment temperature of 30°C was significantly different from the treatment temperature of 32, 28 and 26°C, but for the treatment of 28°C, there was no significant difference compared to the treatment of 26°C.

3.4 Larvae survival rate (SR)

| Treatment | SR(%) ± SD |
|-----------|------------|
| 26°C      | 14.2 ± 1.3 |
| 28°C      | 19.2 ± 0.8 |
| 30°C      | 23.0 ± 1   |
| 32°C      | 20.4 ± 0.5 |

Based on Table 3, it can be seen that the highest SR grouper larvae SR was found in the 30°C temperature treatment of 23% and the lowest SR rate was found in the 26°C temperature treatment, at 14.2%. The ANOVA test results showed that the highest SR values were found in the 30°C treatment,
which was significantly different from the treatment temperatures of 26, 28 and 32°C. However, the treatment temperature of 32°C was not significantly different from the treatment temperature of 28°C.

4 Discussion
Based on the results of the research on the speed of hatching, there were eggs incubated at 30°C and 32°C with a hatching time that was 11 hours after fertilization. This is in accordance with [6]’s statement that an increase in temperature results in the increased movement of molecules in the cell, which causes the frequency of the molecular collisions to increase. These conditions can increase the rate of cellular reaction and result in an increase in energy income. This affects embryo development. The entry of water causes the embryo to develop more freely in the perivitellin space so then it reaches the stage of hatching faster (at a high temperature) [7]. The highest hatching rate (HR) of the grouper eggs was found at 30°C, at 99%. Temperature is one of the factors that can affect the hatching enzyme’s work. The performance of the disturbed hatching enzymes will affect the process of energy metabolism. This affects the embryo development process and the hatching rate, as the larval survival rate decreases [8]. The fastest growth was found in the 30°C temperature treatment, which was 0.96 mm, which is very different from the treatment at the other incubation temperatures. This is presumed to be the optimum conditions for the growth of sunu grouper larvae, as the larvae growth rate was the fastest when compared to the other treatments. According to [9], high water temperatures can cause most of the energy stored in the fish's body to be used for self-adaptation to a less supportive environment, which can damage the metabolic system or substance exchange. In addition, at the optimum temperature, their growth will increase. [10] adds that in most fish species, the rate of metabolism above the optimum temperature will increase and this causes the energy to begin to be diverted from growth due to the high metabolic rate. This causes the rate of growth decreases. Water temperature plays an important role in fish life which can affect the amount of dissolved oxygen. This, in turn, can affect the metabolism rate and growth of the fish [11]. The optimum temperature causes high larval resistance which is expected to increase the Survival Rate (SR). Low temperatures can hinder the development of enzyme production, thus slowing the hatching process, while high temperatures result in the premature hatching of an embryo that is mostly unable to survive.

5 Conclusion
Different temperature incubations in the sunu groupers resulted in the fastest hatching time being at incubation temperatures of 30°C and 32°C. The best hatching rate, length growth and survival rate was found at the incubation temperature of 30°C

6. References
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