

SPECIES DIVERSITY OF BIRDS IN CLUNGUP MANGROVE CONSERVATION SENDANG BIRU, KABUPATEN MALANG, EAST JAVA AS BIOINDICATOR

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ABSTRACT

Clungup Mangrove Conservation (CMC) is a location managed by Bhakti Alam Sendang Biru Organization. Mangrove management activities were carried out continuously starting from mangroves clearing in 1998 until it is all used up and started replanting when people found it difficult to catch fish. Mangroves are plants which lived at maximum subsiding tide point to maximum rising tide point area, with mud as its substrate. For other organisms, mangroves used as shelter and foraging place. One of those organisms is birds, birds can be used as bioindicators of environmental quality because it has a sensitivity to environmental changes. This study divided into 4 stations based on mangrove vegetation, the results observed were for Shannon Index at 1.99-2.3 and Margalef Index at 3.5-3.8 for morning observations. While for afternoon observation resulted as Shannon Index at 1.2-2.2 and Margalef Index at 1.8-3.9. The main focus is some water birds such as *Ardeola speciosa*, *Todiramphus chloris*, *Aldeco coerulescens*, *Butorides Striata*, *Todiramphus sanctus* and *Charadrius javanicus* which shows that mangrove ecosystems provide a function of nursery ground for fish and feeding ground for birds.

Keywords: *Bird, Biodiversity, Mangrove Ecological Services, Environment, Bioindicator*

1. INTRODUCTION

Mangrove forest is such ecosystems that receive enormous pressure due to human's management system. Alteration function of the land is the main cause, in Indonesia more than 50% mangrove forests damaged due to its alteration into fish farming called tambak (Dharmawan, *et al.*, 2016; Iman, *et al.*, 2016).

CMC is one of location with conservative mangrove forests management concept, also used as a tourism destination (Harahab and Setiawan, 2017). Local people are the one who forms groups that try to restore mangrove forests into its original functions. According to them, mangrove forests were logged until it's clear then replanted. After a long time, mangroves returned quite dense and some animals started to return, one of them was the bird. Birds are sensitive toward changes in their habitat, so birds can be a bioindicator of the quality of an ecosystem (Pawar, 2011; Mohd-azlad, *et al.*, 2015). Shannon Diversity Index, Margalef Richness Index, and Evenness Index are classical indices that are widely used to measuring biodiversity. Generally, diversity value will be equal to ecosystems quality, usually, Shannon diversity index will be 1.5 to 3.5 and rarely surpasses 4. If the diversity value is high, so the ecosystems quality consider stable and ecosystem quality will be considered unstable if it has under 1,5 (Magurran, 2004).

2. METHOD

This research was conducted in mangrove conservation area called Clungup Mangrove Conservation (CMC) at August 2018 where the conservation efforts carried out independently by locals starts from wiped out mangrove area until now begin turning green again. Bird watching did during two sessions, in morning and afternoon following diurnal bird's biological clock. Morning observation was started from 5 am until 8 am, and afternoon observation was started from 3 pm to 6 pm. Researcher use 15 minutes observation period for each station (Alexandrino, *et al.*, 2016). Observation stations showed in Figure 1. Observations limited to birds that seen or heard only. Data obtained will be analyzed using Shannon Index and Margalef Index to get an

overview about the state of the mangrove ecosystem



Figure 1: Observation stations, the picture obtained by GPS mapping. The yellow arrow indicating station with a number written for each station

3. RESULT AND DISCUSSION

Based on birds diversity and richness value observed, showing that its diversity and richness are in moderate point. Commonly said that diversity will be equal with ecosystem quality when an ecosystem is damaged or disturbed on the contrary its decreasing diversity value. According to mangrove forests condition which started by mass logging and after restoration process for a while, the birds diversity value needs to be appreciated because it shows moderate health of mangrove ecosystem to provide ecosystem services. Some water bird which consumes little fish like Raja Udang Bird and Cekakak appear. The returns of this small fish eater birds indicated the nursery zone function in mangrove forests has returned. For fish, this nursery zone has a role as spawning and breeding area, but for water birds, this area turns into feeding zone. Waterbirds such as Cekakak or Raja Udang appearance indicating that there are much small fish presented as their favorite food compare to others.

Other bird species found are common species and able to found anywhere, do not mean to discredit their role but they are specifically not able to retrieve information about mangrove ecosystem except only as a representation of bird community. Mangrove ecosystem providing a number of valuable ecosystem services such as breeding ground, feeding ground, spawning, and nursery habitat for fish and even a shelter for migration bird (Gotelli and Chao, 2013). There are 24 species

that separately by 2 part. The birds with (*) mark will be focused for indicator and whole species will be used for community character which will found out by Shannon diversity index and Margalef Index.

Table 1. Birds Observation Result

No	Species	Amount	
		Morning	Afternoon
1	Blekok Sawah (<i>Ardeola speciosa</i>)*	3	1
2	Cucak Kutilang (<i>Pycnonotus aurigaster</i>)	14	6
3	Walet Linchi (<i>Collocalia linchi</i>)	6	20
4	Merbah Cerukcuk (<i>Pycnonotus goiavier</i>)	6	5
5	Cekakak Sungai (<i>Todiramphus chloris</i>)*	4	3
6	Burung Madusriganti (<i>Cinnyris jugularis</i>)	6	4
7	Perkutut Jawa (<i>Geopelia striata</i>)	3	2
8	Bondol Peking (<i>Lonchura punctulata</i>)	10	0
9	Cinenen Pisang (<i>Orthotomus sutorius</i>)	8	1
10	Ayam Hutan Hijau (<i>Gallus varius</i>)	1	2
11	Kipasan Belang (<i>Rhipidura javanica</i>)	1	4
12	Cipoh Kacat (<i>Aegithina tipia</i>)	7	1
13	Bondol Jawa (<i>Lonchura leucogastroide</i>)	7	0
14	Cabai Jawa (<i>Dicaeum trochileum</i>)	0	1
15	Tekukur biasa (<i>Streptopelia chinensis</i>)	0	6
16	Raja Udang Biru (<i>Alcedo coeruleascens</i>)*	4	4
17	Cinenen Jawa (<i>Orthotomus sepium</i>)	2	2
18	Burung Madu Kelapa (<i>Anthreptes malacensis</i>)	2	1
19	Remetuk Laut (<i>Gerygone sulphurea</i>)	2	1
20	Sepah Kecil (<i>Pericrocotus cinnamomeus</i>)	3	0
21	Kokokan Laut (<i>Butorides striata</i>)*	1	1
22	Cekakak Suci (<i>Todiramphus sanctus</i>)*	1	2
23	Cerek Jawa (<i>Charadrius javanicus</i>)*	1	0
24	Layang-layang Batu (<i>Hirundo tahitica</i>)	1	1

* = Water bird

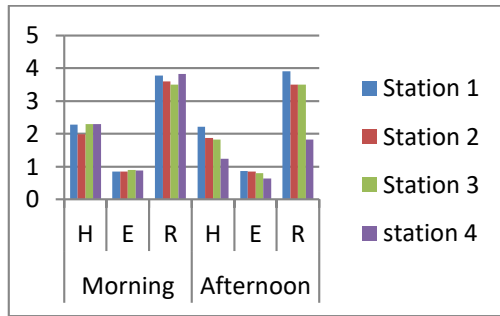


Figure 2: Diagram shows Shannon Index, Evenness Index, and Richness Index of birds around Clungup Mangrove Conservation in 4 observation station on scale 1-5.

3.1. SPECIES DIVERSITY INDICES

Diversity (traditional metric) has two primary components. It is species richness (the number of species in a local community) and species composition (abundant and kind of species itself) (Gotelli and Chao, 2013). Shannon diversity index is widely used because of the index sensitive with abundant and number of species. The study revealed that the Shannon diversity index (shown as H) at the result observed was for Shannon Index at 1.99-2.3 and Margalef Index at 3.5-3.8 for morning observations. While for afternoon observation resulted as Shannon Index at 1,2-2,2 and Margalef Index at 1.8-3.9. This indices show how character of bird community in CMC, when a ecosystem nearly undisturbed, Shannon index will show at it maximal number about 3.5 and with the result Shannon index for bird community shown at 1.2 – 2.3 it can be interpreted that in average level of diversity, from that Shannon index we can have evenness and shown that value close to 1 which is there are no species with dominant abundant there. So Bird Diversity indices here will be a starting point to assessment bird biodiversity in CMC which it will become a tool for assessing the whole ecosystem.

3.2. WATERBIRD AS AN INDICATOR

There are some waterbird there, even there is no mangrove bird observed, water bird is enough to be an indicator of mangrove

ecological service with intact thinking, mangroves provide a nursery ground for fish that will later become spawning areas and will form a young fish population that will become food for water birds such as *Ardeola speciosa*, *Alcedo coerulescens*, *Butorides striata*, *Charadrius javanicus*, *Todiramphus sanctus*, *Todiramphus chloris*. All of the waterbird was found is fish feeder even some of them protected by rule in Indonesia such as *Todiramphus chloris* and *Todiramphus sanctus*. *Ardeola speciosa* is an example of an ecosystem health indicator that is a non-migrant bird (BirdLife International, 2016). This is important because when a non-migratory bird can be found it means food sources are available there or shelter is there. *Ardeola speciosa* has an eating behaviour in the form of aquatic animals so it can be interpreted that the presence of *Ardeola speciosa* shows that the mangrove ecosystem is able to provide food for *Ardeola speciosa* and habitat for aquatic animals which are food from *Ardeola speciosa* (Charoenpokaraj, 2014). *Todiramphus sanctus* and *Todiramphus chloris* from Alcedinidae they are acting as predator of various species so they are have important roles in ecosystem, if predator appears in ecosystem that reveal if the ecosystem itself in a good condition because because the flow of energy from the trophics level flows from the lowest trophic level (plants) then to the next level the plant eats then to the predator, so that the level of predator will not appear if the ecosystem does not provide services to the trophics under predators (Dobson, *et al.* 2006). *Alcedo coelurescens* is one of water bird found in CMC it has feeding behaviour aquatic insect, crustaceans and small fish (BirdLife International, 2016). The Appearance of this bird is shown that the environment has providing food for *Alcedo coelurescens* so CMC has become a feeding ground for this birds even this bird according to mangrove ecosystem didn't have any significant role. *Butorides striata* main course was aquatic prey such as fish, prawns, crabs, mollusks, insects and spider, feeding for life (Wee and Wang, 2009). Even this bird in full-migrant (BirdLife International, 2016) category but it still became a good sign if CMC area having the good condition because according to from it's feeding behaviour appearance from this bird can be assuming if its try to get some

food in CMC area. There was endemic species was found, it was *Charadrius javanicus*. *Charadrius javanicus* reported hunting crab for food and found became aggressive when it comes to breeding season (Iqbal, *et al.*, 2013) main threats for this bird due to human disturbance of coastal habitats and its egg may also be collected for food (BirdLife International, 2017).

4. CONCLUSION

The impact from recover of the Clungup Mangrove area has begun to look better, it is necessary to know that the mangroves in the clungup area have been exhausted and then conserved until now the impact can be seen on the bird community. The Shannon diversity index shows the intermediate number, as well as the index of species richness and species evenness, is relatively good because it is close to number 1. Aquatic species that eat aquatic prey such as fish, prawn, crab, mollusks, and insects are an indicator that the mangrove ecosystem has provided back nursery ground and spawning ground for fish and feeding ground for bird. Bird species that found at CMC mostly were predator species that indicate energy stream from lowest trophic level to the top trophic level was flowing. It means that the mangrove ecosystem providing needs of all trophic level and becoming stable ecosystem.

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6. REFERENCES

- Alexandrino, E. R., Buechley, E. R., Karr, J. R., Ferraz, K. M. P. M., Ferraz, S. F. B., Couto, H. T. Z. C., and Sekercioglu, C. H. 2016. Bird Based Index of Biotic Integrity: Assessing The Ecological Condition of Atlantic Forest Patches in Human-modified Landscape. Ecological Indicators.
- BirdLife International 2016. *Ardeola speciosa*. The IUCN Red List of Threatened Species 2016: e.T22697138A93601050. <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22697138A93601050.en>.
- BirdLife International. 2016. *Alcedo coerulescens*. The IUCN Red List of Threatened Species 2016 : e.T22683117A92976544. <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22683117A92976544.en>
- BirdLife International. 2016. *Butorides striata*. The IUCN Red List of Threatened Species 2016: T22728182A94973442. <http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22728182A94973442.en>
- BirdLife International. 2017. *Charadrius javanicus*. The IUCN Red List of Threatened Species 2017: e.T22693839A118306149. <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22693839A118306149.en>
- Charoenpokaraj, N. 2014. Bird Diversity in Fruit Garden in Bang Nang Li Sub-District, Amphawa District, Samut Songkram Province. *Suan Sunandha Journal of Science and Technology Vol. 1 No. 1*.
- Dharmawan, B., Bocher, M., and Krott, M. 2016. The failure of the mangrove conservation plan in Indonesia: Weak research and an ignorance of grassroots politics. *Ocean and Coastal Management* 130: 250 – 259.
- Dobson, A., Lodge, D., Alder, J. Cumming, G. S., Keymer, J., McGlade, j., Mooney, H., Rusak, J. A., Sala, O., Wolters, V., Wall, D., Winfree, R., and Xenopoulus, M. A. 2006. Habitat Loss, Trophic Collapse, and Declined of Ecosystem Services. *Ecology*, 87(8), 2006, pp. 1915-1924.
- Gotelli, N. J. and Chao, A. 2013. Measuring and Estimating Species Richness, Species Diversity, and Biotic Similarity from Sampling data. *Encyclopedia of Biodiversity*, Volume 5.
- Harahab, N., and Setiawan. 2017. Suitability Index of Mangrove Ecotourism in Malang Regency. *ECSOFiM: Journal of Economic and Social of Fisheries and Marine*. 2017. 04(02): 153 – 165.

- Ilman, M., Dargusch, P., Dart, P., and Onrizal. 2016. A historical analysis of the drivers of loss and degradation of Indonesia's mangroves. *Land Use Policy* 54: 448–459.
- Iqbal, M., Taufiqurrahman, I., Gilfedder, M., and Baskoro, K. 2013. Field Identification of Javan Plover *Charadrius javanicus*. *Wader Study Group Bulletin* 120(2): 96 – 101
- Magurran, A. E. 2004. *Measuring Biological Diversity*. Blackwell Science Ltd.
- Mohd-azlad J., Richard A. N., and Lawes M. J. The Role of Habitat Heterogeneity in Structuring Mangrove Bird Assemblages. 2015. *Diversity* 2015, 7, 118-136 ISSN 1424-2818.
- Pawar, P.R. 2011. Species diversity of birds in mangrove of Uran (Raigad), Navi Mumbai, Maharashtra, West Coast of India. *Journal of Experimental Sciences* 2011, 2(10): 73-77 ISSN: 2218 – 1768.
- Wee, Y. C. and Wang, L. K. 2009. Observation On The In-Captivity Development Of A Rescued Chick Of The Striated Heron, *Butorides striatus* (Linnaeus). *Nature in Singapore* 2009: 193 – 202.