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Snake Species and Their Habitat Preferences on Marsegu Island, West Seram, Maluku, Indonesia

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ABSTRACT

Maluku, an archipelagic region, has unique ecological features that support a high level of biodiversity. One such island in this region is Marsegu Island, located in the Western Seram Regency, which is recognised as a nature reserve and serves as a natural habitat for several species of snakes. This study identifies snake species and analyses habitat preferences on Marsegu Island. Data were collected using the Visual Encounter Survey (VES) method. A total of six snake species from four families were recorded, with Colubridae being the most dominant. Species showed distinct habitat preferences: Xenopeltis unicolor was often found under decaying wood in mangrove areas, while Ahaetulla prasina was associated with *Cerbera manghas* trees. Larger species, such as Malayopython reticulatus, were found in coral rubble, while Cerberus schneiderii preferred semi-aquatic habitats in mangrove mud. The results suggest that the distribution of snakes on Marsegu Island is strongly influenced by morphological and behavioral adaptations to specific habitat types. This study provides new ecological insights into snake species in mangrove ecosystems and highlights the critical role of habitat conservation in maintaining biodiversity on Marsegu Island.

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INTRODUCTION

Indonesia is the world's largest archipelagic country, with 17024 islands (Indonesian Geospatial Information Agency, 2022). It is recognized as one of the world's biodiversity hotspots. The region harbors an exceptionally high diversity of flora and fauna, including herpetofauna, which comprises amphibians and reptiles, with more than 1100 species representing approximately 16% of the world's total species (Iskandar & Erdelen, 2006). Despite this richness, scientific studies on herpetofauna, particularly snakes, remain limited in Indonesia (Iskandar & Erdelen, 2006), even though 247 snake species have been identified nationwide. Snake research in Indonesia has primarily focused on Sumatra, Kalimantan, Sulawesi, and Java (De Rooij, 1917; De Lang & Vogel, 2005; Iskandar & Colijn, 2002). Snakes play a crucial ecological role as predators, helping regulate prey populations such as rodents and amphibians, and hold both ecological and economic significance (Shine, 1991; Greene, 1997). Snakes inhabit diverse environments, ranging from terrestrial ecosystems to freshwater and marine habitats (Mattison, 2014; De Lang & Vogel, 2005, Das, 2015). Their habitat preferences are influenced by environmental factors such as temperature, humidity, vegetation cover, and prey availability, which support their survival and reproduction (Luiselli, 2006; Halliday, 2016).

Marsegu Island, located in the Western Seram Regency, Maluku Province, is a conservation area with high biodiversity and potential habitats that support various reptile species. The island holds dual conservation status: it is designated as a Protected Forest under the Decree of the Minister of Forestry No. 10327/Kpts-II/2002 and as a Marine Nature Tourism Park under the Decree of the Minister of Forestry and Plantations No. 114/Kpts-II/1999. Marsegu Island encompasses a variety of ecosystems, including mangrove forests, coastal forests, and lowland forests, which provide suitable habitats for various snake species. However, information on snake species composition and habitat preferences on the island remains limited, potentially hindering the effectiveness of conservation strategies and environmental management. Local reports indicate frequent encounters with different snake species on Marsegu Island, suggesting a significant population. Most herpetofauna studies in Indonesia have focused on snake taxonomy and distribution, while specific habitat preference data remain scarce. Research by De Lang and Vogel (2005) and Iskandar and Colijn (2002) extensively documented reptile taxonomy and distribution in Sulawesi and other Indonesian regions but did not explore the habitat factors influencing the distribution of specific species. Herpetofaunal studies in Maluku, particularly concerning snake communities on Marsegu Island, are still rare. Research in similar ecosystems has demonstrated that environmental factors play a critical role in determining the distribution and abundance of snake species (Luiselli, 2006; Wanger *et al*., 2010). However, empirical data on these factors in the Maluku region remain limited. This study aims to identify and document snake species, as well as to analyze their habitat preferences on Marsegu Island, located in the Western Seram Regency, Maluku. The findings are expected to provide a substantial contribution to the existing body of knowledge on herpetofaunal biodiversity in Indonesia, particularly within the under-documented Maluku region, and to offer a scientific foundation for the sustainable management of snake species and their natural habitats on the island

MATERIALS AND METHOD

Study Site.

This study was conducted on Marsegu Island, located in the West Seram Regency, Maluku Province, Indonesia. Marsegu Island lies in the Buano Strait to the north, bordered by the Seram Sea on the west, east, and south (Figure 1). Astronomically, Marsegu Island is located at 02°59' - 03°01' S and 128°02' - 128°03' E. Geographically, the island exhibits highly variable topography, encompassing flat areas, slightly undulating terrain, and steep-sloped rocky regions. The maximum elevation of the island reaches 35 meters above sea level. The total area of Marsegu Island is approximately 240.20 hectares, with a length of about 2.75 km and a width of approximately 1 km, while its coastline extends for 6.698 km (Irwanto, 2017). The habitats on Marsegu Island encompass a range of vegetation types, including secondary forest, *Imperata cylindrica* grasslands, coastal vegetation, mangrove forests, coconut plantations, and *Ipomoea pes-caprae* communities. Among these, secondary forests and mangrove ecosystems represent the dominant vegetation types, predominantly distributed across the central and western regions of the island **(Figure 1).** These characteristics provide ideal conditions for studying herpetofauna, particularly snake species. The island's geographic isolation and habitat diversity offer valuable insights into the distribution patterns, behavior, and ecology of snakes, as well as their adaptations to the constraints of an insular environment (Meiri *et al*., 2015; Whittaker & Fernández-Palacios, 2021).

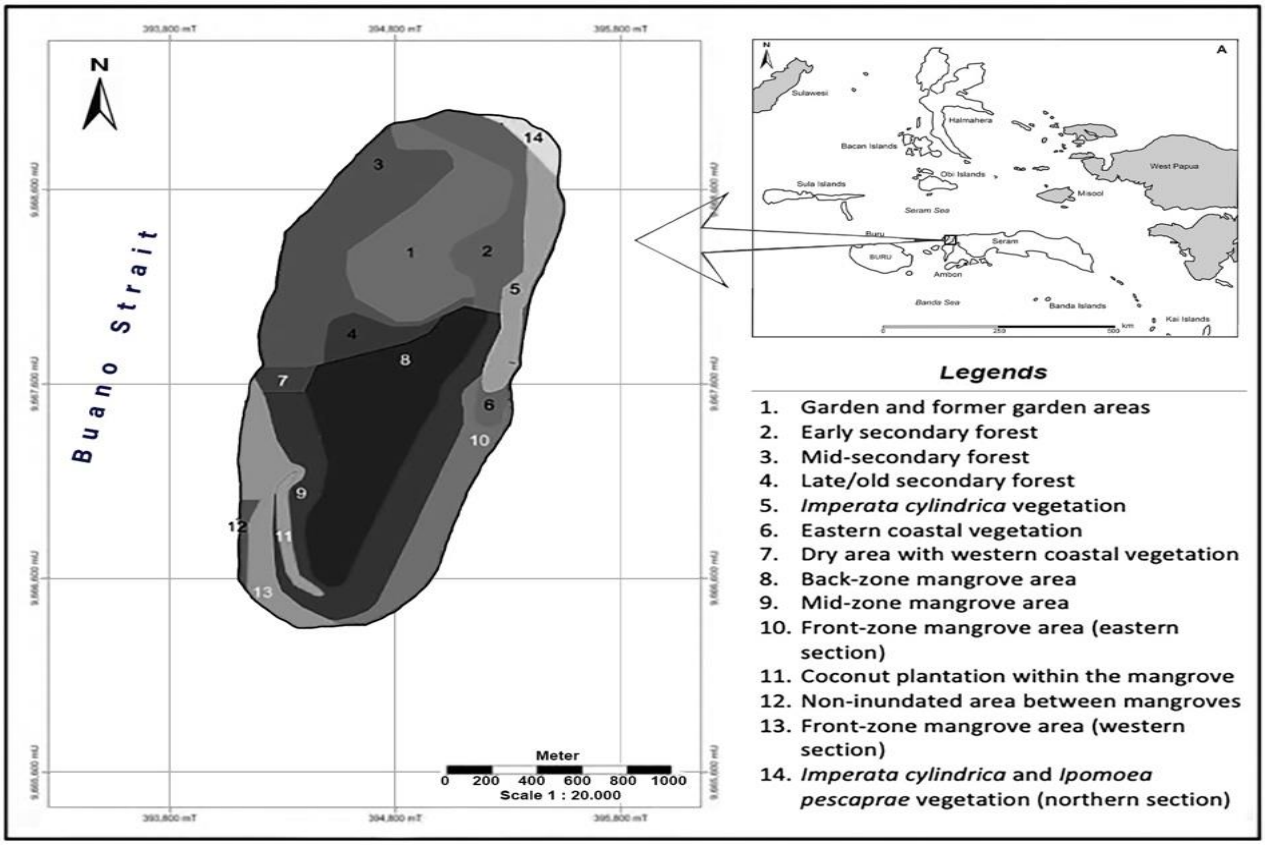

Figure 1.Research location map on Marsegu Island, West Seram Regency, Maluku, Indonesia [Modified map from Irwanto, 2017]

Research Tools and Materials

This study employed an exploratory method using the Visual Encounter Survey (VES) technique (Crump & Scott, 1994) to identify snake species on Marsegu Island. These methods required researchers to walk along predetermined transects across Marsegu Island while directly observing herpetofauna species encountered in the field (McKay, 2006). The tools used in this research included maps and compasses for navigation and for determining transect locations and observation points, cameras or smartphones for documenting snake specimens, tweezers for sample collection, and sample bags for storing specimens to be transported to the laboratory. Additionally, wooden sticks were used to clear vegetation or rocks during snake searches, and flashlights or headlamps were used for dusk surveys. Safety equipment, such as gloves and boots, was also provided to protect researchers from snake bites or stings, while writing materials were used to record field findings. A first aid kit was available for emergency care in case of accidents. The materials used in this study included sample bottles, 10% chlorobutanol, syringes, 70% ethanol, and herpetofauna field guides, such as *A Field Guide to the Reptiles of Southeast Asia* (Das, 2015) and *Nature Guide: Snakes, Other Reptiles and Amphibians* (Mattison, 2014) for snake species identification.

Snake Survey and Species Identification

The snake survey was conducted over one week, with observations carried out both during the day (from 06:00 AM to 7:00 PM) and at night. Researchers followed designated transects, using wooden sticks to clear vegetation and inspect rocky areas and tree branches in forested and rocky habitats in search of snakes (McKay, 2006). Upon encountering a snake, in situ identification was performed using relevant herpetofauna field guides, such as *A Field Guide to the Reptiles of Southeast Asia* (Das, 2015) and *Nature Guide: Snakes, Other Reptiles and Amphibians* (Mattison, 2014). If a species could not be identified in the field, a specimen was collected for further examination in the laboratory. Small snakes were preserved in jars containing chlorobutanol solution, while larger snakes were euthanized using a 70% ethanol injection. The collected data

were analyzed descriptively based on morphological characteristics and meristic traits, including body coloration, size, pattern, and head shape (Shine, 1991; McKay, 2006; Vitt & Caldwell, 2014). Each recorded species was described in detail regarding its physical appearance to determine whether it was endemic or commonly distributed in other regions (Das, 2015).

Habitat Preferences

Environmental conditions at snake encounter sites were meticulously documented to determine habitat preferences. Observations included vegetation type, soil conditions, and the structural characteristics of the microhabitats where the snakes were found. Detailed records of location and surrounding physical conditions were maintained to analyze the relationship between snake species and their specific habitats on Marsegu Island. This comprehensive documentation enabled researchers to assess the factors influencing snake distribution and map their habitat preferences within a small island ecosystem (Shine, 1991; McKay, 2006, Vitt & Caldwell, 2014). Marsegu Island exhibits diverse habitat conditions characterized by variations in vegetation types, soil composition, and the availability of natural resources that may affect snake habitat preferences. The collected data were analyzed descriptively to construct the ecological profiles of the snake species identified, including an analysis of species distribution and their association with specific microhabitats (Mattison, 2014)

RESULTS AND DISCUSSION

Species and Morphological Characteristics of Snakes on Marsegu Island

This study identified six snake species from four families, with 11 individuals observed. The Colubridae family dominated the community with seven individuals, followed by Pythonidae with two individuals, and Xenopeltidae and Homalopsidae, each represented by one individual **(Table 1)**.

Table 1. Snake species and their abundance on Marsegu Island

Family	Species	Indonesian Name	Number of Individuals
Xenopeltidae	*Xenopeltis unicolor*	Dharmawangsa Snake	1
Colubridae	*Ahaetulla prasine*	Green Vine Snake	4
	Dendrelaphis pictus	Golden Tree Snake	3
Pythonidae	*Malayopython reticulatus*	Reticulated Python	1
	Simalia clastolepis	Yellow Python	1
Homalopsidae	*Carberus schneiderii*	Dog-faced Water Snake	1

Six snake species from four families indicates that Marsegu Island supports a relatively diverse herpetofauna community. The dominance of the Colubridae family, with seven individuals, suggests a high adaptability of this group to the local ecosystem, particularly in mangroves and surrounding habitats. Previous studies have demonstrated that Colubridae is the most common snake family in various tropical ecosystems due to its ecological flexibility in resource exploitation and adaptation to varying environmental conditions (Vitt & Caldwell, 2014; Shine, 1991; Kurniawan *et al*., 2021). In contrast, the lower abundance of Pythonidae, Xenopeltidae, and Homalopsidae may reflect more specific habitat preferences or particular ecological pressures (Luiselli, 2006; Kurniawan *et al*., 2019). The presence of large snake species such as *Malayopython reticulatus* and *Simalia clastolepis* suggests that the ecosystem of Marsegu Island provides sufficient resources for these apex predators, including prey availability and suitable habitats (Shine *et al*., 1998; Reed & Rodda, 2009). Similar studies in Indonesia and Southeast Asia confirm that Pythonidae species are frequently found in ecosystems with dense vegetation and abundant prey availability (Murphy, 2007, Das, 2015; Septiadi *et al*., 2019).

Morphologically, the species *Xenopeltis unicolor* (Dharmawangsa snake) exhibits an elongated head with sharp posterior teeth, a slender iridescent brown body measuring 60 cm in length, and a 15 cm tail. *Ahaetulla prasina* (Green Vine Snake), an arboreal species, has a pointed head, a slender light-green body measuring 74 cm, and a 20 cm tail. Species *Dendrelaphis pictus* (Golden Tree Snake) has a small, dark brown body measuring 67 cm long and a 17 cm tail. The two Pythonidae species, *Malayopython reticulatus* (Reticulated Python) and *Simalia clastolepis* (Yellow Python), exhibit distinct morphological traits of large snakes. The

species *Malayopython reticulatus* has an oval head, a broad dark brownish-black body measuring 187 cm, and a 30 cm tail. Species *Simalia clastolepis* has a more slender body with a yellowish-black coloration and a total length of 142 cm. Meanwhile, the Homalopsidae species, *Cerberus schneideri* (Dog-faced Water Snake), shows adaptations to semi-aquatic habitats, characterized by a broad head and elongated teeth, a cylindrical dark-brown patterned body measuring 120 cm, and a 20 cm tail **(Table 2)**. The morphological diversity of these species reflects specific ecological adaptations to their respective habitats. The dominance of Colubridae suggests a high adaptability of this group to mangrove ecosystems and their surroundings. These findings reinforce the importance of mangrove habitat conservation as a key ecosystem supporting herpetofauna communities.

Table 2. Morphological characteristics of snakes on Marsegu Island

No	Species	Morphological Characteristics
1	*Xenopeltis unicolor*	▪ **Head:** elongated, with 10 supralabial scales and 10 infralabial scales, and sharp posterior teeth ▪ **Body:** slender, iridescent brown, total length 60 cm, 16 dorsal scale rows, and 169 ventral scales ▪ **Tail:** length 15 cm, two pairs of anal scales, and 128 subcaudal scales
2	*Ahaetulla prasina*)	▪ **Head:** tapered/oval, with 9 supralabial scales and 8 infralabial scales, and rear-fanged dentition ▪ **Body:** small and slender, light green, total length 74 cm, 15 dorsal scale rows, and 194 ventral scales ▪ **Tail:** length 20 cm, two pairs of anal scales, and 154 subcaudal scales
3	*Dendrelaphis pictus*	▪ **Head:** elongated, with 10 supralabial scales and 10 infralabial scales, and uniform dentition ▪ **Body:** small and slender, dark brown, total length 67 cm, 15 dorsal scale rows, and 167 ventral scales ▪ **Tail:** length 17 cm, two pairs of anal scales, and 127 subcaudal scales
4	*Malayophyton reticulatus*	▪ **Head:** oval, with 12 supralabial scales and 12 infralabial scales, and sharp, backward-curving teeth ▪ **Body:** broad and elongated, dark brownish-black, total length 187 cm, 80 dorsal scale rows, and 332 ventral scales ▪ **Tail:** length 30 cm, two pairs of anal scales, and 102 subcaudal scales
5	*Simalia clastolepis*	▪ **Head:** oval, with 12 supralabial scales and 12 infralabial scales, and sharp, backward-curving teeth ▪ **Body:** slender and elongated, yellowish-black, total length 142 cm, 80 dorsal scale rows, and 297 ventral scales ▪ **Tail:** length 28 cm, two pairs of anal scales, and 85 pairs of subcaudal scales
6	*Cerberus schneiderii*	▪ **Head:** broad, with 10 supralabial scales and 10 infralabial scales, and long teeth ▪ **Body:** slender, brown with black markings, total length 120 cm, 24 dorsal scale rows, and 148 ventral scales ▪ **Tail:** length 20 cm, two pairs of anal scales, and 124 subcaudal scales

Morphological variations among snake species on Marsegu Island demonstrate their close adaptations to habitat and hunting strategies. The species *Xenopeltis unicolor* has a slender, iridescent brown body, indicative of adaptations to a subterranean lifestyle and humid environments (Wallach *et al*., 2014). Its elongated head and sharp posterior teeth facilitate the predation of small prey within the substrate. Species *Dendrelaphis pictus* and *Ahaetulla prasina* exhibit typical characteristics of arboreal snakes, including slender bodies and pointed heads. Species *Ahaetulla prasina* possess a long tail that enhances stability when navigating tree branches (Das, 2015), while *Dendrelaphis pictus* exhibits semi-arboreal adaptations, enabling resource exploitation across different vegetation strata (Shine, 1991). Pythonidae species exhibit the characteristic traits of large snakes with broad, robust bodies. *Malayopython reticulatus*, reaching a length of 187 cm, represents a typical apex predator capable of preying on large vertebrates (Reed & Rodda, 2009). *Simalia clastolepis*, although morphologically similar, has a yellowish-black body coloration that may aid in camouflage within shrubland habitats (Murphy, 2007). The Homalopsidae species, *Cerberus schneideri*, exhibits adaptations to semi-aquatic habitats, possessing a broad head and elongated teeth that facilitate hunting in shallow waters and muddy

substrates (Murphy, 2007; Murphy *et al*., 2012). These adaptations are consistent with other Homalopsidae species in coastal and wetland ecosystems (Giri *et al*., 2011).

Habitat Preferences and Movement Strategies

This study found that *Xenopeltis unicolor* was located beneath decaying wood in mangrove areas, indicating a preference for humid and concealed environments. Species *Ahaetulla prasina* was predominantly observed in Bintaro trees (*Cerbera manghas*), a habitat that supports its hunting strategy and camouflage. *Dendrelaphis pictus* was primarily found on decaying tree trunks, reflecting its adaptation to arboreal and semi-terrestrial habitats. The two Pythonidae species exhibited different habitat preferences: *Malayopython reticulatus* was found among coral piles, likely as shelter and thermoregulation sites. Simalia *clastolepis* was more frequently encountered in densely vegetated shrubland. The semi-aquatic species *Cerberus schneideri* was observed in muddy areas near mangroves, aligning with its preference for wetland environments **(Table 3).**

Table 3. Habitat preferences and behavioral characteristics

Species	Habitat Preference	Locomotion Behavior
Xenopeltis Unicolor	Beneath decaying wood in mangrove areas	Crawling
Ahaetulla prasine	On *Cerbera manghas* trees	Coiling
Dendrelaphis pictus	On decomposing tree trunks	Crawling
Malayopython reticulatus	Among coral rock piles	Coiling
Simalia Clastolepis	Within shrub vegetation	Crawling
Carberus Schneideri	In mud near mangrove areas	Crawling

The distribution of snake species on Marsegu Island demonstrates a strong correlation between morphology, habitat preference, and movement behavior. *Xenopeltis unicolor* was observed beneath decaying wood in the mangrove area, a habitat that provides optimal moisture and protection from predators. This habitat selection is consistent with previous studies conducted in various Southeast Asian regions (Wallach *et al*., 2014). Arboreal species such as *Ahaetulla prasina* were found on *Cerbera manghas* trees, facilitating camouflage and providing easier prey access, such as small reptiles and insects. A study by Pizzatto *et al*. (2007) indicated that arboreal snakes often rely on looping movements to maintain stability on tree branches, a behavior also observed in *Ahaetulla prasina*.

For semi-arboreal species like *Dendrelaphis pictus*, the preference for decomposing tree trunks suggests an adaptive capability to exploit multiple vegetation strata. This strategy enables these snakes to access resources on the ground and in lower vegetation layers (Shine, 1991, Lamsiang *et al*., 2020). Meanwhile, species from the Pythonidae family exhibited more varied habitat preferences. *Malayopython reticulatus* was found in coral rubble and was likely used as a refuge for thermoregulation and ambush hunting. Studies on *Malayopython reticulatus* across Southeast Asia have confirmed its ability to adapt to diverse habitats, ranging from rainforests to urban environments (Fitch, 1999). *Simalia clastolepis* was more frequently encountered in dense shrublands, which provide shelter and access to potential prey such as birds and small mammals. A unique adaptation was also observed in *Cerberus schneiderii*, which is predominantly found in muddy areas near the mangrove zone. Its crawling on muddy substrates aligns with its semi-aquatic nature, preying on fish and small amphibians (Murphy, 2007). These findings suggest that movement patterns are closely linked to energy efficiency in resource exploitation within specific habitats.

Ecological Implications and Conservation

This study underscores the critical role of mangrove ecosystems as primary habitats for various snake species on Marsegu Island. Mangroves provide shelter, food resources, and ideal microhabitat conditions for species such as *Cerberus schneideri* and *Xenopeltis unicolor*. Habitat degradation due to human activities, such as deforestation and land conversion, may negatively impact the sustainability of herpetofaunal communities (Giri *et al*., 2011; Zakaria *et al*., 2022). The dominance of Colubridae in this community suggests high ecological tolerance, allowing them to persist in changing environmental conditions. However, habitat-specific species, such as *Malayopython reticulatus* and *Simalia clastolepis*, highlight the need for micro-scale conservation strategies that account for habitat heterogeneity (Luiselli, 2006). This study provides insights into

snake diversity on Marsegu Island and reinforces the urgency of mangrove conservation as an integral component of biodiversity conservation efforts.

CONCLUSION

This study reveals that Marsegu Island supports a diverse herpetofauna community, with the dominance of Colubridae indicating high adaptability to mangrove ecosystems. The observed snake species exhibit diverse morphology and hunting strategies, reflecting their habitat-specific adaptations. The presence of apex predators such as *Malayopython reticulatus* and *Simalia clastolepis* highlights the importance of prey availability and suitable habitats for survival. While Colubridae dominates, species with more specialized habitat requirements, such as certain Pythonidae and Homalopsidae, emphasize the necessity of habitat management and conservation considering microhabitat diversity. The findings provide crucial evidence of the role of mangrove ecosystems in supporting snake biodiversity and highlight the urgent need for mangrove conservation to ensure the persistence of herpetofauna communities.

AUTHORS CONTRIBUTION

Samangun designed the research, collected and analyzed data, and wrote the manuscript. Leimena and Eddy supervised the research and provided critical revisions to the manuscript.

CONFLICT OF INTEREST

The authors declare no conflicts of interest, and will take full responsibility for the content of the article, including implications of AI-generated art.

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