NESTING SITE REQUIREMENTS FOR GREEN TURTLE (*CHELONIA MYDAS* L.) IN INDONESIA

By

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SUMMARY

Green turtle (Chelonia mydas *L.) tend to have their nesting sites in sunken places above high tide mark on sea shore which are gently sloping into deep water. Sand particles form more than 90% and the remaining are dust and clay particles. The particles can be classified as fine to medium size. Mineral fractions of sand in the nesting sites are varied, it depends on its parent material. Quartz is one of the most significant component on turtle nesting sites. Vegetasion along the beach where turtles build their nest are usually composed of* Pandanus tectorius *and* Ipomoea pescaprae.

INTRODUCTION

Indonesia covers a wide area, consisting of thousands of islands which spread from Aceh in western part to Irian Jaya in the eastern part of the region. Some of the islands are very rich in marine turtle populations. Marine turtles are natural resources of great value to some peoples of Indonesia, especially turtle eggs harvested in certain regions. Also, in several regions marine turtle generate employment and provide as protein source for the people. However, most people rely on them directly for cash income. The green turtle is the main commercial species being in great demand for traditional purposes such as steak and calipee for turtle soup. Turtle consumption has a long history and recently the demand is increasing from year to year. Turtle meat may be cooked as steak or soup, it also produces oil as a raw material for cosmetics and medicines. In several regions the carapace is used in traditional home industries.

In general, especially the green turtle and leatherback are found along the coast facing the deep ocean. Green turtle spread choice at good nesting areas, such as beaches of West Sumatra, South of Java and the beaches of East Kalimantan, etc. These turtle are found inside the reefs, but lagoons with marine grasses and algae are more preferable places.

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MATERIALS AND METHODS

The main study was focused on the nesting site of green turtle populations in several regions. In this research it will be discussed the texture, sand composition, beach vegetation, and the laying density of the nesting site. Samples of the sand composition of the nest were randomly collected. Methods used for sand grain analysis is according to Nuitja and Uchida (1983). Classification of sand particles is based on King's (1961) method. The analysis of minerals of sand particles is composed by using line counting method. Using a tea spoon, sand particles were spread on a glass object of 3,5 x 5,0 cm. One or two drops of nitrobenzene ($U_6H_5O_2$) were added and shaken evenly with a wire. After that, sample was placed on the rolling table of a polarisation microscope and finally the mineral composition in the fraction was counted.

Samples for texture composition study were taken from the nesting site to be analyzed in the laboratory. The analysis is as follows : 10 grams of sample is placed into a 800 ml beaker glass, 30 to 50 ml of 6,0% H_2O_2 added then covered with a glass and left for one night to eliminate organic matter to enable react perfectly. If there is still foam, several drops of acetic acid (CH_3COOH) were added to neutralize the foam. In the next morning, the beaker glass is put in a water bath for about 2 to 3 hours, and shaked occasionally. If the sample has a high humus content, which can be recognized from its dark color, add 10 to 20 ml of 30% H_2O_2. The additional H_2O_2 destroys the organic matter and turns the color of solution to lighter one which also elimanates air bubbles, then add 45 ml of 0,4 NHCL into suspenson in the nesxt morning, the precipitate is removed and the sample is washed with pure water. The treatment by washing is carried out until free of Cl which can be tested by using $AgNO_3$. If the sample contains Cl, it can be recognised by AgCl precipitation. The purpose of washing treatment is to remove the soluble matter and electrolites which disturb peptisation. Pure water is added sufficiently to the organic matter, carbonate and free Cl of the sample (about 1/3 of beaker glass). About 5 ml of $Na_4P_2O_7$ (natriumpirophospat) 0.0006 molar is added and then shake the suspension. After one day, the suspension becomes dispersion, the samples are filtered with 0.05 mm mesh of sieve and poured into a sedimentation cylinder. The sand fraction is left on the sieve and only dust and clay fractions are put into the glass cylinder. The sand fractions are dried in a water bath, drying is then continued in an oven with a temperature of 105°C about 2 hours. Then it is cooled in a desicator and weighed on an analytical balance. Add distilled water up to 800 ml to the suspension in a glass. Shake for one minute and allow it to settle for one night. In the next morning, if there still precipitation add several drops of $Na_4P_2O_7$, 0.0006 molar and shake until the dispersion is

perfect. Fill a glass cylinder with pure water up to the mark. Put the cylinder in a water bath for one night. In the next morning after it is shaked for one minute, directly pipet (I) 50 ml at a half depth of suspension. Evaporate the suspension until it dries up in a water bath, and then dry it in an oven at 105°C for 2 hours, then cooled it in a desiccator and weighed both the silt and clay fraction. Shake the suspension again one minute after setting it for 3 hours 36 minutes at the temperature 26°C. Directly pipet (II) 25 ml at 5,2 cm swept of suspension. Evaporate it on a water bath, and dry it in an oven at 105°C, cool it in a desiccator and weight the clay fraction. Vegetation analysis was conducted by using the method of Costing in Soerianegara and Indrawan (1982) to determine the quantity of sample plots, based on species area curve. Sample collection was carried out by using many equally distributed sample plots. The results of this vegetation analysis is an Important Value Index (IVI).

RESULT AND DISCUSSIONS

1. Texture and grain size composition.

Turtle starts crawling into the beach after sunset or at night. No turtle makes nests in the forest or bushes zones, because those areas are difficult to be passed through and back to the sea. Many tracks show that turtles may choose the suitable place to lay. Sands form of nests, more than 90% of the nesting site (Table 1). Usually the sands are very loose. The porosity is always good and aeration take place very well from the upper hole to the bottom. The smallest dust and clay were absent may be due to the strong winds, abration and flooding by river. It should be noted that metabolism inside the eggs requires sufficient air and a stable nest temperature. If the texture composition is different from that observed e.g. containing more dust or clay, it is more difficult for the turtles to dig their egg hole.

Nesting sites at Sukomade, show that during Dec. '81 and '82 (Northwest season), green turtles nests consists of grains with diameter of 0.22 to 0.26 mm all the way from the surface to the bottom. During Southeast season, the grain size is between 0.21 to 0.24 mm on the surface and 0.16 to 0.28 mm in the bottom (Figure 1). The distribution of sand diameters on Pangumbahan and Citirem beaches are between 0.15 to 0.21 mm on the surface and in the bottom. In general, the texture of nesting sites of green turtle are usually to be formed by small dust

Table 1. The percentage of texture composition of green turtle (*Chelonia mydas* L.) from several nesting sites.

Location	Month (Obs. no.)	Texture		
		Clay	Dust	Sand
Sukomade	Dec. '81 (12)	1.05 ± 0.11	0.82 ± 0.25	98.15 ± 0.31
	July '82 (12)	1.01 ±0.09	0.73 ± 0.19	98.25 ± 0.29
	Dec. '82 (12)	0.83 ± 0.06	1.41 ± 0.20	97.75 ± 0.23
	April '83 (12)	0.85 ± 0.06	0.78 ± 0.16	98.37 ± 0.26
Pangumbahan	Oct. '83 (10)	2.48 ± 0.11	4.20 ± 0.24	91.18 ± 0.45
	July '83 (10)	2.61 ± 0.21	3.96 ± 0.62	93.44 ± 0.57
Citirem	Oct '84 (10)	2.36 ± 0.14	3.57 ± 0.35	94.07 ± 0.62
	July '84 (10)	2.23 ± 0.44	4.18 ± 0.12	93.60 ± 0.17
Banyuwangi Selatan	May '86 (15)	2.29 ± 0.12	3.27 ± 0.21	94.46 ± 0.23
Sindangkerta	July '82 (10)	1.91 ± 0.09	2.18 ± 0.19	95.55 ± 0.52
Sindangkerta	Oct. '90 (10)	2.21 ± 0.54	2.32 ± 0.09	94.63 ± 0.27

and clay, but 90% or more is sand. According to King (1961) and Tair (1968) the predominate particle size above is classified as fine to medium types. This size seems suitable for green turtle nesting (Hendrickson, 1958). But Seng and Tow (1980) noted that the green turtle beach of Perhintian Island and Redang Island in the Northern part of, Trenggagu, consists predominantly of fine sand. Hendrickson (1958) mentioned that fine sand is more resistant to dig than any other types.

2. The sand material of nesting site.

Sand samples of 12 nests from Sukomade nesting sites are shown in figure 2. The character of dominant fraction of sand is influenced by local materials. In Sukomade two fractions are dominant, those are impure quartz (41 to 60%) and stony fragments (12 to 31%). Other fractions are relatively small, those are clean quartz about 2 to 6%, epidote ranging 2 to 10%, orthoclase 2 to 8%, iron quartz 0 to 4%, and the rest are small amount of opal, augite, hypersethene and brown amphibole. The composition of mineral on Pangumbahan, Citirem beaches

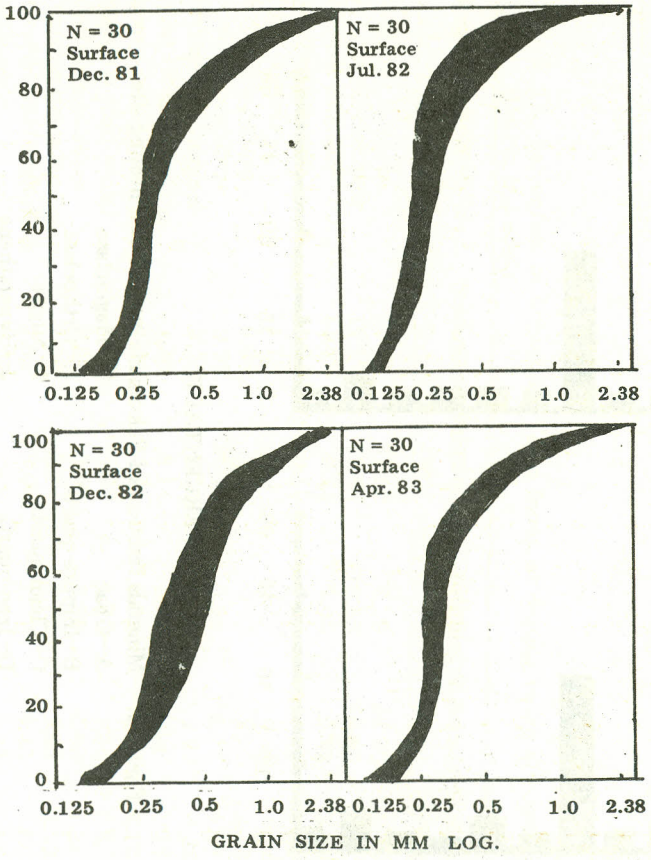

Figure 1A. Diameter in mm on the surface of green turtles nest at Sukomade beach.

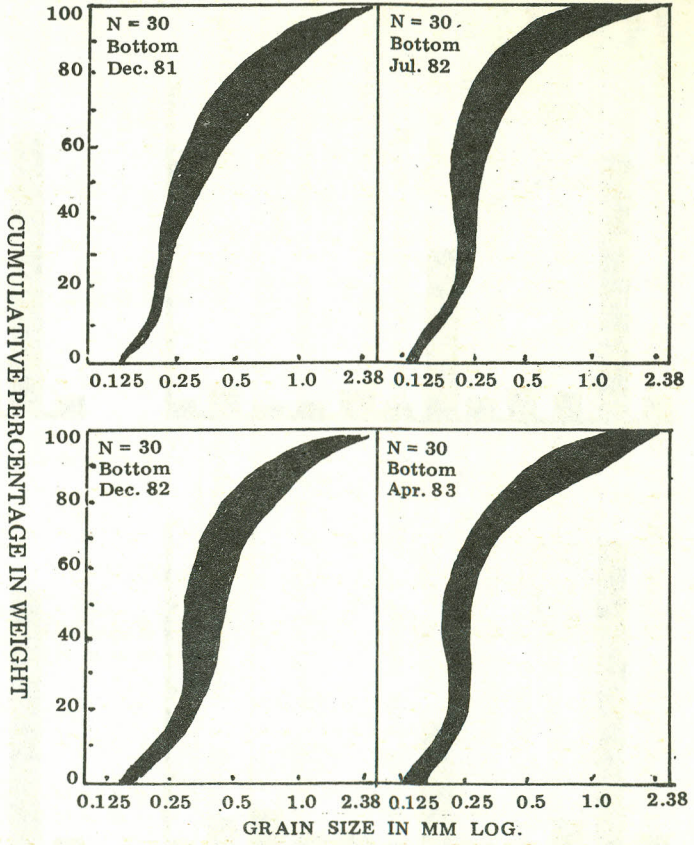

Figure 1B. Diameter in mm in the bottom of green turtles nest at Sukomade beach.

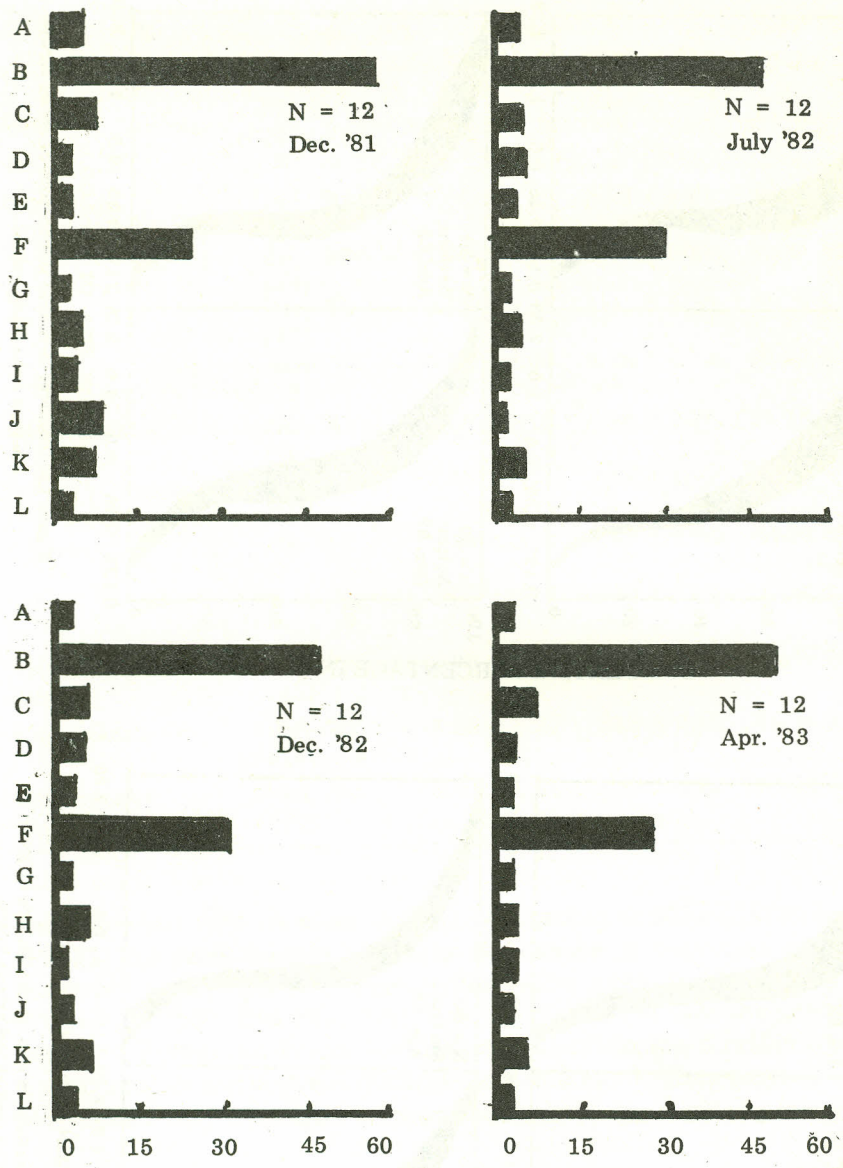

Figure 2. Minerals fraction of Sukomade green turtle nesting site

A—Opac	G—Plagioclase
B—Impure quartz	H—Orthoclase
C—Clean quartz	I—Augite
D—Iron quartz	J—Hypersthene
E—Grit material	K—Epidote
F—Stony fragments	L—Amphibol

are different (Table 2) although the impure quartz also occures in those sites. Lime concretion is dominant on the nesting sites of Pangumbahan and Citirem. In the inshore of Batunamprak near nesting sites, we could find coral reefs. A whitish color of lime concretion on the nesting site is probably influenced by decaying corals. The nesting sites of Banyuwangi Selatan and Sindangkerta, its mineral composition are almost the same with Sukomade. At Sukomade and Banyuwangi Selatan nesting sites, the color is brown black which is influenced by particles from Sukomade river and Segara Anakan, and the color of Sindangkerta nesting site is black.

Table 2. Percentage of mineral fraction of sand nest for green turtle on some nesting sites.

Kind of mineral	Citirem	Pangumbahan	B. Selatan	Sindangkerta
Lime concretion	68.0	53.5	10.2	8.9
Impure quartz	20.8	24.5	48.8	45.1
Clean quartz	2.3	5.0	6.4	4.8
Iron quartz	0.3	1.0	1.6	2.2
Opal	3.0	3.3	3.2	2.3
Plagioclase	1.3	4.3	3.7	4.7
Amphibole	1.5	3.8	6.3	11.8
Augite	1.3	2.8	7.2	9.2
Hypersthene	0.7	0.5	5.8	7.2
Stony fragments	0.8	1.3	7.0	3.8

Table 3. The percentage of Important Value Index of nesting beach at some locations in Indonesia.

Scientific name	Sukomade	Pangumbahan	Citirem	B. Selatan	Sindangkerta
Pandanus tectorius	74.51	81.62	79.19	68.80	76.65
Gynura procumbens	19.17	12.01	15.55	10.45	14.02
Hibiscus tiliaceus	13.49	9.24	7.00	5.22	3.45
Spinifex littoralis	14.04	19.15	16.20	10.85	20.25
Vigna marina	11.78	9.11	7.27	8.45	6.66
Hernandia peltata	10.05	7.86	9.63	9.55	12.10
Ipomoea pescaprae	9.39	12.16	10.36	12.15	15.25
Barringtonia insignis	8.72	6.72	2.15	7.20	4.35
Cycas rumphii	7.32	2.14	1.92	3.44	5.12
Hoya diversifolia	5.55	4.68	2.92	2.23	5.10
Canavalia ensiformis	4.06	4.22	3.73	1.88	3.68
Muntingia calabura	3.97	0.00	2.30	0.00	1.14
Cynodon dactylon	3.89	2.14	2.34	1.22	2.12
Calophyllum inophyllum	3.62	3.00	1.71	2.25	3.60
Cassia alata	3.78	2.66	1.82	1.55	2.34
Stemona javanica	2.10	1.16	0.00	1.20	1.87
Terminalia catappa	1.67	1.44	1.49	1.12	1.87

3. Beach vegetation.

Vegetation analysis in one way to study the species composition and structure of the nesting site of green turtle. The Important Value Index (IVI) reflected dominant plant species on the nesting habitat of the green turtle. The nesting habitat of green turtle at some nesting sites along the beach in Indonesia were dominated by *Pandanus tectorius* which has the highest IVI (Table 3). The pioneer plants are *Ipomoea pescaprae* and *Spinifex littoralis*. Meermohr (1926) stated that the green turtle breeding site on Berhala Island is also pioneered with *I. pescaprae*. The innermost zone beach vegetation formation consists of *Calophyllum inophyllum*, *Terminalia catappa*, *Hibiscus tiliaceus*, etc. In general, this zone is established by the plants growing on solid soil. It is obvious that sand particles are few in this area.

4. Nest distribution.

The beach was divided into four zones, namely intertidal, supratidal, bushes and forest zones. The intertidal and supratidal zones had 0.05% nests and 58.94% nests respectively in observed on Sukomade nesting site from October 1981 to April 1983. The border between bushes and supratidal zones had 1.31% nests. There were no nest in the bushes and forest zones. Most nests recorded are in the area of supratidal either at Sukomade, Pangumbahan, Citirem, Banyuwangi Selatan and Sindangkerta beaches, etc. The monthly frequency values (%) at Sukomade nesting site were obtained from two areas in supratidal zone (Table 4). In the shade area of the supratidal, 286 nests (24.8%) were found, particularly near *Pandanus tectorius*, and 75.4% nests in the open area.

Table 4. Distribution of green turtle nest (%) in open and shadow areas of supratidal zone in Sukomade beach from October 1981 to April 1983.

Month	No. of nest (%) in supratidal	
	Open	Shade
January	60.5	39.5
February	65.8	34.2
March	78.9	21.1
April	76.6	23.4
May	82.8	17.2
June	63.0	37.0
July	60.1	39.9
August	69.0	31.0
September	36.4	63.6
October	68.2	31.8
November	71.6	28.4
December	77.5	22.5
Average	75.4	24.6

CONCLUSIONS

The type of beach favored by green turtle for nesting seems to be areas with steep sloping, with a high beach platform and above the flood tide, such as in West Sumatra, South of Java (Sukomade, and Banyuwangi Selatan in East Java, Pangumbahan, Citirem and Sindangkerta in West Java), East Kalimantan, etc. All beaches are in general situated between 30 to 60 meters from the low tide mark. The instinct of animals such as green turtle to the location as their home is very strong (McConnaughey, 1974). Plants such as *Pandanus tectorius* and the type of sand serve as favorable place for the strong homing instinct and nesting (Morse, 1980). The particles of sand for green turtle nesting are fine to medium sizes. In general, green turtles are nesting at night. The darkness of the dense beach vegetation and the silence are preferable to lay. Most nests recorded are in the areas of supratidal in front of beach vegetation. There are about 70% or more of total number of nests were found in the open areas which is in the sunshine on the supratidal zone is more effective for egg incubation in the nest.

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