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The Biophysical Characteristics Of Hatching Habitat Of Lekang Turtle (*Lepidochelys olivacea*) Eggs In Turtle Conservation And Education Center, Bali

Suryono[1*], R Ario[1], E Wibowo[1], G Handoyo[2]

[1]Department of Marine Science, Faculty of Fisheries and Marine Science, Diponegoro University Jl. Prof. Soedharto, SH, Tembalang, Semarang
[2]Department of Oceannography, Faculty of Fisheries and Marine Science, Diponegoro University Jl. Prof. Soedharto, SH, Tembalang, Semarang

Email: suryono1960@gmail.com

Abstract. *Lekang* turtle (*Lepidochelys olivacea*) is one of the fauna that is protected as an endangered population. This marine reptile was able to migrate in great distance along the Indian Ocean, the Pacific Ocean, and South East Asia. Its existence has long been threatened, either by nature or human activities that endangered the population directly or indirectly. The decreasing number of sea turtle population that nest in Bali area is one indication of the reducing number of *Lekang* turtle in Indonesia. If left unchecked, it will result in the loss of *Lekang* turtle. This study aims to determine the successful percentage of conservation techniques and *Lekang* turtle hatching eggs (olive ridley sea turtle) in TCEC, Bali. The method used in this research is the method of observation or direct observation done in the field. Data collection is done by direct observation in the field. The results showed that the turtle breeding site is located in an area that is less strategic because too far from the sea, so that the temperature and humidity cannot be stable. Water content is most an important factor in the growth of embryo and egg hatching. This will lead to the decrease of hatching percentage of turtle eggs.
Keywords : Hatching, Lekang turtle *(Lepidochelis olivacea*), TCEC Bali

1. Introduction

It is recorded that six out of seven species of sea turtle in the world live in the waters of Indonesia. They are Green Turtle (*Cheloniamydas*), Hawksbill (*Retmochely simbricata*), Grey Turtle / *Lekang* turtle (*Olive ridley* sea turtle), Flat Turtle (*Natator depressus*), Star Turtle (*Dermochelys coriacea*), and the loggerhead Turtle (*Caretta caretta*).This amount is still being debated because Nuitja (1992) [1] said that there are only five species as *Caretta caretta* does not exist in Indonesia. However, some researchers revealed that *Caretta caretta* has home ranges that include Indonesia [2].

Various policies related to the management of turtle have been done so far, either by Ministry of Forestry, Ministry of Environment, and the Ministry of Marine Affairs and Fisheries. Even the government is continuously developing appropriate policies in turtle conservation management efforts by doing regional cooperation with some institutions such as the IOSEA-CMP, SSME, and BSSE. The emergence of Law No. 31 of 2004 on fisheries and Government Regulation No. 60 of 2007 on Conservation of Fish Resources brings new nuance in the management of turtle conservation [3].

Nevertheless, the granting of protection status alone is clearly insufficient to restore or at least maintain the population of turtle in Indonesia. A comprehensive, systematic, and measurable conservation management should be implemented immediately, including providing technical

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knowledge on the management of sea turtle conservation for the parties concerned, especially the executors in the fields. But so far, there are not many books containing information on the management of turtle conservation that is easily understood by all people. Therefore, in line with the management of turtle conservation efforts in Indonesia, a technical manual for the perpetrators of turtle conservation management is indispensable

2. Material and methods

The research was conducted from August 4th until 22nd, 2014 in TCEC (Turtle Conservation and Education Center) conservation area, Bali. The method used in this activity is the method of observation or direct observation made in the field to determine the existing activities in TCEC (Turtle Conservation and Education Center) conservation area. The equipment used in this study include thermometer, gloves, buckets, cameras, hoes, and stationery.

Temperature measurement in semi-natural nest was done twice a day in a vulnerable specified time during egg incubation period, which is 40 days. Temperature measurement in semi-natural nest was conducted at 08.00 pm. To measure the temperature, it was used a thermometer with an accuracy of 0.5ºC. It was inserted into the semi-natural spring nest to a depth of approximately 20cm and then the temperature was recorded. Then the egg nest was dug up to take the rotten eggs using gloved hands. The rotten eggs were separated and then buried. The discussion or interview was conducted with relevant parties regarding *Lekang* turtle conservation and development.

The calculation of *Lekang* Turtle hatching success percentage was calculated based on the ratio between the number of hatched eggs and the number of incubated eggs in the nest (Dobbs, *et. al*., 1999) [4], it is as follows:

$$HSs = \frac{JS}{JS + TM} \times 100\ \%$$

Description:
HSS = hatching success rate (%)
JS = the number of hatched eggs
TM= the number of eggs that failed to hatch

3. Results and discussion

Water As one effort to conserve turtle, it was built TCEC (Turtle Conservation and Education Center), a turtle breeding conservation in Serangan, Bali. This is used as a conservation, semi-natural nest, and hatching maintenance until the turtle babies are released back to the sea. This turtle breeding location is less strategic because it is too far from the sea, so that the temperature and humidity are not stable. Water content is an important factor in the growth of embryo and egg hatching [5]. This will lead to the decrease of hatching percentage of turtle eggs.

The data of nest temperature taken during the study, the number of eggs, the success of hatched eggs, and the eggs that failed to hatch can be seen in Table 1.

Table 1. The Hatching Results of *Lekang* Turtle (*Lepidhochelys olivacea*) Eggs.

DAYS TO-	DATE	TEMPERATURE	NUMBER OF EGGS	HATCH	FAIL HATCH
		(ºC)	(grain)	(grain)	(grain)
1	06/8/2014	29	-	-	-
2	07/8/2014	30	-	-	-
3	08/8/2014	31	-	-	-
4	09/8/2014	30	-	-	-
5	10/8/2014	31	100	59	41
6	11/8/2014	32	100	25	75
7	12/8/2014	31	-	-	-
8	13/8/2014	33	146	49	97
9	14/8/2014	30	97	72	25
10	15/8/2014	30	-	-	-
11	16/8/2014	29	-	-	-
12	17/8/2014	30	-	-	-
13	18/8/2014	31	-	-	-
14	19/8/2014	30	-	-	-
15	20/8/2014	29	-	-	-
16	21/8/2014	30	122	96	26

The following table is the percentage result Lekang turtle hatching eggs (olive ridley sea turtle) that hatch early.

Table 2 . The Percentage Result of *Lekang* Turtle (*Lepidhochelys olivacea*) Eggs.

Early eggs	NestTemperature (^{0}C)	Eggs hatch	Hatching percentage %
100	31	59	59
100	32	25	25
146	33	49	33
97	30	72	74
122	30	96	78

Nest condition greatly affects the success of turtle eggs to hatch. There are two main factors that directly affect the success of turtle eggs to hatch during the incubation period, they temperature and water content in the nest. The result of nest temperature measurement ranges in 30º - 33ºC with the average temperature is in Table 2. According to Marquez (1990) [6], if the temperature during the incubation period is much lower or higher than the optimum temperature of 28º - 32ºC, the eggs will hatch less than 50%. The tolerable temperature for the hatching success of turtle eggs is 25º - 34ºC. The low and high nest temperature will determine the sex of the turtle babies [7], [8].

The results of temperature measurement do not show daily fluctuation. This proves that the metabolism process in each nest relatively produces the same heat. In other words, there is not any nest experiencing lower or higher metabolism rate. There is higher temperature range by the time the eggs hatch. This shows that by the time the eggs hatch the metabolism process increases. Nuitja (1992) [1] said that 5 days before the eggs hatch, the nest temperature will increase a few degrees due to the higher metabolism process of the eggs.

The factors that affect the hatching success are the nest temperature, nest depth, the number of eggs implanted, the predators, the egg itself, and also the quality of the sand. The depth of semi-natural spring hatchery in TCEC is about 30 – 40 cm. The depth of the nest is measured without any certain measurement, it is made based on the approximate measurement of the turtle egg growers. This indicates a less optimal hatching in the semi-natural hatchery. Substrate sand that is too dry causes the

withdrawal of fluid out from the eggs resulting embryonic death [7], [8]. Excessive moisture content may also cause high humidity. High humidity in the nest increases the growth of fungi and bacteria that can cover the pores of the eggshell. This coverage can disrupt the following process of egg respiration and cause the restriction of the embryo growth even lead to death [9].

If the data of hatching eggs in TCEC is compared to the data in Sukamade Beach, there is a significant difference. The result of hatching eggs in Sukamade Beach is much higher than the result of hatching eggs in TCEC. This may happen because there several factors, the different temperature of the nest, the depth of the egg nest, the quality of the sand in the nest, the humidity of the nest, the number of eggs, the diameter of the nest.

On August 10th, the total amount of eggs got was 100 eggs or 59%, while on August 11th the total amount of eggs got was 100 eggs with the hatching percentage is 25%. This was because the eggs in the nest were already rotten caused by predators. On August 13th, the total amount of eggs got was 146 eggs with the percentage of 33%. The small percentage was caused by the number of hatched eggs was divided by the number of initial and on August 13th there were no eggs that failed to hatch, and the remain of hatching continued on the next day on August 14th. On August 14th the total amount of eggs got was 97 eggs with hatching percentage of 74% and on August 21st the total amount of eggs got was 122 with hatching percentage of 78%.

Semi-natural hatchery conditions must be made as similar as the original nest so that the percentage of the turtle egg hatching success increases. To make the semi-natural hatchery conditions similar to the original ones is very difficult since the natural condition changes every time. The water content in natural nest is more than the water content in semi-natural hatchery since the location of natural nests is closer to the coast line than the location of semi-natural hatchery. Besides that, the semi-natural hatchery is closed (roofed) that will block the water when it rains and will shade it from the sunlight. The difference of the nest condition affects the turtle hatching success.

Semi-natural egg hatching is done inside a building measuring 3 x 3 m with a substrate of beach sand. This is done to reduce the risk of failure of turtle eggs to hatch in the natural nest, the risk of predators, the risk from people who still want to hunt turtle eggs, and also the risk of the existing coastal vegetation. Turtle eggs are taken from the natural nest and moved to the semi-natural nest. The eggs are planted and will hatch in the average time of 1.5 – 2 months. The planted eggs are marked with plates / boards containing information on the types of turtle, the number of eggs, and the egg planting time. Management activities in the semi-natural egg hatching include recording the number of eggs that successfully hatch, the number of dead turtle babies, and also keeping the hatching house clean. The eggs that are not ready to hatch are replanted in the nest until they ready to hatch completely. Eggs will be collected that are stated to fail to hatch are collected and then buried. This is done in order not to cause odor and do not call other animals to come to prey on the eggs that still exist in the semi-natural nest.

Besides that, another outside factor that cause the failure of hatching is the character defect. This is caused by the position of eggs that are stacked and pressed together in the nest so that the eggs below get the pressure most and get less oxygen. This can cause the differentiation process of embryonic turtle in the eggs disrupted resulting in the formation of organs is not maximum. Then it can be stated that the egg abnormalities cause the body hatching growth defects and unhealthy, and can lead to premature death. There is also a predator in the sand that is used as the medium for the hatching. This is one obstacle to the successful hatching of turtle eggs. When the nest is dismantled, there is a kind of animal that inhibit the growth of turtle eggs, they are red ants. Than ants eat turtle eggs in the nest so that the eggs cannot develop and hatch.

Dismantling the nest is done to clean the nest for reusing and also to assess how many eggs that cannot hatch into hatching. Based on the data obtained, the failure of egg hatching in the semi-natural hatchery is due to the internal factor of the turtle egg itself. Turtle eggs that cannot hatch do not have embryos.

Besides that, the water content in the sand is also an important factor in the growth of turtle eggs and egg hatching. The more the embryos grow in the eggs, the more they absorb water from the eggs. This makes the diameter of eggs expanded and enlarged several millimeters. On the contrary, dry sand

will absorb water from the eggs it has a higher salt concentration than the eggs. This water absorption by sand can cause the embryo in the egg does not develop and die [5].

According to Darmawan (1995)[10], turtles make holes for nesting that are not close to the beach so that the sea water cannot reach the nest and the temperature and humidity will be maintained. The eggs exposed to the sea water will usually be damaged and fail to hatch. Therefore, the distance of semi-natural hatchery in Sukamade Beach is not too close to the beach to avoid excessive intrusion of sea water that can destabilize either the temperature or the humidity of the nest that will affect the success of the turtle hatching.

4. Conclusion

Considering the condition of the surrounding area, *Lekang* turtle (*Lepidochelys olivacea*) conservation technique in TCEC Bali is good enough. The success percentage of *Lekang* turtle egg (olive ridley sea turtle) hatching observed is quite high.

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