

## The Diversity of Waterbirds Species in Jatipapak Mangrove Ecosystem at Kucur Resort, Alas Purwo National Park, East Java

Arif Mohammad Siddiq<sup>1\*</sup>, Hari Sulistiyowati<sup>2</sup>, Retno Wimbaningrum<sup>3</sup>, Rendy Setiawan<sup>4</sup>, Nissaul Qisti<sup>5</sup>, Dudun Supriadi<sup>6</sup>

<sup>1, 2, 3, 4, 5</sup> Universitas Jember, Indonesia

<sup>6</sup> Alas Purwo National Park, Indonesia

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\*Correspondence email:

[arifsiddiq\\_fmipa@unej.ac.id](mailto:arifsiddiq_fmipa@unej.ac.id)

\*Contact number:

### ABSTRACT

The study aims to determine the composition and diversity of waterbirds species in the Jatipapak mangrove ecosystem at Alas Purwo National Park (APNP). This research was conducted on September-October 2020 with terrestrial and marine surveys in three stations. Data collection includes the waterbirds species and the number of individuals of each species. Data analysis used species composition and diversity index (Shannon Wiener= $H'$ ). The results of the study obtained the existence of 837 individuals waterbirds consisting of seven families, 16 genera, and 23 species. The waterbird communities in this area are composed of 11 species of resident birds and 12 species of migratory birds. The diversity index of waterbird species obtained is 2.31 which means moderate level. Based on the conservation status, there were 22 species of waterbirds that were classified as least concern (LC) and one species namely the Lesser Adjutant (*Leptoptilos javanicus*) which was included in the Vulnerable (VU) category.

#### ***Keanekaragaman Spesies Burung Air di Ekosistem Mangrove Jatipapak Resor Kucur, Taman Nasional Alas Purwo, Jawa Timur***

**ABSTRAK:** Penelitian bertujuan untuk menentukan komposisi dan keanekaragaman spesies burung air di ekosistem mangrove Jatipapak di Taman Nasional Alas Purwo (TNAP). Penelitian ini dilakukan pada bulan September-Oktober 2020 dengan survei darat dan laut di tiga stasiun. Data yang dicatat meliputi spesies burung air dan jumlah individu setiap jenis. Analisis data menggunakan penentuan komposisi spesies dan indeks keanekaragaman jenis Shannon Wiener ( $H'$ ). Hasil penelitian diperoleh 837 individu burung air yang terdiri dari 7 famili, 16 genus, dan 23 spesies. Komunitas burung air di kawasan ini terdiri dari 11 spesies burung penempat dan 12 spesies burung migran. Nilai indeks keanekaragaman jenis burung air yang diperoleh adalah 2,31 yang berarti dalam kategori sedang. Berdasarkan status konservasi, terdapat 22 spesies burung air yang tergolong least concern (LC) dan satu spesies yaitu bangau tongtong (*Leptoptilos javanicus*) yang masuk dalam kategori Vulnerable (VU).

### INTRODUCTION

Alas Purwo National Park (APNP) is a conservation area that is geographically located on the eastern tip of Java Island. This

conservation area consists of several ecosystems, which one is mangrove forest with total area around 1,079 ha (Sulastini, 2011). Mangrove is a type of vegetation that

is influenced by tides which have a dual function and are a very important link in maintaining the balance of biological cycles of a body of waters. Mangrove forests are one of the rare ecosystems in the world, covering only 2% of the earth's surface area and the largest mangrove ecosystem is found in Indonesia (Harianto & Setiawan, 2021). One of the mangrove ecosystems found in this area is the Jatipapak at Kucur Resort, which is part of the Pangpang Bay. Based on the Decree of the Governor of East Java No. 188/338/KPTS/013/2020, the Pangpang Bay has been designated as an Essential Ecosystem Area (EEA). This status is given because this area is life-supporting and unique. It also plays an important role as a habitat for animals and plants in conservation areas. One of the animals that inhabits in the area is waterbirds.

Waterbirds are a group and class of birds that use their legs to swim or have long legs to walk in water that allow them to find food in the aquatic environment (Nurdin et al., 2021). The waterbird communities use the mangrove ecosystem as a place for foraging, breeding, nesting, and molting (Arcos et al., 2019);(Zockler et al., 2021). These places provide various needs for waterbirds such as muddy areas, river water, and areas for bordering the sea which are essential habitats for waterbirds (Purity et al., 2019). The presence of waterbirds in the mangrove ecosystem is referred to as a keystone species which affects the composition of the types of organisms in an ecosystem (Nurdin et al., 2021). The communities of waterbird act as secondary and tertiary consumers who are able to control prey populations, such as groups of plankton, gastropods, bivalves, crustaceans, and small pelagic fish (Chanate et al., 2020). This is in agreement with Nugraha et al. (2021) that mangroves are a source of habitat and habitat because mangrove ecosystems are rich ecosystems. The existence of bird species in mangrove forest habitats is strongly influenced by environmental factors, both biotic and

abiotic factors from the mangrove forests they occupy.

According to Mubarrok and Ambarwati (2019), birds need several conditions for their survival, including suitable habitat conditions and safe from all kinds of disturbances. The diversity of bird species in an area can indicate how there is in the area. The presence of waterbirds and terrestrial birds is an indicator of wetland health. The importance of monitoring bird species diversity needs to be done in order to protect from threats and habitat destruction (Iswandaru et al., 2019). In 2022, it was reported that there were 17 species of birds from 12 families with a total of 827 individuals in Bogor (Septiawan et al., 2022) The composition of these species is still fluctuating due to Indonesia's geographical position which is one of the destinations for some migratory birds to transit and rest (Yong et al., 2021), or the presence of resident birds that have not been recorded so far. Species diversity refers to the variety of species within a biological community.

According to Grantham (2000), 227 bird species were reported at APNP, and 71 waterbird species were observed in several areas such as Cungur, Segoro Anak, Ngagelan, Trianggulasi, Sunglon Ombo, Pancur, Plengkung, Perpat, Bringinan, and Sembulungan. It is revealed that not all wetland areas, particularly mangrove ecosystems at APNP, have been explored or studied, including the Jatipapak Mangrove area at Kucur Resort. Therefore, it is very important to explore the diversity of waterbirds in this area. The results of this study certainly contribute to the renewal of data on the composition and diversity of waterbirds in the new geographic range at APNP. So that information about the existence of waterbirds at APNP can be more valid and complete. On the other hand, this research becomes one of the important monitoring parts of the in-situ conservation program of bird communities at APNP. This research can be used as an additional

reference to biological material on the topic of biodiversity.

**METHOD**

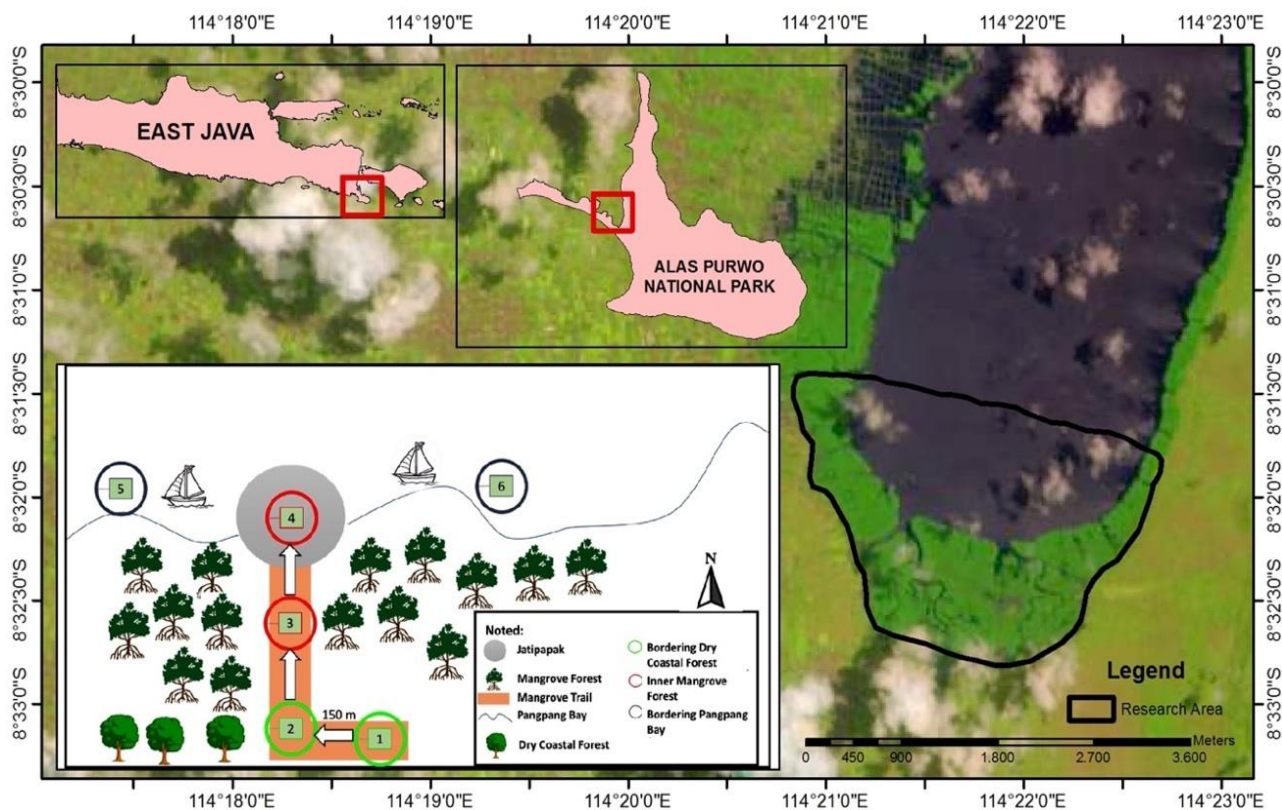
**Study Sites**

The study was conducted in the Jatipapak Mangrove ecosystem at Kucur Resort, APNP with an observation area of 120 Ha. These observations were carried out at three representative stations (ST) of the mangrove ecosystem, including: Station I at bordering dry coastal forest (8°32'26.00"S and 114°22'18.56"E), Station II at inner mangrove forest (8°32'15.20"S and 114°22'17.47"E), and Station III at bordering Pangpang Bay (8°32'7.53"S and 114°22'15.43"E) (Figure 1).

**Field Observation and Species Identification**

This research was conducted on September 2020 and October 2021. Observation of waterbirds used the terrestrial and marine survey (Lawrence et

al., 2020). Terrestrial surveys were carried out at stations I and II with tracking on the mangrove trail, while marine surveys were carried out at station III using motorboats (Figure 1). This observation started in the morning (06.00 - 09.00 am), then midday (01.00 - 03.00 pm), and late afternoon (04.00 - 06.00 pm). The equipment used in this observation included binocular Bushnell Powerview 10×50 D, camera Canon EOS 60D, telephoto lens 75-300 mm, and notes. The data was collected from this location included the waterbirds species, the number of individuals of each species, and the type of habitat occupied. Identification of waterbirds used the morphological characteristics (body and color pattern), body movement, flight behaviours, and sounds recording (Lawrence et al., 2020). Several sound recordings of waterbirds were also verified using Xenocanto database (<https://xeno-canto.org/>) (Siddiq et al., 2023).



**Figure 1.** Study area of waterbirds in Jatipapak mangrove ecosystem at APNP

## Data Analysis

The waterbirds species was analyzed by determining the species composition and species diversity index. The diversity level of waterbirds species was obtained using the Shannon-Wiener Index ( $H'$ ) (Magurran 1988). The conservation status was gained from the website of the International Union for Conservation of Nature (IUCN) Redlist (<https://www.iucnredlist.org/>) and the Indonesian Government Regulation on Environment and Forestry Number nomor p.106/menlhk/setjen/kum.1/12/2018. Information on the type of feed and behavior (migratory and resident category) was confirmed using the reference of Guideline book "Seri Panduan Lapang Burung-burung Indonesia: Sumatera, Kalimantan, Jawa, Bali" (Taufiqurrahman et al., 2022), migratory shorebirds on the East Asia-

Australasian Fylway, and seabird survey in Jakarta Bay (Tirtaningtyas & Yordan 2017).

## RESULTS AND DISCUSSION

The results showed that the presence of 837 individuals of waterbirds consists of 23 species, 16 genera, and seven families. Based on seasonality, there are 12 migrant species and 11 resident species were found in this study. Furthermore, based on IUCN Redlist status, there are 22 species of least concern (LC) and one species of near threatened (NT), while for protection status there are 14 species of not protected status and nine species of protected status by the Indonesian Government Regulation on Environment and Forestry Number 106, 2018. For complete information it show in table 1 below.

**Table 1.** The Composition of waterbirds Jatipapak mangrove, APN

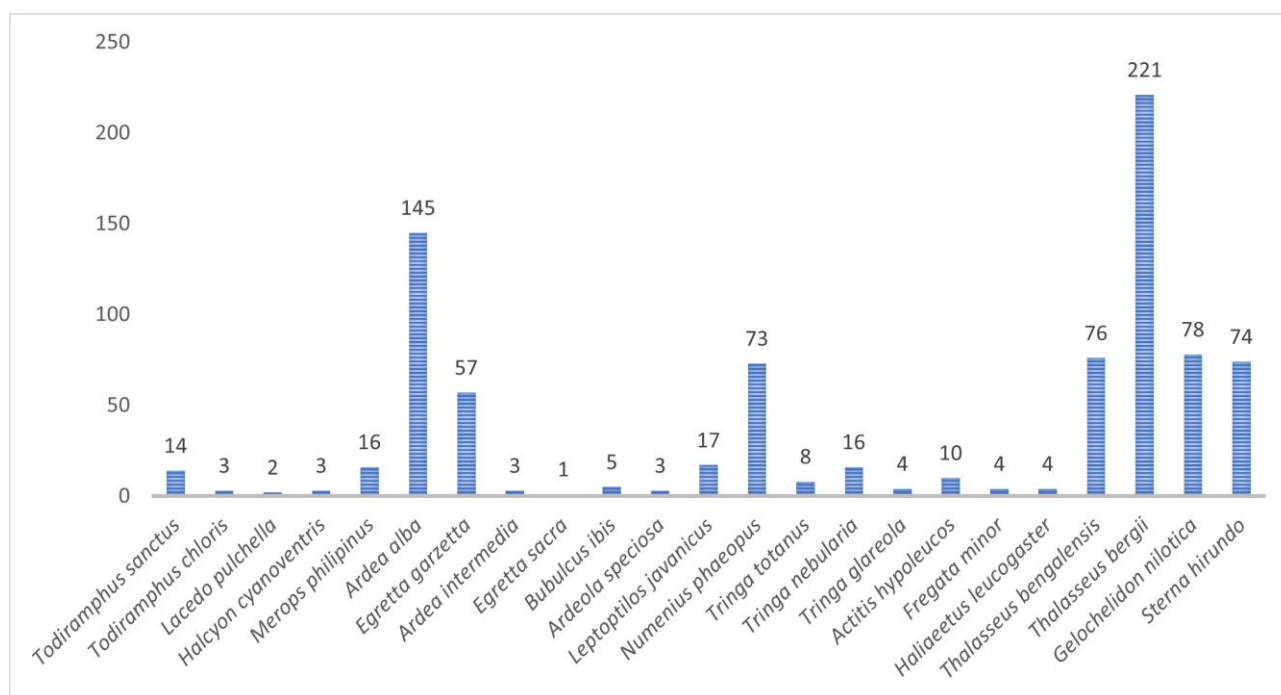
Order	Scientific Name	English Name	Seasonality	IUCN	Protection
Alcedinidae	<i>Todiramphus sanctus</i>	Sacred Kingfisher	MIG	LC	NP
	<i>Todiramphus chloris</i>	Collared Kingfisher	RES	LC	NP
	<i>Lacedo pulchella</i>	Banded Kingfisher	RES	LC	NP
	<i>Halcyon cyanoventris</i>	Javan Kingfisher	RES	LC	NP
Meropidae	<i>Merops philippinus</i>	Blue-tailed Bee-eater	MIG	LC	NP
Ardeidae	<i>Ardea alba</i>	Great Egret	RES	LC	PR
	<i>Ardea intermedia</i>	Intermediate Egret	RES	LC	NP
	<i>Egretta garzetta</i>	Little Egret	RES	LC	NP
	<i>Egretta sacra</i>	Pacific Reef-egret	RES	LC	NP
	<i>Bubulcus ibis</i>	Cattle Egret	RES	LC	NP
	<i>Ardeola speciosa</i>	Javan Pond-heron	RES	LC	NP
Ciconiidae	<i>Leptoptilos javanicus</i>	Lesser Adjutant	RES	VU	PR
Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel	MIG	LC	PR
	<i>Tringa totanus</i>	Common Redshank	MIG	LC	NP
	<i>Tringa nebularia</i>	Common Greenshank	MIG	LC	NP
	<i>Tringa glareola</i>	Wood Sandpiper	MIG	LC	NP
	<i>Actitis hypoleucos</i>	Common Sandpiper	MIG	LC	NP
Fregatidae	<i>Fregata minor</i>	Great Frigatebird	MIG	LC	PR
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied Sea-eagle	RES	LC	PR
Laridae	<i>Thalasseus bengalensis</i>	Lesser Crested Tern	MIG	LC	PR

Order	Scientific Name	English Name	Seasonality	IUCN	Protection
	<i>Thalasseus bergii</i>	Greater Crested Tern	MIG	LC	PR
	<i>Gelochelidon nilotica</i>	Common Gull-billed Tern	MIG	LC	PR
	<i>Sterna hirundo</i>	Common Tern	MIG	LC	PR

**Noted:** Migrant (MIG), Resident (RES), Least Concern (LC), Vulnerable (VU), Not Protected (NP), Protected (P)

The diversity index of waterbird species in Jatipapak Mangrove at APNP belongs to the moderate category ( $H'=2.31$ ). This level is influenced by the dominance of *Th. bergii* (221 individuals) (Figure 2). This species is found in large groups and mixed with other tern groups such as *Th. Bengalensis*, *G. nilotica*, *S. hirundo*, and the Ardeidae groups (*A. alba* and *E. garzetta*). Species *Th. bergii* is a common migratory seabird from Laridae that has a wide distribution near the coast and around small coral islands in India (Byju et al., 2023). The types of birds are found only in a location

because the bird has a pattern of adaptation to a limited habitat, adaptations such as food factors and the type of vegetation inhabited (Romano et al., 2020). Therefore, this species is indeed quite common and occupies several wetlands areas on Java Island with a large population during migration periods. Payo payo et al. (2018) reported that *Th. Bergii* on the coast of Southern Africa has a high survival rate. Therefore, it shows that *Th. bergii* has a high population potential and can dominate the waterbirds community.



**Figure 2.** Total individuals of each waterbirds species in Jatipapak Mangrove at APNP

The species richness of waterbirds in mangrove ecosystem at Jatipapak APNP is higher than the Peniti mangrove forest in Pontianak (19 species) (Linda & Rafdinal, 2020), the Sabar Miokre mangrove forest in

Cirebon (5 species) (Purwanto et al., 2021), and the Lantebung mangrove forest in Makassar (18 species) (Purity et al., 2019). This condition can indicate that the mangrove ecosystem in Jatipapak APNP



provides the habitat needed by waterbirds species. Bird species will take advantage of a good environment for the main habitat as a nest because in that location birds get food and also shelter themselves from predators and extreme weather (Potvin et al., 2021). According to Ramadhani et al. (2022), mangrove vegetation is used by waterbirds for foraging, breeding, or just resting. From the observations, the mangrove vegetation in this area is used by the Meropidae, Ardeidae, Ciconiidae, and Scolopacidae for sunbathing and resting. Meanwhile, in mudflats, Families of Ardeidae, Ciconiidae, and Scolopacidae are used to hunt invertebrate like crustaceans, bivalves, and gastropods (Pangestu et al., 2023). The same thing also happened to the mudflat area in the coastal wetlands of East Lampung which was used by members of the Ciconiidae and Scolopacidae for foraging activities (Ginantra et al., 2020). This is in agreement with research conducted by Aprilia et al. (2020), that indeed the habitat of this bird is in mangrove forests and alkaline land that eats some fish and crustaceans.

Waterbirds in the Jatipapak mangrove at APNP are 23 species out of 71 species found by in Cungur, Segoro Anak, Ngagelan, Trianggulasi, Sunglon Ombo, Pancur, Plengkung, Perpat, Bringinan, and Sembulungan. The presence of 12 migratory species in Jatipapak also shows that the mangrove ecosystem is an important area for bird migration, especially waterbirds (Liordos & Kontsiotis, 2020). The seabird groups in Jatipapak consist of two families, those are, Fregatidae and Laridae. Laridae members (*Th. bergii*, *Th. bengalensis*, *G. nilotica*, *S. hirundo*) are found in large groups (10-75 individuals) and often seen mixed together. These four species were observed in terms of foraging and resting in fisherman's cages. In particular, reports of members of the Fregatidae recorded in Java waters are still limited (Schultz, 2020). Sedayu et al. (2020) reported the presence of three species of Fregatidae (*F. andrewsi*, *F. minor*, and *F. ariel*) in Jakarta Bay.

Meanwhile, Widodo (2009) reported the presence of *F. ariel* on the coastline of Baluran National Park. The presence of *F. minor* in APNP. According to Burner et al. (2018), *F. minor* is a migratory bird that can be found in the Indonesian ocean, except for Kalimantan. This species is also found breeding in Christmas Island, Manuk Island, and Volcano in the Banda Sea.

The existence of waders in this area is also recorded from two families, which are Ardeidae and Scolopacidae. Species from Ardeidae are full residents and used the Jatipapak mangrove vegetation as a resting place and possibly as a nesting area. Five species of Scolopacidae in this area are wintering migrant birds in groups and are often seen intermingling with members of Ardeidae and Laridae. The report from Desmawati et al. (2017) also states that the coastal areas of Java, which are mangrove forests and ponds in Wonorejo Surabaya, are transit areas for four *Numenius* species. One of the species is *N. phaeopus*. This species is found in several small groups in Jatipapak. The species is active for foraging in mudflat areas at low tide and resting in the dry canopy of the *Rizophora mucronata* vegetation. In Sumatra's coastline, approximately 42 species of migratory waders were reported that they used the mudflat area to foraging (Putra et al., 2020).

Mangrove ecosystem at Jatipapak provides three types of habitat for waterbirds, those are, mangrove vegetation (low and high tide condition), mudflat (low tide condition), and open waters (high tide condition). The waterbirds were found in mangrove vegetation are all of species from families Alcedinidae, Meropidae, Ardeidae, Ciconiidae, and Scolopacidae. Furthermore, those found in the mudflat area are all of species from families Ardeidae, Ciconiidae, and Scolopacidae. Whereas those found in aquatic habitats, especially those perched on "sera" or fisherman cage are all of species from family Fregatidae and Laridae. Species from Accipitridae (*Ha. leucogaster*) are found foraging in the open waters around

the mangroves. According to Backström and Winkelmann (2022), *Ha leucogaster* in the Australian Capital Territory, it has some preference for prey such as mammals, birds (including water birds), turtles, and fish.

The existence of birds in an area is due to the fact that there are abundant sources of food and drink, and have benefits for birds to shelter, rest and breeding grounds (Fattah & Rabou, 2019).



**Figure 3.** Documentation of representative waterbirds in Jatipapak APNP: (A) *T. sanctus*; (B) *T. chloris*; (C) *M. philippinus*; (D) *A. hypoleucos*; (E) *Tr. nebularia*; (F) *Tr. tetanus*; (G) *N. phaeopus*; (H) *Le. javanicus*; (I) *B. ibis*; (J) *E. garzetta*; (K) *Ad. alba*; (L) *Ad. intermedia*; (M) *Ar. speciosa*; (N) *F. minor*; (O) *Ha. leucogaster*; (P) *G. nilotica*; (Q) *Th. bergii*; (R) *S. Hirundo*

Based on the conservation status of the IUCN Redlist, there are 22 species of waterbirds listed as of least concern and one species (*Leptoptilos javanicus*) is vulnerable. This species of Ciconiidae is a relatively large bird in which the population has decreased significantly. This is due to the decreasing availability of nesting sites which is caused by the development in coastal areas and the low bird regeneration which is

caused by bird eggs being preyed upon by predators (Patankar et al., 2021). It is also Fernández-pereira and Morales-castilla (2023) argued that human activities in an area can affect the composition of bird species in the region. The population of *Le. javanicus* in APNP is relatively stable and spreads in mangrove area and sadengan feeding ground. The main disturbance is only natural predators that prey on Lesser

Adjutant eggs, while disturbances from humans are less common due to strict surveillance of the area by officers. As for the protection status, there are 14 waterbirds species that have not been protected, and nine species that are protected by the Indonesian government through the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia No:P.106/Menlhk/Setjen/Kum.1/12/2018. Through the results of this study, it is expected that the conservation of waterbirds in APNP can be carried out in a sustainable manner. The results of this study indicate that Jatipapak is an essential wetland area for waterbirds habitat, both resident and migrant.

#### CONCLUSIONS AND SUGGESTIONS

Waterbirds from the mangrove ecosystem in Jatipapak at TNAP consist of 23 species that occupy mangrove vegetation, mudflat areas, and open waters. The results of the diversity index are 2.31 which was included in the medium category. For seasonality, the waterbirds consist of residents and wintering migrant. The researchers suggest for further research can conduct in other mangrove areas at APNP, so that it can provide a thorough update on the waterbirds diversity in this park.

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