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Species diversity and spatial distribution of bats in Butuan City, Philippines

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Abstract. *Pastor PJB, Susi CGO, Quidet JJ, Ladesma JIA, Estaño LA. 2024. Species diversity and spatial distribution of bats in Butuan City, Philippines. Biodiversitas 25: 2791-2799.* Southeast Asia's mammalian biodiversity is exceptional in the Philippines, especially on Mindanao Island, where 53 bat species have been documented. While prior studies in the Caraga region identified vulnerable and endemic bat species, research on diversity and conservation in Butuan City remains limited. Bat biodiversity is essential in the country, and understanding Butuan City's bat populations is critical for conservation. This study recorded a total of 2,583 bats belonging to the family Pteropodidae with species *Ptenochirus jagori* Peters 1861, *Ptenochirus minor* Yoshiyuki 1979, *Macroglossus minimus* E.Geoffroy 1810, *Cynopterus brachyotis* Müller 1838, *Rousettous amplexicaudatus* E.Geoffroy 1810, as well as *Scotophilus kuhlii* Leach 1821 belonging to the family Vespertillionidae. Across six sampling sites, moderate species richness of Pteropodidae bats was observed (Shannon-Weiner Diversity Index, H' 1.13-1.47). However, analyses of evenness and dominance revealed variations in community structure. Barangay De Oro displayed the most balanced abundance, while other sites likely harbored a dominant species, potentially *C. brachyotis* or *P. jagori*. Bray-Curtis Similarity results corroborated these findings, grouping sites based on shared assemblages. Moreover, the significance of Butuan City for bat conservation is emphasized by the capture of a substantial proportion of a Philippine endemic (38.37%, *P. jagori*) and a Mindanao endemic (3.99%, *P. minor*). Distribution patterns across the sampled barangays suggested habitat specialization, with some species exhibiting preferences for specific features. Notably, *S. kuhlii* was captured exclusively in Ampayon. These findings highlight the need for multifaceted conservation strategies. Protecting core habitat areas within Bilay, Maguinda, and Sumile of Butuan, particularly for endemic species, is crucial.

Keywords: Bat diversity, Butuan City, Chiroptera, endemic species, Philippines, spatial distribution

INTRODUCTION

The Philippines' mammalian fauna is very exceptional due to its high overall species diversity and endemism (Alviola et al. 2022). Mindanao's biogeographic region, in particular, is known for its diverse mammal fauna (Perez and Nuñeza 2020). Specifically, in the volant category, bats that belong to the order Chiroptera are the Philippines' one of the most diverse mammalian order, comprising 53 recognized bat species in the Mindanao islands, with fewer than five bat families (Monteclaro and Nuñeza 2015). Three of these are known to be distributed only in the Mindanao Islands (O'Malley et al. 2006; Lobite et al. 2013). Philippine bats spend most of their time in the primary forest. Most bats hide in caves, and about 2000 caves have been identified in the Philippines, where they perform critical ecosystem functions (Medellin et al. 2017; Quibod et al. 2019).

For Caraga, Philippines, these chiropteran faunas are very important contributors to the region's biodiversity (Villancio et al. 2020). For instance, fruit and nectar-feeding bats are significant pollinators to many plants and are effective seed dispersers for many tree species, especially in tropical forests (De La Peña-Domene et al. 2014). On the other hand, insectivorous bats eat night-flying insects, including many agricultural pests, especially mosquitoes; hence, they play a vital role in managing insect populations (Donatus et al. 2019). Also, caves located in the region, in Siargao Islands, for example, are home to Philippine endemic bat species (*Rhinolophus virgo* K.Andersen 1905 and the *Hipposideros pygmaeus* Waterhouse 1843), which are now in potential threat due to observed anthropogenic disturbances in their habitats (Nuñeza and Galorio 2014).

Anthropogenic disturbances such as the mining activities within Caraga have caused a threat to the region's floristic diversity (Sarmiento 2019). Moreover, land-use change in the Caraga Region, driven by agriculture, logging, and infrastructure development, posed a continuous danger across a wide array of species, most especially the mammalian fauna (Li et al. 2014). These threats to the natural habitat of bat fauna ultimately lead to the decline of its diversity in the region (Quibod et al. 2019). This is due to the fact that roosting and foraging areas are directly reduced by habitat loss in bats, which causes population decline (Frick et al. 2020). Bat populations become isolated due to forest fragmentation, which reduces gene flow and makes them more susceptible to extinction events (López-Wilchis et al. 2021). Additionally, utilizing pesticides, which can kill bats

through direct poisoning and bioaccumulation in the food chain, is also a common practice in the Caraga Region's intensive farming methods (Perez et al. 2015; Oliveira et al. 2021). As a key component of pest management, insectivorous bats can have a cascade effect on agricultural ecosystems when their numbers drop as a result of pesticide use (Tanalgo et al. 2021).

Although several endemic and threatened species have been identified within Mindanao (Nuñeza and Galorio 2014; Tanalgo and Hughes 2018; Quibod et al. 2019; Balo et al. 2021; Tanalgo et al. 2021; Lama et al. 2023), in Butuan City of Caraga, data on bat faunal composition is still scarce and continuous assessment is highly needed. Because it has not been possible to fully estimate the number of bats in the Philippines that are extinct or endangered, several species are currently threatened. They may go extinct in the wild as a result of anthropogenic activities (Frick et al. 2020). Mindanao has very little baseline information on bat diversity and distribution, which has an impact on conservation efforts for its species (Lama et al. 2023).

This study was purposely conducted to identify the taxonomy of existing bat fauna and to assess its diversity and distribution in Butuan City, Philippines, to contribute to the growing study of Chiropteran research in the Philippines, most especially in Mindanao. The baseline data from this study can be used to inform future investigations and policies regarding the management and conservation of ecosystems, especially in urban settings. In the long run, a greater understanding of Mindanao's biodiversity will help protect important ecosystems, particularly those that are threatened by direct human activity and habitat degradation, which is currently occurring to accommodate expanding populations (Agduma et al. 2023). This baseline contribution will help with that understanding. Furthermore, this study will ultimately provide individuals who do without an existing sense of environmental responsibility exposure to urban biodiversity (especially through educational programs), therefore instilling ethical awareness towards the conservation of nature (Gallo et al. 2017).

MATERIALS AND METHODS

Study area

Butuan City, Philippines was the chosen area of study, located at 8.9475° North and 125.5406° East (Figure 1). Due to the absence of preliminary bat surveys, sampling locations were determined using a combination of geographic and ecological factors. These areas are the barangays that harbor some remaining forest patches in the city, such as agro-forest and secondary to mixed forest. Six (6) barangays were selected as sampling sites, namely, Bilay (Site 1), Maguinda (Site 2), Tungao (Site 3), Sumile (Site 4), De Oro (Site 5), and Ampayon (Site 6). According to topographic characteristics, these regions have a tropical rainforest climate. The current land use includes agricultural areas with rice fields and residential houses, agroforest and secondary forest areas, and grassland for animal grazing. The neighboring forests are also maintained to support and sustain critical ecosystem functions and services, such as Taguibo's watershed, which provides water for home and agricultural usage (Estaño 2023).

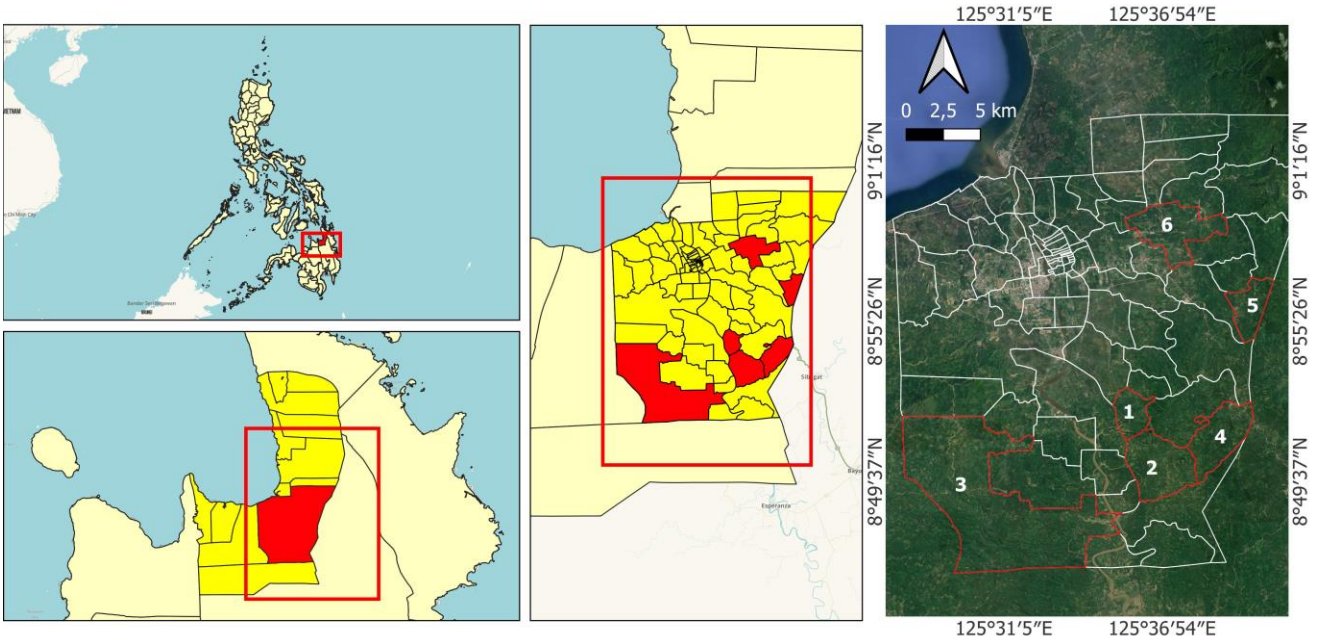

Figure 1. Map showing the sampling sites within Butuan City, Philippines. Aerial view of all sampling sites of chiropteran assessment and the established permanent sites using QGIS v3.36.0. 1: Bilay; 2: Maguinda; 3: Tungao; 4: Sumile; 5: De Oro; and 6: Ampayon, Butuan City, Agusan del Norte, Philippines

Field survey and collection

Six-meter mist nets were used and established along possible flyways in each of the ten sampling points at every site. Field survey and collection was conducted from May to June of 2021. Mist nets were set at every 1800 H and checked regularly every 30m. Bats were then released from the nets at 0530H to minimize stress (Sedlock et al. 2008). Every captured bat was recorded and then photographed. Red nail polish was used to mark the nails for every identified bat before releasing them. The study was carried out for a duration of 3 nights for each site with a total of 180 net nights. No specimens or samples of bats were collected.

Bats taxonomic identification and species composition

Bats were identified using the field guide to bats of Philippine Island developed by Ingle and Heaney (1992) and the Rapid Color Guide No. 49 Version 1.2 (web version) entitled Bats of the Mindanao Island, Philippines. The sex, age, and reproductive condition of captured bats were recorded, and standard external measurements (total length, tail length, forearm length, and ear length) were taken to aid identification up to the species level. The reproductive condition was determined by examining the genitalia of males and noting signs of pregnancy and mammary gland development in females (Johnson and Lacki 2013; Linton and Mcdonald 2020). Species composition per habitat was also identified.

Data analysis

The relative abundance was calculated by dividing the number of individuals of a species by the total number of all species. Next, to investigate the species abundance distributions between sites, a rank abundance of bats in the sampled habitats was developed in Microsoft Excel. Shannon-Weiner (H'), Evenness (eH'/S), and Dominance were calculated for their diversity indices. Bray-Curtis similarity was also used to measure the compositional similarity between sites. Heat map and dot distribution map was also employed to illustrate the distribution and accumulation of bat species across sampling sites. Calculations of diversity indices, Bray-Curtis similarity index, and preparation of graphs were done using PAST version 4.04 software, Microsoft Office Excel 2016, and Google Colab. Formulation of key distribution maps was made in QGIS version 3.36.0.

Conservation status, occurrences, and population trends

The conservation status and population trends for all bats were identified through the International Union for Conservation of Nature (IUCN) Red Lists and Department of Environment and Natural Resources (DENR) Order Number 09-2019 or the list of threatened Philippine fauna and their categories.

RESULTS AND DISCUSSION

Species composition and relative abundance

This study documented a diverse bat species within selected barangays of Butuan City, Philippines. However, a closer examination of the captured individuals revealed a clear pattern in their composition and abundance (Table 1). An overwhelming majority (2,578 out of a total of 2,583 bats, which translates to 99.8%) belonged to the family Pteropodidae, commonly known as fruit bats. Within this dominant family, Greater Musky Fruit Bat (*Ptenochirus jagori* Peters 1861) emerged as the most abundant species, with a capture count of 991 individuals (38.37%). Following *P. jagori* in terms of abundance was the Common Short-nosed Fruit Bat (*Cynopterus brachyotis* Müller 1838), with 852 captured individuals (32.98%). Geoffroy's Rousettes (*Rousettus amplexicaudatus* E.Geoffroy 1810) was the third most captured species within Pteropodidae with 504 individuals (19.51%), followed by the Lesser Long-tongued Bat (*Macroglossus minimus* E.Geoffroy 1810) at 128 individuals (4.96%). Lastly, the Lesser Musky Fruit Bat (*Ptenochirus minor* Yoshiyuki, 1979) rounded out the captured Pteropodidae species with 103 individuals (3.99%). In stark contrast to the overwhelming presence of fruit bats, only 5 individuals were captured from the family Vespertillionidae, the Lesser Asiatic Yellow Bat (*Scotophilus kuhlii* Leach 1821), which are insectivorous bats (0.19%). This remarkable disparity in abundance between Pteropodidae and Vespertillionidae necessitates further investigation to understand the ecological dynamics at play within the surveyed barangays.

The near-complete dominance of frugivorous bats (Pteropodidae) suggests a habitat highly suitable for their dietary needs. The abundance of *P. jagori*, *C. brachyotis*, *R. amplexicaudatus*, *M. minimus*, and *P. minor* indicates a diverse assemblage of fruit-bearing trees and flowers within the surveyed area. These bats play a vital role in seed dispersal and ecosystem health by consuming fruits and dispersing seeds through their droppings over long distances (De La Peña-Domene et al. 2014). Their high numbers suggest that the environment provides a reliable source of food throughout the year.

Conversely, the minuscule number of insectivorous bats (Vespertillionidae) captured, represented by only *S. kuhlii*, raises intriguing questions. This scarcity could be indicative of several factors. Firstly, a lack of prey abundance, particularly aerial insects, might be a contributing factor. The observed low abundance of Vespertilionidae during the sampling period may be attributed to seasonal fluctuations in prey availability (Bhartiy and Elangovan 2021). Because insect populations, these bats' primary food source, may vary greatly throughout the year, possibly the bat numbers decreased due to reduced supplies of their preferred food over the sampling period. Pesticide use or the absence of suitable vegetation to support a diverse insect community could also be potential explanations (Russo et al. 2018).

Table 1. Summary of data showing the species composition, relative abundance (RA), distribution, and conservation status of bats within selected barangays of Butuan City, Philippines

Taxa	Conservation status	Distribution status	Sampling sites						Total	(RA%)
			S1 (RA%)	S2 (RA%)	S3 (RA%)	S4 (RA%)	S5 (RA%)	S6 (RA%)		
Pteropodidae:										
P. jagori	LC	PE	156 (23.39%)[2nd]	229 (39.01%)[1st]	234 (54.29%)[1st]	221 (53.51%)[1st]	98 (26.85%)[2nd]	53 (44.17%)[1st]	991	38.37%
P. minor	LC	ME	20 (3.00%)[5th]	33 (5.62%)[4th]	- (0.00%)[5th]	21 (5.08%)[5th]	29 (7.95%)[5th]	- (0.00%)[6th]	103	3.99%
M. minimus	LC	NE	36 (5.40%)[4th]	12 (2.04%)[5th]	23 (5.34%)[4th]	24 (5.81%)[4th]	31 (8.49%)[4th]	2 (1.67%)[5th]	128	4.96%
C. brachyotis	LC	NE	333 (49.93%)[1st]	211 (35.95%)[2nd]	99 (22.97%)[2nd]	55 (13.32%)[3rd]	119 (32.6%)[1st]	35 (29.17%)[2nd]	852	32.98%
R. amplexicaudatus	LC	NE	122 (18.29%)[3rd]	102 (17.38%)[3rd]	75 (17.40%)[3rd]	92 (22.28%)[2nd]	88 (24.11%)[3rd]	25 (20.83%)[3rd]	504	19.51%
Vespertillionidae:										
S. kuhlii	LC	NE	- (0.00%)[6th]	- (0.00%)[6th]	- (0.00%)[5th]	- (0.00%)[6th]	- (0.00%)[6th]	5 (4.17%)[4th]	5	0.19%
TOTAL			667	587	431	413	365	120	2583	

Note: Sampling sites are the selected barangays (S1: Bilay; S2: Maguinda; S3: Tungao; S4: Sumile; S5: De Oro; S6: Ampayon); LC: Least Concern; PE: Philippine Endemic; ME: Mindanao Endemic; NE: Non-Endemic. The relative abundance (RA%) of each species per site is shown with their respective rankings

Further studies investigating the specific types of vegetation present, along with insect abundance and diversity, would be crucial to solidify these initial observations. Additionally, exploring the roosting preferences of the captured bat species could provide insights into the availability of suitable roosting sites within the barangays. A comprehensive understanding of the habitat structure, prey availability, and roosting ecology of these bat species is vital for long-term conservation efforts (Froidevaux et al. 2021; Suominen et al. 2023). By understanding the factors influencing bat diversity in Butuan City, we can develop strategies to maintain healthy bat populations, which play a critical role in seed dispersal, insect control, and overall ecosystem health.

Relative abundance curves across various sampling sites (Figure 2) unveiled distinct abundance patterns for the five primary Pteropodidae species. Notably, *C. brachyotis* showed marked dominance in Barangay Bilay (S1) and Barangay De Oro (S5). This suggests that these sites offer exceptionally suitable foraging grounds for this species, potentially harboring an abundance of its preferred fruits. The vegetation of these sampling sites harbors fruit trees and dominates *Ficus* spp., which is a commonly observed food source for fruit bats. Conversely, *P. jagori* displayed a higher abundance in barangays Maguinda (S2), Tungao (S3), Sumile (S4), and Ampayon (S6). This observation implies a potential preference for different fruit types or a more generalist diet compared to *C. brachyotis*.

The remaining captured species, *R. amplexicaudatus* and *M. minimus*, also displayed variations in abundance across sites. While the specific ranks may not be identical across all sites, the data suggests potential niche partitioning within the bat community. For instance, within Sites 1 and 5, dominated by *C. brachyotis*, *R. amplexicaudatus*, and *M. minimus* might occupy subordinate ranks, potentially feeding on different fruit resources or utilizing distinct foraging microhabitats within the same site. This pattern could be mirrored in Sites 2, 3, 4, and 6, where *P. jagori* is most abundant, with *R. amplexicaudatus* and *M. minimus* exhibiting varying subordinate ranks based on their specific ecological niches.

P. minor, with a relatively low abundance representing only 3.99% of the total captures, did not exhibit a clear dominance in any specific site. It was present in Sites 1, 2, 4, and 5 but absent in Sites 3 and 6. While its presence across multiple sites suggests some level of habitat flexibility, it's important to acknowledge that *C. brachyotis*, *P. jagori*, *R. amplexicaudatus*, and *M. minimus* were all captured in every site. *P. minor* might have a naturally lower population density compared to the other species, making it less likely to be captured in every site despite potentially utilizing similar habitats. This could also mean that the species might exhibit a preference for specific microhabitats within the sites, making them less susceptible to capture compared to species with broader foraging strategies (Froidevaux et al. 2022).

Diversity and similarity indices

Diversity index values (Table 2) show that Barangay De Oro (Site 5) stands out with the highest evenness (0.87) and lowest dominance (0.25), suggesting a balanced distribution of captured individuals among all five species. This implies no single species dominates the bat community, potentially due to a diverse habitat or abundant preferred fruits for all species. In contrast, Bilay, Maguinda, Sumile, and Ampayon (sites 1, 2, 4, and 6) displayed moderate evenness (0.70 to 0.72) and dominance (0.31 to 0.36) values. While these sites maintain moderate species richness, they likely harbor a dominant species, possibly *C. brachyotis* or *P. jagori*, suggesting these locations offer particularly suitable foraging grounds. Site 3 (Tungao) exhibited the lowest H' (1.13) and slightly higher dominance compared to other sites with similar evenness. This could indicate a lower species richness or a more pronounced dominance by a single species, warranting further investigation into captured species composition.

These findings highlight the importance of considering both species richness and evenness for bat conservation. While barangay De Oro, with its balanced abundance, might be a priority due to its potential for harboring a wider variety of ecologically important bat species, all sites with a moderate level of diversity deserve protection. Understanding the dominant species at each location can lead to tailored conservation strategies, such as focusing on habitat preservation to benefit both dominant and subordinate species, ensuring a balanced bat community persists (Rodhouse et al. 2015).

Table 2. Biodiversity indices in Butuan City across selected Barangays

Sampling sites	No. of species	Diversity (Shannon_H')	Evenness (eH'/S)	Dominance (D)
Site 1	5	1.26	0.7051	0.3412
Site 2	5	1.28	0.7197	0.3152
Site 3	4	1.13	0.774	0.3807
Site 4	5	1.254	0.7012	0.3597
Site 5	5	1.472	0.8717	0.25
Site 6	5	1.248	0.6965	0.3256

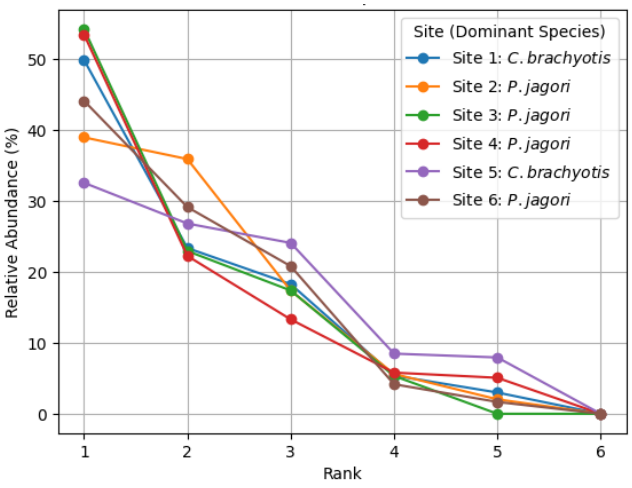

Figure 2. Rank-abundance curve of bat species in each sampling site. Species indicated per site are the species of the highest abundance

This data emphasizes the need for ongoing monitoring and habitat conservation efforts to ensure the long-term sustainability of the diverse bat fauna in Butuan City. Bray-Curtis Similarity (Figure 3) reveals an interesting pattern of species composition across the sites. Interestingly, Tungao and Sumile emerge as the most similar bat communities (Bray-Curtis similarity=0.9742), suggesting that the bat species captured at these locations share a very high degree of overlap. This could be attributed to several factors, such as similar habitat characteristics (e.g., vegetation type, fruit availability) that cater to the same bat species or geographical proximity, allowing for easy movement between these sites. Following closely behind are De Oro, Maguinda, and Bilay, exhibiting a high degree of similarity (Bray-Curtis similarity>0.93) with Tungao and Sumile. This suggests that while these sites might harbor some unique bat species compared to Tungao and Sumile, a significant core group of species is shared across these locations. The slightly lower similarity values compared to Tungao and Sumile could indicate variations in habitat features or resource availability that influence the presence or abundance of certain bat species. Finally, Ampayon stands out as the least similar bat community (Bray-Curtis similarity = 0.7455) compared to all other sites, particularly Bilay (furthest at 0.7455). This significant difference suggests a distinct bat assemblage present at Ampayon. This dissimilarity could be due to unique habitat characteristics in Ampayon that favor a different set of bat species compared to the other sites (Peixoto et al. 2018). *S. kuhlii*, which was only found in Ampayon, was one of the indicative factors of the said dissimilarity. Ampayon is characterized as having a secondary forest with several Agricultural areas-a preferred habitat for *S. kuhlii* (Ahmad-Bakri et al. 2021).

Distribution, endemic significance, and conservation needs

The analysis of captured bat individuals in the study reveals an interesting mix of endemic and non-endemic species (Figure 4). While a significant portion (57.64%) comprises non-endemic species like *M. minimus*, *C. brachyotis*, *R. amplexicaudatus*, and *S. kuhlii*, the presence of endemic species provides a more complex picture with important conservation implications. The significant presence of *P. jagori*, a Philippine endemic, highlights the importance of Butuan City for this bat species. Urgent conservation efforts should prioritize protecting habitats suitable for *P. jagori* to ensure the long-term viability of its populations within the city. The capture of *P. minor*, a Mindanao endemic, raises a critical conservation concern. Its low abundance (3.99%) suggests a potentially vulnerable population within Butuan City. Targeted research to understand its specific habitat requirements and threats is crucial for developing effective conservation strategies for this critically endangered species (Fidelino et al. 2020).

The observed distribution patterns of captured bat species in Butuan City (Figure 5), along with data on their densities in adjacent barangays (Figure 6), offer valuable insights into geographic and ecological dynamics. Habitat specialization and resource availability seem to play a significant role. While *P. jagori* (Philippine endemic) is present across all sites, its higher density in Bilay, Maguinda, and Sumile suggests a preference for specific habitat features or resources concentrated in these areas (Figure 6.A); understanding these preferences through further research is vital for targeted conservation efforts. The Mindanao endemic *P. minor* (Figure 6.B) reinforces this concept with its exclusive presence in Bilay, Maguinda, Sumile, and De Oro, highlighting a more restricted habitat association and the urgency of protecting its specific requirements within these locations (Tanalgo and Hughes 2018).

For *M. minimus* (Figure 6.C) and *C. brachyotis* (Figure 6.D), their presence across all sites with higher densities in Bilay suggests a potential preference for the habitat features or resources found in this barangay. Their broader adaptability allows them to utilize resources across Butuan City, but Bilay might offer more optimal foraging conditions.

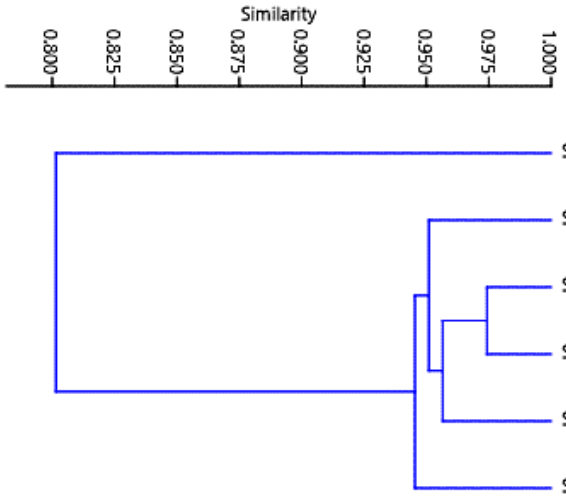

Figure 3. Bray-Curtis Similarity of bat species across sampling sites: Bilay (S1); Maguinda (S2); Tungao (S3); Sumile (S4); De Oro (S5); Ampayon (S6)

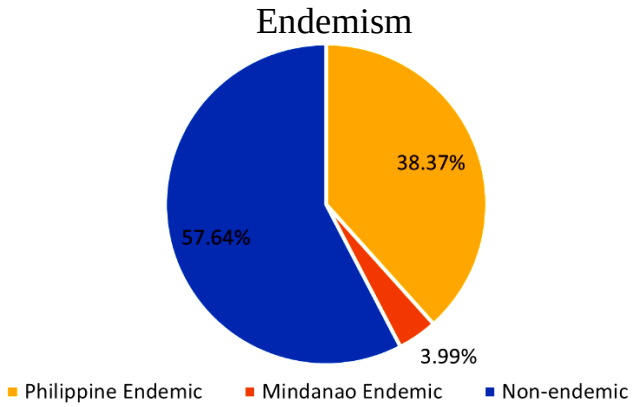

Figure 4. Pie chart showing the endemism of collected bat individuals

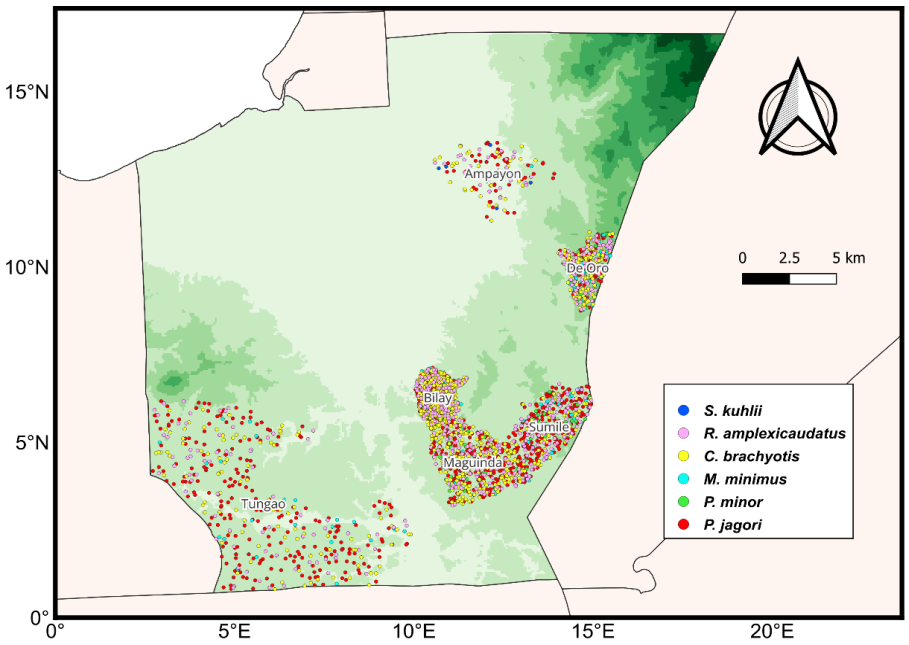

Figure 5. Map showing the spatial distribution and accumulation of all collected species across sampling sites

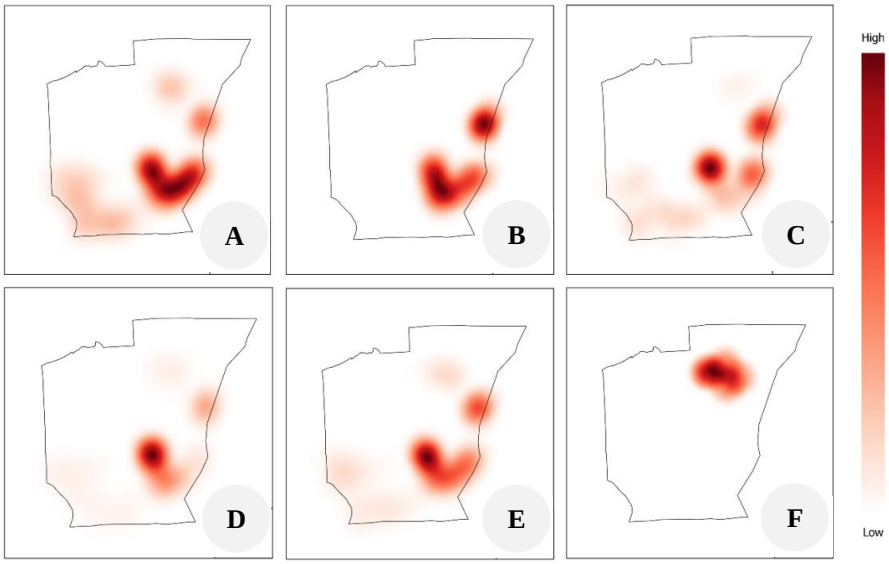

Figure 6. Heat map showing the distribution patterns of each collected bat species across sampling sites: A. *Ptenochirus jagori*; B. *Ptenochirus minor*; C. *Macroglossus minimus*; D. *Cynopterus brachyotis*; E. *Rousettus amplexicaudatus*; F. *Scotophilus kuhlii*

A similar trend is seen with *R. amplexicaudatus* (Figure 6.E), with its higher density in Bilay, Maguinda, and Sumile followed by De Oro, suggesting a preference for similar habitat features across these locations. The exclusive capture of *S. kuhlii* in Ampayon (Figure 6.F) further emphasizes the potential role of specific habitat requirements or resource utilization patterns influencing bat distribution.

These geographic patterns extend beyond Butuan City. Higher densities of several bat species (excluding *S. kuhlii*) in adjacent barangays like Bilay, Maguinda, and Sumile compared to De Oro, Tungao, and Ampayon suggest a potential gradient in habitat suitability. These barangays may offer more extensive and higher quality foraging grounds or roosting sites compared to the others. The presence of both endemic and non-endemic species in De Oro also suggests potential connectivity corridors between Butuan City and its surroundings, offering hope for the conservation and management of bat species (Li and White 2024). De Oro might serve as a stopover or foraging ground for some bat species while they move between other locations.

From a conservation perspective, these findings highlight the importance of considering habitat heterogeneity within Butuan City and its surrounding areas. Protecting core

habitat areas within Bilay, Maguinda, and Sumile, especially for the endemic species *P. jagori* and *P. minor*, becomes crucial (Tanalgo and Hughes 2018). Additionally, understanding the ecological factors that influence bat distribution across the broader landscape can help identify critical connectivity corridors that warrant protection to maintain healthy bat populations (Frick et al. 2020). By taking a multifaceted approach that considers both site-specific and landscape-level factors, conservation efforts can be tailored to ensure the long-term sustainability of this diverse bat fauna in Butuan City.

In summary, this study revealed moderate bat diversity (H' 1.13-1.47) across six sampling sites in Butuan City, Philippines. While all sites captured at least four Pteropodidae species, evenness (eH'/S) and dominance (D) values indicated variations in community structure. Site 5, which is in De Oro, displayed a partly balanced abundance since it has the highest evenness value (0.8717), which means that species composition in this site is evenly distributed, whereas *C. brachyotis* or *P. jagori* dominates other sampling sites. Bray-Curtis Similarity results further supported these findings, grouping sites based on shared assemblages. Notably, a significant presence of Philippine endemics (38.37%, *P. jagori*) and a Mindanao endemic (3.99%, *P. minor*) underscores Butuan City's importance for bat conservation. Distribution patterns observed across sampled barangays suggest habitat specialization, with some species favoring specific features (e.g., *P. jagori* and *P. minor* in Bilay, Maguinda, and Sumile). Additionally, *S. kuhlii* was only captured in Ampayon in a few numbers, suggesting a potentially unique habitat preference or resource utilization pattern compared to other locations and possibly posing a threat to the population. These findings highlight the need for multifaceted conservation strategies, including habitat protection, management, identification of connectivity corridors, as well as long-term monitoring and research to ensure the long-term sustainability of this diverse bat fauna. Protecting core habitat areas, particularly in Bilay, Maguinda, and Sumile, for endemics is crucial. Habitat management strategies based on species resource requirements and identifying connectivity corridors between Butuan City and surrounding areas are essential. Long-term monitoring and research on resource availability, threats, and population trends are necessary to ensure the long-term sustainability of this diverse bat fauna.

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