Fisheries Journal, 14(4), 1810-1817 (2024)
http://doi.org/10.29303/jp.v14i4.1044

EFFECTIVENESS OF DIFFERENT PHOTOPERIODS ON THE GROWTH PERFORMANCE OF FRESHWATER LOBSTER (*Cherax quadricarinatus*) SEEDS MAINTAINED AT AN ALKALINITY OF 80 MG/L

Efektivitas Photoperiod Yang Berbeda Terhadap Kinerja Pertumbuhan Benih Lobster Air Tawar (*Cherax quadricarinatus*) Yang Dipelihara Pada Alkalinitas 80 mg/l

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(Received July 23rd 2024; Accepted August 24th 2024)

ABSTRACT

One of the freshwater commodities that is thought to have the potential to sell well on the world market in the future is freshwater lobster. This animal is a nocturnal animal commodity (animal that is active at night). This animal is thought to have the potential to sell well on the world market due to the high price and market demand which has not yet been met. Therefore, research efforts are needed on freshwater lobster seeds, to increase growth and survival. One of them is the use of alkalinity and photoperiod. The research design carried out was a Completely Randomized Design (CRD). consisting of 4 treatments with 3 repetitions. During the 40 day rearing period, pellets are given. Research shows that there are significant differences between each photoperiod in the growth of absolute weight, absolute length, molting percentage, daily growth rate and survival of freshwater crayfish. Treatments with different photoperiod times showed that the best results were obtained in treatment P2 with photoperiod time (16G:8T) and the lowest in treatment 3 (21G:3T). Based on research results, it is recommended that the use of photoperiod (16G:8T) is effective for increasing the growth and survival of freshwater lobsters. The results of this research can be used as information regarding the most effective photoperiod for freshwater lobsters.

Keywords: Growth, Photoperiod, Survival

ABSTRAK

Salah satu komoditas perairan tawar yang diduga berpotensi laku di pasar dunia kedepannya adalah lobster air tawar. Hewan ini merupakan komoditas hewan nokturnal (hewan yang aktif di malam hari). Hewan ini diduga berpotensi laku di pasar dunia karena tingginya harga serta permintaan pasar yang hingga saat ini belum tercukupi. Oleh karena itu diperlukan upaya penelitian terhadap benih lobster air tawar, untuk meningkatkan pertumbuhan dan kelangsungan hidup. Salah satunya penggunaan alkalinitas dan photoperiod. Rancangan penelitian yang dilakukan adalah Rancangan Acak Lengkap (RAL). yang terdiri dari 4

perlakuan 3 ulangan. Selama 40 hari masa pemeliharaan, pakan yang di berikan pelet. Penelitian menunjukkan perbedaan antar setiap waktu photoperiod secara nyata terhadap pertumbuhan bobot mutlak, panjang mutlak, persentase molting, laju pertumbuhan harian, dan kelangsungan hidup lobster air tawar. Perlakuan waktu photoperiod yang berbeda menunjukkan hasil terbaik diperoleh pada perlakuan P_2 dengan waktu photoperiod (16G:8T) dan paling rendah pada perlakuan 3 (21G:3T). Berdasarkan hasil penelitian direkomendasikan, penggunaan waktu photoperiod (16G:8T) efektif untuk meningkatkan pertumbuhan dan kelangsungan hidup lobster air tawar. Hasil penelitian ini dapat dijadikan informasi mengenai waktu photopriod yang paling efektif untuk lobster air tawar.

Kata Kunci: Kelangsungan Hidup, Pertumbuhan, Photoperiod

INTRODUCTION

One of the freshwater commodities that is suspected to have the potential to sell in the world market in the future is freshwater lobster. This animal is a nocturnal animal commodity (animals that are active at night). Freshwater lobsters usually live in the waters of lakes, swamps and rivers. This animal is suspected to have the potential to sell in the world market due to high prices and market demand that has not been met until now. Therefore, research efforts are needed on freshwater lobster seeds, to increase growth and survival so that lobster production can meet market demand.

Wiyanto & Hartono (2003), explained that freshwater lobsters are generally active in foraging at night (nocturnal) and are also a type of omnivore. The longer the dark time given, it is expected to accelerate the growth of lobsters because considering that lobsters are animals that actively forage at night.

Alkalinity plays an important role in determining the ability of water to support growth in waters, the main things that determine alkalinity are bicarbonate ions, carbonate ions and hydroxyl ions (Agusnar, 2007).

Research on photoperiod has been carried out by several researchers including catfish (Belly et al., 2013), in Siamese catfish (Setiawan et al., 2015) and on baung fish (Benny, 2017). The results of the above study state that the longer the dark time, the better it will be for its growth. Therefore, information is needed about the effectiveness of different photoperiods on the growth performance of freshwater lobster seeds maintained at optimum alkalinity.

METHODS

Place and Time

The research was conducted in October – November 2022 at the Experimental Pond of the Faculty of Agriculture, University of Samudra.

Tools and Materials

The materials used are freshwater lobster seeds measuring 2 - 3 cm, commercial feed measuring 0.5 mm, and 1 kg of agricultural lime. The tools used in the study were scales, calipers, blowers, aquariums, black plastic, pH meters, thermometers, DO meters, hoses, lamps, stationery, and shelters.

Research Design

The method carried out was an experiment using a complete randomized design (RAL) with 4 treatments and repeated as many as 3 replicates.

The treatment of the research can be seen as follows:

P0 : Application of photoperiod time of 12 hours dark and 12 hours light

P1 : Application of photoperiod time of 15 hours dark and 9 hours light
P2 : Application of photoperiod time 18 hours dark and 6 hours light
P3 : Application of photoperiod time 21 hours dark and 3 hours light

Procedure

Before conducting the research, first prepare dolomite lime soaking which is useful to increase alkalinity until it reaches the optimum parameter (80 mg/L). Then a container in the form of styrofoam totaling 12 pieces with a size of 47cm x 37cm x 25cm is prepared, then sterilized using chlorine and rinsed with clean water. Water for seed maintenance media is sterilized by precipitating it so that water quality is maintained. Then each container is given a pipe paralon (shelter) as a shelter and aerated for 24 hours so that dissolved oxygen in the water increases.

Preparation of the alkalinity solution is carried out by dissolving dolomite lime in stock water. After being dissolved, the lime is mixed in each test container. so that the alkalinity content is in accordance with the optimum dose of 80 mg/L, with the dilution formula (V1 × M1 = V2 × M2) (Kurniasih, 2008).

The freshwater lobster seeds used are 120 heads, 2-3 cm in size obtained from Takengon, Central Aceh with a dense stocking of 10 fish per container. Stocking is carried out after freshwater lobsters are acclimatized first. The acclimatization process is carried out to avoid stress on freshwater lobsters. The treatment began at 18.00 WIB, each container was completely closed using black plastic to provide dark engineering to the freshwater lobster seed cultivation container. For the bright time in this study, the researcher used a 10-watt lamp.

Control is carried out every day by opening and closing plastic containers according to the treatment time. Maintenance is carried out for 40 days. The freshwater lobster sample used was 10 fish per container. Freshwater lobster seeds are fed pellets by ad satiation, pellet feeding is done 3 times per day.

To find out the data on body weight and long growth, sampling was carried out. To measure the length of the lobster's body, a caliper is used, while to measure the weight of the seeds, a digital scale is used. The samples to be sampled are 10 per replicate. The number of lobsters sampled is evenly distributed according to the number of seeds in the container. Sampling is carried out every 10 days from the beginning of the study.

Data Analysis

The water quality data taken includes: pH, Temperature, alkalinity and DO. Water quality pH and temperature measurements are carried out every 10 days, DO is measured every 10 days, while alkalinity is measured in the laboratory by taking water samples from each maintenance aquarium to find out the water quality parameters of each aquarium.

Data collection was carried out every 10 days during the study with a duration of the first day of the trial (H0) and the last day of the study (H40), through sampling of 10 lobsters per container. Lobster picking must be done slowly using a bucket and then transferred into a basin filled with water. Then, the lobster seeds were measured one by one in length and weighed with a digital scale. The number of lobsters must be observed and carried out every day so that the deaths that occur in the raised lobsters can be known.

The growth performance measured in this study is the calculation of the daily growth rate using the formula Zonneveld et al., (1991), as follows:

$$LPH = \frac{Wt - Wo}{T} x100$$

Information:
LPH = Daily Growth Rate (%/day)
Wt = Final weight (gr)
Wo = Starting weight (gr)
T = Duration of the study (days)

The growth performance measured in this study is the calculation of absolute length growth using the formula Effendie (2002) as follows:

$$P = Pt - Po$$

Information:
P = Absolute length growth (cm)
Pt = End length (cm)
Po = Initial length (cm)

Absolute weight gain is measured using a digital scale. Absolute growth is calculated using the formula Effendie (2002) as follows:

$$W = Wt - Wo$$

Information:
W = Absolute weight growth (gr)
Wt = Final average weight (gr)
Wo = Initial average weight (gr)

Lobster life graduation is calculated using the formula Effendie, (2002) as follows:

$$KH = \frac{Nt}{No} x\ 100$$

Information:
SR = Survival rate (%)
Nt = The number of viable seeds at the end of the experiment (tail)
No = The number of seeds alive at the beginning of the experiment (tail)

The percentage of molting can be measured using the formula Mohammad Sayuti et al (2018):

$$Moulting\ Percentage = \frac{Number\ of\ Moulting\ Test\ Animals}{Number\ of\ Test\ Animals}\ x\ 100\%$$

Observation data on growth performance, namely absolute weight growth, daily weight growth, absolute length growth, daily length growth, and survival rate were analyzed using Variety Fingerprint Analysis (ANOVA) If the test results showed significant differences, it was continued with the duncan test to determine the difference in each treatment. Water quality data was analyzed based on the survival of freshwater lobster seeds. Water quality analysis is described descriptively.

RESULT

Growth performance

The growth performance of freshwater lobsters can be observed from absolute length growth, absolute weight growth, and survival of freshwater lobsters. Based on the results of the study, the application of photoperiod time on freshwater lobsters for 40 days can be obtained the highest results at the time treatment of 18G:6T and the treatment that gives the lowest at the time treatment of 21G:3T. According to Reni et al., (2023) stated that the application of photoperiod can affect lobster activity when obtaining food, therefore photoperiod is very influential on the growth and survival of lobsters.

The results of the variant analysis (Anova) can be seen in Table 1. Based on the Anova test, the application of different photoperiod levels had a significant effect (P<0.05) on the growth performance which included (PBM, PPM and LPH) freshwater lobsters that were given an additional photoperiod time of 18G:6T were significantly different from other treatments, while 12G:12T, P15G:9T, and 21G:3T were not significantly different.

Table 1. Growth Performance of Freshwater Lobster (*Cherax quadricarinatus*)

Parameters	Photoperiod			
	(P0) 12G:12T	(P1) 15G:9T	(P2) 18G:6T	(P3 21G:3T
Starting Weight (gr)	1,35±0,04^{a}	1,33±0,04^{a}	1,39±0,13^{b}	1,35±0,04^{a}
Bobot Akhir (gr)	2,23±0,04^{a}	2,23±0,04^{a}	2,45±0,13^{b}	2,13±0,04^{a}
Initial Length (cm)	3,16±0,01^{a}	3,16±0,02^{a}	3,20±0,12^{b}	3,17±0,03^{a}
End Length (cm)	4,03±0,01^{a}	4,05±0,02^{a}	4,22±0,12^{b}	4,01±0,03^{a}
Absolute Length Growth (cm)	0,87±0,00^{a}	0,89±0,01^{a}	1,01±0,07^{b}	0,83±0,01^{a}
Absolute Weight Growth (gr)	0,88±0,02^{a}	0,90±0,02^{a}	1,06±0,07^{b}	0,77±0,02^{a}
Daily Growth Rate (%)	2,21±0,07^{a}	2,24±0,09^{a}	2,64±0,19^{b}	1,94±0,06^{a}

Remarks: Numbers followed by the same letter are not real at α = 0.05 The values listed are the average value and standard error.

Moulting Percentage

The results of the ANOVA test gave the result that the value of Fcal > F0.05, and a further test was carried out by Duncan. The research conducted for 40 days obtained data on the percentage of freshwater lobster (*Cherax quadricarinatus*) as seen in Table 2:

Table 2. Percentage of freshwater lobster moulting (*Cherax quadricarinatus*)

Treatment	Moulting Percentage (%)
P0 12G:12T	40,0±5,77^{ab}
P1 15G:9T	43,3±3,33^{ab}
P2 18G:6T	53,3±3,33^{b}
P3 21G:3T	33,3±3,33^{a}

Remarks: Different letters in the same column show a real difference in treatment (P>0.05), the value listed is the average value and the error standard.

Survival Rate

In the ANOVA test, it was found that the value of Fcal> F0.05, and a further test was carried out by Duncan. The research conducted for 40 days obtained data on freshwater lobster (*Cherax quadricarinatus*) as seen in Table 3 below:

Table 3. Survival of freshwater lobster (Cherax quadricarinatus)

Treatment	Survival rate (%)
(P1) 12G:12T	100±0,00[b]
(P2) 15G:9T	93,3±3,33[a]
(P3) 18G:6T	100±0,00[b]
(P4) 21G:3T	90±0,00[a]

Remarks: Different letters in the same column show a real difference in treatment (P>0.05), the value listed is the average value and the error standard.

Water Quality

Another factor that can affect the survival and optimal growth of freshwater lobsters is the environment in which they are maintained, such as water quality. The observed water quality parameters were temperature, pH and DO. The results of water quality measurements during the study are presented in Table 4:

Table 4. Water quality of maintenance media during the study

Parameters	Photoperiod				Optimum
	P0	P1	P2	P3	Range
Temperature (°C)	26,7-27,2	26-27,4	26,9-28,2	26,9-27	26-30
DO (mg/l)	3,50-4,10	3,8-4,80	3,50-4,10	3,80-4,20	>3,0
pH (ppm)	6,7-7	7,2-7,5	7-7,5	6,9-7,7	6,5-7,5

Optimum range: Trisnasari et al, (2020)

DISCUSSION

Based on the results of the duncan test, the growth performance can be seen in table 1. Different photoperiod treatments on freshwater lobster seeds gave the highest growth value in the photoperiod treatment of 18G:6T and the treatment that gave the lowest growth value occurred in the treatment of 21G:3T. Photoperiod is one of the ways that directly promotes growth performance, survival and appetite. The 21G:3T photoperiod treatment gave the lowest value. This shows that it is suspected that the maximum limit of freshwater lobsters living in the dark only reaches the dark time for 18 hours, so if it exceeds the time limit, it can cause decreased growth for freshwater lobsters because according to Nisak et al., (2017), the feed given is not all eaten by lobsters, and not all of them are absorbed for growth, but some are absorbed for energy for activities. So if freshwater lobsters stay longer in the dark, then the lobsters are more active, so that the energy obtained from food will be absorbed into the lobster's activities, so slow growth occurs. This is in accordance with Setiawan's research, (2015) light has a direct influence on the movement, behavior, and diet of lobsters. It is suspected that because of the lighting that suits the needs of lobsters, it has an influence on daily activities to eat lobsters in survival. In dark conditions for too long, lobsters will find it more difficult to find food, lobsters tend to stay outside the shelter and lobsters are more active.

Different lighting can produce different eating opportunities in their daily activities. Lighting that suits the needs of lobsters tends to increase the adaptability of freshwater lobsters to their environment. According to Mahendra et al., (2018) freshwater lobster is a bottom feeder of one of the eaters at the bottom of the water. It is suspected that due to the addition of photoperiod time and alkalinity solution, lobsters are more active in foraging so that this improves the growth performance and survival of lobsters.

Based on the results of the duncan, the moulting percentage shows that P2 is significantly different from P3 but not significantly different from P0 and P1. In this study, the highest percentage of molting occurred in treatment 2 (18G:6T) which was 53.3% and the lowest treatment was found in treatment 3 which was 33.3%. It is suspected that there is an addition of an alkalinity solution made from agricultural lime mixed with research water. In

accordance with Arsono's research, (2010) the addition of alkalinity solution can produce the growth of freshwater lobsters and the availability of calcium in the water increases significantly. Lobsters need calcium for the classification process during moulting, so the addition of lime in the water is thought to increase alkalinity and growth significantly in lobster growth.

From the results of the further test of Duncan, it can be seen that survival shows that the treatment of P0 and P2 is not significantly different, but is significantly different from P1 and P3.

It can be seen in Table 3 that the best survival rate is found in the P0 and P2 treatments, which is at 100±0.00b, while the lowest survival is found in P3, which is 90±0.00a. In this study, the survival rate obtained very good results, where the value of the survival rate of freshwater lobsters was not less than 80%. The high average value of survival is in accordance with the feed that has been given and can be used optimally for the survival of freshwater lobster seeds.

Longer dark hours can increase lobsters' activities in foraging and for survival because these animals consider that the surrounding conditions are night. However, the negative impact of the dark factor that has been too long can produce negative results for lobster life (Widiarso, 2011).

Setiawan et al., (2015) also explained that irradiation as an external factor can also affect the high and low survival rate of fish. In P3, lobsters run out of food stock due to dark factors for a very long time, lobsters are always outside the research pipeline because they think that their surroundings are night so that competition in obtaining food is inevitable so that cannibalism occurs. In this study, the researcher used lobster seeds with a uniform size of 2-3 cm and sufficient food stocks so that there was no cannibalism in the fight for food so that the survival rate of the test animals was high.

Maintenance for 40 days based on water quality can be tolerated by test animals. The temperature ranged from 26-28℃, the dissolved oxygen (DO) content ranged from 3-4.8 mg/l, and the pH content ranged from 6-7 according to the research of Trisnasari et al., (2020). According to (Hartono et al., 2003) the oxygen required in freshwater lobsters must be more than 3 mg/l. According to mahendra (2018), the optimal temperature to support the growth of freshwater lobsters is 28℃. Meanwhile, according to Rosmawati et al., (2019) the pH range needed for freshwater lobsters ranges from 6-7.5 ppm.

CONCLUSION

Different photoperiod times had a significant effect ($p<0.05$) on absolute weight gain, absolute length growth, survival rate, daily growth rate, and molting percentage. The photoperiod time (18G:6T) can increase the growth of absolute weight by 1.06 g, the daily growth rate by 2.64% and the absolute length growth by 1.01 cm during the study. Further research is needed to see the amount of light entering the container, to be able to influence more growth.

ACKNOWLEDGEMENT

The author would like to thank his father and mother who always supported me until I was able to complete this journal, thank you to the two supervisors who always took the time for the author to consult and thank my friends who always helped me from the beginning of the lecture.

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