Final Evaluation Report

Your Details	
Full Name	Desamarie Antonette P. Fernandez
Project Title	CARNIVORA PH: Understanding the ecological niche partitioning of carnivorans in Palawan Island, Philippines
Application ID	36495-1
Date of this Report	15 November 2023

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Identify food items of each carnivoran species to determine their dietary niche		■		Faecal samples were collected and processed, but food species identification is on-going.
Analyse the activity period of each species and determine their temporal niche			■	Finished
Use occupancy modelling to determine each species' spatial niche			■	Finished
Estimate each species' home range	■			The reviewer of the original proposal advised the removal of this objective.
Train national park staff, local university students, and other stakeholders in the establishment and maintenance of camera trap arrays			■	Finished

2. Describe the three most important outcomes of your project.

From March 2022 to March 2023, 30 camera trap stations were set in the vicinity of the national park, 20-30 cm from the ground and approximately 1 km from each other (Figure 1). There were also 10 cameras set 5-17 m from the ground in the canopy of selected fruiting trees. In 3,882 trap-nights, the total number of species detected was 27, with 20 identified and seven currently unidentified.

Spatial Niche Analysis
The most frequently detected carnivoran was the Palawan stink badger (*Mydaus marchei*), followed by the common palm civet (*Paradoxurus philippinensis*), Sunda leopard cat (*Prionailurus javanensis*), collared mongoose (*Urva semitorquata*), binturong (*Arctictis binturong*), and Asian small-clawed otter (*Aonyx cinereus*) (Figures 2 and 3). The Malay civet (*Viverra tangalunga*) was not detected, which may indicate its rarity in the site or a lower abundance in surveyed areas.

Single species occupancy modelling of the more frequently detected species showed that tree cover had a positive effect on the occupancy of Palawan stink-badgers and Sunda leopard cats. Common palm civets had higher occupancy probabilities in areas that are farther away from villages, while collared mongooses

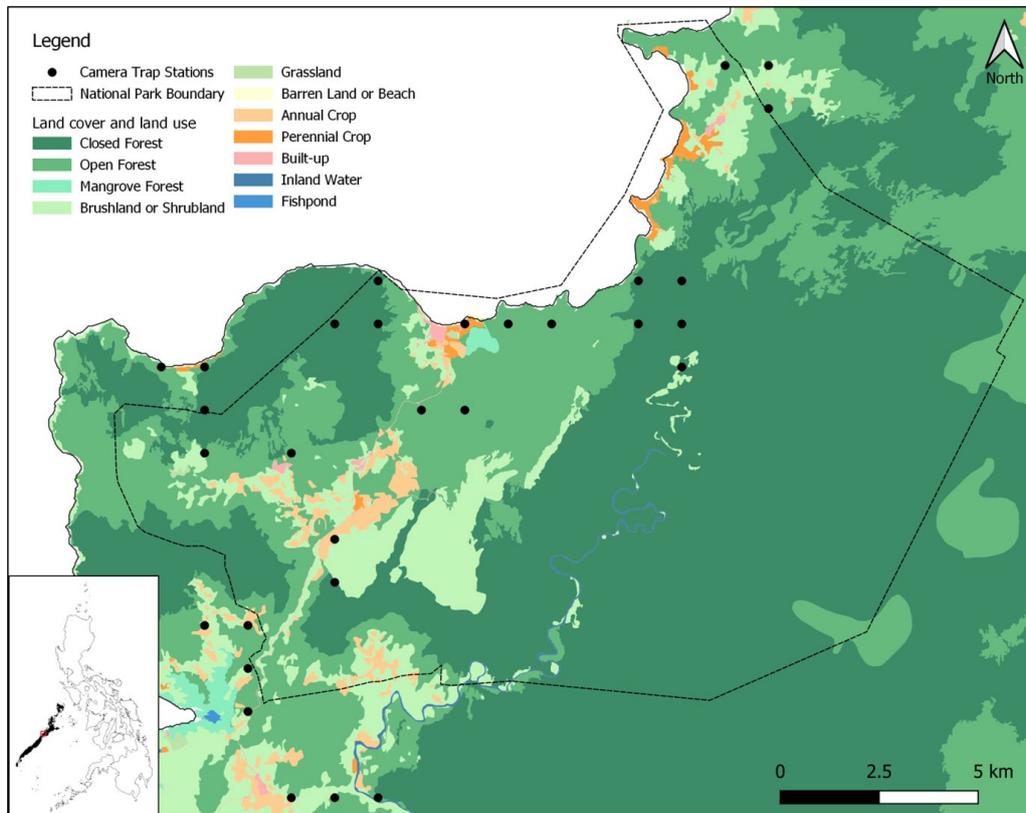had higher occupancy probabilities in areas that are closer to natural inland waterways.

Figure 1. Camera trap locations in Puerto Princesa Subterranean River National Park, Palawan Island, Philippines (Data source: NAMRIA, 2021).
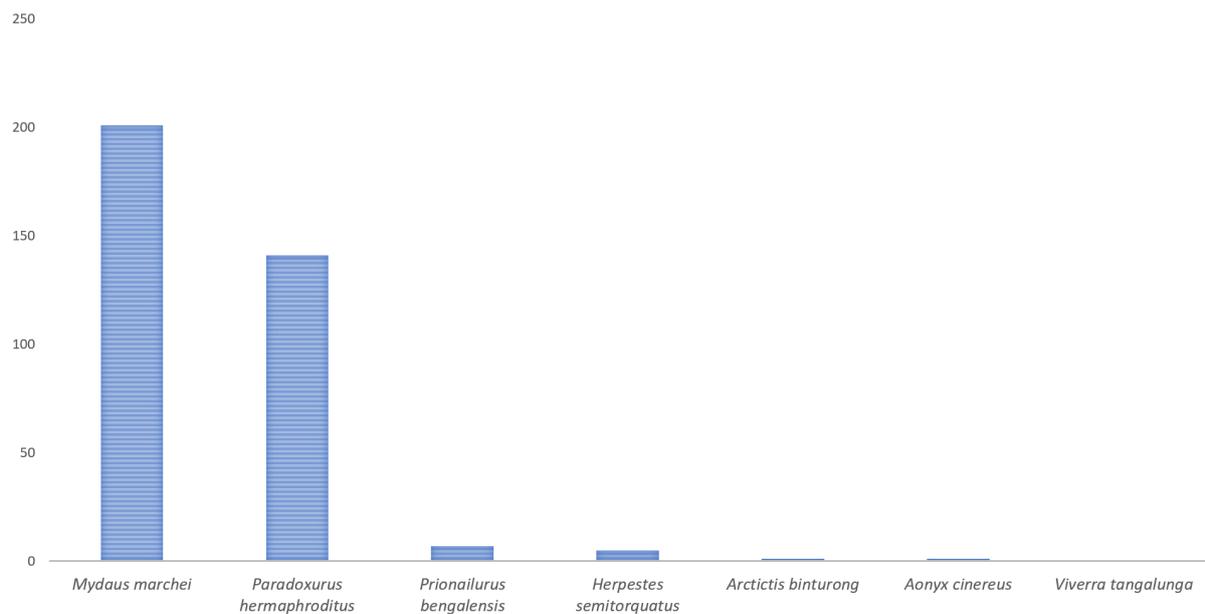

Figure 2. Absolute frequency of independent detections of carnivoran species in Puerto Princesa Subterranean River National Park, Palawan Island, Philippines.
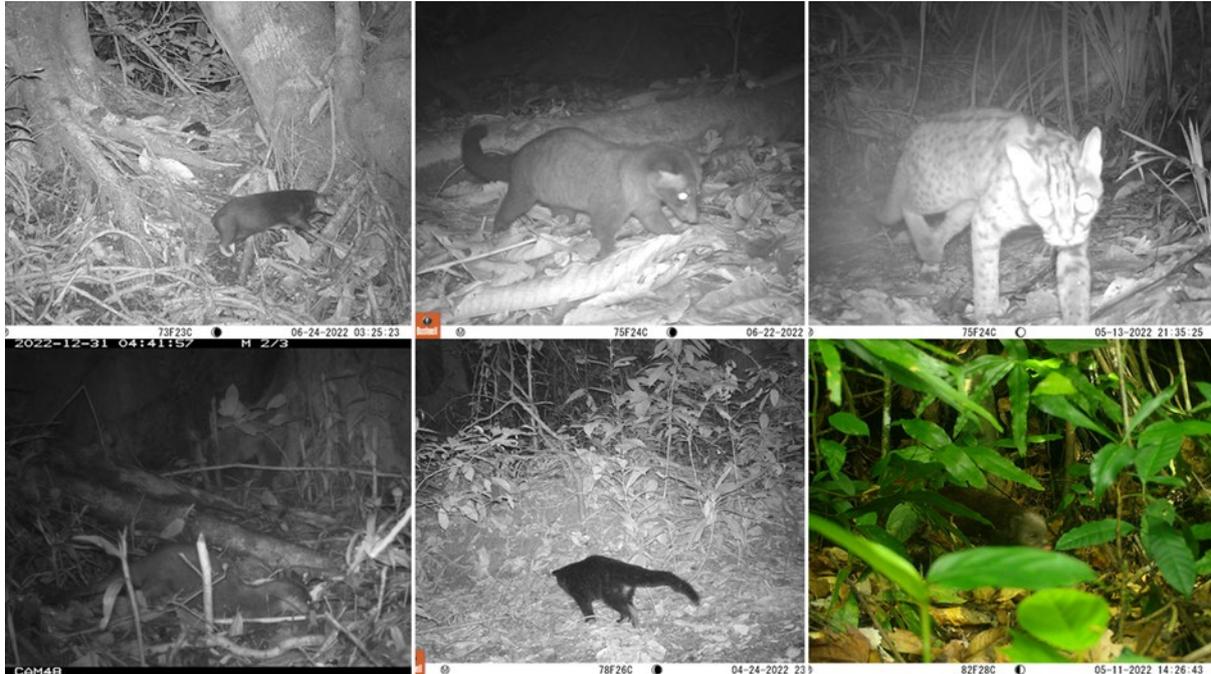
Figure 3. Camera trap photos of carnivorans in Puerto Princesa Subterranean River National Park, Palawan Island, Philippines. (Clockwise from upper-left corner: Mydaus marchei, Paradoxurus philippinensis, Prionailurus javanensis, Urva semitorquata, Arctictis binturong, and Aonyx cinereus).

Temporal Niche Analysis

Of the carnivorans detected, only the Palawan stink-badger, common palm civet, Sunda leopard cat, and collared mongoose had enough samples for analysis using kernel density estimation and Watson-Wheeler test for homogeneity. With its diurnal activity pattern, the collared mongoose had a low level of temporal niche overlap with the other species (Figure 4). Not much is known about the diet of the collared mongoose, but records from Borneo indicate that it may prey on small vertebrates and invertebrates (Payne et al., 1985). Their low temporal overlap with the other carnivorous species, the Sunda leopard cat and Palawan stink-badger, could indicate an adaptation to reduce intraguild competition. Although the Palawan stink-badger, common palm civet, and Sunda leopard cat showed high to moderate temporal overlaps, they did not have the same peaks of activity, which may indicate a small degree of temporal niche partitioning.
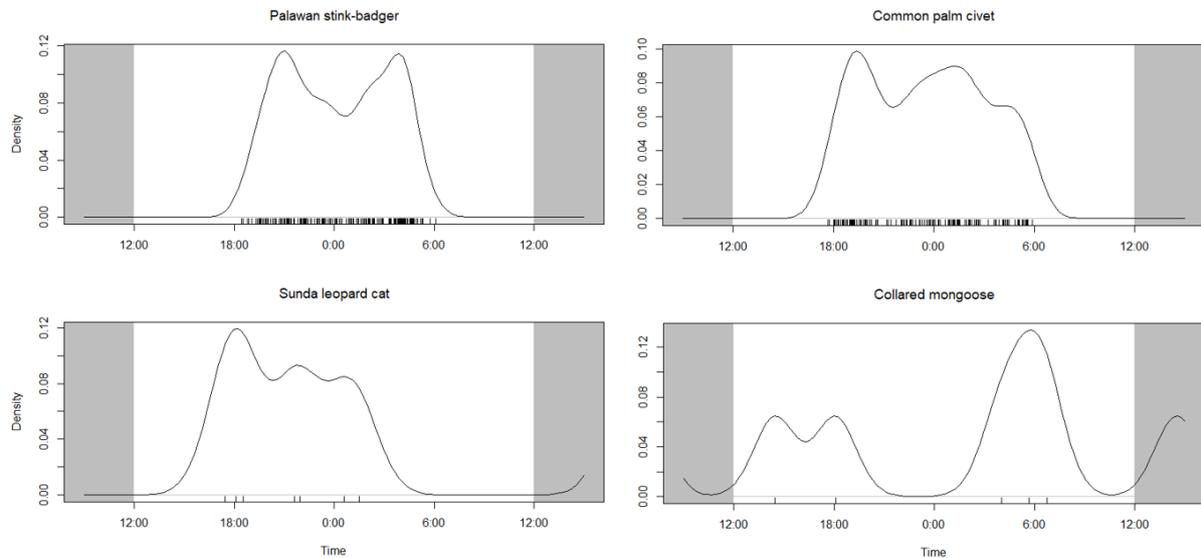
Figure 4. Activity patterns of carnivorans in Puerto Princesa Subterranean River National Park, Palawan Island, Philippines.

Dietary Niche Analysis

A total of 35 faecal samples were collected along trails inside the national park. After processing, 25 samples were found to likely belong to carnivorans based on their shape, size and the presence of carnivoran of hair contained in the samples (typically ingested due to auto-grooming behaviour). The species of food items in each sample will be determined using morphological examination of seeds, bones and other remains, and comparison with collected fruit specimens and museum specimens.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

On 17 December 2021, Typhoon Rai devastated Palawan Island with "sustained winds of up to 150 kph (93 mph)" (Fabro, 2022). Fallen trees and landslides prevented accessibility to many areas of our study site, Puerto Princesa Subterranean River National Park (PPSRNP). This then negatively affected the initial installation of camera traps provided by the Muséum National d'Histoire Naturelle (MNHN). The prioritisation of manpower toward typhoon recovery efforts also greatly reduced the efficiency of the field work during the first half of 2022. The consequent installation of 10 camera traps purchased through funding from The Rufford Foundation was better implemented during the second half of the year, but a large portion of the national park remained inaccessible.

We compensated for this by installing camera trap stations in a variety of habitat types that are both accessible and can represent the diversity of landscapes in the national park. Based on the 2020 national land cover map of the Philippines (NAMRIA, 2021), a total of 18,173 ha or 82% of the national park consists of forest habitats and 18% non-forest. Thus, we set up our camera trap locations to represent these proportions in accessible areas.

Although these methods produce only an estimate of the ecological niche of each target species, this is the first such study on a carnivoran community in the country. Specifically, this is the first quantitative ecological data gathered for many Palawan carnivorans and these will be valuable in assessing their conservation needs. Spatial niche analysis showed that higher tree cover, higher distance away from human habitation, and proximity to natural waterways play a factor in the occupancy of some carnivorans. In light of increasing urbanisation and the continuous decline of forest habitats in the Philippines, the threat to these species is now urgent and clear.

During the study, roadkill incidents involving common palm civet and the endemic Palawan stink badger were reported. Temporal niche analysis elucidated the nocturnal activity pattern of many of these species. Thus, the increasing tourist traffic, road development, and lack of streetlights, motorist awareness, and warning signages inside the national park may lead to an increase in roadkill incidents.

4. Describe the involvement of local communities and how they have benefitted from the project.

National park rangers, local volunteers, and hired local guides assisted the team in our fieldwork and benefitted by being trained in the establishment and maintenance of camera trap arrays. Three of the project volunteers listed in the Team Members section below are young female Philippine biologists who gained valuable research experience and exposure by participating in this project. Local scientists were invited to join our fieldwork to help survey food items such as fruits and invertebrates, and they in turn benefitted by saving costs on field logistics while surveying their own target taxa inside the national park. A local conservation NGO, Centre for Sustainability PH, assisted in the management of this project and benefitted by receiving the camera traps purchased using this grant as a donation. These cameras will be used in other biodiversity monitoring projects across Palawan Island.

5. Are there any plans to continue this work?

Yes, we intend to renew this project for a second phase as more data is needed for some of the rarer species such as the Sunda leopard cat, collared mongoose, binturong, Asian small-clawed otter, and Malay civet. We will set up camera traps in previously inaccessible areas of the national park as well as other study sites, particularly in northern Palawan. We will also add more canopy camera traps in order to survey the vertical space use of the more arboreal species.

6. How do you plan to share the results of your work with others?

We have already presented some of our results in scientific conferences. We presented a short talk about the ecology of the Palawan stink badger during the Congrès des Jeunes Chercheur-e-s du Muséum, a student conference in Paris, France, in May 2023. We presented a short talk about the ecology of the collared mongoose during the Student Conference on Conservation Science in New York, USA, in October 2023. We presented a lecture on the overview of the whole project during the Global Forests Autumn Doctoral School at Oxford, United Kingdom, in

October 2023 (links provided in the References). Some footage from our fieldwork and camera traps were used in a short film about feline conservation that is being played in the temporary exhibit "Félins" at the MNHN in Paris, France.

In the future, we will present talks in professional conferences such as the European Conference of Tropical Ecology at Lisbon, Portugal, in February 2024, and the Frugivores and Seed Dispersal Symposium in Brazil in August 2024. As part of the principal investigator's PhD thesis, we are currently in the process of writing a number of articles that will be published in internationally indexed scientific journals. These include but are not limited to a review article on carnivore research in the Philippines, an article about the ecology of the endemic Palawan stink badger, and an article on the spatiotemporal ecology of carnivorans in Palawan.

We also intend to report these findings during the next meeting of the PPSR national park management board in November 2023 and to other stakeholders such as the Palawan Council for Sustainable Development. During these presentations, we will suggest strategies to mitigate the threats to these species. Furthermore, we intend to create Facebook, Instagram, and YouTube pages for the project so that we can disseminate some of our results to the general public.

7. Looking ahead, what do you feel are the important next steps?

The presentation of our results to the national park management board will be the most impactful next step in this project as this group of stakeholders is the most directly involved in the conservation of our study site. The publication of our results in scientific journals and social media will also be important.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

The Rufford Foundation logo was used in the slideshows of numerous presentations that were previously mentioned. The foundation received exposure to the audiences of these talks, which included students, professors, and the global scientific community. The foundation will also be acknowledged in all resulting publications. Furthermore, the logo will also be used in future social media posts that contain data gathered from this project. These posts will go out to the general public.

9. Provide a full list of all the members of your team and their role in the project.

Desamarie Antonette Fernandez, Principal Investigator - Overall project manager and supervisor.

Aubrey Jayne Padilla, Project Volunteer - Assisted in tree climbing, camera trap maintenance, and other field activities.

Rollyna Marie Domingo, Project Volunteer - Assisted in tree climbing, camera trap maintenance, and other field activities.

Myka Allam, Project Volunteer - Assisted in diet analysis.

Omar Sebastian Panlilio, Project Volunteer - Field logistics coordinator.

Prof. Pierre-Michel Forget, Thesis Director - Assisted in project planning and troubleshooting.

Prof. Geraldine Veron, Thesis Co-Director - Assisted in project planning and troubleshooting.

For. Augusto A. Asis, Arnold Magallanes, and Oscar Calibuso - Forest guides and PPSR national park rangers.

10. Any other comments?

We would like to thank The Rufford Foundation for this grant, and we hope to continue studying the carnivorans of Palawan.

References:

Fabro K.A.S. 24 January 2022. Typhoon exposes biodiversity haven Palawan's vulnerability — and resilience. Mongabay. Retrieved on 24 October 2023 from: https://news.mongabay.com/2022/01/typhoon-exposes-biodiversity-haven-palawans-vulnerability-and-resilience/

Payne, J., Francis, C. M., & Phillipps, K. (1985). A field guide to the mammals of Borneo. The Sabah Society and WWF Malaysia.

Program of the Congrès des Jeunes Chercheur-e-s du Muséum 2023: https://cjcm.fr/pdf/programmecjcm2023.pdf

Program of the Student Conference on Conservation Science New York 2023: https://www.amnh.org/content/download/417367/6034785/file/sccs-ny-2023-conference-program.pdf

Program of the Global Forests Autumn Doctoral School: https://www.mfo.ac.uk/event/autumn-school-global-forests-2023-tropical-forests-conservation-issues-and-management

Figure 5. Some photos of the project team in the field.