

## Birds in the west coast of South Kalimantan, Indonesia

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**Abstract.** Riefani MK, Soendjoto MA. 2021. *Birds in the west coast of South Kalimantan, Indonesia. Biodiversitas* 22: 278-287. There is no comprehensive data on birds in the west coast of South Kalimantan, yet the areas are pressured by human activities, especially the rapidly growing tourism. This study aimed to investigate the diversity of bird species that occurred in the west coast of South Kalimantan and to compare the similarities of bird communities across four villages used as the sampling sites, i.e. Sungai Rasau, Sungai Bakau, Tabanio, and Pagatan Besar. Transect method combined with concentration count method were used to record diurnal bird species and number of individuals in five replications from April to September 2020. The observation area was 100 m from the shoreline toward the sea and 400 m from the shoreline toward the inland along 2 km with observation time was 07.00-11.00 and 16.00-19.00. Shannon Wiener species diversity index ( $H'$ ), a Dice community similarity index based on the presence or absence of species (ISD), and a community similarity index (modification) based on the number of individuals per species (ISM) were analyzed. In total, there are 101 bird species recorded belonging to 41 families with Sungai Bakau Village has the highest number of species (81 species), while Pagatan Besar Village is the lowest (62 species). Thirty-four species are categorized as waterbirds. Twenty-three species are categorized as migratory birds. In terms of diversity index from highest to lowest are Sungai Bakau (4.04), Sungai Rasau (3.95), Pagatan Besar (3.65), and Tabanio (3.48). The similarity of the ISD community ranges from 0.74-0.84, while the ISM ranges from 0.73-0.90. One case (Sungai Bakau - Tabanio) shows that community similarity based on the number of individuals per species is smaller than based on the presence or absence of species. Based on the protection status following Indonesian government regulation, most (84.16%) birds are categorized as unprotected, while based on the conservation status of IUCN, the majority (91.09%) are Least Concern. The results of this study can be used as baseline information for sustainable management of the area in various aspects, including future research (such as on pest and disease control), tourism (such as bird watching), and education (such as field guide).

**Keywords:** Diurnal bird, diversity, South Kalimantan, similarity, status

### INTRODUCTION

South Kalimantan is one of the five provinces in the main island of Kalimantan (Indonesian Borneo) which has coastlines. The coastlines are located in the southwest, south and east of the province. In more detail, the coastline stretches from the west of the Barito River estuary (administratively included in the Barito Kuala District which borders the Central Kalimantan Province), to the east of the Barito River estuary in Banjar District, to the south to Tanjung Selatan in Tanah Laut District, to the northeast through Tanah Laut District to Pagatan in Tanah Bumbu District, and to the north through Tanah Bumbu District and Kotabaru District to the border with East Kalimantan Province.

Like most coastal ecosystems, the west coast of South Kalimantan also consists of two habitats with different characteristics. The first part is the land/terrestrial habitat, which is located from the shoreline toward the inland. The other part is the beach, which is actually the transition area between land and sea, and is located from the shoreline towards the sea at the lowest tide. The shoreline is a virtual line along the coast which is actually the outermost part of

the vegetated land. This line separates the land from the ocean, which is covered by seawater. The beach is alternately or periodically flooded and not inundated by seawater. When high tide or seawater moves inland, beach either covered with vegetation or non-vegetated (sandy/muddy beaches) appears inundated or even submerged. On the other hand, when the sea recedes or the seawater moves away from the land towards the sea, the beach becomes dry and the vegetation that grows or appears to be growing on dry land and non-vegetated areas (sandy/muddy beaches) is evident. According to the Ramsar Convention Secretariat (2016), beach is classified as wetlands. The Ramsar Convention stated that wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters.

The west coast of South Kalimantan is an interesting area to study its biological resources, especially the diversity of birds (avifauna). There are two rationales for the importance of studying bird diversity in this region. First, there is no comprehensive information on the species

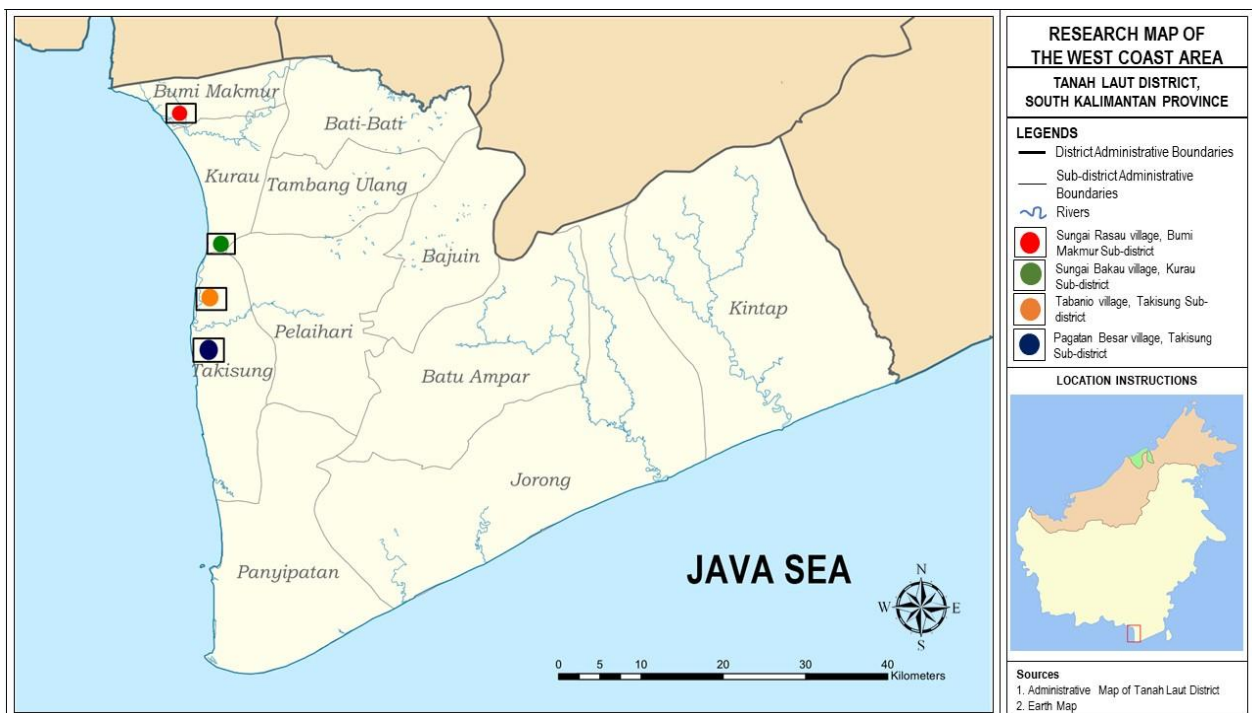
richness of bird in this area although preliminary surveys suggested that there were many bird species occurred on the west coast which can be classified into aquatic and non-aquatic birds. The only research is from Riefani and Arsyad (2019) who reported that among the aquatic birds that occurred in Pagatan Besar Village, there were birds that were categorized as migratory birds. Second, four villages on the west coast of South Kalimantan Province have developed tourism, yet the attracting objects have been merely focused on physical resources. The villages of Tabanio, Takisung, and Batakan, for example, make sandy beaches and seawater as tourism features. One other village, namely Pagatan Besar Village, utilizes mangrove forest as a tourist attraction. However, the growth and development of mangroves, especially api-api or white mangrove (*Avicennia marina*) planted by the community (Soendjoto 2019) hampered activities to observe migratory birds that used to forage on muddy beaches.

This study aimed to investigate the diversity of bird species that occurred in the west coast of South Kalimantan and to compare the similarities of bird communities across four villages used as the sampling sites. We expected the results of this study can be used as baseline information for sustainable management of the area in various aspects, including future research (such as on pest and disease control), tourism (such as bird watching), and education (such as field guide).

**MATERIALS AND METHODS**

**Study area**

Data were collected from four villages in the west coast of South Kalimantan which were directly adjacent to the Java Sea, namely Sungai Rasau, Sungai Bakau, Tabanio, and Pagatan Besar (Figure 1). Detailed information on geographical site and habitat characteristics are presented in Table 1.



**Figure 1.** Map of four research sites located in the west coast of South Kalimantan Province, Indonesia

**Table 1.** Site of data collection, geographical coordinates and habitat characteristics

Site code	Site	Geographical coordinates	Habitat characteristics
SR	Sungai Rasau Village, Bumi Makmur Sub-district, Tanah Laut District	3°33'30"S - 3°34'35"S; 114°34'06"E - 114°34'50"E	Muddy/sandy flat, mangrove forest, coastal forest, fishpond, rice field, grass field, settlements
SB	Sungai Bakau Village, Kurau Sub-district, Tanah Laut District	3°42'26" S - 3°43'48"S; 114°37'01"E - 114°37'34"E	Muddy/sandy flat, mangrove forest, coastal forest, fishpond, rice field, grass field, settlements
TB	Tabanio Village, Takisung Sub-district, Tanah Laut District	3°45'28"S - 3°46'38"S; 114°36'28"E - 114°36'46"E	Muddy/sandy flat, mangrove forest, coastal forest, rice field, grass field, settlements
PB	Pagatan Besar Village, Takisung Sub-district, Tanah Laut District	3°47'56"S - 3°49'08"S; 114°36'14"E - 114°36'32"E	Muddy flat, mangrove forest, grass field (grass height is about 5 cm; this meadow is used as a pasture for livestock), settlements

### Data collection

Data collection was carried out 5 times between April-September 2020 using transect and the concentration count methods. The occurrences of diurnal birds were recorded in an area of 100 m from the shoreline toward the sea and 400 m from the shoreline toward the inland along 2 km twice a day at 07.00-10.00 and 16.00-19.00. Along the transect, we walked slowly while identifying species and counting the number of individuals that were seen directly perching or flying on both sides of the transect within a maximum distance of 100 m if the land was open or 25 m if the vegetation (trees) was dense. In the concentration count method, we stopped at a certain point (in this case at a densely vegetated or forested area that was thought to be a gathering place or a completely open area where the birds gathered together), observed, identified the species, and counted the number of individuals. The tools used were GPS, binocular (8x40), counter and camera with telephoto lens. Birds were identified according to MacKinnon et al. (2010), Soendjoto et al. (2015), or Soendjoto et al. (2019). The taxonomical name was referred to the IUCN (2020).

### Data analysis

The name of bird species and the number of individuals in five replications were tabulated and counted. Then, species diversity and community similarity indices were calculated using the following formula.

Species diversity index Shannon-Wiener;

$$H' = - \sum \frac{n_i}{N} \ln \left( \frac{n_i}{N} \right)$$

Where,  $n_i$  = number of individuals of species  $i$ ;  $N$  = number of individuals of all species;  $\ln$  = natural logarithm.

Community similarity index Dice;

$$IS_D = \frac{2A}{2A+B+C}$$

Modified community similarity index;

$$ISM = \frac{n_i(A+B)}{n_i(A+B) + n_jA + nkB}$$

Where,  $ISD$  = Dice community similarity index calculated based on the presence or absence of species;  $ISM$  = community similarity index whose equation is a modification of the  $ISD$  and the calculation is based on the number of individuals of each species from the communities being compared;  $A$  = number of species present at the two compared sites;  $B$  = number of species present only at the first site;  $C$  = number of species present only at the second site;  $n_i(A+B)$  = the number of individuals of species  $i$  present at site  $A$  and at the same time at site  $B$ ;  $n_jA$  = number of individuals of species  $j$  only at site  $A$ ; and  $nkB$  = the number of individuals of the  $k$  species that exist only at site  $B$ .

In addition, the status of the bird species protection was determined according to Regulation of the Minister of Environment and Forestry, Republic of Indonesia No. P.106/MENLHK/SETJEN/KUM.1/12/2018 concerning Amendment to Regulation of the Minister of Environment and Forestry No P.20.MENLHK/SETJEN/KUM.1/6/2018 on The Protected Flora and Fauna, while the conservation status assigned according to the IUCN (2020).

## RESULTS AND DISCUSSION

### Species diversity

In the west coast of South Kalimantan, a total of 101 bird species belonging to 41 families were recorded (Table 2). The village of Sungai Bakau has the richest species with 81 species, Sungai Rasau Village with 78 species, Tabanio Village with 62 species, while Pagatan Besar Village is the lowest with 62 species. The sites with the highest to lowest diversity of bird species are Sungai Bakau (4.04), Sungai Rasau (3.95), Pagatan Besar (3.69), and Tabanio (3.48).

**Table 2.** Species name, number of individuals and conservation status of bird at the four study sites in the west coast of South Kalimantan, Indonesian

Family/species	Indonesia name	Internasional name	Number of individuals ( $n_i$ )				Status	
			SR	SB	TB	PB	P.106	IUCN
<b>Acanthizidae</b>								
<i>Gerygone sulphurea</i>	Remetuk laut	Golden-bellied Gerygone	21	24	8	15	TD	LC-d
<b>Accipitridae</b>								
<i>Elanus caeruleus</i>	Elang tikus	Black-winged Kite	5	2	1	1	D	LC-s
<i>Haliaeetus leucogaster</i>	Elang laut perut putih	White-bellied Sea-eagle	1	2	1	1	D	LC-d
<i>Haliaastur indus</i>	Elang bondol	Brahminy Kite	3	1	1	2	D	LC-d
<i>Nisaetus cirrhatus</i>	Elang brontok	Changeable Hawk-eagle	1	-	-	-	D	LC-i
<b>Acrocephalidae</b>								
<i>Acrocephalus orientalis</i>	Kerakbasi besar	Oriental Reed-warbler	1	-	-	-	TD	LC-d
<b>Aegithinidae</b>								
<i>Aegithina tiphia</i>	Cipoh kacat	Common Iora	25	18	14	20	TD	LC-u
<i>Aegithina viridissima</i>	Cipoh jantung	Green Iora	4	4	8	6	TD	NT-d
<b>Alcedinidae</b>								
<i>Alcedo meninting</i>	Raja-udang meninting	Blue-eared Kingfisher	1	4	1	3	TD	LC-d
<i>Halcyon smyrnensis</i>	Cekakak belukar	White-breasted Kingfisher	4	2	1	-	TD	LC-i
<i>Pelargopsis capensis</i>	Pekaka emas	Stork-bellied Kingfisher	3	3	1	4	TD	LC-d
<i>Todiramphus chloris</i>	Cekakak sungai	Collared Kingfisher	43	18	28	22	TD	LC-d
<i>Todiramphus sanctus</i>	Cekakak suci	Sacred Kingfisher	6	29	12	7	TD	LC-i

<b>Anatidae</b>									
<i>Anas gibberifrons</i>	Itik benjut	Sunda Teal	5	6	-	-	TD	NT-s	
<i>Dendrocygna arcuata</i>	Belibis kembang	Wandering Whistling-duck	12	15	-	-	TD	LC-d	
<b>Apodidae</b>									
<i>Apus nipalensis</i>	Kapinis rumah	House Swift	23	20	9	-	TD	LC-i	
<i>Collocalia linchi</i>	Walet linci	Cave Swiftlet	27	24	21	22	TD	LC-d	
<b>Ardeidae</b>									
<i>Ardea purpurea</i>	Cangak merah	Purple Heron	-	2	-	-	TD	LC-d	
<i>Ardeola speciosa</i>	Blekok sawah	Javan Pond-heron	24	45	8	9	TD	LC-u	
<i>Butorides striata</i>	Kokokan laut	Green-backed Heron	7	9	1	5	TD	LC-d	
<i>Egretta alba</i>	Kuntul besar	Green White Egret	12	4	-	-	TD	LC-u	
<i>Egretta garzetta</i>	Kuntul kecil	Little Egret	42	10	2	4	TD	LC-i	
<i>Ixobrychus cinnamomeus</i>	Bambangan merah	Cinnamon Bittern	4	5	1	-	TD	LC-s	
<i>Ixobrychus sinensis</i>	Bambangan kuning	Yellow Bittern	4	8	1	-	TD	LC-u	
<b>Artamidae</b>									
<i>Artamus leucorhyn</i>	Kekep babi	White-breasted Woodswallow	16	14	8	9	TD	LC-s	
<b>Campephagidae</b>									
<i>Lalage nigra</i>	Kapasan kemiri	Pied Triller	8	6	5	12	TD	LC-d	
<i>Pericrocotus igneus</i>	Sepah tulin	Fiery Minivet	4	-	-	-	TD	NT-d	
<b>Caprimulgidae</b>									
<i>Caprimulgus affinis</i>	Cabak kota	Savanna Nightjar	8	13	5	6	TD	LC-s	
<b>Charadriidae</b>									
<i>Charadrius dubius</i>	Cerek kalung-kecil	Little Ringed Plover	7	62	-	-	TD	LC-s	
<i>Charadrius leschenaultii</i>	Cerek-pasir besar	Greater Sandplover	9	33	-	85	TD	LC-d	
<i>Charadrius mongolus</i>	Cerek-pasir mongolia	Lesser Sandplover	-	20	-	20	TD	LC-u	
<i>Pluvialis fulva</i>	Cerek krenyut	Pacific Golden Plover	-	34	-	27	TD	LC-d	
<b>Ciconiidae</b>									
<i>Leptoptilos javanicus</i>	Bangau tongtong	Lesser Adjutant	2	1	-	-	D	VU-d	
<b>Cisticolidae</b>									
<i>Orthotomus ruficeps</i>	Cinenen kelabu	Ashy Tailorbird	23	24	11	16	TD	LC-s	
<i>Orthotomus sericeus</i>	Cinenen merah	Rufous-tailed Tailorbird	2	-	2	-	TD	LC-s	
<i>Prinia flaviventris</i>	Prenjak rawa	Yellow-bellied Prinia	8	18	1	6	TD	LC-d	
<b>Columbidae</b>									
<i>Chalcophaps indica</i>	Delimukan zamrud	Emerald Dove	-	-	4	-	TD	LC-d	
<i>Geopelia striata</i>	Perkutut jawa	Zebra Dove	3	8	1	5	TD	LC-s	
<i>Spilopelia chinensis</i>	Tekukur	Eastern Spotted Dove	4	20	2	6	TD	LC-i	
<i>Treron vernans</i>	Punai gading	Pink-necked Green-Pigeon	4	12	2	6	TD	LC-s	
<b>Cuculidae</b>									
<i>Cacomantis merulinus</i>	Wiwik kelabu	Plaintive Cuckoo	3	2	3	5	TD	LC-s	
<i>Cacomantis sommeratii</i>	Wiwik lurik	Banded Bay Cuckoo	-	1	-	-	TD	LC-s	
<i>Centropus bengalensis</i>	Bubut alang-alang	Lesser Coucal	10	10	3	4	TD	LC-i	
<i>Centropus sinensis</i>	Bubut besar	Greater Coucal	3	4	3	4	TD	LC-s	
<i>Chrysococcyx minutillus</i>	Kedasi laut	Little Bronze-cuckoo	1	-	-	-	TD	LC-s	
<b>Dicaeidae</b>									
<i>Dicaeum trigonostigma</i>	Cabai bunga api	Orange-bellied Flowerpecker	-	-	1	-	TD	LC-s	
<i>Dicaeum trochileum</i>	Cabai jawa	Scarlet-headed Flowerpecker	9	7	10	8	TD	LC-s	
<b>Estrildidae</b>									
<i>Lonchura fuscans</i>	Bondol kalimantan	Dusky Munia	10	27	6	5	TD	LC-s	
<i>Lonchura malacca</i>	Bondol rawa	Tricoloured Munia	12	18	8	8	TD	LC-s	
<i>Lonchura punctulata</i>	Bondol peking	Scally-breasted Munia	39	13	27	10	TD	LC-s	
<b>Hirundinidae</b>									
<i>Delichon dasypus</i>	Layang-layang rumah	Asian House-martin	-	-	-	15	TD	LC-i	
<i>Hirundo tahitica</i>	Layang-layang batu	Tahiti Swallow	15	14	11	10	TD	LC-u	
<b>Laniidae</b>									
<i>Lanius schach</i>	Bentet kelabu	Long-tailed Shrike	16	20	8	22	TD	LC-u	
<b>Laridae</b>									
<i>Chlidonias leucopterus</i>	Dara laut sayap putih	White-winged Tern	9	14	-	-	D	LC-s	
<i>Gelochelidon nilotica</i>	Dara-laut tiram	Common Gull-billed Tern	5	-	-	-	D	LC-d	
<i>Sterna hirundo</i>	Dara-laut biasa	Common Tern	15	16	15	16	D	LC-u	
<i>Sterna sumatrana</i>	Dara-laut tengkuk-hitam	Black-naped Tern	7	-	-	-	D	LC-u	
<i>Sternula albifrons</i>	Dara-laut kecil	Little Tern	-	29	-	-	D	LC-d	
<i>Thalasseus bergii</i>	Dara-laut jambul	Great Crested Tern	-	34	-	12	D	LC-s	
<b>Meropidae</b>									
<i>Merops philippinus</i>	Kirik-kirik laut	Blue-tailed Bee-eater	9	13	4	8	TD	LC-s	
<i>Merops viridis</i>	Kirik-kirik biru	Blue-throated Bee-eater	14	11	31	5	TD	LC-s	

<b>Motacillidae</b>									
<i>Anthus novaeseelandiae</i>	Apung tanah	Australasian Pipit	1	3	2	3	TD	LC-s	
<i>Motacilla flava</i>	Kicuit kerbau	Western Yellow Wagtail	2	2	1	-	TD	LC-d	
<b>Muscicapidae</b>									
<i>Cyornis rufigastra</i>	Sikatan bakau	Mangrove Blue-flycatcher	-	-	1	1	TD	LC-d	
<b>Nectariniidae</b>									
<i>Aethopyga siparaja</i>	Burung-madu sepah-raja	Crimson Sunbird	2	3	2	1	D	LC-s	
<i>Anthreptes malacensis</i>	Burung-madu kelapa	Brown-throated Sunbird	15	12	11	6	TD	LC-s	
<i>Cinnyris jugularis</i>	Burung-madu sriganti	Olive-backed Sunbird	13	19	14	4	TD	LC-s	
<i>Leptocoma calcostetha</i>	Burung-madu bakau	Copper-throated Sunbird	1	-	-	-	TD	LC-s	
<b>Pandionidae</b>									
<i>Pandion haliaetus</i>	Elang tiram	Osprey	1	-	-	-	D	LC-i	
<b>Passeridae</b>									
<i>Passer montanus</i>	Burung gereja erasia	Eurasian Tree Sparrow	22	21	41	23	TD	LC-d	
<b>Pellorneidae</b>									
<i>Malacocincla sepiaria</i>	Pelanduk semak	Horsfield's Babbler	-	-	2	-	TD	LC-d	
<b>Picidae</b>									
<i>Chrysophlegma miniaceum</i>	Pelatuk merah	Banded Woodpecker	-	-	2	-	TD	LC-s	
<i>Picoides moluccensis</i>	Caladi tilik	Sunda Pygmy Woodpecker	5	5	1	3	TD	LC-i	
<b>Pittidae</b>									
<i>Pitta sordida</i>	Paok hijau	Western Hooded Pitta	-	-	3	-	D	LC-d	
<b>Ploceidae</b>									
<i>Ploceus manyar</i>	Manyar jambul	Streaked Weaver	2	10	-	-	TD	LC-s	
<b>Pycnonotidae</b>									
<i>Pycnonotus aurigaster</i>	Cucak kutilang	Sooty-headed Bulbul	53	61	76	50	TD	LC-d	
<i>Pycnonotus brunneus</i>	Merbah mata merah	Red-eyed Bulbul	15	4	44	2	TD	LC-d	
<i>Pycnonotus goiavier</i>	Merbah cerukcuk	Yellow-vented Bulbul	15	34	26	37	TD	LC-i	
<i>Pycnonotus plumosus</i>	Merbah belukar	Olive-winged Bulbul	4	-	4	-	TD	LC-s	
<b>Rallidae</b>									
<i>Amaurornis cinerea</i>	Tikusan alis-putih	White-browed Crake	-	1	-	-	TD	LC-u	
<i>Amaurornis phoenicurus</i>	Kareo padi	White-brested Waterhen	3	9	3	12	TD	LC-u	
<b>Recurvirostridae</b>									
<i>Himantopus leucocephalus</i>	Gagang bayam timur	White-headed Stilt	12	8	-	3	TD	LC-i	
<b>Rhipiduridae</b>									
<i>Rhipidura javanica</i>	Kipasan belang	Sunda Pied Fantail	15	11	13	8	TD	LC-s	
<b>Scolopacidae</b>									
<i>Actitis hypoleucos</i>	Trinil pantai	Common Sandpiper	11	12	3	6	TD	LC-d	
<i>Calidris alba</i>	Kedidi putih	Sanderling	-	40	-	5	TD	LC-u	
<i>Calidris ruficollis</i>	Kedidi leher merah	Rufous-necked Stint	-	41	-	18	TD	NT-d	
<i>Gallinago megala</i>	Berkik rawa	Swinhoe's Snipe	-	-	4	-	TD	LC-u	
<i>Limosa lapponica</i>	Biru laut ekor-blorok	Bar-tailed Godwit	7	13	-	8	TD	NT-d	
<i>Numenius madagascariensis</i>	Gajahan timur	Far Eastern Curlew	-	4	-	7	D	EN-d	
<i>Numenius phaeopus</i>	Gajahan penggala	Whimbrel	-	6	-	-	D	LC-d	
<i>Tringa glareola</i>	Trinil semak	Wood Sandpiper	5	24	-	8	TD	LC-s	
<i>Tringa nebularia</i>	Trinil kaki-hijau	Common Greenshank	-	11	-	-	TD	LC-s	
<i>Tringa stagnatilis</i>	Trinil rawa	Marsh Sandpiper	5	8	-	-	TD	LC-d	
<i>Xenus cinereus</i>	Trinil bedaran	Terek sandpiper	10	23	-	28	TD	LC-d	
<b>Strigidae</b>									
<i>Ketupa ketupa</i>	Beluk ketupa	Buffy Fish-owl	-	2	-	-	TD	LC-s	
<i>Otus lempiji</i>	Celepuk reban	Sunda Scops-owl	-	-	1	-	TD	LC-s	
<b>Sturnidae</b>									
<i>Acridotheres javanicus</i>	Kerak kerbau	Javan Myna	25	55	25	7	TD	VU-d	
<b>Timaliidae</b>									
<i>Mixormis gularis</i>	Ciung-air coreng	Pin-striped Tit-babbler	15	35	7	13	TD	LC-s	
<b>Vangidae</b>									
<i>Hemipus hirundinaceus</i>	Jinjing batu	Black-winged Flycatcher-shrike	-	4	-	1	TD	LC-d	
<b>Zosteropidae</b>									
<i>Zosterops flavus</i>	Kacamata jawa	Javan White-eye	3	-	-	-	TD	EN-d	
<i>Zosterops palpebrosus</i>	Kacamata biasa	Indian White-eye	2	8	-	-	TD	LC-d	
		Number of individuals (N)	817	1242	576	705			
		Number of species (S)	78	81	63	62			
		Species diversity index (H')	3.95	4.04	3.48	3.69			

Note: 1) Site of data collection: SR: Sungai Rasau, SB: Sungai Bakau, TB: Tabanio, PB: Pagatan Besar. 2) Protection status according to Minister of Environment and Forestry, Republic of Indonesia No P.106/MENLHK/SETJEN/KUM.1/12/2018 (2018): D: protected, TD: unprotected. 3) Conservation status according to IUCN (2020): EN: endangered, VU: vulnerable, NT: near threatened, LC: least concern, i: increasing, d: decreasing, s: stable, u: unknown

Most (66.34% or 67 species) of the 101 bird species are categorized as non-waterbirds, while the rest (34.66%) are waterbirds. Eight waterbird families in the west coast include of Anatidae, Ardeidae, Charadriidae, Ciconiidae, Laridae, Rallidae, Recurvirostridae, and Scolopacidae, and are among 34 families of waterbirds in the world described by Ducks Unlimited New Zealand (2017) or among 33 families described by Wetlands International (2020).

Twenty-one of 34 waterbird species are categorized as migratory birds, including Greater Sandplover, Lesser Sandplover, Pacific Golden Plover, Little Ringed Plover, Common Gull-billed Tern, Little Tern, White-winged Tern, Great Crested Tern, Common Tern, White-headed Stilt, Far Eastern Curlew, Marsh Sandpiper, Whimbrel, Common Sandpiper, Terek Sandpiper, Wood Sandpiper, Common Greenshank, Swinhoe's Snipe, Sanderling, Rufous-necked Stint, and Bar-tailed Godwit. Based on the colored flag attached to the bird's leg and referring to the meaning of the flag color in EAAFP (2018), R. Yuliansyah (2020, pers. com.) found Sanderling of South Australia on the sandy stretch of the Sungai Bakau, and T.K. Utomo (2020, pers. com.) found Rufous-necked Stint of China-Chongming Island in Pagatan Besar.

Besides the migratory waterbirds, there are also non-waterbirds that are categorized as migrants. They are Osprey, the raptor and Blue-tailed Bee-eater, the insectivore. Osprey has been observed soaring above waters and ponds and then perching on the dry tree of the Sungai Rasau. The presence of Osprey at that site indicates that the migratory raptors (Germi et al. 2009, Bierregaard et al. 2014, Purwanto et al. 2015) or these wetland raptors (Irham 2012) make the west coast as a stopover site. In the southern hemisphere, these birds that spread around the world become non-breeding visitors in Indonesia (van Balen 1998, Purwanto et al. 2015) as well as breeding visitors in Australia (Clancy 2006; Dennis and Clancy 2014, Detmar and Dennis 2018). Osprey was recorded in February-March 2016 flying around an artificial lake in the Tarjun Cement Factory Area, Kotabaru (Riefani et al. 2019).

Blue-tailed Bee-eater and Blue-throated Bee-eater are migratory birds in Malaysia (Nisbet 2013) and Thailand (DeCandido et al. 2010). There has not been any specific publication on the bee-eaters as migratory birds in Indonesia. According to Soendjoto et al. (2018) and Riefani et al. (2019), Blue-tailed Bee-eater was not always found, while Blue-throated Bee-eater was almost always found in 2013-2017 observations in Tabalong District, South Kalimantan and more than 300 hours of field observation in Kotabaru District, South Kalimantan. Therefore, we only include Blue-tailed Bee-eater as migratory birds and not Blue-throated Bee-eater. Nash and Nash (1985) mentioned Blue-tailed Bee-eater as one of the migratory birds in South Sumatra and do not mention Blue-throated Bee-eater as such.

The following two bird species were also found on the west coast. Both are highlighted in this paper because their presence and distribution are not stated in field books, such as Smythies (1960) and MacKinnon et al. (2010). Therefore, these findings can be considered as new records

that are important for updating data or revising field books. The first is White-breasted Kingfisher which was found in Tanah Laut District, to be precise at Sungai Rasau, Sungai Bakau, and Tabanio. The presence of the bird was observed 9 times, both solitary and 2 individuals, adding to new information that this bird is indeed distributed in Kalimantan Selatan or even Kalimantan in general. Smythies (1960) did not mention the presence of this bird in Borneo. Avibase (2020b) even said that not a single subspecies of White-breasted Kingfisher existed in Indonesia. According to Avibase (2020b), the birds spreading across the Arabian Peninsula to the Caucasus Mountains and the northwestern part of India are *Halcyon smyrnensis smyrnensis*; in West India and Sri Lanka *H.s. fusca*, in the Andaman *H.s. saturator*; as well as in Myanmar to Peninsular Malaysia and Indochina *H.s. perpulchra*. MacKinnon et al. (2010) stated that the distribution of this bird in Sumatra and Java. According to Strange (2012), its distribution was even only in Sumatra. The distribution of White-breasted Kingfisher in Sumatra is supported by the report of Ayat (2011), Arief et al. (2015), Kamal et al. (2016), Santosa et al. (2016), Syamsi (2017), and Iswandaru et al. (2018), while in Java there was the report by Taufiqurrahman et al. (2019). White-breasted Kingfisher was also found in West and South Kalimantan (Myers 2016), industrial plantation companies in West Kalimantan (Ata Marie and Ekologika Consultants 2017), Sebangau National Park, Central Kalimantan (Adi 2018), oil palm plantations in Central Kalimantan (Santosa et al. 2018), and the Liang Anggang Protected Forest Area, Kalimantan Selatan (Wulansari et al. 2020).

The second is Streaked Weaver which was found breeding in Sungai Rasau and Sungai Bakau. In the observations conducted in July 2020, an average of 7.3 nests hung per coconut tree (*Cocos nucifera*) (n = 10) at about 20 m above ground level. More nests (up to 32 nests) were found hanging from branches of the *Acacia auriculiformis* tree at about 6-10 m above ground level. The tree is on the roadside of Sungai Bakau Village. The distribution of Streaked Weaver in Tanah Laut District adds to new record in primary publications. Early records suggest that the distribution of Streaked Weaver in Indonesia is only in Java and Bali (MacKinnon et al. 2010) and not recorded in Borneo (Smythies 1960, MacKinnon et al. 2010). IUCN (2020) said that this bird spreads in Southeast Asia (Cambodia, Myanmar, Singapore, Thailand, Vietnam), South Asia (India, Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka), China, and even Egypt. Particularly in Indonesia, the map attached to the IUCN report (2020) shows that the distribution of Streaked Weaver is consistent with MacKinnon et al. (2010) mentioned above. According to Avibase (2020a), the Streaked Weaver spreading across Indonesia (the islands of Java, Bali and Bawean) is a subspecies of *Ploceus manyar manyar*; in eastern Pakistan to western India and Sri Lanka *P.m. flaviceps*; in Northeast India (Assam) to Bangladesh and northern Myanmar *P.m. peguensis*; and in Southwest China (Yunnan) to Thailand and Vietnam *P.m. williamsoni*.

The presence of Streaked Weaver in Kalimantan was published by Soendjoto et al. (2014) and Iqbal et al. (2016).

The nests hung from the branches of rambai or mangrove apple (*Sonneratia caseolaris*) and rumbia or sago palm (*Metroxylon sago*) trees. From interviews with the community, Soendjoto et al. (2016) stated that this bird had been detected in Banjar District in 2011. It is likely that the birds were brought by bird traders from Java Island and then accidentally released. Birds can also be deliberately released by keepers who are tired of raising animals or are not careful with raising them after buying them from traders.

In a field trip in 2017, we even found 3 occurrences of this bird with its nest hanging individually on bundung or greater club rush (Cyperaceae: *Scirpus grossus*), one of the swamp plants around Sungai Puting, Tapin District. On each stem of 1-1.5 m high there was only one nest attached. In 2018 the weaver's nest was found hanging on a branch of the mangrove apple at a height of about 20 m above the ground in the swamplands of Lambung Mangkurat University, Banjarmasin City. Streaked Weaver is considered to be pests, along with Dusky Munia, Dusky Munia, Scally-breasted Munia, and Eurasian Tree Sparrow because they eat rice grown by the people living in the settlements west of the university campus complex.

It is important to note that the states of the bird species richness and diversity indices are temporary (subject to change) and only apply to this study due to the following reasons. First, this study focuses on diurnal birds, so that nocturnal birds are not observed and identified. Observation and identification of only certain diurnal bird species, for example, those that are small in size and inhabit mangrove forests, coastal forests, or forests with thick canopy cover or those that are migrants, require a longer duration or frequency of observation. Observation and identification of nocturnal bird species are relatively challenging. Certain strategies or techniques need to be developed because what is faced is not only the dark sight, but also the thickness of the canopy and/or tidal inundation. In this study, two nocturnal bird species that were found by chance were Buffy Fish-owl and Sunda Scops-owl. It is likely that there are other nocturnal bird species at the sites.

Second, one sub-district on the west coast (Panyipatan sub-district) has not been represented in the study. However, the following findings of bird species from a wildlife photographer can be used as a guide that there are actually other birds on the west coast. Lesser Frigatebird (*Fregata andrewsi*), Great Tit (*Parus major*), Black-bellied Malkoha (*Phaenicophaeus diardi*), Buff-banded Rail (*Hypotaenidia philippensis*), and Copper-throated Sunbird (*Nectarinia calcostetha*) were sighted in the area by P. Irawan (2020, pers. com.).

### Community similarity

The community similarity index between sites based on the presence or absence of species (0.77-0.84) is lower than that based on the number of individuals per species (0.79-0.90) (Table 3). The exception is the index based on the presence or absence of species between Tabanio and the

Sungai Bakau which is slightly higher than that based on the number of individuals of each species. Since the index based on the number of individuals for each species is generally higher or closer to 1.00, this index is better to use to measure community similarity between two sites.

The similar resources with adequate availability are the factors that cause the similarity of bird communities in the two compared sites to be categorized as high. These resources include food, nesting, microclimate and occurrence of predators. In the case of migratory bird species, both intra and inter continents, birds leave certain sites and come to other sites because they have the same resource. Site and season cause the availability of prey and species requirements for energy to vary and in turn the proportion of foraging birds also varies (Burton et al. 2004). The presence and diversity of migratory birds in various habitat types is largely determined by microhabitat, availability of food sources, and safety in resting and foraging areas (Sonobe and Usui 1993, Howes et al. 2003).

In the Sungai Bakau, the feed source area is disturbed by tidal inundation. Some waterbirds, or to be precise in this case are shorebirds, generally forage on mudflats that lie after the shoreline towards the sea. They forage in colonies within the same species and even with other waterbird species. However, when the high tide inundates or submerges the muddy areas, they move to and forage on other muddy areas, such as active ponds, non-operational ponds or former ponds. In this non-vegetated inland muddy field, they can still stand on the surface of the mud and their beaks can still reach the food on the surface or in the mud. Moving and looking for food in the mud inland is a strategy for waterbirds to survive. In general, the waterbird diet consists of plants, such as terrestrial plants, seeds and aquatic macrophytes, and animals, such as zooplankton, snails, shells, worms, crabs, mollusks, crustaceans, arthropods, larvae, and imago of terrestrial and aquatic insects (Coleoptera, Diptera, Heteroptera, Odonata), nectonic macroinvertebrates, fish, amphibians, and water snakes (Ntiamao-Baidu et al. 1998, Horváth et al. 2012). The feed is obtained easily when the mud bed is not inundated by seawater and facilitates the birds to behave according to their morphology; for example, the soles and toes may step on the mud and the beak reaches for feed in the mud.

**Table 3.** Bird community similarity index between sites

Site	Sungai Rasau	Sungai Bakau	Tabanio	Pagatan Besar
Sungai Rasau	1.00	0.87	0.90	0.85
Sungai Bakau	0.84	1.00	0.73	0.88
Tabanio	0.78	0.74	1.00	0.79
Pagatan Besar	0.77	0.84	0.78	1.00

Note: The numbers below the diagonal line (top left - bottom right) are the community similarity index based on the presence or absence of species, and while above the diagonal line are that based on the number of individuals of each species.

The conditions that make water birds move are not only the tidal mud area, but also the growth and development of mangrove species. In Pagatan Besar village, for example, the muddy area which was originally an open area has gradually turned into a mangrove forest. The development of mangrove forests makes it difficult for migratory birds who are accustomed to foraging for food together (in colonies) on muddy plains in open areas. This change was observed from four ironwood walkways, which according to Soendjoto (2019) have 1.5 m wide and about 100 m long, jutting from the shoreline towards the Java Sea. The height of the walkway floor is 0 m from the ground level at the starting point of the walkway (at the shoreline) and about 2 m from the ground level (mud) at the end of the walkway (towards the sea). At Titian 1, which is located at the northernmost point, mangrove forests which are dominated by white mangrove are observed to be getting higher. The height in 2018 was around 4-5 m and in 2020 it is about 6 m. However, the sea and the mud can still be observed from the end of the walkway. At Titian 2, which is located 490 m to the south of Titian 1, the sea and mud can still be observed from half the length of the walkway to the end of the path in 2018. In 2020, the sea and mud can no longer be observed. The white mangroves reach 3-4 m in high and are covering the view. At Titian 3, which is located 190 m to the south of Titian 2, the sea and mud can be observed from the base to the end of the bridge in 2018 because the height of the white mangroves growing on the left and right is only about 0.5 m from the surface of the mud. In 2020, the height of the flames is 2 m around the base of the walkway and about 1 m around the end of the walkway. Several individual white mangroves had grown out of the direction of the sea from the end of the bridge. In other words, mangrove forests are growing or expanding. The sea and mudflats can still be observed starting from one-third of the length of the walkway to the end of the path. Titian 4 which is located 180 m to the south from Titian 3, the sea and mud can still be observed freely. The white mangroves are still few in number. In other words, the density is very low compared to the density of the white mangroves around Titian 1, 2, and 3. The height is also about 0.5 m above the ground (mud).

The stretch of mud on the west coast is formed by sediments carried by the Maluka River, Tabanio River, Pagatan Besar River, and Barito River as the widest river in South Kalimantan and then deposited in the Java Sea, where these rivers flow into. The main sediments on the Barito River are sand, clay and silt (Arisanty et al. 2014). Because the Barito River is the main route for coal transportation (Novico and Priohandono 2012), coal shale is also observed in the mud. According to Arisanty et al. (2012), shorelines can change and the changes are caused by human activities, such as logging, forest and land fires, intensive agriculture, and mining.

### **Bird status**

Based on protection status of the regulation of Minister of Environment and Forestry, Republic of Indonesia No P.106/MENLHK/SETJEN/KUM.1/12/2018 (2018), most bird species (84.16%) are categorized as unprotected. Only

16 species (15.84%) are protected. Based on their conservation status of IUCN (2020), most bird species (91.09%) are categorized as Least Concern with a tendency of population to decrease (30 species), increase (13 species), stable (36 species), and unknown (13 species). The rest are categorized as Near Threatened (5 species, namely Green Iora, Sunda Teal, Fiery Minivet, Rufous-necked Stint, and Bar-tailed Godwit), Vulnerable (2 species, namely Lesser Adjutant and Javan Myna), and Endangered (2 species, namely Far Eastern Curlew and Javan White-eye. A large number of unprotected bird species while at the same time the least concern status is of course alarming. Many bird species have not been studied intensively, but their sustainability or survival is threatened.

Currently, people catch birds for at least two purposes. First, birds are used as a pet. Zebra Dove, Eastern Spotted Dove, Sooty-headed Bulbul, Yellow-vented Bulbul, and Javan Myna are kept because of their voice. Unfortunately, birds are kept without partners so they cannot reproduce. Second, bird species are consumed. White-breasted Waterhen, Yellow Bittern, and Wandering Whistling-duck are species that are traded and then enjoyed for their meat. The over catching and consumption of birds has definitely wiped them out.

In addition, land conversion, especially the protected areas or conservation areas into production areas also threatens the bird. Forest-dwelling birds who like lush bushes or under-canopy dwellers such as Western Hooded Pitta, Ioras, Pin-striped Tit-babbler, and Emerald Dove have lost their habitats. In contrast, birds that are able to adapt to open areas or grass vegetation find new habitats. They include Eurasian Tree Sparrow, Australasian Pipit, Western Yellow Wagtail, and Javan Myna.

Each bird species has its own ecological roles and functions. As carnivores, eagles and Brahminy Kite help maintain the balance of nature. Sooty-headed Bulbul, Yellow-vented Bulbul, and flowerpeckers are frugivores that help spread plant seeds from certain sites to other sites, so do Zebra Dove, Eastern Spotted Dove, and munias as granivores. Long-tailed Shrike, bee-eaters, and Sunda Pied Fantail as insectivores play a role in controlling pests and diseases in plants. Sunbirds as nectarivores not only act as nectar eaters, but also helps pollinate.

In conclusion, 101 bird species found in the west coast of South Kalimantan are classified as minimal. The species diversity index of the four sample sites ranges from 3.48 to 4.04. In general, the similarity index based on the number of individuals per species is greater than that based on the presence or absence of the species. Migratory birds can be developed as unique attractions or ecotourism objects on this west coast. White-breasted Kingfisher and Streaked Weaver are worth noting in field books when these birds have been found spreading in Kalimantan.

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