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Ichthyofaunal Diversity in Mangrove Based Estuary of Way Kambas National Park

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Abstract. Fish fauna survey was conducted in Way Kambas National Park, to explore fish diversity originating from mangrove ecosystem areas. Fish samples was obtained using electrofish (12V 10A), nets, fishing rods and hand fish net. Sampling was conducted at three stations, Wako, Kuala Kambas and Kuala Penet. Result showed that there were 26 fish morphospecies based on early morphology and body trait identification. Specimens identified consisted of 16 families and 21 species. Kuala Penet has highest diversity with H = 2.78, E = 0.72, d = 5.45. Keting fish (*Mystus* sp.) was the highest abundance compared to others. Further identification using molecular approach such as DNA Barcoding is needed to confirm the type of each species.

1. Introduction

Way Kambas National Park (TNWK) is a national park covering 1300 square kilometres in Lampung province, southern Sumatera, Indonesia. It consist of swamp forest and lowland rain forest. Mangroves is one of the coastal swamps in the eastern of TNWK areas. This mangrove based estuarine ecosystem harbors a large number of fin fishes i.e. more or less 267 species of fishes which belong under 81 families. Estuary's own ecological characters and mangrove's all beneficial features support this high species diversity here. But due to continuously increasing natural and anthropogenic stresses, nowadays this entire species community faces a tremendous problem of extinction.

Mangrove ecosystem is an environment that has special characteristics, namely the forest floor that is regularly inundated with water and is influenced by salinity and fluctuations in water level due to tides. Mangrove ecosystems are a breeding ground for various aquatic animals such as fish, crustaceans, crabs and mollusc. Fish is one of the biota that makes mangroves as a place of refuge, foraging and breeding, thus fish become one of the fauna inhabitants of the mangrove with a high diversity of species.

Mangrove areas in Lampung Province suffered damage mainly due to the conversion of mangrove land into aquaculture, settlements, agriculture, and other purposes. Even in the coastal areas of South Lampung Regency (Penengahan District, Ketapang, and Sragi) there are no mangrove areas that are categorized as good, because most of the mangrove area has been converted into shrimp ponds (Lampung Province BPLHD 2009). Based on the study of the Lampung Province Marine and Fisheries Agency in 2007, it was found that the total damage of mangrove forests in Lampung Province reached 45,136.75 ha of the total area, while those still in good condition were around 48,782.97 ha.

Massive degradation in mangrove ecosystem will also affect the diversity of flora and fauna including aquatic biota commonly found in this region, such as various species of fish. There is no research about biodiversity in mangrove ecosystem yet. This present work is aimed to explore the diversity of fish

species originating from mangrove ecosystem areas in Way Kambas National Park, further will be analyzed using DNA barcode technique.

2. Materials and Method

2.1 Collection of fish samples

Sampling was conducted 19-21 July 2018. Samples were collected from three sampling sites in TNWK areas specifically from mangrove based estuarine ecosystem (Fig.1). Fish samples were obtained using some tools such as electrofish (12V 10A), nets, fishing rods and hand fish net. Phenotypic characterization were identified to the lowest taxonomic level following standard references using FAO species catalogue of the world, Kottelat *et al*. and Fishbase (2018).

2.2 Community parameters analysis

The community parameters such as species richness, species diversity and species evenness were calculated as a summary of distribution and abundances of fish species. The species richness was considered to be the total number of species recorded at each sampling and diversity was evaluated using the Shannon diversity index which is less sensitive to sample size than other indices. The formula for calculating Shannon diversity index is $H = -\Sigma\, pi \ln pi$ where *pi*, the proportional abundances of the *i*th species $= (ni/N)$. The Shannon's evenness index was used which was independent of species richness following this formula $E = H/\ln S$, where S is number of species (Odum 1971). While formula for calculating species richness is $d = S-1/\ln N$. Species diversity (H), species richness (d) (Margalef 1958), and species evenesss (E), were calculated to analyse of diversity among the three stations.
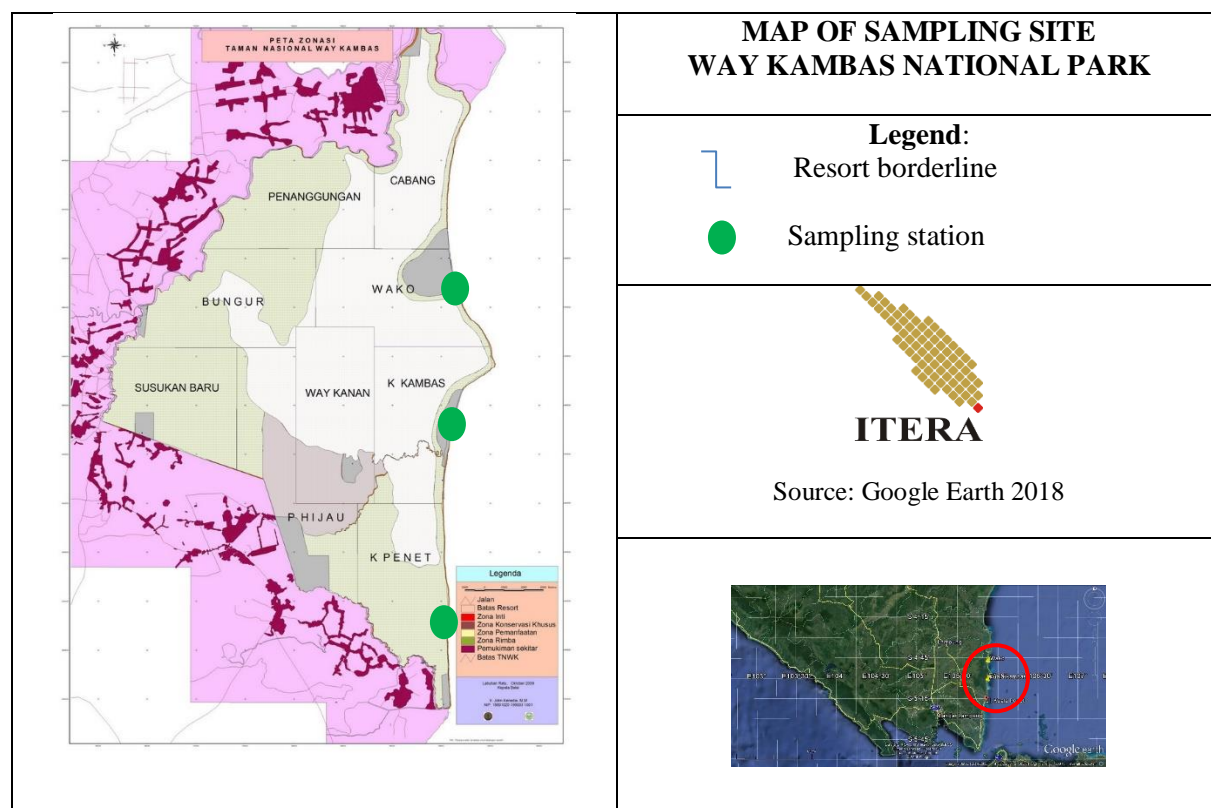

Figure 1 Map of sampling site in Way Kambas National Park

2.3 Specimen and Tissue Preservation for Genetic Analyse

Voucher spesimen were preserved in 10% formalin while few tissue samples that were used as the source of DNA is part of the epaxial muscle tissue were stored within 95% alcohol for the molecular genetic study.

3. Result and Discussion

3.1 Fish species diversity

A total of 111 fish species were identified from the 3 stations i.e Wako, Kuala Kambas, and Kuala Penet (Table 1). The collected fish species belonged to 16 families and 21 genera, many of which commercially important.

In term of of family wise species diversity, family Ariidae was the the most diverse in estuarine rivers, followed by Goobidae and Mugilidae families. The other families were represented by one or two species only.

Table 1 Fish species diversity in mangrove based estuary of Way Kambas National Park

No	Family	Spesies	Vernacular Name	St.1 Wk 1 (Wako)	St.2 WK2 (K. Kambas)	St.3 WK3 (K. Penet)
1	Ambassidae	1. *Ambassis nalua*		0	2	0
2	Anabantidae	2. *Anabas testudineus*	Betok	2	0	6
3	Ariidae	3. *Arius* sp.	Lundu	0	7	3
		4. *Hexanematichthys sagor*	Kedukang	1	0	1
		5. *Arius arius*	Lundu	0	0	1
		6. *Mystus* sp.	Keting	26	5	7
4	Chanidae	7. *Chanos chanos*	Bandeng	0	0	1
5	Eleotidae	8. *Oxyeleotris* sp.	Boboso	0	0	1
6	Gobiidae	9. *Boleopthalmus bodartii*	Gelodok	1	0	0
		10. *Periopthalmus* sp	Gelodok	0	0	1
7	Latidae	11. *Lates calcarifer*	Kakap putih	1	0	0
8	Leiognathidae	12. *Leiognathus* sp.	Pepetek	0	2	1
9	Mugilidae	13. *Valamugil* sp.	Belanak	0	4	1
		14. *Liza* sp.	Belanak	0	0	1
10	Osphronemidae	15. *Trichogaster* sp.	Sepat	4	0	4
11	Polynemidae	16. *Eleutheronema tetradactylum*	Senagngin/ Kuro	0	1	1
12	Schatopagidae	17. *Schatopagus argus*	Kiper	0	1	4
13	Serranidae	18. *Epinephelus* sp	Kerapu	0	0	1
14	Tetraodontidae	19. *Tetraodon* sp.	Buntal	0	7	0
15	Zenarchopteridae	20. *Zenarchopterus* sp.	Krakas	0	0	3
16	Cyprinidae	21. *Osteochilus* sp.	Nilem	0	0	1
17	Spesies 22			0	0	5
18	Spesies 23			0	0	1
19	Spesies 24			0	0	1
20	Spesies 25			0	0	1
21	Spesies 26			0	0	1

Table 2 Analyse result of diversity index (H), evenness (E) and species richness (d) in each station

Index	St.1	St.2	St.3
Diversity index (H')	0.94	1.86	2.78
Evenness (E)	0.52	0.90	0.72
Species richness (d)	1.41	2.08	5.45

The Shannon diversity index, species evenness, and species richness showed significant differences among three stations. Highest values of Shannon diversity index, species evenness, and species richness and lowest values were reflected on Table 2. Among three stations, highest values in each index was recorded in Station 3 (St.3). While the lowest values observed in Station 1 (St.1). Based on morphological identification we are propose about the estimation of family and species numbers. According to the Shannon – Wiener index criteria ($1 < H' < 3$), Station 2 and 3 have a moderate level of species diversity while Station 1 was a low level.

Identification of fish based on morphology requires special knowledge and techniques that may only be done by taxonomists. The DNA barcode technique allows a relatively fast and accurate process of species identification using only a short sequence of mitochondrial DNA gene segments, Cytochrome c Oxidase subunit I (COI). DNA barcoding application will be helpfull to confirm fish species which have been identified by morphological traits.

Conclusion

This present work is a preliminary study to explore the diversity of fish species originating from mangrove ecosystem areas in Way Kambas National Park further will be analyzed using DNA barcode technique. There are about 26 fish morphospecies based on identification of the appearance of morphology and body trait. The community parameters such as species richness, species diversity and species evenness were calculated as a summary of distribution and abundances of fish species. Among three stations, the highest values in each index was recorded in Station 3 (Kuala Penet). Molecular approach such as DNA barcoding application will be the complement data to confirm fish species which have been identified by morphological traits.

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