

IDENTIFICATION OF MIGRATORY BIRDS AND THEIR SPECIFIC CHARACTERISTICS OF HABITAT IN THE SALT WATER LAKE OF GILI MENO, NORTH LOMBOK DISTRICT

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ABSTRACT

The aim of this research was to identify the species of migratory birds in the ecosystem of salt water lake of Gili Meno and their specific characteristics of habitat. Data collection for birds, mangrove and fish species has been carried out in September and October 2013. In this study, a Shannon-Wiener Diversity Index and Importance Value Index (IVI) of mangrove vegetation were calculated to identify carrying capacity of mangrove population in the form of specific habitat in salt water lake of Gili Meno. This research has identified 17 species of birds which are divided into 5 families: Scolopacidae, Charadriidae, Ardeidae, Meropidae and Alcedinidae. Moreover, 3 species of mangrove were discovered that are *A. marina*, *A. lanata* and *E. Agallocha*, as well as one species of fish (Mujair fish/*O. mossambicus*). *N. Nycticorax* and *B. Striatus* were well-known to have higher population than other bird species. The Diversity Index showed that mangrove vegetation in the ecosystem of salt water lake of Gili Meno has a low species diversity (0.565). This is due to higher dominance of one species than the others. What is more, the IVI of *A. marina* demonstrated a fairly significant value compared to that of other species (189,01). Mangrove vegetation which surrounds the ecosystem of salt water lake of Gili Meno has formed a unique habitat and an ideal stopover site for migratory birds. The ecosystem not only provides shelters from predators but also supplies for various abundant feeding sources. The lake itself is rather shallow and muddy around the shore which gives advantages for the migratory birds to obtain plenty small fish from the lake.

Keywords: Migratory Birds, Salt water lake, Gili Meno and Characteristics of habitat

INTRODUCTION

Indonesia is the fifth country after Colombia, Peru, Brazil and Ecuador which have the highest megabiodiversity of birds, as many as 1539 species (Sudaryanto, 2006). Those species are divided into 20 Order and 90 Families (Yamin and Jamaluddin, 2002) and some of them are endemic (around 381 species). The increasing habitat degradation has led to the fact that nearly 400 species of birds are now threatened with extinction (Thinh, 2006).

One of bird groups that are interesting to study is migratory birds. This group is a bird group that move from one region to another, either inter-island or inter-continent, and will return to their origin (Shackelford *et al.*, 2005). This migration occurs because of seasonal change or the birds feeding habits in a relatively far distance. Small islands in Indonesia provide habitats for a variety of migratory bird species to stopover. Habitat characteristic of various ecosystems in each

island possesses its own specific and unique characteristics. Often, these migratory birds can attract tourists visiting the islands (Aeny, 2004).

One of small islands (Lombok: small island = gili) that exist around Lombok Island is Gili Meno. This small island is one of three islands included in Gili Matra village. Gili Meno is well-known for its specific and unique salt water lake (Rachman, 2004) and has a pleasing panorama. Moreover, its ecosystem also saves a great potential of various exotic animal species. Research conducted by Setiawan (2008) explained that no less than 11 species of migratory birds use the habitat to stopover in migration season. Some of them are *Phalacrocorax melanoleucos*, *Actitis hypoleuco*, *Ardea purpurea* and *Charadrius dubius*.

To date, several researches have been carried out to identify many migratory bird species in the ecosystem of salt water lake of Gili Meno, one of them is by Setiawan (2008). However, in the research, field observation was only performed once and the researcher has not done a study of microhabitat and factors that make the salt water lake as one of preference habitat for migratory birds. Therefore, this research was conducted to identify the diversity of migratory bird species in the ecosystem of salt water lake of Gili Meno and recognize the habitat

characteristics that could support the wild birds' lives in the ecosystem.

MATERIALS AND METHODS

The objects of this research were migratory birds utilizing the lake as their activity place. This research was undertaken in September and October 2013. The first data collection was performed on the 24th-26th of September and the second data collection was completed on the 18th-20th of October 2013. Data collected were bird species, mangrove vegetation and fish species.

Data collection of bird species was conducted on field in the morning from 07.00-10.00 and in the afternoon from 15.00-17.00. The observation was performed in 4 spots which were determined purposively on field. Bird species were observed and identified by directly observing morphological features and characteristics of the birds based on a guide to the birds of Wallacea (Coates and Bishop, 2000). Morphological features observed included: (i) shape and size of body, beak and feet, (ii) the colours of feather on body, beak, and feet, (iii) visible specific features, as well as (iv) sounds produced.

Analysis of mangrove vegetation was performed on sampling spots that have been directly marked by a GPS device. The vegetation analysis was undertaken by making 10 x 10 m quadrants. Obtained vegetation data included vegetation species, trunk diameter, and the individual number of each species. Furthermore, fish were caught utilizing a fish net in cooperation with local community. The vegetation data were then analysed by calculating density, Frequency, Dominance, IVI, and Shannon-Wiener Diversity Index (H').

RESULTS AND DISCUSSIONS

A total of 17 species belonging to 5 families have been identified in this research. The five bird families are Scolopacidae, Charadriidae, Ardeidae, Meropidae dan Alcedinidae. Of the 17 identified species, 16 species are migrants (Table 1). The non-migrant bird and inhabitants of Gili Meno is the species of *Halcyon sancta*.

Black-crowned Nirtg-heron (*N. Nycticorax*) is a species with the highest population identified. As stated by Coates

Other fairly numerous migratory bird species discovered during this research were those belong

and Bishop (2000), this species is a migratory species that reproduce in their migration sites. On several observation spots in the vicinity of mangrove forest, their active and already inactive nests were discovered. In addition to that, it was observed that Striated Heron (*B. striatus*) was also on fairly high population number. Both bird species are known to prefer similar habitat which is mangrove area, muddy sites and shallow puddle (Zulfan, 2009; Setiawan 2008; Mustari, 1992). These species difference is in their feeding activity. *Nycticorax nycticorax* was more often spotted perched on tree branches and once in a while went down to catch small fish. Meanwhile, *B. striatus* was more active and often walked around the lake to find preys.

This research discovery is supported by previous research conducted by Setiawan (2008) who also discovered both bird species in high individual number. It was further stated that mangrove ecosystem in salt water lake of Gili Meno could highly sustain the existence of the two species population. Additionally, food availability in the vicinity of lake and the lake's proximity to adjacent beach also provided more varied habitat choices for these birds.

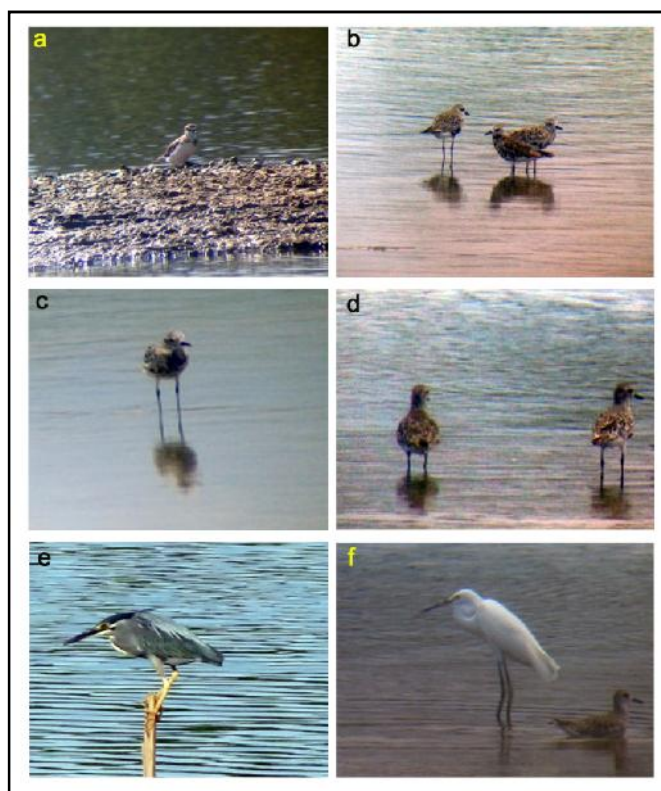


Figure 1. Documented bird species. a. Cerek Jawa (*Charadrius javanicus* Chasen, 1938); b & c. Cerek Besar (*Pluvialis squatarola*); d. Trinil Semak (*Tringa glareola* Linnaeus, 1758); e. Kokokan Laut (*Butoroides striatus*); f. Kuntul Kecil (white) (*Egretta garzetta*), Trinil Pantai/small brown (*Actitis hypoleucos*).

to Trinil category i.e: Common Sandpiper (*Actitis hypoleucos*), Wood Sandpiper (*Tringa glareola*),

Marsh Sandpiper (*Tringa stagnatilis*) and Common Redshank (*Tringa tonatus*). Detailed observation has successfully identified the four species clearly. Detailed observation was necessary because occasionally, these four species were in large group (>10). The observation of these bird species was basically simple to perform due to significant differences in size and features of each species. Nevertheless, *A. hypoleucos* and *T. glareola* were often found feeding in pairs or individual on the lake shore.

Another migratory bird category is Cerek including Little Ringed Plover (*Charadrius dubius*), Javan Plover (*C. javanicus*) and Grey Plover (*Pluvialis squatarola*). Two of the three species (*C. Javanicus* and *Pluvialis squatarola*) have not been reported in the study conducted by Setiawan (2008), this might be because of different observation time. According to Coates and Bishop (2000), both species are migratory birds and do not reproduce so that sometimes they are not observed in certain time. It was further explained that the three species prefer shallow and calm mangrove habitat, natural habitat and far from human activity. This result demonstrate that the three migratory species presence can be utilized as habitat indicator

that salt water lake of Gili Meno can support the lives of wild animals. Mulyawati (2007) also reported that this bird group likes muddy mangrove area and shallow water.

The next bird category observed was Kuntul comprising 3 species: Little Egret (*Egretta garzetta*), Reef Egret (*E. sacra*) and Intermediate Egret (*E. intermedia*). The population of *E. Garzetta* was the highest of the three species with the highest individual number observed on field was 16 individuals. This species occupied almost half of the lake's shore around 08.00-09.00 and 15.00-17.00 when they are actively feeding. On the other hand, *E. intermedia* was only found 4 individuals at the most during the research. Posture, larger body size and typical beak colors (bright yellow) appears to distinguish the two species. Unlike *E. garzetta* and *E. scara*, *E. intermedia* often becoming active between 09.00-10.00 and sometimes it was not observed in the afternoon. Meanwhile, *E. sacra* was rarely seen lingering around the lake. This may be due to food competition on the lake shore. The species was mostly spotted on the beach shore at low tide in the afternoon then returned to the mangrove ecosystem afterward.

Table 1. Birds species discovered in salt water lake ecosystem of Gili Meno

Family	Indonesia	English	Latin
Scolopacidae	Trinil Pantai	Common Sandpiper	<i>Actitis hypoleucos</i>
	Trinil Semak	Wood Sandpiper	<i>Tringa glareola</i>
	Trinil Kaki Merah	Common Redshank	<i>Tringa tonatus</i>
	Trinil Rawa	Marsh Sandpiper	<i>Tringa stagnatilis</i>
	Gajahan Erasia	Eurasian Curlew	<i>Numenius arquata</i>
Charadriidae	Cerek Kalung Kecil	Little Ringed Plover	<i>Charadrius dubius</i>
	Cerek Jawa	Javan Plover	<i>Charadrius javanicus</i>
	Cerek Besar	Grey Plover	<i>Pluvialis squatarola</i>
Ardeidae	Cangak Merah	Purple Heron	<i>Ardea purpurea</i>
	Kuntul Perak	Intermediate Egret	<i>Egretta intermedia</i>
	Kuntul Kecil	Little Egret	<i>Egretta garzetta</i>
	Kuntul Karang	Reef Egret	<i>Egretta sacra</i>
	Kowak Malam Abu	Black-crowned Nigrt-heron	<i>Nycticorax nycticorax</i>
	Kowak Malam Merah	Rufous Nigtt-heron	<i>Nycticorax caledonicus</i>
	Kokokan Laut	Striated Heron	<i>Butoroides striatus</i>
Meropidae	Kirik-Kirik Laut	Blue-tailed Bee-eater	<i>Merops philippinus</i>
Alcedinidae	Cekakak Suci	Sacred Kingfisher	<i>Halcyon sancta</i>

Other bird species that were observed around the lake were Sacred Kingfisher (*Halcyon sancta*) and Blue-Tailed Bee-eater (*Merops philippinus*). Sacred Kingfisher often noticed on several spots on the lake shore to catch small fish. Decreasing lake water has led to higher salinity causing small fish to surface, so that it was easier for the birds to catch their prey. Occasionally, Sacred Kingfisher

produced strong sounds when they flew or met the same species. In contrast, *M. philippinus* was more aerial. This species make use of mangrove habitat as feeding site which provide abundant insects.

Mangrove ecosystem is an integral part of the ecosystem of salt water lake of Gili Meno. This mangrove ecosystem provide excellent microhabitat for many wild animals, especially migratory birds.

As stated by Elfidasari and Junardi (2006), one of many functions of mangrove is as nesting and stopover sites for various bird species. Healthy mangrove ecosystem is more preferred and visited by many bird species as it provide huge potential as food sources.

Mangrove ecosystem in Gili Meno consist of three mangrove species: *Avicennia lanata*, *Avicennia marina* dan *Exoecaria agallocha*. The calculation of species relative dominance showed that *A. marina* dominate the habitat in the ecosystem of the salt water lake (69.45%), followed by *A. lanata* (23.81%) and *E. agallocha* (6.74%). Moreover, relative species density index also illustrated a fairly dense coverage of *A. marina*. In contrast, species diversity index (0.565) demonstrated the low species diversity in the mangrove ecosystem because of *A. marina* dominance.

In addition to plant resources, the habitat of

salt water lake of Gili Meno also offer animal resource for migratory bird feeding. The mangrove ecosystem ability to maintain the stability and fluctuation of salinity and temperature causes fresh water species capable to adapt in the saltwater habitats. From the results of fishing using fishing nets and rods it was found that only one species of fish inhabit the whole habitat of the salt water lake. The identified species is Mujair fish (*Oreochromis mossambicus*). As indicated by Kosztowny *et al* (2008), this fish species can adapt well in salt water from juvenile. This is because of its ability to activate ATPase anzyme to maintain cell membrane activity, especially on the gill rakers to keep active despite the high salinity. Further research to identify other animal species which is potential as feeding resource for migratory birds is of high importance. Moreover, research on the histological and anatomic differences of Mujair fish from salt water and fresh water is required.



Figure 2. Coverage shape and characteristics of mangrove a. *Avicennia marina* with close coverage along the lake shore b. Oval leaf tip shape with white lower leaf surface is the diagnostic character of *A. marina*.

The calculation of Importance value Index (IVI) showed that the most important species was *A. marina*. This species was discovered almost in all ecosystem area around the salt water lake. This was supported by the calculated diversity index of Shannon-Wiener which showed the low diversity of mangrove vegetation in the ecosystem. In other words, the ecosystem is dominated by *A. marina*.

The existence of mangrove vegetation in a habitat will form a specific ecosystem and provide abundant resources. Davies *et al.*, (1996) stated that mangrove ecosystems have important roles in sustaining the lives of animals on coastal line and terrestrial. Mangrove vegetation in the ecosystem of salt water lake of Gili Meno also provide abundant feeding resource for migratory birds like small insects and fish. This is also supported by Abdurakhman (2002) research who discovered that food availability in a habitat will be more frequently visited by animals (burung). Yamin and

Jamaludin (2002) also explained that excellent vegetation will provide diverse resources to sustain bird lives in a habitat.

Dominant bird species observed in this study is Black-crowned Night-heron (*N. nycticorax*) and Striated Heron (*B. striatus*) which are migratory birds that reproduce in their migration sites (Coates and Bishop, 2000). Both species made many nests on dense mangrove tree canopy. These species have successfully dominated the ecosystem of salt water lake of Gili Meno may because both species can obtain their suitable life requirements such as food, nesting place and shelter from predators.

Other migratory birds which belong to Tringid category (*A. hypoleucos* and *T. glareola*) often spotted fly actively and walked along the shallow lake shore to find food. Both species are different from other two species from the same group (*T. stagnatilis* and *T. totanus*). *T. stagnatilis* and *T. totanus* are relatively not very active and often

Table 2. Data analyses of mangrove vegetation biodiversity

Name		Sum	Value				
Indonesia	Latin		RDen	RF	RD	IVI	H'
Api-api putih	<i>Avicennia marina</i>	23	22,55	42,11	23,81	88,46	
Api-api	<i>Avicennia lanata</i>	79	77,45	42,11	69,45	189,01	0,565
Buta-but	<i>Exoecaria agalocha</i>	8	7,84	15,79	6,74	30,37	

Explanation :

RDen : Relative Density
 RF : Relative Frequency

RD : Relative Dominance
 IVI : Importance Value Index
 H' : Shannon-Wiener Diversity Index

observed in groups. The high availability of small fish and water insects on the surface of the lake make the lake habitat is mostly preferred by many migratory bird species. The lake ecosystem which

almost 90% covered by mangrove vegetation contribute to the ideal condition of the habitat for migratory birds to stopover.

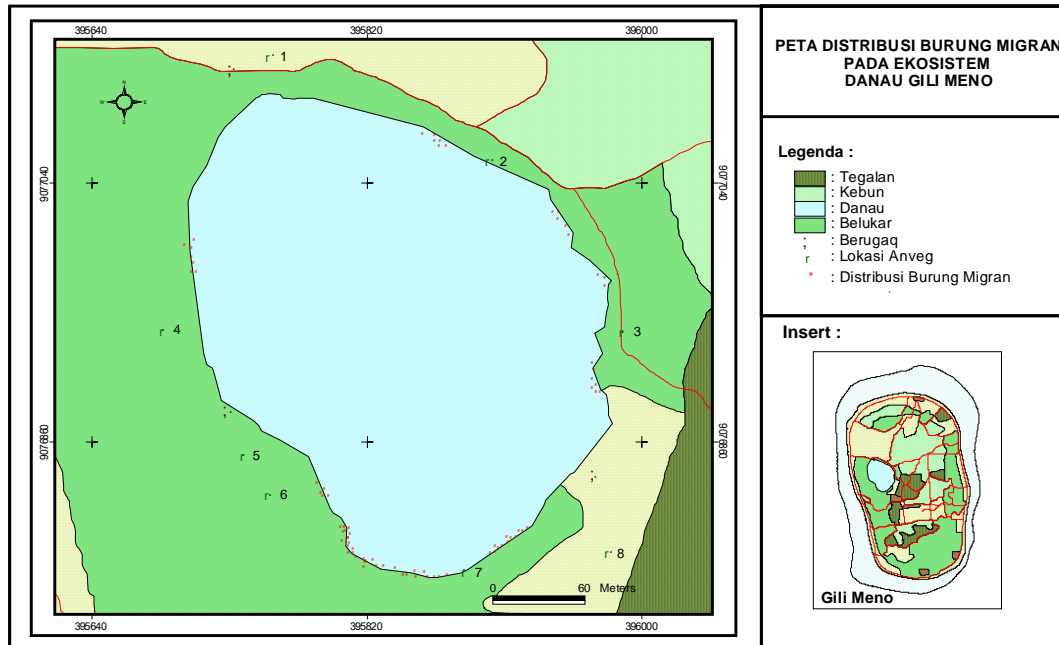


Figure 3. Distribution map of migrant birds in a salt water lake of Gili Meno. From this map, it is clear that migratory birds (red spots) are more active in the south of the lake. This is supported by the shallow banks of the, dense mangrove coverage and the far location from human activity.

The fairly dense mangrove vegetation which surround the salt water lake ecosystem has formed a characteristic and sustainable habitat for many wildlife including migratory birds. Habitat with dense canopy and which tend to be wet is more favored by birds (Mulyawati, 2007; Anonim^a, 2000). Additionally, a relatively shallow, sandy and muddy area is a preferred area for migratory bird species. This research discovered that the migratory birds were more concentrated on the southern area of the lake. This area is relatively shallow, muddy to sandy, has denser mangrove coverage and more importantly, is far from road access (human activity). Birds distribution map that has been prepared clearly shows that the main characteristic of preferred habitat of migratory birds is habitat with wet, shallow, sandy to muddy land, as well as

dense vegetation canopy and which is far from human activity.

Natural and undisturbed habitat is more favored by migratory birds. Habitats with high canopy and dense mangrove coverage provide nesting places, protection, nursing site and suitable feeding resources. Shallow and sandy to muddy areas can facilitate birds to find food especially small fish. In addition, areas that are far from road access and human activity, are safer and unstressful. These characteristic factors are specific for the habitat of salt water lake of Gili Meno which in turn make it a favored place to stopover during migratory season. New species observed in this habitat which was undiscovered in previous research was Javan Plover (*Charadrius javanicus*). This species has been reported to migrate along the

shoreline of Sumatera, Kalimantan, Java as well as Bali and just reported in 2011 to stopover in several habitats in West Nusa Tenggara (Anonim^c, 2013; McKinnon, 1991). This may be because of decreasing quality of habitats in western part of Lombok Island so that the species chose healthier habitat to migrate to. The presence of this migratory bird also indicates that the ecosystem of salt water lake of Gili Meno is still in a good condition and therefore should be protected.

Overall, bird species discovered during this research were higher in number than those observed by Setiawan (2008) in August 2008. It is assumed that different observation time take part in the different result from this research. However, this research did not discovered Pecuk Padi Belang (*Phalacrocorax melanoleucos*) which were present in Setiawan's research. These data should be updated to identify whether habitat change (habitat degradation) or migration season and observation time is the determining factor which affect the absence of several bird species.

CONCLUSION

There are 17 bird species identified in this research belonging to 5 families i.e. Scolopacidae, Charadriidae, Ardeidae, Meropidae and Alcedinidae. Of the 17 species discovered, 16 species were migratory birds. In addition, this research also uncovered the especially high population of *N. nycticorax* followed by *B. striatus*. This study also identified 3 species of mangrove: *Avicennia marina*, *A. lanata* and *Exoecaria agallocha* as well as one species of fish (Mujair fish/*Oreochromis niloticus*). The existence of the fairly good mangrove vegetation and sufficient food availability contributed to the ideal condition of the habitat of saltwater lake of Gili Meno as migration site for birds during migration seasons.

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