Species identification and spawning of sea turtle at Meti Island North Halmahera Regency

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Abstract. Sea turtles are large, air-breathing reptiles that inhabit tropical and subtropical seas throughout the world. With long lifetimes and wide-ranging migration patterns, sea turtles are exposed to many sources of danger both in coastal area and in the open sea, including environmental accidents. Sea turtles are most endanger and threaten with extinction, many are listed in the IUCN Red List or at CITES list. The objective of this study was to identify sea turtles species in Meti Island, their nesting area and its characteristics. Data on nesting area obtained from direct observation and interview with the local community. The result showed that there are three species of sea turtles found in Meti Island i.e. Chelonia mydas, Eretmochelys imbricata, and Lepidochelys olivacea. There are two locations of nesting area i.e. the coastal area of Meti Island and Pasir Timbul Island. The characteristic of the substrate at nesting area was medium sand, fine sand, and coarse sand. The slope of the coast of nesting area is approximately 35° at Meti Island while the upper side at Timbul Island was steeper with approximately 40°. Marine flora at the nesting site is dominated by seagrass and sargassum which is suitable for nesting area for sea turtle. Shore vegetation at Meti Island consist of Hernandia nymphaefolia, Scaevola taccada, Thespesia populnea, Pandanus sp, Guettarda speciosa, Terminalia catappa, Crinum asiaticum, Millettia pinnata, Cycas circinalis, Thuarea involute, Cardia subcordata while shore vegetation of Pasir Timbul Island consist of Ipomoea pes-caprae, Wedelia biflora, Spinifex littoreus, Scaevola taccada, Argusia argentea, Terminalia catappa, Pandanus sp, Hernandia nymphaefolia, and Cocos nucifera.

1. Introduction
Sea turtles are large, air-breathing reptiles that inhabit tropical and subtropical seas throughout the world. With long lifetimes and wide-ranging migration patterns, sea turtles are exposed to many sources of danger both anthropogenic and natural [1, 2, 3]. Sea turtles, their nests, and hatching are faced by many habitual threats like predators ants, crabs, birds, fish, human [3, 4].

All species of sea turtles are listed by the IUCN as being endangered, and the hawksbill Eretmochelys imbracata is listed by IUCN in 1996 as critically endangered. Sea turtles have become endangered as a result of the adverse consequences of human activities, and are classified as animals that are protected under the Convention on International Trade in Endangered Species (Appendix I CITES) category. Positive human action is required to ensure the survival of most species of marine turtles [5, 6].

Sea turtles are hardback animals with long-live span and their complex life-cycle so that all forms of utilization must receive serious attention. In addition, the characteristics of the turtle's life cycle exposed them to many threads hence need to be protected to obtain their sustainability. In response to their endangered status, the government of the Republic of Indonesia had ratified the CITES list of endangered species in 1978 and in 1999 through Government Regulation No. 7/199 The Indonesian government has established all types of turtles as protected animals. By Ministry of Marine Affairs...
and Fisheries of the Republic of Indonesia and Minister of Forestry’s Regulation on Strategic Direction for National Species Conservation 2008 – 2018, sea turtles are set as priority species and special policy directives for protected groups [7].

The area seven species of sea turtles recognized worldwide and six of them are found to distribute in Indonesia waters i.e. green sea turtles (Chelonia mydas), hawksbill sea turtle (Eretmochelys imbricata), olive ridley sea turtle (Lepidochelys olivacea), leatherback sea turtle (Dermochelys coriacea), flatback sea turtle (Natator depressus), and loggerhead sea turtle (Caretta caretta). Although all the species of sea turtles in Indonesia are protected, the threat towards sea turtles populations is still existed mainly due to harvesting for their eggs, meat, and carapace and damage to the nesting habitat [8].

Sea turtles are found in North Halmahera, especially Meti Island, where people still harvest them as a source of food either their meat and their eggs. The carapace of also sold for ornaments and many accessories. This study aims to identify the species of sea turtles found in the coastal area of Meti Island and Pasir Timbul Island and the characteristics of the nesting area. The output of this research is a database of sea turtles found in Meti and Pasir Timbul Island and the characteristics of nesting habitat which will be used by local government for the management of sea turtles in this study area.

2. Materials and Method

2.1. Study site
Meti Island is located at geographical coordinates of 128°03’30” E – 103°4 18” N. The width of this area of is 2000 ha while Pasir Timbul is close to The Meti Island with geographic coordinates of 128°03’31,78”E – 103°5’35,55”N, (Figure 1). The Pasir Timbul Island is uninhabited and is still an administrative area of the Meti Village. The observation was made at two stations at The Meti Island and one station at The Pasir Timbul Island.

![Figure 1. Map of nesting site of green sea turtles (Chelonia mydas), olive ridley sea turtle (Lepidochelys olivacea) and hawksbill sea turtles (Eretmochelys imbricata)]
2.2. Data sampling and method of analysis
The study uses purposive sampling method [9] carried out intentionally based on information obtained from the local community concerning the location sea turtle nesting area. For nesting habitat characteristics, data was collected and observed directly in the field covering grain size, coastal slope, and coastal vegetation [10]. Identification of sea turtle species was carried out based on identification key proposed by [7, 11, 12].

3. Results and Discussion
Meti Island and Pasir Timbul Islands are two of several islands found in North Halmahera Regency. Based on observation and interviewed with the local community of Meti Island, these two islands have been noted as the sea turtle nesting site. Only two sites from the whole coastal area of Meti Island was identified as the sea turtle nesting site. The sites in Meti Island where sea turtle nest their eggs are site noted as observation Location (LP), LP-1 (A = 0.40 Ha; P = 1,024.78 m / 103°3'30'' N and 128°03'37'' E) and LP-2 (A = 0.99 Ha; P = 2,462.33 m /103°4'21'' N and 128°03'25'' E), while at Pasir Timbul Island is noted as LP-3 turtle station (A = 0.18 Ha; P = 386.96 m / 103°5'32'' N and 128°03'35'' E).

3.1. Sea turtle identification
Many published research explains that there are 6 species of sea turtles identified in Indonesian waters [7, 11, 12, 13]. Each type of turtle species has a morphological characteristic form like the type of shell, the number of coastal scutes in the carapace, the number of inframarginal scutes in the plastron, the prefrontal scales number and the number of postocular/postorbital scales that distinguish between each turtle type. These characteristics (Figure 2, 3, and 4) were used to identify sea turtle species.

From this study, 3 of 6 species found to distribute in Indonesia waters were found in Meti Island and Pasir Timbul Island of North Halmahera. These species are the green sea turtle (*Chelonia mydas*), olive ridley sea turtle (*Lepidochelys olivacea*) and hawksbill sea turtles (*Eretmochelys imbricata*).

![Morphology](image)

**Figure 2. Morphological characteristic of green sea turtle (*Chelonia mydas*)**

Based on Figure 2, there are 3 main parts of the turtle’s body used in the identification of green turtles are the head, plastron, carapace. In the green turtle head there is 1 pair of prefrontal scales, the Plastron section has 4 inframarginal scutes without pores, whereas in the carapace there are 4 lateral scutes and 5 vertebral scutes. Identification of olive ridley turtle (*Lepidochelys olivacea*) was also carried out by observing the head, plastron and carapace. In the head there are 2 pairs of prefrontal scales, in the plastron there are 4 inframarginal scutes without pores and on the carapace there are 4 Lateral scutes and there are 6 vertebral scutes.
Hawksbill sea turtles visually have a morphological form in the head, plastron and carapace parts which are very different from *Chelonia mydas* and *Lepidochelys olivacea*. Hawksbill sea turtles (*Eretmochelys imbricata*) have a head shape with a bird-like beak and there are 2 pars of prefrontal scales on the head, the carapace and the plastron have scales arranged in layers. The plastron has 4 inframarginal scutes without pores and the carapace has 4 lateral scutes.

3.2. Spawning habitat

Sand is a place that is absolutely necessary for sea turtle laying eggs, nesting habitat for each sea turtle has its own peculiarities. Generally the habitat for turtle propagation has wide and sloping beach characteristics and is located above the coast and has an average slope of 30° on the upper coast [1]. But the nesting location of Meti Island and Pasir Timbul Islands has its own peculiarities where there are differences in spawning locations (Figure 5). On the coast of Meti Island (LP-1 and LP-2) has a slope of the beach at the bottom of the middle has a slope of 30° and at the top has a slope of 35°. Whereas on the Pasir Timbul Island (LP-3) has a different coastal slope, in the central part of the island has a slope of 35° but along the edge of the island has a slope ranging from 35°-50°.

Observations on the behavior of *Lepidochelys olivacea* showed that at tilts of 45° to 50° when the turtles headed for the nesting location of Pasir Timbul Island, sea turtles tended to show behavior by walking around turning the direction towards the upper part of the beach at an angle where the slope is not too big to lay eggs. This spawning behavior shows that turtles tend to look for spawning sites with low slope to lay eggs. Panjaitan *et al.* (2012) [14] in their research on green turtles also explained that the slope of the beach is very influential on landing and making nests or nesting burrows. Spawning sites on the long sand beach of Meti Island and on Pasir Timbul Island have sand derived from...
weathering of shells and coral reefs. sea of Meti Island dan Pasir Timbul Island dominated by seagrass and Sargassum which is a suitable habitat for the enlargement area of hatchlings when hatching at the nesting site. Hatchlings that seek refuge and forage in the Sargassum region are considered as disappearing periods and are referred to as the lost years [1].

Land vegetation around the Pasir Timbul Island consisting of Ipomoea pes-caprae, Wedelia biflora, Spinifex littoreus, Scaevola taccada, Argusia argentea, Terminalia catappa, Pandanus sp, Hernandia nymphaeifolia, Cocos nucifera. Land vegetation in Meti Island consisting of Hernandia nymphaeifolia, Scaevola taccada, Thespesia populnea, Pandanus sp, Guettarda speciosa, Terminalia catappa, Crinum asiaticum, Millettia pinnata, Cynchos circinalis, Thuarea involute, Cardia subcordata. The spawning sites of LP-1 and LP-2 have dense terrestrial vegetation and are good for nesting sites for green turtles (Chelonia mydas) that make nests under the shade of sea pandanus trees (Pandanus tectorius) [14].

Sand burrow turtle nesting on Meti Island and Pasir Timbul Island Embossed based on the results of grain analysis dominated by fine grain sizes (0.125-0.25 mm), medium (0.25-0.5 mm) and coarse (0.5-1 mm). Panjaitan et al. (2012) [14] in their research found that green turtles (Chelonia mydas) favored fine sandy beaches as a habitat for their nesting, so that the nesting locations of LP-1, LP-2 and LP-3 have sand dominance that is suitable for turtle nesting.

4. Conclusion
Green turtles (Chelonia mydas), Olive ridley sea turtle (Lepidochelys olivacea) and Hawksbill sea turtles (Eretmochelys imbricata) are 3 out of 6 species of turtles in Indonesia found in the spawning areas of Meti Island and Pasir Timbul Islands in North Halmahera Regency. Sand burrow turtle nesting in the nesting location is dominated by fine categories (0.125-0.25 mm), medium (0.25-0.5 mm) and coarse (0.5-1 mm). The varying slope of the beach at the nesting location influences the turtle’s behavior towards the burrow excavation site to lay eggs.

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References
[1] Mast R B, Hutchinson B J and Villlegas P E (Eds) 2015 Sea Turtles of Costarica. The State of the World’s Sea Turtles (SWOT). 10th Anniversary Special Edition Report. +3 45
[2] Wallace B P et al 2010 Regional Management Units for marine turtles: A novel framework for prioritizing conservation and research across multiple scales. PLoS ONE 5(12): e15465. doi:10.1371/journal.pone.0015465

[3] IAC Secretariat 2006 Threats to sea turtles and possible solutions. Pro Tempore Secretariat of the Inter-American Convention for the protection and conservation of sea turtles

[4] James R, García S A, Wheldon S, Garrido T E, Vacas R M, and Munhoz T 2014 Investigation and Conservation of Sea Turtles, Drake Bay, Osa Peninsula, Costa Rica. Corcovado Foundation Technical Report

[5] Zepeda-Borja K M, Ortega-Ortiz C D, Torres-Orozco E and Olivas-Ortiz A 2017 Spatial and temporal distribution of sea turtles related to sea surface temperature and chlorophyll-a in Mexican Central Pacific waters. Rev. de Bio.Mar. y Oceano. 52 (2) 375-385

[6] Tisdell C and Wilson C 2002 Ecotourism for the survival of sea turtles and other wildlife. Biodiversity and Conservation 11 1521-38

[7] Dermawan A et al 2009 Technical Guidelines for Sea Turtle Conservation Management (Jakarta: Directorate of Conservation and Marine Parks) p 62 (In Indonesia).

[8] Mardiatutti A, Kusrini M D, Manullang S and Soerharto T 2008 Strategic Direction for National Species Conservation 2008 - 2018 (Jakarta: Directorate General of Forest Protection and Nature Conservation - Indonesian Ministry of Forestry: JICA)

[9] Teddile C and Yu F 2007 Mixed methods sampling: a typology with examples Journal of Mixed Methods Research 1 77-100

[10] Ario R, Wibowo E, Pratikto I and Fajar S 2016 Turtle habitat conservation from threaten at Turtle Conservation and Education Center (TCEC), Bali. Jurnal Kelautan Tropis 19 (1) 60-68. ISSN 0853-7291 (In Indonesia)

[11] Adnyana W 2016 Bio-ecology of sea turtle in Indonesia. Paper presented at Nat. Sem and Workshop of Sea Turtle Conservation 4 June 2016 Jogjakarta Indonesia p 21 (In Indonesia)

[12] Pritchard P C H and Mortimer J A 1999 Taxonomy, External Morphology and Species Identification. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4 p18

[13] Wyneken J 2001 The Anatomy of Sea Turtles. National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NMFS-SEFSC-470. vii + 52

[14] Panjaitan R A, Iskandar and Syawaludin A H 2012 The relationship of shoreline changes to green turtle laying habitat (Chelonia mydas) at Pangumbahan beach Ujung Genteng Sukabumi Regency Journal of Fisheries and Marine 3(3) 311-320. ISSN: 2088-3137 (In Indonesia)