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Research Articles

Spatial Distribution and Utilization of Marine Habitats by Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricata*) in the Gili Matra Island Marine Protected Area

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ABSTRACT

Sea turtles are one of the key biota in coastal and marine ecosystems whose existence is not only ecologically important, but also holds social, cultural, and economic value. Indonesia, as the largest archipelagic country in the world, is home to six of the world's seven sea turtle species, making it a globally significant habitat for the sea turtle life cycle. The Gili Matra Marine Protected Area, encompassing the three islands of Gili Trawangan, Gili Meno, and Gili Air, is one of the strategic regions with high potential for sea turtle conservation. This study aims to document and analyze the spatial distribution and habitat use of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) in the Gili Matra Marine Protected Area. Data collection was carried out during the period of September to October 2024, adjusted to weather conditions and water visibility. The method used was the Underwater Turtle Visual Census Methodology. The composition of sea turtle species and habitat characteristics were analyzed using descriptive analysis to summarize the patterns of species presence, habitat types, and environmental conditions observed during the survey. The findings indicate that the area supports both species, with sea turtles observed at various depths (9–16 meters) across multiple dive sites. The predominance of female individuals and the variation in species presence across sites suggest species specific habitat preferences and potential influences of environmental conditions. Both sea turtle was mostly observed in locations associated with coral reef structures.

Keywords: Behaviour, Marine, MPA, Sea Turtle Sightings

INTRODUCTION

Sea turtles are one of the key biota in coastal and marine ecosystems whose existence is not only ecologically important, but also holds social, cultural, and economic value (Martinez-Estevez et al., 2021; Stevani Gulo et al., 2025). As migratory species that travel long distances between regions, sea turtles play a crucial ecological role in maintaining food web balance and the dynamics of marine habitats such as seagrass beds and coral reefs (Mello-Fonseca et al., 2021; Snape et al., 2022). Despite their vital ecological role, sea turtle populations around the world are facing serious threats that have led to drastic declines in their numbers. Illegal harvesting of eggs, meat, and body parts, degradation of coastal habitats due to development, marine pollution, and global climate change are the primary factors endangering the survival of sea turtles (Fendjalang, 2020). In addition, the increasing intensity of poorly managed marine tourism activities such as snorkeling, diving, and boat traffic poses further pressure on critical sea turtle habitats, particularly in coastal areas used for foraging and daily movements.

Indonesia, as the largest archipelagic country in the world, is home to six of the world's seven sea turtle species, making it a globally significant habitat for the sea turtle life cycle (Huffard et al., 2012; Rohmah et al., 2023). The Gili Matra Marine Protected Area, encompassing the three islands of Gili Trawangan, Gili Meno, and Gili Air, is one of the strategic regions with high potential for sea turtle conservation. This area includes a combination of diverse coastal and marine habitats such as seagrass beds, coral reefs, and calm shallow waters known to be important areas for sea turtle activities such as foraging and swimming (Jupri et al., 2017).

Although this region has been designated as a marine protected area, scientific data describing the spatial distribution and habitat utilization of sea turtles in the area remains very limited. The available information is still general and lacks systematic field-based observations. Yet, to support effective and adaptive zone-based management, there is a critical need for data that clearly identify key habitats used by sea turtles, in terms of encounter intensity, habitat depth, and seafloor substrate types. The absence of such data may result in suboptimal conservation area management, such as in determining core protection zones or regulating marine tourism activities that could disrupt sea turtle life. Therefore, research on the spatial distribution and habitat utilization of sea turtles in the Gili Matra Marine Protected Area is of great importance.

By conducting direct observations of sea turtle presence and their habitat characteristics, the information obtained can be used to design more accurate and evidence-based management strategies.

This study aims to document and analyze the spatial distribution and habitat use of green turtles (*Chelonia mydas*) and hawksbill turtles (*Eretmochelys imbricata*) in the Gili Matra Marine Protected Area. Through a field-based observational approach, this research seeks to identify important marine areas used by both species, as well as describe the depth and habitat characteristics they prefer. The findings from this study are expected not only to contribute to the scientific understanding of sea turtle ecology in the Gili Matra MPA but also to serve as a practical reference for formulating more targeted and sustainable sea turtle conservation policies.

MATERIALS AND METHODS

Time and Location of the Study

This study was conducted in the Gili Matra Marine Protected Area, located in North Lombok Regency, West Nusa Tenggara Province. The observation sites included several dive points around the three main islands: Gili Trawangan, Gili Meno, and Gili Air (Figure 1). The field activities were carried out during the period of September to October 2024.

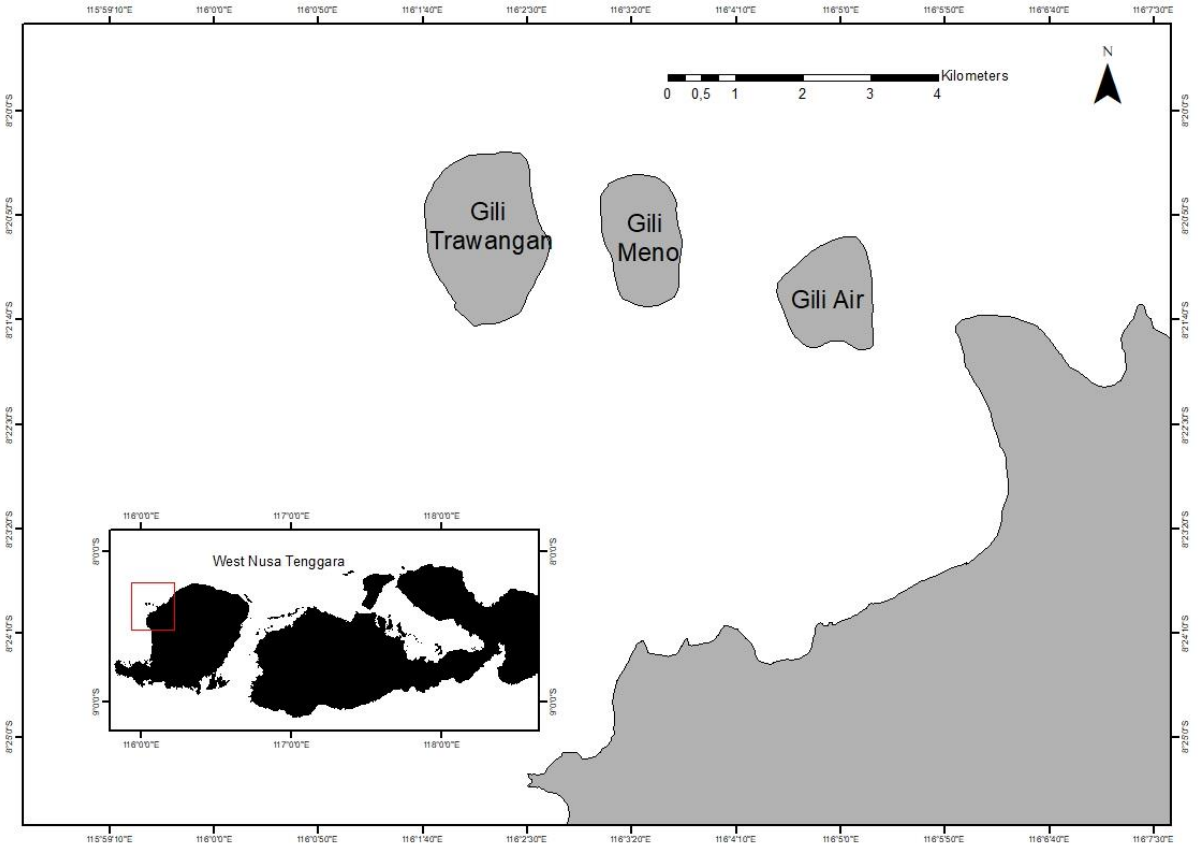


Figure 1. Location of Research

Sampling

Data collection was carried out during the period of September to October 2024, adjusted to weather conditions and water visibility. The method used was the Underwater Turtle Visual Census Methodology (Environmental Research Institute Charlotteville, 2024). At the start and end of each survey, the team estimates horizontal visibility. Divers swim at a moderate speed, 1.5–2 meters above the seafloor, while observing the bottom, subsurface, and occasionally the surface for sea turtle sightings. Areas like large plate corals, caves, or flat resting spots should be carefully checked. Since there's no visual range limit, any sea turtle sighting must be signaled to the team. The spotting buddy team records the sighting details (time, loacation, species, coordinate, photo of left and rifht of sea turtle, sex, deep, and behaviour) on a prepared slate.

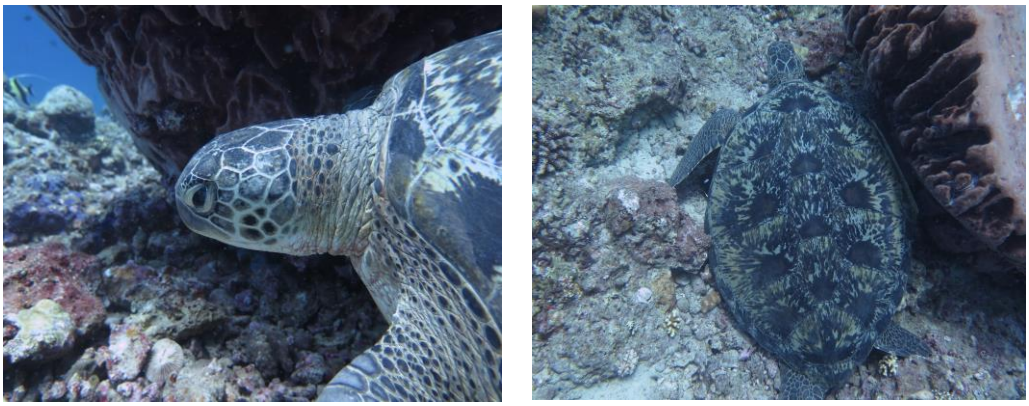
Data Analysis

The composition of sea turtle species and habitat characteristics were analyzed using descriptive analysis (Afifah et al., 2019; Manurung, 2023) to summarize the patterns of species presence, habitat types, and environmental conditions observed during the survey. This approach allowed for the identification of key habitat features associated with sea turtle sightings and provided an overview of species distribution within the study area. The spatial distribution of sea turtles will be presented in the form of maps to visualize the locations of sightings and habitat use patterns within the study area. These maps will help identify key areas frequently utilized by sea turtles.

RESULTS AND DISCUSSION

Sea Turtle Species Composition

The presence of both hawksbill turtles (*Eretmochelys imbricata*) and green turtles (*Chelonia mydas*) in the same area indicates that the Gili Matra National Marine Protected Area provides a supportive ecosystem for these two species. However, since the two species have different habitat preferences, their distribution within the conservation area can serve as an indicator of the health and diversity of the marine environment. The condition of coral reefs and seagrass beds in the area is crucial for sustaining these sea turtle populations (Martinez-Estevez et al., 2021). Hawksbill turtles and green turtle rely more heavily on coral reefs for feeding and shelter (Atjo et al., 2023). Factors such as food availability, habitat quality, and anthropogenic pressures in the area influence the distribution and population composition of both species. The presence of both species underscores the importance of conserving a range of marine habitat types. Integrated habitat management efforts that consider both ecosystems are essential to ensure the long-term sustainability of sea turtle populations in the region.



A B

Figure 2. Green turtle (*Chelonia mydas*): (A) left side of the cheek; (B) carapace

Green turtles have a smoother head compared to hawksbill turtles, with smaller and less distinct scale patterns. The head is usually lighter in color, often featuring shades of greenish-brown or gray that help with camouflage in seagrass environments. The cheeks of green turtles

are relatively plain, lacking the prominent mosaic texture seen in hawksbill turtles, which serves as a distinguishing feature between the two species (Adnyana & Hitipeuw, 2009).

The carapace of green turtles is rounder and flatter, without serrated edges, and typically displays a more uniform coloration with minimal pattern variation. This carapace shape is adapted to support swimming in open waters as well as within seagrass beds. Its smoother texture allows green turtles to move more efficiently through the relatively shallow habitats they frequent.

A B

Figure 3. Hawksbill turtle (*Eretmochelys imbricata*): (A) left side of the cheek; (B) carapace

Hawksbill turtles are characterized by a distinctive mosaic-like scale pattern on the head, with dark coloration and clearly defined edges. The cheek area is prominent, featuring larger and more pronounced scales that give it a rough texture, setting it apart from other species. These features are often useful for individual identification, particularly in photoidentification surveys used to monitor movements and distribution of individuals (Adnyana & Hitipeuw, 2009).

The carapace of the hawksbill turtle has a unique shape, resembling a saw with sharp, overlapping edges. These overlapping scutes form a serrated structure along the carapace margin, which is a key morphological trait of this species. The carapace tends to be elongated and oval in shape, with distinct scute patterns an adaptation that reflects its close association with coral reef environments.

Spatial Distribution of Sea Turtle

Table 1 and Figure 4 present observational data on the sightings of two sea turtle species, *Chelonia mydas* (green turtle) and *Eretmochelys imbricata* (hawksbill turtle), at various locations within the designated conservation area. Each row in the table includes the specific locations where sea turtles were observed. Observation sites included several dive points: Hans Reef, Sunset Point, Batfish, and Meno Wall.

Table 1. Distribution of Sea Turtle Sightings

No	Date and Time	Species	Location	Sex	Deep (meter)	Behaviour
1	Sept, 26 2024 (8.15 AM)	*C. mydas*	Hans Reef	Female	15	Feeding
2	Sept, 26 2024 (8.20 AM)	*E. imbricata*	Hans Reef	Female	15	Resting
3	Sept, 26 2024 (11.10 AM)	*C. mydas*	Hans Reef	Female	16	Feeding
4	Sept, 26 2024 (11.15 AM)	*C. mydas*	Hans Reef	Female	16	Resting
5	Sept, 26 2024 (11.20 AM)	*C. mydas*	Hans Reef	Female	16	Resting
6	Oct, 11 2024 (3 PM)	*E. imbricata*	Sunset Point	Female	10	Resting
7	Oct, 17 2024 (11.20 AM)	*C. mydas*	Bat Fish	Female	9	Resting
8	Oct, 18 2024 (9.35 AM)	*E. imbricata*	Meno Wall	Male	12	Feeding

At Hans Reef, sea turtles were observed at depths ranging from 15 to 16 meters, with the dominant species being *Chelonia mydas*, primarily female individuals. At Sunset Point, only *Eretmochelys imbricata* (female) was recorded at a depth of 10 meters. At Bat Fish, a single female *Chelonia mydas* was found at a depth of 9 meters. Meanwhile, at Meno Wall, a male Eretmochelys imbricata was observed at a depth of 12 meters. According to (Atjo et al., 2023)this is presumed to be due to the relatively healthy coral reef habitat in the area, which serves as a shelter and foraging ground for both sea turtle species.

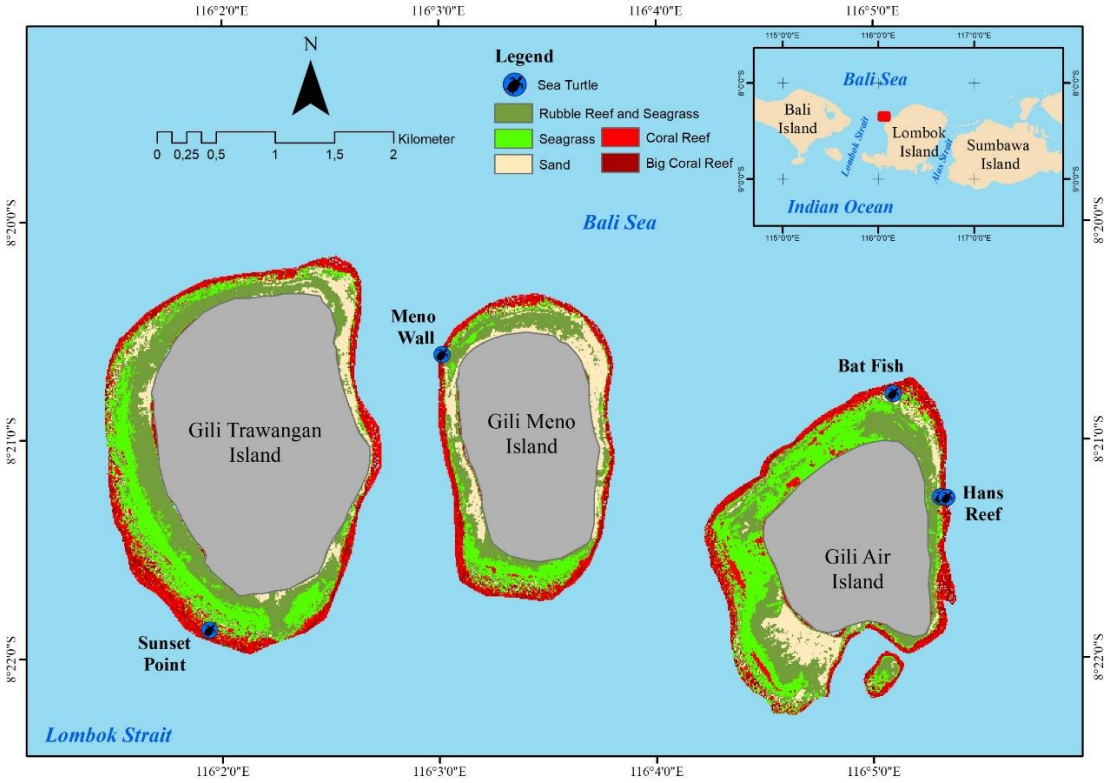


Figure 4. Distribution of Sea Turtle Sightings in the Gili Matra Marine Protected Area

Moreover, the predominance of female individuals in the observations could indicate a potential skew in local sex ratios, possibly influenced by environmental factors such as sand temperature at nesting beaches (which determines hatchling sex), or behavioral differences in

habitat use between males and females. These patterns highlight the importance of continuous monitoring and habitat-specific protection strategies within the Gili Matra Marine Protected Area, especially in maintaining reef health and reducing anthropogenic stressors like tourism pressure and anchor damage.

Most of the sea turtles recorded during the survey were female, with the exception of one male individual found at Meno Wall. The depth at which sea turtles appeared varied between 9 and 16 meters. These observations provide valuable information on population distribution, depth preferences, and sex composition of sea turtles in the area. The data can be used for further analysis on habitat preferences, such as depth differences favored by each species and gender variation across locations. This knowledge is highly beneficial for sea turtle conservation efforts, particularly in identifying critical habitat zones and supporting sustainable population management within the observed area.

Based on the observation times recorded in Table 1 and Figure 4, the majority of sea turtle sightings occurred during the morning hours, specifically between 8:15 AM and 11:35 AM. Out of eight total observations, seven individuals green turtle and hawksbill turtle were encountered in the morning. These sightings included a mix of behaviors such as feeding and resting, suggesting that the morning period is an active time for sea turtle activities in the Gili Matra Marine Protected Area. At Hans Reef, both species were observed within a short time frame, indicating the ecological richness of the area during morning dives. Only one sighting was recorded in the afternoon, at 3:00 PM on October 11, involving a resting female hawksbill turtle at Sunset Point. No observations were recorded in the late afternoon or evening. According Dujon et al. (2017); Seminoff et al. (2020) generally, green turtles are more active during the day than at night.

These patterns suggest that morning is the optimal period for sea turtle monitoring, as turtles are more likely to be encountered engaging in both foraging and resting activities during this time. The reduced sightings in the afternoon may be influenced by changes in sea turtle behavior, environmental factors such as light and temperature, or decreased visibility for observers.

CONCLUSION

This study highlights the presence and spatial distribution of *Chelonia mydas* (green turtle) and *Eretmochelys imbricata* (hawksbill turtle) within the Gili Matra Marine Protected Area. The findings indicate that the area supports both species, with turtles observed at various depths (9–16 meters) across multiple dive sites. The predominance of female individuals and the variation in species presence across sites suggest species specific habitat preferences and potential influences of environmental conditions. Both sea turtle was mostly observed in locations associated with coral reef structures. These patterns emphasize the ecological importance of protecting diverse habitat types to support both species. The study also underscores the need for integrated habitat-based management and the importance of using spatial and behavioral data to inform conservation zoning. Protecting key foraging and resting habitats, regulating tourism activity, and incorporating scientific evidence into decision making are essential steps toward ensuring the long-term sustainability of sea turtle populations in Gili Matra.

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