Global Scientific JOURNALS

GSJ: Volume 10, Issue 1, January 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

LAND SUITABILITY OF THE TURTLE NESTING HABITAT ON THE PEKIK NYARING BEACH, CENTRAL BENGKULU REGENCY BENGKULU PROVINCE

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ABSTRACT

Pekik Nyaring Beach, Central Bengkulu Regency is a turtle nesting beach. Nesting beaches tend to have their own characteristics that influence turtles to land. The purpose of this study was to determine the environmental parameters that affect turtle nesting habitat and determine the suitability of land for laying turtle eggs at Pekik Nyaring Beach, Central Bengkulu Regency, Bengkulu Province. The research was conducted in June 2021 at Pekik Nyaring Beach, Central Bengkulu Regency using survey methods for data collection, as well as descriptive analysis methods at the data analysis stage. The results showed that the suitability of parameters affecting turtle landings at Pekik Nyaring Beach was in accordance with the characteristics of turtle nesting habitats. Characteristics at Pekik Nyaring Beach include a width of 19.53 m with a beach slope included in the flat category, namely 2.5°, making it easier for turtles to land and climb towards the vegetation to lay their eggs. Sand grain size 0.15 – 0.25 m included in the category of medium fine sand can make it easier for turtles to make nests. The temperature of the sand at Pekik Nyaring Beach is 28.5 – 29.25°C. And the vegetation on Pekik Nyaring Beach is dominated by Sea Fir and Bayhops.

Keywords: *Land suitability, Nesting habitat, Pekik Nyaring Beach, Turtle*

1. INTRODUCTION

Turtle is a species in the reptile class that spends most of its life on the high seas. The female turtle will return to the beach where she hatched to release her eggs. Turtles have a tendency to lay eggs with certain beach conditions. There are several factors in influencing the landing of turtles to lay eggs such as physical factors and biological factors. Physical factors such as temperature can affect turtle eggs. Eggs in the nest are influenced by temperature to determine the sex of the

hatchlings (turtle chicks), if the nest temperature is warmer the hatchlings will be born female, on the other hand if the nest temperature is cooler then the hatchlings will be born male. In addition to temperature, the width of the beach is more than 7 meters and the degree of beach slope less than 30° the presence of coastal vegetation as protection from predators is a factor in turtle landings [1]. Other factors that influence turtle landings include the season and the availability of food in the ocean.

Turtle is one of the species listed in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) and 'Red List' on the IUCN (International Union for the Conservation of Nature and Natural Resources) which means that its existence in nature has been threatened to extinct so that all forms of utilization and circulation must receive serious attention. This condition causes all turtle species in Indonesia to be granted protected status by the state as stated in Government Regulation Number 7 of 1999 concerning the preservation of protected plant and animal species. In addition to regulations that protect turtles, conservation activities are also needed to support turtle conservation.

Pekik Nyaring Beach is one of the coastal areas in Bengkulu Province which is included as a productive turtle nesting area. The turtle that lays eggs in this area is dominated by the Olive Ridley Sea Turtle, but Hawksbill turtles are also found. Unfortunately, the public's understanding of turtle conservation is still lacking because there are still practices of buying and selling turtle eggs. Therefore, to support turtle conservation efforts at Pekik Nyaring Beach, it is necessary to conduct research on the suitability of the land for turtle nesting habitats at Pekik Nyaring Beach, so it is hoped that supervision and care in the turtle nesting area can be managed optimally without disturbing the preservation of the surrounding environment. The purpose of this study was to determine the environmental parameters that affect turtle nesting habitat and determine land suitability for turtle laying eggs.

2. METHOD

This research was conducted in April – June 2021 at Pekik Nyaring Beach, Central Bengkulu Province. The method used in this research is a survey method. The survey was conducted to collect data on turtle nest points. Sampling using purposive sampling method with consideration of the turtle landing place to lay eggs.

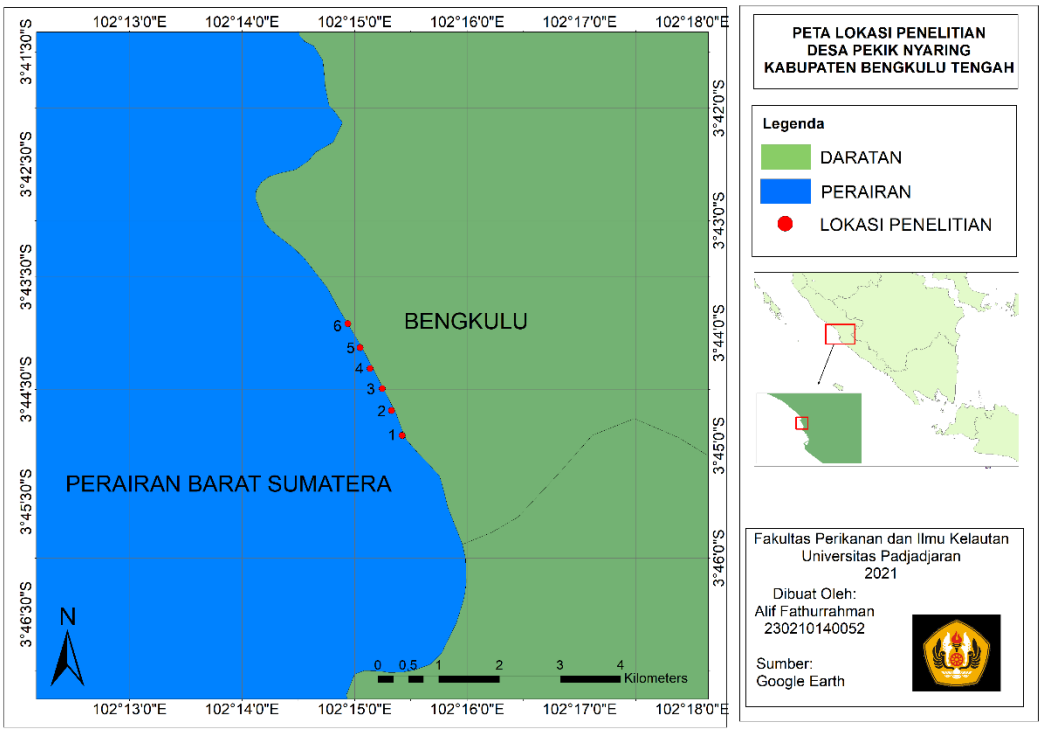

Image 1. Research Location Site

This research was conducted in three stages. The first stage is the study stage and the determination of the sampling point. The second stage is data collection, namely, primary data in the form of beach width, beach slope, sand temperature in the nest and vegetation in the field, and secondary data taken in the form of tidal data. The third stage is data analysis using comparative descriptive analysis based on the suitability of turtle nesting habitats. Then, all data were compared with the suitability table (Table 1) to see the suitability value of the spawning beach. If all parameters in the station match, then it is categorized as very suitable for turtle nesting habitat. If three or four parameters in the station match, then it is included in the appropriate category for turtle nesting habitat. If less than two parameters in the station match, then it is included in the unsuitable category for turtle nesting habitat. The tools used in this research are Sieve Shaker, Piston Core, KUMMOD software, Google Earth software, GPS (Global Positioning System), Digital Thermometer, Stationery, Camera, Roll Meter, Waterpass, and Laptop.

Table 1. Suitability of Spawning Habitats

Parameter	Suitability	
	Suitable	Not Suitable
Beach Width (m)	>7	<7
Coastal Slope (°)	<30	>30
Sand's	0,1 – 0,5	>0,5 or <0,1

Grain Size (μm) Sand		
Temperature (°C)	28 – 35	>35 or < 28
Vegetation	Dominated by: Bayhops (*Ipomoea pes-caprae*) atau Pandan Laut (*Pandanus tectorius*) atau Sea Fir (*Casuarina equisetifolia*)	Not Vegetated

3. RESULT AND DISCUSSION

3.1. Tidal

Tides affect turtle landings, high tides can affect individual turtles who land by utilizing tide water will more easily reach the nesting beach so that turtles can save energy when they reach the spawning area. The results of tidal data processing show that Pekik Nyaring Beach has double daily tides, in one day there are two high tides and two low tides.

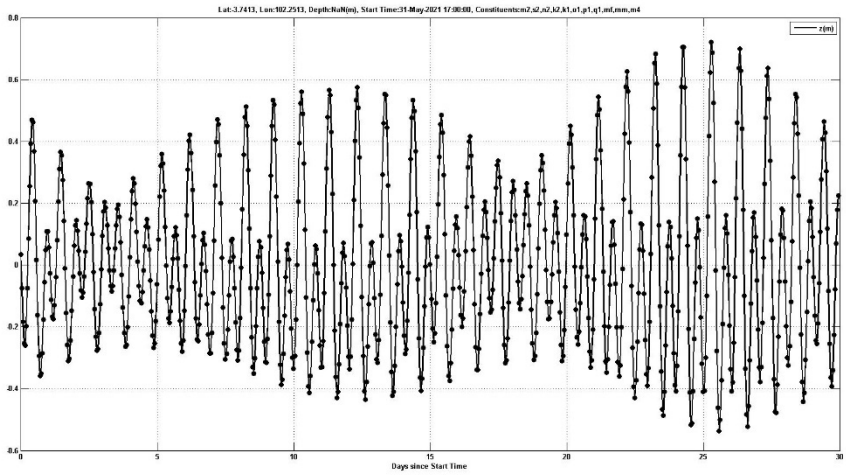

Image 2. Tidal Chart Pekik Nyaring Beach in June 2021
(Source: *Tide Model Driver*)

Tides have a close relationship with turtle nesting activities. Turtles save energy by utilizing high tides to reach dry (supratidal) areas to then build nests and lay eggs [2]. In addition, tides can affect turtles in determining the location of the nest, turtles will lay eggs far from the tidal limit of sea water to avoid the nest being submerged in water when high tide occurs [2]. Observations show that the highest tide occurs at night. The highest tidal value is used to be the boundary of the intertidal zone in measuring the width of the beach.

3.2. Beach Width and Slope

Pekik Nyaring Beach has a length of ± 4.2 km. The width and slope of the beach can affect the turtles landing and making nests, because the turtle's eyes are only able to see well at an angle of 150° downwards, so the beach slope must be below 30° [3]. In addition, turtles lay their nests 7 to 80 meters above the farthest high tide [1]. The results of observations of beach width and beach slope at Pekik Nyaring Beach can be seen in Table 2.

Table 2. The Width and Slope of Pekik Nyaring Beach

STATION	BEACH WIDTH (m)	BEACH SLOPE (°)
1	29,6	2,5
2	20,2	2,1
3	14,6	2,0
4	17,1	2,8
5	18,4	3,1
6	17,3	2,6
Average	19,53	2,5

The results of the measurement of the beach width, at station 1 of 29.6 m, at station 2 of 20.2 m, at station 3 of 14.6 m, at station 4 of 17.1 m, at station 5 of 18.4 m, at station 6 of 17.3 m. Olive Ridley Turtles and Hawksbill Turtles requires width of the beach more than 7 m from the highest tide. The width of the beach affects the increase in turtles and nest placement, if the width of the beach is not suitable, it will be difficult for turtles to make nests [1]. Based on the biophysical suitability of the turtle nesting habitat, the width of Pekik Nyaring Beach is suitable because each station has a width of more than 7 m.

The results of the measurement of the beach slope, at station 1 has a value of 2.5 °, at station 2 has a value of 2.1 °, at station 3 has a value of 2 °, at station 4 has a value of 2.8 °, at 5 has a value of 3.1°, at station 6 it has a value of 2.6°. A beach angle of less than 30° is a suitable beach for turtle nesting beaches, because the turtle's eyes cannot see at an angle of 150° down [3]. Based on the biophysical suitability of the turtle nesting habitat, the slope of Pekik Nyaring Beach is suitable because each station has a slope of less than 30°.

3.3. Grain Size

Turtles choose a nesting beach with a sand with grain diameter of 0.1 – 0.5 m or a fine to medium sand type [4]. The fine sand makes it easier for female turtles to dig for nests and makes it easier for hatchlings to reach the beach surface after hatching from eggs. The data on the size of the sand grains at Pekik Nyaring Beach is shown in Table 3.

Table 3. Grain Size Pekik Nyaring Beach

Station	Grain Size (µm)	Classification
1	0,19	Fine
2	0,23	Medium
3	0,18	Fine
4	0,16	Fine
5	0,25	Medium
6	0,15	Fine

Based on Table 3 at station 1 the sand grain size is 0.19 m and is classified as fine sand. At station 2 the large sand grains are 0.23 m and are classified as medium sand. At station 3 the large sand grains are 0.18 m and are classified as fine sand. At station 4 the sand grains are 0.16 m in size and are classified as fine sand. At station 5 the sand grains are 0.25 m in size and are classified as medium sand. At station 6 the sand grains are 0.15 m in size and are classified as fine sand.

3.4. Temperature

Sand temperature affects laying and hatching, if the sand temperature is too high (>35℃) it will be difficult for turtles to make nests, but if the temperature is too low (<28℃) it can affect the incubation period and hatching success rate [3]. Temperature also affects the sex of the hatchlings that will hatch. If the temperature is less than 29℃, most of the hatchlings are male, on the other hand, if the temperature is more than 29℃, most of the females will hatch [5]. The results of sand temperature data collection based on the time and location of data collection are in Table 4

Tabel 4. Average Sand Temperature Pekik Nyaring Beach

Station	Observation Time	Day Temperature (℃)			Average Temperature (℃)
		1	2	3	
1	06.00	26	27	28	27
	12.00	30	32	32	31,33
	18.00	29	30	30	29,67
	24.00	26	26	27	26,33
				Average	**28,58**
2	06.00	28	26	26	26,67
	12.00	31	31	30	30,67
	18.00	30	29	29	29,33
	24.00	27	27	28	27,33
				Average	**28,50**
3	06.00	26	27	27	26,67

	12.00	33	34	33	33,33
	18.00	31	33	30	31,33
	24.00	28	28	26	27,33
				Average	**29,67**
4	06.00	27	26	28	27
	12.00	31	33	32	32
	18.00	29	32	31	30,67
	24.00	27	27	28	27,33
				Average	**29,25**
5	06.00	26	26	27	26,33
	12.00	33	32	31	32
	18.00	31	32	30	31
	24.00	28	26	26	26,67
				Average	**29**
6	06.00	27	27	28	27,33
	12.00	32	30	32	31,33
	18.00	30	29	29	29,33
	24.00	27	28	27	27,33
				Average	**28,83**

Pekik Nyaring Beach has a sand temperature in the range of 26 – 34℃ and an average sand temperature of 28.97℃. It can be seen in Table 4, at station 1 it has a range of 26 – 32℃ with an average temperature of 28.58℃. Station 2 has a range of 26 – 31℃ with an average temperature of 28.5℃. Station 3 has a range of 26 – 34℃ with an average temperature of 29.67℃. Station 4 has a range of 26 – 33℃ with an average temperature of 29.25℃. Station 5 has a range of 26 – 33℃ with an average temperature of 29℃. Station 6 has a range of 27 – 32℃ with an average temperature of 28.83℃. The highest temperature is at station 3, because it is located in an open area. The lowest temperature is at station 2, because it is located under the shade of lush vegetation.

3.5. Vegetation

The existence of coastal vegetation is very important for turtle nesting nests, especially for egg incubation. Sea turtle nesting nests are often found under the cover of coastal vegetation. The presence of vegetation is able to maintain the temperature in the egg incubation process and instinctively vegetation is considered to increase safety for laying eggs to avoid predators [1]. The types of vegetation found in the Pekik Nyaring Beach area include: Sea Fir (*Casuarina equisetifolia*), Biduri (*Calostropis gigantea*), Bayhops (*Ipomoea pes-caprae*), Cuscuta (*Cassytha filiformis*), and Napier Grass (*Pennisetum purpureum*).

Tabel 5. Vegetasi di Tiap Stasiun

Stasiun	Vegetasi
1	-Sea Fir -Bayhops -Biduri
2	-Sea Fir -Bayhops
3	-Sea Fir -Biduri -Cuscuta
4	-Sea Fir -Bayhops -Cuscuta
5	-Sea Fir -Napier Grass -Cuscuta
6	-Sea Fir -Bayhops -Napier Grass

The existence of coastal vegetation is a biological characteristic of turtles in determining the location for making nests and laying eggs. Each beach has different vegetation. Along Pekik Nyaring Beach is generally dominated by Sea Fir and Bayhops. Sea fir is a type of tree that can protect turtle nests from the sun, causing the area to be shady and cool compared to coastal areas without coastal vegetation [6]. Bayhops is a type of shrub that can maintain the stability of the humidity of the nest sand [6]. The better the condition of the vegetation, the more suitable an area for turtle nesting habitats. Coastal vegetation affects turtle landings. Good coastal vegetation is useful as a protector of turtle nests from sunlight, waves, rain, predators, and maintains the stability of humidity, temperature, and the surrounding environment [6].

3.6. Turtle Nesting Beach Suitability

Turtles have a tendency to choose their nesting beaches. A suitable nesting beach for turtles has certain characteristics according to the type of turtle that landed on the beach. The characteristics of the beach that is used as a turtle nesting habitat has a beach width of >7 m (Nuitja, 1992), a beach slope of <30° [3], grain size 0.15 – 0.25 m [7], substrate temperature 28 – 35°C [3], and with a vegetation background of Pandan Laut, Sea Fir, and Bayhops plants [1]. The analysis was divided into 3 categories, the very suitable category had five parameters according to the characteristics of the turtle nesting habitat, the appropriate category had four or three parameters according to the characteristics of the turtle nesting habitat, and the category did not match the results with only less than two parameters that matched the results. turtle nesting habitat

characteristics. The results of the biophysical suitability analysis for each station at Pekik Nyaring Beach can be seen in Table 6.

Table 6. The Results of the Analysis Suitability of Turtle Nesting Beaches Hasil

Parameter	Station					
	1	2	3	4	5	6
Beach Width (m)	29,6^{S}	20,2^{S}	14,6^{S}	17,1^{S}	18,4^{S}	17,3^{S}
Beach Slope (°)	2,5^{S}	2,1^{S}	2^{S}	2,8^{S}	3,1^{S}	2,6^{S}
Grain Size (µm)	0,19^{S}	0,23^{S}	0,18^{S}	0,16^{S}	0,25^{S}	0,15^{S}
Sand Temperature (℃)	28,58^{S}	28,5^{S}	29,67^{S}	29,25^{S}	29^{S}	28,83^{S}
Vegetasi	Sea Fir, Bayhops, Biduri^{S}	Sea Fir, Bayhops^{S}	Sea Fir, Bayhops, Biduri, Cuscuta^{S}	Sea Fir, Bayhops, Cuscuta^{S}	Sea Fir, Bayhops, Napier Grass, Cuscuta^{S}	Sea Fir, Bayhops, Napier Grass^{S}

Ket: ^{S} = Suitable
^{TS} = Not Suitable

Based on Table 6, station 1 has a width of 29.6 m, a slope of 2.5°, a sand grain size of 0.19 m, an average sand temperature of 28.58℃, and is set in the vegetation of Sea Fir, Bayhops, and Biduri. So station 1 is categorized as very suitable for turtle nesting habitat. Station 2 has a width of 20.2 m, a slope of 2.1°, a sand grain size of 0.23 m, an average sand temperature of 28.5℃, and has a background of Sea Fir and Bayhops vegetation. So station 2 is categorized as very suitable for turtle nesting habitat. Station 3 has a width of 14.6 m, a slope of 2°, a sand grain size of 0.18 m, an average sand temperature of 29.67 , and a background of vegetation of Sea Fir, Bayhops, Biduri, and Cuscuta. So station 3 is categorized as very suitable for turtle nesting habitat. Station 4 has a width of 17.1 m, a slope of 2.8°, a sand grain size of 0.16 m, an average sand temperature of 29.25 , and a background of vegetation of Sea Fir, Bayhops, and Cuscuta. So station 4 is categorized as very suitable for turtle nesting habitat. Station 5 has a width of 18.4 m, a slope of 3.1°, a sand grain size of 0.25 m, an average sand temperature of 29℃, and a background of vegetation of Sea Fir, Napier Grass, and Cuscuta. So station 5 is categorized as very suitable for turtle nesting habitat. Station 6 has a width of 17.3 m, a slope of 2.6°, a sand grain size of 0.15 m, an average sand temperature of 28.83℃, and has a background of Sea Fir, Bayhops, and Napier Grass as a background. So station 6 is categorized as very suitable for turtle nesting habitat

Based on Table 6. It can be concluded that Station 2 – Station 5 is a very suitable area for turtle nesting habitat, because all parameters are suitable for turtle nesting habitat. However, no

turtles were found at stations 2 – 5, allegedly due to human factors who carry out activities at night in the form of fishing on the coast using nets and fishing rods, making bonfires around the station, and looking for wood that lands on the beach to become firewood and charcoal.

4. Conclusion

Based on the results of the suitability analysis of the parameters that affect the landing of turtles at Pekik Nyaring Beach, it is in accordance with the characteristics of the turtle nesting habitat. Characteristics at Pekik Nyaring Beach include a width of 19.53 m with a beach slope included in the flat category, namely 2.5°, making it easier for turtles to land and climb towards the vegetation to lay their eggs. The size of the sand grains of 0.15 – 0.25 m is included in the category of medium-fine sand which can make it easier for turtles to make nests. The temperature of the sand at Pekik Nyaring Beach is 28.5 – 29.25℃. And the vegetation on Pekik Nyaring Beach is dominated by Sea Fir and Katang-katang. Station 2 – Station 5 is categorized according to turtle nesting habitat.

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