Asian Journal of Aquatic Sciences, August 2023. Vol 6, Issue (2) 224-228
e-issn: 2716-4608
p-issn: 2655-366X

THE EFFECT OF TEMPERATURE DIFFERENCES ON HATCHING RATES OF LEKANG TURTLE (*Lepidochelys olivacea*) EGGS IN SEMI-NATURAL NESTS

Daniel Paskah Ginting[1]*, Syafruddin Nasution[1], Yusni Ikhwan Siregar[1]
[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau
Kampus Bina Widya KM. 12,5, Simpang Baru, Bina Widya, Pekanbaru, Riau 28293
*danielpaskah@gmail.com

ABSTRACT

This research was conducted on August 31, 2021 – December 7, 2021, at the UPTD KPSDKP, West Sumatra Province. The purpose of this study was to determine the effect of temperature differences on incubation time, hatching rate, and survival rate of turtle hatchlings (*Lepidochelys olivacea*). The method used in this study is an experiment that uses 3 trials plus 1 control, with 3 repetitions. Turtle eggs were incubated with the same depth and number of eggs with the addition of different temperatures from incandescent lamps with different powers. Then proceed with the calculation of incubation time, percentage of hatching, and survival of hatchling. Based on the results of the research, for the calculation of incubation time, the experimental unit with the shortest incubation period was produced by experimental unit B, with a temperature range of 27.5–29.5ºC, which was 58 days. The incubation period that took the longest was the control experimental unit with an average temperature of 25ºC, which was 65 days. For the results, the most optimal hatching rate was produced by experimental unit B, with an average hatching rate of 86%. Meanwhile, the lowest hatching rate was obtained from experimental unit C with an average hatching rate of only 53.3%. Then for the survival of the hatchlings after being quarantined for one week, all of them show the number 100%, which means that no hatchlings died during the quarantine.

Keywords: Temperature, *Lepidochelys olivacea*, Incubation, Semi-natural nests.

1. INTRODUCTION

The lekang turtle is a type of carnivorous turtle that has a strong and large beak that functions to find prey such as squid, shrimp, jellyfish, and others. The lekang turtle lives in shallow tropical and subtropical waters[1]. Lekang turtles are also often found laying eggs on black sand beaches, such as the coastline of Kota Pariaman and Air Manis Beach, Padang City. Lekang turtles come ashore to lay their eggs when the tide is highest and with little rain.

The lekang turtle can lay eggs twice in one season, spending approximately 2 hours in one egg laying, counting from the rise of the mother turtle to the closing of the nest[2]. The lekang turtle's eggs are round with a diameter of 3.8– 4 cm[3-4] and a weight of 2.9 – 3 g[4]. The lekang turtle usually lay eggs 2 to 3 times a year, 10-14 days apart. Turtle nests are 40–80 cm deep and 20–30 cm in diameter. The lekang turtle can lay 50 – 147 eggs once[3].

The success of hatching turtle eggs semi-naturally is influenced by two factors, namely abiotic and biotic[5]. Abiotic factors include temperature, humidity, depth, time, and method of egg transfer, as well as the density of eggs in the nest. While biotic factors include predators and microorganisms.

One of the factors that most determine the success of hatching turtle

Received : 13 May 2023
Accepted : 13 July 2023

eggs is temperature. A good temperature range for hatching is 25 – 35^{0}C, with an optimal temperature of 29^{0}C[3]. Availability of water also determines the success of hatching turtle eggs because turtle eggs are very sensitive to drought so an environment that is too dry results in a higher mortality rate[6].

According to Sheavtiyan et al.[7], the success of hatching turtle eggs has a high percentage at a depth of 30-49 cm because it produces the optimal temperature in the nest, which is 28-32^{0}C. Nest temperature also determines sex in turtles. The lower the temperature in the nest or masculine temperature (<28^{0}C) will produce male turtles, while the higher the temperature in the nest or feminine temperature (>30^{0}C) will produce female turtles. The body size of hatchlings is larger at masculine temperatures than at feminine temperatures. This is due to the longer incubation period and more yolk converted into hatchling tissue, resulting in a larger body size[8].

The decrease in the number of turtles in the world has made this animal a protected animal. The poaching of turtles by irresponsible parties and pollution which destroys living habitats as well as the laying of turtle eggs causes many turtles to die and hatch failures. Natural nests are the best places for hatching turtle eggs because they have conditions suitable for hatching turtle eggs[9].

However, due to the increasing destruction of the beaches which are the nesting and nesting sites for sea turtles, a conservation effort has been taken in the hope of maintaining the turtle population in the world. The semi-natural hatchery is used as a solution that is very helpful in solving the problem of hatch failure due to damage to nesting habitats. The semi-natural hatchery is hatching that is carried out by moving sea turtle eggs from their natural nest to nests that are made to resemble their natural nests. The semi-natural hatchery has optimal hatchability if the percentage of hatching success reaches 80%[10]. Turtle eggs that have been planted in semi-natural nests will hatch within 45 - 60 days.

The UPTD Conservation and Oversight of Marine Resources and Fisheries in Pariaman City (UPTD KPSDKP) are a conservation unit engaged in tourism-based turtle conservation. The UPTD KPSDKP has a semi-natural semi-indoor hatchery so that it minimizes predator disturbance and increases the percentage of successful hatching of turtle eggs. However, semi-natural hatching does not guarantee 100% hatching of eggs.

There is still little research on the effect of temperature differences on the hatching rate of lekang turtle eggs semi-naturally, so the authors experimented by incubating lekang turtle eggs with a temperature difference added from an incandescent lamp placed above a semi-natural nest

2. RESEARCH METHOD

Time and Place

This research was conducted in April-July at the Regional Task Force for Conservation and Supervision of Marine Resources and Fisheries, Pariaman City. The UPTD KPSDKP is a tourism-based turtle conservation area.

Methods

The method used in this study was an experimental method using a completely randomized design (CRD) consisting of 4 treatments with 3 repetitions while the treatments used in this study were as follows:

A = 10-watt incandescent lamp
B = 25-watt incandescent lamp
C = 40-watt incandescent lamp
D = Control

Procedure

This research began by relocating Lekang turtle eggs from natural nests located on turtle nesting beaches along the coastline of Pariaman City. The number of eggs that were relocated was 120 eggs

planted in 12 different semi-natural nests and randomized.

Eggs that have gone through the relocation stage at the UPTD KPSDKP are immediately replanted into the nest of the experimental unit with a nesting depth of 40 cm. After planting the eggs in semi-natural nests, then given treatment in the form of control, and adding outside temperature by installing lamps with 3 different powers and attaching a thermostat which functions to cut off the current of the lamp when the temperature given exceeds the desired temperature. Nest moisture measurements were carried out with a soil tester.

After the turtle eggs hatched, the number of eggs that hatched and the treatment was recorded. According to Rouli[3] , the hatching rate is calculated by the formula:

$$HR\ (\%) = \frac{\text{number of eggs hatched}}{\text{number of eggs}} \text{ x } 100\%$$

Eggs that have hatched into hatchlings will be maintained in a quarantine pond for one week, and the resistance of everyone will be observed before being released. Survival rate is calculated by the formula:

$$SR = \frac{\text{Number of surviving ind}}{\text{Number of Ind}} \text{ x } 100\ \%$$

Data Analysis

The obtained hatchability percentage data were statistically processed using one-way ANOVA analysis to obtain the best temperature for the incubation period based on the hatching rate of lekang turtle eggs using the SPSS 2.0 Windows application.

3. RESULT AND DISCUSSION

Effect of Temperature on Old Curing

Data from the results of the long incubation of turtle eggs are then averaged and presented in Figure 1.

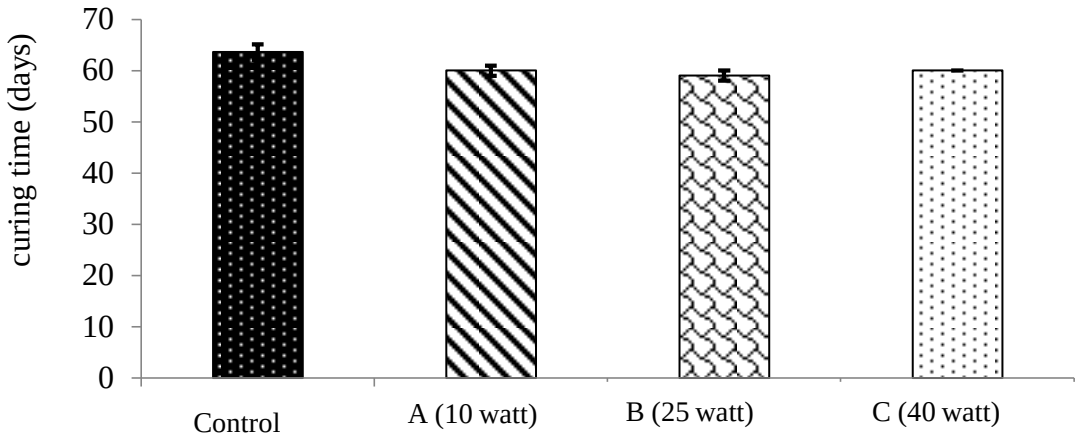

Figure 1. Average (±SD) curing time

The control treatment showed a figure of 63.6 days, which is the result of the average incubation time of each nest repetition, where the control nest was the nest with the longest incubation time. Treatment A in the figure shows the value of 60 days which is the average value of the three replicates from nest A. The next treatment shows the number 59 days which is the average value of the incubation time of the experimental unit B. The incubation time of experimental unit C is 60.

Based on the results of the research conducted, different results were obtained from the length of incubation of each experimental unit. The temperature difference received from the addition of temperature by the lamp turned out to have a big influence on the incubation time.

Semi-natural nests that are affected by the additional temperature from the lights give an effect because the light intensity is direct and covered by the bucket so the effect on incubation time is different

for each experimental unit. The temperature difference is influenced by the amount of light intensity so that the heat received by the sand on the surface is propagated into the nest[11].

Hatching Rate

After conducting research for 3 months at the UPTD KPSDKP of West Sumatra Province, turtle eggs that were incubated in semi-natural nests managed to hatch and produce different hatching percentages from each nest (Table 1).

Table 1. Average hatching rate (%)

No.	Unit trial average	HR (%)
1	Control	76.6
2	A (26 - 28ºC)	80
3	B (27.5 – 29.5ºC)	86
4	C (30.2 – 32.2ºC)	53.3

From the data shown in Table 1, the highest average hatching percentage is in Experimental Unit B and the lowest is in Experimental Unit C. Based on the research results, the data obtained was then processed statistically and obtained a significance value (p) = 0.007 where if $p < 0.05$ then there is an effect and significantly different, then there is an effect of temperature on hatching percentage.

The resulting hatching rate is quite varied because the temperature range added is in the range of 26 - 32ºC. Kushartono et al.[12] said that turtle eggs are in a tolerant temperature range in the range of 25 - 35ºC, whereas if the temperature is below, and above the tolerant temperature, embryo development will be disrupted.

Apart from the temperature factor, many factors affect the high or low hatching percentage. Environmental factors such as weather and rain intensity are also factors that can inhibit the growth of embryos from turtle eggs[3]. At the time of the study, the semi-natural nests were covered in buckets, thereby minimizing rainwater input which could affect hatching delays. In the research that has been done, the average temperature of the nest is in the range of 25–30.36ºC, which is proven to have a percentage of nests above 50%.

Survival Rate

After the turtle eggs hatch into hatchlings, the next step is the calculation of survival. Newly hatched hatchlings are kept in rearing ponds for 7 days from the first day they hatch. The survival rate of hatchlings hatched from semi-natural incubation is at 100%. During maintenance, which was carried out within one week, no hatchlings died until the hatchlings were released.

Temperature differences in semi-natural hatching did not affect hatchling resistance. Hatchling resistance is influenced by other factors such as water quality, as well as the quality of the feed for the hatchlings. Water quality that must be considered in maintaining water quality is salinity, pH, temperature, and dissolved oxygen[13].

Good and stable water pH for the growth of hatchlings is 6.65 -7.5. The pH level for quality of seawater in the quarantine pond has a pH of 7, where the pH is in a good number according to the pH range for hatchling growth. Suitable salinity and following where turtles live is in the range of 32.2–35.75 ppt[13]. Meanwhile, the salinity in the hatchling pond is 30 ppt, which means that the salinity in the hatchling pond is slightly lower than the good range for hatchlings. In the rearing pond, the water temperature is at 28ºC, where this temperature is in a good range according to experts. Based on this, the water quality in the hatchling quarantine pond at the West Sumatra Province UPTD KPSDKP is in good condition for the life of turtles and hatchlings.

4. CONCLUSION

Based on the results of research conducted at the UPTD KPSDKP of West Sumatra Province, it can be concluded that temperature differences have a significant effect on the duration of incubation and

affect the results of the hatching rate of lekang turtle eggs. Providing the right temperature during the incubation period of turtle eggs can shorten the incubation period, and produce optimal hatching rates. Differences in temperature during the incubation period did not affect the survival and survival of the hatchlings. Things that affect the survival and survival of the hatchlings are the quality of the feed and the quality of the water where the hatchlings live.

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