



Freshwater Fish Distribution and Biodiversity in the Padang-Bengkulu Border Area

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ABSTRACT

Freshwater fish exploration in Sumatra necessary to do especially the western regions. Its because the region has a unique type of waters and rivers are short order. This study aims to determine the distribution and diversity of freshwater fish in the Padang - Bengkulu border area. Sampling was conducted on 13 rivers with a total of 40 sampling site. A total of 6848 fish consisting of 37 species successfully collected. The highest catches from Mukomuko I station while the lowest catches in Pasar Sebelah. The most common species found is the family Cyprinidae, while the widest distribution of species is the family Cichlidae. The diversity of species is obtained ranged between 0.89-1.41 which is low. There is a dominance of species at each station ranged between 3.42. The highest similarity is obtained from the close sampling site and have a similar habitat. Public awareness to doing traditional conservation are seen like restrict area for catch the fish and this called Rantau Larangan.

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1. Introduction

Sumatra Island is one of the largest islands in Indonesia and has two types of waters which are lotic (*running water*) and lentic (*standing water*) water (McConnell, 2002). Generally, rivers in the western Sumatra have different types of waters compared to rivers in the east (Gusmaweti & Leswati, 2018). The Bukit Barisan that

spans from the north to the south of Sumatra causes the east and West Rivers never meet (Whitten *et al.*, 1997). West Sumatra province is one of regions that have characteristics with these types of waters, especially Padang – Bengkulu border area. This area has many major rivers with different substrates in each river stream, and relatively Short River orders (Nuryadi *et al.*, 2010). In addition, this area does not have floodplain area whereas have functions as a spawning area and nursery ground for freshwater fish. This characteristic makes low the diversity of habitat and species (Husnah & Wibowo, 2012).

Study relating to freshwater fish diversity in the Sumatra Island has been conducted more than a century ago. Exploration by Weber and Beaufort (1916) found about 129 fish species in Sumatra. Most of the freshwater fish exploration was only carried out in the eastern region of Sumatra, while the western region has a low exploration (Kottelat, 1993). This is related to freshwater fishing activities performed by the local community, which is not the main livelihood. Low exploration also cause considerable less information about the distribution and diversity of freshwater fish. The aim of this study was to determine freshwater fish species distribution pattern and diversity in the Padang – Bengkulu border area. This information is expected to provide database for local government for fish resources management in the local area.

2. Material and methods

Sampling site

This research was conducted by survey method on 13 rivers in the border area of Padang – Bengkulu from July to September 2016 (figure 1). Every rivers were divided into three to four sampling station and sampling technique used *purposive random sampling*. The station were distinguished from upstream to downstream because of riparian area and rivers type. Fish samples were captured by installing fishing gear such as fishing rods, net, gillnets (with 1.0, 1.5, 2.0, and 2.5 mesh size), bubu (fish trap) as well. In each station, the fishing gears were installed in the water for one hour at three o'clock in the morning and evening. The fish traps (Bubu) were left for 12 hours and repeated every day for a week.

Sample preparation

Samples of fish collected were washed with clean water and taken the pictures. Then, all specimens were preserved in 4% formaldehyde, and then transferred to a series of alcohol solution until 70% alcohol. Fish specimens were identified based on classification system of Kottelat *et al.* (1993), Kottelat & Whitten (1996) and Saanin (1984) to the lowest taxa

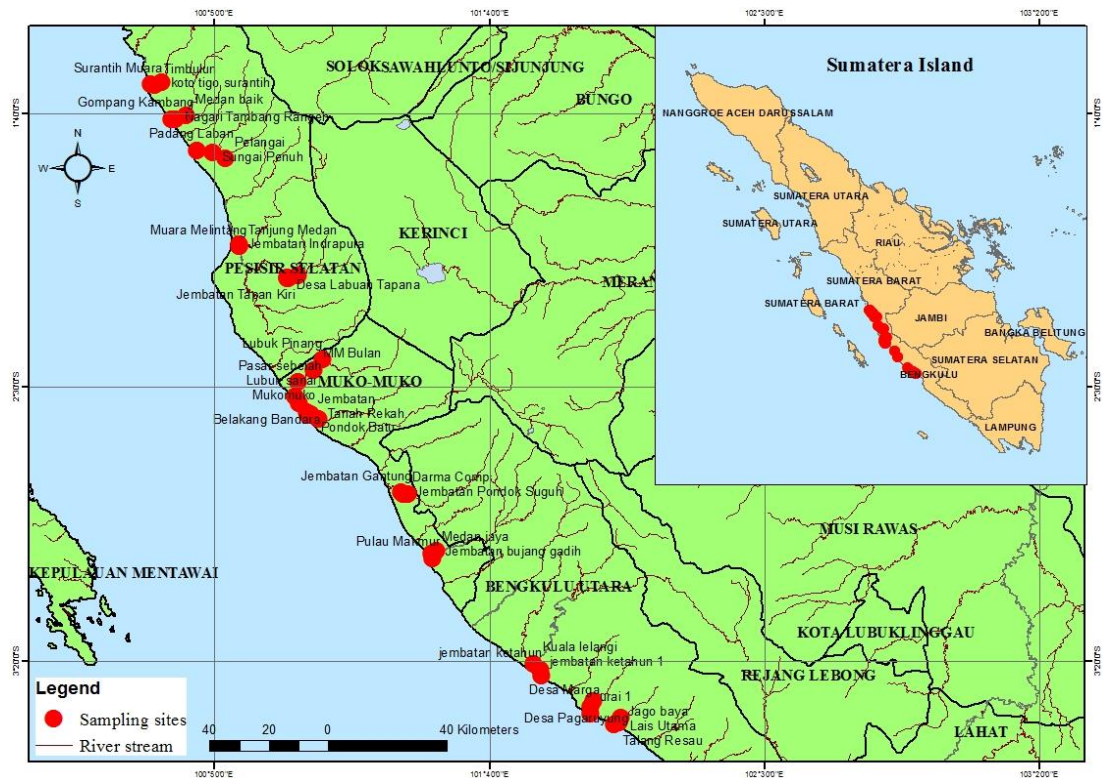


Figure 1. sampling site

Data Analysis

The data were analyzed three commonly employed indices such as diversity index (Shannon-Wiener), evenness index, and dominance index (Magurran, 1987). In addition, similarity of the fish species in the all sampling stations were calculated using Minitab 16 (Minitab inc. 2003) program.

3. Result

Thirty seven species of freshwater fishes, belonging to 29 families were recorded during this study (Table 1). The family Cyprinidae was found to be the most species caught (4 species), followed by the family Gobidae, Terapontidae, Lutjanidae and Osphronemidae (two species each). While in other families only one species were captured. The highest number species captured were *Osteosilus haseltii* (521 individual) and *Oreochomis niloticus* (421 individual). *Poecillia reticulata* was found only 2 species and was the lowest fish caught.

Table 1. Collected fish species during research in the Padang-Bengkulu border area

No.	Family	Species	Local name	Number of location	Redlist IUCN
1	Cyprinidae	<i>Osteoscilus vittatus</i>	Puyau	13	LC
		<i>Hampala macrolepidota</i>	Gariang	12	LC
		<i>Barbonymus gonionotus</i>	Gariang Putih	10	LC
		<i>Cyprinus carpio</i>	Mas	9	VU
2	Lutjanidae		Kurau	8	LC
		<i>Lutjanus johnii</i>	Kuniang		
		<i>Lutjanus fulvous</i>	Kurau	9	LC
3	Terapontidae	<i>Terapon puta</i>	Kuning	5	LC
		<i>Terapon jarbua</i>	Kuning	6	LC
4	Gobidae	<i>Periophthalmus gracilis</i>	Belondo	2	-
		<i>Glossogobius giuris</i>	Gapi Putih	7	LC
5	Osphronemidae	<i>Trichogaster pectoralis</i>	Sepat siam	12	LC
		<i>Trichogaster tricopterus</i>	Sopek	12	LC
6	Poeciliidae	<i>Gambusia affinis</i>	Nyamuk	9	LC
		<i>Poecilia reticulata</i>	Gapi	1	-
7	Apogonidae	<i>Apogon sangiensis</i>	Sangi	9	LC
8	Ambassidae	<i>Ambassis miops</i>	Sangi	9	LC
9	Siganidae	<i>Siganus vermiculatus</i>	Ketang garih	5	LC
10	Scaptophagidae	<i>Scaptophagus argus</i>	Ketang-ketang	5	LC
11	Tetraodontidae	<i>Arothon reticularis</i>	Bota	5	LC
12	Paralichthyidae	<i>Pseudohombus arsuis</i>	belondo	4	LC
13	Toxotidae	<i>Toxotes microlepis</i>	Sumpit	2	LC
14	Channidae	<i>Channa striata</i>	Karamutiang	12	LC
15	Mugilidae	<i>Crenimugil crenilabis</i>	Belanak	2	LC
16	Helostomatidae	<i>Helostoma temminckii</i>	Sapek tambak	12	LC
17	Balitoridae	<i>Homaloptera ophiolepis</i>	Gapi belang	8	LC
18	Anabantidae	<i>Anabas testudineus</i>	Puyung	12	LC
19	Siluridae	<i>Ompok hypophthalmus</i>	Laih	2	LC
20	Serranidae	<i>Epinephelus coiodes</i>	Sebelah	4	LC
21	Gerreidae	<i>Gerres poleti</i>	Kapeh	4	LC
22	Bagridae	<i>Mystus sabarus</i>	Sengek	3	LC
23	Anguillidae	<i>Anguilla nebulosa</i>	Panjang	3	NT
24	Carangidae	<i>Caranx popuensis</i>	Kapas-kapas	4	LC
25	Clariidae	<i>Clarias</i>	Lele	12	LC
26	Synbranchidae	<i>Monopterus albus</i>	Belut	12	LC
27	Cichlidae	<i>Oreochromis niloticus</i>	Nilo	13	LC
28	Platycephalidae	<i>Platycephalus indicus</i>	Timah	7	LC
29	Loricaridae	<i>Hypostomus</i>	Sapu-sapu	10	LC
		<i>plecostomus</i>			

The fish captured according to the sampling site (Fig. 2) were 6848 individuals in 40 stations from 13 rivers. The highest catches from the river in Mukomuko I station was 1182 fish and the lowest catches was from the river on Pasar Sebelah station with 275 fish. Moreover, The distribution of family at each station showed in each sampling station showed the highest species found in surantih dan the lowest found in ketahun (31 and 13 species) respectively.

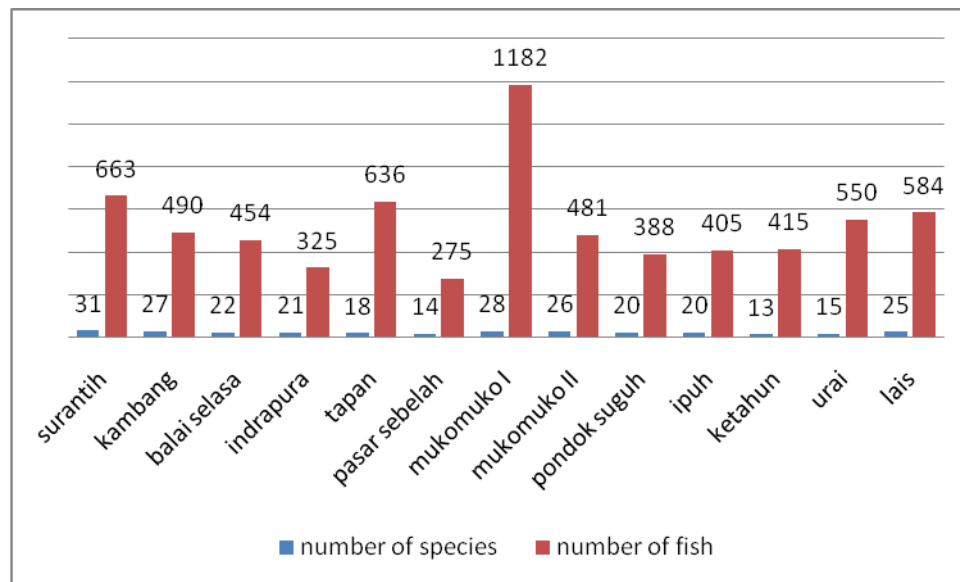


Figure 2. Fish catches and species distribution based on the sampling sites

Calculation of Shannon-Wiener index according to sampling station and species captured, the fish diversity index was not significantly different (Table 2). Species diversity value obtained in this study revealed that species richness at each sampling station was low. The highest diversity value was recorded in the river on Tapan station and the lowest in Ketahun. High species richness was found in the Tambang station, while Pasar sebelah and Ketahun station were low compared to others. The evenness index exhibited value close to zero (0), which means there is species dominance at the each sampling station. Similarity index represents the correlation between type of species and sampling station that ranged from 15.50 - 100 (Fig 4.). There is division of sample into two large clusters at a value of 15.50. The highest similarity value/index (100) was recorded at station 10 (Ipuh station) and station 11 (Ketahun station), followed by station 3 (Balai Selasa) and station 4 (Tapan) (79.16) and station 5 (Pasar Sebelah) and station 9 (Pondok Suguh) (53.38). While, the lowest similarity is found in the relationship between station 1 (Surantih) and station 13 (Lais) with value of 42.94.

Tabel 2. Species Richness Indices (d), Evenness index (E), and diversity Index (H) based on sampling sites

Sampling Sites	Individuals	Species	d	E	H
Surantih	663	26	2.83	0.28	1.07
Kambang	490	33	3.62	0.28	1.08
Balai Selasa	454	25	2.72	0.29	1.1
Indrapura	325	23	2.49	0.26	0.99
Tapan	636	21	2.26	0.37	1.41
Pasar Sebelah	275	13	1.36	0.23	0.89
Mukomuko 1	1182	26	2.83	0.28	1.06
Mukomuko 2	481	28	3.06	0.28	1.06
Pondok Suguh	388	21	2.26	0.27	1.03
Ipuh	405	23	2.49	0.26	1.01
Ketahun	415	13	1.36	0.23	0.88
Urai	550	18	1.92	0.27	1.03
Lais	584	28	3.06	0.28	1.08
Individuals	6848	37			
Average	526.77	22.92	2.48	0.28	1.05

4. Discussion

Species Distribution and Component

The rivers in the border area of Padang-Bengkulu was dominated by the family of Cyprinidae (Tabel 1). The previous study was also recorded the family Cyprinidae found to be dominant in the freshwater water of Sumatra island (Wargasmita, 2005; Hamidah, 2004; Kottelat *et al.*, 1993), including Aceh (Muchlisin & Azizah, 2009), South Sumatera (Nurdawati & Prasetyo, 2007; Husnah *et al.*, 2008) and Riau (Simanjuntak *et al.*, 2006). Sampling was obtained during rainy season involved can caught high abundance of fish. The rising water level provide high level of nutrient. It's condition caused many of fish found in the water (Nikolsky, 1963). However, the different result was observed by Husnah *et al.* (2008) that the Musi river in South Sumatra was found to have high number of species compared with rivers in the border area of Padang-Bengkulu. It might be due to the *electrofishing* was not used in catching the fish during this study because of local regulation. *Electrofishing* is a very effective method for obtaining fish especially in shallow and running water (Alonso, 2001).

Mukomuko I stasion is an open water that has characteristic of relatively stagnant water flow and a lot vegetation thus causing a high number of fish caught. The estuary species (4,27 %) such us *Mugil crenilabis* (Mugillidae), *Caranx popuensis* (Carangidae), and *Ambasis miops* (Ambassidae) were most abundant species

recorded/found throughout study period. The high number of estuary fish in that station might be due to type of rivers that is short and jutting into the sea. Estuary fish will be found in the tidal area with a distance of 200 m from the river mouth (Rahmatika *et al.*, 2002). The juvenile phase was also found in that area which revealed that the area is a nursery ground for several species of marine fish (Husnah & Wibowo, 2012).

Fish species caught is largely composed of indigenous species (81%) in the rivers of Padang-Bengkulu area. However, there are only three *non-native* species such as *Oreochromis niloticus*, *Gambusia affinis*, and *Poecilia reticulata* to the rivers. The species *O. niloticus* from family Cichlidae have a wide distribution in the river compared with species from other families (Figure 3). The Cichlidae family is an omnivorous fish which is able to adapt to a variety of environmental conditions (Peterson *et al.* 2005). In addition, most species from this families are non-native species which their existence can cause various consequences including predation (Knight, 2010) and competition with other species (Blanchet *et al.*, 2007). Study in Cisadane river, Bogor have reported that *non-native* species may threaten loss of indigenous species in the water (Hadiaty, 2011).

Diversity Index and Species Richness Indices

Diversity index is a measure that reflect the variety of individuals in different each species (Magguran, 1987). The present study showed that the species diversity index was low due to dominance of species in the river (Table 3). Study in the Aceh Tengah river, Aceh province (Muchlisin & Azizah, 2009) and Musi river, South Sumatra (Husnah *et al.*, 2008) have also found the low diversity index due to the dominance of several species. Diversity index is opposite with dominance species value. If diversity index decrease, dominance value will be increase.

Tapan station is a station that has the characteristics of lotic water types and has a higher diversity value compared to other stations. The same result was also observed in the Musi river, South Sumatra that the lotic waters have lower diversity value (Husnah *et al.*, 2008). In addition, there is a prohibition area for fishing to surrounding community called "Rantau Larangan" and also custom system causing the abundance of fish in the study site. Conversely, the highest species richness was found in the lentic area (Kambang station) in which, is likely to be affected by vegetation that grow along river stream. Several other studies in various rivers such as Batang Nareh, West Sumatra (Murni *et al.*, 2014) and Aceh province (Muchlisin & Azizah, 2009), have also reported the same result that lentic area has a high species richness. Vegetatio provides abundance of food resources for fish in the river (Jacobsen *et al.*, 2002).

Evenness and Similarity Index

Evenness index (E) exhibited a value close to zero which means that the distribution of individuals or species in the sampling site was considerably uniform (Liet *et al.*, 2012). In the present study, the number of individuals of each species is different and may be due to the dominance of species. The condition might be caused by habitat and water level difference. This is also supported by the result of dominance index which was 3.42 (greater than 0.5), which indicates that there is dominance of certain species in the river (Odum, 1993). Similar result of species dominance was also reported in the Musi river, South Sumatra province by Husnah *et al.* (2008) and in the Aceh province by Muclisin & Azizah (2009).

Similarity index represents the similarity of species in which the highest values are obtained between two close sampling stations. The possible reason for this is that the similarity of habitat types and adjacent distances caused the stations to have similar species. The result of this study observed that Ipuh and Ketahun stations have similar habitat types which are stagnant water with Blackwater type, while Surantih and Lais stations have very different types of waters. Surantih is a zone with running waters while Lais is relatively stagnant water. According to Husnah *et al.* (2008), the similarity of habitat types and abiotic factors of the waters causes the same type of fish species captured. The ecological characteristics of the river from the same mountain area (Bukit Barisan) allow each species to move from one river to others (Muclisin & Azizah, 2009).

Management of fish resources in this area is already quite good, where the local community already has the awareness to create conservation areas naturally based on local regulations. This is exhibited in the Tapan station which has the highest type of fish compared to other stations due to the presence of regions called "Rantau Larangan". But in other areas, fish conservation activities have not been implemented. From this study, we expect in other areas, particularly at Mukomuko station which also has a high species diversity to create a conservation area naturally.

5. Conclusion

In the border area of the city of Padang - Bengkulu, 37 species originating from 29 families were found. This region shows the highest distribution of *Oreochromis niloticus* from the family Cichlidae. Generally, species diversity in the study site is low, which indicates the dominance of some species. The highest value of diversity is at the Tapan station. Similarity among stations with the highest value (100%) is obtained at adjacent stations (stations 10 and 11).

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