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Bird surveys in Turtle Islands Wildlife Sanctuary, Philippines

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ABSTRACT

Bird observations were conducted in all six islands within the Turtle Islands Wildlife Sanctuary, Tawi-Tawi, Philippines in May 2017, March 2018 and August 2019. Purposive sampling technique using digital cameras, binoculars and spotting scopes were used to document the bird species and to assess their population. A total of 44 species were observed including the IUCN Vulnerable Grey Imperial Pigeon *Ducula pickeringii* (Cassin, 1854), the near-threatened Mantanani Scops Owl *Otus mantananensis* (Sharpe, 1892) and the Philippine Megapode *Megapodius cumingii* (Dillwyn, 1853). Baguan Island recorded the highest number of species (38) followed by Taganak Island with 25 species, Boan Island with 21 species, Great Bakkungan and Lihiman Islands has 18 species each, while the island with the least number of species observed was Langaan (14). Among the islands, only Baguan retained mature beach forest. Locals in Boan Island were observed keeping native birds as pets. The presence of these restricted-range bird species as well as the updated baseline data, provide significant contribution in defining priority islands for avian conservation. Additional surveys are recommended in the area particularly in the relatively undisturbed Baguan Island during migratory season.

Keywords: Mantanani scops owl, Sulu, Tawi-Tawi

INTRODUCTION

The Philippines consists of 7,641 islands (Maritime Industry Authority 2021) is located at the western most part of the Pacific Ocean and is identified as one of the world's biologically rich countries when it comes to diversity of

3676 ecosystems, species and genetic diversity. Avian diversity in the country is
3677 among the highest in the world where more than 7% of the land area was
3678 declared as Important Bird Areas (IBAs) and secondary regions (Stattersfield
3679 et al. 1998; Collar et al. 1999). Important Bird Areas are sites that are
3680 significant for the conservation of bird populations in a worldwide scale due
3681 to the presence of threatened, endemic and restricted-range species (Haribon
3682 Foundation 2014). Among the outstanding IBAs is the Sulu Archipelago
3683 (Alban 2005).

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3685 A number of threatened birds are known to occur only in Sulu
3686 archipelago and nowhere else in the world (Ong et al. 2002; BirdLife
3687 International 2019). Despite the high concentration of endemic and
3688 restricted-range species, very few ornithological expeditions have been
3689 conducted on the smaller islands including the Turtle Islands (Dickinson et al.
3690 1991; Kennedy et al. 2000; Mallari et al. 2001) and earlier collections were
3691 concentrated on Tawi-Tawi, Jolo, Sitangkai and Simunol (Guillemard 1885;
3692 Mearns 1909; Dickinson et al. 1991; Kennedy et al. 2000; Peterson et al. 2000).

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3694 The Turtle Islands is located at the southwestern edge of Sulu Sea right
3695 at the tip of the international treaty limits separating the Philippines and
3696 Malaysia. It ranked as the 11th major marine nesting grounds in the world for
3697 the endangered Green Sea Turtle *Chelonia mydas* (Linnaeus, 1758). This
3698 small group of islands is highly valued and recognized for its critical marine
3699 turtle habitat. Hence, the entire municipality covering six islands, namely
3700 Langaan, Lihiman, Baguan, Great Bakkungan, Boan, and Taganak, was
3701 declared as a protected area known as Turtle Islands Wildlife Sanctuary
3702 (TIWS) pursuant to Republic Act 7586 as amended by RA 11038. It has a total
3703 area of 242,967 ha (242.97 km²), including its surrounding waters (PAMB
3704 2018).

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3706 Knowledge on the birds of TIWS is important in helping us understand
3707 the relationships of the birds in TIWS to Borneo and Philippines and whether
3708 the endemic and restricted-range species of the Sulu archipelago are also
3709 found in TIWS. The bird observations of Ivan Sarenas in Baguan and Taganak
3710 Islands (Yu et al. 2016) added 28 new records and was the only available
3711 recent information on the avifaunal community of TIWS. This study presents
3712 the status of the forest habitats on each island, bird species composition,
3713 abundance, and diversity in the islands of Baguan, Taganak, Boan, Lihiman,
3714 Langaan and Great Bakkungan. These are essential in identifying priority
3715 islands for bird conservation.

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3721 **METHODS**

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3723 **Site Description**

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3725 **Langaan** (6°12'17.306"N, 118°8'59.02"E) - The island measures 7 ha
 3726 with a relatively flat, sandy landscape. Its vegetation is dominated by coconut
 3727 *Cocos nucifera* (L.) and with some beach forest trees covering a quarter of the
 3728 island (3 ha). This was visited on 22-23 May 2017 and 24 August 2019.

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3730 **Lihiman** (6°13'56.114"N, 118°4'7.53"E) - A 29 ha island with an active
 3731 mud volcano on the northern section. The mud volcano forms a 20 m crater
 3732 that drains directly to the sea. A plantation of "agoho" *Casuarina equisetifolia*
 3733 (L.) (estimated at 4 ha) surrounds the volcano and are the only known plants
 3734 growing around the mud volcano. On the lower sections of the steep hill are
 3735 native species of trees e.g., "talisay" *Terminalia catappa* (L.) and "kapok"
 3736 *Ceiba pentandra* (L.). Patches of mangroves are observed on the uninhabited
 3737 coastal areas. This was visited on 22-23 May 2017 and 24 August 2019.

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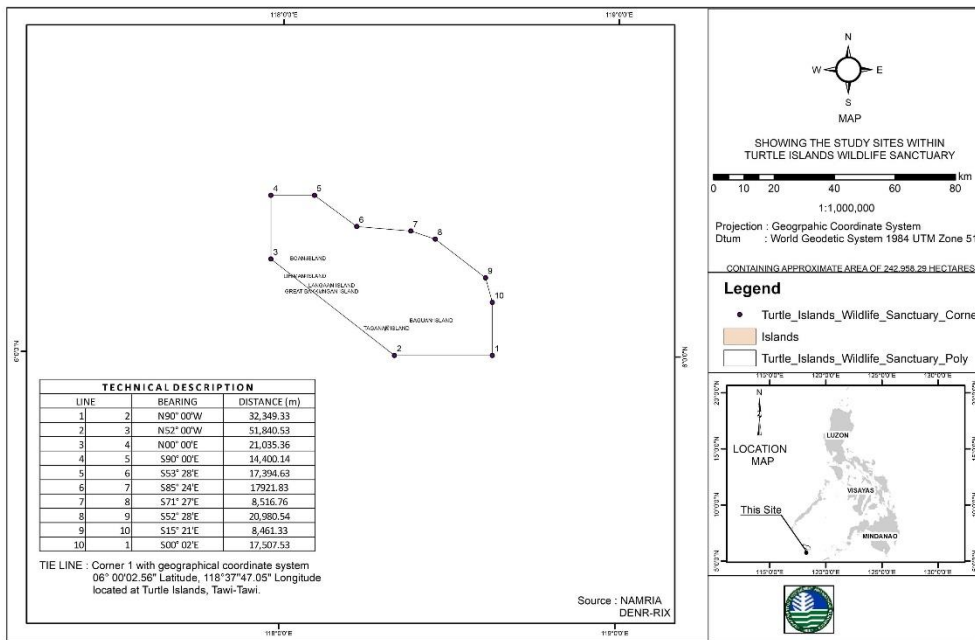
3739 **Baguan** (6°6'13.171"N, 118°26'50.411"E) - This 29.1 ha island is
 3740 designated as a strict protection zone. It is the only uninhabited island within
 3741 TIWS. It is mostly flat in the southern section with a hilly northern portion
 3742 that reached an elevation of 40 m above sea level and leads to a steep drop
 3743 with large volcanic boulders on the northern sandy shoreline. The
 3744 "Balinghasai" *Buchanania arborescens* (Blume), coconut and other beach
 3745 forest trees dominated the terrestrial flora. This was visited on 21 May 2017,
 3746 21 March 2018, and 22-23 August 2019.

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3748 **Great Bakkungan** (6°11'14.045"N, 118°7'10.514"E) - This 51 ha hilly
 3749 island is dominated by coconuts *C. nucifera*, mangoes *Mangifera indica* (L.)
 3750 and bananas *Musa* sp. interspersed with grassland that serve as grazing areas
 3751 for goats. An active mud volcano in the northern end is surrounded with
 3752 grasslands and occasional "bignay" *Antidesma* spp. trees. The highest altitude
 3753 reaches 58 m elevation. This was visited on 22-23 May 2017 and 24 August
 3754 2019.

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3756 **Boan** (6°17'6.912"N, 118°4'41.43"E) - A 76 ha island has an elevation
 3757 of 59 m above sea level. The island features a cluster of coastal communities
 3758 and a hilly landscape. Few native trees are observed on the island. A patch of
 3759 residual forest on the northern side was reported in the 1990s, but only *Ficus*
 3760 spp., coconuts, bananas and brushland are observed during the survey. A
 3761 patch of mangroves composed mostly of *Rhizophora* spp. is observed in the
 3762 southern coastal area. We visited on 22-23 May 2017 and 24 August 2019.



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Figure1. Map of Turtle Islands Wildlife Sanctuary, Philippines.

Taganak (6°4'44.375"N, 118°18'53.611"E) - The island has an estimated land area of 116 ha and elevation at 148 m above sea level. It is mostly flat on the southern side with a low plateau-like feature at the central section. Mainly devoid of forest except for the native vegetation on the rocky section in the north. The rest of the island is covered with “cogon” *Imperata cylindrica* (L.) with mango and banana plantation as well as other seasonal agricultural plants. We visited last 19-20 May 2017, 21 March 2018, and 25 August 2019. The exact location of the study sites visited during the survey is shown in Figure 1.

Status of Forest Habitats

To identify priority islands for bird conservation, basic description of the general type of habitat was conducted by a) recording the most numerous plants identified at least at the family level, b) presence of fruiting and flowering plants, c) average height of canopy and understory plants and d) anthropogenic disturbances. A drone was also used to take images and videos to determine the different land uses and in estimating remaining natural vegetation. Photos of flowering and fruiting trees were also taken for taxonomic identification using the works of Pelser et al. (2011) and Primavera (2009).

3788 **Birds Species Composition and Abundance**

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A purposive sampling method and photo documentation were carried out in the six islands. Birds seen and heard calling were recorded using 8 x 42, 10 x 42 roof prism binoculars and 80 x 45 degree spotting scopes, and photographed using digital cameras with 600 mm telephoto lenses. In the case of Baguan Island, four count stations were used by observers to search and record the species and numbers of birds for at least eight minutes (Bibby et al. 2000; Lee and Marsden 2008). Taxonomy and nomenclature followed the Handbook of Birds of the World and the BirdLife International Illustrated Checklist of the Birds of the World (del Hoyo et al. 2014; del Hoyo and Collar 2016). Kennedy et al. (2000), Lee et al. (2018) and Jakosalem et al. (2019) were used in identifying birds while Allen (2020) was used as reference for the residency and conservation status. A total of 27 observation hours were spent in the whole area as follows; 16 hours - Baguan; 8 hours - Taganak; 2.5 hours - Lihiman; 4.5 hours - Langaan; 5.5 hours – Boan; 2 hours - Great Bakkungan.

3805 **Birds Species Diversity**

The Shannon – Weiner index of diversity was determined between islands. This index takes both abundance and richness into account using the formula: $H = - \sum [pi \cdot \ln(pi)]$ where, *Sum* is the summation; *pi* is the proportion of each species in a sample.

3813 **RESULTS**

3815 **Status of Forest Habitats**

Very little natural vegetation exists on the islands except in Baguan and Langaan. In Baguan, 89% of the island was covered with beach forest (Table 1). The “balinghasai” *Buchanania* spp. was the most common species encountered followed by figs *Ficus* spp., “culasi” *Lumnitzera littorea* (Jack) Voigt, “buta-buta” *Excoecaria agallocha* (L.), “tabigi” *Xylocarpus granatum* (Koen.), “piagao” *Xylocarpus moluccensis* (Lam.) M. Roem and “tungog” *Ceriops* spp. There were still traces of secondary growth beach forests in Taganak and Langaan Island. In Great Bakkungan and Boan, *Antidesma* spp. grows in the grassland areas. The *Buchanania* spp., *Antidesma* spp. and *Ficus* spp. appear to be the major source of fruits for fruit-eating wildlife e.g., doves *Ptilinopus* sp., *Ducula* sp. and many others.

3832 Table 1. Estimated forest cover on the islands of Turtle Islands Wildlife
 3833 Sanctuary.
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Name of Island	Size (ha)	Estimated forest (ha)	Description of habitats	Encountered Plant Species
Baguan	29	26	Secondary beach forest	<i>Buchanania</i> spp., <i>Ficus</i> spp., <i>Xylocarpus</i> spp., <i>Excoecaria</i> sp.
Taganak	116	8	Second growth with grassland	<i>Xylocarpus</i> spp., <i>Excoecaria</i> sp., <i>Cocos nucifera</i> (L.), <i>Mangifera indica</i> (L.), <i>Musa</i> sp.
Lihiman	29	5	<i>Casuarina</i> tree plantation	<i>Casuarina equisetifolia</i> (L.), <i>Cocos nucifera</i> , <i>Terminalia catappa</i> (L.)
Langaan	7	2	Beach forest	<i>Excoecaria agallocha</i> (L.), <i>Cocos nucifera</i>
Boan	76	24	Brushland and mangroves	<i>Cocos nucifera</i> , <i>Ficus</i> spp., <i>Macaranga</i> sp., <i>Terminalia catappa</i>
Great Bakkungan	51	20	Brushland and grassland	<i>Cocos nucifera</i> , <i>Antidesma</i> spp., <i>Mangifera indica</i> , <i>Terminalia catappa</i>

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Birds Species Composition and Abundance

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Of the six islands visited, Baguan Island (38) recorded the highest number of species followed by Taganak (25), Boan (21), Lihiman (19), Great Bakkungan (18), and lastly was Langaan with 14 species (Table 2).

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Table 2. Counts and relative abundance of birds (in parenthesis) recorded during current surveys on the six islands of TIWS. Note that 1 – Baguan; 2 – Boan; 3– Langaan; 4 – Lihiman; 5 – Great Bakkungan and 6 – Taganak. An asterisk placed before the scientific name denotes migratory birds.

Scientific Name	1	2	3	4	5	6
* <i>Fregata ariel</i> (Gmelin, 1789)	4 (3)					
* <i>Fregata minor</i> (Gray, 1845)	1 (1)					
<i>Haliaeetus leucogaster</i> (Gmelin, 1788)	1 (1)	1 (1)	1 (3)	1 (1)	1 (2)	1 (2)
<i>Haliastur indus</i> (Boddaert, 1783)	1 (1)	2 (2)	1 (3)	3 (2)	1 (2)	2 (3)
<i>Butorides striata</i> (Linnaeus, 1758)		1 (1)		1 (1)	1 (2)	
<i>Amaurornis phoenicurus</i> (Pennant, 1769)		1 (1)				
<i>Hypotaenidia torquatus</i> (Linnaeus, 1766)		1 (1)				
<i>Egretta sacra</i> (Gmelin, 1789)	1 (1)	1 (1)	1 (3)	1 (1)		1 (2)
<i>Bubulcus ibis</i> (Linnaeus, 1758)	1 (1)					

Scientific Name	1	2	3	4	5	6
* <i>Tringa brevipes</i> (Veillot, 1810)	1 (1)					1 (2)
* <i>Charadrius leschenaultia</i> (Lesson, 1826)	1 (1)					1 (2)
<i>Sterna sumatrana</i> (Raffles, 1822)	16 (13)	4 (4)	2 (6)	5 (3)	2 (4)	1 (2)
* <i>Chlidonias hybrida</i> (Pallas, 1811)	8 (7)				5 (11)	5 (8)
<i>Onychoprion anaethetus</i> (Scopoli, 1786)	1(1)					
<i>Thalasseus bergii</i> (Lichtenstein, 1823)				64 (44)		
* <i>Phalaropus lobatus</i> (Linnaeus, 1758)			2 (6)			
<i>Megapodius cumingii</i> (Dillwyn, 1853)	9 (8)					3 (5)
<i>Treron vernans</i> (Linnaeus, 1771)	4 (3)	3 (2)			7 (15)	2 (3)
<i>Treron axillaris</i> (Bonaparte, 1855)	1(1)					
<i>Ptilinopus melanospila</i> (Salvadori, 1875)		3 (2)				6 (10)
<i>Ducula pickeringii</i> (Cassin, 1854)	8 (7)					
<i>Ducula bicolor</i> (Scopoli, 1786)	5 (4)					
<i>Columba vitiensis</i> (Quoy & Gaimard, 1830)	1(1)					
<i>Chalcophaps indica</i> (Linnaeus, 1758)	1(1)	2 (2)				1 (2)
<i>Spilopelia chinensis</i> (Scopoli, 1786)	3 (3)	3 (4)	1 (3)	26 (18)	4 (9)	1 (2)
* <i>Cuculus saturatus</i> (Blyth, 1843)	1 (1)					
<i>Eudynamys scolopaceus</i> (Linnaeus, 1758)	1 (1)					
<i>Otus mantananensis</i> (Sharpe, 1892)	1 (1)					2 (3)
<i>Pelargopsis capensis</i> (Linnaeus, 1766)	2 (2)					1 (2)
<i>Todiramphus chloris</i> (Boddaert, 1783)	10 (8)	8 (10)	8 (24)	3 (2)	3 (6)	4 (7)
<i>Aerodramus cf amelis</i> (Oberholser, 1906)	1 (1)					
<i>Gerygone sulphurea</i> (Wallace, 1864)	2 (2)	1 (1)	1 (3)	4 (3)	1 (2)	1 (2)
* <i>Hirundo rustica</i> (Linnaeus, 1758)	3 (3)	2 (2)	6 (18)	1 (1)	6 (13)	3 (5)
<i>Pycnonotus goaivier</i> (Scopoli, 1786)	1 (1)	2 (2)		2 (1)	1 (2)	5 (8)
<i>Rhipidura nigritorquis</i> (Vigors, 1831)	2 (2)	1 (1)	1 (3)	1 (1)		2 (3)
<i>Aplonis panayensis</i> (Scopoli, 1783)	3 (3)	23 (28)	1 (3)	1 (1)	2 (4)	1 (2)
<i>Lalage nigra</i> (Forster, 1781)	2 (2)			1 (1)	1 (2)	1 (2)
<i>Artamus leucorhynchus</i> (Linnaeus, 1771)	1 (1)	1 (1)		1 (1)	2 (4)	1 (2)
<i>Oriolus chinensis</i> (Linnaeus, 1766)	1 (1)			1 (1)		
* <i>Motacilla cinerea</i> (Tunstall, 1771)	1 (1)		1 (3)			
<i>Anthreptes malacensis</i> (Scopoli, 1786)	5 (4)	5 (6)	3 (9)	2 (1)	2 (4)	1 (2)

Scientific Name	1	2	3	4	5	6
<i>Cinnyris jugularis</i> (Linnaeus, 1766)	1 (1)				2 (4)	
<i>Lonchura atricapilla</i> (Veillot, 1807)	7 (6)	2 (2)		2 (1)	2 (4)	3 (5)
<i>Passer montanus</i> (Linnaeus, 1758)	6 (5)	18 (22)	3 (9)	27 (18)	4 (9)	9 (15)
Total individuals	119	85	32	147	47	59
Total species	38	21	14	19	18	25
Total breeding residents	30	19	11	18	19	22
Total migratory birds	8	1	3	1	1	3

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A total of eight species were found in all islands: White-bellied Sea eagle *Haliaeetus leucogaster* (Gmelin, 1788), Brahminy Kite *Haliastur indus* (Boddaert, 1783) Spotted Dove *Spilopelia chinensis* (Scopoli, 1786), Collared Kingfisher *Todiramphus chloris* (Boddaert, 1783), Yellow-vented Bulbul *Pycnonotus goavivier* (Scopoli, 1786), Asian Glossy Starling *Aplonis panayensis* (Scopoli, 1783), Brown-throated Sunbird *Anthreptes malacensis* (Scopoli, 1786) and Eurasian Tree Sparrow *Passer montanus* (Linnaeus, 1758). The Asian Glossy Starling was the most frequently encountered bird followed by Eurasian Tree Sparrow. Seven of the bird species were represented with only one individual (Table 2).

A total of nine species were newly recorded in TIWS e.g., Barred Rail *Hypotaenidia torquatus* (Linnaeus, 1766), Whiskered Tern *Chlidonias hybridus* (Pallas, 1811), Black-naped Fruit Dove *Ptilinopus melanospila* (Salvadori, 1875), Pied Imperial Pigeon *Ducula bicolor* (Scopoli, 1786), Metallic Pigeon *Columba vitiensis* (Quoy & Gaimard, 1830), Grey-capped Emerald Dove *Chalcophaps indica* (Linnaeus, 1758), Red-necked Phalarope *Phalaropus lobatus* (Linnaeus, 1758), Black-naped Oriole *Oriolus chinensis* (Linnaeus, 1766) and Great Frigatebird *Fregata minor* (Gmelin, 1766).

Birds Species Diversity

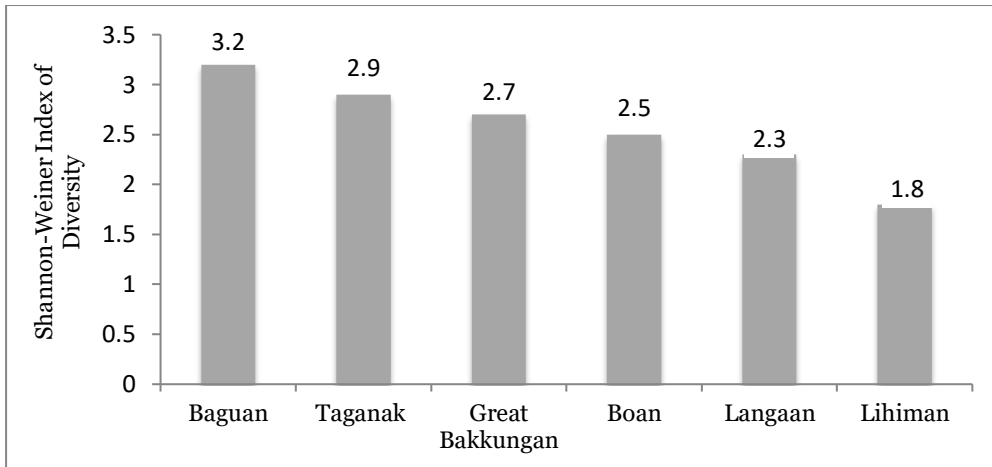
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Baguan recorded the highest index of species diversity ($H' = 3.2$) compared with the other islands (Figure 2). This is followed by Taganak ($H' = 2.9$) and Great Bakkungan ($H' = 2.7$). The smallest island (Lihiman) recorded the lowest species diversity index ($H' = 1.8$).



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3876 Figure 2. Comparison of species diversity indices (Shannon-Weiner) of all six
3877 islands in Turtle Islands Wildlife Sanctuary.

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3880 DISCUSSIONS

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3882 Status of the forest habitat

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3885 The size of the islands did not appear to influence bird diversity but
3886 islands with forest cover recorded more species. Among the six islands,
3887 Baguan still retain a substantial beach forest cover. There were small patches
3888 of beach forest on Langaan, on steep rock cliffs in Great Bakkungan and
3889 surrounding the mud volcanoes in Lihiman. Beach forest on these isolated off-
3890 shore islands serve as important habitats for specialized small-island birds
3891 e.g., Mantanani Scops Owl and Grey Imperial Pigeon. The increasing scarcity
3892 of suitable islands threatens the survival of these species.

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3894 The islands of Baguan and Taganak are important habitats for the
3895 Vulnerable *D. pickeringii*, the near-threatened *Megapodius cumingii pusillus*
3896 (Dillwyn, 1853) and *O.m. mantananensis* as well as terrestrial migratory birds
3897 *Lanius tigrinus* (Drapiez, 1828) and *Larvivora cyane* (Pallas, 1776). The
3898 islands also recorded species that were affiliated with Bornean avifauna
3899 *Aerodramus cf amelis* (Oberholser, 1906) and the *P. moluccensis*. We
3900 anticipate that with more surveys (including nocturnal birds), the bird species
3901 list is likely to increase particularly during the migratory season.

3902

3903 Based on the current data, priorities should focus on Baguan and
3904 Taganak islands for bird monitoring. We also suggest that bio-monitoring
3905 should include monitoring of *M.c. pusillus* nests and *O.m. mantananensis*.
They are known to prefer to breed in small islands (Lambert 1993; Kennedy et

3906 al. 2000; Sloan 2017). A Biodiversity Assessment and Monitoring System
 3907 (BAMS) in TIWS should include be conducted within the migratory season but
 3908 should also include all six islands as sites of this study.

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3910 **Birds Species Composition and Abundance**

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3912 In 1997, there were only 30 birds recorded on TIWS (PAMB 2018). It
 3913 took another 18 years before the list of birds were updated to 58 species (Yu et
 3914 al. 2016). It should be noted that more bird observations were spent on
 3915 Baguan and Taganak than the rest of the TIWS islands. The surveys were also
 3916 conducted off migratory season. These factors introduced bias in our results
 3917 and we caution readers to take this in consideration when interpreting the
 3918 information provided.

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3920 There were 13 new localities recorded from this survey bringing the
 3921 total number of birds on TIWS to 71 species (Table 3). At least 21 migratory
 3922 species recorded in 2015 (Yu et al. 2016) that were not observed during the
 3923 survey (Table 3). Migrants comprise 37% (26 species) of the total birds in
 3924 TIWS. Waterbirds on the other hand share 24% (17 species) of the total birds
 3925 while 13% (10 species) were doves. There were also three species that were not
 3926 observed during the visit e.g., Oriental Dollarbird *Eurystomus orientalis*
 3927 (Linnaeus, 1766), Black-headed Munia *Lonchura atricapilla* (Linnaeus, 1766)
 3928 and Northern Boobok *Ninox japonica* (Temnick & Schlegel, 1844).

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3930 Table 3. Checklist of birds in Turtle Islands Wildlife Sanctuary. Note: * means
 3931 migratory, ^ means new record on TIWS, X means recorded in TIWS and ?
 3932 means needs further validation. The 1997 records were taken from TIWS
 3933 (2018) while the 2015 records were lifted from Yu et al. (2016).

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Species Name	1997	2015	2017 - 2019
*Lesser Frigatebird <i>Fregata ariel</i>	X	X	X
*^Great Frigatebird <i>Fregata minor</i>			X
White-bellied Sea Eagle <i>Haliaeetus leucogaster</i>	X	X	X
Brahminy Kite <i>Haliastur indus</i>	X	X	X
Peregrine Falcon <i>Falco peregrinus</i>		X	
Striated Heron <i>Butorides striata</i>		X	X
^White-breasted Waterhen <i>Amauornis phoenicurus</i>			X
^Barred Rail <i>Hypotaendea torquatus</i>			X
Red-legged Crake <i>Rallina fasciata</i>		X	
Pacific Reef Egret <i>Egretta sacra</i>	X	X	X
Eastern Cattle Egret <i>Bubulcus ibis</i>		X	X
Little Egret <i>Egretta garzetta</i>		X	
Intermediate Egret <i>Egretta intermedia</i>		X	
*Grey-tailed Tattler <i>Tringa brevipes</i>		X	X
*Common Sandpiper <i>Actitis hypoleucos</i>	X	X	
*^Greater Sand Plover <i>Charadrius leschenaultii</i>			X

Species Name	1997	2015	2017 - 2019
*^Red-necked Phalarope <i>Phalaropus lobatus</i>			X
Black-naped Tern <i>Sterna sumatrana</i>	X		X
*^Whiskered Tern <i>Chlidonias hybrida</i>			X
Bridled Tern <i>Onychoprion anaethetus</i>	X		X
Greater Crested Tern <i>Thalasseus bergii</i>		X	X
*Gull-billed Tern <i>Gelochelidon nilotica</i>		X	
Philippine Megapode <i>Megapodius cumingii</i>	X	X	X
Pink-necked Green Pigeon <i>Treron vernans</i>	X	X	X
^Philippine Green Pigeon <i>Treron axillaris</i>			X
Black-naped Fruit Dove <i>Ptilinopus melanospila</i>			X
Grey Imperial Pigeon <i>Ducula pickeringii</i>	X	X	X
Green Imperial Pigeon <i>Ducula aenea</i>		X	
^Pied Imperial Pigeon <i>Ducula bicolor</i>			X
^Metallic Pigeon <i>Columba vitiensis</i>			X
^Grey-capped Emerald Dove <i>Chalcophaps indica</i>			X
Spotted Dove <i>Spilopelia chinensis</i>	X	X	X
Philippine Collared Dove <i>Streptopelia dussumieri</i>	X		
*Oriental Cuckoo <i>Cuculus optatus</i>		X	X
*Himalayan Cuckoo <i>Cuculus saturatus</i>	X	X	
Asian Koel <i>Eudynamis scolopaceus</i>	X	X	X
*Chestnut-winged Cuckoo <i>Clamator coromandus</i>		X	
Hair-crested Drongo <i>Dicrurus hottentotus</i>		X	
Mantanani Scops Owl <i>Otus mantananensis</i>		X	X
*Northern Boobook <i>Ninox japonica</i>		X	
Collared Kingfisher <i>Todiramphus chloris</i>	X	X	X
*Common Kingfisher <i>Alcedo atthis</i>		X	
^Stork-billed Kingfisher <i>Pelargopsis capensis</i>			X
Sunda Pygmy Woodpecker <i>Picoides moluccensis</i>		X	
Ameline Swiftlet <i>Aerodramus cf amelis</i>		X	X
Oriental Dollarbird <i>Eurystomus orientalis</i>		X	
Golden-bellied Gerygone <i>Gerygone sulphurea</i>	X		X
*Barn Swallow <i>Hirundo rustica</i>	X	X	X
*House Swallow <i>Hirundo javanica</i>	X	X	
Yellow-vented Bulbul <i>Pycnonotus goaivier</i>	X		X
*Arctic Warbler <i>Phylloscopus borealis</i>	X	X	
Philippine Pied Fantail <i>Rhipidura nigritorquis</i>	X		X
*Grey-streaked Flycatcher <i>Muscicapa griseisticta</i>		X	
*Asian Brown Flycatcher <i>Muscicapa dauurica</i>		X	
*Dark-sided Flycatcher <i>Muscicapa sibirica</i>		X	
*Siberian Blue Robin <i>Larivora cyane</i>		X	
*Blue Rock Thrush <i>Monticola solitarius</i>		X	
Mangrove Blue Flycatcher <i>Cyornis rufigaster</i>	X		
Glossy Starling <i>Aplonis panayensis</i>	X	X	X
*Chestnut-cheeked Starling <i>Sturnus philippensis</i>	X	X	
Pied Triller <i>Lalage nigra</i>	X	X	X

Species Name	1997	2015	2017 - 2019
White-breasted Woodswallow <i>Artamus leucorhynchus</i>	X		X
^Black-naped Oriole <i>Oriolus chinensis</i>			X
*Grey wagtail <i>Motacilla cinerea</i>		X	X
*Eastern Yellow Wagtail <i>Motacilla tschutschensis</i>		X	
*Brown shrike <i>Lanius cristatus</i>	X	X	
*Tiger Shrike <i>Lanius tigrinus</i>		X	
Brown-throated Sunbird <i>Anthreptes malacensis</i>		X	X
Olive-backed Sunbird <i>Cinnyris jugularis</i>	X		X
Black-headed Munia <i>Lonchura atricapilla</i>	X	X	X
Eurasian Tree Sparrow <i>Passer montanus</i>	X	X	X
Total number of species	30	49	44
Total number of breeding residents	22	17	34
Total number of migratory birds	8	32	10

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The majority of the birds encountered were expected to occur in a wide range of habitats (Kennedy et al. 2000). The *H. torquatus*, *T. chloris* and *Cinnyris jugularis* are considered generalists and survive even in highly modified habitats (Steadman and Freifeld 1998; Kennedy et al. 2000; Sekercioglu 2006; Jakosalem et al. 2019). Rails are also known for their ability to disperse and survive even on remote small islands (Kennedy et al. 2000). We did not encounter birds endemic to the Sulu and Tawi-Tawi archipelago.

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The islands support at least 12 frugivorous birds, 10 of which were pigeons. The Vulnerable *D. pickeringgi* was only observed on Baguan. It was frequently encountered feeding on the ripe fruits of *Buchanania* sp. in groups of five to 10 individuals and sometimes flocks with *D. bicolor* and *C. vitiensis*. They appeared to take advantage on the optimal density of *Buchanania* spp., *Antidesma* spp., figs and other fruit trees in the area. We did not observe the species in the other islands but we suspected that the birds were moving across the islands to opportunistically search for fruit. IUCN (2021) reports on the continuing decline of the population and estimated the number of mature individuals from 1,500 to 7,000. Baguan Island is an important site for this Vulnerable small-island specialist.

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The Near-threatened *O. m. mantananensis* was distributed on small islets off Borneo and the Philippines (Allen 2020; Kennedy et al. 2000). There have been no previous confirmed records of Mantanani Scops Owl in Turtle Islands (Kennedy et al. 2000). At least two individuals were briefly seen and heard calling on Baguan Island last August 2019. There were at least four subspecies that occur in the country but we could not determine if it was subspecies *sibutuensis* or *mantananensis* occurring in Turtle Islands. Local reports indicated the presence of the bird on Taganak Island but we were not able to validate the record due to the limited time spent on the island.

3965 We observed six adult individuals of the Near-threatened *M.c pusillus*
 3966 on Baguan on 22-23 August 2019. One individual was seen digging a one-
 3967 meter deep burrow in one section of a 2 m wide mound (23 August 2019).
 3968 Three individuals were encountered on separate occasions on Taganak Island
 3969 (19-20 May 2017). We presumed the bird also occur on the other islands but
 3970 we only observed breeding mounds on Baguan.

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 3972 These were also noteworthy records in TIWS. A female Sunda Pygmy
 3973 Woodpecker *Picoides moluccensis* (Gmelin, 1788) was photographed
 3974 searching for insects on the main branch of a mango tree on Lihiman Island
 3975 (Yu et al. 2016). This was the first record of the Sunda Pygmy Woodpecker in
 3976 the Philippines. The Tiger Shrike *L. tigrinus* and a female Siberian Blue Robin
 3977 *L. cyane* (Pallas, 1776) were photographed in Baguan while a Chestnut-winged
 3978 Cuckoo *Clamator coromandus* (Linnaeus, 1776) was observed in Taganak
 3979 Island (Yu et al. 2016). All three species have been recorded in the Philippines
 3980 (Allen 2020; Kennedy et al. 2000). The Ameline Swiftlet *A. cfamelis* was first
 3981 reported on Baguan Island in 2015 (Yu et al. 2016). We have observed one
 3982 medium-sized individual with a generally light brown coloration and slightly
 3983 forked tail flying above a cleared section of the beach forest on Baguan Island
 3984 on 23 August 2019.

3985
 3986 The high proportion of migrants (37%) in TIWS illustrate the
 3987 importance of the islands as stop over points for migrating birds particularly
 3988 those that are rarely recorded in the country e.g. *L. cyane* and *L. tigrinus*.
 3989 According to Clarke et al. (2016), the *L. cyane* is a common migrant in the East
 3990 Asian Australasian flyway and is a winter migrant in the Philippines.

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3992 **Birds Species Diversity**

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3994 The high diversity of bird species in Baguan and Taganak islands can
 3995 be attributed to several factors e.g., presence of a beach forest, island size,
 3996 disturbance as well as field effort. Bird species composition and abundance
 3997 are dependent on the overall habitat requirements such as availability of food
 3998 resources, breeding grounds and protection (Gonzalez et al. 2010; Alviola and
 3999 Mohagan 2017; Paguntalan et al. 2021). The presence of native trees on beach
 4000 forest influenced the bird species composition and diversity on Puerco Island
 4001 (Paguntalan et al. 2021) and may have similar patterns with Baguan Island.
 4002 The conduct of purposive search in areas where there is still natural
 4003 vegetation, secondary growth, beach forest, as well as coastal mudflats will
 4004 likely add new records on each island.

4005

4006 The presence of *D. pickeringii*, *O. m. mantananensis* and *M.c pusillus*
 4007 raises the importance of the TIWS as refuge to threatened birds found on small
 4008 islands. These birds are vulnerable to hunting for local pet trade. We observed
 4009 six households on Boan Island that kept birds as pets. The *H. leucogaster*

4010 (adult and juvenile), Pink-necked Green Pigeon *Treron vernans* (Linnaeus,
 4011 1771) (2 individuals), *H. torquatus* (2 individuals) and White-breasted
 4012 Waterhen *Amaurornis phoenicurus* (Pennant, 1769) (2 individuals) are
 4013 placed in home-made bamboo cages or shackled with ropes as pets. The
 4014 conservation management of the TIWS under the Bangsamoro Autonomous
 4015 Region of Muslim Mindanao (BARMM) should consider conserving forests
 4016 habitats for restricted-range and forest dependent small island specialists.

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