

CHALLENGES FOR SEA TURTLE CONSERVATION: A PRELIMINARY STUDY FROM COASTAL NORTHERN MINAHASA PENINSULA, INDONESIA

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ABSTRACT: The past success of sea turtles surviving long periods of environmental changes does not guarantee their continued survival today. This study documents the sea turtle nesting locations in the northern region of Minahasa Peninsula, Sulawesi, Indonesia. The opinions of coastal residents highlight impediments to sea turtle conservation. Interviews and questionnaires from fishing communities in coastal villages supplied the present data set. GPS receivers recorded the geographic positions revealed by the interviews. The data set identified 47 sea turtle nesting sites, some of which are threatened by expanding developments along the coast. The residents knew the breeding areas as they were close to residential communities and easily accessible. Sea turtle nesting grounds should be designated as marine and coastal protected areas by village decrees and conservation regulations enforced. Even though they are aware of the protection granted to sea turtles, coastal villagers knowingly consume turtle meat and eggs. Education, community involvement and law enforcement are needed for proper conservation of sea turtles.

Keywords: sea turtles, nesting sites, regulations, community-based conservation, awareness

INTRODUCTION

Sea turtles have existed and roamed the oceans for millions of years. This means that turtles have survived through the obstacles and pressures of environmental changes on this planet. However, this is not a guarantee that turtles will be successful in coping with environmental changes today and in the future. The acceleration of human activities in the last century is impacting the survival of sea turtles; moreover, sea turtles are vulnerable during every phase of their life cycle (WWF 2005; Esperanza *et al.* 2017).

In the last three decades, sea turtle conservation has become an important issue. Sea turtles are protected biota by national regulations and through biota by national regulations and through international conventions. The Indonesian government signed a joint agreement in 1997 with other ASEAN countries on Sea Turtle Conservation and Protection. Subsequently, in 2001, a memorandum of understanding under the Convention on the Conservation of Wildlife Migratory Species was signed (IOSEA 2009). This agreement is known as the MoU for Sea Turtles in the Indian Ocean and Southeast Asia.

Six species of sea turtles live in Indonesia's seas. These are (a) Green turtle, *Chelonia mydas* (Linnaeus, 1758); (b) Hawksbill sea turtle, *Eretmochelys imbricata* (Linnaeus, 1766); (c) Olive ridley sea turtle, *Lepidochelys olivacea* (Eschscholtz, 1829); (d) Flatback sea turtle, *Natator depressus* (Garman, 1880); (e) Loggerhead sea turtle, *Caretta caretta* (Linnaeus, 1758) and (f) Leatherback sea turtle, *Dermochelys coriacea* (Vandelli, 1761) (DKP 2009; Boneka *et al.* 2015; Prihadi *et al.* 2017; Tapilatu *et al.* 2017).

Sea turtles are protected by Indonesian Government regulations, including Government Regulation Number 7 of 1999 (Republic of Indonesia Government Regulation (PP) 1999), concerning the preservation of protected plant and animal species. Although national regulations for sea turtle protection have existed for a long time, many violations occur including human consumption of turtle eggs (Arunde *et al.* 2018). Nesting locations for sea turtles in North Sulawesi are poorly documented, and those that have been recorded remain unprotected by special regulation.

In contrast to fish and most marine invertebrates, which release eggs and sperm in the water column

(Ompi and Svane 2018), sea turtles lay their eggs in the supratidal zone, between one and ten meters above the highest tide level avoiding their immersion by tides. Generally, terrestrial vegetation covers this zone (Langinan *et al.* 2017) and it is prone to coastal erosion (Panjaitan *et al.* 2007). Such changes in this zone on the island of Derawan (East Borneo) cause decreased numbers of sea turtle nests as well as decrease in number of eggs (Dharmadi and Wiadnyana 2008). Ismane *et al.* (2018) and Harahap *et al.* (2015) studied management practices of sea turtle nest sites at Pangumbahan and Sukabumi (West Java). Kasenda *et al.* (2013) documented nest sites on the East Coast of Minahasa, as did Balaira *et al.* (2017) on the island of Salibabu Talaud, North Sulawesi.

This study has two main objectives: (1) to identify and document sea turtle nesting locations and the species using these sites in the northern region of the Minahasa Peninsula, North Sulawesi; (2) to identify and assess the impacts from human activities on sea turtles in this region, including direct capture and egg collection for consumption or trade, and indirect impacts from coastal development and habitat modification.

MATERIAL AND METHODS

Study site: This study covered the area of the North Peninsula of Minahasa including the cities of Manado and Bitung, and the Regencies of Minahasa, North Minahasa, and South Minahasa. Manado is the local growth center as well as the center of government for the province of North Sulawesi. It is also the port connecting the mainland with the famous tourist diving spot of Bunaken National Park. Bitung City has a natural deep water port with intensive commercial shipping activities of cargo vessels. Minahasa Regencies comprise hundreds of coastal fishing villages.

The present study summarizes results of several research reports previously published in Indonesian. These studies interviewed local residents about their knowledge of sea turtles. More specifically this study used interviews of 92 selected participants, being indigenous fishers, heads of villages, and religious leaders living in the coastal areas. To identify turtle nesting sites, respondents were asked whether they knew any sea turtle nesting sites in their neighborhood. If the answer was yes, then field observations identified the nest location

and documented the position using a GPS receiver. Other questions were: Do you eat sea turtle meat or their eggs? Do you know that sea turtles are an endangered species and protected by law? The survey was conducted between 2016 and 2020.

RESULTS AND DISCUSSION

a. Nesting sites of the sea turtles

This survey documented 47 sea turtle nesting sites in coastal northern Minahasa Peninsula (Fig. 1). Locations were dispersed on all sides of the mainland and on the small neighboring islands. Some locations in Fig. 1 appear very close to one another owing to the small size of individual beaches and the many names attributed to them. Each beach has a natural boundary such as rocky promontories or cliffs. Green sea turtles were reported to be the most common species. Other species included Hawksbill sea turtles. Leatherback sea turtles were reported on the broad sandy beaches on the eastern side of the peninsula (Kasenda *et al.* 2013).

Generally, sea turtle nesting sites are well known to residents because they are located either near villages or even in residential areas. The nesting beaches identified here are often located either next to coconut groves or near community boat mooring areas. The identified sea turtle nesting areas are where residents conduct their daily activities. Therefore, nesting areas that are relatively remote or far from community activity may have been missed by this report.

Fishermen are aware of the unique habits of sea turtles. They know that female turtles return to their home areas to lay eggs. They are also aware that sea turtles migrate up to thousands of kilometers annually, and then during the reproductive season the breeding sea turtles return closer to their egg-laying sites. This knowledge passes from generation to generation. Besides, residents also know the time and season for sea turtle nesting in the area, namely that sea turtles lay eggs at night and usually at the beginning of the dry season (in June). Some residents understand the specific weather conditions when nesting sea turtles emerge from the sea to lay their eggs.

From a conservation point of view, the traditional knowledge of residents about sea turtles has two sides:

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(1) Citizens are the main source of threat. The sea turtle is viewed as a marine resource that is consumed for food. This traditional view is apparent by the continuing capture and collection of eggs for food or trade.

(2) Citizens can become protectors of nesting sites. The traditional habits may change slowly through education and law enforcement. At the same time, citizens are encouraged to use resources sustainably. For example, sea turtle nesting sites may become marine protected areas (DPL) or tourism destinations so that income is generated for residents and the service sector employees.

b. Threats to Sea Turtle Nesting Sites

Coastal development has been rampant many places in Indonesia in recent times. Unfortunately, most development projects have little or no consideration of the sea turtle nesting beaches. The physical changes in some locations now prevent sea turtles from nesting due to permanent structures that protect the coastline from erosion (Laleno *et al.* 2016). The 47 nesting locations identified in this survey are presently threatened and action should be taken to protect them.

The coastal boundary between the land and the sea is subject to concrete armoring to prevent

erosion and facilitate access. In Northern Sulawesi, concrete embankments are commonly used to protect beaches and settlements (Fig. 2) even though the region is a conservation area. Regions such as Bunaken was a residential area with existing beach protection structures before the National Park was established in 1999, hence making this a most popular tourist destination.

The concrete wall in Figure 2A is in the residential area of the village of Raprap, Tatapaan District, South Minahasa Regency, which is part of the Bunaken National Park's southern coast. The concrete embankment has been developed since the early 1990s (Arunde *et al.* 2018). These protective embankments prevent sea turtles from nesting. Information provided in interviews, indicates that sea turtles continue to nest in part of the beach that remains unblocked, but their numbers have dwindled since the 1970s. Similarly, Liang on Bunaken Island, which hosted numerous sea turtle nests until the 1990s, now hosts much lower numbers of nests despite being a center of marine tourism. Even so, the survey shows that sea turtles still nest on the south side of the island of Bunaken near the settlements and on the east coast where there are now tourist cottages.

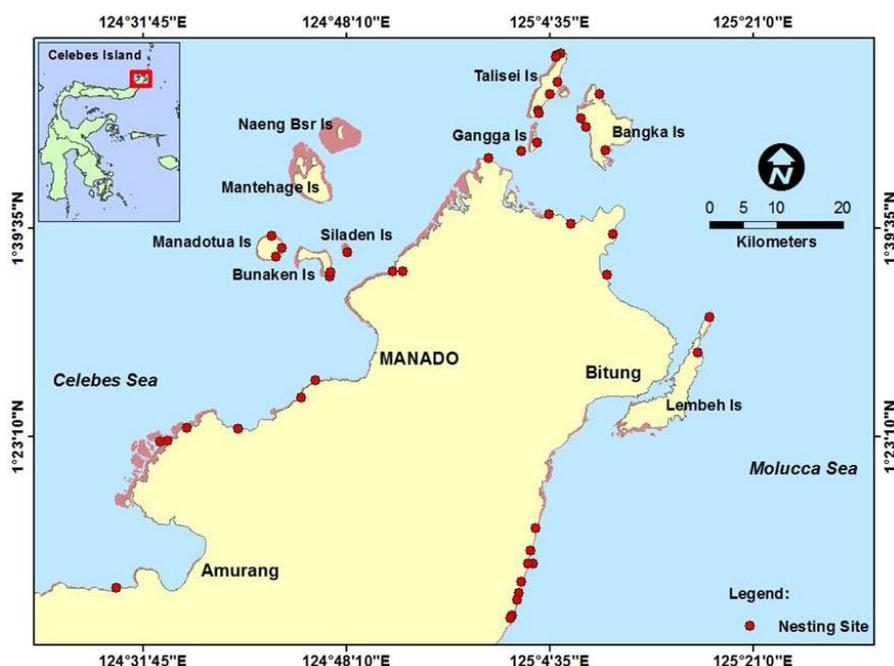


Figure 1. Nesting Sites of Sea Turtle in Northern Minahasa Peninsula.



Figure 2. Raprap Beach, Tatapaan is one of the turtle nesting sites, within the Bunaken National Park. A = protection embankment made of concrete; B = high tide flood protector made of bamboo preventing inundation of the resident's yard.



Figure 3. Nesting sites of sea turtles near Manado city: A= Bulu Mandolang beach almost blocked; B=Murex Kalasey Beach recently visited by nesting sea turtles.

The tragic story of sea turtles is increasingly common in other locations outside the conservation area. For example, in Bulu Village, Mandolang District, Minahasa Regency about 2 km south of Manado City, a concrete embankment from the 1990s borders the beach (Fig. 3A). This survey revealed that sea turtles no longer nest there but now nest on the neighboring Kalasey coast (Fig. 3B), which, although being rocky, was unknown previously as a sea turtle nesting site.

The regional authority can protect sea turtle nesting grounds from further damage by the declaration of a sea turtle protection zone. Presidential Decree Number 51 of 2016 concerning coastal boundaries obliges regional governments to regulate the transition zone between sea and land. The land commonly used by sea turtles to lay eggs is only a few meters from the highest tide level. If

coastal protection is necessary, it should be placed landward of the beach enabling sea turtles to access the dry sand. If the barrier prevents access, then eggs fail to hatch when placed in moist salty sand.

c. Sea Turtles as Food

Fishermen living in Manado and surrounding areas comprised the majority of the 92 respondents interviewed. This survey showed that 89.1% had eaten, and continue to consume sea turtle meat. (Table 1). The same questions were used by Arunde *et al.* (2018) for the islands of Talise, Gangga, and Bangka, and by Aiba *et al.* (2020) for the island of Siau, and Balaira *et al.* (2017) for the island of Salibabu Talaud, also shown in Table 1.

Results from Manado and the neighboring islands highlight the paradox between respondents knowing the regulations and yet still consuming

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sea turtle meat (Table 1). Respondents from Manado obtained sea turtles from either by-catch or purchased from local fishermen. Island respondents used by-catch and traditional means with gear called “jubi” and “lotte” (Arunde *et al.* 2018; Balaira *et al.* 2017). The jubi is similar to spear gun, which uses a sharp arrow. The fisherman usually dives 5 to 10 meters down when searching for turtles. The arrow is released on the turtle’s neck, when it is found (Arunde *et al.* 2018).

The high percentage of “Yes” responses to question A threatens the survival of local sea turtles. Believing marine resources are “Common Property” encourages over-exploitation regardless of the legality and environmental damage. This is a well-known problem world-wide (Hardin 1968; Wulander *et al.* 2018). Regardless of the low education of fishermen, they would stop capturing and consuming turtle meat if they realized the legal implications of their actions if enforcement was strict. Improvements in law enforcement and social responsibility are required. In the Manado area and its surroundings, law enforcement needs more emphasis. The low percentages of “Yes” responses to question B indicate that residents of the islands of Salibabu and Karakelang, Talaud Islands Regency need further education. These islands are far from the mainland, close to the border of North Sulawesi and the South of Philippines, and hence from information centers.

Sea turtle meat is consumed not because of limited fish or protein resources, but more by family or cultural traditions. This unnecessary consumption

of sea turtles should be abandoned, not just because government regulations protecting sea turtles have existed for three decades. Residents should be convinced that protecting sea turtles and their nesting habitats will eventually improve the livelihood of their children and generations of the future.

Government regulations in Indonesia apply to every citizen regardless of their knowledge, or otherwise. The success of Government Regulation Number 60 of 2007 (Republic of Indonesia Government Regulation (PP) 2007), concerning Conservation of Fish Resources, to inform the citizens requires the collaboration of community leaders in villages, sub-districts and in customary and religious institutions. An inherent difficulty is getting remote coastal people to obey Government orders when they believe sea turtles, being common property, are exploitable. Especially since local dishes such as “tuturuga”, sea turtle curry, existed in the 1990s before the regulations passed.

CONCLUSION

The coast of the North Minahasa Peninsula is a nesting area for sea turtles. The 47 documented sites reported here are distributed along the coast and neighboring small islands. All locations are prone to change caused by coastal development and protection against erosion. The turtle nesting sites are easily accessible to residents who collect eggs, even though it is illegal. The local people also still catch turtles for consumption and even trade them on the black market.

Table 1. The responses “Yes” of the questions A: “Do you still eat turtle meat or its eggs?” and B: “Do you know that sea turtles are endangered species and protected by law?”

Study Location	Question A (%)	Question B (%)	Reference
Manado area	89	100	Present Research
Talise Island	88	59	
Gangga Island	75	71	Arunde <i>et al.</i> 2018
Bangka Island	67	89	
Siau Island	82	80	Aiba <i>et al.</i> 2020
Salibabu Island	86	13	Balaira <i>et al.</i> 2017
Karakelang Island	85	28.8	Boneka <i>et al.</i> 2015

RECOMMENDATIONS

1. Nesting sites need protection through government regulation, either in the form of PERDA (Regional Regulation) or by PERDES (Village Regulation, village decree), or through Customary Institution (Culture).
2. Access roads to turtle nesting sites require attention for ecotourism. No physical touching should be permitted.
3. Education on conservation norms and law enforcement must be continuous.

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REFERENCES

- Aiba, E.E., B.T. Wagey, P.A. Angmalisang, A.V. Lohoo, D.R. Kumampung and F.B. Boneka. 2020. Turtle and Siau Islanders. *Jurnal Pesisir dan Laut Tropis* **8(1)**: 65–69. [In Indonesian]
- Arunde, P., F.B. Boneka, B.T. Wagey, N.G.F. Mamangkey, I. Manembu and A. Kambey. 2018. Turtle Conservation in the Islands of Talise, Gangga, and Bangka, North Minahasa District. *Budidaya Perairan* **6(2)**: 61–67. [In Indonesian]
- Balaira, E.M., F.B. Boneka and B.T. Wagey. 2017. Turtle nesting grounds in the Salibabu Island, Talaud District. *Jurnal Pesisir dan Laut Tropis* **1(2)**: 20–25. [In Indonesian]
- Boneka, F.B. and J.N.W. Schadu. 2015. Inventaritation of turtle fishing grounds in the Talaud Islands. Research Reports funded by LPPM Universitas Sam Ratulangi, DIPA Nomor: SPDIPA042.04.2.4000097/2015. 21 p. [In Indonesian]
- Dharmadi, D. and N. Wiadnyana. 2008. Habitat conditions and their relation to the number of Green turtle eggs (*Chelonia mydas*) nesting in Derawan Island, Berau, East Kalimantan. *Jurnal Penelitian Perikanan Indonesia* **14(2)**: 195–204. (DOI: 10.15578/jppi.14.2.2008.195-204) [In Indonesian]
- DKP (Department of Marine Affairs and Fisheries). 2009. Technical Guidelines for Turtle Conservation Management. Published by the Directorate of Marine National Park and Conservation, Directorate General of Marine, Coastal and Small Islands, DKP RI. 123 p. [In Indonesian]
- Esperanza, A.O., A.A. Martinez, M.T. Tuz and E.P. Collazos. 2017. Are anthropogenic factors affecting nesting habitat of sea turtles? The case of Kanzul beach, Riviera Maya-Tulum (Mexico). *Journal of Coastal Conservation* **21**: 85–93.
- Harahap, I.M., A. Fahrudin and Y. Wardiatno. 2015. Collaborative management of the sea turtle Pangumbahan Marine Protected area, Sukabumi. *Jurnal Ilmu Pertanian Indonesia (JIPI)* **60(1)**: 39–46. [In Indonesian]
- Hardin, G. 1968. The tragedy of the commons. *Science* **162**: 1243–1248.
- IOSEA 2009. Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and Southeast Asia. Concluded under the auspices of the Convention on the Conservation of Migratory Species of Wild Animals, Manila, 23 June 2001. Amended by consensus, 1 March 2009. Available at: https://www.cms.int/iosea-turtles/sites/default/files/basic_page_documents/IOSEA_MOUtext_inclCMP_2009_English.pdf (accessed 11 March 2021). 13 pp.
- Ismane, I.M., C. Kusmana, A. Gunawan, R. Affandi and S. Suwardi. 2018. The sustainability of the turtle conservation management area on Pangumbahan beach, Sukabumi, West Java. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan* **8(1)**: 36–43. [In Indonesian]
- Kasenda, P., F.B. Boneka and B.T. Wagey. 2013. The turtle nesting location on the East Coast of Minahasa Regency, North Sulawesi Province. *Jurnal Pesisir dan laut Tropis*, Location of sea turtle spawning in East Coast of Minahasa Regency of North Sulawesi Province. *Journal of Coastal and Tropical Seas* **2(1)**: 58–62. [In Indonesian]
- Laleno, L., J.D. Mamoto and A.K.T. Dundu. 2016. Planning for coastal protection development in the Mangatasik area, Tamboriri District, Minahasa Regency. *Jurnal Sipil Statik* **16**: 795–804. [In Indonesian]

Challenges for turtle conservation: A preliminary study from coastal northern Minahasa Peninsula

- Langinan, F., F.B. Boneka and B.T. Wagey. 2017. Planning for coastal protection development in the Mangatasik area, Tamboriri District, Minahasa Regency. *Jurnal Pesisir dan Laut Tropis* **1(2)**: 26–31. [In Indonesian]
- Ompi, M. and I. Svane. 2018. Comparing spawning, larval development, and recruitments of four mussel species (Bivalvia: Mytilidae) from South Australia. *AAFL Bioflux* **11(3)**: 576–588.
- Panjaitan, R.A. and Iskandar. 2012. The relationship of shoreline changes to the green turtle nesting habitat (*Chelonia mydas*) in Pangumbahan Beach, Sukabumi Regency. *Jurnal Perikanan dan Kelautan* **3(3)**: 311–320. [In Indonesian]
- Prihadi, D. J., A. Shofiyullah and Y. Dhahiyat. 2017. Marine tourism and the locations of protected turtles on Sukamade Beach. *IOP Conf. Series: Earth and Environmental Science* **137**: 1–8.
- Republic of Indonesia Government Regulation (PP). 2007. Number 60 concerning Conservation of Fish Resources. 15 p. [In Indonesian]
- Republic of Indonesia Government Regulation (PP). 1999. Number 7 concerning Preservation of Protected Plant and Animal Species. 10 p. [In Indonesian]
- Regulation of the President of the Republic of Indonesia. 2016. Number 51 concerning Coastal Boundaries. 40 p. [In Indonesian]
- Tapilatu, R. F., H. Wona and P.P. Batubara. 2017. Status of sea turtle populations and its conservation at Bird's Head Seascape, Western Papua, Indonesia. *Biodiversitas* **18(1)**: 129–136.
- Wulander, D., E.Y. Puspasari, N.A. Yunikawati, T. Soseco, B.S. Narmaditya, N. Istiqomah, P. Hardinto, S.H. Utomo and M. Witjaksono. 2018. Causes and solutions of “Tragedy of the commons” in natural resources management of Muncar coastal areas. *International Journal of Engineering & Technology* **7(3,21)**: 120–124.
- WWF (World Wide Fund for Nature) 2005. *Marine turtle conservation in the Asia Pacific Region*. 25 pp.

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