Biodiversity of birds and mammals in the Lake Siombak ecosystem, Medan North Sumatra

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Abstract. The Lake Siombak ecosystem is one of the important ecosystems in the north coast of Medan City, North Sumatra because it’s a combination of lake ecosystems, mangroves, and aquaculture areas. Therefore, it brings into a habitat of various flora and fauna, both aquatic and terrestrial area. This study aims to map the spatial and temporal distribution of terrestrial biota, especially birds and mammals in Lake Siombak ecosystem. This research was conducted in Lake Siombak, from September 2018 to August 2019. The data collected is the number of individuals of birds and mammals. The results of research found 12 species of birds and 2 species of mammals. There are 3 rare species and protected species by both the government and internationally, namely the rhinoceros’ hornbill (Buceros rhinoceros), Brahminy kite (Haliastur indus), and Silvery lutung (Trachypithecus cristatus). Great egret (Ardea alba), Intermediate egret (Egretta intermedia), and Gull billed tern (Sterna nilotica) are also government-protected bird species, but they have not received international attention. Spatially and temporally, Great egret and Intermediate egret are found in abundance at the Lake Siombak ecosystem. Meanwhile, the rhinoceros’ hornbills, Brahminy kite, and Silvery lutung were only found once at the study site.

1. Introduction
The Lake Siombak ecosystem is one of the important ecosystems because it is a combination of lake ecosystems, mangroves, and aquaculture areas in the north coast of Medan City. Therefore, Lake Siombak is a unique, distinctive ecosystem and has many different types of habitats. Lake Siombak which has an area of about 29 hectares [1] is surrounded by various types of mangroves that grow on the lake border, especially in the southeast and north [2,3]. This lake is inhabited by various types of fish, crustaceans, and mollusks, both fresh, brackish, and marine [2,4].

The existence of different types of habitats in the lake siombak ecosystem is also very possible as a habitat for various terrestrial organisms, such as birds and land mammals. Water birds use the mangrove forest as a resting place and a stretch of mud at low tide as well as other wetland areas such as ponds and rice fields as a feeding area [5,6]. Wetlands such as lakes, mangroves, and ponds are important
habitats for waterbirds as a place for breeding, nesting, and raising their young, foraging for food, drinking water sources, shelter, and social interaction. The existence of waterbirds in wetlands is influenced by many factors including altitude and water quality; availability of food, shelter and nesting and predators [7,8]. Meanwhile, land mammals, such as monkeys, use mangrove ecosystems as habitat for foraging (mangrove fruit) [6,9].

Research related to terrestrial biodiversity in ecosystems and shores has never been reported. So far, reports related to biodiversity are related to aquatic organisms [2-4]. The purpose of this study was to describe the spatial and temporal distribution of terrestrial biota in the Lake Siombak ecosystem and its surroundings.

2. Materials and methods

2.1. Study site
This research was conducted in the Lake Siombak, Medan City, North Sumatra Province, Indonesia. This research was conducted from September 2018 to August 2019. The tools used in this study is Nikon B700 as the camera remotely (for bird watching), GPS Garmin Oregon 65 with accuracy up to 3 m, and stationery.

![Figure 1. Sampling location](image)

2.2. Data collection
Data collection was conducted by making visual observations by the Nikon B700 camera with a portrait distance range up to 1 km. Bird identification refers to Phillipps & Phillipps [10], and Sukmantoro et al. [11]. While mammals were identified based on books Phillipps & Phillipps [12], and Supriatna et al. [13].

2.3. Data analysis
Data analysis was carried out descriptively and compared with other studies on tidal lakes.
3. Results and discussion

3.1. Species richness of birds and mammals

The identification results of terrestrial biota in the Lake Siombak ecosystem found 12 species of birds and 2 species of mammals (Table 1). Family Ardeidae contributes 3 species of birds namely A. alba, E. intermedia, and I. cinnamomeus. Based on community information that Buceros rhinoceros (The rhinoceros’ hornbill) occasionally appeared in the Lake Siombak area, especially at the inlet / outlet of the lake (station 8). This bird is a rare bird in the IUCN category status as Vulnerable [12]. The Buceros rhinoceros is one of the largest hornbills. This bird also lives in the forests of Sumatra and Java [10,11]. Another rare and threatened species found in the lake siombak ecosystem is Brahminy kite (H. indus). The hornbill and Brahminy kite are protected species in Indonesia [14].

Monkey (Macaca fascicularis) and The silvery lutung (Trachypithecus cristatus) based on the IUCN category, both are land mammals in the vulnerable category [13]. Lutung is found in mangrove forests, and forests around the coast and rivers of Indochina, Thailand, the Malay peninsula, Sumatra island, Borneo island and several other small islands [12,13]. Hornbills, Brahminy kite, and langurs are 3 protected species in Indonesia [14].

Table 1. Bird species were found at Lake Siombak ecosystem.

| No | Family            | Species                  | Indonesian name               | Common name                      |
|----|-------------------|--------------------------|-------------------------------|----------------------------------|
| 1  | Accipitridae      | Haliastur indus          | Elang Bondol                  | Haliastur indus                  |
| 2  | Ardeidae          | Ardea alba               | Kuntul besar                  | Great egret                      |
| 3  | Egretta intermedia| Egretta intermedia       | Kuntul perak                  | Intermediate Egret               |
| 4  | Ixobrychus cinnamomeus | Bambangan merah         |                               | Cinnamon bittern                 |
| 5  | Bucerotidae       | Buceros rhinoceros *     | Rangkong badak                | The rhinoceros’ hornbill         |
| 6  | Cuculidae         | Centropus bengalensis    | Bubut alang-alang             | Lesser coucal                    |
| 7  | Hirundinidae      | Hirundo tahitica         | layang-layang                 | The Pacific swallow              |
| 8  | Laridae           | Sterna nilotica          | Camar laut                    | Gull billed tern                 |
| 9  | Passeridae        | Passer domesticus        | Burung Gereja                 | house sparrow                    |
| 10 | Phalacrocoracida  | Phalacrocorax sulcirostris | pecuk hitam                  | Little Black                     |
| 11 | Rallidae          | Amaurornis phoenicurus   | Kareo padi                    | Cormorant white-breasted waterhen|

Mammals

| No | Cercopithecidae | Macaca fascicularis | Monyet | Cynomolgus monkey |
|----|-----------------|---------------------|--------|------------------|
| 12 | Cercopithecidae | Trachypithecus cristatus | Lutung kelabu | The silvery lutung |

*Information source of local community

The biodiversity of birds and mammals in Lake Siombak is lower than those found in Teluk Belukar (Nias-Indonesia), as many as 48 species of birds and 7 species of mammal species [15]. The high diversity of birds and mammals in Belukar Bay is due to the wider area of mangroves and lakes in Teluk Belukar compared to the Lake Siombak ecosystem [1-3]. As described by Giessen et al. [6] and Rangkuti et al. [9] that the mangrove ecosystem is a habitat for various terrestrial ecosystems, including birds and land mammals. Bird diversity in other tidal lakes overseas strengthen the fact of lower diversity of species in Lake Siombak, where in Keta and Muni Lagoon (Ghana) 25 species are found [16], in Ribeira
lagoon (Brazil) 174 birds with 54 bird species of it are water bird [17]. In Chile Lake (Odisa India) 205 species of birds were found [18]. This shows that birds in Lake Siombak are lower than other coastal lakes. However, there is a relative similar condition with the Pulicat Lake (Pradesh, India) that also found 13 bird species [19] and 12 bird species in the Nallavadu lagoon (Puducherry, India) [20].

3.2. Spatial distribution of birds and mammals
Spatially, the bird population was more abundance in the west to the river (Table 2). This is assumed due to the density of mangroves (dominated by Nipah) as a halting place for birds. Malindu et al. [21] found a positive correlation to bird populations in mangrove ecosystems. In addition, one of the causes of bird abundance at a location is the availability of foodstuffs [22]. At the river side and station 3 is a shallow area where egrets can find fish and other macroinvertebrates. A. alba and E. garzetta are water birds that usually forage in coastal areas or muddy river estuaries. All three species are fish predators and generally have special habits for foraging by standing in a place or following prey [22].

Monkeys and Langurs also use mangroves for shelter and eat mangrove leaf [23]. Anggraeni et al. [24] that mangroves are a habitat for monkeys and include their food source. Monkeys feed the plant parts such as the fruit and young leaves. Other food sources come from animals, namely Crab (S. serrata) and Mimi (C. rotundicauda) [23].

The great egret (Ardea alba) and Intermediate egret (Egretta intermedia) spread more widely than other birds in Lake Siombak ecosystem. Both were found in large numbers (more than 10 birds per station). At low tide (morning) they were seen to look for food in the mud plain area at stations 3, 10, and 11. While at high tide (noon) they were seen perching on a mangrove tree on the edge of the lake and river at the research location. Birds are generally active foraging in the morning and evening, while during the day reduce their activity by taking shelter and resting in nests or resting trees [22]. Elfidasari [22] and Syahputra et al. [24] found that A. alba and E. garzetta prefer foraging in ponds, rice fields and mud flats.

Swallows and sea gulls are bird species found in large numbers at the study area. However, unlike the egrets, the distribution of swallows and sea gulls is limited to stations 7 to 8. Even, sea gulls are also seen at station 11. Sea gulls and kites are bird species that live in groups. Usually the two birds have a cluster above the water surface [25].

Table 2. Spatial distribution of birds and mammals in the Lake Siombak ecosystem.

| Scientific name     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---------------------|---|---|---|---|---|---|---|---|---|----|----|
| Bird                |   |   |   |   |   |   |   |   |   |    |    |
| A. phoenicurus      | * |   |   |   |   |   |   |   |   |    |    |
| A. alba             | ** | * | * | ** | ** | * | *** | *** | *** |    |    |
| B. rhinoceros       |   |   |   |   |   |   |   |   |   |    |    |
| C. bengalensis      | * | ** |   |   |   |   |   |   |   |    |    |
| E. intermedia       |   |   |   |   |   |   |   |   |   |    |    |
| H. indus            |   |   |   |   |   |   |   |   |   |    |    |
| H. tahitica         |   |   |   |   |   |   |   |   |   | *** | *** |
| I. cinnamomeus      |   |   |   |   |   |   |   |   |   | *** | *** |
| P. domesticus       |   |   |   |   |   |   |   |   |   | *** | *** |
| P. sulcirostris     |   |   |   |   |   |   |   |   |   | *** | *** |
| S. nilotica         |   |   |   |   |   |   |   |   |   | *** | *** |
| Mammals             |   |   |   |   |   |   |   |   |   |    |    |
| M. fascicularis     | ***| ***| ***| ***| ***| ***| ***| ***| ***| ***| ***|
| T. cristatus        | ***| ***| ***| ***| ***| ***| ***| ***| ***| ***| ***|

Note: * few (1-3 tails), ** many (5-10 tails), *** more abundance (> 10 tails)
3.3. Temporal distribution of birds and mammals

Temporally it also shows that Great egret (Ardea alba) and Intermediate egret (Egretta intermedia) are always present in the Lake Siombak ecosystem (Table 3). Meanwhile, Brahminy kite was only found in August during a year of observation, including hornbills only halting in February based on community information. This indicates that the Siombak Lake ecosystem and its surrounding is habitat for Great egret and Intermediate egret. Meanwhile, for Brahminy kite and the hornbill, Lake Siombak is only as a halting place. Bondol eagles and hornbills are birds that have a higher range [26,27] than other birds.

The langurs found in Lake Siombak are also a group of mammals that halting in a moment from the surrounding forest ecosystem. The habitat of langurs in the mangrove ecosystem around the city of Medan is closed to Secanang Belawan mangrove forest and the Pecrut mangrove forest [28]. These langurs are only found in May and June. It is possible that the langur halted to look for food. Lutung prefers young leaves or shoots. Gray langur likes fruit, leaves and bark of prepat (Soneratia caseolaris), leaves and bark of gendorusa (Morinda citrifolia), chemical leaves / seruni (Wedelia biflora), leaves and bark of mangroves (Rhizophora apiculata), cempuk leaves (Passiflora foetida), leaves and cempuk leaves (Passiflora foetida), leaves and bark of napah (Nypa fructicans) [28]. These foods are almost available all around Lake Siombak, where the results of research from Muhtadi et al. [3] found 14 species of mangroves in the lake siombak ecosystem which is dominated by Nypa fructicans and Soneratia caseolaris.

Another case with monkeys, the Lake Siombak ecosystem is found every month at stations 3, 10, and 11. Monkey is primate that has a wide distribution in Indonesia [23]. It’s found in various forest types both in the lowlands and highlands [23]. This shows that the Lake Siombak ecosystem is a habitat for monkeys and Langurs as a transit area for foraging.

| Scientific name | Sept | Oct | Nov | Dec | Jan | Feb | Marc | Apr | May | Jun | Jul | Aug |
|-----------------|------|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|
| **Bird**        |      |     |     |     |     |     |      |     |     |     |     |     |
| A. phoenicurus  | *    | *   | *   | *   | *   | *   | *    | *   | *   | *   | *   | *   |
| A. alba         | ***  | *** | *** | *** | *** | *** | ***  | *** | *** | *** | *** | *** |
| B. rhinoceros   |      |     |     |     |     | *** |      |     |     |     |     |     |
| C. bengalensis  | *    | *   | *   | *   | *   | *   | *    | *   | *   | *   | *   | *   |
| E. intermedia   | ***  | *** | *** | *** | *** | *** | ***  | *** | *** | *** | *** | *** |
| H. indus        |      |     |     |     |     |     | ***  |     |     |     |     |     |
| H. tahitica     | ***  | *** | *** | *** | *** | *** | ***  | *** | *** | *** | *** | *** |
| I. cinnamomeus  | *    | *   | *   | *   | *   | *   | *    | *   | *   | *   | *   | *   |
| P. domesticus   | **   | **  | *   | *   | *   | *   | **   | *   | *   | *   | *   | *   |
| P. sulcirostris | *    | *   | *   | *   | *   | *   | ***  | *   | *   | *   | *   | *   |
| S. nilotica     | *    | *   | *   | *   | *** | *** | *    | *   | *   | *   | *   | *   |
| **Mammals**     |      |     |     |     |     |     |      |     |     |     |     |     |
| M. fascicularis | ***  | *** | *** | *** | *** | *** | ***  | *** | *** | *** | *** | *** |
| T. cristatus    |     |     |     |     |     | *** |     |     |     |     |     | *** |

Note: * few (1-3 tails), ** many (5-10 tails), *** more abundance (> 10 tails)

4. Conclusions

Spatially and temporally, Great egret (Ardea alba) and Intermediate egret (Egretta intermedia) are found abundance in the Lake Siombak ecosystem. Meanwhile, hornbills (Buceros rhinoceros), Brahminy kite (Haliastur indus), and The silvery lutung (Trachypithecus cristatus) were only found once at the study site. There are 3 rare species and are protected by the government and internationally, namely the hornbill (Buceros rhinoceros), Brahminy kite (Haliastur indus), and The silvery lutung
(Trachypithecus cristatus) found at the study site. The great egret (Ardea alba), Intermediate egret (Egretta intermedia) and Gull billed tern (Sterna nilotica) are also government-protected bird species, but they are still less concern internationally.

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