
Turtle Nesting Habitat Conditions on Pandan Island, Pieh Island Conservation Area, West Sumatera

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ABSTRACT

KEYWORDS:

Green Sea Turtle

Hawksbill Turtle

Nesting habitat

Olive Ridley Turtle

*Pieh Island Conservation
Area*

Potential as a suitable habitat for turtles to settle and breed. The objective of this work is to assess the state of turtle nesting sites and evaluate the findings from turtle monitoring efforts in the Pieh Island Conservation Area. Observations were conducted directly from September 25th to September 30th, 2023. A quantitative method was employed. The materials that were utilized consist of green sea turtles (*Chelonia mydas*), hawksbill turtles (*Eretmochelys imbricata*), and olive ridley turtles (*Lepidochelys olivacea*). The nesting habitat data encompasses information on the proximity of vegetation to the tidal limit, beach slope temperature and humidity levels, as well as the depth and quantity of eggs. Four stations serve as research sites. The distance of vegetation from the nests ranged from 7.6m to 13.4m, while the beach slope on Pandan Island varied between 3.62° and 6.19°. The temperature inside the nests ranged from 28°C to 29.1°C, with a humidity level of 77% to 88%. The nests had a depth of 50cm to 60cm. The results of this study show that Pandan Island Beach is a highly suitable site for turtle nesting.

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1. INTRODUCTION

Turtles, as one of the endangered animal species, play an important role in aquatic ecosystems, and have high ecological and conservation value. West Sumatra Province has long been a landing site for turtles that roam Indonesian waters. Factors such as a long coastline, a marine environment rich in biodiversity, and a suitable climate make this region ideal for turtles to lay eggs and breed. These turtles often choose beaches in West Sumatra as nesting places because of their innate instinct to return to their birthplace (Damanhuri, 2007). All types of turtles, including those that live in Indonesian waters, have unique nesting areas. These biophysical characteristics can be viewed from sediment parameters, beach slope, tides, temperature and surrounding vegetation (Isdianto et al., 2022).

The Pieh Island Conservation Area is one of the turtle landing sites in West Sumatra. The beach in the Pieh Island Conservation Area has great potential as a landing and nesting place for turtles. According to Wicaksono et al (2022), The characteristics of a long and sandy coastline, as well as a marine environment rich in food resources are the main factors that make the beaches in this area ideal for nesting turtles. The Pieh Island Conservation Area consists of five small, uninhabited islands, namely Pieh Island, Air Island, Bando Island, Toran Island and Pandan Island. Currently, turtle conservation activities carried out on Bando Island and Pandan Island have succeeded in saving 146,477 turtle eggs, releasing 128,184 hatchlings, and maintaining a hatching success rate of 80.11% (LKKPN Pekanbaru, 2022). The types of turtles found on Pandan Island

in order of dominance are the green sea turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*), and the olive ridley turtle (*Lepidochelys olivacea*).

Until now, the threat to turtle conservation is still quite high, both due to natural and anthropogenic factors. Natural factors include coastal erosion, climate change which can damage turtle habitat and nesting locations (Hawkes, Broderick, Godfrey, & Godley, 2009), and the threat of predators, while human activity factors (Suryawan & Tehupeiyori, 2023) including marine pollution, the accidental capture of turtles by fishing gear (by-catch), and the use of materials originating from turtles such as meat for traditional purposes (Tambunan, Wiryono, & Senoaji, 2021), eggs, and carapace (Firliansyah, Kusri, & Sunkar, 2017; Juliono & Ridhwan, 2017).

The threat of turtle extinction can be overcome by managing turtles through several actions, namely protecting turtle habitats, population monitoring to identify trends and effectiveness of conservation efforts, education and public awareness about the importance of turtle protection (Jemarut, Webliana, & Sari, 2021; Juliono & Ridhwan, 2017), law enforcement against illegal practices, such as egg catching and turtle hunting (Tarigan, Syarifuddin, & Wati, 2020), controlling accidental catch by fishing equipment, and turtle egg conservation programs, including turtle breeding (Fitri, Rauzana, Yasmin, Suwarno, & Dharma, 2023; Komarudin & Fahrannisa, 2023; Zikri, Putera, & Kusdarini, 2023). The aim of turtle management is to minimize the negative impact of threats to turtles and ensure their survival. Turtle management through data collection is very necessary to preserve the existence of turtles and minimize the threat of turtle extinction, especially in the Pieh Island Conservation Area. This research aims to record turtle data and determine the conditions of turtle nesting habitat on Pandan Island, Pieh Island Conservation Area.

2. MATERIALS AND METHODS

2.1. Location of the study

Pandan Island is included in the administrative area of Padang City, West Sumatra Province and is located at coordinates 00°51'77"-00°57'8.25" S-100°08'6'-100°08'23"E. This island has an area of 16.64 hectares with 14.8 hectares covered with vegetation and 0.8 hectares covered with sand (Siahaan, Thamrin, & Tanjung, 2020). The method used to determine the condition of turtle habitat in this research is the field observation method on 25-30 September 2023 on Pandan Island. The distribution of field data collection locations can be seen in Figure XX. The data observed and recorded includes data on the type of turtle landed; turtle morphometrics; size of turtle tracks, turtle landing location, vegetation around the nest, beach slope data, sand temperature and humidity, nest depth, number of turtle eggs, which are then processed quantitatively. According to Sugiyono (2007), this method is used in research that uses a lot of numbers starting from data collection, data interpretation, and the appearance of the results in the form of pictures, tables, graphs, or other displays.



Fig. 1. Location of Field Data Collection.

Figure 1 shows that the field data collection locations are divided into four stations based on the cardinal directions, namely east (East SK), south (South SK), west (West SK), and north (North SK). Taking data in the field around Pandan Island, four turtle nests were obtained between the east station (East SK) and the south station (South SK). Hanif, Damanhuri, & Suparno, (2022) stated that the majority of nesting turtle landings on Pandan Island were green turtles, with the highest landings being in the eastern and southern regions and having a dense coastal vegetation structure.

2.2. Material and tools

The material and tools used for this study are shown in table 1 below:

Table 1. Tool and material for the study.

No	Material and Tool	Description
1.	Rollmeter	Measures the turtle's morphological size, turtle tracks, nest size, and the distance of the nest to the shoreline.
2.	Scale stick	Measure slope
3.	Waterpass	Measures the levelness of the meter
4.	L ruler	Measure the angles
5.	Flashlight	Lightning aid during monitoring
6.	GPS	Determines the turtle landing coordinates
7.	Plastic sample	Sample container for sand samples around nest
8.	Hygrometer	Measures humidity and temperature
9.	Camera	Documentation

2.3. Method

2.3.1. Nest temperature and humidity

Measuring the temperature and humidity of turtle nest sand using a hygrometer. Temperature and humidity measurements are carried out by placing a hygrometer pen in the sand where the eggs are found in the turtle nest. The temperature and humidity measurement results will appear on the hygrometer display.

2.3.2. Depth of the nest

Nest depth was measured when the eggs had been transferred into the bucket by pulling a tape measure straight from the inside to the surface of the nest. An illustration of measuring nest depth can be seen in figure 2.

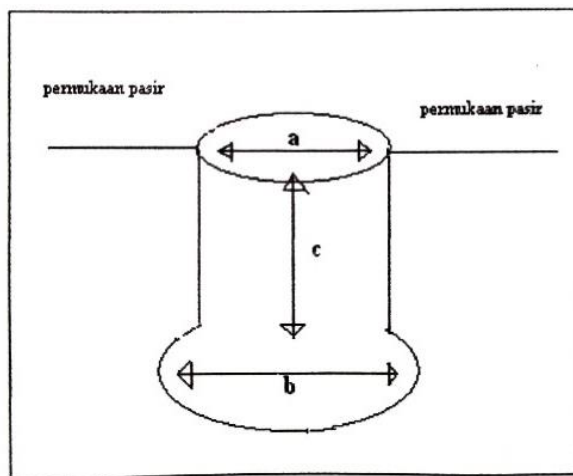


Fig. 2. Measurement of Turtle Egg Nest Parameters.

2.3.3. Beach Slope

Beach slope measurements are made by measuring a straight line between the outermost vegetation and a scale stick on the beach. The measurement of the slope of the beach slope was carried out using the measurement stages according to Sulmartiwi, Tjahjaningsih, & Putera (2015) are as follows: First, install stakes on the highest coastline. Second, the rope is connected from the outermost vegetation to the beach when it is first wet by the waves (highest tide), so that it forms a 90° angle. Third, the angle is measured using a right-angled ruler. Next, the length of the rope is measured using a roll meter. Lastly, measure the height of the stick marked by the string. An illustration of the beach slope measurement process can be seen in figure 3 below.

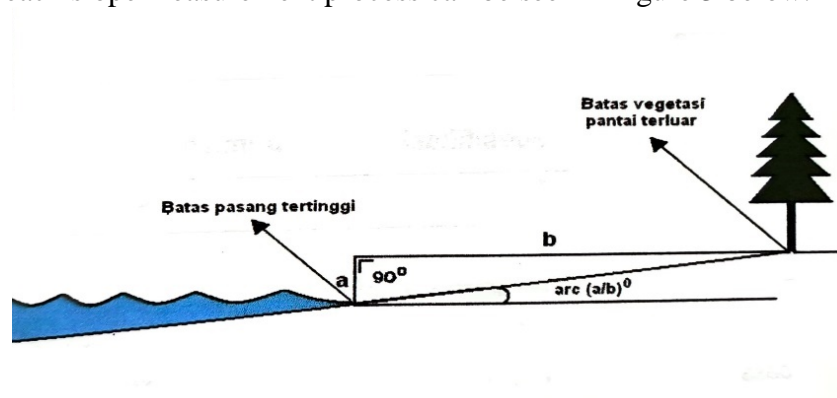


Fig. 3. Beach Slope Measurement.

The results of this measurement are processed using the Mursalin (2017) elevation formula, namely:

$$\tan \theta = \left(\frac{a}{b}\right) \text{ or } \text{Slope } (\%) = \left(\frac{a}{b}\right) \times 100\%$$

a = The height of the stick up to the roll meter limit is tied at an angle of 90° .

b = Length of roll meters

The results of processing the beach slope data are then classified into beach slope categories according to Darmawijaya (1997), namely:

Slopes	Category
3.00° – 8.99°	Sloping
9.00° – 16.99°	Tilt
17.00° – 30.00°	Steep

3. RESULTS AND DISCUSSION

3.1. Turtles appearance

The results of observations of turtles on Pandan Island on 25-30 September 2023 were types of green sea turtles (*Chelonia mydas*) that landed to lay eggs or landed without laying eggs.

No	Species	Found		Eggs amount	Size Trace (cm)	Morphometric (cm)			
		Turtle	Eggs			LK	PK	FD	FB
1	Green Sea Turtle	-	✓	89	101	-	-	-	-
2	Green Sea Turtle	✓	✓	85	90	67	93	52	35
3	Green Sea Turtle	-	✓	73	99	-	-	-	-
4	Green Sea Turtle	✓	✓	76	109	101	108	56	30
5	Green Sea Turtle	✓	-	-	118	-	-	-	-

During field data collection, the number of green sea turtles found on Pandan Island consisted of 4 nesting turtles and 1 non-laying turtle. The number of eggs found from each turtle egg nest ranged from 73-89, with trace sizes ranging from 90-118 cm. Meanwhile, the morphometrics of green turtles can be measured in two out of five turtle landings.

3.1.1. Nest temperature and humidity

Measurements of temperature and humidity in natural nests found during field observations showed that the temperature range for natural green turtle nests was 28 °C - 29.1 °C. The nest temperature conditions found were normal and optimal according to the statement by Harnino et al (2021) that the sand temperature range required for successful hatching of turtle eggs is 25-35°C with an optimal temperature of 29°C. Temperature affects the development of turtle eggs and prevents egg rot. Nest temperature conditions are also a parameter that influences the sex determination of turtle hatchling (Herrera et al., 2020). More male hatchlings are produced at incubation temperatures below 29 °C, whereas more female hatchlings are produced above 29 °C (Santoso, Hestirianoto, & Jaya, 2021). This shows that maintaining the temperature in the optimal temperature range can increase the success rate of egg hatching while modifying the nest temperature, which can be used as an alternative for controlled hatching of eggs to determine the sex ratio of hatchlings.

The humidity conditions of natural turtle nests found during observations on Pandan Island ranged between 77% - 84%, indicating normal conditions based on research by Anshary, Setyawati, & Yanti, (2014), which states that sand moisture is in the normal range of 69-95%. The

results of humidity observations on Pandan Island are slightly above the optimum humidity threshold for turtle hatching, namely 64% - 75% (Akbar, Luthfi, & Barmawi, 2020). Humidity can be caused by the change of seasons, which affects the intensity of rainfall. Nest humidity is an environmental parameter that influences the success of turtle egg hatching (Benni, Adi, & Kurniawan, 2017), which depends on the water content of the sand substrate, nest depth, rainfall, and the distance and slope of the nest to the beach (Sulmartiwi et al., 2015).

3.1.2. Depth of the nest

The depth of the nest, measured from 4 findings of turtle nesting nests, ranged from 50-60 cm, the optimal depth for eggs to hatch optimally (Sulmartiwi et al., 2015). Several factors, including the number of eggs and turtle morphology, can influence the difference in nest size. The number of eggs the turtle will lay in the nest will determine how deep and wide the nest will be. Apart from that, the length of the hind legs (flippers) also determines the size of the nest (Winarto & Azahra, 2022).

3.1.3. Beach Slope

The results of measuring the slope of the beach showed that the slope of the Pandan Island beach was around 3.63% - 6.19%, which was included in the gentle category, based on the classification of slope values by Darmawijaya (1990). The characteristic slope of Pandan Island is one of the supporting factors for turtles to carry out landing and nesting activities on Pandan Island. The slope category is supported by the statement of Benni et al., (2017) that the contour of the beach and the slope of the beach are essential factors in landing sea turtles on the coast. Anshary et al. (2014) added that the steeper the beach, the more difficult it will be for turtles to see objects in front of them, so the more significant the energy required for turtles to climb to the beach.

The characteristics of the beaches, which are relatively sloping, with white sand, and covered with various vegetation on Pandan Island, are relevant to the characteristics of the nesting habitat for green and hawksbill turtles. Research by Yakardinata, Nurifdiansyah, & Damanhuri (2014) (2014) stated that beaches that are suitable for laying eggs for Green Sea Turtles (*Chelonia mydas*) are beaches that are not too sloping, have fine sand, strong currents, and have stretches of coral covered with seaweed. The results of previous measurements in June 2023 by Wilker TWP Pieh officers found that the measured slope of the Pandan Island beach from the highest tide to the outermost vegetation was 2.12 ° - 3.38 °. This difference is caused by changing currents and erosion of the shoreline (abrasion), which makes the slope of the beach on each beach not the same (Siahaan et al., 2020). Differences in beach slope occur due to the accumulation of sand buildup caused by the transfer of sand masses by wind and waves at high tide (Yustina, Suwondo, Arnentis, & Hendri, 2014)

4. CONCLUSIONS

The environmental characteristics and parameters of the turtle nesting habitat on Pandan Island are classified as ideal and suitable based on observations of the temperature range (28-29.1 °C), humidity (77-84%), beach slope (3.63-6.19%), beach width (760 -1,343 cm). There are coconut, ketapang, and waru vegetation types in which turtles like to lay eggs. The type of landed turtle found at the end of September 2023 on Pandan Island was the green turtle (*Chelonia mydas*) with a footprint size of 90-118 cm and dug an egg nest 50-60 cm deep.

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