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Abstract. Tanjung Piai is located in the southern-most tip of mainland Asia. It is one of the most important Ramsar site and Important Bird Area (IBA) in Malaysia. However, this site is receiving a major threat from shipping traffic in Malacca Straits which led to several impacts such as coastal erosion and pollution. Avifauna study of Tanjung Piai was conducted from May until August 2017. The objective of the study is to document the diversity of birds in the wetland areas of Tanjung Piai. The bird was recorded by using direct observation technique as well as mist-net trapping method. A total of 228 individuals, 32 species, and 23 families were recorded. The Shannon-Weiner Index, H', is 3.33 indicated that Tanjung Piai has high diversity and serve as a good habitat for bird species.

1. Introduction

Thousands of birds annually migrate through the East Asian Australasian Flyway (EAAF) from the breeding grounds in Alaska and Siberia to the tropical wintering areas in South-east Asia and Australia [1]. On this distant journey (up to 20,000 km per year) [2], these birds will stop at several stop-over sites to feed and refuel the energy before proceeding to the end-point. Malaysia is located along the EAAF and consists of numerous stop-over site for the birds. Wetland is a paramount importance stop-over sites in Malaysia and is defined as the lands that submerged or inundated by water for some time or for the entire period of times [3,4].

In spite of their importance, the wetland is currently at risk of destruction due to the several human activities. Asia is experiencing an alarming rate of inland wetland loss, posing a risk to the future long-term survival of many species depending on these ecosystems including birds [5]. Such birds that probably affected by wetland loss including shorebirds and waterbirds.

Tanjung Piai, Johor, Malaysia, is a Ramsar site and Important Bird Area (IBA), located at the southern-most tip of mainland Asia, and consists mainly of mudflats and mangrove forests [6]. The wetland area of Tanjung Piai supported vast amount of birds either resident or migratory species and because of this, it was declared as IBA. Unfortunately, Tanjung Piai is receiving impacts by the shipping traffics near the Malacca Straits that led to pollutions and soil erosions. Pollution caused through dumping of wastes from the ships and the wave produced by the big ships will trigger to more erosion to the mudflat area of Tanjung Piai. To some extent, it will affect the diversity of birds utilizing this mudflats and mangrove areas of Tanjung Piai. Therefore, this study aimed to document the diversity of birds in the wetland areas of Tanjung Piai, Johor, Malaysia.

2. Methodology

2.1. Study Area

The study was conducted at Tanjung Piai National Park, Johor, Malaysia (1°15'50.64"N and 103°30'36.57"E) (Figure 1). The total wetland areas of Tanjung Piai covers approximately 526 hectares of mangrove areas and 400 hectares of mudflat area [7]. It forms the only mangrove corridor that connects another Ramsar sites which are Pulau Kukup and the Sungai Pulai wetlands. The mangrove forests of Tanjung Piai is dominated by mangrove trees such as *Rhizophora apiculata* and *Bruguiera cylindrical*. A total of 7 sampling plots were established during this study known as Trail A, Trail B, Mudflat, Fishing Site, Cabin, Riverside and Camping Site.

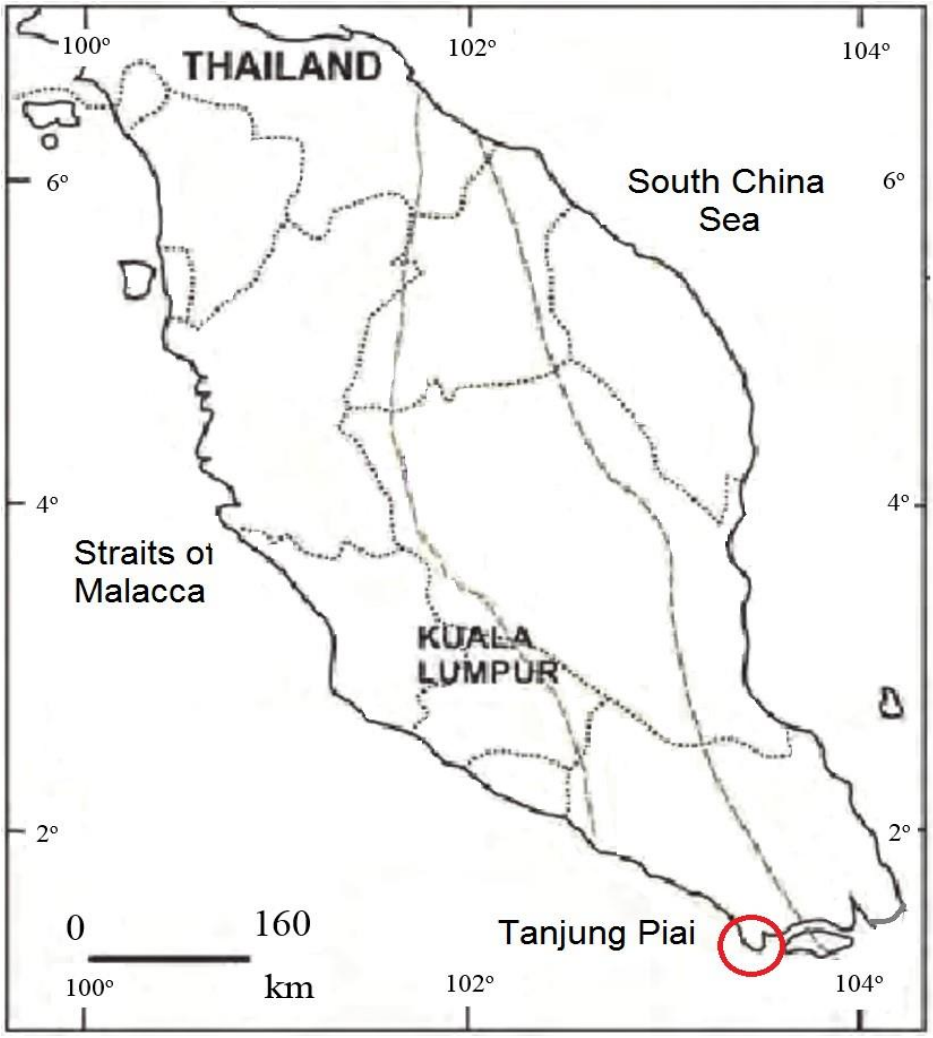

Figure 1. Map of Tanjung Piai, Johor, Malaysia

2.2 Avifauna Study

The study was conducted for four consecutive months from May until August 2017. A monthly observation was done for four days. Mist net trapping and direct observation techniques were used to count bird presence in the study sites. A total of five mist nets (12 m x 12m with 3 pocket) were used to capture bird. The nets were fixed and stretched between two poles and were placed in several locations. The nets were routinely checked for every 2 hours interval [8,9]. The birds captured were then identified and then released back to its nature [10]. In addition, direct observation techniques were done with the aid of a Nikon P1 500 Camera and binoculars. Daily observation was carried out from 0700 hours to 1800 hours every day [8]. Birds that have been recorded were then identified by using a field guide to the birds of Peninsular Malaysia and Singapore [11]. During sampling, birds were counted from at least 100 m away to ensure the researcher's presence did not affect birds activity [12; 13]. Counting of birds under extreme weather conditions (such as windy and/or rainy days) was not conducted due to possible adverse effects on bird activity [13,14].

2.3 Data Analysis

The data obtained through sampling were then analyzed by using statistical software, Minitab 18. Besides that, Shannon-Weiner Diversity Index was used to measure the diversity in this study. All data sets were tested with Shapiro Wilke's W test and Anderson's Darling test for normality. In all cases, $\alpha = 0.05$ was used. One-way ANOVA is used to test the significance of total individual presence between months and also to test the difference in total number of individual presence between the sampling locations.

3. Results and Discussions

A total of 228 individuals of birds were recorded throughout the sampling periods which comprised of 32 species and 23 families. Among these, 7 were migrants and 25 were resident species. According to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, one species is classified as Vulnerable, two species are classified as Near Threatened and the remaining 29 species is classified as Least Concern (Table 1). Lesser adjutant (*Leptoptilos javanicus*) is the only Vulnerable species recorded which count a total of 6 individuals recorded during the whole sampling duration. Furthermore, two species are classified as Near Threatened which are Buff-necked Woodpecker (*Meiglyptes tukki*) and Chestnut-bellied Malkoha (*Phaenicophaeus sumatranus*). Shannon-Weiner Diversity Index, H' obtained from this study is 3.33. There is no significant difference ($F = 0.62$, $p = 0.606$) in total number of individuals of birds recorded between months during the study (Figure 2). In contrast, the significant difference were found in total number of individuals recorded between 7 sampling plots ($F = 2.52$, $p = 0.022$). Mudflats recorded highest number of individual which is 79 individuals followed by Trail B (48 individuals), Riverside (37 individuals), Trail A (22 individuals), Camping sites (16 individuals), Cabin and Fishing sites (13 individuals respectively). Further analysis by using Fisher Individual Test for Differences of Means shows that the differences exists between Mudflat and Trail A ($T = 2.61$, $p = 0.01$); Fishing Site and Mudflat ($T = -3.02$, $p = 0.003$); Cabin and Mudflat ($T = -3.02$, $p = 0.003$) and Camping Site and Mudflat ($T = -2.88$, $p = 0.004$).

Table 1. Species recorded throughout sampling period in Tanjung Piai, Johor.

No	Family	English name	Scientific name	Local name	Distribution status	IUCN status	n
1	Nectariniidae	Thick-billed Spiderhunter	*Arachnothera robusta*	Kelicap-Sabit Paruh Tebal	R	LC	1
2	Nectariniidae	Spectacled Spiderhunter	*Arachnothera flavigaster*	Kelicap Sabit Besar	R	LC	3

3	Nectariniidae	Purple-throated Sunbird	*Nectarinia sperata*	Kelicap Nibong	R	LC	1
4	Nectariniidae	Scarlet Sunbird	*Aetophyga temminckii*	Kelicap Merah	R	LC	3
5	Columbidae	Pink-necked Green-pigeon	*Treron vernans*	Punai Leher Jambu/ Punai Gading	R	LC	1
6	Columbidae	Zebra Dove	*Geopelia striata*	Merbuk	R	LC	5
7	Columbidae	Spotted Dove	*Streptopelia chinensis*	Tekukur Leher Berbintik	R	LC	1
8	Ardeidae	Grey Heron	*Ardea cinerea*	Pucung Seriap	R	LC	9
9	Ardeidae	Great Egret	*Casmerodius albus*	Bangau Besar	M	LC	6
10	Cuculidae	Banded Bay Cuckoo	*Cacomantis sonneratii*	Sewah Berjalur/ Burung Takuweh	R	LC	1
11	Cuculidae	Chestnut-bellied Malkoha	*Rhopodytes sumatranus*	Cenuk Perut Coklat	R	NT	3
12	Picidae	Buff-necked Woodpecker	*Meiglyptes tukki*	Belatuk Leher Kuning	R	NT	3
13	Picidae	Common Flameback	*Dinopium javanense*	Belatuk Pinang Kecil/ Belatuk Mas	R	LC	11
14	Sturnidae	Common Myna	*Acridotheres tristis*	Tiong Gembala Kerbau	R	LC	13
15	Sturnidae	Javan Myna	*Acridotheres javanicus*	Tiong Jawa	R	LC	15
16	Accipitridae	White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Helang Siput	R	LC	2
17	Charadriidae	Lesser Sand Plover	*Charadrius mongolus*	Rapang Mongolia	M	LC	29
18	Scolopacidae	Common redshank	*Tringa totanus*	Kedidi kaki merah	M	LC	13
19	Apodidae	Himalayan Swiftlet	*Aerodramus brevirostris*	Layang-layang Himalaya	M	LC	1
20	Alcedinidae	Collared kingfishers	*Todiramphus chloris*	Pekaka Bakau	R	LC	19
21	Meropidae	Blue-throated Bee-Eater	*Merops viridis*	Beberek Leher Biru	M	LC	6
22	Hirundinidae	Pacific Swallow	*Hirundo tahitica*	Layang-layang Pasifik	R	LC	20
23	Pycnonotidae	Yellow-vented Bulbul	*Pycnonotus goaivier*	Merbah Kapur	R	LC	2
24	Corvidae	Large-billed Crow	*Corvus macrorhynchos*	Gagak Paruh Besar	R	LC	2
25	Turdidae	Oriental Magpie Robin	*Copsychus saularis*	Murai Kampung	R	LC	8
26	Rhipiduridae	Pied Fantail	*Rhipidura javanica*	Sambar Murai Gila	R	LC	12
27	Cisticolidae	Ashy	*Orthotomus*	Perenjak Kelabu	R	LC	8

		Tailorbird	*ruficeps*				
28	Laridae	Whiskered Tern	*Chlidonias hybridus*	Camar Bermisai	M	LC	10
29	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	Burung Botak/ Upih Botak	R	VU	6
30	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	Pipit Pinang	R	LC	11
31	Oriolidae	Black-naped Oriole	*Oriolus chinensis*	Dendang Tengkuk Hitam	R	LC	2
32	Coraciidae	Dollarbird	*Eurystomus orientalis*	Tiong Batu	M	LC	1

Key: LC = Least Concern, VU = Vulnerable and NT = Near Threatened, M = Migrant, R = Resident, n = No.of individuals recorded throughout sampling periods.

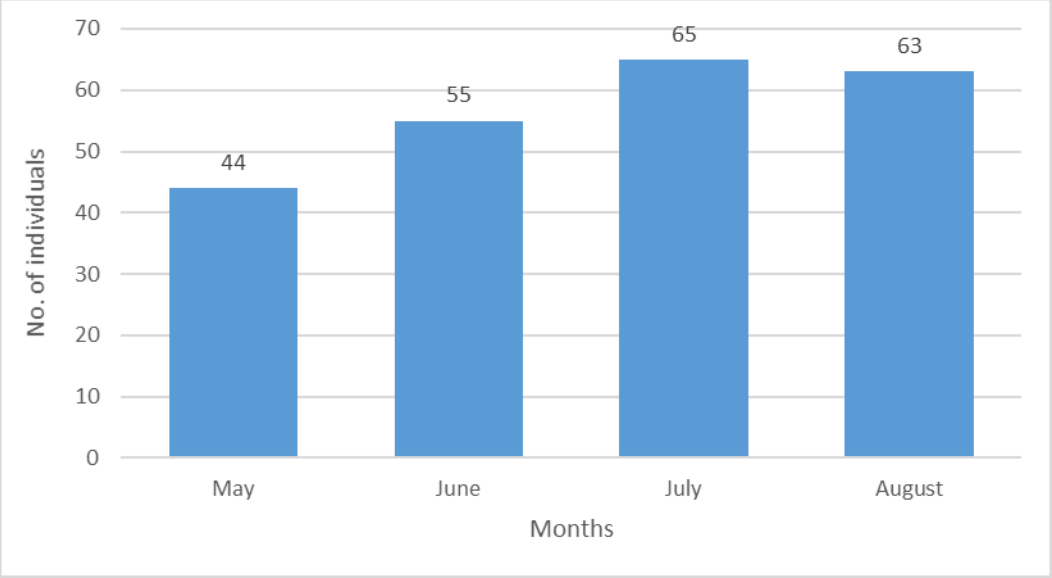

Figure 2. Total number of individuals in months.

This study recorded 7 migrant species which are Great Egret, Lesser Sand Plover, Common Redshank, Himalayan Swiftlet, Blue-throated Bee-eater, Whiskered Tern and Dollarbird although the study was conducted outside the migratory seasons. Lesser Sand Plover, Common Redshank and Whiskered Tern were found in all months while the other found only in July and August. The migratory season in Malaysia generally occur between September until March. However, migrants usually start to arrive in Peninsular Malaysia and Singapore as early as July and August meanwhile, the big flock of migrant usually arrived around September until November [11]. One of the reason for early arrival of migrant species in stop-over site is climate change. Previous study by [15], show that the average arrival and departure dates of 20 migrant bird species in Oxfordshire, United Kingdom have advanced over the past 30 years with respond to increased temperature trends in their African over-wintering grounds.

The presence of Vulnerable and Near Threatened species as well as high diversity index (H' = 3.33) in this study reflected that Tanjung Piai is a good habitat. Diversity index can be used to measure the state of pollution [16]. The index value can be categorized as (1) 3.0 - 4.5 as slight pollution, (2) 2.0 - 3.0 is light pollution, (3) 1.0 - 2.0 is moderate pollution and (4) 0.0 - 1.0 is heavy pollution. Birds are sensitive to environmental change and they occupy a wide range of niches, use

many type of food and physical resources, therefore, they serve as a good indicator of environmental health [17,18]. The diversity value above 3.0 indicated the structure of habitat is stable and balanced while the value below 1.0 indicated the habitat is polluted and degraded [19]. Therefore, from this study it can be concluded that Tanjung Piai is good habitat with less pollution and degradation since the value obtained for diversity index is greater than 3.0.

From data analysis performed, the result show no significance differences occur in total number of individuals of bird recorded between months. On the contrary, the significance differences occurred in total number of individuals founds between 7 sampling location. Selecting an area to live is crucial to all animals including birds, as individuals that occupy sites with greater foraging success and lower predation risk potentially have higher reproductive success and survival, and realize higher fitness [20]. Mudflats recorded the highest number of individuals because of the availability of food resources and offer lower predation risk. An open area of mudflats allowing easy detection of prey [21]. For small birds, feeding closer to cover entails a higher risk of being attacked by predator [22]. Aside from mudflats, Trail B also recorded higher number of individuals. Trail B is located in a dense mangrove forest. Mangrove forests offer a considerable variety of food resources for bird such as fishes, crabs and many more [23,24]. The least number of individuals recorded were in Fishing Site and Cabin. Fishing site is quite isolated and construction were progressing in that area whereas Cabin were located near to the main office of Tanjung Piai National Park. For both locations, human disturbance and interference was the main reason affecting the number of birds recorded.

Although Tanjung Piai is recognized as one of the Ramsar Site in Malaysia, the updated list of birds utilizing this area is still lacking. This might produce a knowledge gap, which in turns might create a challenge to optimize the conservation effort of endangered species [25-28].

4. References

[1] Pepping M, Piersma T, Pearson G and Lavaleye M 1999 Intertidal sediments and benthic animals of Roebuck Bay, Western Australia (Perth, Australia: NIOZ. Curtin University of Technology).

[2] Bamford M, Watkins D, Bancroft W, Tischler G. and Wahl J 2008 Migratory shorebirds of the East Asian-Australasian Flyway: Populations Estimates and Internationally Important Sites (Canberra, Australia: Wetlands International-Oceania)

[3] Malaysia Nature Society 2003 Tanah lembab: air, hayat dan budaya (Kuala Lumpur: Kementerian Sains, Teknologi dan Alam Sekitar Malaysia)

[4] Hussein M K and Mohamed N 2007 Wetland landscape conservation and ecotourism in Malaysia Pertanika J. Soc. Sci & Hum. 15(2) 159-168

[5] Bellio M, Minton C, and Veltheim I 2016 Challenges faced by shorebird species using the inland wetlands of the East Asian-Australasian Flyway: the little curlew example. Mar Freshwater Res **68** 999-1009

[6] Awang N A, Wan Jusoh, W H and Abdul Hamid M R 2014 Coastal erosion at Tanjong Piai, Johor, Malaysia J Coast Res. Special Issue 71 – Coastal Erosion and Management along developing coasts 122-30

[7] Johorparks 2018 Tanjung Piai Retrieved from http://www.johorparks.gov.my/ms/parks/ramsar/index.php?option=com_content&view=article&id=184&catid=80&Itemid=348

[8] Rahmah I and Ismail M 2008 Birds of Endau-Kota Tinggi Wildlife Reserve, Johor. Biodiversity resources and conservation status in Peninsular Malaysia (Kuala Lumpur: Department of Wildlife and National Parks)

[9] Karuppannan K V et al. 2014 Wildlife survey in Taman Rimba Bukit Kerinchi Lembah Pantai, Kuala Lumpur Malaysia. Journal of Wildlife and Parks **28** 9-18.

[10] Malaysia Nature Society 2005 A checklist of the birds of Malaysia Conservation (Kuala Lumpur: Malaysia Nature Society)

[11] Jeyarajasingam A 2012 A field guide to the birds of Peninsular Malaysia and Singapore (New York: Oxford University Press)
[12] De Boer W F and Longamane F A 1996 The exploitation of intertidal food resources in Inhaca Bay, Mozambique, by shorebirds and humans. Biol Conserv **78** 295-303
[13] Ramli R and Norazlimi N A 2017 The Effects of Disturbance on the Abundance and Foraging Behaviour of Shorebirds and Waterbirds in the Tropical Mudflat Areas Sains Malaysiana 46 (3) 365–372
[14] Conner R N and Dickson J G 1980 Strip transect sampling and analysis for avian habitat studies Wildl Soc Bull 8 4-10
[15] Cotton P A 2003 Avian migration phenology and global climate change Proceedings of the National Academy of Sciences of the United States of America 100(21) 12219-12222.
[16] Staub R, Appling J W, Hofsteiler M A and Hass I J 1970 The effects on industrial wastes of Memphis and Shelby country on primary planktonic producers Bioscience 2 905-912.
[17] Mackinnon J, Verkuil YI and Murray N 2012 IUCN situation analysis on East and Southeast Asian intertidal habitats, with particular references to the Yellow Sea (including the Bohai Sea) (UK, London: IUCN, Gland, Switzerland and Cambridge)
[18] Norazlimi N A 2016 Ecological Study of Waders in The Jeram and Remis Mudflats, Selangor Darul Ehsan (Kuala Lumpur: Universiti Malaya, PhD Thesis)
[19] Bhandarkar S V and Bhandarkar W R 2013 A study on species diversity of benthic macro invertebrates in freshwater lotic ecosystems in Gadchiroli district Maharashtra. Int J of Life Sci **1** 22-31.
[20] Leyler J, Lok T, Brugge M, Dekinga A, Spaans B, Van Gils JA, Sandercock BK and Piersma T 2012 Small-scale demographic structure suggests preemptive behavior in a flocking shorebird. Behav Ecol 1226-1233.
[21] Rogers D I 2003 High-tide roost choice by coastal waders Wader Study Group Bulletin **100** 739
[22] Whitfield D P 2003 -Redshank Tringa totanus flocking behaviour, distance from cover and vulnerability to Sparrowhawk Accipiter nisus predation J Avian Biol 34 163-169.
[23] Skiletter G and Warren S 2000 Effects of habitat modification in mangroves on the structure of mollusc and crab assemblages J Expl Mar Biol and Ecol **244** 107-29.
[24] Walters B B, Rönnbäck P, Kovacs J M, Crona B, Hussain S A and Badola R 2008 Ethnobiology, socio-economics and management of mangrove forests: A review Aquatic Botany **89** 220-236.
[25] Bottrill M, Hockings M and Possingham H 2011 In pursuit of knowledge: addressing barriers to effective conservation evaluation Ecology and Society **16** 1–14.
[26] Cardoso P, Erwin T, Borges P and New T 2011 The seven impediments in invertebrate conservation and how to overcome them Biol Conserv **144** 2647–55.
[27] Hou Y, Burkhard B and Müller F 2013. Uncertainties in landscape analysis and ecosystem service assessment J Environ Manage **127** 117–31.
[28] Zeigler S L, Thieler E R, Gutierrez B T, Plant N G, Hines M, Fraser J D, Catlin D H and Karpanty S M 2017 Smartphone technologies and Bayesian networks to assess shorebird habitat selection Wildl Soc DOI: 10.1002/wsb.820

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