

Bird Community in Bagek Kembar Mangrove Essential Ecosystem Area (EEA), Sekotong, West Lombok

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Received: October 17, 2024. Accepted: November 28, 2024. Published: November 30, 2024

Abstract: Birds are wildlife found in many habitats, such as beaches, swamps, mountains and lowlands. This study aims to determine the bird community in the Bagek Kembar essential ecosystem area, West Lombok Regency. Data was collected using the transect path method (exploration) and point count. The research was conducted in November-December. Observation was carried out in the morning at 06.30- 09.30 and in the afternoon at 15.30-18.30 Central Indonesian Time (GMT +8) with representatives of 3 observation locations: pond area, rehabilitation mangrove and natural mangrove. Data collection was done using transect lines (cruising) and point count. The results showed that there were 57 bird species from 23 families categorised into migratory birds (18 species), protected birds (12 species), and six species of birds categorised as NT (Near Threatened). The results of the abundance index of species included in the highest dominant category are Cerulean Kingfisher (*Alcedo coerulescens*), with a value of 7.87% found in the pond area. Furthermore, the results of the diversity index of the three areas have a high diversity index value of 3.900.

Keywords: Abundance; Bird Community; Diversity; Richness.

Introduction

Birds are wildlife found in many habitats, such as beaches, swamps, mountains and lowlands. The diversity and abundance of bird species can indicate how the area is doing. As one of the components of the ecosystem, the existence of birds can be an indicator of whether the environment supports the life of an organism or not because it has a reciprocal and interdependent relationship with its environment [1].

Diversity is a community characteristic related to the number of species or species richness and abundance of species as community constituents. High species diversity indicates that a community has high complexity because there are high interactions within the community [2]. Diversity relates to species richness, the number of species, and the abundance of species as community constituents. Species diversity is the most fundamental study in ecology [3]. A stable and well-developed community will have a high diversity of bird species, and a large variation in vegetation will provide a high richness and diversity of birds. Bird communities on Lombok Island have high species diversity [4]. Bird species diversity differs from one habitat to another, depending on the environmental conditions and factors that influence it [5].

Bagek Kembar is in Cendik Manik Sekotong West Lombok, NTB. The geographical location of Bagek Kembar is at the position of 8.7660 - 8.75880 LS and 116.0530 - 116.0680 BT. The total area included in the Bagek Kembar Essential Ecosystem Area was around 49.5 Ha [6]. Bagek Kembar is a place that utilises mangrove forests as new

tourism, namely as a mangrove tourist attraction area and one of the bird-watching objects [7].

The mangrove vegetation structure in the Bagek Kembar Essential Ecosystem Area describes the proportion of mangrove vegetation at each growth level. Saplings dominate the vegetation structure. Mangroves with tree growth stages are found less; a small proportion are seedlings. The most common mangrove species in this area are from the Rhizophoraceae and Acanthaceae families [8]. Mangrove forests are a haven for aquatic and migratory birds. There are at least 200 bird species that depend on mangrove ecosystems in Indonesia [9]. Birds utilise mangrove vegetation as a nesting place to rest and a place to find food; therefore, the mangrove ecosystem is an ecosystem with an important role [10]. Coastal habitats also determine the activities of living things, both plants and animals, because vegetation on the coast can be used as a stopover or nesting place for birds that live around the coast or migratory birds passing by [11].

The Bagek Kembar area was designated as a Mangrove Essential Ecosystem Area (EEA) in 2018 by the NTB Natural Resources Conservation Center. The Bagek Kembar Mangrove Essential Ecosystem Area is divided into two parts, namely forest areas undergoing natural succession (natural blocks) and forest areas that have been rehabilitated (rehabilitation blocks) [12]. Research related to the presence and community of birds in West Lombok Regency is still very minimal. Research on birds is important because if an area has a high abundance of birds, it can indicate good environmental conditions [13]. Given the important role of birds in an ecosystem and the limited information on bird species diversity in the Bagek Kembar essential ecosystem

How to Cite:

Manisa, S., Hadiprayitno, G., & Suyantri, E. (2024). Bird Community in Bagek Kembar Mangrove Essential Ecosystem Area (EEA), Sekotong, West Lombok. *Jurnal Pijar Mipa*, 19(6), 1078-1084. <https://doi.org/10.29303/jpm.v19i6.7824>

area, it is necessary to research bird communities in the Bagek Kembar essential ecosystem area, West Lombok.

Research Methods

This research was conducted in the Bagek Kembar Essential Ecosystem Area, Sekotong, West Lombok.

Observations were conducted in November-December 2023. The observation time was conducted in the morning at 06.30-09.30 and in the afternoon at 15.30-18.30 Central Indonesian Time (GMT +8) because in this period, the birds are more active [14]. Observations were made in 3 locations: pond area, rehabilitated mangrove and natural mangrove (Figure 1).

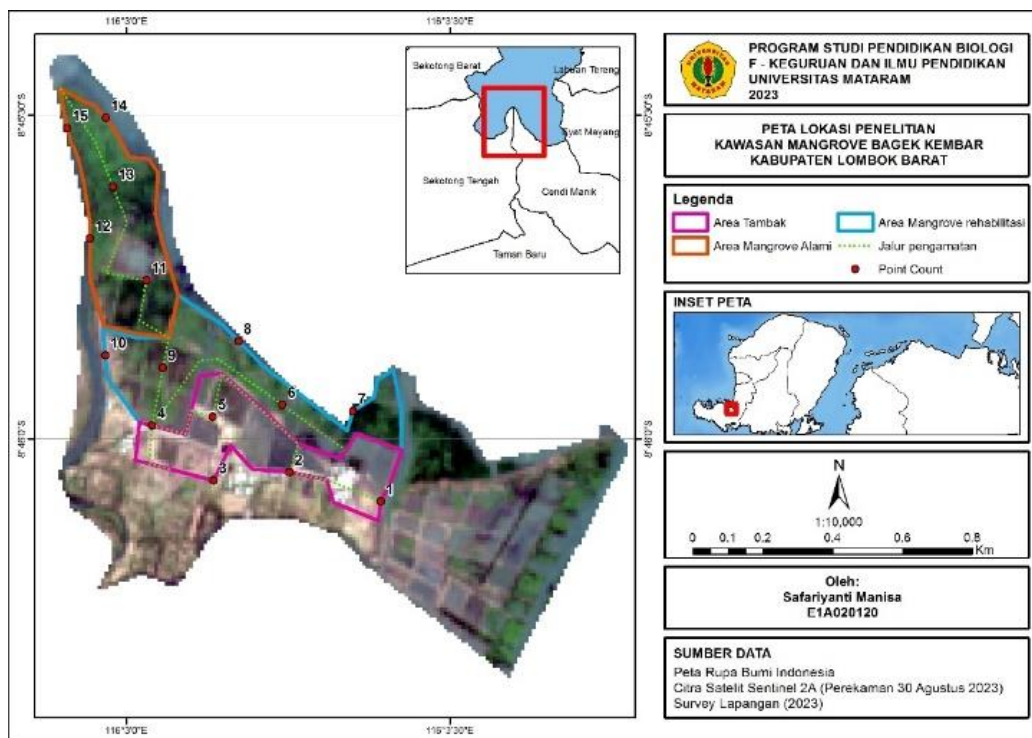


Figure 1. Map of the research location

Data was collected using the transect path method (exploration) and point count. Exploration is done on three paths covering pond areas, rehabilitation mangroves and natural mangroves in the ecotourism of Bagek Kembar. The distance between point count points is 150 meters (Figure 2). Each point count was conducted for 10 minutes with a radius of 20 m, and the species and number of individual birds of each species were recorded within the observation circle [15].

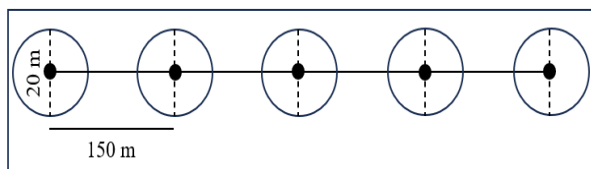


Figure 2. Observation path

Data analysis

The data analysis used is species richness (species classification based on family, migrant status, protection status based on Ministry LHK.No.P.106 of 2018 and IUCN Red List) [16], abundance index, and diversity index.

1. Abundance index

The abundance of bird species was calculated using the formula used [17]:

$$D_i = \frac{n_i}{N} \times 100\%$$

Description:

D_i = Relative abundance

n_i = Number of individuals of each species

N = Total number of individuals

2. Diversity index

The bird species diversity index is measured based on the Shannon-Wiener diversity index Odum, 1993; [18]. calculated by the following formula:

$$H' = - \sum p_i \ln p_i ; p_i = n_i/N$$

Description:

H' = Diversity index

n_i = Number of individuals of species

N = Total number of individuals of all species

Results and Discussion

Bird species richness

Bird species richness was obtained by categorizing by family, migrant status, protection status and status. Results based on observation, 57 bird species were observed in Bagek Kembar Mangrove EEA, comprising 23 families (Table 1).

Table 1. Bird Species Richness in the Bagek Kembar Mangrove EEA

Family	Scientific Name	English Name
Accipitridae	<i>Haliastur indus</i>	Brahminy Kite
Accipitridae	<i>Pernis ptilorhynchus</i>	Crested Honey Buzzard
Alcedinidae	<i>Halcyon sancta</i>	Sacred Kingfisher
Alcedinidae	<i>Halcyon australasia</i>	Cinnamon-banded Kingfisher
Alcedinidae	<i>Halcyon chloris</i>	Collared Kingfisher
Alcedinidae	<i>Alcedo coerulescens</i>	Cerulean Kingfisher
Apopidae	<i>Collocalia linchi</i>	Cave Swiftlet
Apopidae	<i>Collocalia fuchiphagus</i>	Edible-nest Swiftlet
Ardeidae	<i>Ardea alba</i>	Great Egret
Ardeidae	<i>Egretta garzetta</i>	Little Egret
Ardeidae	<i>Egretta intermedia</i>	Yellow-billed Egret
Ardeidae	<i>Ardea cinerea</i>	Grey Heron
Ardeidae	<i>Ardea purpurea</i>	Purple Heron
Ardeidae	<i>Ardeaola speciosa</i>	Javan Pond Heron
Ardeidae	<i>Butorides striata</i>	Striated Heron
Ardeidae	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron
Artamidae	<i>Artamus leucorhynchus</i>	White-breasted Woodswallow
Campephagidae	<i>Lalage seurii</i>	White-shouldered Triller
Campephagidae	<i>Lalage atrovirens</i>	Black-browed Triller
Charadriidae	<i>Charadrius veredus</i>	Oriental Plover
Charadriidae	<i>Pluvialis squatarola</i>	Grey Plover
Charadriidae	<i>Charadrius javanicus</i>	Javan Plover
Charadriidae	<i>Charadrius leschenaultii</i>	Greater Sand Plover
Charadriidae	<i>Charadrius mongolus</i>	Lesser Sand Plover
Cisticolidae	<i>Cisticola juncidis</i>	Zitting Cisticola
Cisticolidae	<i>Cisticola exilis</i>	Golden-headed Cisticola
Cisticolidae	<i>Orthotomus sepium</i>	Olive-backed Tailorbird
Esterildidae	<i>Lonchura pallida</i>	Pale-headed Munia
Esterildidae	<i>Lonchura punctulata</i>	Scaly-breasted Parrot-Finch
Fregatidae	<i>Fregata ariel</i>	Lesser Frigatebird
Hirundinidae	<i>Hirundo tahitica</i>	Pacific Swallow
Meliphagidae	<i>Lichmera lombokia</i>	Scaly-crowned Honeyeater
Meliphagidae	<i>Lichmera indisticta</i>	Brown Honeyeater
Meropidae	<i>Merops philippinus</i>	Blue-tailed Bee-eater
Nectariniidae	<i>Cinnyris jugulaaris</i>	Olive-backed Sunbird
Pachycephalidae	<i>Pachycephala grisola</i>	Mangrove Whistler
Passeridae	<i>Passer montanus</i>	Eurasian Tree Sparrow
Ploceidae	<i>Ploceus philippinus</i>	Baya Weaver
Pycnonotidae	<i>Pycnonotus goiavier</i>	Yellow-vented Bulbul
Rallidae	<i>Porzana fusca</i>	Ruddt-breasted Rail
Rallidae	<i>Amaurornis phoenicurus</i>	White-breasted Waterhen
Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous Fantail
Scolopacidae	<i>Numenius arquata</i>	Eurasian Curlew
Scolopacidae	<i>Numenius phaeopus</i>	Whimbrel

Scolopacidae	<i>Numenius madagascariensis</i>	Eastern Curlew
Scolopacidae	<i>Tringa totanus</i>	Common Redshank
Scolopacidae	<i>Tringa nebularia</i>	Common Greenshank
Scolopacidae	<i>Tringa glareola</i>	Wood Sandpiper
Scolopacidae	<i>Actitis hypoleucos</i>	Common Sandpiper
Scolopacidae	<i>Xenus cinereus</i>	Terek Sandpiper
Scolopacidae	<i>Heteroscelus brevipes</i>	Grey-tailed Tattler
Scolopacidae	<i>Limosa lapponica</i>	Bar-tailed Godwit
Scolopacidae	<i>Calidris faerruginea</i>	Curlew Sandpiper
Sternidae	<i>Sterna bengalensis</i>	Lesser Crested Tern
Sternidae	<i>Sterna bergii</i>	Swift Tern
Sternidae	<i>Chlidonias hybridus</i>	Whiskered Tern
Zosteropidae	<i>Zosterops chloris</i>	Lemon-bellied White-eye

The most commonly found family is the Scolopacidae family, with 11 species, and the Ardeidae family, with 8 species (Figure 3). The Scolopacidae family has the most diverse species in the waterbird group. Ost of this family is characterised by its thin, straight or some of them curved beak and has a distinctive habit of Information [19].

Waterbirds have sensitive beaks that can sense prey under the mud. The availability of food such as small shellfish, shrimp, crabs, small fish, and flies are important factors that attract birds that are naturally available food

in the habitat [20]. Families with only one species were Artamidae, Fregatidae, Hirundinidae, Meropidae, Nectariniidae, Pachycephalidae, Passeridae, Ploceidae, Pycnonotidae, Rhipiduridae and Zosteropidae. The sum of species found was two from the families Accipitridae, Apopidae, Campephagidae, and Esterildidae. Other families, such as Alcedinidae, found four species, Ardeidae 9 species, Charadriidae 5 species, Cisticolidae and Sternidae 3 (Figure 3).

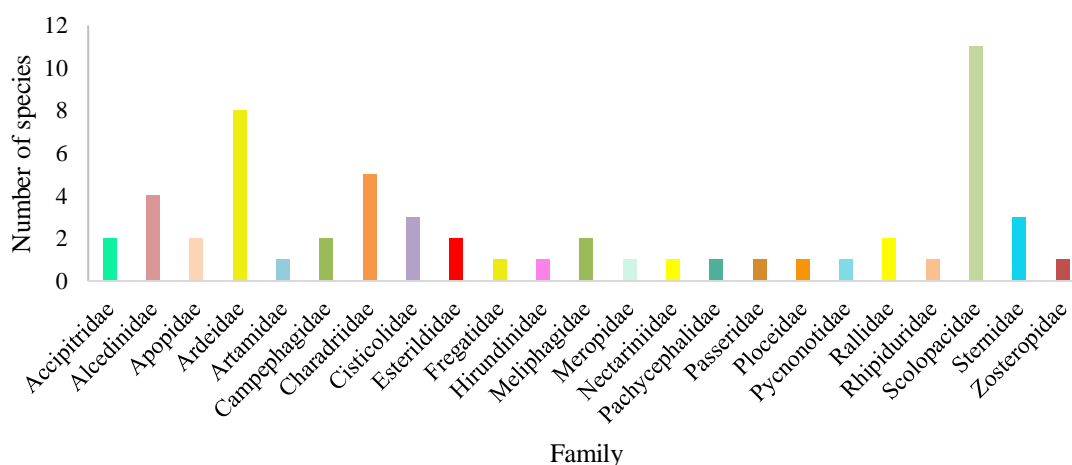


Figure 3. Bird family richness at the Bagek Kembar Mangrove EEA

Based on migrant status, protection status and IUCN status, 18 migrant species (*Charadrius veredus*, *Charadrius squatarola*, *Charadrius leschenaultii*, *Charadrius mongolus*, *Numenius arquata*, *Numenius phaeopus*, *Numenius madagascariensis*, *Tringa totanus*, *Tringa nebularia*, *Tringa glareola*, *Actitis hypoleucos*, *Xenus cinereus*, *Tringa brevipes*, *Limosa lapponica*, *Calidris faerruginea*, *Thalasseus bengalensis*, *Thalasseus bergii*, *Chlidonias hybrida*) and 45 non-protected species.

According to Ministry of Environment and Forestry No. P.106 2018 [21], 12 protected bird species (*Haliastur indus*, *Halcyon sancta*, *Ardea alba*,

Charadrius veredus, *Charadrius javanicus*, *Porzana fusca*, *Numenius arquata*, *Numenius phaeopus*, *Numenius madagascariensis*, *Thalasseus bengalensis*, *Thalasseus bergii*, and *Chlidonias hybrida*) and 45 non-protected species were found in the Bagek Kembar Mangrove EEA. The IUCN status of bird species observed in the Bagek Kembar Mangrove EEA includes 6 bird species categorized as NT (Near Threatened) (*Haliastur indus*, *Charadrius javanicus*, *Numenius arquata*, *Tringa brevipes*, *Limosa lapponica*, and *Chlidris faeruginea*) and 51 species categorized as LC (Least Concern) or low risk (Figure 4).

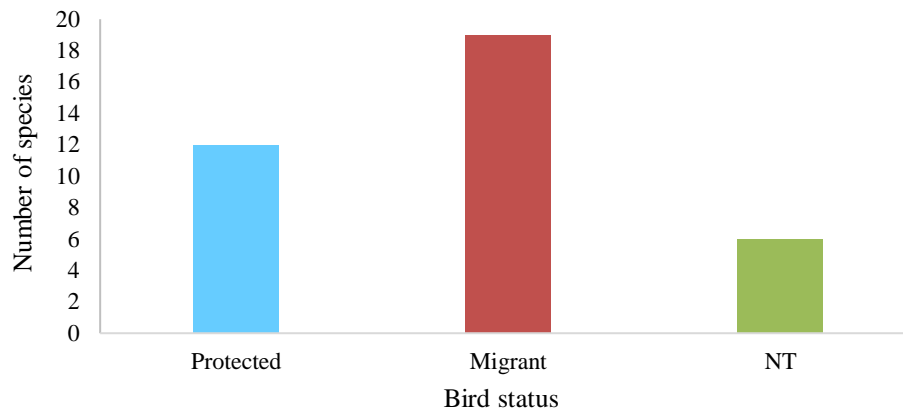


Figure 4. Status of birds in the Bagek Kembar Mangrove EEA

Migratory birds make migrations influenced by several factors, namely the physical environment, such as changes in temperature and food supplies [22]. Types of animal migration are generally distinguished based on location and time. Depending on its location, migratory bird migration is a type of directional migration (latitudinal migration), which is a movement from one place to another, where the altitude of the location of origin and destination is not a major factor. This type of migration is often carried out between places that are far apart and have extreme differences in weather conditions. According to the time migration of birds included by the return migration type, a movement to a certain destination regularly returns to the original location [23]. Waterbirds migrating to Indonesia usually arrive from September to March and return to their breeding grounds from March to April [24].

The existence of 11 bird species protected under the Permen of Environment and Forestry regulations is a concern and priority for the Indonesian government to defend them from the threat of poaching, trade and habitat destruction. As easy to see and enjoy the sound of, many bird species are in demand and sought after by humans to

be captured from the wild and kept. This activity has greatly affected the declining number of bird species and populations of birds in an area [25].

Species categorised as NT (Near Threatened) indicate that the bird species have been evaluated, and the results of the evaluation state that the bird species is categorised as NT due to the decreasing number of species. Bird species with conservation status NT indicates that conservation measures are needed to prevent extinction [26]. Bird species categorised as LC (Least Concern), or low risk indicates that the bird species have been evaluated but do not meet the criteria of a near-threatened species because it is still commonly found and in large numbers [27].

Abundance of bird species

The abundance of bird species in Bagek Kembar Mangrove EEA was categorised into ponds, rehabilitated mangroves, and natural mangroves (Table 2). Bird species with relative abundance $\geq 5\%$ are categorised as dominant, 2 - 4% as sub-dominant, and $<2\%$ as non-dominant [28].

Table 2. Bird abundance index in the Bagek Kembar Mangrove EEA

Region	The abundance index value (%)			
	Dominant species	Di	lowest species	Di
Tambak	<i>Alcedo coerulescens</i>	7.87	<i>Halcyon australasia</i>	0.2
	<i>Passer montanus</i>	5.91		
Mangrove Rehabilitasi	<i>Ardeola speciosa</i>	5.3	<i>Porzana fusca</i>	0.53
Mangrove Alami	<i>Egretta garzetta</i>	6.21	<i>Halcyon australasia</i>	0.33

The most dominant abundance value is Cerulean Kingfisher (*Alcedo coerulescens*). This species is abundant in the pond area because there is plenty of food available for bird species, such as small shrimp and bivalves. The other dominant bird species, the Eurasian Tree Sparrow (*Passer montanus*), is a terrestrial bird species. Terrestrial bird groups utilise open land for activities [29].

Natural mangrove areas include muddy areas dominated by Little Egret (*Egretta garzetta*), which are water bird species. This is in accordance with the statement of [2] that water bird species are bird species that utilise water areas, and all their lives are related to waters or wetlands. Differences influence the presence of

bird species in an area, such as plant species, comfort level, and location area, which can affect the type and number of birds found in an area [8].

The least common bird species encountered during the study was the Cinnamon-banded Kingfisher (*Halcyon Australasia*), a solitary bird type sensitive to human presence, so its presence is rarely found in this area. Another rarely encountered bird species is the Ruddt-breasted Rail (*Porzana fusca*), which has the lowest abundance value in the rehabilitated mangrove area. *Porzana fusca* is a shy bird that inhabits shallow, muddy wetlands such as mangroves, swamps and rice fields near coastal areas [13]. Species abundance is

influenced by three things: the characteristics of colonising species, habitat suitability of certain species, and adaptation of a species.

Bird species diversity

The value of the diversity index (H') of bird species in the Bagek Kembar Mangrove EEA consists of

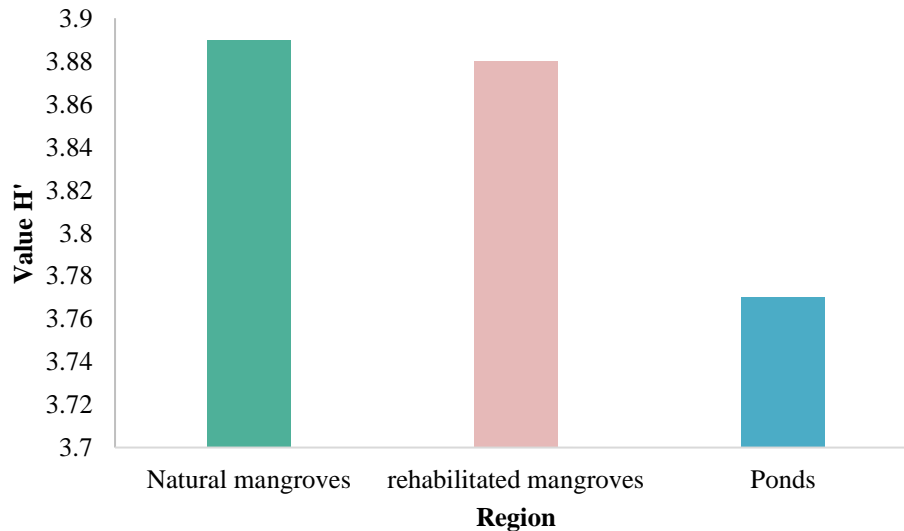


Figure 5. Bird diversity index in the Bagek Kembar Mangrove EEA

The natural mangrove area has the highest diversity index of the other areas at 3.894; in this area, the most bird species are found. This area is located further into the mangrove forest and at the end of the coast, with high vegetation, closed vegetation and low human activity. Habitats with higher vegetation diversity will provide more food so that the food choices provided are also more numerous for birds [30]. Plant species diversity affects the bird species diversity, where the higher the diversity of tree or plant species found in the area, the higher the bird diversity [31].

All three areas have a high diversity index value of 3.900. This diversity index value is considered good, indicating that Bagek Kembar Mangrove EEA bird habitats are good for bird survival. Food availability for birds is strongly related to the vegetation of an area. Vegetation structure and the availability of food sources in a habitat are the main factors influencing species diversity [32].

Conclusion

The richness of bird species found in Bagek Kembar EEA is 57 species consisting of 23 families. Birds found in Bagek Kembar are categorized into migratory birds (18 species), protected birds (12 species), and 6 bird species in the NT (Near Threatened) category. The abundance index of bird species in the Bagek Kembar Mangrove EEA included the highest dominant category, namely the Cerulean Kingfisher (*Alcedo coerulescens*) with a value of 7.87%, which is found in the pond area. The results of the diversity index of the three areas have a high diversity index value of 3.900. In the pond area of 3.777, rehabilitated mangrove area of 3.888 and natural mangrove area of 3.894.

a pond area of 3.777, a rehabilitated mangrove area of 3.888 and a natural mangrove area of 3.894 according to Figure 5. The three areas have similar diversity index values and are included in the high diversity index of 3.900.

Acknowledgements

The authors would like to thank the BKSDA NTB, the management of the Bagek Kembar Mangrove EEA for granting research permits, independent study students of Biology Education, Dr. Drs. Karnan, M.Si. as examiners, Bang Husni, BSC Kecial and friends who have helped them.

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