Coral Bay Nickel Corporation

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DATE : November 2, 2022

FOR : **ENGR. WILLIAM P. CUÑADO**
Director
ENVIRONMENTAL MANAGEMENT BUREAU
DENR Compound, Visayas Ave.,
Diliman, Quezon City

Attention: **ENGR. ESPERANZA A. SAJUL**
Chief, Environmental Impact Assessment and Management Division

FROM : **BENJAMIN ARMAND A. TANSINGCO**
VP-Environmental Management

SUBJECT : **Report on the 2022 Fauna Monitoring Report of the HPP Project Site**

Dear Director Cuñado:

We are submitting herewith to your office the "2022 Monitoring Report of CBNC Terrestrial Vertebrates," in compliance to the EMoP of the December 2018 Environmental Performance Report and Management Plan (EPRMP) of Coral Bay Nickel Corporation. The field investigation for this study was conducted last June-13-18, 2022 by Forestereplan Landscape Consultancy Service.

We shall take note of the recommendations made by the assessment team on the monitoring report and will make our best effort to implement those that are possible for our company to undertake.

Thank you very much.

Very truly yours,

BENJAMIN ARMAND A. TANSINGCO
VP- Environmental Management

Copies Furnished:
1. **JOE AMIL M. SALINO**
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   Palawan Council for Sustainable Developmentc

Coral Bay Nickel Corporation

Faunal Component

Wildlife Monitoring Survey in Rio Tuba, Palawan

2022 Monitoring Report of CBNC Terrestrial Vertebrates

June 2022




Prepared by

FORESTERplan©

Landscape Consultancy Service

"Sustainable Practice, Sustainable Return"

022 MONITORING REPORT OF CBNC TERRESTRIAL VERTEBRATES

Prepared for

CORAL BAY NICKEL CORPORATION
Rio Tuba, Palawan

BY

FORESTEREPLAN LANDSCAPE CONSULTANCY SERVICE
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Philippines

08 AUGUST 2022

FORESTEREPLAN LANDSCAPE CONSULTANCY SERVICE conducted the 2022 monitoring survey of terrestrial vertebrates solely for the use of the Coral Bay Nickel Corporation in accordance with generally accepted professional principles in environmental assessment and mine progressive rehabilitation. No other warranties, express or implied are made.

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AUTHORSHIP AND REVIEW

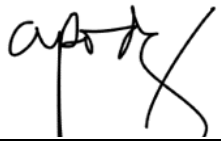
Document Title: 2022 MONITORING REPORT OF CBNC TERRESTRIAL VERTEBRATES

Date: August 10, 2022

Author/s: ANNA PAULINE O. DE GUIA
PAULO MIGUEL KIM

Reviewer: ANNA PAULINE O. DE GUIA

REVISION HISTORY

REVISION	DATE OF ISSUE	DESCRIPTION	AUTHORITY	
			NAME	SIGNATURE
0	June 12-18,2022	Fieldwork for the Monitoring of Terrestrial Vertebrates	Anna Pauline O. de Guia Wildlife Specialist/ Consultant	
1	August 15,2022	Submission of the 1st draft for CBNC Review	Anna Pauline O. de Guia Wildlife Specialist/ Consultant	
2	September 9,2022	Submission of revised draft to CBNC based on the comments and suggestions of EMQS staff	Anna Pauline O. de Guia Wildlife Specialist/ Consultant	
3		Submission of Final Report to CBNC	Anna Pauline O. de Guia Wildlife Specialist/ Consultant	

EXECUTIVE SUMMARY

The annual monitoring of terrestrial vertebrates was conducted on June 12-18, 2022, during the onset of the rainy season. Eight sites were targeted for monitoring: Ibelnan, TSF1 (Rehabilitated Tailings Storage Facility 1), Bulanjao, Magas-Magas, Kinurong, TSF3, Nagoya and Ursula Island.

A total of 101 terrestrial vertebrate species (74 birds, 10 amphibians, 7 reptiles and 10 mammals) were documented during the 2022 monitoring survey. A similar number of species was documented during the previous 2021 survey (101 species); however, there are variations in ratio of vertebrate species.

BIRDS

a) The highest number of species was documented in TSF3 with 40, followed by TSF1 (33), Kinurong (32), Magas-Magas (22), Nagoya (21), Bulanjao (21), Ibelnan (20) and Ursula Island with 15. One species was common to all sites, *Cinnyris jugularis aurora*.
b) Only one migratory species, *Pandion halieatus*, was documented this season.
c) Among the general habitat types, forestlands and associated habitats yielded the highest percentage of occupancy (41.9%), followed by mixed habitats (18.9%) and grassland and open country (12.2%). The rest rank by less than 10% of occupancy (i.e., forest edge, wetlands and associated habitats), cosmopolitan, riparian and agricultural).
d) Omnivores and insectivores were found to have dominated over other feeding guilds (28.4% each). Carnivorous birds occupied 17.6% of the total number of species, followed by frugivores (12.2%). At lower tiers, granivores had a percentage of 6.8%, herbivores at 2.7% and the remaining piscivores, nectarivores and invertivores all at 1.4%
e) A large majority of bird species (75.7%) in the monitoring sites were found to be residents, with only 20.3% classified as Philippine endemics. Near endemic, migratory and introduced species were each represented by a single species (1.4%).
f) Based on the 2022 IUCN Red list criteria, 89.2% of species were found to be Least Concern, 8.1% as Near Threatened, and 1.4% each for vulnerable and endangered species. According to the DENR Red list Criteria, 91.1% were Other Wildlife Species, 4.1% were Endangered and 1.4% were Critically Endangered. The PCSD criteria ranked Least Concern as the highest (63.3%), Endangered at (10.8%), 9.5% as Vulnerable and 4.1% as Critically endangered. A portion of the species (12.2%) were not classified under their criterion.
g) Shannon species diversity index was found to be higher in TSF3, followed by TSF1. Magas-magas and Bulanjao ranked moderately high species diversity while Kinurong, Nagoya, Bulanjao and Ibelnan were ranked with low diversity indices. Ursula Island had a very low species diversity over the others.

MAMMALS

a) Ten species of mammals (6 volant and 4 non-volant) were documented from the 8 monitoring sites; 2 from Bulanjao, 2 from Ibelnan, 4 each from Kinurong, Nagoya and Magas-magas, 3 from Ursula Island 3 from TSF3 and 4 from TSF1.
b) *Cynopterus brachyotis* was the only species of mammals which were consistently documented from the other sites.
c) Frugivore mammals were the dominant feeding guild (40%), followed by omnivorous mammals (20%) and insectivorous mammals (20%).
d) A large majority of mammal species were found to be native species (77.8%). Introduced and endemic species of mammals were each represented by a single species (11.1%). The single introduced species, *Rattus tanezumi*, is a household and agricultural pest.
a) Based on the 2022 IUCN Red list criteria, 90% of species were found to be Least concern and 10% was classified under Near Threatened. According to the DENR Red list Criteria, 90% were Other Wildlife Species, 10% were classified as not classified and 10% species were identified as Endangered. The PCSD criteria ranked Least Concern as the highest (80%) with Not Classified and Endangered as represented by 10% of each.
e) Relatively speaking, the Shannon diversity index in each of the monitoring sites were found to range from low to very low.

HERPETOFAUNA

a) A total of 17 species (10 species of frogs and 7 species of reptiles) were documented from each of the 8 monitoring sites. The highest species richness for herpetofauna was in Bulanjao (8 species), followed by Ibelan and TSF3 (5 species), Kinurong and Magas-magas (4 species each) and Nagoya Bay and Ursula Island (2 each). TSF1 was found to have the lowest species richness (1 species)
b) Seventy percent or 7 species of herpetofauna were found to be endemic are resident. Among amphibians, 70% of species were found to be endemic while among reptiles, 67.1% were similarly native.
a) According to the IUCN, 70% of the species of amphibians are Least Concern 10% are endangered, 10% Vulnerable, and 10% Near Threatened. For reptiles, 71.4% were classified as Least concern while 28.4% was classified as unclassified (Not Classified). Based on the DENR Red List, all frog and reptile species were classified under Other Wildlife Species. Under the PCSD conservation status classification, 30% of amphibians were classified under Least Concern, 10% under Vulnerable, 10% under Endangered and 50% of species did not have any classification. Similarly, all reptile species documented by the survey had no PCSD classification.
c) Species diversity and richness were ranged from low to very low though generally ranked higher than mammals in some sites and just below those of birds.

MONITORING AREAS

Eight designated monitoring sites (Table 1) were surveyed for terrestrial vertebrate fauna from June 13-18, 2022. Each site was assessed for its avian, herpetofaunal and mammal diversity, using standardized sampling methods. These designated sites have been the subject of annual assessments since the early 2000's and have had consistent data since then.

METHODOLOGY

Standardized sampling techniques were utilized for the monitoring activity. A similar set of protocols were utilized for the activities as conducted during the previous years. They consist of the following: for bird sampling, standard point count transects using ocular observation and supplemented by opportunistic catch from mist nets; for reptiles and amphibians, a nocturnal visual encounter survey across selected microhabitat; for non-volant mammals, baited trapping array; and for volant mammals, the use of mist-net series. Two teams monitored a designated daily to fit the schedule. Nagoya and Ursula Island were exceptions due to logistical reasons.

The specifics of each sampling methods for each taxon are detailed below.

Avifaunal sampling

Bird sampling was conducted between 5:30- 8:00 AM (dawn) and between 3:30 – 6:00 PM (dusk) to maximize peak activities of birds. A standard 2-km transect was established for each monitoring site, targeting the length of each site. To ascertain bird diversity and abundance, a point-count system was used. The transect was divided into 100-m intervals. Direct ocular observation was conducted at each interval point (5 minutes on each point) using binoculars and field guides. Auditory calls were used to supplement non-ocular observations. Opportunistic sightings between intervals were also noted. Photo documentation was conducted using telephoto cameras.

Simultaneous transect walks were conducted in adjacent monitoring sites (i.e., Ibelnan and Magas-Magas) as a measure against possible double count biases. Mist-net series (2-3 per series) were set serially in the late afternoon in strategic locations along the sampling sites (e.g., possible flyways, near rivers and streams, forest edges and interiors). Mist-net captures were added as supplementary occurrence and distribution data for the cryptic bird species. A series of three 12-meter nets were checked intermittently from early afternoon to early morning for captures per site, amounting to a total 561.6 m^2h mist net hours.

Identification, nomenclature, classification and conservation status was based on the works of Kennedy et al. (2000), Desmond (2020) and the Wild Bird Club of the Philippines-Checklist of Birds of the Philippines (2021).

Mammal sampling (non-volant and volant)

Live traps were predominantly used to sample murids and similar small non-volant mammals. A total of 20-25 wire traps were baited with peanut butter-infused roasted coconut and deployed across each site, targeting potential runways and dens (i.e., buttresses, ground-level holes, grass).

Table 1. Eight monitoring sites under Coral Bay Nickel Corporation (CBNC) for the 2022 faunal assessment.

Station ID	Sites	GPS Coordinate	Elevation (masl)	Classification	Description
1	Ibelnan Intake Dam and Resort Area	N 8.57065, E 117.39279	119.31	Ultramafic secondary growth	Comprises of secondary growth on ultramafic soil running adjacent to a stream. Ibelnan Intake Dam is a series of dams which connects the primary dam to a sub-dam near the resort area. Canopy levels are low and there is an absence of large trees along the transect trail
2	Lower and Upper Kinurong	N 8.55475, E 117.419	19.81	Rehabilitated man-made ponds	A pair of man-made siltation ponds (upper and lower) used to process and release water used in plant operations. The ponds are situated smaller planting facilities which maintain and facilitate the rehabilitation of the surrounding forest. The lower pond is used to monitor water quality prior to its release.
3	Nagoya Beach	N 8.50452, E 117.44957	9.144	Coastal community and agricultural land	A human-occupied beach represented by agricultural plantations and secondary growth. As the entry to Nagoya port, human occupancy is high from workers as well as from the local coastal community. A stretch of mangrove forest extends from the port to the communities.
4	Magas-Magas/ Mangingidong	N 8.57209, E 117.40382	57.04	Forest edge	A small patch of forest directly adjacent to mining roads. Due to the high daily traffic of trucks and other vehicles, the area has near constant noise disturbance and dust. Large broadleaf trees are an infrequent occurrence along the patch and the area is greatly dominated by secondary growth.
5	Mt. Bulanjao Forest	N 8.56405, E 117.37325	495.03	Primary and secondary forest	Secondary to primary forest (at higher elevations). Relatively undisturbed but shows previous signs of disturbance (roads were rough but shows signs of development). The base of the mountain road is bordered by a stream system. At 500 masl, patches were cleared from a previous mining activity.

Station ID	Sites	GPS Coordinate	Elevation (masl)	Classification	Description
6	Rehabilitated Tailings Storage Facility 1 (TSF1)	N 8.56811, E 117.42181	69.45	Rehabilitated agricultural grassland	Rehabilitated Tailings Storage Facility 1 (previously TSF1) is a rehabilitated storage pit. Previously utilized for processing nickel, all vegetation are secondary growth and replanted. Currently being used for reforestation and rehabilitation activities by CBNC.
7	Ursula Island Game Refuge and Bird Sanctuary	N 8.34002, E 117.51532	4.16	Island coastal forest	Island sanctuary and bird refuge. Ursula Island is a protected area which houses a few rare bird species, including the Mantanani owl, Nicobar pigeon and is the breeding site of the Pied imperial pigeon. It is also the nesting site of Green and hawksbill turtles and the feeding site of *Pteropus hypomelanus*. Currently under prolonged infestation from introduced rats. The coastal forest consists of heavy canopy cover and thick undergrowth. Various large trees (i.e. *Ficus*) can be seen in the interior of the island.
8	TSF3 Adjacent Area	N 8.59116, E 117.42201	59.98	Rehabilitated grassland	Extended grassland and scrub area. The area runs adjacent to the road of a local community. Currently under development into a new tailings storage facility. A minor stream tributary intersects with the site.

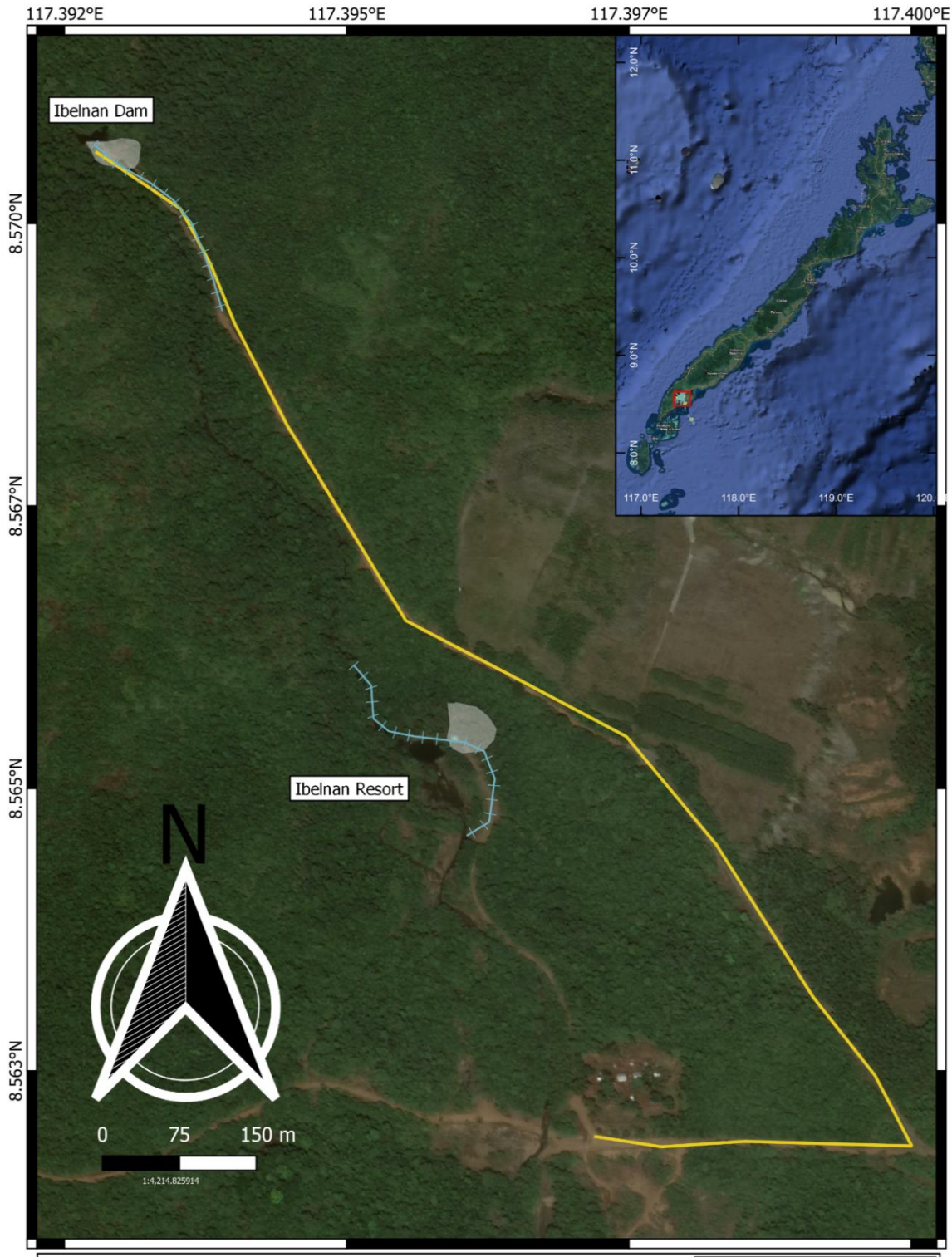


Figure 1. Map of faunal assessment survey for Ibelnan Intake Dam and Resort Area , Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.
Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

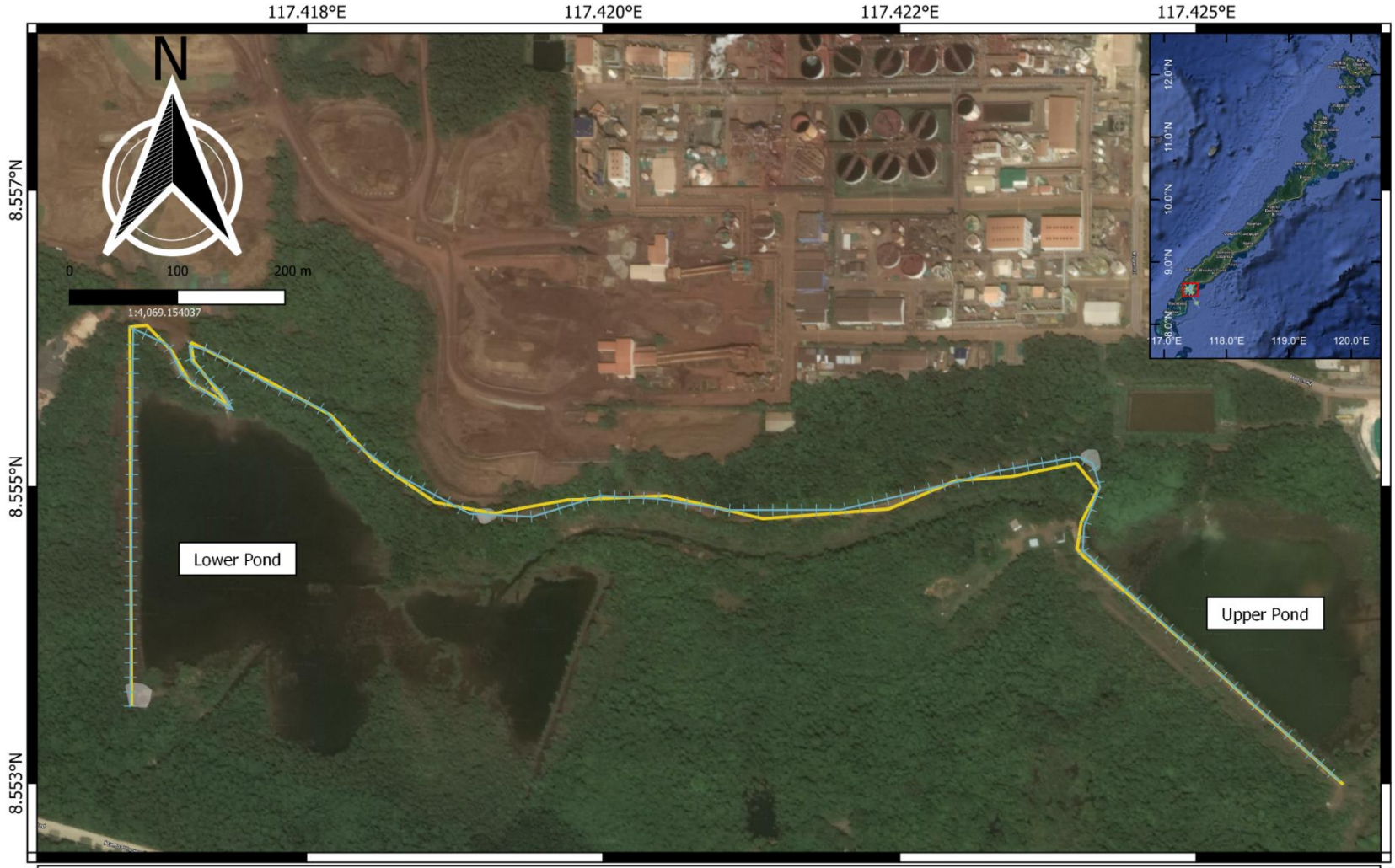


Figure 2. Map of faunal assessment survey for Lower and Upper Kinurong , Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

Figure 3. Map of faunal assessment survey for Nagoya Beach, Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim, July 2022

Figure 4. Map of faunal assessment survey for Magas-Magas, Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

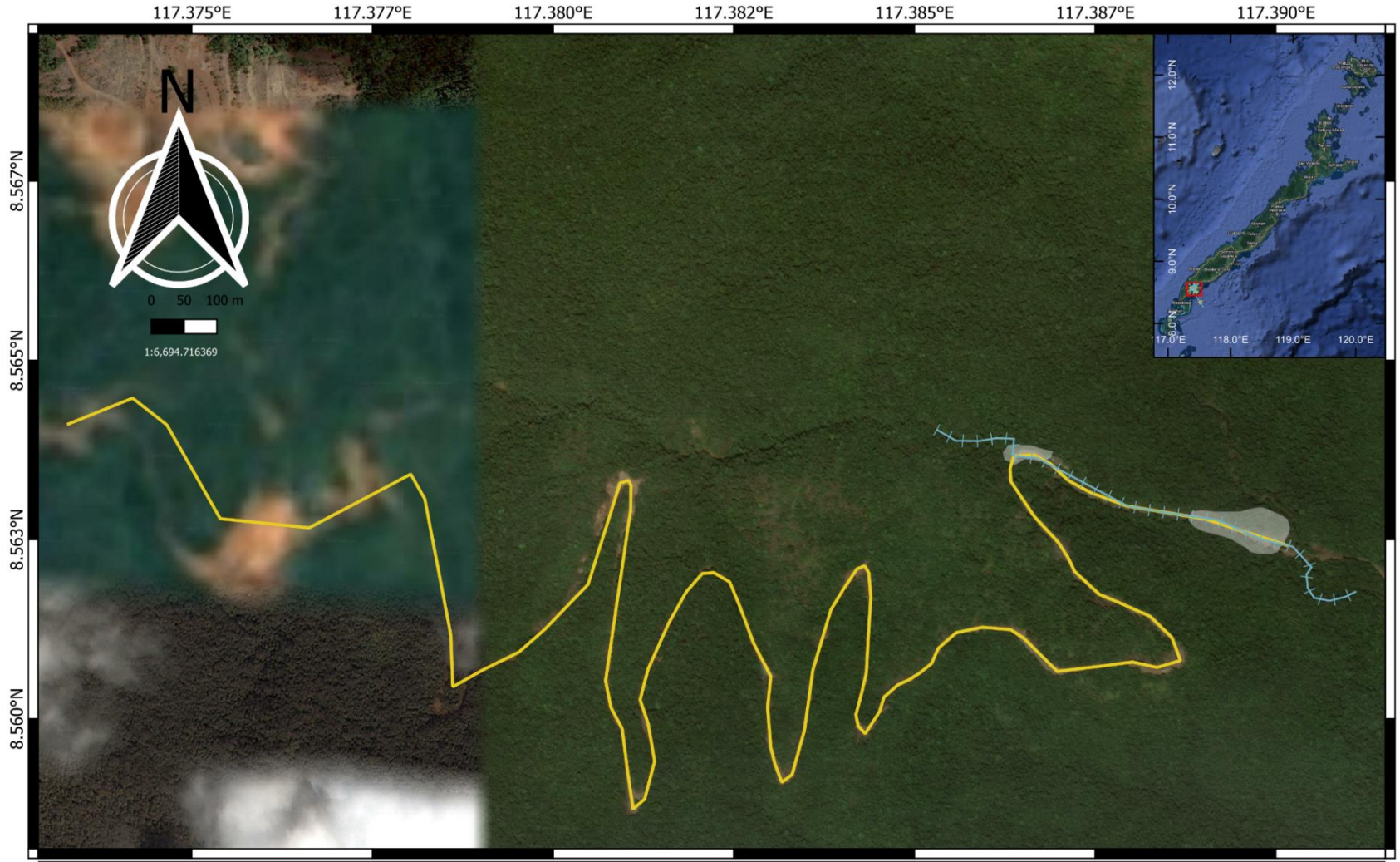


Figure 5. Map of faunal assessment survey for Mt. Bulanjao Forest, Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

Figure 6. Map of faunal assessment survey for Rehabilitated Tailings Dam (TSF1), Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

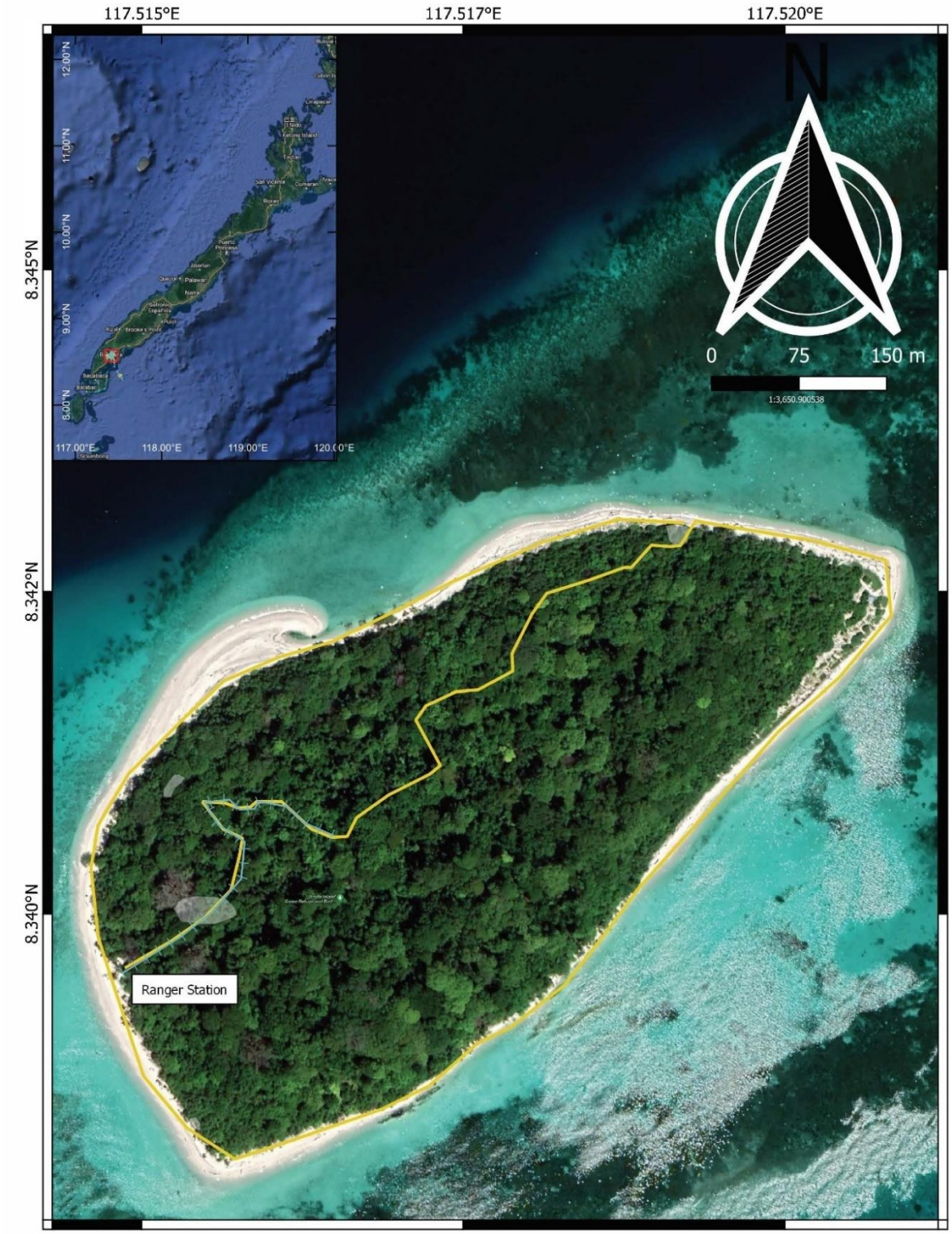


Figure 7. Map of faunal assessment survey for Ursula Island Game Refuge and Bird Sanctuary, Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.
Prepared by : Paulo Kim, July 2022

Legend:
- Herpetofaunal transect
- Bird Survey
- Mist net and trap locations

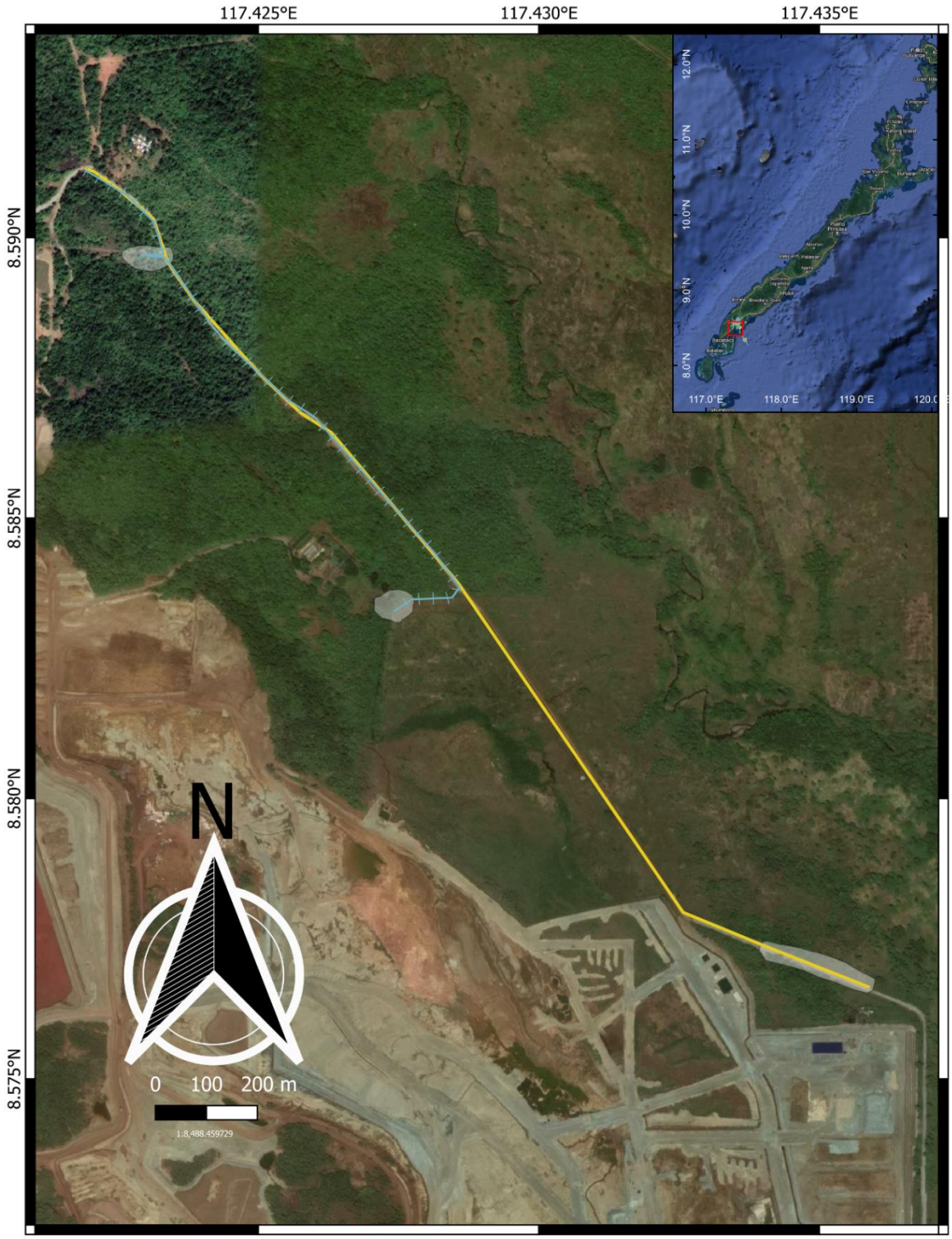


Figure 8. Map of faunal assessment survey for TSF3 Adjacent Area, Coral Bay Nickel Corporation (CBNC), Rio Tuba, Palawan, Philippine Islands.

Prepared by : Paulo Kim

nests etc.). Traps were placed during the early afternoon and checked early for captures in the early morning the day after. The total trapping nights per site was 25 traps per night.

The nets were set and opened at 6:00 PM and removed the following morning at 6:00 AM. Net watching was conducted from 6:00 - 8:00 PM, targeting the smaller insect bats. A sky net was set in Ursula Island to target the larger flying foxes. All captures were processed and released in the early morning. Netting nights per site was computed at 1,132 m^2h mist net hours.

Medium to large non-volant species were documented opportunistically. Tracks and other sign identification (e.g. droppings, wallowing areas, scratch marks, dens) and direct sightings were documented for terrestrial and arboreal species.

Identification, nomenclature, classification and conservation based on the works of Heaney et al. (1998) and Esselstyn (2004), as well from the IUCN Redlist site (2021).

Herpetofauna (Reptiles and Amphibians)

Herpetofauna sampling was conducted from 7:00 to 10:00 PM. Strip transects (up to a total of 1 km) were used with visual encounter surveys across the established bird transect. A total of 6 man hours were accrued per night in each site. Specific microhabitats (e.g. streams, forest litter, tree holes and foliage) were targeted for purposive sampling. Direct ocular observations were used to sample for species diversity and abundance, supplemented by auditory calls when possible.

Specimens for each species were extensively photo documented and identified using guides and journal articles from Brown and Alcala (1978, 1980), Diesmos et al. (2016) and Leviton et al (2019).

RESULTS

BIRDS

Seventy-four species of birds (42 families) (Figure 9) were documented from the 8 monitoring sites during the 2022 terrestrial vertebrate survey. The olive-backed sunbird (*Cinnyris jugularis aurora*) was a common species among all of the sites.

A comparison of previous bird surveys (2020 and 2021) with the current survey (Table 2) shows several species which were redocumented after being absent from some contemporary surveys.

There was a slight decrease in the number of species from 2021 to 2022 (84 species to 75 species) as seen in parentheses. Of the 74 bird species documented, 40 species (43) were documented in TSF3, 33 species (17) in TSF1, 32 species (37) in Kinurong, 21 species (31) in Bulanjao, 22 species (27) in Magas-Magas, 21 (25) species in Nagoya, 20 species (27) were in Ibelnan and 15 (15) species in Ursula Island. This discrepancy between the two sampling periods may be accounted for by the onset of the rainy seasons in June 2022 and being the off-season for bird migration.

Table 2. Species of birds observed and recorded from 8 CBNC monitoring sites during the 2022 monitoring survey.

Species	Common Name	Monitoring Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF 3	Ursula Island	Bulanjao
BIRDS									
Accipitridae									
Haliaeetus leucogaster	White-bellied sea eagle	2						1	4
Spilornis holospilus	Philippine serpent eagle								1
Aegithinidae									
Aegithina tiphia	Common Iora		9	6	4	4	8		
Alcedinidae									
Ceyx cyanopectus	Indigo-banded kingfisher		1						
Ceyx erithaca	Oriental Dwarf-kingfisher								1
Pelargopis capensis	Stork-billed kingfisher		2						
Todiramphus chloris	Collared kingfisher	1	11	5	14	21	13	17	
Anatidae									
Dendrocygna arcuata	Wandering whistling duck		132						
Apodidae									
Collocalia (esculenta) marginata	Philippine glossy swiftlet	6	17	5	10	12	8		
Collocalia troglodytes	Pygmy swiftlet	6							
Ardeidae									
Ardea purpurea	Purple heron		1						
Egretta garzetta	Little egret		2						
Artamidae									
Artamus leucorynchus	White-breasted woodswallow					4		9	
Bucerotidae									

Species	Common Name	Monitoring Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF 3	Ursula Island	Bulanjao
Anthracoceros marchei	Palawan hornbill		1						4
Campephagidae									
Lalage nigra	Pied triller				1		2	4	
Pericrocotus igneus	Fiery minivet								1
Caprimulgidae									
Caprimulgus macrurus	Large-winged nightjar	1	1	1		1	1		
Chloropsidae									
Chloropsis palawanensis	Yellow-throated leafbird	8	6	2					6
Cisticolidae									
Cisticola (juncidis) tinnabulans	Double zitting cisticola						7		
Orthotomus sericeus	Rufous-tailed Tailorbird	5	9	3	8	7	8		11
Columbidae									
Caloenas nicobarica	Nicobar pigeon							3	
Chalcophaps indica	Emerald dove		1				1	7	
Ducula bicolor	Pied Imperial pigeon							2057	
Ducula pickeringii	Grey-Imperial pigeon							3	
Geopelia striata	Zebra dove				10	3	4		
Spilopelia chinensis	Eastern spotted dove						3		
Treron vernans	Pink-necked green pigeon	3	4			17	4		
Corvidae									
Corvus enca	Slender-billed crow		6		5	7	3		2
Cuculidae									
Cacomantis merulinus	Plaintive cuckoo					1	1		
Centropus bengalensis	Lesser coucal				2	4	6		
Centropus sinensis	Greater coucal		3	1		1	1		

Species	Common Name	Monitoring Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF 3	Ursula Island	Bulanjao
Eudynamys scolopaceus	Asian koel							4	
Phaenicophaeus curvirostris	Chestnut-breasted malkoha	2	3						
Dicaeidae									
Dicaeum pygmaeum	Pygmy flowerpecker	5	9	2	3	2	5		8
Prionochilus plateni	Palawan flowerpecker	12	9	3		5	2	1	4
Dicruridae									
Dicrurus leucophaeus	Ashy drongo		2			10	9		
Estrildidae									
Lonchura atricapilla	Chestnut munia			4		2	9		
Lonchura leucogastra	White-bellied munia						3		
Lonchura punctulata	Scaly-breasted munia		2		3	6	15		
Falconidae									
Falco peregrinus	Peregrine falcon								3
Hirundinidae									
Hirundo rustica	Barn swallow				2				
Hirundo tahitica (javanica)	House/ Pacific swallow		2		5	5	2		
Irenidae									
Irena tweedddalii	Palawan fairy-bluebird		1						
Locustellidae									
Megalurus palustris	Striated grassbird						4		
Megapodidae									
Megapodius cumingii	Tabon megapode							5	
Monarchidae									
Hypothymis azurea	Black-naped monarch	1	4	4			2		2
Terpsiphone cyanescens	Blue-paradise flycatcher			2		3	3		
Motacillidae									

Species	Common Name	Monitoring Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF 3	Ursula Island	Bulanjao
Anthus rufulus	Paddyfield pipit			3		1	4		
Muscicapidae									
Copsychus (Kittacincla) niger	White-vented shama	2		2	2	3	2		
Nectariniidae									
Aethopyga shelleyi	Lovely sunbird					2			6
Antreptes malacensis	Brown-throated sunbird						2		
Arachnothera longirostris	Little spiderhunter	2			1	1			
Cinnyris jugularis aurora	Olive-backed sunbird	7	5	5	4	4	5	6	7
Leptocoma sperata	Purple-throated sunbird	1		5			5		7
Pandionidae									
Pandion halietus	Osprey		1						
Pariidae									
Pardaliparus amabilis	Palawan tit								3
Passeridae									
Passer montanus	Eurasian tree sparrow				17	4	3		
Pellornidae									
Pellorneum (Trichastoma) cinereiceps	Ashy-headed babbler				1				
Picidae									
Chrysocolaptes erythrocephalus	Red-headed flameback						1		
Pittiidae									
Pitta (sordida) sordida	Western Hooded Pitta			3					1
Psittaculidae									
Tanygnathus lucionensis	Blue-naped parrot	1		4		1			
Pycnonotidae									

Species	Common Name	Monitoring Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF 3	Ursula Island	Bulanjao
Alophoixus frater	Palawan Bulbul	15	14	6	10	2	2		6
Brachypodius atriceps	Black-headed bulbul		7			2	8		
Iole palawanensis	Sulphur-bellied bulbul					3			
Pycnonotus cinereifrons	Ashy-fronted Bulbul	19	22	9	6	11	9		15
Rallidae									
Hypotaenidia torquata	Barred rail		1				1		
Rhipiduridae									
Rhipidura nigritorques	Philippine pied fantail				4			7	
Sittidae									
Sitta frontalis	Velvet-fronted nuthatch								1
Strigidae									
Otus mantananensis	Mantanani owl							3	
Ninox scutulata	Brown hawk owl						2		
Sturnidae									
Aplonis panayensis	Asian glossy starling		7		68	19	16	8	
Gracula religiosa	Hill myna			3			3		1
Timaliidae									
Mixornis (gularis) woodi	Palawan Tit-babbler	1	3	4		4	3		
Zosteropidae									
Zosterops japonicus	Mountain white-eye					1			

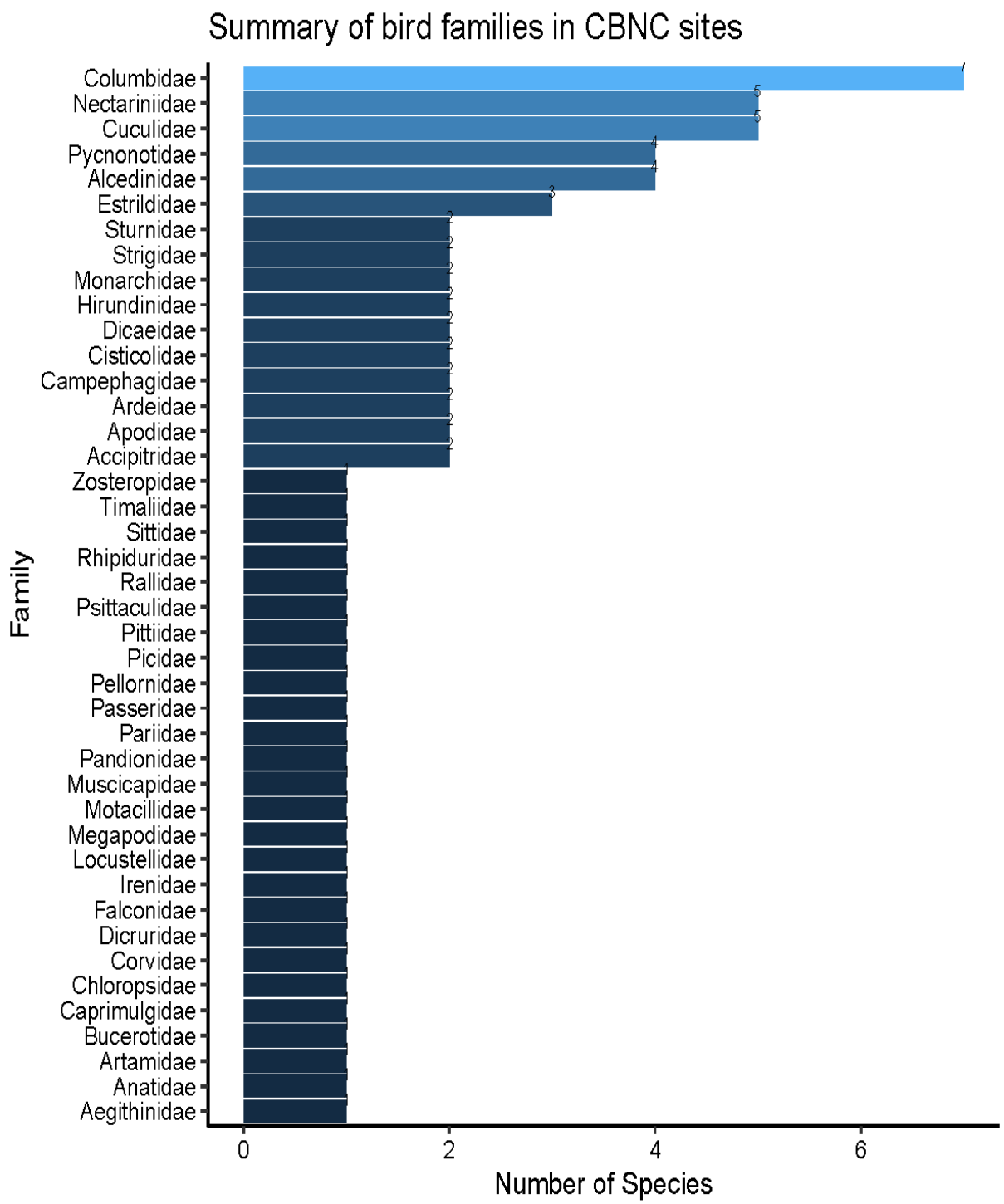


Figure 9. Comparison of number of species per bird family.

In comparison with the 2021 monitoring wherein 83 species were documented, the 2021 survey yielded a slightly lower number of species, with 74. Combining the results of the 2020, 2021 and 2022 monitoring of birds, a total of 113 species were documented. Of those listed, 15 species were uniquely documented in 2020, 10 species only in 2021 and 9 species only in 2022 (Table 3).

Table 3. Comparison of documented bird species in the CBNC monitoring sites from 2020 to 2022.

Scientific Name	Monitoring Period		
	2020	2021	2022
Accipiter trivirgatus	x		
Actitis hypoleucos		x	
Aegithina tiphia	x	x	x
Aethopyga shelleyi	x	x	x
Alcedo atthis	x		
Alophoixus frater	x	x	x
Amaurornis phoenicurus	x	x	
Anthracoceros marchei			x
Anthreptes malacensis	x	x	x
Anthus rufulus	x	x	x
Aplonis panayensis	x	x	x
Arachnothera (longirostra) dilutior	x	x	x
Ardea intermedia		x	
Artamus leucorynchus	x	x	x
Batrachostomus chaseni		x	
Brachypodius atriceps	x	x	x
Bubulcus coromandus	x	x	
Butorides striata		x	
Cacomantis merulinus		x	x
Caloenas nicobarica		x	x
Caprimulgus macrurus	x	x	x
Centropus bengalensis	x	x	x
Centropus sinensis	x	x	x
Ceyx cyanopectus			x
Ceyx erithaca		x	x
Chalcophaps indica	x	x	x
Charadrius mongolus	x		
Chloropsis palawanensis	x	x	x
Chrysocolaptes erythrocephalus	x	x	x
Cinnyris jugularis aurora	x		x

Scientific Name	Monitoring Period		
	2020	2021	2022
Circus melanoleucos	x	x	
Cisticola (juncidis) tinnabulans	x	x	x
Collocalia marginata	x	x	x
Collocalia troglodytes	x	x	x
Copsychus(Kittacincla) niger	x	x	x
Corvus enca	x	x	x
Cyanoptila cyanomelana	x		
Dendrocygna arcuata	x	x	x
Dicaeum pygmaeum	x	x	x
Dicrurus hottentottus		x	
Dicrurus leucophaeus	x	x	x
Dinopium everetti	x	x	
Dryocopus javensis	x	x	
Ducula aenea	x		
Ducula bicolor		x	x
Ducula pickeringii		x	x
Egretta alba	x		
Egretta garzetta	x		x
Egretta sacra	x	x	x
Elanus caeruleus		x	
Eudynamys scolopaceus		x	x
Falco peregrinus	x		x
Ficedula platenae		x	
Gallinula chloropus		x	
Galliralus striatus	x		
Geopelia striata	x	x	x
Gracula religiosa	x	x	x
Haliaeetus ichthyaetus		x	
Haliaeetus leucogaster	x	x	x
Hirundo rustica	x		x
Hirundo tahitica	x	x	x
Hypothymis azurea	x	x	x
Hypotaenidia torquata			x
Ixobrychus cinnamomeus		x	
Iole palawanensis	x	x	x
Irena tweeddalii			x
Lalage nigra	x	x	x
Lanius cristatus	x		x
Leptocoma sperata	x	x	x

Scientific Name	Monitoring Period		
	2020	2021	2022
Lonchura atricapilla	x	x	x
Lonchura punctulata	x	x	x
Lonchura leucogastra	x	x	x
Macronus gularis	x	x	
Malacocincla cinereiceps	x	x	
Megalurus palustris		x	x
Megapodius cumingii		x	x
Mixornis (gularis) woodi			x
Monticola solitarius	x		
Motacilla (flava)cinerea	x		
Muscicapa griseistica	x		
Muscicapa sibirica	x		
Muscicapa daurica	x		
Ninox scutulata			x
Nycticorax nycticorax	x	x	
Oriolus chinensis	x	x	
Orthotomus sericeus	x	x	x
Otus mantananensis		x	x
Pandion haliaetus	x	x	x
Pardaliparus amabilis	x	x	x
Passer montanus	x	x	x
Pelargopis capensis	x	x	x
Pellorneum (Trichastoma) cinereiceps			x
Pericrocotus divaricatus	x		
Pericrocotus igneus			x
Phaenicophaeus curvirostris			x
Phylloscopus borealis	x		
Pitta sordida		x	x
Polyplectron napoleonis	x	x	
Prioniturus platenae	x	x	
Prionochilus plateni	x	x	x
Pycnonotus cinereifrons	x	x	x
Rhipidura nigritorquis	x	x	x
Sitta frontalis	x	x	x
Spilopelia chinensis	x	x	x
Spilornis holospilus	x	x	x
Strix seloputo		x	
Tanygnathus lucionensis	x	x	x
Terpsiphone cyanescens	x	x	x

Scientific Name	Monitoring Period		
	2020	2021	2022
Todiramphus chloris	x	x	x
Treron vernans	x	x	x
Tringa brevipes	x		
Turnix suscitator		x	
Zosterops japonicus			x

While variations in the quantity of monitoring sites depended on accessibility of sites, a consistent 6 monitoring sites (Ibelnan, Kinurong, TSF1, Magas-Magas, Nagoya and Bulanjao) were the common sites of survey. The addition of TSF3 in 2021 and inclusion of Ursula Island in the last two survey efforts has added to the increased number of new and redocumented species. Comparison of results shows that while there was an increase in the number of species documented from 2020 to 2021 but a decrease from 2021 to 2022.

This decrease in the number of species does coincide with the onset of the wet seasons as well as on the lapse of the migratory season of birds (September to April). Bird sampling surveys can be affected by the overall weather and season when it was conducted. As the migratory seasons end, the frequency of migrant birds steadily decreases. The occurrence of rain (incidence during the current survey was common though usually at in the afternoon) can also affect the current bird counts.

While the current 2022 survey may have decreased in the number of species, including migrant species like *Elanus caeruleus* (Black-winged kite), there were a surprising increase in the number of bird species which were previously undetected in contemporary surveys. Birds such as *Anthracoceros marchei* (Palawan Hornbill) and *Pericrocotus igeneus* (Fiery minivet), previous counts prior to the 2020 surveys, have been noticeably absent until the current surveys. At least one new species, *Zosterops japonicus* (warbling white-eye) is a new addition to the species roster in CBNC. Apart from *Pandion haliaetus* (Western Osprey), a resident migrant, no other migrant species was documented in the current survey.

Table 4 shows the habitats, feeding guilds, distribution of species of birds documented during the June 2022 monitoring of terrestrial vertebrates with corresponding conservation status categorized by the IUCN, DENR and PCSD.

Table 4. Comparison of documented bird species in the CBNC monitoring sites from 2020 to 2022.

Species	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
BIRD						
Accipitridae						
Haliaeetus leucogaster	Wetlands, coasts and related habitats	Resident	Carnivore	LC	OWS	EN
Spilornis holospilus	Forestland and related forest habitats	Resident	Carnivore	LC	OWS	EN
Aegithinidae					OWS	
Aegithina tiphia	Forestland and related forest habitats	Resident	Omnivore	LC	OWS	EN
Alcedinidae					OWS	
Todiramphus chloris	Mixed habitat	Resident	Carnivore	LC	OWS	LC
Ceyx erithaca	Riparian forest and streams	Resident	Carnivore	LC	OWS	LC
Ceyx cyanopectus	Riparian forest and streams	Resident	Carnivore	LC	OWS	LC
Pelargopis capensis	Wetlands, coasts and related habitats	Resident	Carnivore	LC	OWS	LC
Anatidae						
Dendrocygna arcuata	Wetlands, coasts and related habitats	Resident	Herbivore	LC	OWS	LC
Apodidae					OWS	
Collocalia (esculenta) marginata	Forestland and related forest habitats	Endemic	Insectivore	LC	OWS	LC
Collocalia troglodytes	Grassland and open country	Resident	Insectivore	LC	OWS	LC
Ardeidae					OWS	
Ardea purpurea	Riparian forest and streams	Resident	Carnivore	LC	OWS	LC
Egretta garzetta	Wetlands, coasts and related habitats	Resident	Carnivore	LC	OWS	LC
Artamidae					OWS	
Artamus leucorynchus	Forestland and related forest habitats	Resident/ Migratory	Insectivore	LC	OWS	LC
Bucerotidae						
Anthracoceros marchei	Forestland and related forest habitats	Endemic	Frugivore	VU	OWS	NC
Campephagidae					OWS	
Pericrocotus igneus	Forestland and related forest habitats	Endemic	Omnivore	NT	OWS	NC

Species	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
Lalage nigra	Mixed habitat	Resident	Insectivore	LC	OWS	LC
Caprimulgidae					OWS	
Caprimulgus macrurus	Forestland and related forest habitats	Resident	Insectivore	LC	OWS	LC
Chloropsidae					OWS	
Chloropsis palawanensis	Forestland and related forest habitats	Endemic	Omnivore	LC	OWS	VU
Cisticolidae					OWS	
Orthotomus sericeus	Forest edge and open forest	Resident	Insectivore	LC	OWS	LC
Cisticola (juncidis) tinnabulans	Grassland and open country	Resident	Insectivore	LC	OWS	LC
Columbidae					OWS	
Treron vernans	Forestland and related forest habitats	Resident	Frugivore	LC	OWS	LC
Geopelia striata	Grassland and open country	Resident	Omnivore	LC	OWS	LC
Chalcophaps indica	Mixed habitat	Resident	Frugivore	LC	OWS	LC
Spilopelia chinensis	Grassland and open country	Resident	Granivore	LC	OWS	LC
Caloenas nicobarica	Mixed habitat	Resident	Herbivore	NT	EN	CRI
Ducula bicolor	Forestland and related forest habitats	Resident	Frugivore	LC	OWS	VU
Ducula pickeringii	Forestland and related forest habitats	Resident	Frugivore	LC	OWS	EN
Corvidae					OWS	
Corvus enca	Forestland and related forest habitats	Resident	Omnivore	LC	OWS	LC
Cuculidae					OWS	
Phaenicophaeus curvirostris	Mixed habitat	Resident	Carnivore	LC	OWS	LC
Cacomantis merulinus	Forest edge and open forest	Resident	Invertivore	LC	OWS	LC
Centropus bengalensis	Grassland and open country	Endemic	Insectivore	LC	OWS	LC
Centropus sinensis	Farmlands and related agricultural areas	Resident	Insectivore	LC	OWS	LC
Eudynamys scolopaceus	Forestland and related forest habitats	Resident	Omnivore	LC	OWS	LC
Dicaeidae					OWS	

Species	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
Dicaeum pygmaeum	Forestland and related forest habitats	Resident/ Migratory	Frugivore	LC	OWS	LC
Prionochilus plateni	Grassland and open country	Endemic	Frugivore	LC	OWS	VU
Dicruridae					OWS	
Dicrurus leucophaeus	Forestland and related forest habitats	Resident/ Migratory	Insectivore	LC	OWS	LC
Estrildidae					OWS	
Lonchura atricapilla	Mixed habitat	Resident	Granivore	LC	OWS	LC
Lonchura punctulata	Mixed habitat	Resident	Granivore	LC	OWS	NC
Lonchura leucogastra	Mixed habitat	Resident	Granivore	LC	OWS	NC
Falconidae					OWS	
Falco peregrinus	Cosmopolitan	Resident	Carnivore	LC	OWS	NC
Hirundinidae					OWS	
Hirundo tahitica (javanica)	Mixed habitat	Resident	Insectivore	LC	OWS	LC
Hirundo rustica	Grassland and open country	Resident	Insectivore	LC	OWS	LC
Irenidae					OWS	
Irena tweedddalii	Forestland and related forest habitats	Endemic	Frugivore	NT	OWS	NC
Locustellidae					OWS	
Megalurus palustris	Grassland and open country	Resident	Inverttivore	LC	OWS	LC
Megapodidae						
Megapodius cumingii	Forestland and related forest habitats	Resident	Insectivore	LC	VU	EN
Monarchidae						
Hypothymis azurea	Mixed habitat	Resident	Insectivore	LC	OWS	LC
Terpsiphone cyanescens	Forestland and related forest habitats	Endemic	Insectivore	LC	OWS	VU
Motacillidae					OWS	
Anthus rufulus	Grassland and open country	Resident	Insectivore	LC	OWS	LC
Muscicapidae					OWS	
Copsychus (Kittacincla) niger	Forestland and related forest habitats	Endemic	Insectivore	LC	OWS	LC
Nectariniidae					OWS	
Arachnothera longirostris	Mixed habitat	Resident	Omnivore	LC	OWS	VU

Species	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
Cinnyris jugularis aurora	Cosmopolitan	Resident	Omnivore	LC	OWS	LC
Leptocoma sperata	Mixed habitat	Endemic	Omnivore	LC	OWS	LC
Aethopyga shelleyi	Mixed habitat	Resident	Omnivore	LC	OWS	LC
Antreptes malacensis	Cosmopolitan	Resident	Omnivore	LC	OWS	LC
Pandionidae					OWS	
Pandion halietus	Cosmopolitan	Migratory	Piscivore	LC	OWS	EN
Pariidae					OWS	
Pardaliparus amabilis	Forestland and related forest habitats	Endemic	Omnivore	NT	OWS	VU
Passeridae					OWS	
Passer montanus	Mixed habitat	Introduced	Granivore	LC	OWS	LC
Pellornidae					OWS	
Pellorneum (Trichastoma) cinereiceps	Forestland and related forest habitats	Endemic	Insectivore	LC	OWS	LC
Picidae						
Chrysocolaptes erythrocephalus	Forestland and related forest habitats	Endemic	Omnivore	EN	EN	EN
Pittiidae						
Pitta (sordida) sordida	Forestland and related forest habitats	Resident	Carnivore	LC	OWS	LC
Psittaculidae						
Tanygnathus lucionensis	Forestland and related forest habitats	Resident	Frugivore	NT	CRI	CRI
Pycnonotidae						
Alophoixus frater	Forest edge and open forest	Resident	Omnivore	LC	OWS	LC
Pycnonotus cinereifrons	Forest edge and open forest	Endemic	Omnivore	LC	OWS	LC
Brachypodius atriceps	Forest edge and open forest	Resident	Omnivore	LC	OWS	LC
Iole palawanensis	Forest edge and open forest	Endemic	Omnivore	LC	OWS	VU
Rallidae						
Hypotaenidia torquata	Wetlands, coasts and related habitats	Resident	Omnivore	LC	OWS	NC
Rhipiduridae						
Rhipidura nigritorques	Forestland and related forest habitats	Resident	Insectivore	LC	OWS	LC
Sittidae					OWS	

Species	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
Sitta frontalis	Forestland and related forest habitats	Resident	Insectivore	LC	OWS	LC
Strigidae					OWS	
Ninox scutulata	Forest edge and open forest	Resident	Carnivore	LC	OWS	NC
Otus mantananensis	Forestland and related forest habitats	Near Endemic	Carnivore	NT	VU	EN
Sturnidae						
Aplonis panayensis	Forestland and related forest habitats	Resident	Omnivore	LC	OWS	LC
Gracula religiosa	Forestland and related forest habitats	Resident	Omnivore	LC	VU	CRI
Timaliidae						
Mixornis (gularis) woodi	Forestland and related forest habitats	Resident	Insectivore	LC	OWS	NC
Zosteropidae					OWS	
Zosterops japonicus	Forestland and related forest habitats	Resident	Omnivore	LC	OWS	LC

In terms of habitat occupancy, forestlands and related habitats ranked highest in terms of percentage (41.9%), followed by mixed-habitat dwellers (18.9%), grassland and open country (12.2%) and forest edge and open forest (9,5%). At a minority are habitats such as wetlands, riparian forests, and agricultural habitats, as well as species which inhabit a cosmopolitan habitat (Figure 10).

Largely speaking, a tie between omnivorous and insectivorous birds largely dominated the feeding guilds of the area (each 28.4%), followed by carnivores (17.6%) and frugivores (12.2%). The rest occupied a minority of feeding guilds, as seen in Figure 11. Diversity in feeding niches is often indicative of the resources that are available for exploitation. Birds in particular feed on a variety of food materials, ranging from the nectar of plants to the meat of smaller vertebrate. As such, their diversity is equally matched by either a single or a mixed feeding guild

The prevalence of the omnivorous feeding guild imply that the success of food utilization is not entirely on the ability to make use of a resource exclusively but to make use of one or more in the unavailability of the other. As such omnivorous birds are often characterized by having a primary food staple but can utilize other resource in certain times or phase of their life (i.e., nectarivore sunbirds having an insectivorous diet as juveniles). This advantage allows omnivores greater versatility and adaptability. The abundance of insect prey, both in disturbed and pristine habitats, may also be the reason for the greater dominance of insect-feeding birds compared to others.

While insect abundance can greatly be affected by certain natural or anthropogenic changes, they are also one of the more versatile groups to occur. With consideration to the varying levels of disturbance among the CBNC plots, it may be surmised that a degree of acclimatization is being reached by fauna in the area, resulting in the emergence of certain feeding guild over others.

The distribution status of bird species documented during the 2022 monitoring is presented in Figure 12. Almost 76% percent (75.7%) of the species are resident, 20.3% are endemic and near endemic, migratory and introduced each had 1.4% each. Th season for bird migration had lapsed for the season then, with only one migrant/resident species, *Pandion haliaetus* Osprey being documented.

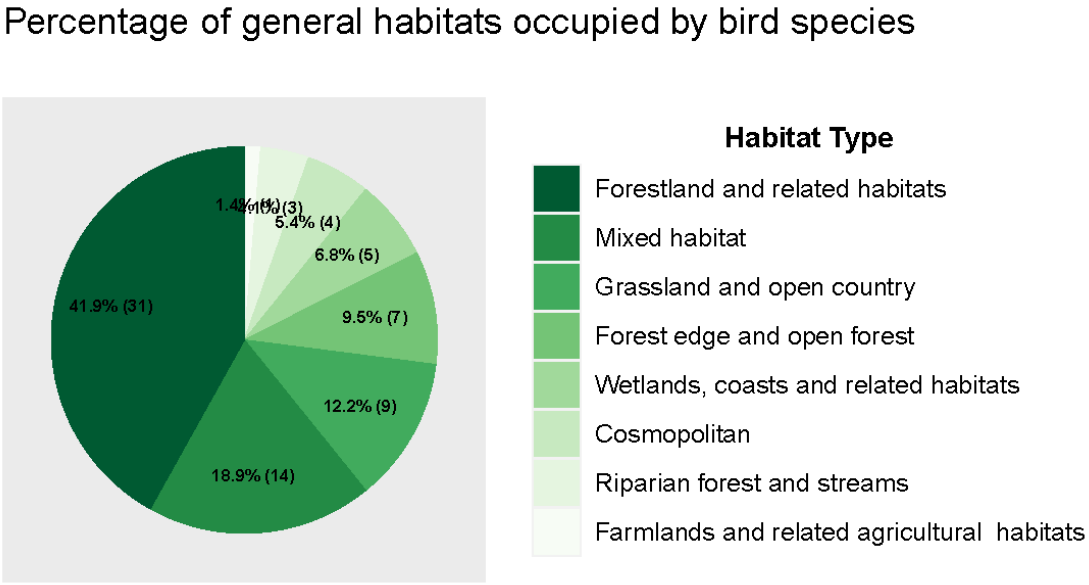


Figure 10. Percentage of general habitats occupied by bird species.

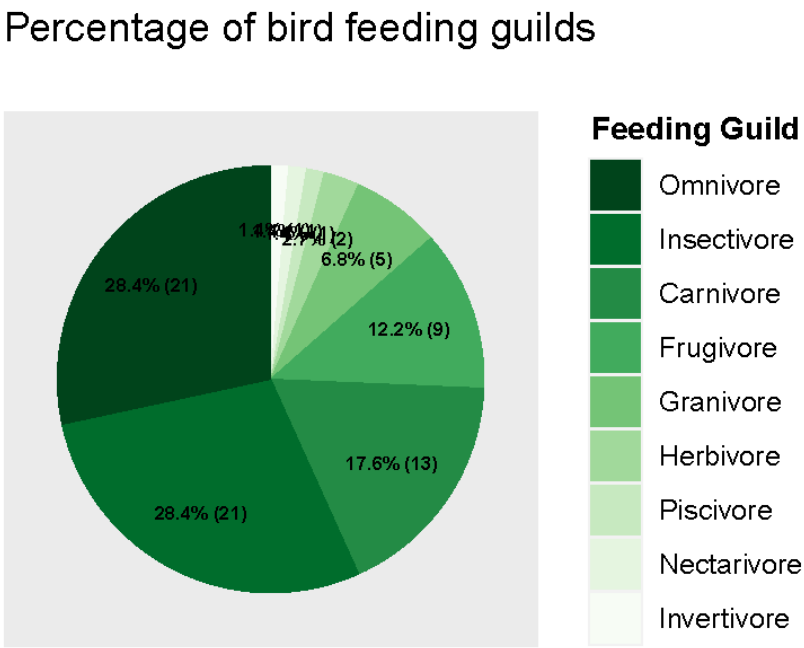


Figure 11. Percentage of avian feeding guilds

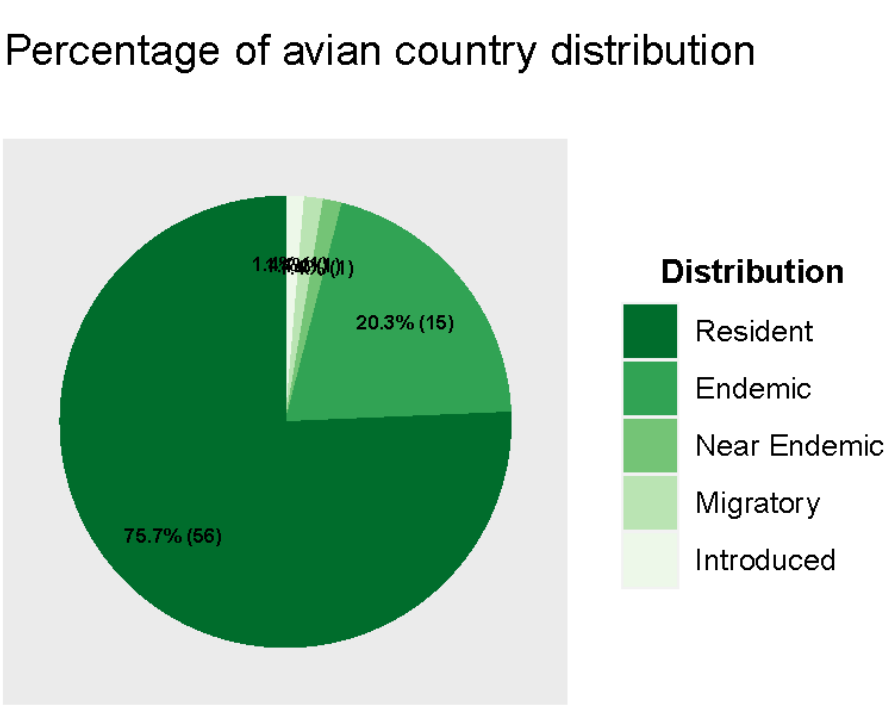


Figure 12. Percentage of avian country distribution.

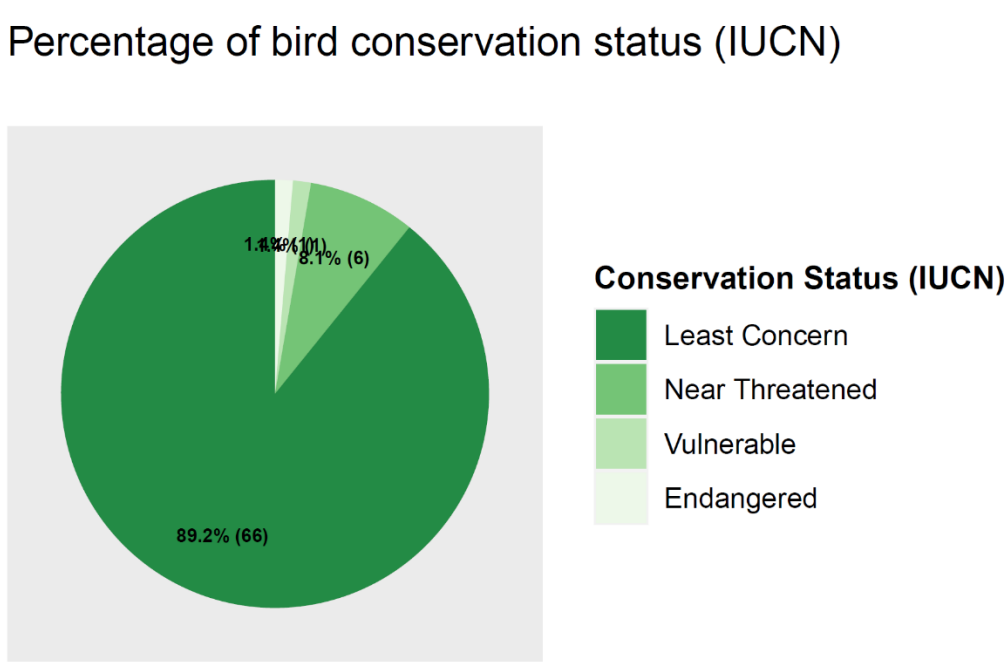


Figure 13A. Percentage of avian conservation status (IUCN).

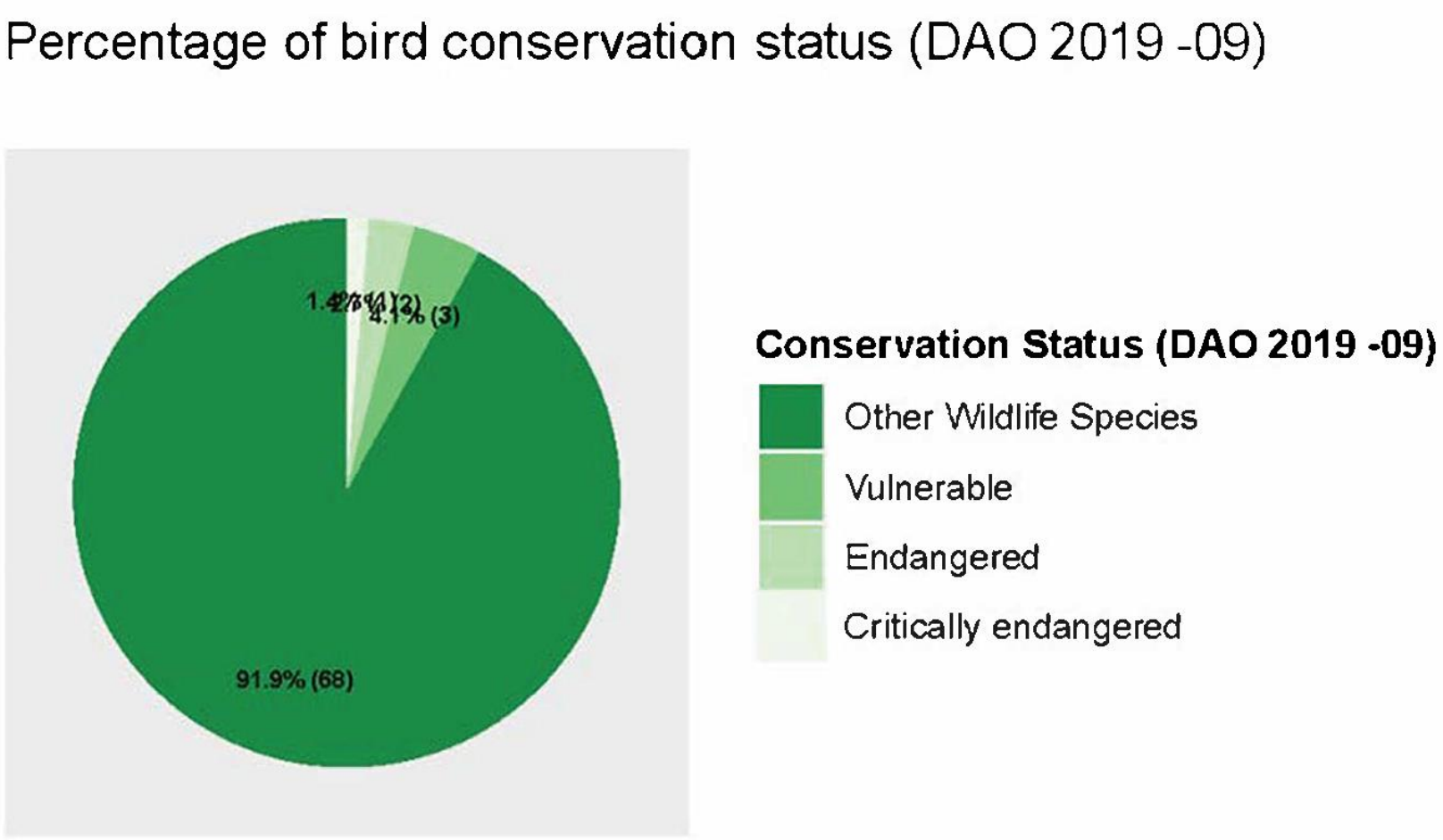


Figure 13B. Percentage of avian conservation status (DENR).

Percentage of bird conservation status (PCSD)

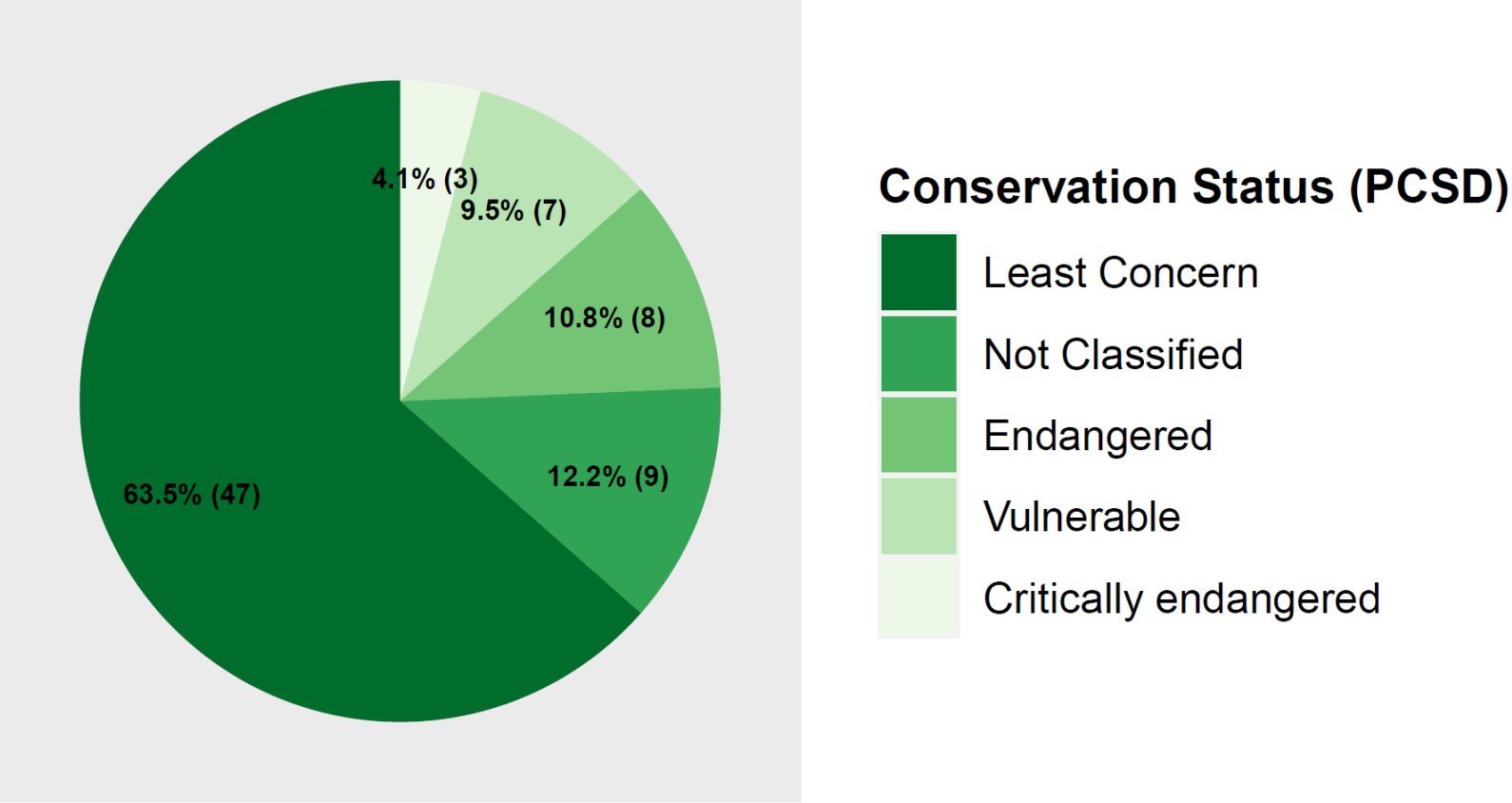


Figure 13C. Percentage of avian conservation status (PCSD).

The conservation status of bird species according to the IUCN, DENR and PCSD are presented in Figure 13. According to IUCN Redlist, only 1.4% of the species of birds is Endangered (*Chrysolaptes erythrocephalus*), 8.1% are Near Threatened (*Caloenas nicobarica*, *Pecrocotus igneus, Irena tweeddalii, Otus mantananensis, Pardaliparus amabilis, and Tanygnathus lucionensis*), 1.4% is Vulnerable (*Athracoceros marchei).* The rest of the species (98.2%) are of Least Concern.

For the DENR, 91.9% are the Other Wildlife Species category (non-threatened species, etc., which has the tendency to become threatened due to destruction of habitat…DAO 2017-11), 4.1% are Vulnerable (*Gracula religiosa, Megapodius cumingii* and *Otus mantananensis)* and 2.7% are Endangered (*Caloenas nicobarica*, and *Chrysolapthes erythrocephalus*). Only 1 species (1%) is listed as Critically Endangered, *Tanygnathus lucionensis*.

The PCSD categorized 63.5% of bird species as Least Concern, 9.5% Vulnerable (*Arachnotera longirostris, Chloropsis palawanensis, Ducula bicolor, Iole palawanensis, Pardaliparus amabilis, Prionochilus plateni* and *Terpsiphone cyanescens* while 10.8% are Endangered (*Aegithinia tiphia*, *Chrysolaptes erythrocephalus, Ducula pickeringii, Haliaeetus leucogaster, Megapodius cumingii, Otus mantananensis, Pandion haliaetus,* and *Spilornis cheela*). Five percent (4.1%) are under the Critically Endangered category these are (*Caloenas nicobarica*, *Gracula religiosa* and *Tanygnathus lucionensis*). A percentage (12.2%) of species remain unclassified due to the absence of a corresponding conservation status under the PCSD criteria.

Table 5. Comparison of values of diversity indices (birds) between monitoring sites.

Sites	Richness	Abundance	Dominance	Diversity	Evenness
TSF3	40	190	0.04083	3.41	0.7566
TSF1	33	173	0.06011	3.103	0.6745
Kinurong	32	298	0.2153	2.382	0.3384
Magas-Magas	22	82	0.05651	2.972	0.8875
Nagoya	21	180	0.1741	2.349	0.4986
Bulanjao	21	94	0.07877	2.744	0.7405
Ibelnan	20	100	0.0996	2.574	0.6562
Ursula Island	15	2135	0.9284	0.2449	0.08517

COMPARISON OF DIVERSITY INDICES (BIRDS)

Diversity indices are used as measures for estimating the state of biodiversity of an area based on the collected data on richness and abundance. It may be used to make broad assessments on what the current state of diversity is in an area and may allow limited assumptions of possible factors that may have affected it. Greater statistical analysis conducted over a longer period is further utilized to corroborate these results.

Species richness was highest in TSF3 (40 species), with the lowest (15 species) in Ursula Island. Sites with the highest number of species have some similarities in terms of habitat types and disturbance levels (Table 5). TSF3, TSF1 and Kinurong are either rehabilitated or undergoing development, factors which potentially destroys and creates new habitats and shifting in resource in the area. In essence, they are all mixed habitat types, and as discussed earlier, mixed habitat type usage allows for a greater diversity of resource that allows birds from nearby niches to take advantage of.

TSF3, which is undergoing development, has degraded secondary growth, intermingling with grasslands though a river system that allows insect prey and opportunistic fruiting trees to flourish, thereby allowing a several bird species to use the area both as roosting and breeding sites. The high species richness is supported a majority of generalist bird species like munias, pipits, swallows, swifts and some specialist species like mynas, monarchs and doves. The evenness parameter is relatively high in TSF3, with no species in particular dominating over others. The area allows simultaneous co-existence of wetland and forest birds with generalist species that occupy the open country habitats, with no permanent occupancy nor permanent food source that would allow competition among species.

Incidentally due to these circumstances Kinurong ranks third in the highest species richness. This is further supported by a Shannon index value. Its ranking as the second greatest abundance of individuals counted is reflected by the conversely opposite values of its dominance and evenness index. There is a dominating species in the area, *Dendrocygna arcuata*, which occurs in large numbers across the two ponds in Kinurong. These ponds draw numerous bird species from herons to kingfishers to even drongos and flowerpeckers.

Magas-Magas represents an area that is relatively depauperate of richness and abundance, incidentally due to the heavy vehicle traffic that occurs through the area daily. Heavy dust clouds and constant noise pollution does not make it an ideal area for bird activity. Bird abundances were lower in this area, with an even distribution among species which could potentially tolerate the daily disturbance.

Nagoya Bay is similarly a site with a relatively poor bird diversity and abundance. Though previous surveys have made unique sightings of migratory species over the years, the species which inhabit this coastal-agricultural habitat are common generalist species that tolerate human occupation. Permanent wetlands species that are expected near the coast are infrequent, with kingfishers and the occasional raptor being some of the more common species. Though it is likely that this may change with the onset of migratory season as well as the emergence of the fruiting or flowering trees that are sustained in nearby plantations.

Mt. Bulanjao ranked surprisingly low this season in terms of species richness. With only 21 species and 94 individuals, it had a moderately high diversity index but with evenness

that suggests that not all species were documented. Notably, from previous surveys, *Anthracoceros marchei* and *Gracula religiosa* were absent from the current bird count. Their absence is unusual but not uncommon, as some bird flocks will move to different areas of a forest to feed if forging opportunities have lessened. It may also have been affected by the weather patterns at the time of the count, as it had been cloudy and prone to drizzling rain in Bulanjao both in the early morning and afternoon. It also bears mentioning that the dirt road along the mountain had been developed slightly to accommodate vehicles, though traffic through the mountain is infrequent. Further monitoring is recommended if road traffic may become a potential factor in Bulanjao.

Ibelnan ranked second lowest in terms of species richness, though similarly showed a moderately high evenness index. Similar to Bulanjao, comparison between the current survey and the previous year shows that some species had been markedly absent, notably *Amaurornis phoenicurus* and *Batrachostomus chaseni*. As a nocturnal species, *B. chaseni* is a relatively cryptic species and is harder to encounter unless specifically tracked. This may explain its absence in the current survey. The absence of *A. phoenicurus*, common water bird species, is unusual in consideration of the abundant feeding areas at the Ibelnan stream system. Regardless, this lessened species richness may be related to the presence of vehicle traffic in the nearby site of Magas-magas.

Among the 8 sites, Ursula Island ranked last in terms of species richness (15 species), which is further corroborated by a similarly small Shannon index (0.2449). However, the site fundamentally stands-out as a unique habitat due to its existence as a bird sanctuary and game reserve. As emphasized by the high dominance index, a single species, Ducula bicolor, outcompetes all other species in the island in terms of abundance. The island is the species breeding and roosting grounds, leaving the island every morning to forage in the mainland and returning later in the day in order to rest. Despite the low diversity, the island also houses some unique species such as the rare Nicobar pigeon, ground dwelling megapodes and even the diminutive Mantanani owl. Though anthropogenic threats play a minor role in the ecological dynamics of the island, the introduction of foreign predators and invasive species suggest that the local bird population may risk a potential decline should such issues go unaddressed.

Table 6. Volant and non-volant mammals documented from 8 sites during the 2022 monitoring of Terrestrial vertebrates.

Species	Common Name	Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF3	Ursula Island	Bulanjao
NON-VOLANT									
Cercopithecidae									
Macaca fascicularis	Long-tailed macaque		7		4				
Muridae									
Maxomys panglima	Palawan maxomys	1		1					1
Rattus tanezumi	Asian house rat							1	
Sciuridae									
Sundasciurus steeri	Southern Palawan squirrel			1	3	1			
VOLANT									
Megadermatidae									
Megaderma spasma	False vampire bat						1		
Vespertilionidae									
Myotis cf. muricola	Whiskered myotis					1			
Pteropodidae									
Cynopterus brachyotis	Short-nosed fruit bat	2	7	51	31	21	40	1	4
Macroglossus minimus	Dagger-toothed nectar bat		3		7	1	2		
Pteropus hypomelanus	Small flying fox							12	
Rousettus amplexicaudatus	Geoffroy's rousette		7	2					

MAMMALS

Ten species of mammals, 6 volant and 4 non-volant belonging to 6 families were documented from the 8 sites where mist-netting and live trapping were conducted. Nagoya, Kinurong, Magas-Magas and TSF3 had 4 species, Ursula Islands had 3 species and Bulanjao and Ibelnan with 2 species. TSF1 had the highest number of documented species with 5 species. The most common and abundant species is *Cynopterus brachyotis* which was documented in all the sites. The list of mammals documented from the 8 monitoring sites is presented in Table 6.

Of the 10 species documented in 2022, two were not observed in 2021 these were two insect bats *Myotis muricola* and *Megaderma spasma*. Insect bats can be difficult to target using mist-netting, an issue often affected by the weather, location, and potential availability of prey item. These two bat species while absent in contemporary surveys, are among the species infrequently detected by older surveys.

Other species which were not detected by the current survey but were more likely still present in the sites include two common species, *Eonycteris spelaea* and *Tupaia palawanensis*. *E. spelaea* is a common fruit bat species whose occurrence overlaps with other bat species, particularly in human-habitated and agricultural areas. Possible limits to its absence in the current survey are variable but it is possible that as a primarily nectarivore bat, flowering among the fruiting trees planted along the monitoring sites may have already passed and that the individuals of the species may be foraging on forestlands where flowering and fruiting are not as restricted. *Tupaia palawanensis* is not as predominant in Nagoya as from the previous survey. Instead, *Sundasciurus steeri* singularly occupies the niche in the fruiting and coconut plantation in the monitoring site. A consistent sighting annually along with the much larger *Pteropus vampyrus*, *Pteropus hypomelanus* was still detected in Ursula Island, though no other sites has had a similar sighting.

Table 7. Habitat, feeding guild, distribution and conservation status of mammals documented in 2020.

Family	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
NON-VOLANT						
Cercopithecidae						
Macaca fascicularis	Mixed Habitat	Native	Omnivore	LC	OWS	LC
Muridae					OWS	
Maxomys panglima	Forestland and related forest habitats	Endemic	Herbivore	LC	OWS	LC
Rattus tanezumi	Mixed Habitat	Invasive	Omnivore	LC	OWS	LC

Family	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
Sciuridae					OWS	
Sundasciurus steeri	Mixed Habitat	Endemic	Frugivore	LC	OWS	LC
VOLANT					OWS	
Vespertilionidae					OWS	
Myotis cf. muricola	Mixed Habitat	Native	Insectivore	LC	OWS	NC
Megadermatidae					OWS	
Megaderma spasma	Mixed Habitat	Native	Insectivore	LC	OWS	LC
Pteropodidae					OWS	
Cynopterus brachyotis	Mixed Habitat	Native	Frugivore	LC	OWS	LC
Macroglossus minimus	Mixed Habitat	Native	Nectarivore	LC	OWS	LC
Rousettus amplexicaudatus	Mixed Habitat	Native	Frugivore	LC	OWS	LC
Pteropus hypomelanus	Mixed Habitat	Native	Frugivore	NT	EN	EN

Most of the species of mammals inhabit mixed habitat types, specifically forestlands and agricultural areas (90%) (Figure 14). Only 10% of the species documented are strict forest species, specifically *Maxomys panglima*. *Pteropus hypomelanus* is uniquely the only species documented from coastal beach forest and forestlands and not present in agricultural lands (Table 7).

There are more frugivores (40%) than omnivores (20%) and insectivore (20%) as shown in Figure 15. This increased number of fruit-feeding mammals, represented at a majority by fruit bats and squirrels, are related to the mixed habitat occupancy of both forestlands and agricultural lands (specifically those of orchard and coconut plantations).

Majority of the species are native to the Philippines (77.8%) while only one species was a Palawan endemic (11.1%) (Figure 16). Only one invasive species (*Rattus tanezumi*) was documented by the current survey. Though a common pest species in agricultural lands and households, it has been documented inside the Ursula Island Bird and Game Refuge as an ongoing infestation brought about by accidental introduction from local fishing vessels.

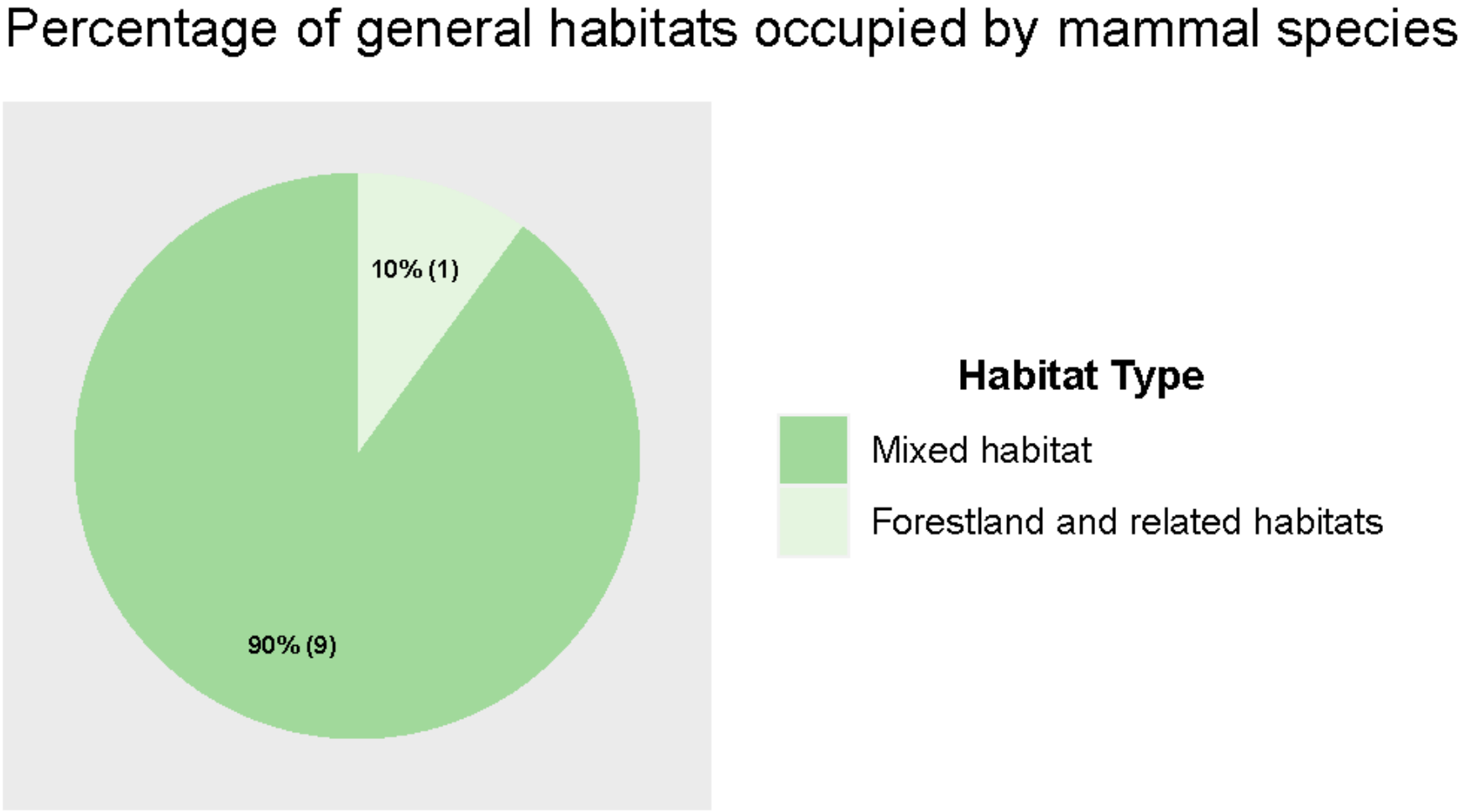


Figure 14. Percentage of general habitats occupied by mammal species.

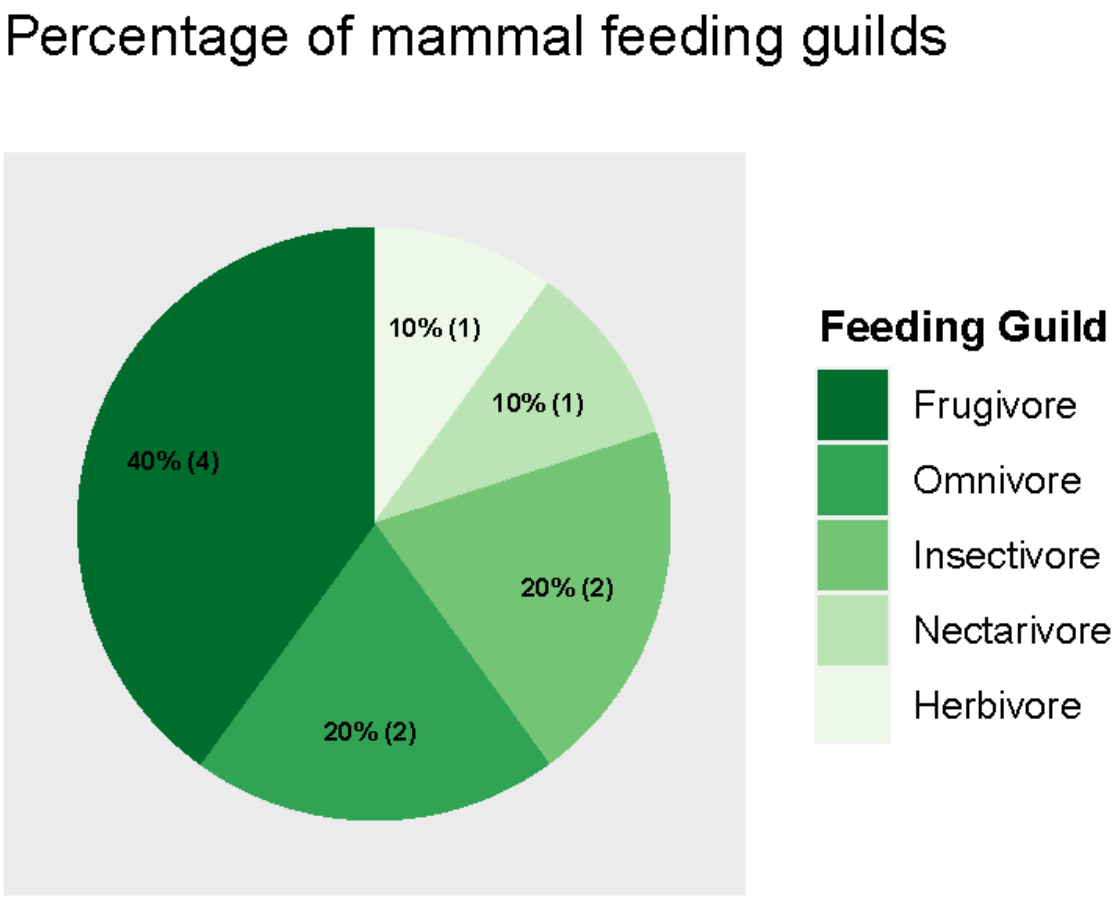


Figure 15. Percentage of mammal feeding guilds.

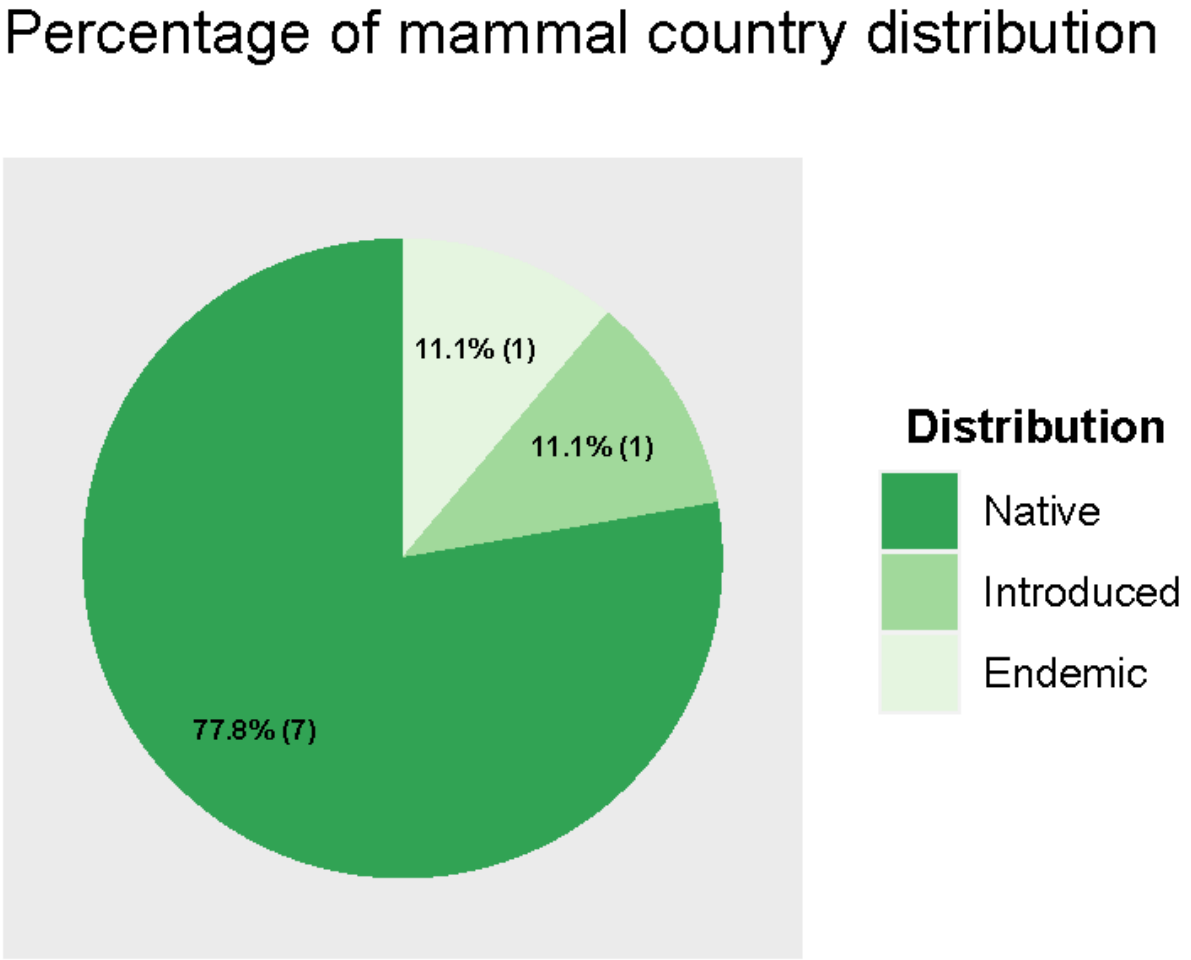


Figure 16. Percentage of mammal country distribution.

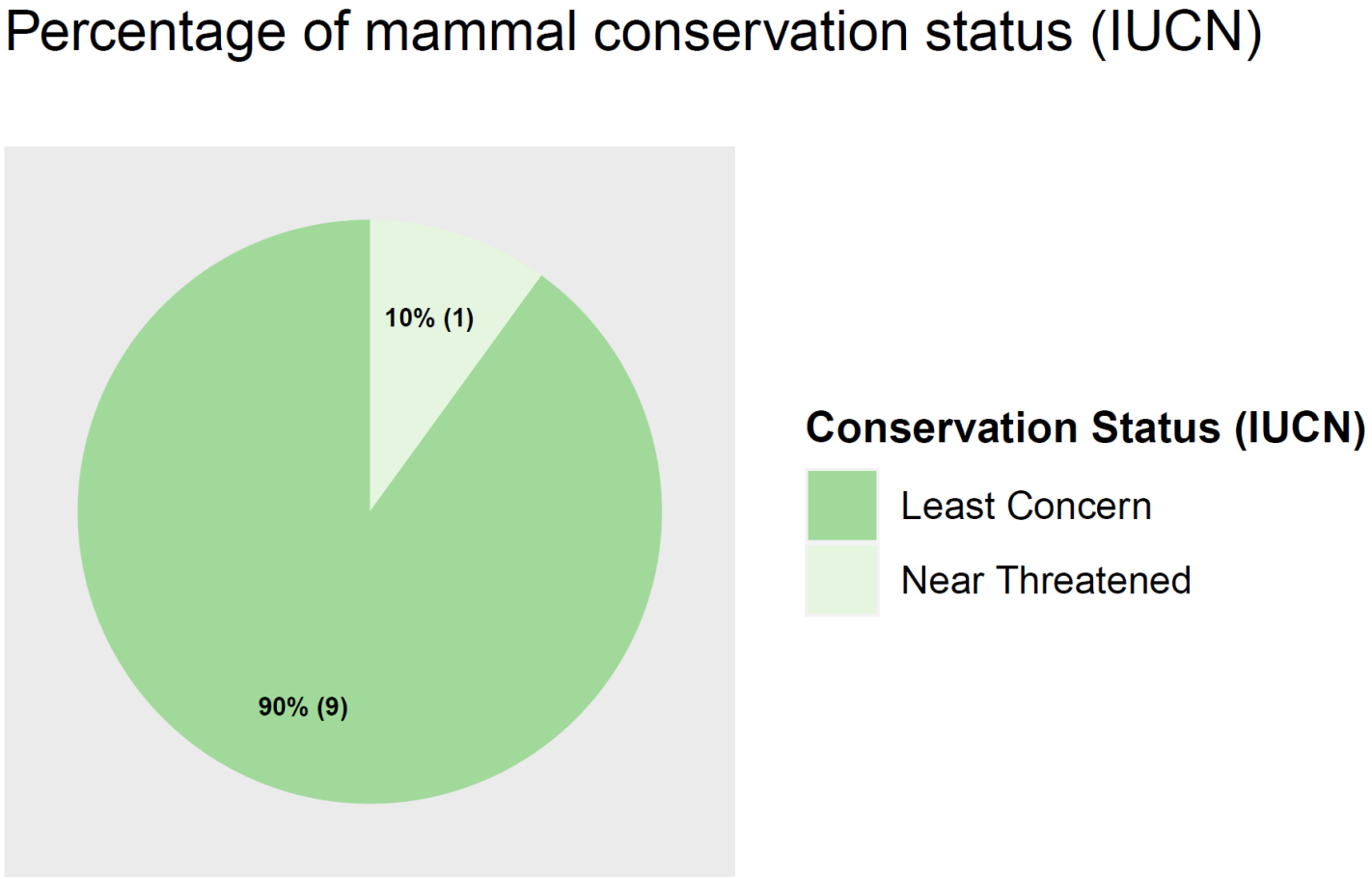


Figure 17A. Percentage of mammal conservation status (IUCN).

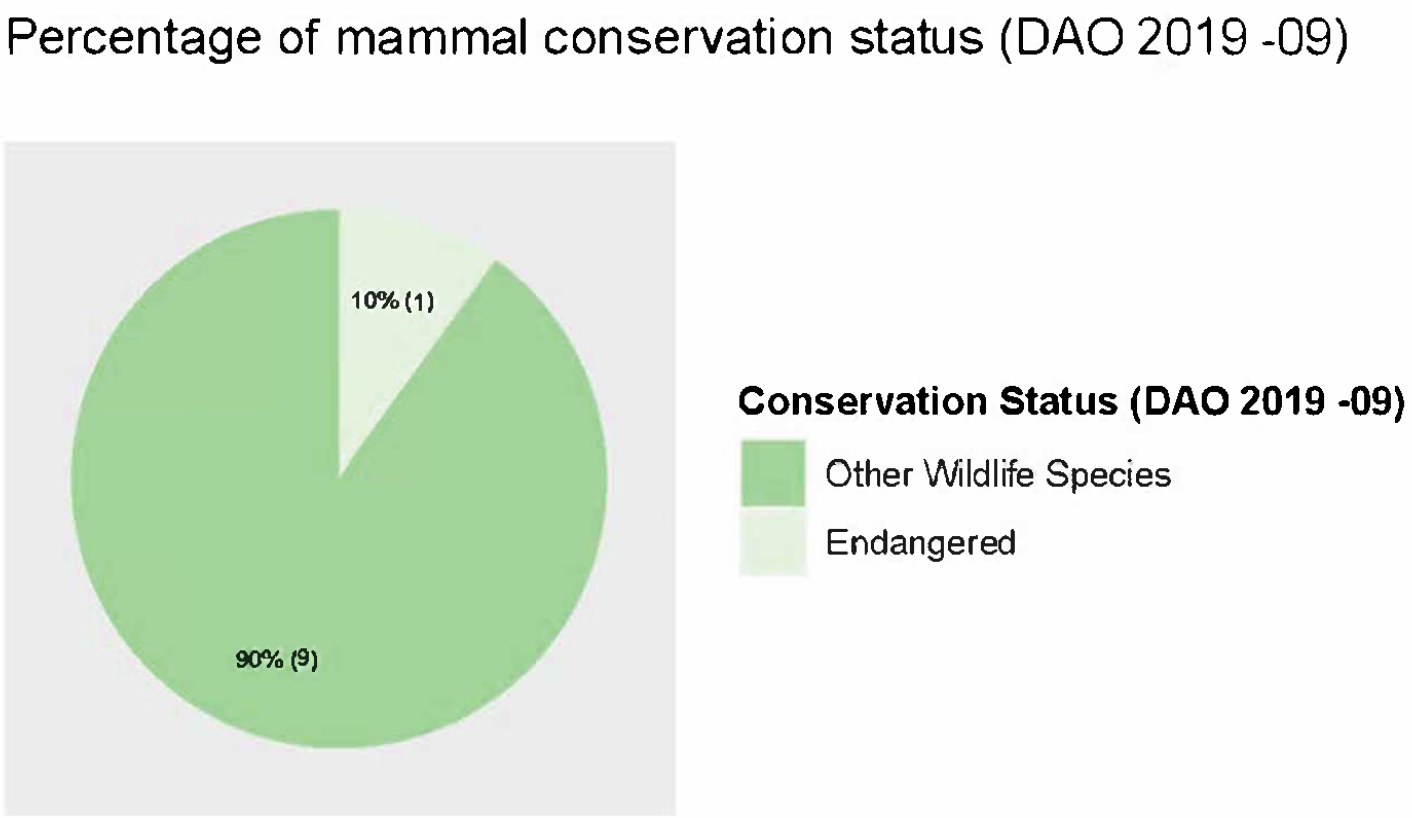


Figure 17B. Percentage of mammal conservation status (DENR).

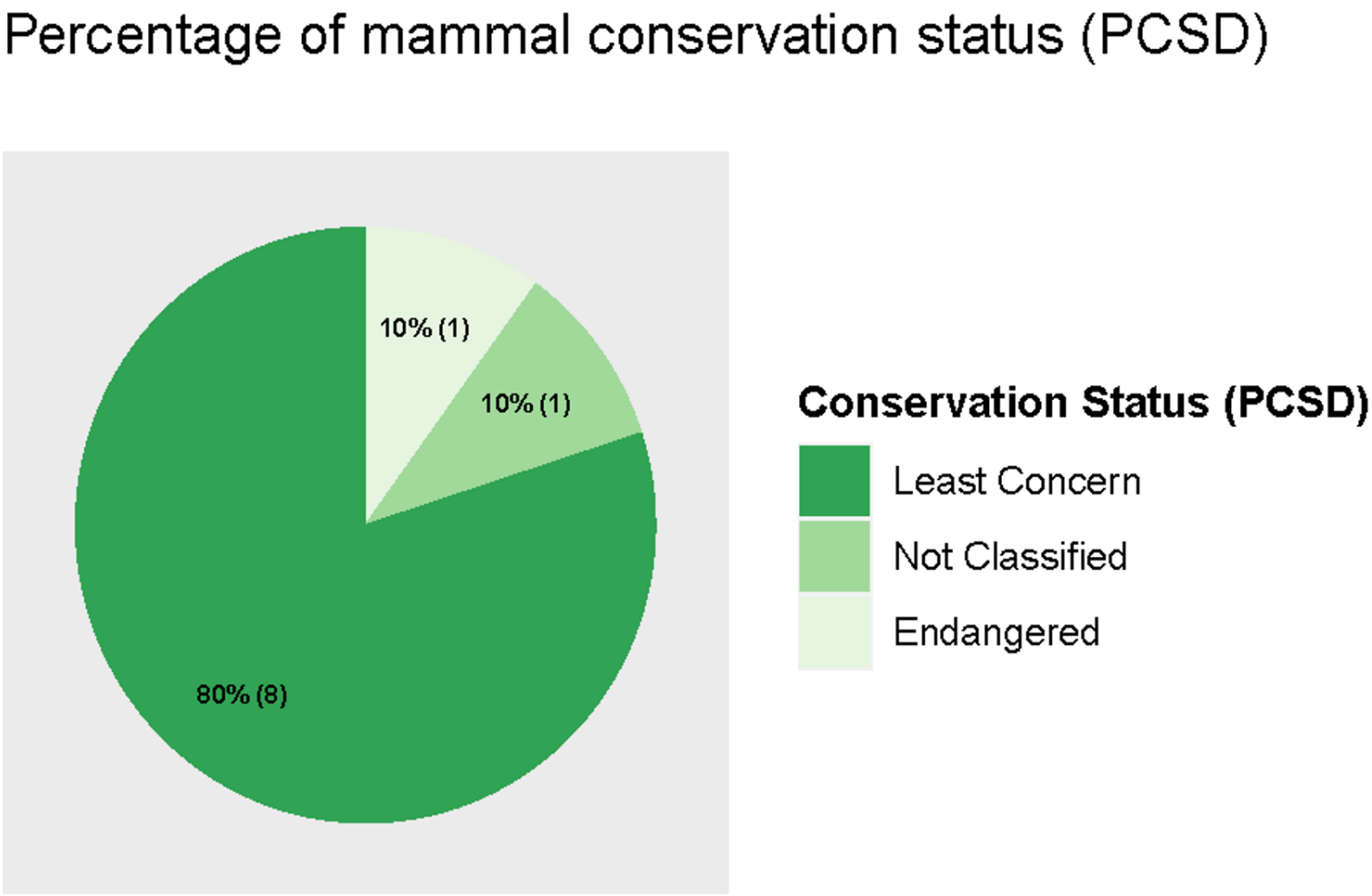


Figure 17C. Percentage of mammal conservation status (PCSD).

The IUCN lists *Pteropus hypomelanus* in the Near Threatened category (10%) and the rest of the species of mammals as Least Concern (90%) (Figure 17A). The same species is Endangered in both the DENR and PCSD lists. The species is threatened by excessive hunting and habitat loss due to conversion of forests, logging, and mining.

Most other mammals were classified under Least Concern in all three conservation statuses. One species, *Myotis cf. muricola* was not classified in the PCSD category. Figure 17 shows the percentage of species belonging to different conservation status according to the IUCN (90% Least Concern,10% Near Threatened), DENR (90% Other Wildlife Species, 10% Endangered), and PCSD (80% Least Concern, 10% Endangered, 10% Not Classified).

Table 8. Comparison of values of diversity indices (mammals) between monitoring sites.

Sites	Richness	Abundance	Dominance	Diversity	Evenness
Magas-Magas	5	110	0.4655	0.8613	0.4732
Nagoya	5	90	0.3778	1.164	0.6406
Kinurong	5	48	0.3177	1.362	0.7809
TSF1	5	48	0.4427	0.9502	0.5172
TSF3	4	86	0.467	0.8419	0.5802
Ursula Island	4	28	0.4362	0.9477	0.645
Bulanjao	3	10	0.42	0.9433	0.8562
Ibelnan	3	6	0.3889	1.011	0.9165

COMPARISON OF DIVERSITY INDICES (MAMMALS)

Table 8 shows the comparison of values of diversity indices between the monitoring sites during the mammal survey. Overall, there is a low species diversity and richness in almost all the monitoring sites, although they appear so only when compared to the more abundant bird species. Mammals can be notoriously hard to monitor without a larger time frame allotted for each site. The current survey shows a general estimate of diversity, however more accurate results would need a longer netting and trapping duration, typically enough to construct a species accumulation curve.

Based on the current survey, the highest species diversity was found in Kinurong, followed by Nagoya, Ibelnan, and TSF1. The lowest diversity index was found for TSF3. This difference may be attributed to the habitat types and availability of food in each of the monitoring sites. Nagoya Bay, apart of the coastal areas, also comprises of agricultural lands and orchards which have fruits bearing trees in bloom throughout the year. A large percentage of the mammal documented are frugivore bats and they will typically travel to and aggregate among areas with flowering and fruiting trees. This is a

similar case of TSF1, a rehabilitated area with fruiting trees and crops as part of the restoration measure. Kinurong and Ibelnan are likely also frequented by mammals due to

both areas sustaining large bodies of freshwater water that provide a more varied niches to be exploited. On the other hand, TSF3 is a relatively wide expanse of grassland with patches of trees that are steadily becoming more reduced due to the construction of a new Tailings storage facility in the area, proving less cover and food source for most species but conservatively allowing more specialized species like insect bats to thrive.

Species evenness was found to be relatively large for most of the monitoring sites, indicating that there were likely no species outcompeting other species, at least in the context of each habitat. This is further corroborated by a low dominance index among the 8 sites. Notably, *Cynopterus brachyotis* was a common species in all of the sites, even in Ursula Island were sighting of the species have proven sporadic over years of monitoring.

The overall species richness dipped by one species between the 2021 and the current survey. *Tupaia palawanensis* and *Eonycteris spelaea* are among two species which were not documented from the current surveys. As referenced by the 2021 report, the pandemic lockdowns which were previously instated and prevented prolonged mining activities may have indirectly allowed the emergence of some mammal's species in the monitoring sites. It is also likely that with the resumption of work, this may have once again returned the CBNC sites to its previous levels of disturbance.

Unusually, there were a decrease of Rattus tanezumi, a pest species, in all the sites, with only a single individual captured in Ursula Island. It may be attributed to the sporadic rains that occurred during some of the trapping nights. Its is likely that should longer trap nights be implemented, more individuals would have been detected.

Pteropus hypomelanus was a noted new species captured in Ursula Island, with *P. vampyrus* being the more common captures in previous years. No other individuals were documented in any of the other monitoring sites.

HERPETOFAUNA

This year's monitoring survey yielded 17 species of herpetofauna belonging to 11 families: 10 species of amphibians, 6 species of lizards and 1 species of snake (Table 9). The highest number of species was documented in Bulanjao (8 species), followed by Ibelnan (5 species), Kinurong (4 species), TSF3 (5 species), Magas-Magas (4 species), Nagoya (2 species), Ursula Island (2 species) and TSF1 (1 species).

In terms of pristine microhabitats, the stream system at the base of Mt. Bulanjao ranked with the highest number of species. Unlike the other sites, Bulanjao, though disturbed by previous mining activities, boasts the greatest forest density among the 8 monitoring sites. The site largely dominated by forestlands and has riparian forests which are optimal habitats for amphibians and reptiles.

A few other sites share a similar combination of factors with Bulanjao, namely the presence of a freshwater system and an adjoining vegetated area. This can be seen in Ibelnan (a riparian secondary growth forest with a large stream system), TSF3 (a mixed forest-grassland with a small adjoining stream) and Kinurong (siltation ponds bordered by replanted trees). Amphibians generally out-number reptile species in these cases, as their biology is more tied to water systems.

In the case of more disturbed habitats like Nagoya and TSF1, species are generally less abundant, but reptiles predominate these areas due to their adaptability to anthropogenic disturbances and general ability to live independent of water bodies.

While the distributions of species were mediated by habitat type, some species were higher in terms of abundance in their respective sites. Specifically, *Staurois nubilus* had the highest number of individuals documented in each of Bulanjao and Ibelnan. Other species similar between the two sites include *Megophyrs ligayae*, *Pulchrana moellendorffi*, *Sanguirana sanguinea* and *Gekko monarchus*. Both sites shared certain similarities, including a stream system, rocky microhabitats, and adjacent forest. Both also have previous anthropogenic development but are currently abandoned and undisturbed by human presence.

Some semi-aquatic species (*P. moellendorffi* and *Limnonectes* acanthi) were present in other sites, such as the smaller stream in Magas-Magas and the grassland creek in TSF3. Disturbance-tolerant species like *Ingerophrynus philippinicus* and *Bronchocela cristatella* were observed in sites with human-heavy activities such as Kinurong siltations ponds and the roads in Magas-Magas.

Table 9. List of species of herpetofauna documented during the 2022 monitoring survey of terrestrial vertebrates.

Species	Common Name	Sites							
		Ibelnan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF3	Ursula Island	Bulanjao
AMPHIBIANS									
Bufonidae									
Ingerophrynus philippinicus	Palawan toad		3				2		2
Ceratobatrachidae									
Alcalus mariae	Mary Inger's frog								3
Dicroglossidae									
Limnonectes acanthi	Busuanga warty frog		5	1					5
Occidozyga laevis	Puddle frog						1		
Megophyridae									
Megophrys ligayae	Palawan horned toad	2							3
Microhylidae									
Kaloula pulchra	Banded bullfrog						1		
Ranidae									
Pulchrana moellendorffi	Culion frog	3		1			1		7
Sanguirana sanguinea	Southeast Asian wood frog	4							3
Staurois nubilus	Palawan torrent frog	26							18
Rhacophoridae									
Polypedates cf. macrotis	Brown-striped tree frog			1				1	
REPTILES									
Agamidae									

Species	Common Name	Ibe Inan	Kinurong	Magas-Magas	Nagoya	TSF1	TSF3	Ursula Island	Bulanjao
Bronchocela cristatella	Green crested lizard		1				1		
Draco cf. reticulatus	Reticulated flying lizard				1				
Gekkonidae									
Gekko gecko	Tokay gecko					1			
Gekko monarchus	Spotted house gecko	1		1					5
Hemidactylus frenatus	Common house gecko		1						
Varanidae									
Varanus cf. palawanensis	Palawan monitor lizard				1				
Colubridae									
Dendrelaphis levitoni	Palawan bronzeback							1	

Table 10. Habitats, distribution, and conservation status of herpetofauna documented during the 2022 monitoring of terrestrial vertebrates.

Family	Habitat Classification	Distribution	Feeding guild	Conservation Status		
				IUCN	DAO 2019 - 09	PCSD
AMPHIBIAN						
Bufonidae						
Ingerophrynus philippinicus	Mixed habitat	Endemic	Insectivore	LC	OWS	NC
Ceratobatrachidae						
Alcalus mariae	Riparian forest and streams	Endemic	Insectivore	EN	OWS	NC
Dicroglossidae					OWS	
Limnonectes acanthi	Wetlands, coasts and related habitats	Endemic	Invertivore	VU	OWS	LC
Occidozyga laevis	Cosmopolitan	Native	Invertivore	LC	OWS	NC
Megophyridae					OWS	
Megophrys ligayae	Forestland and related forest habitats	Endemic	Insectivore	NT	OWS	EN
Microhylidae					OWS	
Kaloula pulchra	Forestland and related forest habitats	Introduced	Insectivore	LC	OWS	NC
Ranidae					OWS	
Pulchrana moellendorffi	Riparian forest and streams	Endemic	Invertivore	LC	OWS	LC
Sanguirana sanguinea	Riparian forest and streams	Endemic	Invertivore	LC	OWS	VU
Staurois nubilus	Riparian forest and streams	Endemic	Invertivore	LC	OWS	LC
Rhacophoridae					OWS	
Polypedates cf. macrotis	Riparian forest and streams	Native	Insectivore	LC	OWS	NC
REPTILES					OWS	
Agamidae					OWS	
Bronchocela cristatella	Mixed habitat	Native	Insectivore	LC	OWS	NC
Draco cf. reticulatus	Forestland and related forest habitats	Endemic	Insectivore	LC	OWS	NC
Gekkonidae					OWS	
Gekko monarchus	Riparian forest and streams	Native	Insectivore	LC	OWS	NC
Gekko gecko	Forestland and related forest habitats	Native	Insectivore	LC	OWS	NC

Hemidactylus frenatus	Cosmopolitan	Native	Insectivore	LC	OWS	NC
Varanidae						
Varanus cf. palawanensis	Mixed habitat	Endemic	Carnivore	UNK	OWS	NC
Colubridae					OWS	
Dendrelaphis levitoni	Mixed habitat	Endemic	Carnivore	UNK	OWS	NC

Among amphibians, a half of the species (50%) were found to stream and riparian forest dwellers (Figure 18). As frogs have a higher fidelity to water systems due to their biology, this occupancy of water systems has been proven as a constant among this faunal group. Reptiles, on the other hand, were found to be majorly a mixed habitat species (42.9%). This is further exemplified by the specific reptile species which were documented: *Hemidactylus frenatus* and *Gekko gecko* are common reptiles in human habitations but can similarly be found among other habitat types, *Dendrelaphis levitoni* is known to inhabit disturbed forest edges but can similarly be detected along coastal forests and *Varanus palawanensis* can freely move between across forests, agricultural areas and even coastal forest and mangroves. The habitats, distribution, and conservation status of herps documented during the 2021 monitoring is presented in Table 10.

In terms of feeding guild, there is an equal distribution (50% each) between non-insect invertivore and insectivore amphibians while a greater number of reptiles were found to occupy an insectivorous diet (71.4%) over a carnivorous diet (28.6%) (Figure 19).

Seventy percent of amphibians were found to be Palawan endemic species while 67.1% of reptiles in the area were found to be native species (Figure 20). Only one introduced species, *Kaloula pulchra*, was documented by the current study.

The percentage of species based on conservation status is presented on Figure 21 (amphibians) and Figure 22 (reptiles). According to the IUCN Red List, 10% of amphibians were classified as Near Threatened (*Megophyrs ligayae*), Vulnerable (*Limnonectes acanthi*) and Endangered (*Alcalus mariae*) each while among reptiles, 71.4% was classified as Least Concern. Based on the Philippine Red List of Threatened Wildlife Fauna by DENR (2019), 100% of amphibian species and all reptile species were Other Wildlife Species under the DENR criteria. A similar trend was also observed for the classification under PCSD, wherein all of the reptile species were not classified under any categories though among amphibians, 10% were found to be under Vulnerable (*Sanguirana sanguinea*) and another 10% was found to be endangered (*Megophrys ligayae*).

Table 11. Comparison of values of diversity indices (herpetofauna) between monitoring sites.

Sites	Richness	Abundance	Dominance	Diversity	Evenness
Bulanjao	8	92	0.3036	1.596	0.5484
Ibelnan	5	72	0.3862	1.166	0.535
TSF3	5	12	0.3056	1.474	0.7274
Kinurong	4	20	0.34	1.277	0.7174
Magas-Magas	4	8	0.3125	1.386	0.8
Nagoya	2	4	0.375	1.04	0.9428
Ursula Island	2	4	0.375	1.04	0.9428
TSF1	1	2	0.5	0.6931	1

COMPARISON OF DIVERSITY INDICES BETWEEN SITES (REPTILES AND AMPHIBIANS)

Diversity values were low for herpetofauna (Table 11), though generally higher than most other mammal diversity indices but lower than birds. However, some sites were had a higher species richness over others. This discrepancies between sites are largely due to the presence of freshwater bodies.

Species diversity and richness was highest in Bulanjao (1.596, 8 species) and lowest in TSF1 (0.6931, 1 species). It must be noted that while evenness and dominance values in certain sites like TSF1, Ursula Island and Nagoya are at the extreme ends of the indices, they are interpreted based on the paucity of reptiles and amphibians in the areas. Due to only one or two species being documented in the area, incidence of dominance, even at low abundance, will be reflected in the corresponding diversity indices.
Primary contributing factors to the resulting diversity values may be attributed to the season, weather, temperature, time, human disturbances, and availability of microhabitats. The location of the stream systems in Bulanjao are far from human habitation and are not affected by potential pollutants in the water nor by noise and light pollution. This isolation largely contributes to the presence of amphibian species which are unique to that habitat like *Alcalus mariae*. This can similarly be said for Ibelnan, which had previously undergone human development but was subsequently abandoned. Bot sites exhibited an increased number of aquatic and semi-aquatic frogs that prefer pristine waters compared to those found in the man-made ponds at Kinurong or the disturbed streams in Magas-Magas and TSF3. It is for this reason that only more generalist and terrestrial species like the introduced *Kaloula pulchra* and the endemic Ingerophyrnus philippinicus were found highly disturbed areas as in Magas-magas

On the other hand, most of the reptiles found in the sites were species that could tolerate high levels of disturbance. These are primarily gecko species like *Gekko monarchus* and *Hemidactylus frenatus*, which can adaptively switch between forest and man-made

structures depending on the availability in an area. Certain species like *Draco reticulatus* and *Varanus palawanensis* were found in Nagoya Bay, the former frequenting coconut plantations due to the abundance of prey items and the later with its ability to traverse across water to move from mangrove to the nearby agricultural lands.

In another interesting note in Ursula Island was the documentation of *Dendrelaphis levitoni*, an arboreal snake species which was also previously documented in past surveys (latest was back in 2014) but had largely been absent in contemporary ones. Furthermore, a sighting of a single amphibian, *Polypedates cf. macrotis* (but more likely *P. leucomystax*) was made in the current survey. This finding is significant as the coastal forest in Ursula is largely devoid of freshwater bodies. The only existing, albeit potentially saline sources some from accumulated rainwater in tree holes and debris. This could be the first sighting to record to document a frog species. It is recommended that herpetofauna surveys be conducted in the interior of the island more properly to ascertain whether the documented species was just a one-time accidental introduction or if other individuals exist in the island.

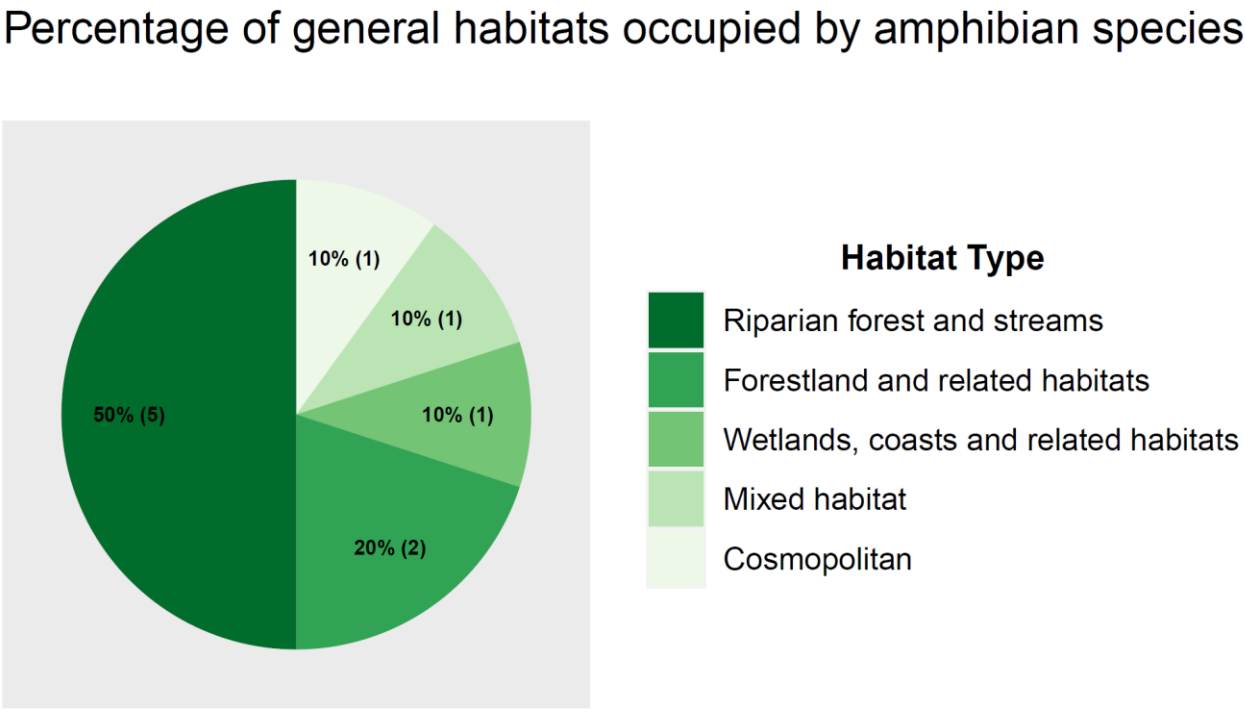


Figure 18A. Percentage of amphibian species thriving in different habitats.

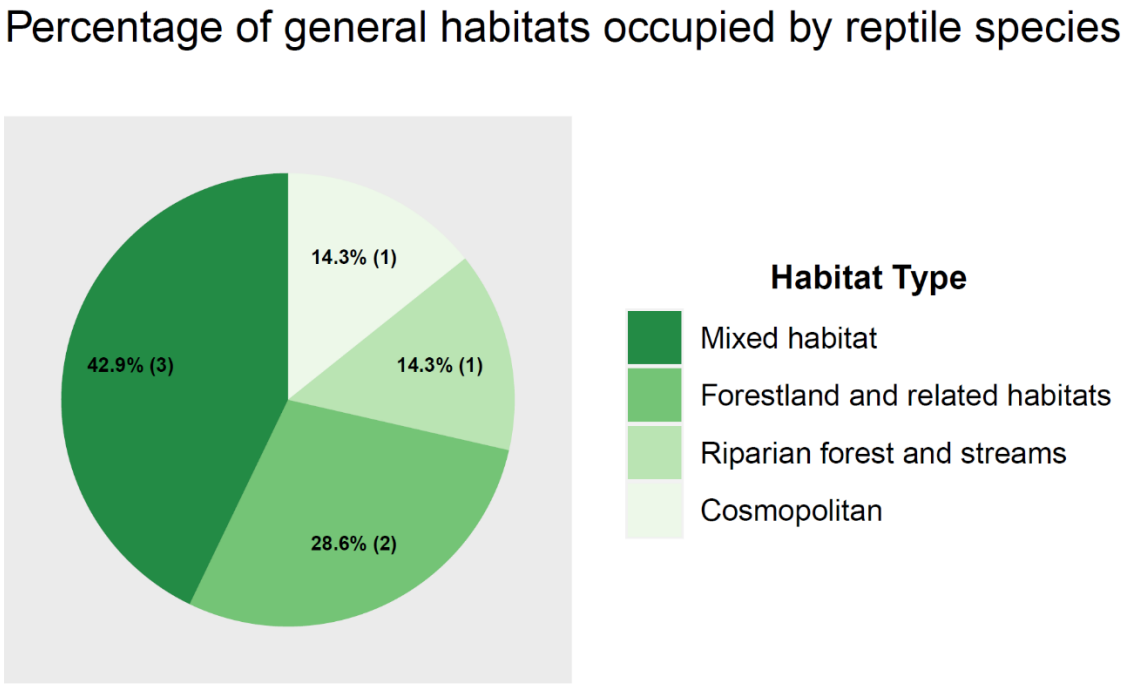


Figure 18B. Percentage of reptile species thriving in different habitats.

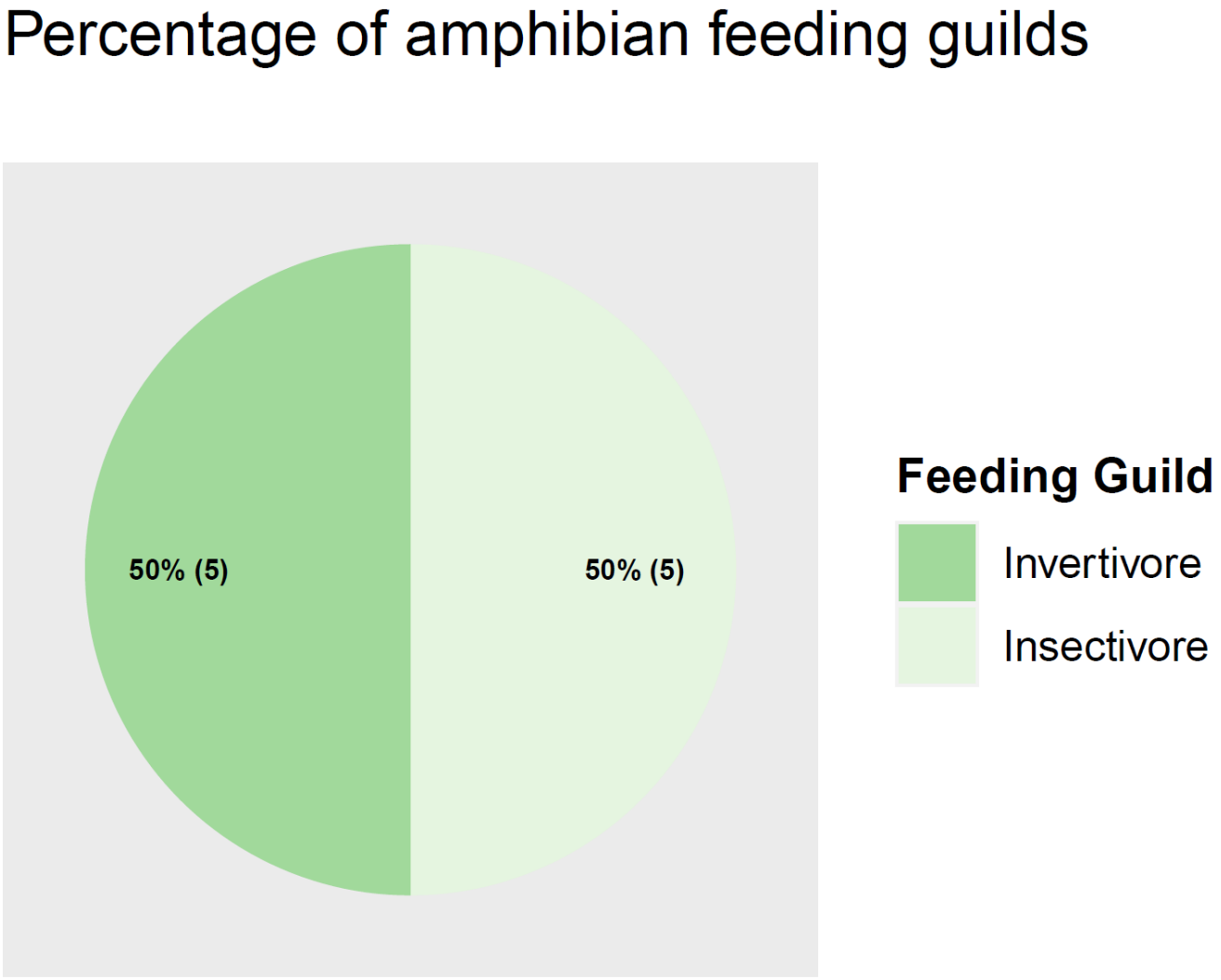


Figure 19A. Percentage of feeding guilds occupied by amphibians.

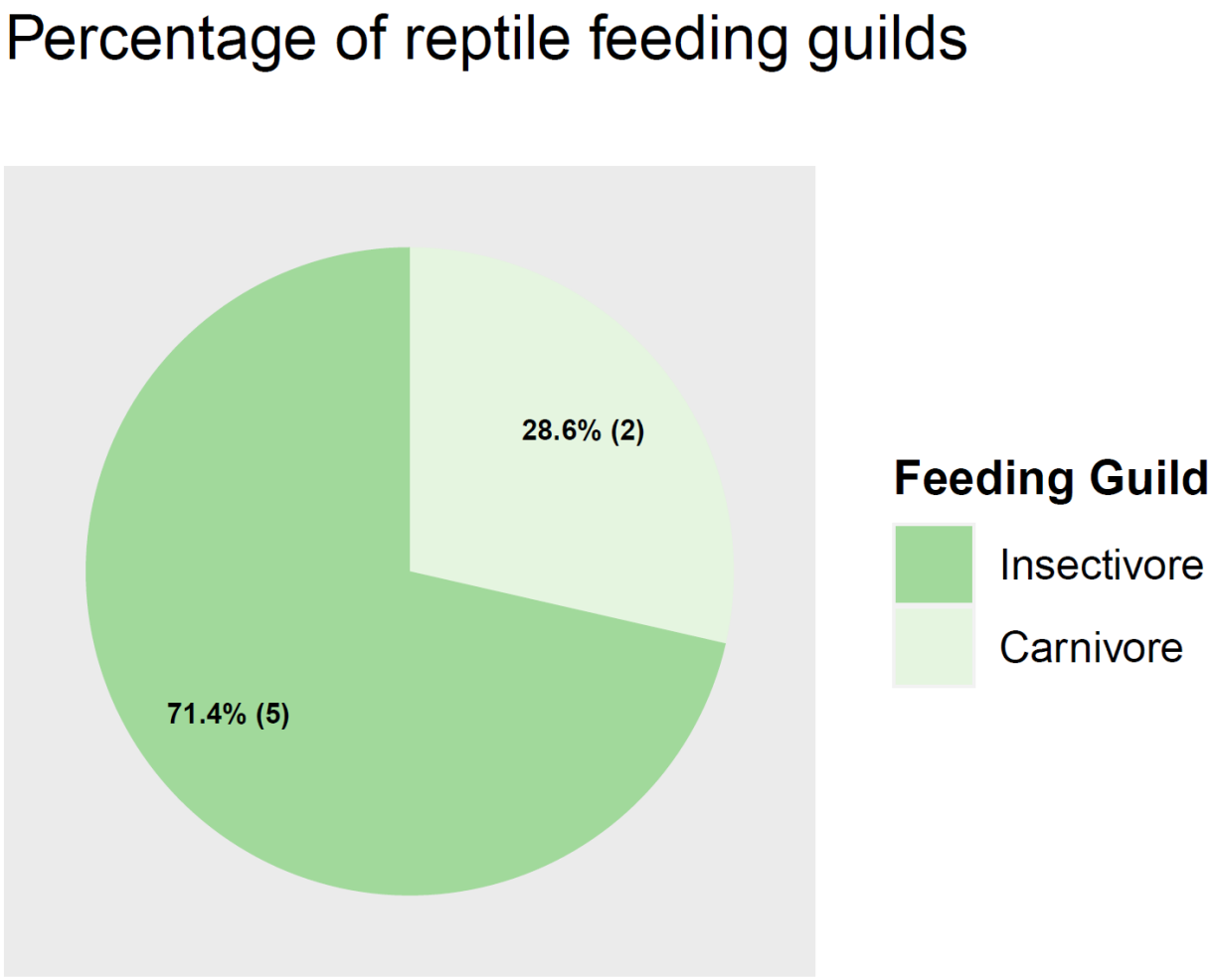


Figure 19A. Percentage of feeding guilds occupied by reptiles.

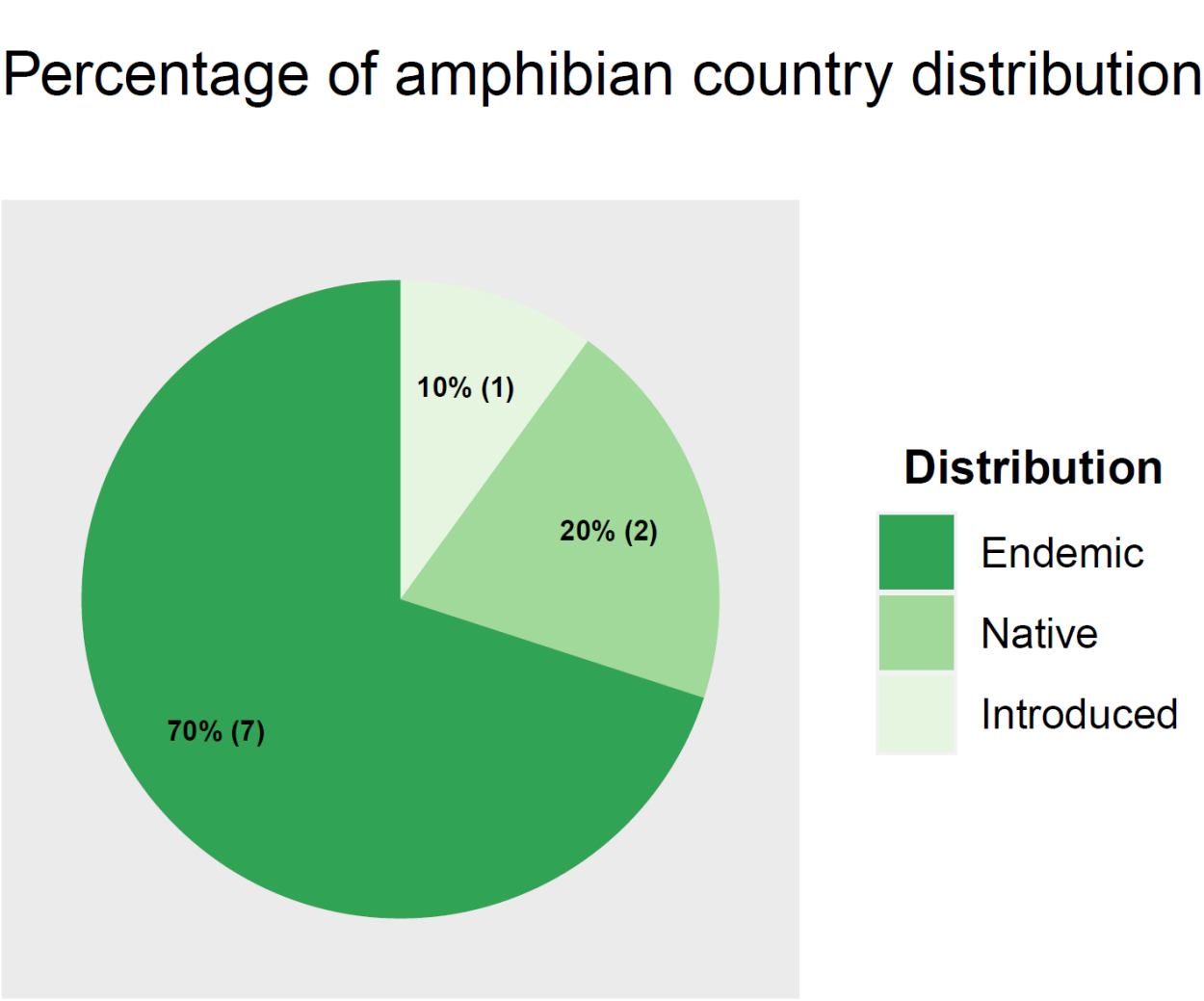


Figure 20A. Percentage of herpetofauna country distribution.

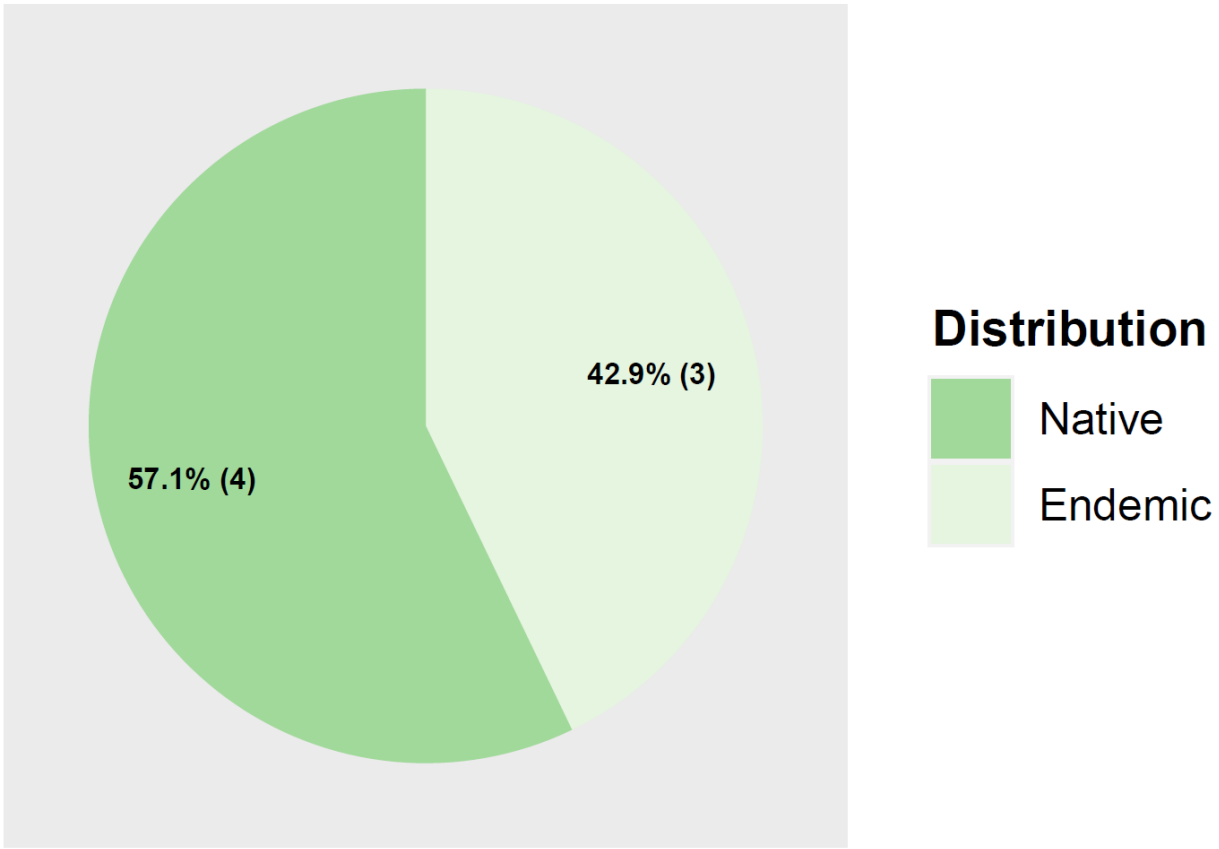


Figure 20B. Percentage of herpetofauna country distribution.

Percentage of amphibian conservation status (IUCN)

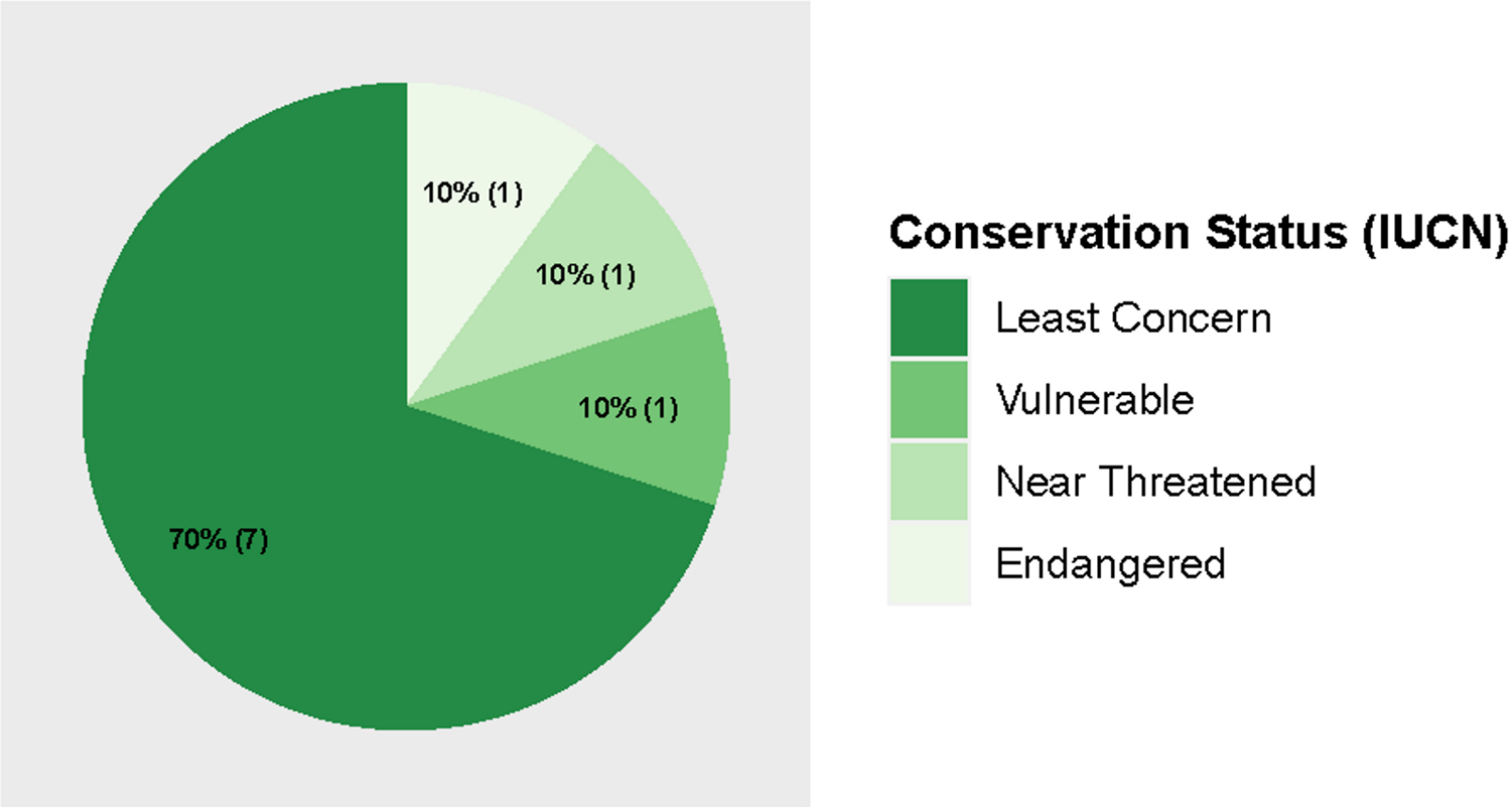


Figure 21A. Percentage of amphibian conservation status (IUCN).

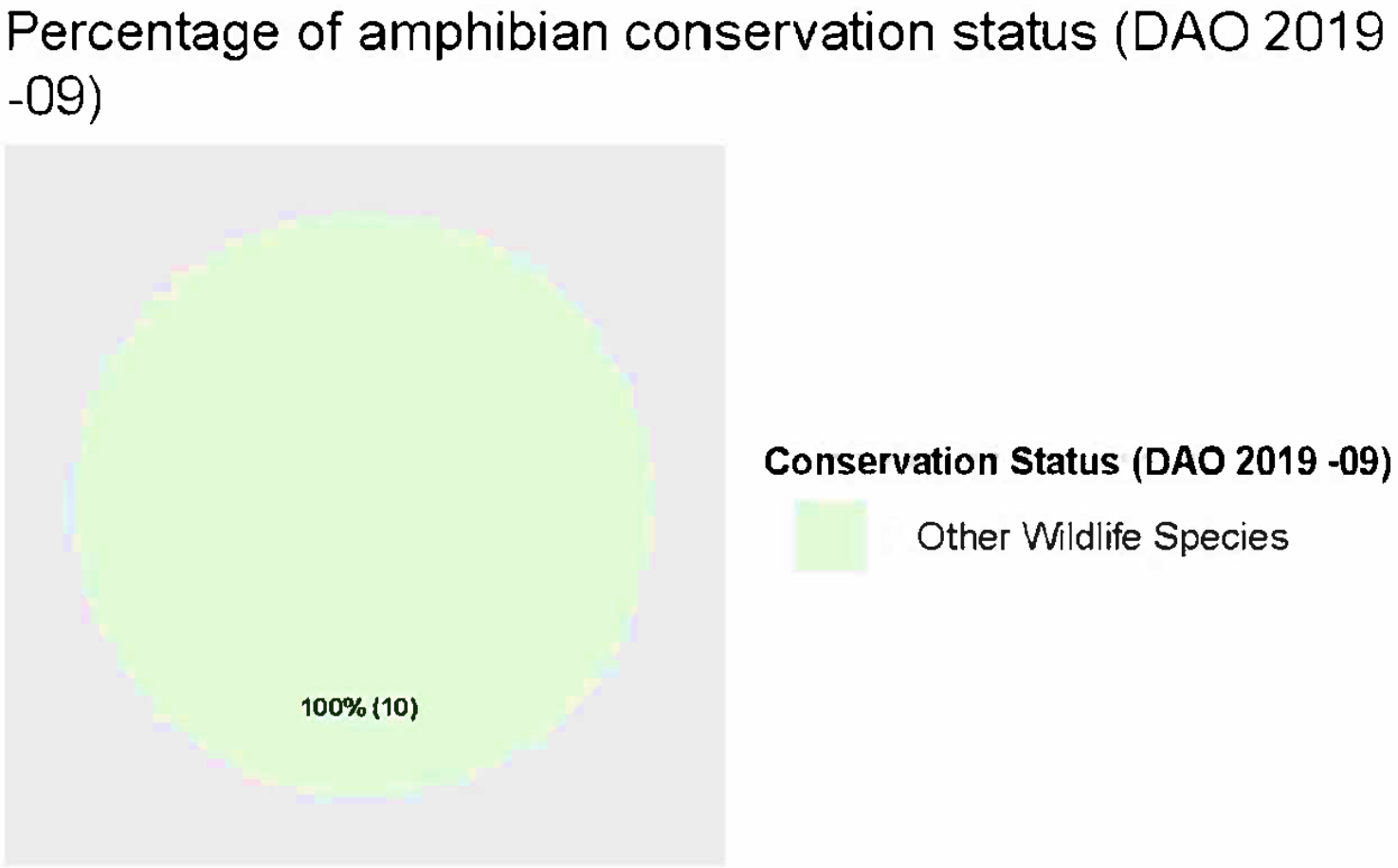


Figure 21B. Percentage of amphibian conservation status (DENR).

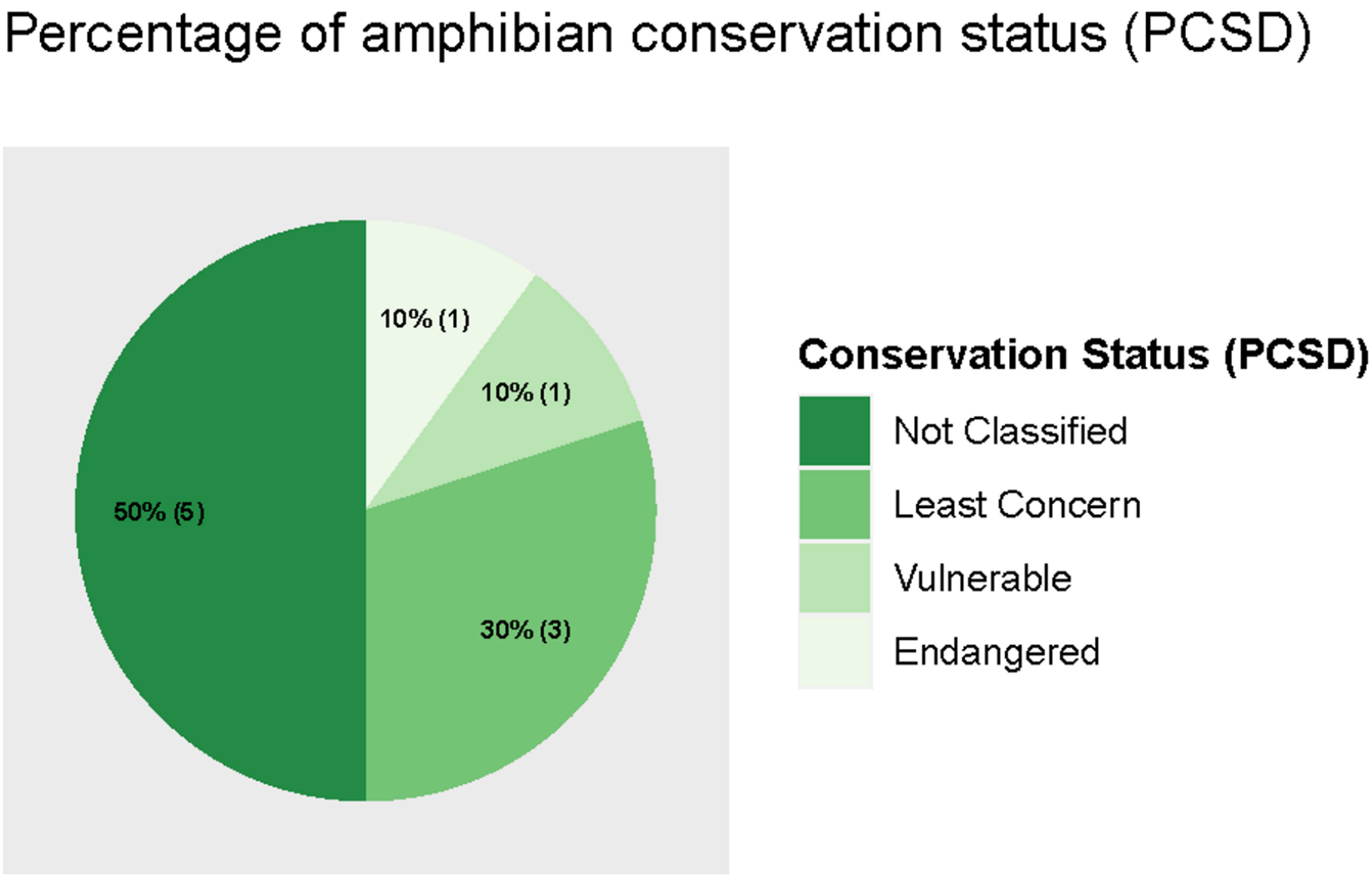


Figure 21C. Percentage of amphibian conservation status (PCSD).

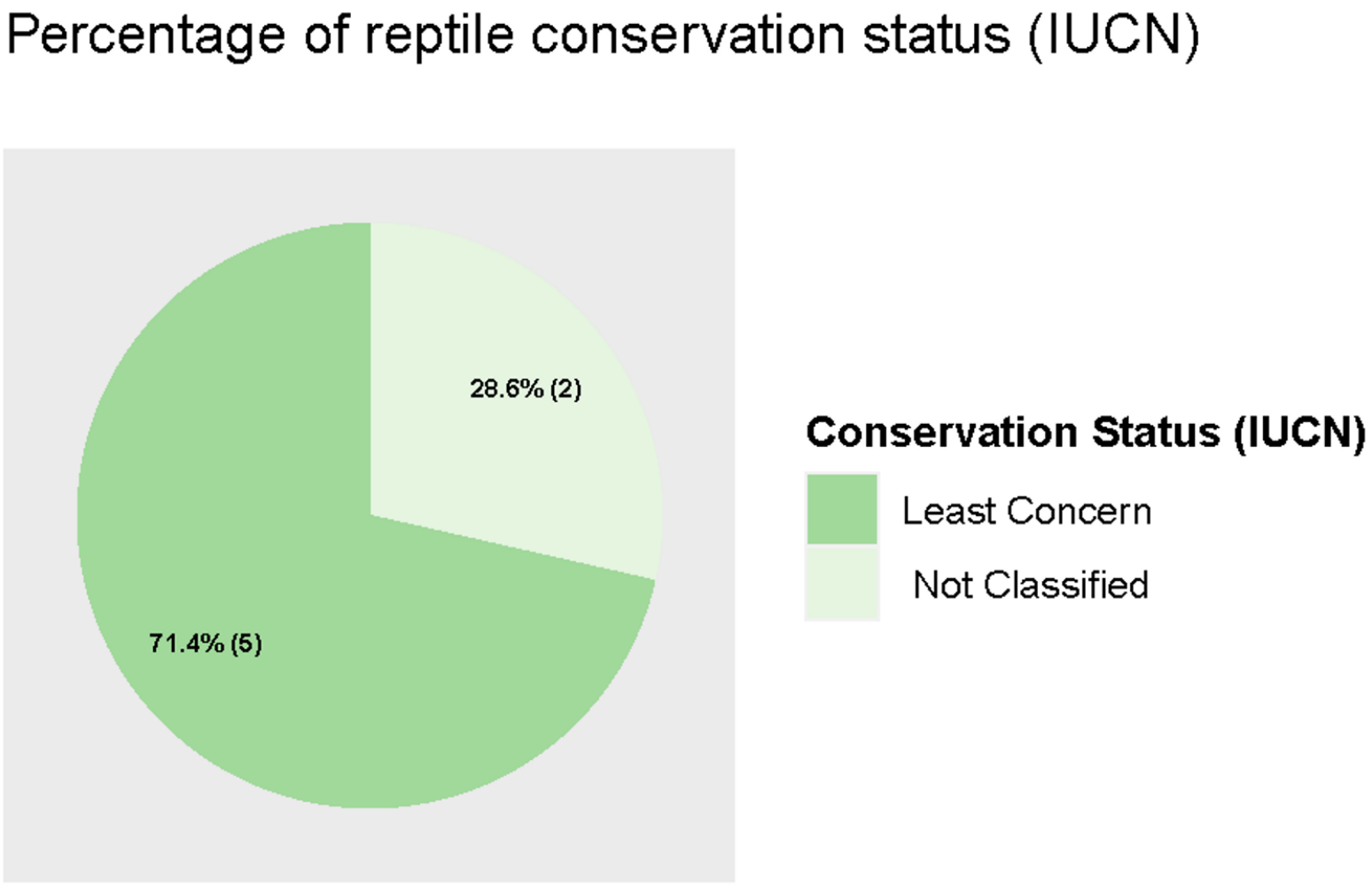


Figure 22A. Percentage of reptile conservation status (IUCN).

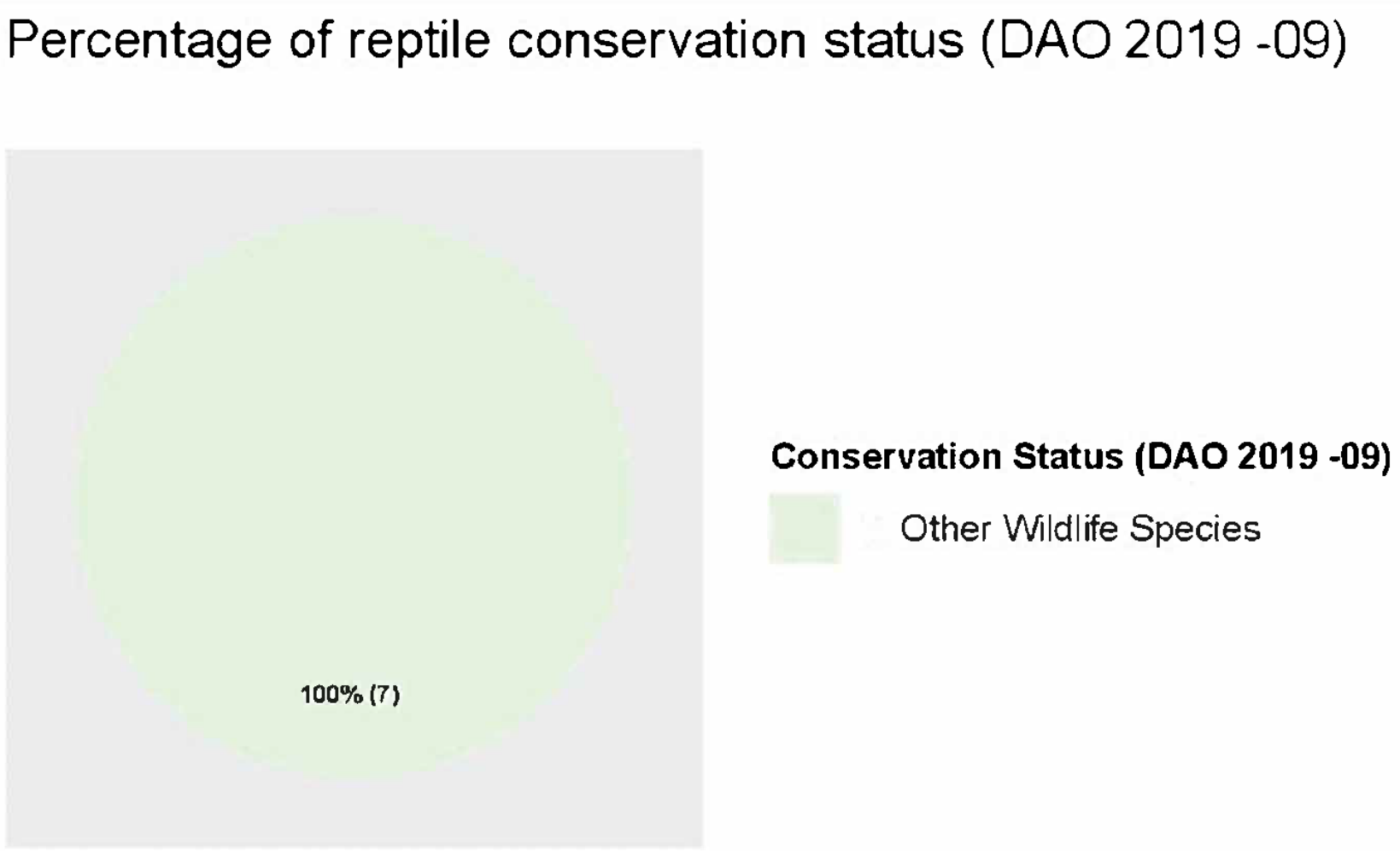


Figure 22B. Percentage of reptile conservation status (DENR).

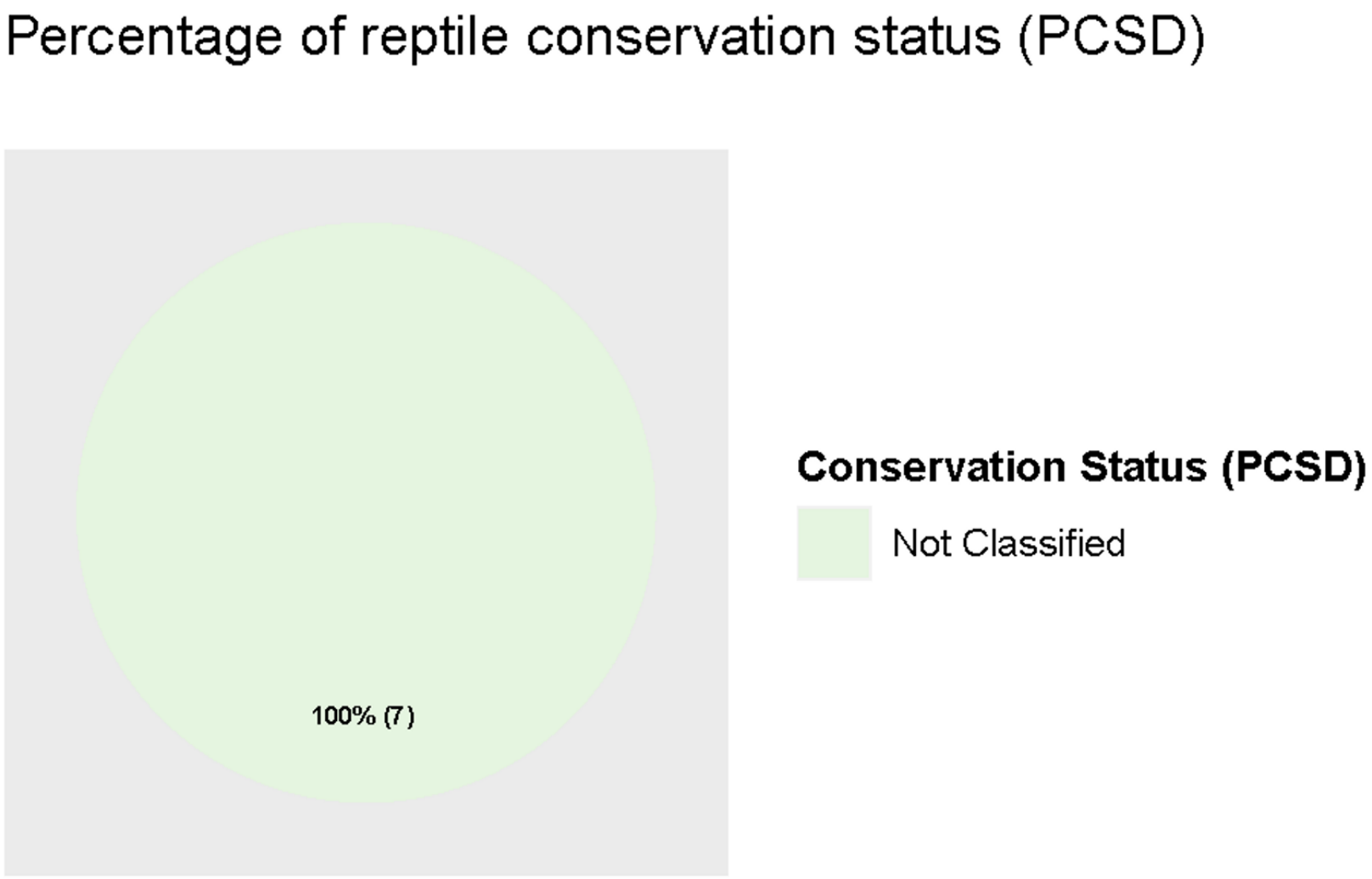


Figure 22C. Percentage of reptile conservation status (PCSD).

Summary and Conclusion

The annual monitoring activities of terrestrial vertebrates in Coral Bay Nickle Corporation and the areas under its jurisdiction and maintenance was conducted during the 2nd week of June and targeted 8 monitoring sites. The faunal current survey documented 101 terrestrial vertebrate species, a surprisingly similar number to the previous 2020 and 2021 faunal surveys. In summary, there were 74 species of birds (83 in 2021, 81 in 2020), 10 mammal species (11 in both 2021 and 2020), 10 species of amphibians and 7 species of reptiles (7 in 2021, 9 in 2020).

The increase and decrease of species richness is influenced by several physical and biological factors in the environment. The sighting and occurrence of certain species may be limited by the climate and the weather pattern at the time of monitoring. They are also affected by the levels of disturbance as well as the presence of anthropogenic disturbances. These in turn can affect whether habitats remain static or change drastically. Natural disturbances such as landslides, forest fires and tidal pattens may also influence the rise and decline of certain groups of animals. Finally, even the biases of the investigators and the duration of the survey will affect how many species will be documented. For this reason, standardized techniques are used to minimize collector biases.

Monitoring activities been the previous year and the current was conducted in roughly the same period, with the predominant onset of the wet seasons and the lapse of bird migration. At the time of survey, survey days were characterized by dry weather that was interrupted by afternoon or evening rain.

Of 83 bird species in 2020, 22 species were not documented in the 2022 survey; however, it documented 9 species of birds which were not listed before. The only site with a constant number of species over the years in Ursula Island, though it has not received consistent surveys in every monitoring period.

Among mammals, three species found in 2021 were not found in the current survey. However, 3 other species were documented that were absent from last year's list. *Pteropus hypomelanus* was recorded in Ursula Island instead of the yearly sighting of *Pteropus vampyrus*. Two insect bats, *Myotis muricola* and *Megaderma spasma* were similarly redocumented after absences from past listing.

For the herpetofauna listing, a large increase from 9 species to 17 species was documented. Eight new species of reptiles and amphibians was documented by the current survey. The uncommon species *Alcalus mariae* was again re-included in the species listing after its absence in the last few years of survey efforts. Similarly, the

presence of *Varanus palawanensis* in Nagoya was a new record for the area. *Dendrelaphis levitoni*, along with the presence of a potential frog species in Ursula Island, are likewise highlights in the survey.

Currently, the data points out that despite anthropogenic disturbances in their area of jurisdiction, the actions and rehabilitation work performed by Coral Bay Nickel Corporation to mitigate the impact of their operations appears to be sustaining some level of balance with the local ecosystems. At the very least, disturbances are localized to specific areas like TSF3 and Magas-magas while other sites like Bulanjao, Ursula Island and Ibelnan have improved in terms of the wildlife community. While the current survey documented slightly fewer species than the previous year, species which were not previously listed or were absent from the older inventories, were included. However, changes and shifts in the species diversity are expected when conducting surveys during the onset of different seasons.

However, some key point from the current survey should be noted.

The development of the dirt road in Mt. Bulanjao to accommodate vehicles may inevitably affect the distribution of some disturbance sensitive species, should road traffic become a regular occurrence. A similar matter may be said for TSF3 as development continues the new tailings storage facility, though the number of generalist species may not be as affected.

As previously recommended, monitoring activities should be geared towards the period between the dry season and the wet season (April to June) to coincide with the appearance of migratory birds. As all areas inherently have a degree of all species, it is recommended that herpetofaunal sampling be conducted in all sites to ensure that all sites are equally assessed.

In Ursula Island, sustained trapping efforts should be maintained if eradication (or control) of the introduced rat population to the island to be achieved. Regular trapping must be performed and maintained by the assigned personnel consistently to prevent possible resurgence in the population. As rats present a danger to the breeding birds in the island, controlling their numbers is key to the long-term survival of the bird population. In cases of baits being ignored by the rats, it is recommended that trapping should cycle through using different baits (i.e., using dried fish, grains etc.) to prevent acclimatization to the regular coconut bait. The introduction of other animals to act as a biological control for the rats must also be addressed. It must be greatly emphasized that introducing cats, monitor lizards and snakes (all natural predators of birds and potentially arboreal) will not solve the rat population problem and will likely become a worse problem to the protected bord population in the island. Similar measures must be undertaken to eradicate all

introduced predators to the island, as they will inevitably become predators of both ground and canopy nesting birds. Regarding the standardization of the bird counts for the population of *Ducula bicolor* in an area, it is recommended that the counts be conducted every few months and with the same number of people station in set locations around the island. Tally counters can be used for the activity to allow for faster counting times. Both exit (early morning) and entry (early afternoon) counts must be timed consistently in order to get as unbiased a count as possible. A protocol can be drafted with a wildlife specialist on bird counts if necessary to ensure that accurate and consistent data is obtained annually.

Appendix I. Pictorial documentation of bird species from the general CBNC area (2022).

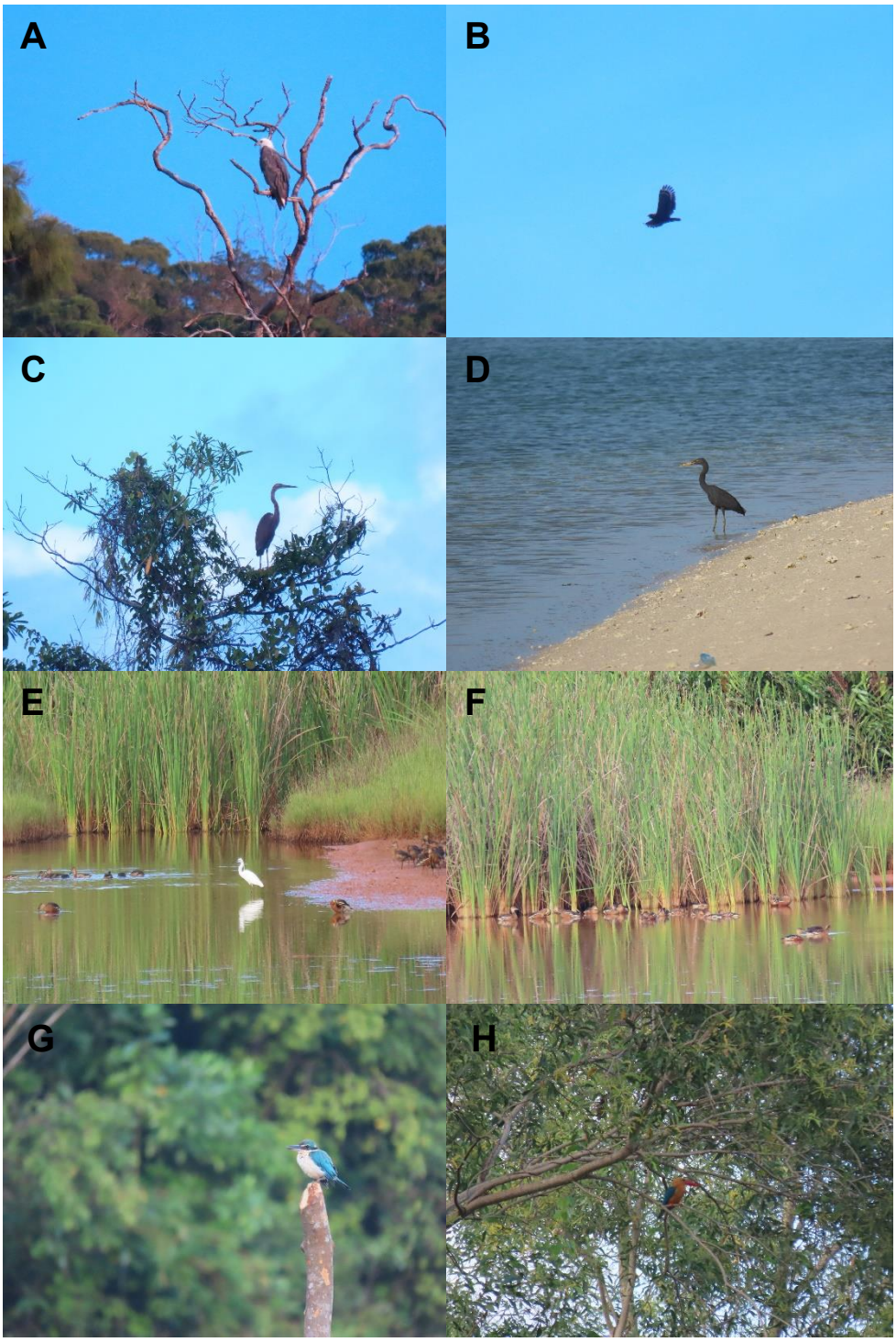


Figure 23. Representative bird species of CBNC. *Haliaeetus leucogaster* (A), *Spilornis holospilus* (B), *Ardea purpurea* (C), *Egretta sacra* (D), *Egretta garzetta* (E), *Dendrocygna arcuata* (F), *Todirahmpus chloris* (G) and *Pelargopis capensis* (H). Fifteen of 74 species of birds recorded are endemic to the Philippines. Photos by P. Kim.

Figure 24. Representative bird species of CBNC. *Chalcophaps indica* (A), *Ducula bicolor* (B), *Geopelia striata* (C), *Treron vernans* (D), *Chloropsis palawanensis* (E), *Aegithina tiphia* (F), *Caprimulgus macrurus* (G) and *Corvus enca* (H). Fifteen of 74 species of birds recorded are endemic to the Philippines. Photos: P. Kim.

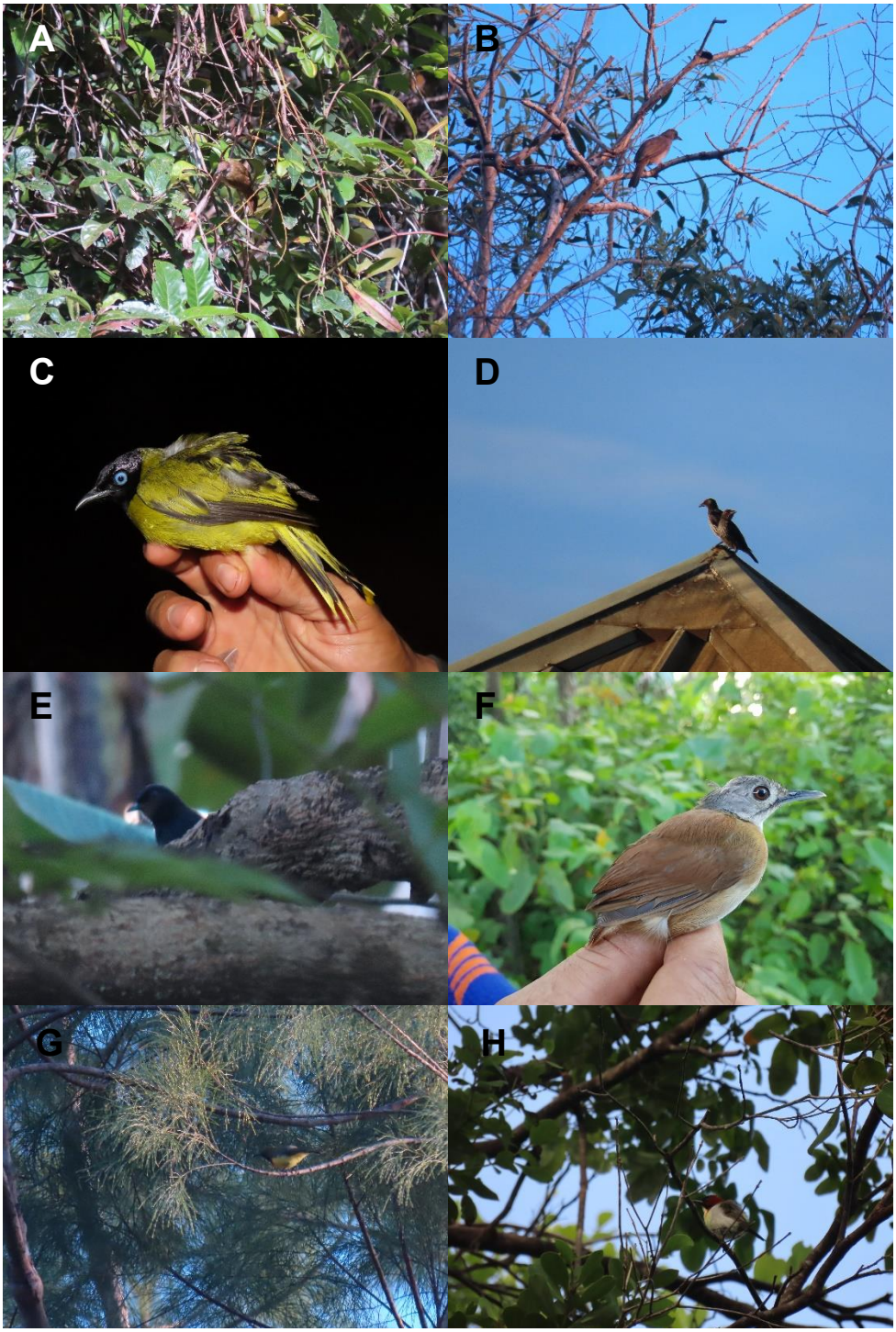


Figure 25. Representative bird species of CBNC. *Alophoixus frater* (A), *Pycnonotus cineirofrons* (B), *Brachypodius atriceps* (C), *Aplonis panayensis* (D), *Copsychus niger* (E), *Pellorneum cinereiceps* (F), *Cinnyris jugularis aurora* (G) and *Aethopyga shelleyi* (H). Fifteen of 74 species of birds recorded are endemic to the Philippines. Photos: P. Kim.

Figure 26. Representative bird species of CBNC. *Arachnothera longirostris* (A), *Hirundo tahitica* (B), *Eudynamys scolopacea* (C), *Centropus sinensis* (D), *Prionochilus plateni* (male) (E), *Prionochilus plateni* (female) (F) and *Hypothymis azurea* (G). Fifteen of 74 species of birds recorded are endemic to the Philippines. Photos: P. Kim.

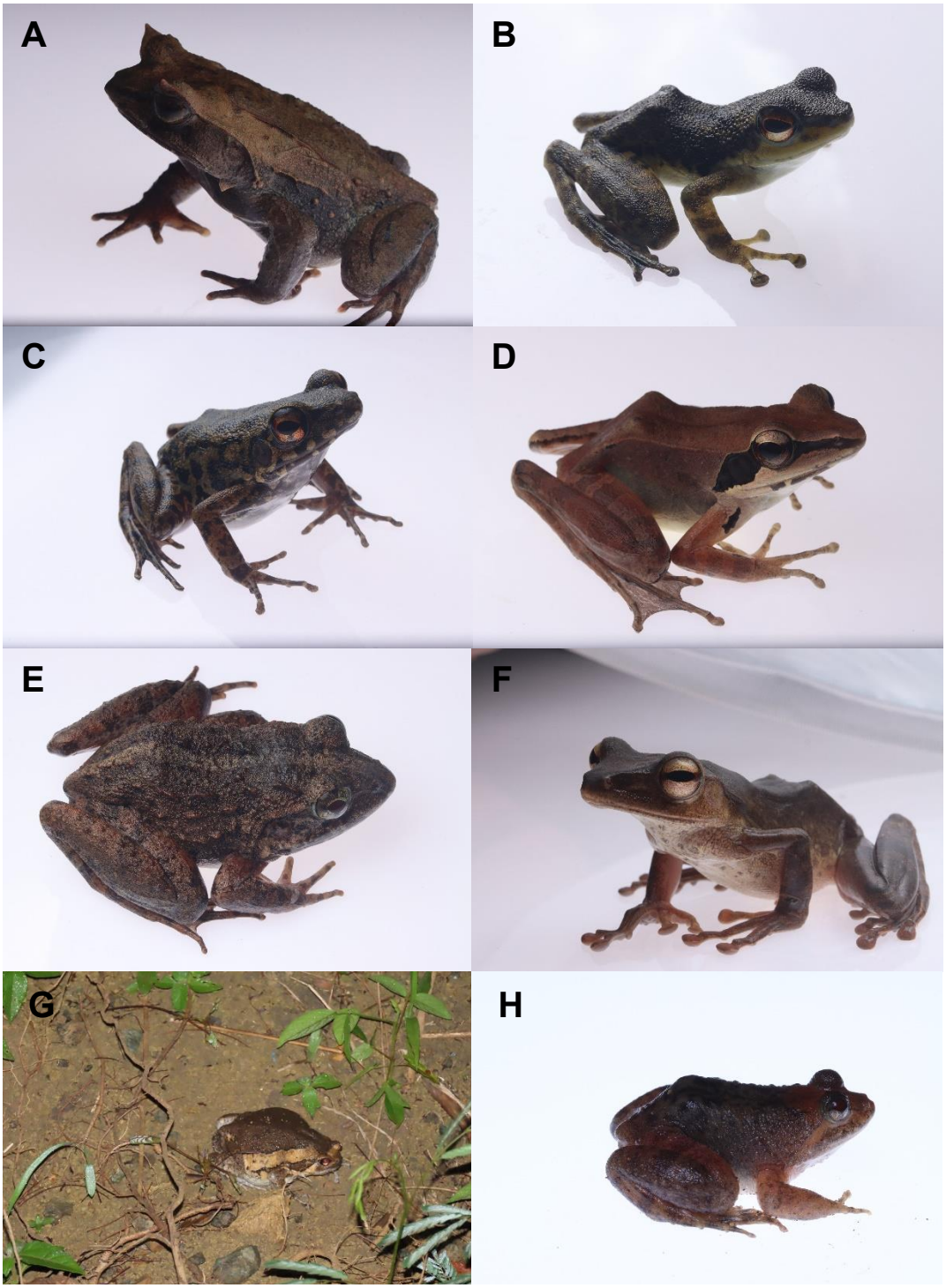


Figure 27. Representative bird species of CBNC. *Megophrys ligayae* (A), *Staurois nubilus* (B), *Pulchrana moellendorffi* (C), *Sanguirana sanguinea* (D), *Limnonectes acanthi* (E), *Polypedates cf. macrotis*)(F), *Hypothymis azurea* (G) and *Occidozyga laevis* (H). Ten of 17 species of herpetofauna recorded are endemic to the Philippines. Photos: P. Kim.

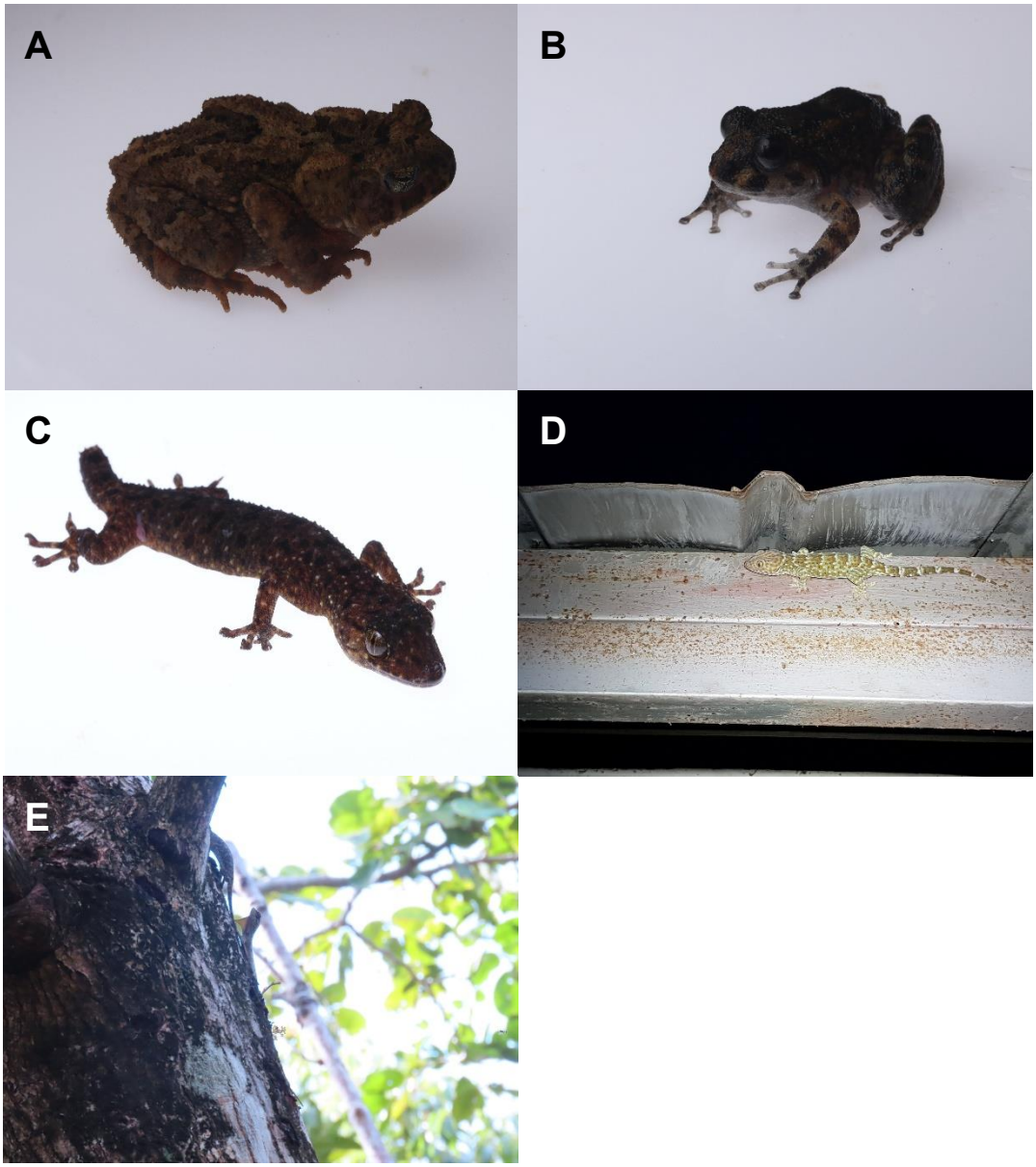


Figure 28. Representative bird species of CBNC. *Ingerophrynus philippinicus* (A), *Alcalus mariae* (B), *Gekko monarchus* (C), *Gekko gecko* (D) and *Draco reticulatus* (E). Ten of 17 species of herpetofauna recorded are endemic to the Philippines. Photos: P. Kim.

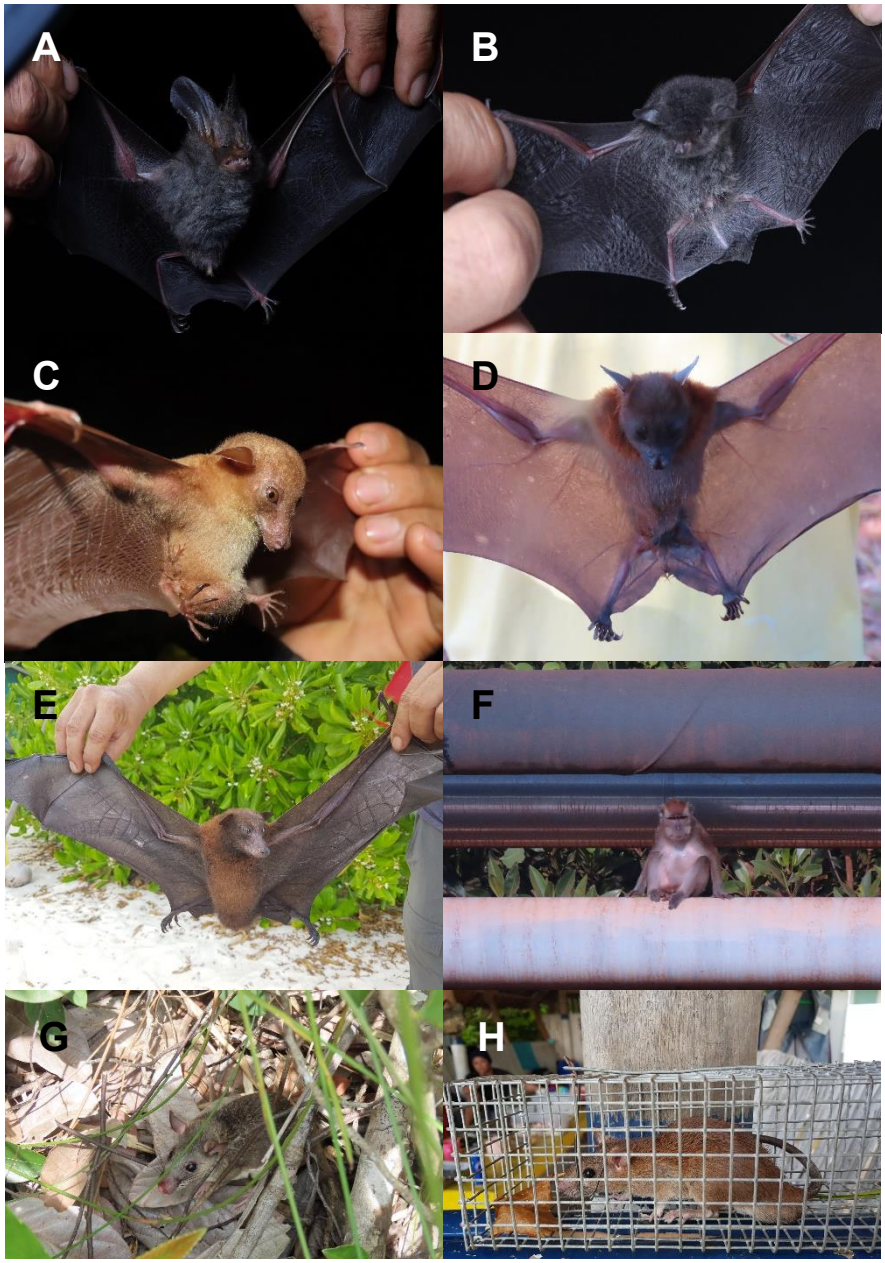


Figure 29. Representative bird species of CBNC. *Megaderma spasma* (A), *Myotis cf. muricola* (B), *Macroglossus minimus* (C), *Cynopterus brachytis* (D), *Pteropus hypomelanus* (E), *Macaca fascicularis* (F), *Maxomys panglima* (G) and *Rattus tanezumi* (H). Two of 10 species of mammals recorded are endemic to the Philippines. Photos: P. Kim.