

Population and distribution of some herons in Babakan Rancabayawak, Bandung City, Indonesia

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Abstract. Megantara EN, Husodo T, Iskandar J, Nurjaman D, Suroso, Aminuddin SF, Atsaury ZIA, Wulandari I, Shanida SS. 2021. Population and distribution of some herons in Babakan Rancabayawak, Bandung City, Indonesia. *Biodiversitas* 22: 5389-5396. The Cinambo River flood control channel in the Rancabayawak impacts the decline in the habitat quality of some herons, such as cattle egret [*Bubulcus ibis* (Linnaeus, 1758)], little egret [*Egretta garzetta* (Linnaeus, 1766)], and Javan pond-heron [*Ardeola speciosa* (Horsfield, 1821)]. Besides, many built-up areas due to the urbanization in peri-urban areas also impact habitat quality, such as the loss of plants commonly used as perching and nesting sites. Along with the development of Rancabayawak as a built-up area, it is essential to study the management of those birds. This study aims to reveal: 1) plants used as perching and nesting sites, 2) population size and distribution, and management efforts on *B. ibis*, *E. garzetta*, and *A. speciosa* in Babakan Rancabayawak Hamlet, Gedebage Subdistrict, Bandung, West Java, Indonesia. A mixed-methods approach was applied in this study by calculating the estimated population and bird nests, plant inventory survey, and the installation of the A8 mini GPS. *Bambusa vulgaris*, *Leucaena leucocephala*, and *Mimosa pigra* are plants that are used as perching and nesting sites by *B. ibis*, *E. garzetta*, and *A. speciosa*. The estimated population mean of those birds was 630 individuals, 92 individuals, and 43 individuals, respectively, with the population average of those birds, is 1680 individuals. Three hundred twenty-nine nests (329) were found during the study. Based on distribution mapping, birds moved east and south, covering paddy fields in Rancaekek, Solokanjeruk, and Majalaya within a radius of 12 km. Management efforts can be conducted by not cutting down the plants that become nesting and perching sites and maintaining the wetlands in their habitats.

Keywords: Ardeidae, egret, heron, Rancabayawak, freshwater swamp

INTRODUCTION

Globally, the paddy field has become an essential habitat for aquatic birds, including in Indonesia (Howes et al. 2003), China (Lin et al. 2018), and South America (Dias et al. 2014). Although the paddy field is essential habitat for aquatic birds, its ecosystem in many regions has dramatically changed due to conversion to other land use types (Harisa 2016). Iskandar and Iskandar (2020) said that cattle egret [*Bubulcus ibis* (Linnaeus, 1758)], little egret [*Egretta garzetta* (Linnaeus, 1766)], and Javan pond-heron [*Ardeola speciosa* (Horsfield, 1821)] had been recorded for a long time in the Babakan Rancabayawak (Bandung, Indonesia), e.g., paddy field. Pang et al. (2019) said that *E. garzetta* often builds its nests in multi-species heronries. In multi-species heronries, the coexistence of hundreds of breeding birds results in dense nesting and partitioning of the available space.

Iskandar and Iskandar (2020) state that, in early 2002, before the construction of the Cinambo River flood control channel, the paddy fields were still a swamp in Babakan Rancabayawak. Along with the construction of the Cinambo River flood control channel, the paddy fields in

Babakan Rancabayawak have not flooded much anymore. However, the increasing population has led to the transfer of wetlands, e.g., paddy fields and swamps, into residential lands. Even though the paddy field was converted into built-up lands, such as housing in the Babakan Rancabayawak, those birds still survive in the area. A similar condition happened in Greece (Kazantzidis et al. 2013). The wetlands have been exploited and modified according to human needs (crop and animal farming, urban and industrial development, fishing, tourism, etc.), so that those land changes are a serious threat for three heron species, such as the purple heron (*Ardea purpurea*), the squacco heron (*Ardeola ralloides*), and the black-crowned night heron (*Nycticorax nycticorax*).

Heronries are the sources of the breeding population of herons, egrets, and other associated water birds. Heronries play a vital role in the conservation of these birds. For successful conservation and recovery of aquatic bird, an extensive understanding of the eco-biological requirements of these birds are essential (Li et al. 2016). The management efforts need to be carried out to preserve the population of birds amidst a large amount of built-up land in Babakan Rancabayawak. It is necessary to protect its

habitat as a whole. Ecologically, bird habitats include shelter, resting, nesting, and hunting. Based on the introduction, this study aims to reveal: 1) the plants that are commonly used as perching and nesting places of *B. ibis*, *E. garzetta*, and *A. speciosa*; 2) estimation of population size and distribution of *B. ibis*, *E. garzetta*, and *A. speciosa*; and 3) management efforts to maintain the existence of *B. ibis*, *E. garzetta*, and *A. speciosa* in Babakan Rancabayawak, Gedebage Subdistrict, West Java.

MATERIALS AND METHODS

Study area

This study was conducted in January-March 2018 in Babakan Rancabayawak Hamlet, Cisaranten Kidul Village, Gedebage Subdistrict, Bandung City, West Java, Indonesia (Figure 1). Babakan Rancabayawak consists of several land cover types: riparian, shrubs, settlements, and home gardens. For assessment of bird population size, We divided the sampling area into three zones. Zone A consists of common bamboo (*Bambusa vulgaris*), candlenut (*Aleurites moluccanus*), and wild tamarind (*Leucaena leucocephala*). Zone B consists of *B. vulgaris*. Zone C consists of *B. vulgaris*, *L. leucocephala*, banana (*Musa* sp.), and giant sensitive plant (*Mimosa pigra*).

Procedures

Data collection was conducted using qualitative approaches, including bird population size, bird's nest observation, population distribution, vegetation, and prey.

The birds studied were *B. ibis*, *E. garzetta*, and *A. speciosa* of the family Ardeidae.

Bird population size

Data were collected by direct counting using the "in-out" technique (Iskandar 2017). The population size was assessed for 21 days by directly counting the population that comes out (out) and enter (in) to the nest in the *B. vulgaris*, as well as the birds that remain in or in around the bird's nest (Iskandar 2017). The counting (out) was conducted at 05.15 - 07.00 a.m. and continued until no more birds came out of the *B. vulgaris*. Meanwhile, the counting (in) was conducted at 04.00 - 06.00 p.m. and continued until no more birds returned to the *B. vulgaris*. When We counted birds that returned to the nest (in the evening), We did not count on birds that came out of the nest or vice versa to minimize multiple counting. The parameters observed in the calculation of population size, including bird species, the number of individuals. The direction of movement of each individual (in-out) was observed based on the four cardinal directions. Bird identification referred to the field guidebook of bird species in nature (Bibby et al. 1992; MacKinnon et al. 1992; Howes et al. 2003).

Vegetation types

An inventory survey was conducted to determine the vegetation type and plant composition in the bird's habitat. In addition, We recorded the plant species used as a nesting and resting place and place for hunting prey.

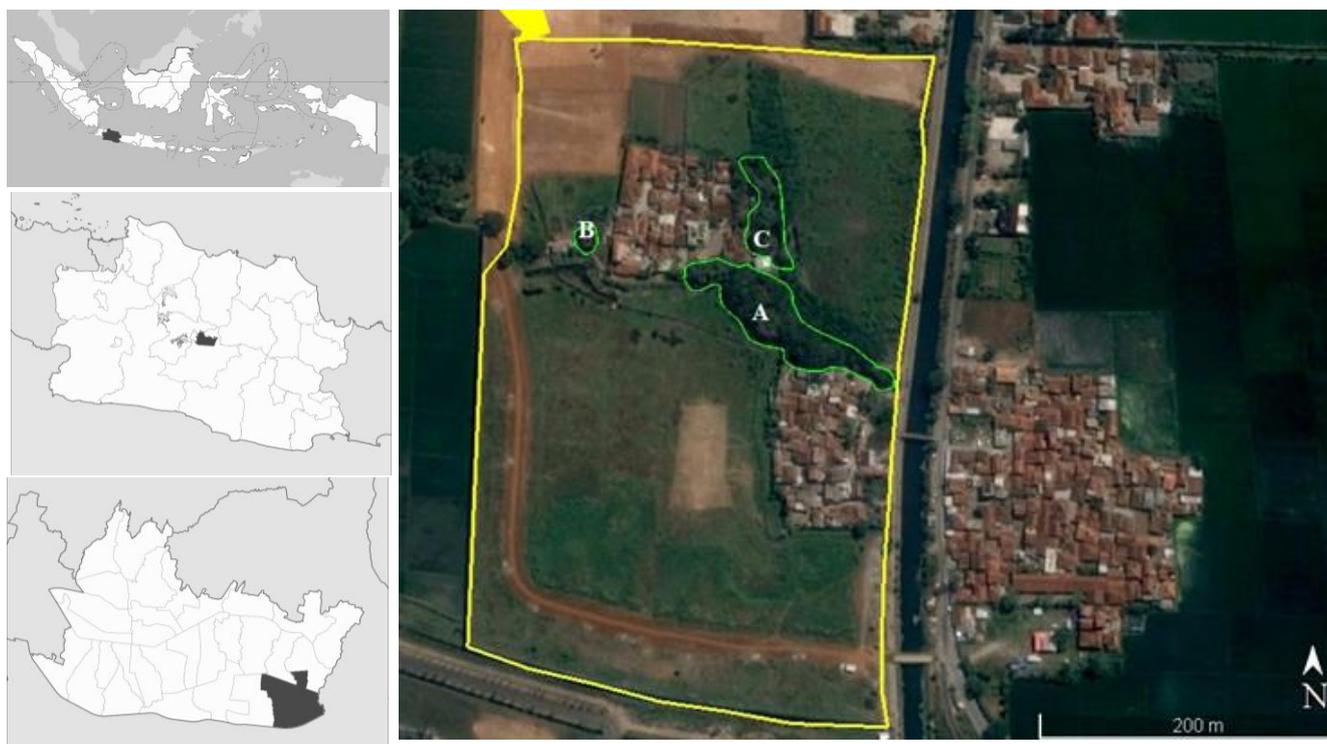


Figure 1. Study area in Babakan Rancabayawak Hamlet, Cisaranten Kidul Village, Gedebage Subdistrict, Bandung City, West Java, Indonesia. Note: yellow line: study area; green line: sampling area to assess the population size

Nest observation

Nest counting was carried out on nests that are still actively used by birds. Counting was conducted in three zones, including zone A (southern part), zone B (western part), and zone C (eastern part) (Figure 2).

Bird's prey

Data on birds' prey was obtained through semi-structured interviews and direct observation. The survey was conducted in the paddy fields around the Summarecon Apartment Settlement and *Gelora Bandung Lautan Api* (football stadium). The survey was also conducted by observing leftovers under clumps of *B. vulgaris*. The semi-structured interview was achieved through the purposive sampling of informants, e.g., farmers and village heads (*Ketua RW Babakan Rancabayawak*) who were considered to have in-depth knowledge of birds' prey.

Population distribution

Several procedures need to be performed to determine the distribution of birds, including capturing the birds, installing a mini GPS A8, marking birds using hair color, and morphometrics on the three birds species. Bird catching was done through mist nets. Mist net was made of nylon with a size of 4 cm x 14 cm x 3.5 m with a total of three bags. Three traps were deployed in the east during 12 hours (05.45 a.m. - 06.00 p.m.) and monitored every two hours. The three captured bird species were identified at the species level. In addition, morphometric measurements were performed, feather coloring to simplify identification, and the installation of a mini GPS.

The A8 mini GPS used had dimensions of 43.2 x 32 x 13.6 mm, weighs 5 grams, and is integrated on the GSM frequency on the 850/900/1900 Mhz network. The captured birds were GPS-mounted on their backs using tiny bags, and then the birds were released back into their habitat. Within 30 minutes, GPS will send an SMS (Short Messaging System) containing information about the location (google maps link), coordinates, and the remaining GPS battery. We deployed the A8 mini GPS for four days. After that, We caught those birds and removed the GPS.

Data analysis

Data were analyzed qualitatively. The population size of the birds was analyzed and displayed in the population size estimate (minimum-maximum). The minimum and maximum population size estimates were obtained from the calculation based on the in-out technique. Plant composition and communities, and prey were analyzed descriptively. Information on the distribution of birds is depicted in a map, then analyzed descriptively.

RESULTS AND DISCUSSION

Population size

Of 21 days, We used five days to assess the population size. We recorded *B. ibis* has the largest estimated population size compared to other birds, with an average of 1109 individuals (Table 1).

Table 1. Estimation of population size of birds

Species	Estimation of population size		
	Out	In	Mean
<i>Bubulcus ibis</i>	1087	1131	1109
<i>Egretta garzetta</i>	185	165	175
<i>Ardeola speciosa</i>	84	77	81
Subtotal	1357	1374	1365
Unidentified	269	361	315
Total	1626	1734	1680

Ardeola speciosa was recorded with the least estimated population size, with an average of 81 individuals. The *E. garzetta* was recorded with an average of 175 individuals. Therefore, We recorded the total population size of birds is 1680 individuals.

Vegetations of bird's habitat

The study site consists of several vegetation types, including riparian, shrubs, and home gardens (Table 2). We recorded 60 species in 29 families in the Babakan Rancabayawak. Riparian vegetation in the Rancabayawak River recorded 41 species from 21 families, dominated by *Imperata cylindrica*. Along the Rancabayawak River, the reforestation area is planted by *B. vulgaris*. This bamboo is deliberately grown by the community, hoping that the plant can be a nest to the birds.

The shrub vegetation consists of 20 species from 14 families. The vegetation is dominated by *M. pigra* and plays an essential role for birds. *Mimosa pigra* has a height <2 meters with peas, inviting other fauna, such as insects or spiders, as one of the birds' prey. Therefore, the existence of *M. pigra* must be maintained or preserved naturally. Based on the observation, *M. pigra* was used as a sleeping site, breeding site, feeding site, and roosting site by *A. speciosa*.

Home garden vegetation consists of 29 species from 18 families. *Leucaena leucocephala* dominates this vegetation. This species is used as a shelter, roosting, and sleeping site by *B. ibis*, *E. garzetta*, and *A. speciosa*. Besides, *B. vulgaris*, which is also found in the home gardens, is often used as a sleeping, breeding, feeding, roosting, and nesting site of *B. ibis*, *E. garzetta*, and *A. speciosa*. Therefore, *L. leucocephala* and *B. vulgaris* are very important for these birds to meet their daily needs.

Based on the calculation, 219 nests were found in zone A, 53 nests were found in zone B, and 57 nests were found in zone C (Figure 2). Thus, a total of 329 nests was made. During observation, *B. ibis*, *E. garzetta*, and *A. speciosa* tended to make a nest using twigs from *L. leucocephala*, *B. vulgaris*, *M. pigra*, and sometimes using *Cyperus rotundus*.

Egretta garzetta prefers higher trees with less shrubby undergrowth because it decreases the disturbance from the human being or other predators from the bottom of trees (Pang et al. 2019). In Faisalabad, Pakistan, cattle egrets were found to build their colonies where the area was not wild and preferably almost near water availability, roadside, and human vicinity (Kour and Sahi 2013; Abdullah et al. 2017). Male cattle egrets establish the breeding territory. The nest was typically built in *Acacia*

nilotica and *Syzygium cuminii*. The nest was made up of rough unlined structures of sticks, reeds, shrubs, and twigs retained in wedges of branches in trees. The cattle egrets started the nest building much before they had a mate. The cattle egrets were seen to collect twigs from the nearby fields, stealing from old nests and collecting from the ground, fallen from other nests (Abdullah et al. 2017).

The biological and ecological behavior of *B. ibis* colonies varies from one region to another, depending on certain intrinsic factors, but mainly by extrinsic factors, such as the availability of water and prey (Mohammedi et al. 2016) and the quality of nest trees for the safety of nests and chicks (Si Bachir et al. 2011). In North-Western Algeria, *B. ibis* nested on three plants such as *Ficus elastica*, *Jacaranda mimosifolia*, and *Pinus halepensis*. *Ficus elastica* is the most attractive than other trees for cattle egret's breeding. *Ficus elastica* hosted a larger population than *J. mimosifolia* and even more than *P. halepensis*. This preference may be related to the volume of vegetation cover and probably the foliage that provides covers, and subsequently, security (Mohammedi et al. 2020). The nest's height above the ground affects the breeding success while not influencing the clutch size (Ashoori and Barati 2013). Neb and Selmi (2019) showed that the clutch size and hatching success decreased when the breeding season progressed.

If viewed from the foraging habitat, birds use paddy fields as a place to hunt. The nearest paddy field from Babakan Rancabayawak includes paddy fields around *Gelora Bandung Lautan Api/GBLA* (football stadium) and residual paddy fields around Summarecon Apartment

Settlement, and paddy fields in Rancanumpang Village Gedebage Subdistrict. Information on the locations of these paddy fields was obtained from community and direct observation.

Birds' prey

One of the factors that cause birds to abound in a location is the availability of feed or prey. Based on the observation, 19 species were recorded as prey for the Ardeidae birds. Seven of the 19 species were observed through direct observation (Table 3). Generally, *E. garzetta*, *B. ibis*, and *A. speciosa* feed on fishes, insects, lizards, snakes, earthworms, frogs, snails, eels, and shrimps. Usually, the leftovers can be found below and between the clumps of *B. vulgaris* and at the foraging places (paddy fields).

The presence of grasses and shrubs was an ideal habitat for insects, allowing abundant prey for *E. garzetta* (Fadila et al. 2019). *Egretta garzetta* is popular for its role in bio-control cattle parasites and land pests. It feeds on a wide range of prey, mainly insects, moths, spiders, frogs, earthworms, and fishes (Shafey 2012), so the cattle egret's role was essential to the farmer (Rezk 2015). On the other hand, *B. ibis* depends on insects like a housefly, fish, and other invertebrates for food, particularly those that fly after being scared by related large mammals (Kour and Sahi 2012; Jayaratne et al. 2015). Jayaratne et al. (2015) also said that *B. ibis* is considered essential as they feed on the garbage sites of Sri Lanka and control the number of house flies.



Figure 2. Preference of plants as bird habitat to meet daily needs. A. Nests of *Bubulcus ibis* in *Bambusa vulgaris*, B. Nest of *Ardeola speciosa* in *Mimosa pigra*, C. Roosting site of *Leucaena leucocephala*, D. Roosting site in *Bambusa vulgaris*

Table 2. Plant composition in Babakan Rancabayawak Hamlet, Bandung City, Indonesia

Family species	Common name	Local name	Riparian	Shrub	Homegarden
Anacardiaceae					
<i>Mangifera indica</i> L.	Mango	<i>Mangga</i>	✓	✓	
Annonaceae					
<i>Annona muricata</i> L.	Soursop	<i>Sirsak</i>			✓
Araliaceae					
<i>Polyscias scutellaria</i> (Burm.f.) Fosberg	Balfour Aralia	<i>Mangkokan</i>			✓
Arecaceae					
<i>Cocos nucifera</i> L.	Coconut	<i>Kelapa</i>	✓		✓
<i>Cyrtostachys lakka</i> Becc.	Sealing-wax palm	<i>Palem merah</i>			✓
<i>Acmella paniculata</i> (Wall. ex DC.) R.K.Jansen	Toothache plant	<i>Rumput jotang</i>	✓		
Asteraceae					
<i>Ageratum conyzoides</i> L.	Billygoat-weed	<i>Babadotan</i>	✓	✓	
<i>Bidens pilosa</i> L.	Hairy beggarticks	<i>Harega</i>	✓	✓	
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Redflower ragleaf	<i>Sintrong</i>	✓	✓	
<i>Mikania cordata</i> (Burm.f.) B.L.Rob	Heartleaf hempvine	<i>Balakacida</i>	✓		
Bignoniaceae					
<i>Spathodea campanulata</i> P.Beauv.	African tulip tree	<i>Kiacret</i>			✓
Cannaceae					
<i>Canna indica</i> L.	African arrowroot	<i>Bunga tasbe</i>	✓	✓	
Caricaceae					
<i>Carica papaya</i> L.	Papaya	<i>Pepaya</i>	✓		✓
Combretaceae					
<i>Terminalia catappa</i> L.	Sea Almond	<i>Ketapang</i>	✓		
Convolvulaceae					
<i>Ipomoea batatas</i> (L.) Lam.	Sweet potato	<i>Ubi jalar</i>		✓	
Cyperaceae					
<i>Cyperus rotundus</i> L.	Java grass	<i>Rumput teki</i>	✓	✓	
Elaeocarpaceae					
<i>Elaeocarpus grandiflorus</i> Sm.	Lily of the valley tree	<i>Anyang anyang</i>		✓	
Euphorbiaceae					
<i>Acalypha siamensis</i> Gagnep.	Tumput	<i>Teh</i>			✓
<i>Antidesma bunius</i> (L.) Spreng.	Chinese laurel	<i>Buni</i>			✓
<i>Manihot esculenta</i> Crantz	Bitter cassava	<i>Singkong</i>	✓		✓
Fabaceae					
<i>Gliricidia sepium</i> (Jacq.) Kunth	Madre cacao	<i>Gamal</i>	✓		✓
<i>Leucaena leucocephala</i> (Lam.) de Wit	Wild tamarind	<i>Lantorogung</i>	✓	✓	✓
<i>Maniltoa grandiflora</i> (A.Gray) Scheff.	Handkerchief tree	<i>Pohon saputangan</i>			✓
<i>Mimosa pigra</i> L.	Giant sensitive tree	<i>Rumput garuk</i>	✓	✓	
<i>Mimosa pudica</i> L.	Sensitive plant	<i>Putri malu</i>	✓	✓	
<i>Paraserianthes falcataria</i> (L.) I.C.Nielsen	Albazia	<i>Albasiah</i>	✓		✓
<i>Parkia speciosa</i> Hassk.	Stink bean	<i>Petai</i>		✓	✓
<i>Samanea saman</i> (Jacq.) Merr.	Rain tree	<i>Trembesi</i>	✓		
<i>Sesbania grandiflora</i> (L.) Poir.	Vegetable hummingbird	<i>Turi</i>	✓		
Gnetaceae					
<i>Gnetum gnemon</i> L.	Gnemon tree	<i>Tangkil</i>			✓
Lauraceae					
<i>Persea americana</i> Mill.	Avocado	<i>Alpukat</i>	✓		✓
Malvaceae					
<i>Hibiscus macrophyllus</i> (Blume) Oken	Largeleaf rosemallow	<i>Tisuk</i>			✓
<i>Hibiscus rosa-sinensis</i> L.	China-rose	<i>Bunga sepatu</i>			✓
<i>Sida rhombifolia</i> L.	Arrowleaf sida	<i>Sidagori</i>	✓	✓	
Meliaceae					
<i>Swietenia macrophylla</i> King	Broad-leafed mahogany	<i>Mahoni</i>	✓		✓
Moraceae					
<i>Artocarpus communis</i> J.R.Forst. & G.Forst.	Breadfruit	<i>Sukun</i>	✓	✓	✓
<i>Artocarpus heterophyllus</i> Lam.	Jackfruit	<i>Nangka</i>	✓	✓	✓
Muntingiaceae					
<i>Muntingia calabura</i> L.	Malayan cherry	<i>Kersen</i>			✓
Musaceae					
<i>Musa x paradisiaca</i> var.	Banana	<i>Pisang</i>	✓		✓
Myrtaceae					
<i>Psidium guajava</i> Juss.	Guava	<i>Jambu batu</i>	✓		✓
<i>Syzygium aqueum</i> (Burm.f.) Alston	Water apple	<i>Jambu air</i>			✓

Oxalidaceae				
<i>Averrhoa carambola</i> L.	Star fruit	<i>Belimbing</i>		✓
<i>Oxalis corniculata</i> L.	Yellow wood sorrel	<i>Calincing</i>	✓	
Poaceae				
<i>Bambusa vulgaris</i> Nees	Common bamboo	<i>Bambu haur hijau</i>	✓	✓
<i>Chrysopogon zizanioides</i> (L.) Roberty	Vetivergrass	<i>Akar wangi</i>	✓	
<i>Cymbopogon citratus</i> (DC.) Stapf	Lemon grass	<i>Serai</i>	✓	
<i>Imperata cylindrica</i> (L.) P.Beauv.	Cogongrass	<i>Alang-alang</i>	✓	✓
<i>Leersia hexandra</i> Sw.	Southern cutgrass	<i>Kilameta</i>	✓	
<i>Pennisetum purpureum</i> Schumach.	Elephant grass	<i>Rumput gajah</i>	✓	
<i>Saccharum arundinaceum</i> Retz.	Hardy sugar cane	<i>Tebu</i>	✓	✓
Rubiaceae				
<i>Hedyotis corymbosa</i> (L.) Lam.	Two-flowered Oldenlandia	<i>Rumput mutiara</i>	✓	✓
Sapindaceae				
<i>Dimocarpus longan</i> Lour.	Longan	<i>Lengkeng</i>		✓
<i>Filicium decipiens</i> (Wi& Arn.) Thwaites	Fern tree	<i>Kisabun</i>	✓	
Solanaceae				
<i>Capsicum annum</i> L.	Cayenne pepper	<i>Cabai</i>	✓	
<i>Solanum melongena</i> L.	Eggplant	<i>Terong</i>	✓	
<i>Solanum torvum</i> Sw.	Turkey berry	<i>Tekokak</i>		✓
Verbenaceae				
<i>Lantana camara</i> L.	Shrub verbena	<i>Saliara</i>	✓	
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Blue porter weed	<i>Pecut kuda</i>	✓	✓
Zingiberaceae				
<i>Costus megalobrachteia</i> K.Schum	Costus	<i>Pacing</i>	✓	
<i>Etilingera elatior</i> (Jack) R.M.Sm.	Painted net leaf	<i>Honje</i>	✓	

Table 3. Birds' prey in Babakan Rancabayawak, Bandung City, Indonesia

Local name	Common name	Taxa	Data types
<i>Ikan emas</i>	Common carp fish	Cyprinidae	O
<i>Ikan nila</i>	Nile tilapia	Cyprinidae	O
<i>Katak</i>	Frog	Anura	O
<i>Capung</i>	Dragonfly	Odonata	O
<i>Kepiting sawah</i>	Freshwater crab	Gecarcinucoidea	O
<i>Ular</i>	Snake	Squamata	O
<i>Belut</i>	Eel	Synbranchidae	I
<i>Remis</i>	Mussels	Veneridae	I
<i>Keong sawah</i>	Freshwater snail	Ampullariidae	I
<i>Kasir</i>	Cricket	Gryllidae	I
<i>Laba-laba</i>	Spider	Arachnida	I
<i>Belalang</i>	Grasshopper	Orthoptera	I
<i>Udang</i>	Shrimp	Crustacea	I
<i>Ikan beunteur</i>	Rasbora fish	Cyprinidae	I
<i>Ikan tampele</i>	Betta fish	Cyprinidae	I
<i>Kecebong</i>	Tadpole	Amphibians	I
<i>Cacing</i>	Earthworm	Haplotaxids	I
<i>Orong-orong</i>	Asian grass lizard	Squamata	I
<i>Kadal</i>	Lizard	Squamata	O

Notes: O: Observation; I: Interview; Source: Primary Data (2018)

Distribution

Based on the tracking using GPS mini A8, *B. ibis* tends to move towards the east and south by the radius of 1-12 km. *Egretta garzetta* tends to move northwards with a radius of 1-2 km. *Ardeola speciosa* was traced to move south with a radius of movement of less than 1 km (Figure 3). Based on direct observation, the birds also move from all four cardinal winds.

Based on the distribution map of the birds, it can be seen that these birds are found in the green area. Green area is identified as paddy fields, ponds, settlements, industries,

and vacant or unused land. The paddy field is found dominant in the eastern and southern area of Babakan Rancabayawak Village as one of the factors influencing the distribution of the Ardeidae. Those areas are referred to the Rancaekek, Majalaya, and Solokan Jeruk. Pinto et al. (2013) stated that land cover affects the displacement and habitat use of Ardeidae, such as *Ardea alba*, *Ardea cocoi*, and *B. ibis*. Therefore, We assume that the movement of birds is influenced by the source of foraging, in this study, the paddy field.

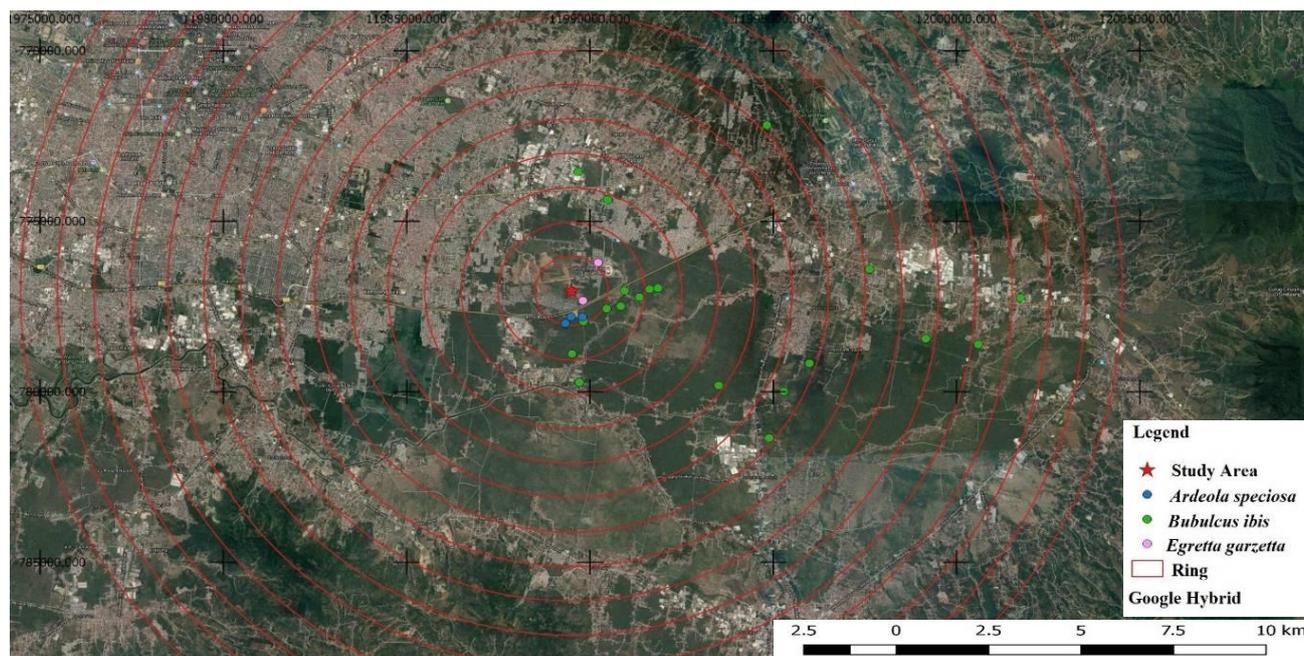


Figure 3. Distribution of *Bubulcus ibis*, *Egretta garzetta*, and *Ardeola speciosa* in West Java, Indonesia

The farthest radius of distribution from Babakan Rancabayawak is 12 km. In general, birds of the Ardeidae can explore various wetland habitats (Pinto et al. 2013). Most of the wetlands within a radius of 12 km from Babakan Rancabayawak are paddy fields in the Rancaekek, Majalaya, and Ciparay. Therefore, We assume that the paddy fields in these areas are essential habitats for Ardeidae birds to meet their daily needs.

We conclude that *B. ibis*, *E. garzetta*, and *A. speciosa* will still survive in the Babakan Rancabayawak, Gedebage Subdistrict. *Bambusa vulgaris*, *L. leucocephala*, and *M. pigra* are plants that are used as perching and nesting sites by *B. ibis*, *E. garzetta*, and *A. speciosa*. The estimated population mean of those birds was 630 individuals, 92 individuals, and 43 individuals, respectively, with the population average of those birds, is 1680 individuals. The number of birds' nests is 329 nests. Based on distribution mapping, birds moved east and south, covering paddy fields in Rancaekek, Solokanjeruk, and Majalaya within a radius of 12 km. Management effort can be conducted by not cutting down the plants that become nesting and perching sites and maintaining the wetlands in their habitats.

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