ASSESSMENT OF AVIFAUNA IN SCIENCE CITY OF MUÑOZ, NUEVA ECIJA, PHILIPPINES: AN AGRO-ECOTOURISM SITE DIVERSITY

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Abstract: Birds are being studied due to their economic and ecological significance. They help in plant reproduction, acting as pollinators, control pests in gardens, farms and other places, and even act as biological indicators. However, no study has been undertaken relating to avifauna inhabiting agro-ecotourism farm particularly in Central Luzon, henceforth this study was conducted. A survey was done to determine the diversity of avifauna residing agro-ecotourism farm of Science City of Muñoz, Nueva Ecija, Philippines. Transect walk and mist-netting have been used to rapidly assess the diversity of birds in five selected sites of a 658 hectares agro-ecotourism farm. The study revealed a total of 34 species of birds, twenty-three (23) of these were photographed and identified, eight (8) were observed through binoculars and the remaining three (3) were known through bird calls. However, the data highlighted that the overall diversity of avifauna in an agro-ecotourism setting was only 1.533 and falls under the scale of very low index, as interpreted using Fernando's Biodiversity Scale (cited in Sarmiento and Mercado 2019). Information from this present study could be used for species listing records that can help in strategic planning and conservation management in an agro-ecotourism farm.

Keywords: abundance, agro-ecotourism farm, birds, conservation, diversity

Introduction:

Birds are important not only because of their aesthetically pleasing beauty, making them fascinate to watch, but because they pose economic and ecological significance. They help in plant reproduction, acting as pollinators, control pests in gardens, farms and other places and even act as biological indicators. With their presence, they can tell whether the environment is all fine or if there is something wrong with it (Harney and Bhute 2014). Areas with minor disturbances and high structural diversity can provide different niches and micro-habitats for an extensive kind of birds, high number of individuals, and

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species richness (Calimpong and Nuñeza 2015), albeit birds are sensitive to environmental changes (Harisha and Hosetti 2009) that even minor environmental disruption affects them significantly. Owing to these, they served as basis to assess the environment all through the time (Singh and Laura 2013). However, bird diversity is being threatened due to different pressures. Bird population has been dwindling mainly due to human disruptions and modifications of their natural habitats. The closer the human-made structures to bird surroundings, the lesser the abundance of various kinds of birds because it causes pressures to the avian diversity (Singh and Laura 2013). Because of this, conservation efforts and strategic planning have been accounted for so as to protect them. As for this reason, bird species diversity must be studied to evaluate the status of a certain area. An assessment of bird diversity can serve as a good indication of environmental health in and around the area (Singh and Laura 2013).

Ascaño II et al. (2016), identified 10 Endemic Bird Areas (EBA) in the Philippines comprising Batanes and Babuyan Island, Mindoro, Luzon, Negros and Panay, Tablas, Romblon and Sibuyan, Cebu, Mindanao, and the Eastern Visayas, the Sulu Archipelago, and Palawan. Likewise, Philippines displays 576 bird species, 74 (12.8%) of which are threatened with worldwide extinction. As many as 59 (30.7%) of the 192 endemic Philippine species are universally threatened and a further 40 endemic species are near threatened (Bird International 2001) as cited by Gomez et al. (2009). However, there has been no documentation of bird species present in an agro-ecotourism farm yet; particularly in Science City of Muñoz, Nueva Ecija, a city which promotes sustainable agriculture and addresses the acute threat to biodiversity in central region of Luzon. This present documentation provides information about the current bird species in five selected sites of a 658 hectares agro-ecotourism. Information from this present study could be used for species listing records that can help in strategic planning and conservation management in an agro-ecotourism farm.

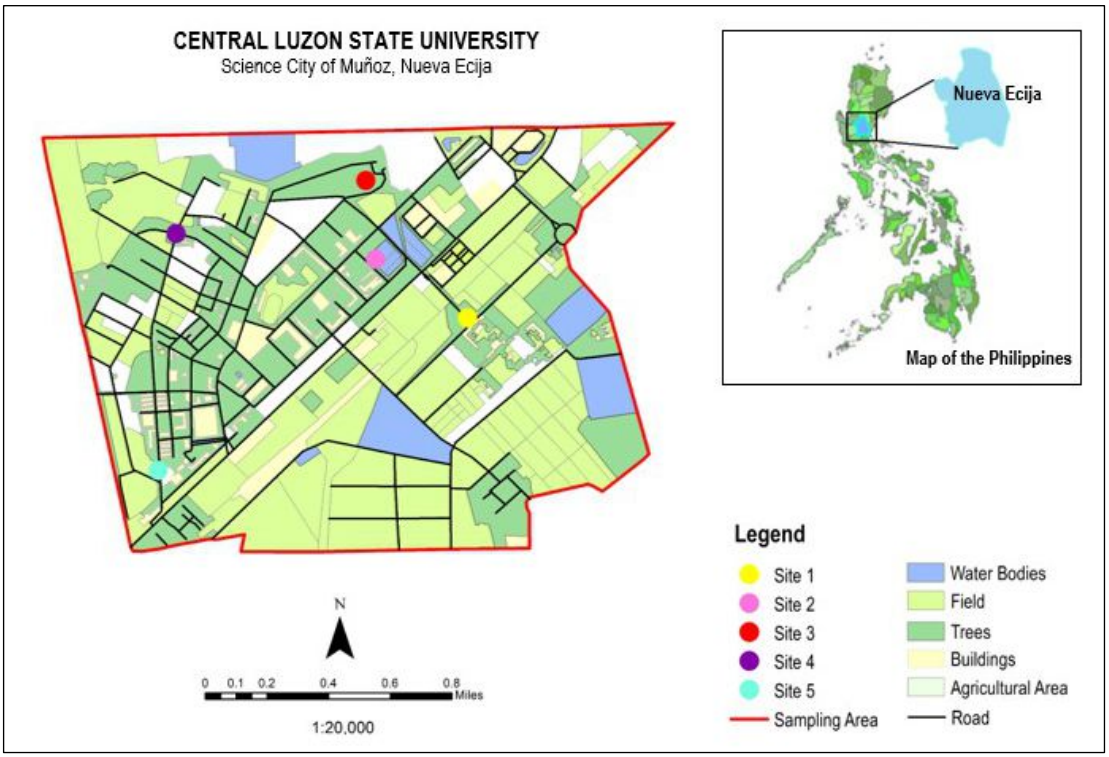
Materials and methods:

Study area and study sites

Central Luzon State University (CLSU) is globally situated at 15.75 ˚N latitude and 121.08 ˚E longitude and has a total land area of 658 hectares which is mainly composed of agricultural rice field, fruit-bearing trees and infrastructures. CLSU can be found in the municipality of Science City of Muñoz, Nueva Ecija, Philippines (Fig. 1). It is the lead agency of the Muñoz Science Community and the seat of the Regional Research and Development Center in Central Luzon. CLSU is one of the premiere institutions for agriculture in the Philippines and in Southeast Asia. It is also listed as one of the most beautiful school campuses in the Philippines due to its expansive and rural inspired forest and rice field landscapes and architectures, which focus on sustainability and ecological balance with rural and modern architecture; and for this reason, CLSU has been declared as agro-ecotourism farm model in Central Luzon, Philippines (Central Luzon State University 2016).

Five (5) sampling sites from 658 hectares were established for the survey and documentation of bird species. Site 1 was a reforested site, characterized by the presence of intermittent ponds and introduced and native tree species, primarily *Casuarina equisetifolia* and *Swietenia macrophylla*; Site 2 harbors four large ponds surrounded by fruit orchards planted with *Sandoricum koetjape*, *Tamarindus indica* and *Mangifera indica*; Site 3 is characterized by the presence of large parts of rice fields and fish ponds wherein *C. equisetifolia* and other fruit-bearing trees are common; Site 4 is composed of buildings, rice fields and experiment farms planted with vegetables and ornamentals; and, Site 5 is featured by the presence of mango farms, uncultivated land and residential area in its general vicinity.

Figure no. 1 Map of the Philippines, showing the established sites for mist-netting



Ethical considerations

Pursuant to Republic Act 9147, known as "Wildlife Resources Conservation and Protection Act", Chapter 3, Section 15, gratuitous permit from the Department of Environment and Natural Resources (DENR) was secured prior to the conduct of the study. It is a permit issued for non-commercial scientific or educational undertaking to collect wildlife. Furthermore, the institution approved the procedure in accordance with Administrative Order No. 40 series of 1999, otherwise known as "Rules and Regulations on the Conduct of Scientific Procedures Using Animals" pursuant to Republic Act No. 8485 otherwise known as the "Animal Welfare Act of 1998".

Collection of birds and data

Transect walk, or systematic walk, was conducted across the sampling sites to explore the bird species by observing, asking, listening, and looking (Keller 2019). All the birds that were observed during the walk were counted and documented. Bird calls, via a sound recorder, were recorded to aid in the identification process. Similarly, as a supplemental data, those birds which were not seen but heard were also documented. Moreover, by means of bird songs and call archives online, the birds were identified up to species level. Further, mist-netting method was also used to survey the diversity of birds. From the five (5) established sites, two mist-nets measuring 12 m x 24 m were positioned along ecotones, water bodies and near fruit-bearing trees in the afternoon and were being retrieved the following early morning. Birds that were captured in the mist nets were released carefully. The bird diversity assessment in the area was undertaken from August through December 2018.

Identification of bird species

Photographs and recorded bird calls, through the aid of a book entitled *A Guide to the Birds of the Philippines* by Kennedy et al. (2000) were utilized in the identification of collected bird species. In addition, unfamiliar bird calls were identified all the way through bird call archives online (https://www.xeno-canto.org). Furthermore, the authentication of bird species was performed with the help of an expert.

Data Analysis

Shannon Diversity Index was computed to determine the diversity, evenness and dominance of bird species in the study area and Fernando's Biodiversity Scale (in Sarmiento and Mercado 2019) was used to interpret the diversity index value.

Results and discussion:

A total of thirty-four (34) bird species were observed, photographed, and identified from the five (5) established sampling sites on a 658-hectare of agro-ecotourism farm of CLSU, Science City of Muñoz, Nueva Ecija (Fig. 2, Annexes). Twenty-three (23) bird species were photographed during the transect walk: Cattle Egret (*Bubulcus ibis*), Yellow Bittern (*Ixobrychus sinensis*), Cinnamon Bittern (*Ixobrychus cinnamomeus*), Green-backed Heron (*Butorides striata*), Black-crowned Night-heron (*Nycticorax nycticorax*), Little Egret (*Egretta garzetta*), Common Moorhen (*Gallinula chloropus*), White-breasted Waterhen (*Amaurornis phoenicurus*), Barred Rail (*Hypotaenidia torquatus*), Little Ringed Plover (*Charadrius dubius*), Red Turtle-dove (*Streptopelia tranquebarica*), Zebra Dove (*Geopelia striata*), Collared Kingfisher (*Todiramphus chloris*), Barn Swallow (*Hirundo rustica*), Tahiti Swallow (*Hirundo tahitica*), Yellow-vented Bulbul (*Pycnonotus goiavier*), Oriental Magpie-robin (*Copsychus saularis*), Sunda Pied fantail (*Rhipidura javanica*), Pied Triller (*Lalage nigra*), Brown Shrike (*Lanius cristatus*), Long-tailed Shrike (*Lanius schach*), Eurasian Tree Sparrow (*Passer montanus*) and Tricoloured Munia (*Lonchura malacca*). Meanwhile, eight (8) species of birds were observed through binoculars, and the remaining three (3) species were identified through their bird calls. All the bird species are categorized as least concern status according to the IUCN Red List of Threatened Species (2020).

Meanwhile for the diversity of birds in the study area, results revealed that Site 2 attained the highest diversity value of 2.879 while the lowest diversity value was from Site 3 which is 1.219. Meanwhile, Site 1 was the highest among sampling areas for the evenness measurements (0.867). On the other hand, Site 3 featured the lowest evenness of 0.379. Diversity of birds in an agro-ecotourism site has an overall diversity of 1.533 (very low) with an overall evenness of 0.442 (Tab. 1).

Among the five (5) selected sampling sites, Site 2 and Site 3 have the most observed bird species during the assessment resulting in twenty-five (25) total individuals of birds in each site. This could be due to the presence of large fish ponds and vast areas of rice fields; however most birds that were observed in the areas were mostly pest eating birds and migratory. Birds that were observed in sites were seen chewing rice grains that might cause damage to the milky stage of the crop due to perching birds on the panicles resulting in crop loss. This observation was evidently proved by International Rice Research Institute (IRRI), wherein some species of birds feed off the panicles by either landing upon them, by perching on nearby objects or by eating the dropped grain on the ground when fields are harvested. This only means that birds could also be considered a pest of rice despite of it is function in maintaining the balance of an ecosystem, however according to IRRI (2013) little is known about exactly how much damage is caused by birds to rice crops.

Table no. 1 Computed Shannon Diversity and Evenness with its relative value for each study site

Study areas	Total number of species	H'	E	Do	Relative value
Site 1	18	2.506	0.867	1	Moderate
Site 2	25	2.879	0.864	0.997	Moderate
Site 3	25	1.219	0.379	1	Very Low
Site 4	8	1.433	0.689	1	Very Low
Site 5	7	1.698	0.872	1	Very Low
Overall sites	34	1.533	0.442	1	Very Low

Note: H' = Shannon Diversity Index, E = Evenness, Do = Dominance

In addition, it can be noted that among all the established sites, Site 2 and Site 3 have no noticeable disturbances which may have provided good niches for most migratory birds. According to Calimpong and Nuñeza (2015), minor disturbances observed and high structural diversity that can provide different niches and micro-habitats for an extensive kind of birds, high number of individuals and species richness can be recorded. By contrast, Site 5 has the least number of species having seven (7) individual bird species which can be accounted to the presence of residential area and busy roads. Gamalo and Baril (2018) stated that in farmlands, richness and species abundance of avifauna were lowest in the area next to the road. Ford et al. (2000) also stated that absence of suitable habitat occurring along road verges could actually contribute to the low species diversity of birds in an area. Traffic volume and noise could also be a contributing factor for this, Kociolek et al. (2015) and Jack et al. (2015) pointed out that birds exposed to loud noise experienced elevated stress levels, such as increased heart rate, which over time may translate into increased risk of developing physiological stress and / or physiological disorders. One more thing is that it could also interfere with bird songs, which are used in attracting mates and establishing and defending territories.

Unlike in forest ecosystem where birds are more diverse due to its high vegetation diversity and anthropogenic activities in forest ecosystems are less minimal. Additionally, most island-endemic birds are assumed to rarely use distressed environments, such as plantations and agro-forests, due to the development of specialized morphological and interactive characteristics, which outcomes in a preference for precise natural forest resources (Azman et al. 2011 and Paz et al. 2013). Whereas for agro-ecotourism farm low diversity of bird species could be attributed first to unsuitable characteristics of habitat to support the needs (i.e. diet and various habitat) of many endemic or numerous species of birds. Secondly, anthropogenic activities such as extensive farming, building of infrastructure and roads, noise and pollution from vehicles could be major reasons why avifauna in the area is very low in diversity.

Conclusions:

This study was conducted in an agro-ecotourism farm of CLSU, Science City of Muñoz, Nueva Ecija. For the whole duration of the conduct (August to December 2018), a total of 34 bird species were identified and among all the species, Cattle egret (*Bubulcus ibis*) was the most dominant species. Based on the results, the bird diversity of the study area falls under the category of very low diversity. This implies that the habitats present in an agro-ecotourism farm are not very suitable for many kinds of birds and can strain the diversity of birds as well. Habitat types are important to birds, specifically during breeding time. Human activities, as the study area adapts with the inevitable and rapid modernization due to science and technology advancement, causes disruptions to habitats or areas that may be a place for bird species. This poses greater threat to bird species as well upon environment. The data of this study

could provide baseline information which can be used for biodiversity management plan for proper conservation and protection of wildlife.

Recommendations:

The following are recommended based on the conduct and/or results of the study: 1. Conduct of another assessment which can be done during the dry season in order to make a comparison of the diversity of bird species during wet and dry seasons 2. Conduct an on-site observation taking into consideration the impact of people and their actions that may have impacts on the behavior of bird species and 3. Analyze the impact of birds in the yield or extent of damage in the rice crops of Philippine agriculture.

Rezumat:

EVALUAREA AVIFAUNEI ÎN ORAȘUL ȘTIINȚIFIC DIN MUÑOZ, NUEVA ECIJA, FILIPINE: DIVERSITATEA UNEI LOCAȚII AGRO-ECOTURISTICE

Păsările sunt studiate datorită semnificației lor economice și ecologice. Ele ajută la reproducerea plantelor, acționând ca polenizatori, controlează dăunătorii din grădini, ferme și alte locuri și chiar acționează ca indicatori biologici. Cu toate acestea, nu a fost întreprins niciun studiu referitor la avifauna care se găsește într-o fermă de agro-ecoturism, în mod particular în Luzon Central, unde acest studiu a fost realizat. Au fost realizate observații pentru a determina diversitatea avifaunei care populează ferma de agro-ecoturism din orașul științific Muñoz, Nueva Ecija, Filipine. Metoda transectelor și plasele de colectare au fost folosite pentru a evalua rapid diversitatea păsărilor. Au fost selectate cinci locații pe suprafața de 658 hectare ale fermei de agro-ecoturism. Studiul a relevat un total de 34 de specii de păsări, dintre care douăzeci și trei (23) au fost fotografiate și identificate, opt (8) au fost observate prin binoclu și restul de trei (3) au fost recunoscute prin apeluri de păsări. Totuși, datele au evidențiat faptul că diversitatea avifaunei într-o locație de turism agro-ecologic este de doar 1.533 și se încadrează sub limita inferioară a indicelui, așa cum rezultă folosind Scala de biodiversitate a lui Fernando (citată în Sarmiento și Mercado 2019). Informațiile din acest studiu ar putea fi utilizate pentru completarea listelor de specii înregistrate în zonă și care pot ajuta la planificarea strategică și la gestionarea conservării într-o fermă agro-ecoturistică.

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References:

ASCAÑO II C.P., ALBUTRA Q.B., ANSIGBAT V.V., MUGOT D.A., DEMAYO C.G. (2016), Avifauna assessment in and around the hydraulic mining area of Brgy. Tumpagon, Cagayan de Oro City, Philippines, *Journal of Scientific Research and Development* 3(4): 83–90.

AZMAN N.M., LATIP N.S.A., SAH S.A.M., AKIL M.A.M.M., SHAFIE N.J., KHAIRUDDIN N.L. (2011), Avian diversity and feeding guilds in a secondary forest, an oil palm plantation and a paddy field in riparian areas of the Kerian River Basin, Perak, Malaysia, *Tropical Life Sciences Research* 22(2): 45–64.

CALIMPONG D.M.T., NUÑEZA O.M. (2015), Avifaunal diversity of Bega Watershed, Prosperidad, Agusandel Sur, Philippines, *Journal of Biodiversity and Environmental Sciences* 6(4): 385–400.

CENTRAL LUZON STATE UNIVERSITY (2016), Model Agro-tourism Site. Retrieved from https://clsu.edu.ph/about/highlights/model-agro-tourism-site.php

FORD H., BARRETT G., SAUNDERS D., RECHER H. (2000), Why have birds in the woodlands of Southern Australia

declined? *Biol. Conserv.* 97: 71–88. doi: 10.1016/S0006-3207(00)00101-4

GAMALO L.E.D., BARIL J.A. (2018), Effect of Road to Avian Diversity, Abundance and Richness in selected rice fields along Laguna National Highway, *J. Wetlands Biodiversity* 8: 7-17.

GOMEZ J.P.S., SISON R.V., LOHMAN D.J. (2009), New bird records for Alabat Island, Quezon Province, Philippines, *Forktail* 25: 147–150.

HARISHA M.N., HOSETTI B.B. (2009), Diversity and distribution of avifauna of Lakkavalli Range Forest, Bhadra Wildlife Sanctuary, Western Ghat, India, *Ecoprint: An International Journal of Ecology* 16: 21–27. https://doi.org/10.3126/eco.v16i0.3469

HARNEY N.V., BHUTE K.B. (2014), Diversity of avifauna in and around Chalbardi (Rai) lake near Bhadrawati, District Chandrapur (M. S.), India, *Journal of Global Biosciences* 3(2): 399–405.

INTERNATIONAL RICE RESEARCH INSTITUTE (2013), *The birds of IRRI*, Vol. 12, No. 2 Retrived at http://books.irri.org/RT12_2_content.pdf

IUCN (2020), *The IUCN Red List of Threatened Species*. Version 2020-2. Retrieved from https://www.iucnredlist.org Downloaded 09 July 2020.

JACK J., RYTWINSKI T., FAHRIG L., FRANCIS C. (2015), Influence of traffic mortality on forest bird abundance, *Biodiversity Conservation* 24: 1507–1529. doi: 10.1007/s10531-015-0873-0

KELLER S. (2019), *Sustainable Sanitation and Water Management Toolbox. Transect walk*. https://sswm.info/humanitarian-crises/urban-settings/planning-process-tools/exploring-tools/transect-walk. Retrieved 29 June 2019

KENNEDY R.S., GONZALES P.C., DICKSON E.C., MIRANDA H., FISHER T.H. (2000), *A guide to the birds of the Philippines*, NY, Oxford University Press.

KOCIOLEK A., GRILO C., JACOBSON S. (2015), *Flight Doesn't Solve Everything: Mitigation of Road Impacts on Birds. Handbook of Road Ecology*, 1st Edn. Chichester: John Wiley & Sons.

PAZ S.L., NGOPRASERT D., NUNEZA O.M., MALLARI N.A.D., GALE G.A. (2013), Philippine-endemic and Mindanao-endemic bird communities on Canticol and Mt. Hilonghilong, Philippines, *Asian Journal of Biodiversity* 4(1): 135–168.

SARMIENTO R.T., MERCADO J.A. (2019), Land use changes and their influence in the conservation of plant diversity within a small Binaba watershed, *Journal of Biodiversity and Environmental Sciences* 14(1): 139–150.

SINGH A., LAURA J.S. (2013), Avifauna species diversity and their abundance in Tilyar Lake, Rohtak, Haryana (India), *Bulletin of Environment, Pharmacology and Life Sciences* 3(1): 180–185.

XENO-CANTO FOUNDATION AND NATURALIS BIODIVERSITY CENTER (2005-2020), Xeno-canto: sharing bird sounds from around the world. Retrieved from https://www.xeno-canto.org.

Annexes:

Figure no. 2 Bird representatives in the five (5) sampling sites

Cattle Egret (*Bubulcus ibis*)

Yellow Bittern (*Ixobrychus sinensis*)

Cinnamon Bittern (*Ixobrychus cinnamomeus*)

Green-backed Heron (*Butorides striata*)

Black-crowned Night-heron (*Nycticorax nycticorax*)

Little Egret (*Egretta garzetta*)

Istros – Museum of Braila "Carol I"

Common Moorhen (*Gallinula chloropus*)

White-breasted Waterhen (*Amaurornis phoenicurus*)

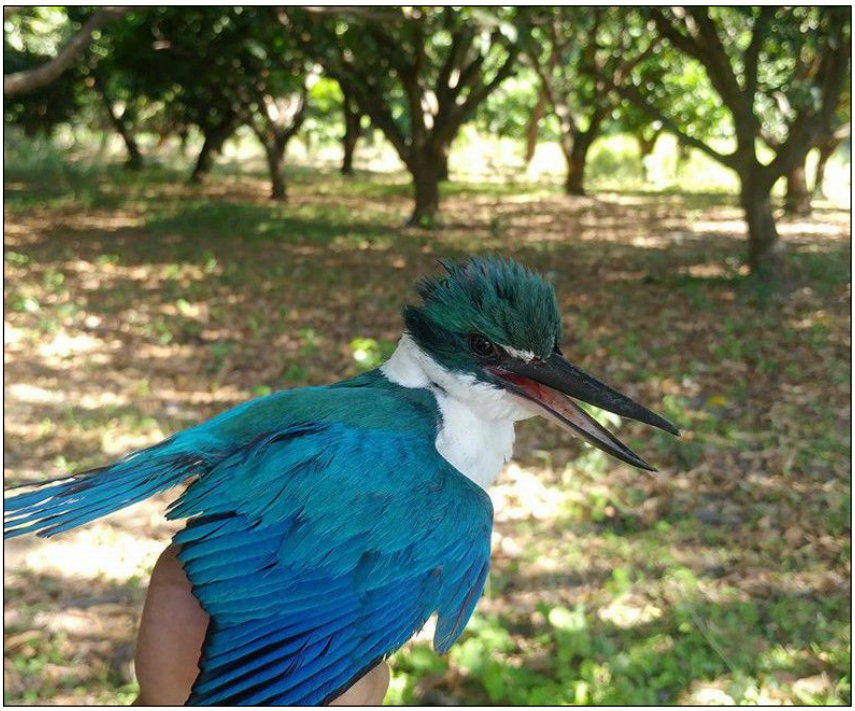
Barred Rail (*Hypotaenidia torquatus*)

Little Ringed Plover (*Charadrius dubius*)

Red Turtle-dove (*Streptopelia tranquebarica*)

Zebra Dove (*Geopelia striata*)

Collared Kingfisher (*Todiramphus chloris*)



Barn Swallow (*Hirundo rustica*)

Tahiti Swallow (*Hirundo tahitica*)

Oriental Magpie-robin (*Copsychus saularis*)

Yellow-vented Bulbul (*Pycnonotus goiavier*)

Sunda Pied Fantail (*Rhipidura javanica*)

Pied Triller (*Lalage nigra*)

Long-tailed Shrike (*Lanius schach*)

Brown Shrike (*Lanius cristatus*)

Eurasian Tree Sparrow (*Passer montanus*)

Tricoloured Munia (*Lonchura malacca*)