Significant Records of Birds in Smaller Islands in Palawan, Philippines

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We documented, for the first time, the birds of Cambari Island and Green Island Bay in Palawan from May 2016 to January 2020. Using a combination of direct observations, area search and photo-documentation, we recorded a total of 64 birds including three threatened species, three near-threatened birds and 22 migrants. Species composition varied between islands and bird diversity ranged from 1.14 – 2. 85 (Shannon-Weiner Index). Puerco Island (popularly known as Banwa Private Island) serves as an important breeding habitat of the Near-endemic Philippine Scrubfowl *Megapodius cumingii* and Mantanani Scops Owl *Otus mantananensis*. Small islands with beach forest and mudflats serve as temporary refuge for migratory species including rare and threatened species. Protection of breeding habitats and integration of native beach forests trees increased bird species richness.

Keywords: Mantanani, Cambari, *Megapodius,* Banwa Private Island

INTRODUCTION

Small islands play an important role in the conservation birds (Allen 2020; del Hoyo et al.; 2014, Kennedy et al., 2000). Two near-endemic Philippine birds are known to depend on small islands for their survival e.g., Philippine Scrubfowl *Megapodius cumingii cumingii* and the Mantanani Scops Owl *Otus mantananensis mantananensis* (Allen 2020; Jakosalem et al., 2019; Bashari et al., 2017; Sloan 2017; Dekker et al., 2000; Kennedy et al., 2000). The *O. mantananensis* is distributed on smaller islands from Tawi-Tawi to

Palawan, Mindoro, and as far as Sibuyan Island (Allen 2020; Jakosalem et al., 2019; Kennedy et al., 2000). The *M. cumingii* breeds and raise their young in the coastal areas and in small islands (Bashari et al., 2017; Sloan 2017; Dekker et al., 2000; Kennedy et al., 2000).

The coastal mudflats, mangroves, and beach forests in small Islands also serve as temporary refuge for thousands of migrating birds passing through the East-Asian Australasian Flyway (Allen 2020; Jensen & Sonco, 2016; Kennedy et al., 2000) and Philippines is located right in the middle of the flyway (Jakosalem et al., 2019; Li et al., 2007; Mullarney et al., 2001; Kennedy et al., 2000). The archipelago is sometimes used as a staging point for migrating birds to and from Borneo (Koike et al., 2016). At least 140 species regularly visit, and 138 vagrant birds are occasionally recorded. Of the 278 migrants, seven are threatened with extinction: IUCN Critically Endangered Christmas Frigatebird *Fregata andrewsi,* IUCN Endangered Far Eastern Curlew *Numenius madagascariensis,* IUCN Endangered Great Knot *Calidris tenuirostris,* IUCN Vulnerable Chinese Egret *Egretta eulophotes,* and the IUCN Near-threatened (DENR Vulnerable) Malay Plover *Charadrius peronii* (IUCN, 2020).

The available information on bird diversity on smaller islands in the Philippines is scanty (Alcala & Sanguila, 1969; Jakosalem et al., 2002; King et al., 2004; Paguntalan et al., 2004; Matillano et al., 2008; Gonzalez et al., 2010; Bucol et al., 2011; Tabayag & Cruz, 2013; Jensen et al., 2015; Jensen & Sonco, 2016) as historical records are limited to collections that date back to over a century ago (Kennedy et al., 2000; Jensen & Sonco, 2016). There are even fewer studies of birds in Palawan (Alviola, 1997; Gonzalez et al., 1997; Balatibat 2008; Paguntalan et al., 2008; Mallari et al., 2011; Bernardo, 2017) and most of them focus on threatened species e.g., Philippine Cockatoo (Widmann et al., 2008a; Widmann et al., 2008b), Philippine Scrubfowl (Matillano et al., 2008; Tabayag & Cruz, 2013), Palawan Peacock Pheasant (Brooks & Miranda 2015). The available publications on birds of islets centered on Caganyancillo and were largely based on the collection of specimens from a century ago. The visit of McGregor (1904) in 1903 followed by Worcester (1911) provided the first description of the seabird colony in the Tubbataha Reefs. Over a long period, no studies had been conducted on the small islands of Cagayancillo until the ornithological visits by the Haribon Foundation for Conservation of Natural Resources (1981), Cruz and White (1989), Arquiza and White (1999), Heegard and Jensen (1992), Manamtam (1996) and Jensen and Sonco (2016).

Birds dependent on coastal beaches and small islands are vulnerable to climate breakdown and urban development (Allen, 2020; Kennedy et al., 2000; Ma et al., 2019; Zhang & Ouyang, 2019). The landscape of Palawan has significantly changed in the last two decades including Green Island Bay. A full profile of the bird species in the five islands provides pertinent information needed for future small island management. This study is also the first documentation of the bird species composition and diversity of Green Island Bay and Cambari Island in Palawan, Philippines.

METHODS

We visited four of the 11 islands in Green Island Bay in Roxas, namely, Small Pagbo Island, Johnson Island, Modessa (also called Reef) Island, and Puerco Island (also known as Banwa Private Island from 2016 to 2019 (see Figure 1). A total of 63 observation hours were spent in all islands: four hours in Small Pagbo Island, six hours in Johnson Island, 14 hours in Modessa, and 36 hours in Puerco Island. Surveys were also conducted in Cambari Island in Araceli, Palawan from 22-23 May 2019 where six hours were spent observing birds.

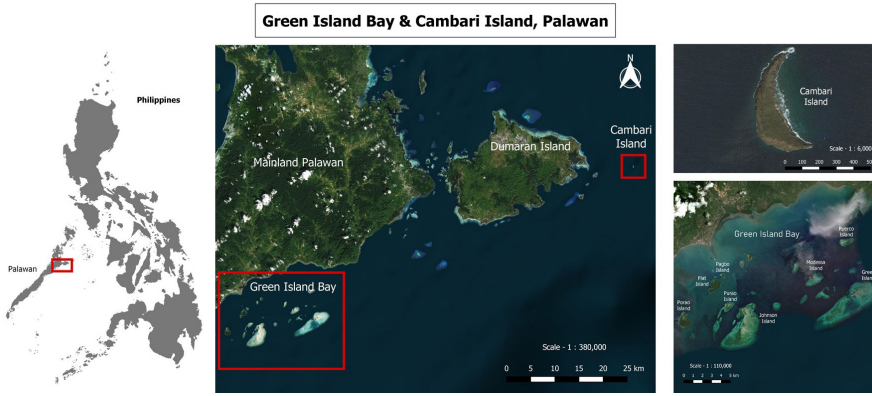

Figure 1. Map of Palawan showing the survey sites

Site Description

Modessa Island. Modessa Island (10017'0.5" N; 119027'4.3" E), also known as Reef Island, is relatively flat, surrounded by white sand, and dominated by *Cocos nucifera*. The southern section was developed into a resort, while the

remaining part of the island remained undeveloped. During low tide, sand bars were exposed around the island. Visits were conducted from 22-24 June 2017.

Puerco Island. Puerco Island (10019'7.8" N; 119028' 53.8" E) is a 6.2 ha island also known as Banwa Private Island. It is pear-shaped and flat, and used to be dominated mainly by Cocos nucifera but had since been replanted with native plants and beach forest associated trees. A 200 square meter beach forest was created as a Tabon Breeding Sanctuary. Surveys were conducted from 14-16 May 2016; 27-29 June 2017; 9-18 March 2018; 14-18 May 2018; 16-18 October 2018; 19 and 26 March 2019; 9,11,16, and 24 May 2019; 7,16,21, and 28 June 2019; 11, 18, and 25 July 2019; 2, 8, 15, and 22 August 2020; 2-6, 10, 17, and 24 September 2019; 8, 15, and 23 October 2019; 8 and18 November 2019; and 9, 26 March 2020.

Pagbo Island. Pagbo Island (10017'10.3" N; 119021'51.1"E) is a coralline island (estimated at three hectares) mostly dominated by mangroves with at least one household on the western section. The island is mostly underwater with a small section exposed during high tide. A colony of over 50,000 flying foxes roosts on the mature *Rhizophora* in the island. Visits were conducted on 16 March 2017; 12 August 2018; and 4 October 2019. **Johnson Island** (10015'2.9" N; 119023'7.4" E) is a flat island located south of Modessa and east of Pagbo Island with highest elevation at six meters. Johnson Island is mostly dominated by *Cocos nucifera* and has a small community of fisherfolks living on the island. A rock outcrop in the southern section gets connected with a narrow sand bar that is exposed during lowtide. An estimated 30-hectare mudflat with seagrass beds surround the island. *Rhizophora* mangrove trees of about a meter tall grow on top of the seagrass beds. Visits were conducted on 16 December 2018 and 3 October 2019

Cambari Island. Located off the coast of Araceli Island municipality in Palawan, Cambari Island (100 32' 56" North; 1200 5' 36" East) is a crescent-shaped, rocky island that rises up to eight meters of elevation. It is surrounded by coral reefs and has a very narrow and small beach area. No humans inhabited the island and there was no surface water. The island was mostly barren, and stunted native trees clung to the rocky outcrops along deep crevices running along the cross section of the entire length of the island. Average height of the trees was six meters. Surveys were conducted on 23-24 May 2019.

Bird Observations. Bird observations were conducted from March 2017 to December 2019 (with GP Permit # 2019-15 from Palawan Council for Sustainable Development). We used a modified version of the *Area Search* method in monitoring bird populations (Dunn et al., 2006). Using a 10 x 42 roof-type binoculars and a 20 x 60 spotting scope, observers walked around each island during low tide to list down and count the birds seen and heard calling on mudflats. Purposive searches were also conducted in clusters of beach forest trees, coconut stands, mangroves, and rocky sections of the islands. The Field Guide to the Waterbirds of ASEAN (Lee et al., 2018), Jakosalem et al. (2019) and Kennedy et al. (2000) were used as reference in identifying species. We also visited the islands at night to search for nocturnal birds.

Comparison of Diversity

Species richness is defined in this study as the number of species present in an area. In comparing bird diversity, we used the Shannon – Weiner's index of diversity formula:

$$H' = - [\Sigma Pi^{*}LN(Pi)]$$

where H' was the diversity index, Pi was the proportion of each species in a sample, and LN (Pi) was the natural logarithm of this proportion. In comparing the similarity of the population size of each species, the proportion of the distribution of the individuals among different species, Evenness (J') was calculated using the ratio of the observed diversity to maximum diversity using the equation:

$$J' = H'/Hmax$$

where H' is the Shannon-Wiener Diversity Index and Hmax was the natural log of total number of species.

RESULTS

A total of 64 species of birds were recorded of which three were threatened, three were near-threatened, 22 were migratory, and 42 are native to the Philippines (Table 1). The threatened birds included the IUCN Endangered Far Eastern Curlew and Great Knot as well as the Vulnerable Chinese Egret Egretta eulophotes. The Near-threatened species included the Eurasian Curlew Numenius phaeopus, Grey-tailed tattler, and Mongolian Plover Charadrius peronii. Among the native species, the breeding residents included the Philippine Scrubfowl, Mantanani scops owl, Barred Rail Hypotaenadia torquatus, Glossy starling Aplonis panayensis, Garden sunbird Cinnyris jugularis, Pacific Reef Egret (dark and white phase) Egretta sacra, Collared Kingfisher Todiramphus chloris, Glossy Swiftlets Collocalia esculenta, and Black-headed Munia Lonchura atrocapilla.

Table 1

List of Bird Species Recorded from 2014-2019 (Note that * - migratory bird; Nt – Near threatened; Vu – Vulnerable; En – Endangered)

Species Name	Pagbo	Modessa	Cambari	Johnson	Puerco
Lesser Frigatebird *Fregata ariel*					1 (0.002)
Brown Booby *Sula leucogaster*					1 (0.002)
Barred Rail *Gallirallus torquatus*		4 (0.02)	3 (0.02)		19 (0.05)
Philippine Scrubfowl *Megapodius cumingii*		4 (0.02)			80 (0.22)
Pacific Reef Egret (dark phase) *Egretta sacra*	1 (0.007)	6 (0.03)	2 (0.01)	4 (0.009)	12 (0.03)
Little Egret Egretta garzetta	2 (0.014)	7 (0.035)	1 (0.009)	24 (0.05)	7 (0.02)
*Chinese Egret *Egretta eulophotes* (Vu)		2 (0.01)		64 (0.15)	6 (0.017)
Intermediate Egret *Egretta intermedia*		1 (0.005)		32 (0.07)	2 (0.005)
Great Egret *Egretta alba*		1 (0.005)		21 (0.049)	1 (0.005)
Great-billed Heron *Ardea sumatrana*		1 (0.005)			1 (0.005)
Striated Pond Heron *Butorides striatus*	1 (0.003)	6 (0.03)		4 (0.009)	9 (0.025)

Black-crowned Night Heron *Nycticorax nycticorax*	2 (0.006)				3 (0.008)
Cattle Egret *Bubulcus ibis*					1 (0.005)
Black-winged Stilt *Himantopus himantopus*					1 (0.005)
White-bellied Sea-eagle *Haliaeetus leucogaster*			1 (0.009)		1 (0.005)
Osprey *Pandion haliaetus*					1 (0.005)
Malay Plover *Charadrius peronii* (Nt)		2 (0.01)			1 (0.002)
*Lesser Sand Plover *Charadrius mongolus*		1 (0.005)		31 (0.072)	3 (0.008)
*Greater Sand Plover *Charadrius leschenaultii*		2 (0.01)		34 (0.079)	2 (0.005)
*Whimbrel *Numenius phaeopus*	1 (0.003)	1 (0.005)		12 (0.028)	3 (0.008)
*Eurasian Curlew *Numenius arcuata* (Nt)		1 (0.005)		4 (0.009)	1 (0.002)
*Far Eastern Curlew *Numenius madagascariensis* (En)				2 (0.004)	3 (0.008)
*Ruddy Turnstone *Arenaria interpres*		2 (0.01)		12 (0.028)	2 (0.005)
*Great Knot *Calidris tennuirostris* (En)				65 (0.15)	1 (0.002)
*Common Sandpiper *Actitis hypoleucos*				2 (0.004)	2 (0.005)
*Curlew Sandpiper *Calidris ferruginea*				21 (0.049)	
*Grey-tailed Tattler *Tringa brevipes*		4 (0.02)		18 (0.04)	3 (0.008)
*Sanderling *Calidris alba*				3 (0.007)	
*Grey Plover *Pluvialis squatarola*					1 (0.002)
*Common Greenshank *Tringa nebularia*		6 (0.03)		11 (0.025)	3 (0.008)
*Common Redshank *Tringa totanus*		2 (0.01)		8 (0.018)	2 (0.005)
Black-naped Tern *Sterna sumatrana*	21 (0.072)	12 (0.06)	24 (0.21)	8 (0.018)	6 (0.017)
Whiskered Tern *Chlidonias hybridus*	12 (0.041)	25 (0.12)		4 (0.009)	2 (0.005)
Greater Crested Tern *Sterna bergii*	6 (0.02)	16 (0.08)			3 (0.008)

Gull-billed Tern *Gelochelidon nilotica*				1 (0.002)	
Philippine Green Pigeon *Treron axillaris*			4 (0.036)		
Pink-necked Green Pigeon *Treron vernans*			8 (0.07)		1 (0.002)
Grey-capped Emerald Dove *Chalcophaps indica*		1 (0.005)	1 (0.009)		1 (0.002)
Pied Imperial Pigeon *Ducula bicolor*			31 (0.28)		2 (0.005)
Western Koel *Eudynamys scolopaceus*					2 (0.005)
Himalayan Cuckoo *Cuculus saturatus*					1 (0.002)
*Northern Boobok *Ninox japonica*					1 (0.002)
Mantanani Scops Owl *Otus mantananensis* (Nt)	2 (0.006)	2 (0.01)		1 (0.002)	3 (0.008)
Savanna Nightjar *Caprimulgus affinis*	1 (0.003)	1 (0.005)			1 (0.002)
Glossy Swiftlet *Collocalia esculenta*		21 (0.1)		6 (0.014)	16 (0.045)
Collared Kingfisher *Halcyon chloris*	2 (0.006)	4 (0.02)	7 (0.06)	2 (0.004)	6 (0.017)
*Common Kingfisher *Alcedo atthis*	1 (0.003)	1 (0.005)		2 (0.004)	2 (0.005)
Barn Swallow *Hirundo rustica*	2 (0.006)	2 (0.01)		4 (0.009)	38 (0.1)
Pied Triller *Lalage nigra*	1 (0.003)	1 (0.005)	3 (0.02)		
Black-naped Oriole *Oriolus chinensis*			4 (0.03)		
Golden-bellied Gerygone *Gerygone sulphurea*	1 (0.003)	2 (0.01)	2 (0.019)	2 (0.004)	4 (0.01)
Glossy Starling Aplonis panayensis	16 (0.054)	21 (0.106)	8 (0.19)	16 (0.037)	16 (0.045)
*Chestnut-cheecked Starling *Agropsar philippensis*					1 (0.002)
*Brown Shrike *Lanius cristatus*	1 (0.003)	1 (0.005)		2 (0.004)	6 (0.017)
Rufous-crowned Bee-eater *Merops americanus*					2 (0.005)
Philippine Pied Fantail *Rhipidura nigrirostris*	1 (0.003)	2 (0.01)	2 (0.018)		

*Japanese Paradise Flycatcher *Tersiphone atrocaudata*					1 (0.002)
*Artic Warbler *Phylloscopus borealis*					1 (0.002)
White-breasted Wood Swallow *Artamus leucorynchus*					3 (0.008)
*Grey Wagtail *Motacilla cinerea*					1 (0.002)
Garden Sunbird *Cinnyris jugularis*	7 (0.024)	3 (0.015)	6 (0.054)	2 (0.004)	9 (0.02)
Eurasian Tree Sparrow *Passer montanus*	26 (0.089)	28 (0.14)	4 (0.036)	6 (0.014)	36 (0.1)
Black-hooded Munia *Lonchura atrocapilla*	35 (0.12)	2 (0.01)			6 (0.017)
Scaly-breasted Munia *Lonchura nisoria*					2 (0.008)
Total species	*21*	*37*	*17*	*33*	*57*
Total migratory birds	*3*	*14*	*6*	*13*	*22*
Total threatened and near-threatened birds	*0*	*1*	*1*	*2*	*7*
Total observation hours	*4*	*14*	*6*	*3*	*36*

Of the five islands, Puerco recorded the highest number of species followed by Modessa, Cambari, Johnson, and Pagbo (Table 1). Six species composed of Garden Sunbird Cinnyris jugularis, Eurasian Tree sparrow Passer montanus, Collared Kingfisher Todiramphus chloris, Black-naped Tern Sterna sumatrana, Little Egret Egretta garzetta, and Pacific Reef Egret Egretta sacra were observed in all areas. However, there were at least 10 species recorded in Puerco that were not observed in the other islands. These included the Chestnut-cheecked Starling Agropsar philippensis, Japanese Flycatcher Tersiphone atrocaudata, White-breasted Woodswallow Artamus leucorynchus, Hooded Pitta Pitta sordida, Rusty-crowned Bee-eater Merops americanus, Cattle Egret Bubulcus ibis, Yellow wagtail Motacilla cinerea, Himalayan Cuckoo Cuculus saturatus, Brown Booby Sula leucogaster, and Lesser Frigatebird Fregata ariel. An immature Black-winged Stilt Himantopus himantopus was recorded once in Puerco Island but not on the other sites. The bird must have only stopped to rest as it was weak when it reached the island on 27 August 2019. It was no longer seen the next day.

The island of Cambari also hosts a number of species that were not recorded in the other sites including the White-bellied Sea-eagle Halieaeetus leucogaster, Pompadour Green pigeon Treron pompadoura, Pink-necked Green Pigeon Treron vernans, and Black-naped Oriole Oriolus chinensis. Few waterbirds were observed in Cambari as it was mostly rocky and did not have a mudflat. Fewer birds were recorded in Pagbo as only a small section of the island had remained above water during high tide. A huge colony of about 42,000 flying foxes roosted on the southwestern section of the mangrove area.

Abundance, diversity, and species dominance. Bird abundance varied between islands. The most represented group consisted of egrets and herons, and terns and doves (Table 1). Majority of the species were represented singly or came in pairs, with few species having more than 10 individuals. The most abundant bird species was the M.c. cumingii (0.22), followed by the Vulnerable Chinese Egret E. eulophotes (0.16) and the Endangered Great Knot C. tenuirostris (0.15). Both the E. eulophotes and C. tenuirostris were observed and photographed roosting on the sandbar along with Great Egrets Egretta sacra, Intermediate Egrets Egretta intermedia, Little Egret Egretta garzetta, and sandpipers during high tide in Johnson Island. Terns on the other hand were regularly observed feeding in flocks and roosting on an exposed sandbar close to the island of Modessa and Puerco during high tide. The high abundance score of the Black-naped terns Sterna sumatrana was largely influenced by the breeding colony observed in Cambari. At the time of the survey, breeding pairs were tending the nest set on the crevices of the bare rock. At least six nests had one to two whitish to light buff eggs with blotches, and two nests were observed with one pullus.

The island of Puerco recorded the most number of species and the highest diversity index (H'=2.85). Johnson Island had only 33 species, but it had a higher diversity index value (H'=2.67) compared to Modessa (H'=1.96) which had 36 species. Cambari recorded the lowest diversity index (Table 2) among the five islands.

Table 2

Comparison of Shannon-Weiner Diversity Index Values

Name of Island	Total number of species	D	H'	Hmax	Evenness
Pagbo	21	0.05	1.2	1.32	0.90
Modessa	36	0.07	1.96	1.55	1.26
Cambari	17	0.16	1.14	1.23	0.92
Johnson	33	0.07	2.67	1.52	1.75
Puerco	55	0.08	2.85	1.74	1.63

The diversity of species varied across the islands. Puerco Island was the most diverse (H' = 2.85), followed by Johnson (H' = 2.67) and Modessa (H' = 1.96). Cambari and Pagbu had almost the same index of diversity (Table 2). Puerco Island had more species compared to Johnson, but there was relatively the same chance of finding same species (D= 0.07 and 0.08) in both islands. Birds in both Pagbo and Cambari almost had the same relative abundance values (Table 2), but Cambari had a higher chance (16%) of encountering different species compared to the other islands including Puerco (D = 0.08) (Table 2).

Selected species accounts. Black-crowned Night Heron Gosachius goisagi (IUCN Least Concern) was caught on CCTV camera as it was hunting for newly hatched M.c. cumingii chick emerging from the nest at night on 20 August 2020. At least three birds were known residents of the island. This was the first time the species was observed preying on newly hatched M.c. cumingii chick.

Philippine Scrubfowl Megapodius cumingii (DENR DAO 2019 - 09 Endangered). Six nest fields were closely monitored on Puerco Island from 2016 to 2019. These are presented in detail in a separate paper (Paguntalan et al. in press). A pair was also observed scratching for food under coconut palms, and two more were observed under the beach forest trees in Modessa Island on 24-26 June 2017. We did not encounter the bird in Cambari Island, but it was cited in nearby islands and in the coastal areas of Araceli in Dumaran, as reported by locals. The locals had also cited the bird in Johnson Island.

Malay Plover Charadrius peronii (IUCN Near-threatened; DENR DAO 2019 – 09 Vulnerable). A pair was first recorded in Puerco Island in

November 2013 (Tabayag & Cruz, 2013). We observed one individual at a beach in Puerco on August 2018. A pair was also photographed in Modessa on 24 June 2017. A breeding pair was also reported in Cambari Island in 2017, but we did not encounter the species during the visit on May 2019.

Mantanani Scops Owl Otus mantananensis (IUCN Near-threatened). A resident pair on Puerco Island had successfully bred since 2014. At least one or two immature owls with the parents were observed on the months of May to October. One immature bird was seen with the parents perched about eight meters on a branch of a Syzygium on June 2017. A female was accidentally flushed from the nest that was nestled at the base of the frond of a 10-meter tall cocount in June 2018. The young bird was seen with the parents until early October 2018. The pair bred again in June 2019 and June 2020. The two immature birds were photographed with their parents on 15 August 2020. The birds were perched on a branch about five meters from the ground. One immature bird was close to the larger one (presumably the female), and the other was perched between the two birds and a slightly smaller mature bird (presumably the male). We heard two birds calling (responding to each other's call) in Modessa Island (24-25 June 2017) and one individual on Pagbo Island (4 October 2019). We were not able to visit Cambari and Johnson at night. Locals in Johnson Island reported seeing at least a pair on the island.

Northern Boobok Ninox japponica (IUCN Least Concern; DENR Vulnerable). Feeding on a Philippine Megapode chick, one individual was first photographed perched on a branch early morning on March 2017. This was the first time the bird was recorded on the island. Another individual was photographed perched on the main branch of a tree close to the nesting fields of the Philippine Megapode on 23 September 2019.

Pied Imperial Pigeon Ducula bicolor (IUCN Least Concern). The bird was encountered in Cambari and Puerco Islands. Two active nests were seen set on branches of trees on top of the northernmost ridge of Cambari Island. At least 31 individuals were counted last 22 May 2019. Birds were either moving in pairs or in groups of five to eight individuals. One individual was observed roosting on Puerco Island on 24 May 2019, while two individuals were observed roosting last 3 October 2019.

The Pompadour Green Pigeon Treron pompadoura was recorded on Cambari Island in Araceli, Palawan. At least four individuals were observed

feeding on fruits along with Pied Imperial Pigeons Ducula bicolor and Pink-necked Green Pigeon Treron vernans. Two of the birds were perched for more than 10 minutes on exposed branches along a steep rock wall on the eastern side of Cambari Island. We suspect the birds, opportunistically feeding on ripe fruits, were moving between small islands and mainland Palawan.

DISCUSSION

Puerco Island was visited in 2013 by Tabayag and Cruz (2013) and documented 41 species of birds. This study added 16 more species making Puerco the most diverse among the islands surveyed (1.6 Shannon – Wiener diversity index). Birds were unevenly distributed (D = 0.08) and were largely dominated by the M.c. cumingii. Majority of the birds recorded were migrants e.g., sandpipers, Chestnut-cheeked Starling Agropsar philippensis, Japanese Paradise Flycatcher Tersiphone atrocaudata and Arctic Warbler Phylloscopus borealis, and native birds occasionally observed to exploit on available food resources. Only 13 species were breeding on the island. The higher number of species recorded was primarily due to more time spent in Puerco than in the other areas. We advice readers to take this into consideration when comparing the results of Puerco with the rest of the other islands.

Cambari Island was the least diverse (1.14 Shannon-Wiener diversity index), with fewer dominant species (D = 0.16) compared to the other islands. The beach forests attracted a number of native birds e.g., D. bicolor, Grey-capped Emerald Dove Chalcophaps indica, and T. vernans feeding on ripe fruits and invertebrates. The trees on cliffs also provided nesting sites for the D. bicolor and H. leucogaster.

A breeding pair of O. m. mantananensis in Puerco Island was regularly monitored since 2016. Immature birds were observed with the parents from July to October. We only recorded the adult pairs from the month of November to July. We suspect that the immature birds stay with the parents for about two months before moving to the nearby small islands. The other nearby islands in Green Island Bay and in Aracelli are important for the movement of populations of O. m. mantananensis as the species is reported to prefer smaller islands and islets (Kennedy et al., 2000; Sloan, 2017; Allen, 2020).

Tourism development in Palawan particularly in the municipalities of Roxas and Dumaran had significantly increased in the last two decades (Gonzales & Reyes, 2018). Catering to higher-end markets, Puerco Island was launched as Banwa Private Island in 2019. In the course of the development of the island, a 200-square meter area was set aside as Tabon Sanctuary. The protection of the nesting field in the Tabon Sanctuary largely contributed to the increase in the breeding population of Philippine Scrubfowl (Paguntalan et al., in press). Biodiversity monitoring and conservation was integrated in the daily operations of the island. This has played a key role in reducing the threats and disturbance on the species. In the case of Pagbo and Johnson, no other structural development were observed except for a few households. There were however Rhizophora mangroves planted on seagrass and on the mudflats in Johnson where migratory birds including the Endangered Far Eastern Curlew Numenius madagascariensis and the Vulnerable E. eulophotes were observed feeding.

The Municipality of Aracelli had initiated discussions on the prospect of showcasing Cambari Island for sustainable tourism activities. During the survey, at least two local groups of tourists visited the island. Local guides took the visitors up on the rocky slopes to get an overlooking view of the island. The rocks were unstable and slippery when wet, and some sections had large gaps that were dangerously steep and deep. A colony of Black-naped terns nested on the rocks while pigeons and H. leucogaster were also nesting on low lying branches close to the ridge. The Municipality should reconsider allowing tourists to climb and move around the island.

The small islands in Palawan are important habitats for Near-endemic M. c. cumingii, O. m. manatanensis, and the IUCN Near-threatened C. peronii. Both M. c. cumingii and O. m. mantananensis are suspected to be moving between islands in search for food and establish breeding territories. The protection of the breeding areas in Puerco had largely contributed to the increase in the breeding populations of M. c. cumingii. The integration of native beach forest trees had attracted species of birds to roost and feed on the ripe fruits. The experience of Puerco Island shows that habitat management, replanting of native beach forest trees, and integrating wildlife protection can go hand in hand with development.

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