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Malacofauna (Mollusca: Gastropoda) community structure in a protected landscape of Tabunan Forest, Cebu City, Philippines

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[2]Department of Forestry, Cebu Technological University. Argao Campus, Cebu 6021, Philippines
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Abstract. *Rosales R, Colita L, Retubado ZA, Caballero J, Lillo E, Malaki AB, Quiñones R, Sacan E. 2025. Malacofauna (Mollusca: Gastropoda) community structure in a protected landscape of Tabunan Forest, Cebu City, Philippines. Biodiversitas 26: 2631-2639.* Malacofauna play a crucial role in sustaining the ecological health of forest ecosystems. They serve as an essential food source for other organisms and play a key role in nutrient cycling. This study aimed to establish an inventory of terrestrial snails in a protected landscape of Tabunan Forest, Cebu Island, Philippines. A two-person team conducted sampling on three permanent plots. The study listed 57 individuals represented by 11 species belonging to nine genera and eight families. Seven families belong to the air-breathing pulmonate group, Order Stylommatophora: Helicinidae, Chronidae, Bradybaenidae, Achatinidae, Trochomorphidae, Zoonitidae, and Camaenidae. One family belongs to the prosobranch group, Order Caenogastopoda: Cyclophoridae. The most abundant were *Geophorus acutus* and *Geophorus agglutinans*. *Ryssota oweniana* has the widest geographical distribution with 100% constancy rate with recorded occurrence in all plots. Seven out of 11 species were recorded only in one plot while two species were recorded in two plots. The result showed a highly restricted distribution of the land snail species in the protected landscape. The limited geographic distribution can adversely affect the reproduction capacity and population growth of the land snail species. The low population density may also indicate that the forest is undergoing environmental pressure either from human activities or climatic change. It is recommended that future studies be conducted to monitor the status of the land snail population within the protected landscape.

Keywords: Bioindicator, conservation, invasive, karts, leaf litter, terrestrial

INTRODUCTION

Malocofauna refers to the diverse group of soft-bodied invertebrates under phylum Mollusca of class Gastropoda (Wagh et al. 2021). The Philippines is home to 31% (22,000 out of 70,000 species) of all the mollusk species documented globally with an endemism of 90-95% for marine mollusk and an estimated 2-4% for terrestrial gastropods (Ong et al. 2002). Geographic barriers between islands have significantly enhanced endemism by restricting the migration of land snails across different forest habitats (Auffenberg and Páll-Gergely 2020). It is highly possible that a substantial number of land snail species remain undiscovered or undescribed as only a few islands have been extensively surveyed or studied for malacofaunal inventory.

The significant diversity and functional roles of many land snails in terrestrial ecosystems, combined with their small size and limited mobility, make them particularly well-suited to serve as environmental bioindicators (Gheoca et al. 2021). Their presence in the habitat is a fundamental indicator of ecosystem health due to their ability to break down and recycle decaying plant materials. Land snails contribute to ecosystem services by transferring calcium to higher trophic levels, facilitated by their uptake of calcium from soil and organic matter (Gerlach et al. 2013). They also serve as an essential food source for small mammals, amphibians, reptiles, birds, arthropods, and humans. The ecological roles performed by land snails contribute to maintaining habitat integrity, which is essential for sustaining rainforest biodiversity (Belhiouani et al. 2018).

Protected landscape is a globally recognized strategy to safeguard biologically significant regions of the world in response to the alarming rate of biodiversity loss worldwide (Fisher et al. 2024; Rosales et al. 2025). It is widely acknowledged that the loss of biodiversity and climate change are interrelated crises that demand immediate attention (Steffen et al. 2018; Bradshaw et al. 2021). Protected Areas (PA) are essential resources for maintaining landscapes that sustain biodiversity and offer ecosystem services that regulate the climate (Dinerstein et al. 2019). A very ambitious goal established by the international community is to designate 30% of the world's ecosystems as protected areas through the Convention on Biodiversity in 2022. But as other academics have already shown, PA are being required to perform a growing number of other duties, such as enhancing the social well-being of the communities in which they operate (Maxwell et al. 2020).

In response to the global call for biodiversity conservation, the Philippines declared several areas as protected landscape such as the Rajah Sikatuna Protected Landscape (RSPL), Central Cebu Protected Landscape (CCPL), Biri-LAROSA Protected Landscape and Seascape (BLPLS), and others (Aureo et al. 2020; Lillo et al. 2020; Escal and Malabarbas 2021). However, about 61.00% of the Philippines' land is used for agriculture which in 2018 accounted for at least 9.00% of the country's GDP (Agduma et al. 2023). The reduction in Philippine Forest area brought about by logging and agricultural growth has resulted in a significant shift in land cover, endangering the Philippine flora and fauna (Apan et al. 2017).

In Tabunan Forest protected landscape, Cebu Island, Philippines, ecological disturbances were observed such as land conversion, non-regulated wood harvesting, and slash-and-burn activities (Estrada et al. 2024). In a move to save the remaining flora and fauna, a total of 117 terrestrial areas classified as Key Biodiversity Areas (KBA) were established based on vulnerability and irreplaceability (Lillo et al. 2020). The impact of anthropogenic activities on the malacofauna is still unclear as data on the land snail population in Cebu Island are sparse in scientific literatures. The Philippines only has listed *Helicostyla smargadina* as critically endangered endemic species under the International Union of Nature (IUCN) in 2008 (de Chavez and de Lara 2011). The list could be an underestimation of Philippine land snails as other species have been extensively exploited as food and highly understudied.

This study aimed to establish an inventory of land snail species in Tabunan Forest. Information regarding the species composition, relative abundance, and distribution of terrestrial snail species within the protected landscapes of Cebu Island remains poorly documented in published scientific literature. The Tabunan forest has no known data on terrestrial snail species, hence there is no information on its snail population. Considering the vital role of land snails in maintaining ecosystem health on the island, establishing data on these species can aid policymakers in formulating conservation measures to prevent them from becoming threatened or extinct.

MATERIALS AND METHODS

Study area

The Tabunan Forest (N 10.43943, E 123.82494) is located in Barangay Tabunan of Cebu City, Central Philippines (Figure 1). It is part of the Central Cebu Protected Landscape (CCPL) established by a national legislated law through Republic Act No. 9486. The protected landscape is composed of the Buhisan Watershed Forest Reserve, Mananga Watershed Forest Reserve, Sudlon National Park, and Kot-Kot Watershed Forest Reserve.

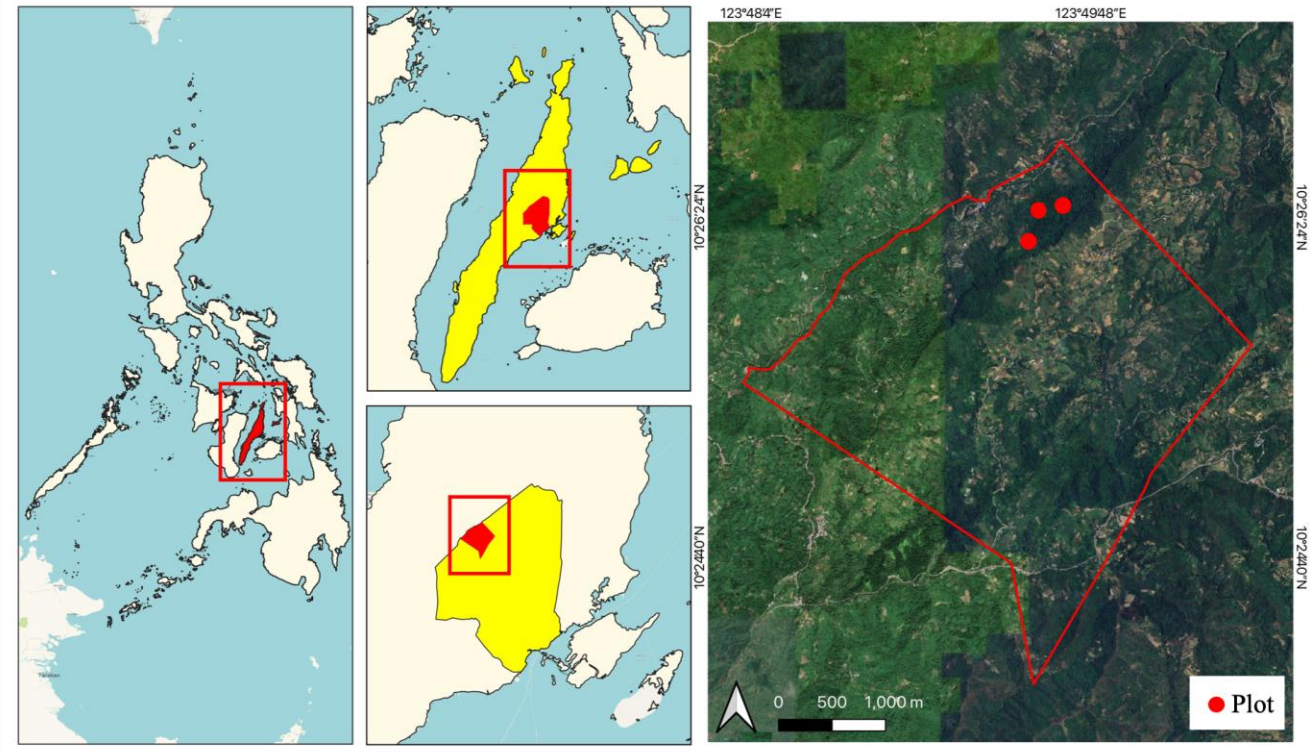

Figure 1. Location map of Tabunan Forest, Cebu Island, Philippines, with the established sampling plots

Establishment of permanent plots

The three permanent plots were established following the protocol of Permanent Biodiversity Monitoring System (PBMS). The plots have a lower elevation of 505 m and upper elevation of 600 m (Table 1). The ambient temperature ranges from 29.7°C to 30.9°C and humidity ranges from 64% to 71%. The PBMS is established in protected landscapes and key biodiversity areas for long-term ecological research. The PBMS utilizes permanent plots within 2 km transect lines for each forest type. The study sites are stratified to include different forest types namely: advance lowland secondary forest (Plot 1), limestone forest (Plot 2), and early secondary forest (Plot 3) (Supsup et al. 2016). The sampling sites were selected based on the criteria established by Solem (1984) and Schilthuizen and Rutjes (2001), such as areas described as stable, temperate, litter-rich, and moderately moist forests. The permanent plots are used to track changes in biodiversity every five years, as well as to monitor the effectiveness of conservation efforts. This conservation strategy is implemented in other protected areas in the Philippines including Mount Makiling Forest Reserve, Mount Calavite Wildlife Sanctuary, and Key Biodiversity Areas in Cebu Island (Malabrigo et al. 2016; Lillo et al. 2019; Alviola et al. 2023).

Each of the permanent plots measured 20x100 m, with a total of three plots established in an open forest (Lillo et al. (2019). General protocol for land snail survey requires a 20x20 m plot size following the protocol of Solem (1984) and Schilthuizen and Rutjes (2001). In this study, a total of 15 subplots were established from the three permanent plots of 20x100 m each plot to ensure consistency with the sampling protocols.

Sampling

Prior to the conduct of the study, a wildlife gratuitous permit no. 2023-05 was obtained from the Department of Environment and Natural Resources (DENR) Region 7 through the recommendation by the Protected Area Management Board (PAMB). Collection of samples was conducted once by a two-person team for two hours on each of the subplot. All sampling activities were done exclusively throughout the day. Specific micro habitat was highly observed such as decaying logs and barks, leaf litter, and underside of leaves during the two-hour sampling. One live specimen was collected as representative for each of the species and also empty shells and shell fragments were also collected (de Chavez and de Lara 2011). Photographs were taken on site and live samples were returned to its natural habitat thereafter. All the data collected from each of the subplot were tallied as one plot based on the permanent biological monitoring system used in this study. Ethical standard and policies imposed by the government were strictly observed by the research team based on the provisions of the permit issued. The Philippine policy requires a gratuitous permit prior to the conduct of the study of sites that are declared as protected areas.

Species identification

All samples collected were sorted into groups based on similar morphological characteristics. Identification of samples were conducted using published keys and reference guides available for tropical terrestrial snails including Schilthuizen and Rutjes (2001), de Chavez et al. (2014), and Valdez et al. (2021). Land snail samples were identified up to species level whenever possible. All collected samples were kept at the biological laboratory of the Cebu Technological University, Cebu City, Philippines.

Data analysis

All the collected samples were counted and analyzed for relative abundance and rarity, and constancy using the following equations;

Species abundance and rarity: Species abundance is the number of individuals in a given area (Brower et al. 1989). Relative abundance is computed as:

$$\text{Relative abundance} = \frac{\text{species abundance}}{\text{total number of individuals}} \text{ x } 100$$

Species with less than 0.5% of the total individual counts are considered rare (Emberton et al. 1997).

Constancy Index: The constancy index (C) for each species is calculated according to Dajoz (1985) and calculated using the following equation:

$$(C) = \frac{p \times 100}{P}$$

Where, p is the number of samples in which a given species occurs and P is the total number of samples analyzed. Species can be classified into three different constancy categories: constant (C≥50%), accessory (25%<C<50%) and accidental (C<25%) (Dajoz 1985).

Table 1. Plot locations and environmental conditions

Plot	Coordinates	Elevation (m)	Air temperature (°C)	Relative humidity (%)	Soil temperature	Soil humidity (%)	Forest type
P1	N 10.43943, E 123.82494	600	30.1	65	28	65%	Advance lowland secondary forest
P2	N 10.44019, E 123.8266	505	26.3	71	27	76%	Limestone forest
P3	N 10.43705, E 123.82458	586	29.5	63	30	68%	Early secondary forest

Species accumulation curve (S43AC) was used to determine the sufficiency of the sampling size. The species accumulation curve plots in excel a number of species collected and identified against a measure of sampling effort obtained from the 15 subplots surveyed (Ugland et al. 2003). To assess whether sampling effort is adequate using a species accumulation curve, observe its trend: if the curve rises steeply in a near-linear fashion, it suggests insufficient sampling, requiring more data collection. Conversely, if the curve initially climbs sharply but then flattens into an asymptote with minimal further increase, it indicates sufficient sampling, allowing for reliable data analysis.

RESULTS AND DISCUSSION

Sampling results

The study has listed a total of 57 individuals represented by 11 species belonging to nine genera and eight families. Seven families belong to the pulmonate group, Order Stylommatophora: Helicinidae, Chronidae, Bradybaenidae, Achatinidae, Trochomorphidae, Zoonitidae, and Camaenidae. One family belongs to the prosobranch group, Order Caenogastopoda: Cyclophoridae. The family Helicinidae and Cyclophoridae were represented by two species and all the other families were represented by one species. Although *Achatina fulica* is on the list, this can be excluded being non-native. The systematic list of all identified land snails is presented in Table 2 and the profile photos of representative specimen are shown in Figures 2 and 3.

Table 2. Systematic list of land snail species in Tabunan Forest, Cebu Island, Philippines

Order, Family	Genus	Species
Stylommatophora		
Helicinidae	*Geophorus*	*Geophorus acutus*
	Geophorus	*Geophorus agglutinans*
Chronidae	*Ryssota*	*Ryssota oweniana*
Bradybaenidae	*Helicostyla*	*Helicostyla daphnis*
Achatinidae	*Achatina*	*Achatina fulica*
Trochomorphidae	*Trochomorpha*	*Trochomorpha metcalfei*
	Trochomorpha	*Trochomorpha schmackerii*
Zonitidae,	*Mesomphix*	*Mesomphix* sp.
Camaenidae	*Genesella*	*Ganesella perakensis*
Caenogastropoda		
Cyclophoridae	*Leptopoma*	*Leptopoma woodfordi*
	Cyclotus	*Cyclotus* sp.

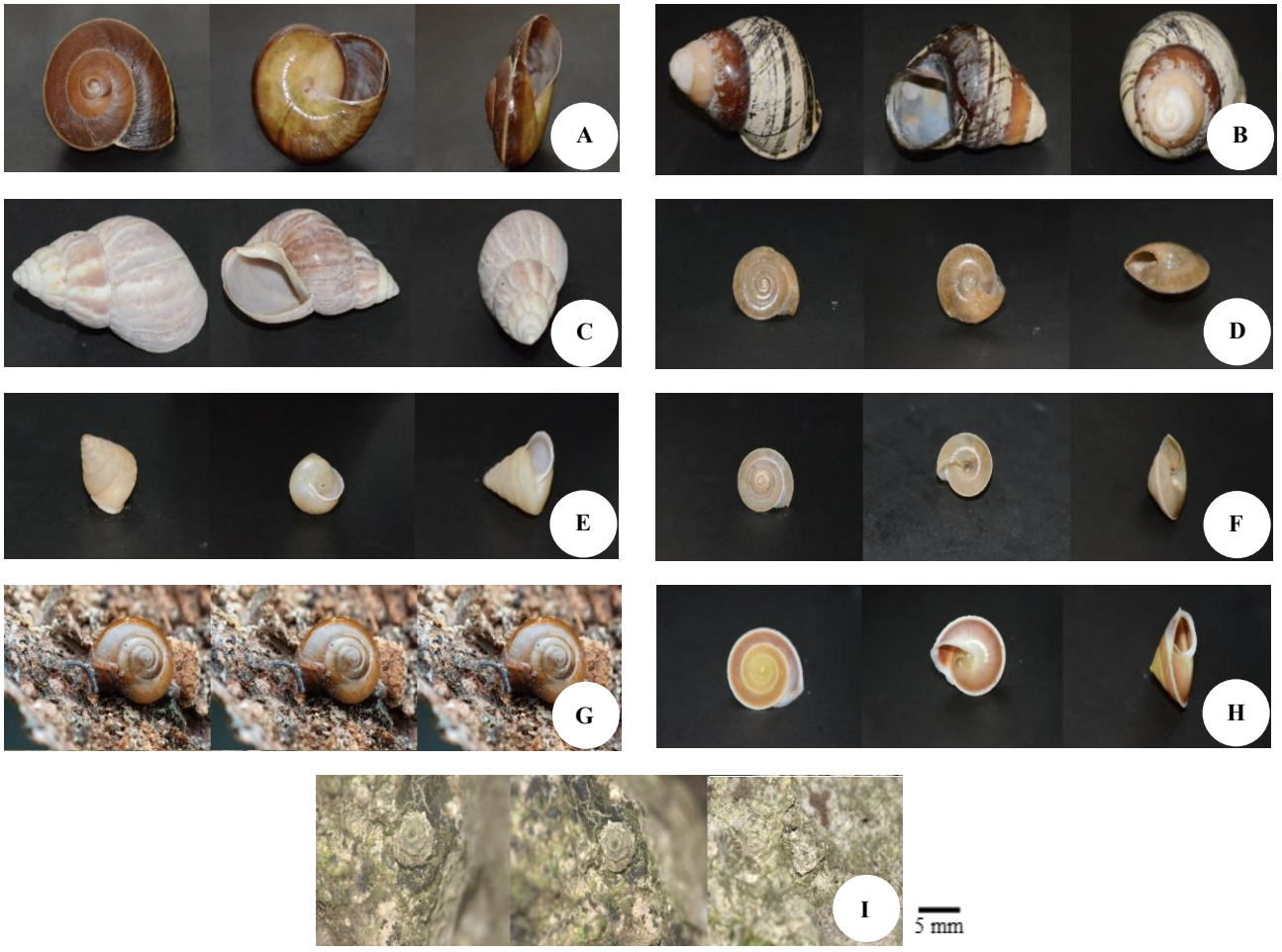

Figure 2. Order Stylommatophora. A. *Ryssota oweniana*; B. *Helicostyla daphnis*; C. *Achatina fulica*; D. *Trochomorpha metcalfei*; E. *Ganesella perakensis*; F. *Trochomorpha schmackeri*; G. *Mesomphix* sp.; H. *Geophorus acutus*; I. *Geophorus agglutinans*

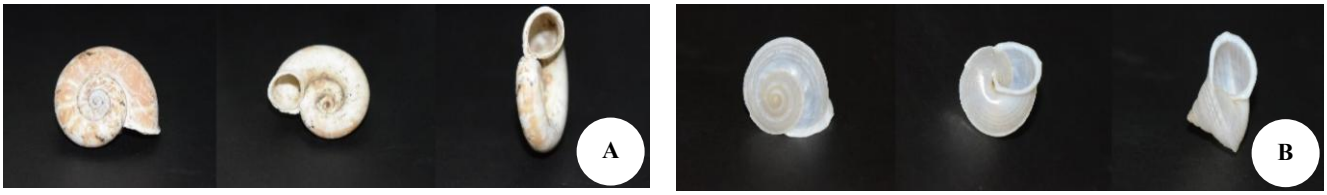

Figure 3. Order Caenogastropoda. A. *Cyclotus* sp.; B. *Leptopoma woodfordi*

Species composition and community structure

The relative abundance and rarity of land snails are shown in Table 3. The population of *G. agglutinans* and *R. oweniana* are the largest with 17 individuals accounting to 29.82% each for a combined 59.65% relative abundance. The two populations, *G. agglutinans* and *R. oweniana,* represent as the most relatively abundant species. *Geophorus acutus* and *Ganesella perakensis* have 5 individuals each with combined relative abundance of 17.44%. Emberton et al. (1997) described species as rare if the species abundance is less than 0.5%. The result indicated no species fall under this category because the species with least abundance is 1.75% represented by one individual: *Helicostyla daphnis*, *Trochomorpha metcalfei, Mesomphix* sp. and *Cyclotus* sp.

The population density of the different land snail population in the study areas is shown in Table 4. Plot 1 has the highest recorded number of species with seven (7) followed by plot Plot 2 with 5 and Plot 3 with 3 species. The abundance per plot was computed based on percent frequencies of specie as shown in Table 4. *Geophorus agglutinans* was the most abundant in Plot 1 (36.36%), while *Ryssota oweniana* was the most abundant in Plot 2 (40%) and Plot 3 (60%). The variability of species may indicate the suitability of the protected landscape of Tabunan forest for land snails.

Occurrence and distribution of land snails

The occurrence and geographic distribution of land snails in study areas were calculated based on constancy (Table 5). Based on the constancy interpretation of Dajoz (1985), three (3) out of 11 species were constant species for having a constancy of ≥50% including *G. agglutinans, R. oweniana,* and *A. fulica*. The only constant species with the widest geographic distribution is *R. oweniana* with a constancy of 100%. Eight (8) land snails were classified as accessory species (25%<C<50%) with a constancy of 33.33%. The distribution of constant species was highly restricted to only one (1) plot. The result showed no accidental species with a constancy of <25%.

Sufficiency of sampling size

Using the samples collected and identified in Table 4, plotted the number of sampling times based on the 15 subplots, the number of snail populations, and the species accumulation curve of the number of terrestrial snail individuals and populations, respectively Figures 2 and 3 (Rong et al. 2020). The curve shows that with the increase in the number of subplots sampled, although the number of terrestrial snail species and individuals gradually increased, they did not rise in a straight line (Figure 4). The characteristics of the growth curve showed a smooth asymptote after a smooth rise.

The steep initial curve indicates a rapid species discovery often due to common or dominant species being sampled early. The steep curve suggests sufficient sampling or high species evenness of the terrestrial snail species. The gradual plateau can be seen in the species accumulation curve where the curve flattens. The flattening curve implies diminishing returns in new terrestrial snail species detected, signaling sufficient sampling effort conducted in the Tabunan Forest.

Discussion

The land snail community structure assessment in Tabunan Forest provides the first extensive records of land snails in a protected landscape in Cebu Island, Philippines. This study listed a total of 11 land snail species including a non-native species – *A. fulica*. It also listed three (3) new island record, namely: *G. agglutinans, G. perakensis* and *Mesomphix* sp.. *Helicostyla daphnis* is a species endemic in the island and previously believed as threatened but found thriving in different forest areas in the island (Flores 2014). The study of Flores (2014) only focuses on the population of *H. dahpnis*. The study covers three locations including the municipalities of Sogod and Borbon located in the northern part of the island, and Argao representing the southern side. The Tabunan Forest is located farther at the center of the island and part of the Central Cebu Protected Landscape. However, there is no prior studies conducted on its malacofaunal diversity and no verifiable data available for comparison. *Geophorus acutus, R. oweniana, H. daphnis, T. metcalfei, T. schmackeri, L. woodfordi* were described by Rosales et al. (2020) in Mt. Lantoy Key Biodiversity Area, Argao, Northern Cebu Island, Philippines. Due to scarcity of data of Philippine malacofauna, some species were identified only at genus level.

The land snail population composition varies from each plot with seven (7) species in Plot 1, five species in Plot 2, and three (3) species in Plot 3. *Ryssota oweniana* and *G. agglutinans* were relatively the most abundant species with 29.82% comprising of 17 collected individuals for each population. However, four species were represented with one individual at 1.75% relative abundance: *H. daphnis*, *T. metcalfei*, *T. schmackeri*, and *Cyclotus* sp.. The low number of individuals may indicate high environmental pressure that affects the increase of the number of individuals per population (Tiago et al. 2017). The study showed that only *R. oweniana* posted a 100% constancy

with the widest distribution in all plots. The geographical distribution of most of the terrestrial snails is highly restricted with eight species occurred only in a single Plot. The highly limited geographical distribution can potentially limit the reproductive capacity of the population (Cernohorsky et al. 2010).

The Tabunan forest is a tropical rainforest characterized by a karst ecosystem where land snails commonly occur (Valdez et al. 2021). The forest vegetation is dominated by species of *Artocarpus sericicarpus* under family Moraceae. The list of plants common in the area are *Terminalia foetidissima*, *Cynometra cebuensis*, *Ficus nota*, *Ficus minahassae*, *Ficus benjamina*, *Ficus chrysolepis*, *A. sericicarpus*, *Parashorea malaanonan*, *Guioa koelreuteria*. These plants serve as essential food source for arboreal land snail species such as *H. daphnis*. *Helicostyla daphnis* is among the extensively collected land snails by the local residents as food due to its relatively large size and as medicine for cough (Funesto and Flores 2017). *Ryssota otaheitana* is another species also heavily consumed by the locals in some parts of the Philippines. *Helicostyla daphnis* and *R. otaheitana* were proposed to be classified as vulnerable due to its limited distribution range in a highly disturbed habitat (Gonzalez et al. 2018). Unregulated collection of the Cebu endemic *H. daphnis* may lead to over harvesting and threaten its population. The overharvesting may adversely affect the dynamics within the food chain due to decreasing food supply of *H. daphnis* for other organisms. Should this practice of collection in the wild unabated, it may pose a long-term negative affect to the survival of other species.

The abundance and wide geographical distribution of land snails have significant implication on the survival of species (Monnier-Corbel et al. 2023). The relatively abundant species will have the capacity to sustain its population. The limited geographical distribution may indicate local extinction due to ecological phenomena such as competition and predation coupled with environmental condition due to anthropogenic pressure (Perez et al. 2023). These interactions and environmental conditions can affect population dynamics of species co-occurring at the same area such as the presence of *A. fulica.* The World Conservation Union (IUCN) listed *A. fulica* as one of the world's 100 most invasive species. *Achatina fulica* is described as voracious feeder and eats almost anything thus competes with native land snails with limited food preference. Due to its tremendous ability for reproduction, the snail can produce as many as 1800 eggs per year and reaches sexual maturity roughly five to eight months (Lima et al. 2020). This behavior will likely limit the population of other land snail species in Tabunan forest. *Achatina fulica* seemingly has wide distribution as it was recorded in different areas in the Philippines including Mt. Makiling, Marinduque Island, Mt. Lantoy in Cebu, Masungi Georeserve, and Sta. Teresita in Cagayan (de Chavez and de Lara 2011; Sosa et al. 2014; Rosales et al. 2020; Parcon et al. 2021; Valdez et al. 2021).

In contrast, previous study in Mt. Lantoy Key Biodiversity Area (KBA), located in the southern part of the island, recorded a total of 890 individuals belonging to 24 land snail species (Rosales et al. 2020). Mt. Lantoy KBA has listed nine (9) new island record species: *Helicostyla phitogaster, Obba horizontalis, Conchlostyla camelopardalis, Trochomorpha schmackeri, Sitala acuta, Euplecta apicata, Helicina clappi, Cyclophorus daraganicus, and Cyclophorus fulguratus.* It was observed that abundant species are well distributed in the study areas, as demonstrated by its constancy.

Table 3. Relative abundance and rarity (N: 57)

Species	No. of Individuals	Relative Abundance and Rarity (%)
Geophorus acutus	5	8.77
Geophorus agglutinans	17	29.82
Ryssota oweniana	17	29.82
Helicostyla daphnis	1	1.75
Achatina fulica	4	7.02
Trochomorpha metcalfei	1	1.75
Trochomorpha schmackerii	1	1.75
Mesomphix sp.	3	5.26
Ganesella perakensis	5	8.77
Leptopoma woodfordi	2	3.51
Cyclotus sp.	1	1.75

Table 4. Percent (%) frequencies of collected land snails (N: 57)

Species	Plot Number		
	1	2	3
Geophorus acutus	22.73	0.00	0.00
Geophorus agglutinans	36.36	36.00	0.00
Ryssota oweniana	4.55	40.00	60.00
Helicostyla daphnis	0.00	0.00	10.00
Achatina fulica	4.55	0.00	30.00
Trochomorpha metcalfei	0.00	4.00	0.00
Trochomorpha schmackerii	4.55	0.00	0.00
Mesomphix sp.	0.00	12.00	0.00
Ganesella perakensis	22.73	0.00	0.00
Leptopoma woodfordi	0.00	8.00	0.00
Cyclotus sp.	4.55	0.00	0.00
S:11 (number of species)	**7**	**5**	**3**
Total no. of individuals per plot	22	25	10

Table 5. Constancy of land snails in the different plots (N: 57)

Species	Plot Number			Constancy (%)
	1	2	3	
Geophorus acutus	1	0	0	33.33
Geophorus agglutinans	1	1	0	66.66
Ryssota oweniana	1	1	1	100.00
Helicostyla daphnis	0	0	1	33.33
Achatina fulica	1	0	1	66.66
Trochomorpha metcalfei	0	1	0	33.33
Trochomorpha schmackerii	1	0	0	33.33
Mesomphix sp.	0	1	0	33.33
Ganesella perakensis	1	0	0	33.33
Leptopoma woodfordi	0	1	0	33.33
Cyclotus sp.	1	0	0	33.33

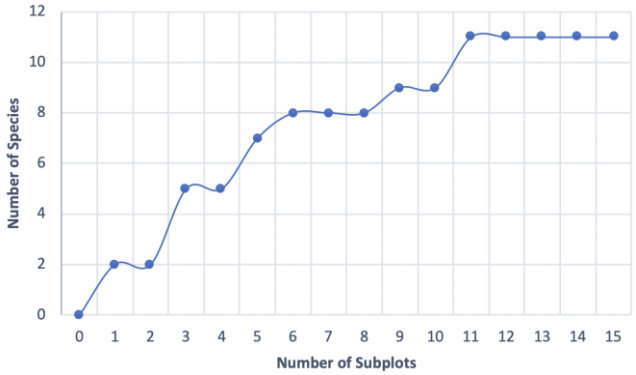

Figure 4. Species accumulation curve

Mt Lantoy KBA clearly possess higher population density and diversity of land snail species than the protected landscape of Tabunan Forest. The presence of *A. fulica* will likely isolate the native land snail species in the forest area. Previous studies suggest that introduced species such as *A. fulica* serves as a disturbance indicator because it is more prevalent in highly disturbed environments such as tropical forest, plantations, and slash-and-burn sites (Parcon et al. 2021). This ecological pattern of introduced species is also observed in East Java, Indonesia (Nurinsiyah et al. 2016; Nurhayati et al. 2021).

The rapid urbanization and increase in population in nearby cities and towns in the island also contributed to the disturbance of the Tabunan Forest. It is highly likely that some parts of the forest are converted into either residential or agricultural thus changing the land use patterns (Patiño et al. 2019). Communities were seen near the vicinity of the forest area with some were opening gardens for tourists. Introduction of non-native species will likely to occur endangering the local flora and fauna (Garces 2019). Construction of roads within and around the forest areas in the Central Cebu Protected Landscape effectively reduced the forest ecosystem into smaller fragments (Fallahchai et al. 2018). Ecological phenomena such as inbreeding may be occurring due to habitat fragmentation and eventually affect the survival of land snails in the Tabunan Forest (Schlaepfer et al. 2018).

In other protected landscapes such as the Mt. Banahaw-San Cristobal Protected Landscape (MBSCPL) in the island of Luzon, it has sampled a total of 868 land snails, with 33 species spread over 24 genera and 9 families (Perez et al. 2023). With ten species, the Camaenidae was the most represented family. *Ryssota otaheitana* was the most prevalent species, accounting for 29.15% of the total samples (253 individuals) (Perez et al. 2023). The malacofaunal diversity in Masungi Georeserve, also Luzon Island, recorded a total of 1,283 individuals belonging to 45 species and 12 families (Valdez et al. 2021). The study in Masungi Georeserve identified three major land snail communities: the first group dominated in warmer habitats with low-calcium soil (non-karst), the second group preferred cooler environments with high-calcium soil (karst), and the third group was found in both habitat types. These two protected areas showed remarkable number of individuals and species per population of land snails. Environmental conditions and habitat characteristics of the MBSCPL and Masungi Georeserve are likely identical with Tabunan Forest. Although sampling plots were higher in Mt. Banahaw-San Cristobal Protected Landscape (MBSCPL) and Masungi Georeserve, the 57 individuals belonging to 11 land snail species of the Tabunan Forest still far lower compared to the two protected landscapes. This clearly suggests an alarming health status of the forest and the failing conservation policies over a protected landscape in Cebu Island.

In conclusion, the inventory of terrestrial snail has recorded 10 species, excluding the *A. fulica* being an introduced species, from three plots across the different locations. It also listed three (3) new island record, namely: *G. agglutinans, G. perakensis and Mesomphix* sp. This study provides the baseline information on the population structure and species composition of terrestrial snails in the protected landscape of Tabunan Forest. The result showed poor health status of the forest in terms of diversity and density and reflects the failing management policy on its conservation goals. Future studies on abundance and diversity of gastropod populations are highly recommended in the same permanent plots to monitor its responses against the long-term effect of environmental change. Local policies for conservation of the protected landscape may be recalculated based on the data presented in this study.

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