

APPLICATION FOR RESEARCH PERMIT IN THE PHILIPPINES

Investigating species limits of endemic birds of the Philippine archipelago

APPLICANT'S DETAILS

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Institution: National University of Singapore

Proposed period of field work: Jan 2022-Dec 2022 (dependent on travel restrictions)

Methods: 1) Mist-netting and obtaining of blood samples from captured birds. All birds to be released unharmed. 2) Sound recording of birds in the field with a handheld recorder.

INTRODUCTION

The taxonomy of Philippine bird species has seen renewed interest in recent years (Oliveros & Moyle 2010, Hosner et al. 2014), with many studies suggesting genetic divergences in taxa that have been historically considered a single species. We aim to extend these investigations by utilising whole-genome and bioacoustic data to complement the largely mitochondrial work (Hosner et al. 2018) that has been so far carried out.

Our lab's prior work in the South-east Asia has resulted in a treasure-trove of discoveries including the description of five new species and five subspecies of birds from a single underexplored island group in Indonesia (Rheindt et al. 2020), the rediscovery of the nominotypic subspecies of the Jerdon's Babbler (Rheindt et al. 2014) after an absence of 73 years, and the detection of cryptic diversity in numerous groups of passerines both on the Southeast Asian mainland (Garg et al. 2016, Gwee et al. 2020) and its islands (Cros et al. 2020) resulting in the elevation of many taxa in these groups to full species. We hope to utilise similar methods of inquiry to better understand the distribution and species limits of birds in the Philippine archipelago.

In the Philippines, we are primarily interested in birds that are thought to inhabit mountain ranges across the archipelago and wide-ranging species with distinct forms or bioacoustic signatures that inhabit less surveyed island groups.

The mountain ranges of the Philippines occupy distinct and discrete areas on the islands and are likely to have been isolated for long periods of time. At present, many montane birds that occur across Mindanao, Mindoro, the Visayas and Luzon are considered conspecific (i.e., Turquoise flycatcher, White-browed (Philippine) shortwing, Mountain leaf-warbler, Bundok flycatcher). However, given the long periods of isolation between these islands it is likely that cryptic species-level lineages may exist across the taxa. In addition, many of the mountain ranges on the larger islands of Luzon and Mindanao are ancient, likely resulting in a long isolation of closely related species between these massifs and thus in additional deep intra-island divergences on each mountain range.

Recent work (Hosner et al. 2018) has revealed the existence of mitochondrially diverged cryptic lineages between regions of the Philippines that were not known to harbour significant avian endemic elements (i.e., Zamboanga Peninsula, Bohol, Samar-Leyte) which require further in-depth investigation. In addition, a few bird species have disjunct distributions that are not aligned with the

presently accepted biogeographic patterns of the Philippines (i.e., *Sterrhoptilus* crowned-babblers, Streak-breasted bulbul, Rufous-lored kingfisher) and these may also harbour cryptic species-level lineages. We hope that our work will also help uncover these patterns.

Through this, we seek to understand patterns of avian diversity and speciation in the Philippines, clarifying the taxonomy of birds in the region while providing additional insights on speciation, conservation resource prioritization/utilisation and population management. In addition, we hope that our research will provide a clearer picture of avian evolution and distribution in the region, potentially increasing the number of endemic bird species in the Philippines and underpinning the importance of local protected area networks and regional conservation networks in safeguarding the full suite of species that inhabit the archipelago.

PROPOSED STUDY SITES

Luzon

- Baggao, Cagayan
- Mt Labo
- Mt Mayon
- Mt Polis
- Kalbario-Patapat Natural Park

Mindoro

- Mt. Halcon
- Siburan Penal Colony
- Sablayan Penal Colony

Tablas

- Brgy. Dubduban Watershed

Sibuyan

- Mt. Guiting-guiting

Negros

- Mt Talinis
- Balinsasayao Twin Lakes
- Mt Kanlaon

Panay

- Mt Madja
- Northwest Panay Peninsula Natural Park
- Alegre Valley

Cebu

- Alcoy Forest
- Tabunan Forest

Samar

- Samar Island Natural Park

Bohol

- Rajah Sikatuna Protected Landscape

Siquijor

- Bulakaw Forest Reserve, San Juan
- Brgy. Tacdog

Camiguin Sur

- Brgy. Itum (Mt. Timpoong-Hibok-Hibok Natural Monument)

Mindanao

- Pasonanca Natural Park
- Senator Ninoy Aquino, Sultan Kudarat
- Mt Malindang
- Mt Kitanglad
- Mt Apo
- Mt Hilong-hilong
- Mt Tagubud
- Mt Hamiguitan
- Lake Holon, South Cotabato

BIOACOUSTICS

Bioacoustic data will be obtained by opportunistically recording the songs and calls of target species while in the field with a handheld recorder

MISTNETTING AND GENETICS

The collection of genetic material will be through the use of a mist-net. Mist-netting sessions will be conducted for 4-8 days at each site, from sunrise until noon. Nets will be closed in the event of rain, extreme heat, or other conditions that may threaten the health of the birds. Each captured bird will be measured morphologically according to standard BTO procedures. One aliquot of blood (~50µL) will be collected from each individual through brachial venipuncture and preserved in ethanol. Birds will be handled for no more than 10 minutes before being released.

Blood samples from birds will need to be exported to Singapore for subsequent DNA extraction, sequencing and data analysis. The import address is as follows:

Avian Evolutionary Laboratory
Faculty of Science, National University of Singapore
Block S3 Level 4
16 Science Drive 4
Singapore 117558

TIMELINE*

Proposed period of fieldwork is Jan 2022 – Jul 2022

Activity	Months from start date of permit																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Preparation for field work																		
Fieldwork in Philippines																		
Sample processing																		
Data analysis																		
Report write-up																		

*timeline may be delayed due to Covid-19 related travel restrictions

References

- Cros, E., Chattopadhyay, B., Garg, K. M., Ng, N. S., Tomassi, S., Benedick, S., Edwards, D. P., & Rheindt, F. E. (2020). Quaternary land bridges have not been universal conduits of gene flow. *Molecular Ecology*, 29(14), 2692-2706.
- Garg, K. M., Tizard, R., Ng, N. S. R., Cros, E., Dejtaradol, A., Chattopadhyay, B., Pwint, N., Packert, M. & Rheindt, F. E. (2016). Genome-wide data help identify an avian species-level lineage that is morphologically and vocally cryptic. *Molecular Phylogenetics and Evolution*, 102, 97-103.
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- Hosner, P. A., Sánchez-González, L. A., Peterson, A. T., & Moyle, R. G. (2014). Climate-driven diversification and Pleistocene refugia in philippine birds: evidence from phylogeographic structure and paleoenvironmental niche modeling. *Evolution*, 68(9), 2658-2674.
- Hosner, P. A., Campillo, L. C., Andersen, M. J., Sánchez-González, L. A., Oliveros, C. H., Urriza, R. C., & Moyle, R. G. (2018). An integrative species delimitation approach reveals fine-scale endemism and substantial unrecognized avian diversity in the Philippine Archipelago. *Conservation Genetics*, 19(5), 1153-1168.
- Oliveros, C. H. & Moyle, R. G. (2010). Origin and diversification of Philippine bulbuls. *Molecular Phylogenetics and Evolution*, 54(3), 822-832.