Effect Of Temperature Difference On Yolk Absorption Rate Of Seabass Prelarvae (*Lates calcarifer*)

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Abstract- Temperature is one of the important water quality parameters in influencing the condition of larvae in the initial development phase. This study discusses how to compare the temperature in the larvae of seabass (*Lates calcarifer*) against the rate of yolk sac absorption. From observing the development of seabass larvae at different temperatures, it is known that the temperature of 24°C, 28°C, 32°C, and 36°C affect the time of absorption of yolk with the time of absorption 45, 51, 36 and 30 hours respectively. From the results of the analysis of variance in the absorption rate of egg yolks, there was a significant difference between each treatment in the early stages of developing seabass larvae (*Lates calcarifer*)

Index Terms- Temperature, seabass, egg yolk absorption, larvae

I. INTRODUCTION

The rate of egg yolk absorption in larvae is greatly influenced by the environment, especially temperature (Hart and Purser (1995); Usman et al, (2003); Klimogianni, et al (2004), Abiotic factors play an important role in the metabolic process to support survival and growth. Temperature as one of the parameters of water quality which directly plays an important role in influencing the condition of eggs and larvae. The relationship between incubation temperature and egg yolk absorption rate is directly proportional to the optimal temperature range (Budiardi et al., 2005) If viewed from a physiological perspective, changes in temperature can affect the speed of metabolism in fish, high metabolic activity requires a large amount of energy so that the rate of absorption of egg yolk becomes faster and vice versa.

This study was conducted to determine the effect of temperature differences on the development of seabass larvae so that there is an increase in survival in seabass hatchery activities, especially during larval rearing activities

II. MATERIALS AND METHODS

A. Time and Place of Research

The study was conducted in May 2019 at the Center for Brackishwater Aquaculture in Takalar Regency, Mappakalompo Village, Galesong District, Takalar District.

B. Method of collecting data

The test larvae samples used were seabass larvae that had just hatched one day (D-1) and were kept until the sixth day (D-6) with a density of 100 fish/liter. The larvae were obtained from natural spawning and hatching of seabass (*L. calcarifer*) which are kept in the Takalar Brackish Aquaculture Fisheries Center. The containers used are white plastic buckets with a volume of 20 L and filled with water with a volume of 15 L. The containers are placed in a closed room (indoor), each of each container is equipped with an Aquarium water heater thermostat (water heater) to maintain the temperature to match treatment. Feed began to be given on day 2 in the form of rotifer natural food (*Brancionus plicatilis*) with a maintained density of 3-6 tails/ml on days 2 to 6. During maintenance, the container was closed with clear plastic to maintain a stable temperature.

This study was designed using a completely randomized design (CRD) consisting of 4 treatments namely 24°C, 28°C, 32°C, and 36°C. Measurement of egg yolk volume was carried out using a Zeiss Primovert microscope which was connected to Zeiss AxioCam, taking data in the form of photos of the egg yolk absorption rate, taking data in the form of photos of egg yolk absorption rate. Samples were taken 1 larva each treatment repeated once every 1 hour in the first 16 hours, then, every 3 hours until the yolk was completely absorbed and after the yolk was gone, observations were continued every 6 hours until the sixth day.

C. Observed parameters

1. Yolk Sac Volume
   Ellipse-shaped yolk volume was calculated using the formula Hemming and Buddington (1988), namely:
   $$\mathbf{V = 0{,}1667\ \pi\ LH^2}$$
   Where:
   V: Volume of Yolk (mm^3)
   L: Diameter of the elongated Yolk (mm)
   H: Shortened Yolk diameter (mm)
2. Yolk Absorption Rate

Yolk sac absorption rate using the formula Hemming and Buddington (1988), namely:

$$YS\ \frac{1}{t}.Ln\frac{Vt}{Vo}$$

Where:
YS: Yolk absorption rate (mm^3/hour)
Vo: Initial yolk sac volume (mm^3)
Vt: Final yolk volume (mm^3)
T: Time (hour)

Data obtained from tabulated observations are presented in tabular or graphical form and analyzed with one-way Variance Analysis with a confidence level of 95%. If the results of the analysis show that there is a real influence, then the W-Tukey test will be conducted at a 5% significance level to determine the level of difference between treatments.

III. RESULT

A. Yolks Volume

The observations showed that the newly hatched seabass larvae appeared transparent and had an average total length of 1.59 ± 0.086 mm, and had an initial volume of yolk with an average of 0.1077 ± 0.009 mm^3 and an oil globule of 0.015 ± 0.004 mm^3.

Yolk absorption time is the length of time the yolk is absorbed in the prelarvae body as endogenous feeding, starting from the hatching egg to almost absorbing the yolk. The time of absorption of yolk with different temperature treatment results in the time of absorption of yolk which is not the same. Data on the time of yolk absorption from each treatment temperature can be seen in Table 1.

Temperature treatment	Duration of Absorption (hours)
S1 (24°C)	45
S2 (28°C)	51
S3 (32°C)	36
S4 (36°C)	30

Table 1. Duration of Yolk Absorption Time

Based on Table 1. it is known that the time of yolk absorption from each treatment is different and the fastest at the temperature of the maintenance media is 36°C, which is 30 hours while the temperature of 24°C and 28°C requires a longer time in the absorption of the yolk, respectively 45 and 51 hours. The length of time of absorption of the yolk is closely related to metabolic activity, namely the length of time of absorption at low temperatures and quickly at high temperatures, where the yolk is a source of nutrients in the metabolic process of larvae.

B. Yolk Absorption Rate

Based on the results of the study showed the rate of absorption of the yolk of high-temperature is faster than low temperatures. The histogram of absorption of the yolk volume can be seen in Figure 1.

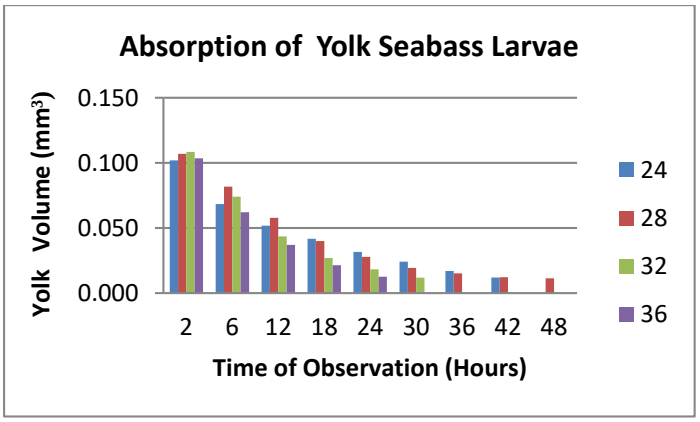

Figure 1. Histogram Reducing the Yolk Seabass Larvae Volume

Based on Figure 1 shows that maintenance on the media temperature 32°C and 36°C has a faster absorption time and yolk absorption rate, compared with temperatures 24°C and 28°C, which is at 42 hours still have yolk volume, namely 0.119 mm^3 and 0.122 mm^3, while at the 48th hour the temperature 28°C still has a yolk of 0.114 mm^3 and depleted at 51 hours. The statistical analysis results of the absorption rate of the yolk observed every 6 hours until the yolk runs out can be seen in Table 2.

Table 2. Yolk Absorption Rate (%)

Hours to-	Temperature treatment			
	S1 (24°C)	**S2 (28°C)**	**S3 (32°C)**	**S4 (36°C)**
6	8.01 ± 1.01^{b}	5.33 ± 0.16^{c}	7.57 ± 0.75^{b}	10.19 ± 0.74^{a}
12	4.64 ± 0.87^{b}	5.78 ± 1.04^{b}	8.88 ± 0.62^{a}	8.66 ± 0.56^{a}
18	3.62 ± 0.27^{c}	6.18± 0.15^{b}	8.02 ± 0.78^{a}	9.12 ± 0.41^{a}
24	4.61 ± 0.51^{b}	6.09 ± 1.44^{b}	6.54 ± 0.74^{ab}	8.87 ± 0.93^{a}
30	4.53 ± 0.93^{a}	6.06 ± 0.82^{a}	7.09 ± 2.21^{a}	-
36	5.84 ± 0.38^{a}	4.03 ± 0.32^{b}	-	-
42	5.91 ± 0.69^{a}	4.04 ± 0.88^{b}	-	-

Note: Different letters in the same column show significant differences between treatments at the 5% level ($p<0.05$)

Based on the results of the analysis of variance shows that temperature has a significant effect ($p>0.05$) on the yolk absorption rate of seabass. W-Tuckey continued test results at 6 hours after hatching experienced a significant absorption rate between each treatment temperature. This is because after the acclimation period of the first 3 hours, the larvae will undergo an adaptation process to adapt to changes in the temperature of the treatment media, seen from the results of further test temperatures 36°C experienced the highest yolk absorption rate, and followed by the absorption rate of 32°C and 24°C is different with the temperature of 28°C the lowest absorption rate is 5.33% in the first 6 hours this is due to not

much change in the initial temperature before the 29°C stocking to the treatment temperature.

Based on the results of statistical analysis the average value of the absorption rate of the yolk treatment temperature 32°C and 36°C respectively by 7.6% and 9.2%, while the rate of absorption of the yolk temperature of 24 ° C and 28 ° C is relatively the same which is 5.3% and 5.4%.

IV. DISCUSSION

The newly hatched seabass larvae appear transparent and have an average total length of 1.59 ± 0.086 mm, and have an initial yolk volume with an average of 0.1077 ± 0.009 mm^3 and an oil globule of 0.015 ± 0.004 mm^3. Compared with some previous results, the results of this study have the same size as the results of the research of Thepot and Jerry (2015) the initial length of the seabass larvae after hatching was 1.58 ± 55 mm, with an oil globule diameter of 264 ± 16 µm, Shadrin, and Pavlov (2015) the initial length of the newly hatched seabass larvae is 1.50 - 1.75 mm and has a size that is almost the same as other fish species such as red snapper of 1.56 - 1.87 mm (Purba, 1994). According to Sofia (1985), the initial length of larvae after hatching is closely related to differences in the total length of the parent, egg diameter, temperature and water salinity when hatching.

Based on Table 1, the treatment temperature of 36°C has the fastest absorption time of yolk which is 30 hours and the temperature of 28°C has the lowest duration of absorption which is 51 hours. while at 24°C the yolk runs out at 45 hours. This is closely related to metabolism at the beginning of maintenance, where during the acclimation process, the rate of absorption of yolk at 24°C is faster, which is caused by the process of adaptation to adapt to initial media temperature changes after stocking.

The results of Kohno's study (1986), reported that seabass yolk was absorbed for 60-70 hours at a medium temperature of 26-28°C. The difference in the length of time the yolk runs out is due to differences in the size of the initial yolk and environmental influences, especially differences in temperature, salinity and dissolved oxygen. The loss of yolk on the second day was also found in red snapper larvae (*Lutjanus campechanus*), which began to run out 55-70 hours (Williams, et al. 2004), Sofia (1985) larvae of baronang fish (*Siganus virgatus*) the yolk of the yolk was completely absorbed at 35 hours, Darma (2015) larvae of the sea pomfret (*Trachinotus blocii*) the yolk was absorbed for 46 hours. Long-time absorption of yolk at low temperatures and fast at high temperatures is caused by metabolic activity. Yolks in the early development phase are used as nutrients for the metabolic processes of larvae.

Based on Figure 1, the temperature of 32°C and 36°C has the fastest absorption of yolk, the rapid absorption rate of the yolk is closely related to larval growth, organ formation and maintenance of body condition (Pramono and Marnani, 2009). One of the most influential effects on the end of yolk absorption is due to environmental influences, especially temperature (Hart and Purser 1995; Usman 2003; Klimogianni et al. 2004) where an increase in temperature causes an increase in the process of yolk absorption in larvae.

The results of the analysis of variance showed that temperature had a significant effect ($p>0.05$) on the rate absorption rate of seabass yolk. W-Tuckey Test Results (table 2) temperature of 36°C provides the fastest response rate of yolk absorption compared to 32.28 and 24°C. This is consistent with the statement of Putri, et al. (2016) which states that high temperatures cause the absorption of yolks in larvae to increase which results in a rapid decrease in yolk volume. This is also consistent with the opinions expressed by Budiardi et al. (2005) which states that the metabolic activity with high temperatures will require large energy so that the rate of absorption of yolk becomes greater. At lower temperatures, metabolic activity runs slower so that the rate of absorption of the yolk is smaller.

Seabass larvae reared at 36°C have a faster yolk absorption time than those maintained at low temperatures, but at too high temperatures it does not provide good long and heavy growth responses. The time of rapid absorption of the yolk is directly proportional to the rate of absorption of the yolk, but not directly proportional to the growth response. At a medium temperature of 36°C, fish tend to be active so that the energy in the yolk is used to stimulate metabolism to achieve homeostasis in the body so that the yolk energy is only used for body maintenance.

V. CONCLUSION

Observation of the development of seabass larvae at different temperatures is known that the temperature of 24°C, 28°C, 32°C, and 36°C affects the time of absorption of the yolk of 45, 51, 36, and 30 hours respectively. The results of the analysis of variants that show that temperature significantly affects the absorption in the early development phase of seabass larvae (*Lates calcarifer*)

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