

A preliminary study on the biodiversity of fish in the Suhui River, Muara Ancalong, East Kutai, Indonesia

¹Rudy A. Nugroho, ¹Yusuf Galih G. Santoso, ¹Firman M. Nur,
²Nova Hariani, ³Suimah Solikin

¹ Animal Physiology, Development and Molecular Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Samarinda, Indonesia; ² Ecology and Animal Systematics Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Samarinda, Indonesia; ³ Yayasan Konservasi Khatulistiwa Indonesia, Samarinda, Indonesia.

Corresponding author: R. A. Nugroho, rudyagung.nugroho@fmipa.unmul.ac.id

Abstract. The main objective of this study was to screen and identify the potency of the fish that are found in the Suhui River as a basis for aquaculture and conservation programs. Twenty-nine fish species were caught from three observatory stations on the Suhui River, Muara Ancalong Municipality, East Kutai in June–July 2015. Results of the current study found that the fish fauna of the Suhui River are clearly dominated by *Osteochilus spilopleura*, which was abundant in all three observatory stations. *Channa striata* is a candidate species for aquaculture in the Suhui River, based on personal communications with local fishermen. Though several potential aquaculture fish species were observed in this preliminary study, further work on potential aquaculture and conservation needs to be done. Such a study could be capable of producing results that would help to reduce malnutrition and poverty in rural areas, and at the same time, help us to widen our scientific knowledge of renewable fisheries resources in the rivers of Suhui Muara, Ancalong Kutai Timur, Indonesia.

Key Words: Kalimantan, Borneo, Cyprinidae, snakehead fish, aquaculture.

Introduction. Indonesia is one of the mega biodiversity spot in the world next only to Brazil (Muchlisin & Siti-Azizah 2009), and for the recent decade the studies on freshwater fish diversity are focused in Sulawesi, Sumatra and Java (Kottelat et al 1993; Muchlisin et al 2015; Partasasmita et al 2015) and lack reports from Kalimantan Island. Meanwhile, Kalimantan or Borneo, has a high biodiversity that remains one of the most forested Provinces in Indonesia, however very limited studies were done in this region.

The Kalimantan possesses extensive wetlands under mature kerangas (heath forest) and peat-swamp vegetation. The Lower Mahakam River area in East Kalimantan contains a series of large seasonal lakes and hundreds of smaller ones, forming a wetland exceeding half a million hectares (Chokkalingam et al 2005). The lake is connected to several small river inflows and backflows from both the Kelinjau and Kedang Kepala Rivers (Stuebing et al 2015). This includes the Suhui River, located in Muara Ancalong District, Kutai Timur Regency in East Kalimantan (Figure 1). The Suhui River, surrounded by natural forest, is home to a population of fish that is traditionally used as a fishing activity by local people. Fishermen use small-mesh gill nets and electrofishing equipment. Besides that fishing activity, the fish diversity of this region has started to attract some scientists.

Though some work has been done by different researchers on fish fauna, the study area has no basic biological information on fish species. Therefore, the objectives of the present study were to inventory the fish diversity of this river and to evaluate the potency of the fish for aquaculture development program. In addition, the present paper

highlights the knowledge of the present scenario of fish diversity of the Suhui River, Muara Ancalong, East Kutai, East Kalimantan, Indonesia.

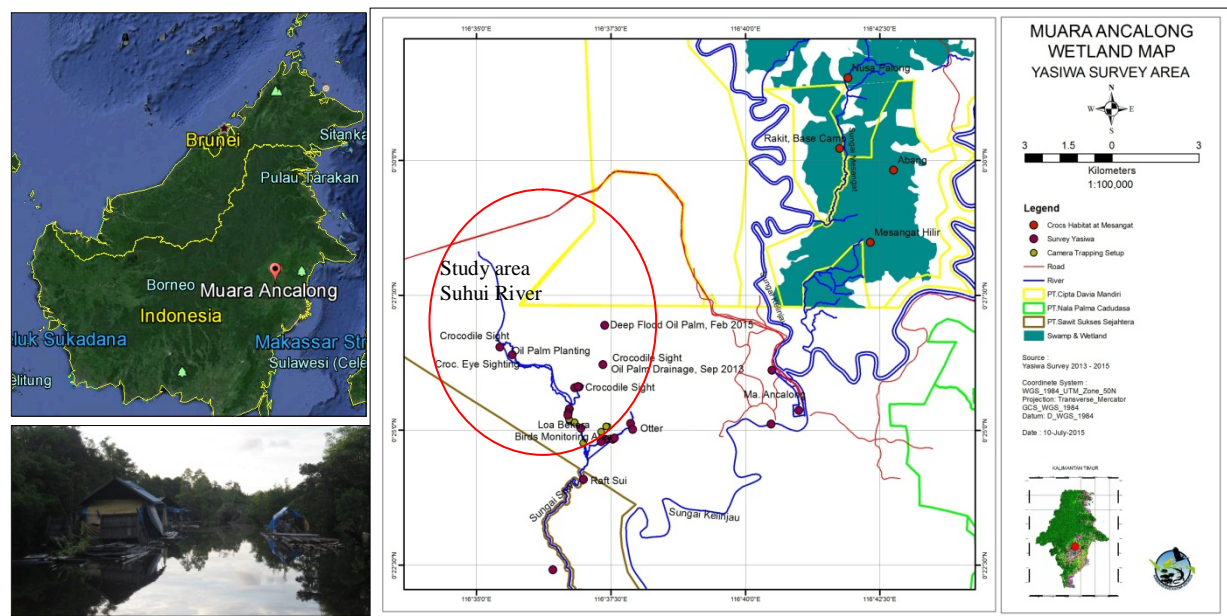


Figure 1. Satellite image of study area and selected photos of sampling sites on the Suhui River, Muara Ancalong, East Kutai, East Kalimantan.

Material and Method. The preliminary study was conducted in June and July 2015. Fish samples were collected from the Suhui River, Muara Ancalong, East Kutai, East Kalimantan. Sampling sites along the river were chosen on the basis of local fishing activities because all fish were collected by local fishermen who could only target river sites where fishing was successful. The fish were collected using seine nets, cast nets, gill nets, and fish traps. The collected specimens were immediately dipped in 10% formalin in a large container that allowed proper spreading of their fins. Interviews with the local fishermen in the study area were done to provide additional information regarding fishing activity and determine which fish have potential as candidates for aquaculture. The specimens were examined in the field and classified into families, which were carried in separate containers. Each container was labelled properly against the physical data sheet of sampling and brought to the laboratory for further taxonomic examination.

Collected specimens were identified as per Kottelat et al (1993) and Saanin (1984). The analysis of the constraints has been evaluated through surveys and interaction with the local people living near the study area. The data collected in the field included: 1) number of fish species and fish families, and 2) number of fish species and fish orders. All fish were collected from three different stations in the Suhui River: Station 1 (Latitude 00°40'92.6"N; Longitude 116°61'71.3" E); Station 2 (Latitude 00°41'46.7"N; Longitude 116°60'14.7"E); and Station 3 (Latitude 00°40'75.4"N; Longitude 116°61'77.3" E). The report covers results of field observations; the numbers of fish families, orders, and species that were collected from the three stations were only handled and evaluated arithmetically, without use of applied statistical models.

Results and Discussion. Some of the riverine fish observed showed a wide range in the Suhui River, Muara Ancalong, Kutai Timur, East Kalimantan. The fish included: *Pristolepis fasciata*, *Cyclocheilichthys apogon*, *Macrochirichthys macrochirus*, *Kryptopterus lais*, *Macrognathus aculeatus*, *Helostoma temminckii*, *Osteochilus melanopleurus*, *Leptobarbus hoevenii*, and others (Table 1). All fish (in total 263 individuals) that were identified can be grouped into 11 families (Figure 2) and 4 orders (Figure 3). One hundred and eighty six (186) individuals were dominated by members of Cyprinidae with 76 individuals of *Osteochilus spilopleura* (Saanin 1984), followed by Bagridae (23 individuals), Siluridae (22 individuals), and Channidae (9 individuals). Pristolepididae, Mastacembelidae,

Helostomatidae, Anabantidae, Pangasiidae, Eleotridae, and Clariidae were each represented by less than nine individuals (Figure 4).

Table 1
Fish diversity of Suhui River, Muara Ancalong, Kutai Timur, East Kalimantan

No	Order	Family	Species	Total individual
1	Cypriniformes	Cyprinidae	<i>Barbichthys laevis</i>	3
2			<i>Barbonymus schwanefeldii</i>	7
3			<i>Crossocheilus oblongus</i>	9
4			<i>Cyclocheilichthys apogon</i>	1
5			<i>Cyclocheilichthys enoplos</i>	10
6			<i>Hampala macrolepidota</i>	7
7			<i>Leptobarbus hoevenii</i>	9
8			<i>Luciosoma setigerum</i>	2
9			<i>Macrochirichthys macrochirus</i>	16
10			<i>Osteochilus melanopleurus</i>	12
11			<i>Osteochilus spilopleura</i>	76
12			<i>Osteochilus vittatus</i>	4
13			<i>Osteochilus wandersii</i>	3
14			<i>Oxygaster anomalura</i>	13
15			<i>Thynnichthys thynnoides</i>	14
16	Perciformes	Anabantidae	<i>Anabas testudineus</i>	2
17		Channidae	<i>Channa micropeltes</i>	6
18		<i>Channa striata</i>	3	
19		Eleotridae	<i>Oxyeleotris marmorata</i>	1
20		Helostomatidae	<i>Helostoma temminckii</i>	5
21		Pristolepididae	<i>Pristolepis fasciata</i>	3
22	Siluriformes	Bagridae	<i>Mystus nigriceps</i>	23
23		Clariidae	<i>Clarias batrachus</i>	1
24		Pangasiidae	<i>Pangasianodon hypophthalmus</i>	8
25		Siluridae	<i>Kryptopterus apogon</i>	11
26		<i>Kryptopterus lais</i>	4	
27		<i>Ompok bimaculatus</i>	4	
28		<i>Ompok hypophthalmus</i>	3	
29	Synbranchiformes	Mastacembelidae	<i>Macrognathus aculeatus</i>	3

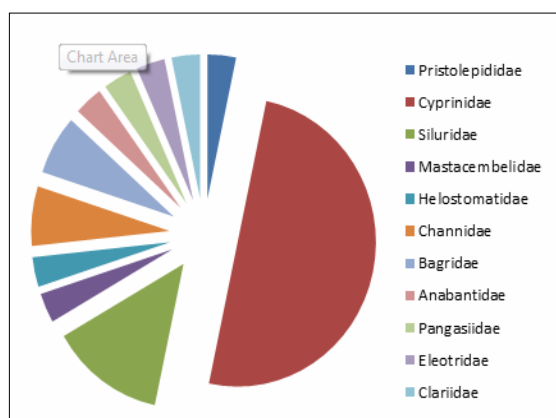


Figure 2. Family distribution of fish of the Suhui River.

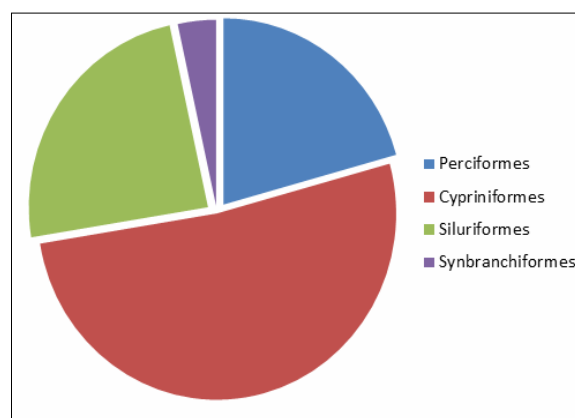


Figure 3. Order distribution of fish of the Suhui River.

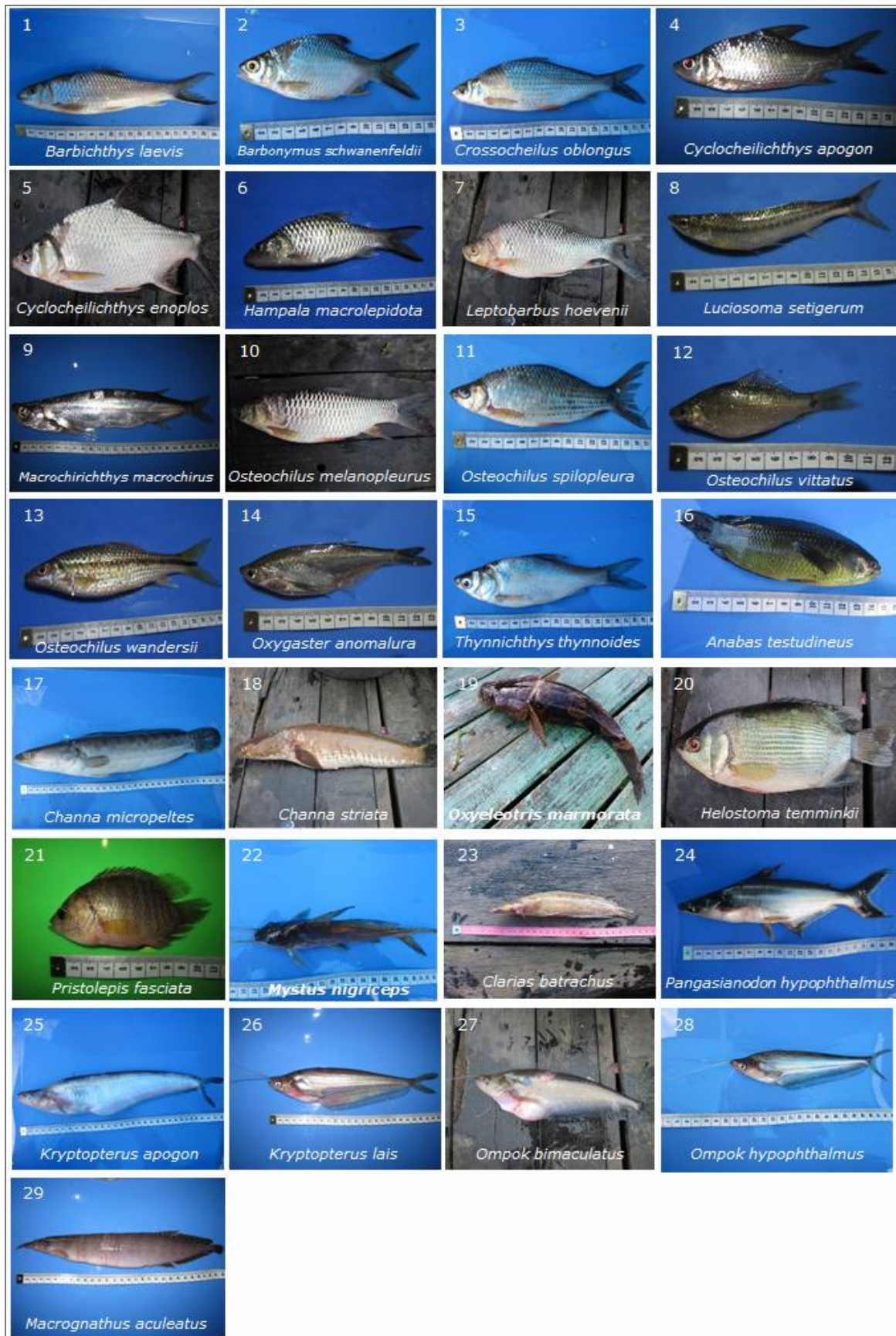


Figure 4. Fish species data collected from the Suhui River, Muara Ancalong, East Kutai, Kalimantan, Indonesia.

Fish are a waterborne resource in the Suhui River, Muara Ancalong. The local people on the Suhui River are fond of fish and a considerable proportion of rural people are meeting their own requirement of fish by their own catching. Although fishing is quite popular in the Suhui River, Muara Ancalong, it is not developed up to the desired level and there is little or even no information regarding fish diversity documentation in that region.

This study was the first attempt to identify riverine fish in the Suhui River, where some local people rely on the fishing activity. Identification of riverine fish as candidates to be cultured in the aquaculture field is not a new thing. It is well known that several aquaculture species used worldwide came from riverine sources (Likongwe 2005). During this study, a total of 263 individuals of fish belonging to 11 families and 4 orders from the Suhui River of Muara Ancalong were collected. Among the 263 fish species, most of the above fish are Cyprinids. There are great differences in the numbers of species from different orders. For example, in the four major orders (Table 1, Figure 3), there are 15 species belonging to the Cypriniformes, while merely 7 species belong to the Siluriformes, the difference being over two times. The difference was even greater for the Perciformes (6 species) and Synbranchiformes (1 species). The order Cypriniformes was found to be the most diversified fish group in terms of both number of species and individuals. Fish biodiversity reported here is based on limited fish samples that fishers collected for us on request, and should not be considered as a final observation for the rivers of Suhui, Muara Ancalong.

Based on our personal communication with local fishermen, the fish that has economic value and potential to be cultured in the research area was *Channa striata*. This fish has an agreeable flavour in local food, medicinal properties, high local market demand, and commercial value (Marimuthu & Haniffa 2004; Srivastava et al 2012), reaching (IDR) 110.000 in Banjarbaru, Indonesia (Rizal 2015). Similarly, Muchlisin (2013) reported that the snakehead (*C. striata*) is one of the high value freshwater fish in Indonesia and it is very promising as a target species for aquaculture.

The *C. striata*, also known as 'Haruan—the carnivore snakehead', has a wide range of habitats, such as ponds, swamps, and rivers (Song et al 2013). According to Chandra & Banerjee (2004), *C. striata* has an ability to tolerate adverse environments due to its accessory respiratory organ with a suprabranchial chamber, which is a unique air-breathing organ. The average size of *C. striata* caught in natural waters ranges from 200 to 500 g (Abol-Munafi et al 2004) and 60 to 70 cm in length (Vidhayanon 2002). This species' preferred temperature range is 20-35°C and it can live in either acidic or alkaline waters. In a monoculture system, the growth of *C. striata* is 1.05% per day (Mohanty & Samantaray 1996) and estimates of mean relative fecundity range from 10.5 to 36.3 oocytes per g body weight (Ali 1999).

Besides collecting fish diversity data and evaluating fish species that have potential to be cultured, this preliminary study may also be used as basic data to monitor fish conservation, especially in the Suhui River. In the Suhui River, fishing activity has been done for more than a decade by local people and is aimed at providing fish for human consumption. Directly or indirectly, the livelihood of the local people depends on fishing. However, due to the decrease in fish, which might be a result of conversion of wetland areas into agricultural fields such as palm oil plantations, further work on fish conservation needs to be done. The agricultural activities might cause harm not only to the fish fauna but also to the entire community of the ecosystem, which causes loss of breeding ground, eutrophication, increased turbidity of the water, and creation of algal blooms that affect many species. Kurniati (2008) revealed that fishing activities and habitat conversion are considered as the main threats to other fauna, such as crocodiles and their habitat.

Furthermore, the local Government of Muara Ancalong, Kutai Timur stated that due to the physical properties of the natural space habitat, resources tend not to be fully controlled or used by the local people. There is a possibility of infiltration using economic power from outside the region. The main source of insecurity in the region is the problem of overexploitation and pollution of water (Noor 2011). Thus, fish conservation in the Suhui River is needed to ensure fish sustainability. The success of conservation often depends on local support, which is strongly influenced by perceptions of the impacts that

are experienced by local communities and opinions of management and governance (Bennett & Dearden 2014).

Conclusions. A total of 29 species of fish belonging to 11 families and 4 orders were recorded during the study. It is concluded that the Suhui River could become a reliable source of future aquaculture species with many fish diversities for the Muara Ancalong region. *Channa striata* is a candidate species that has potential to be cultured in the Suhui River. Further research and attempts should be made to improve local people's ability to culture and conserve fish. There should also be a strong implementation of conservation laws to protect fish habitat in the Suhui River, Muara Ancalong East Kutai, East Kalimantan.

Acknowledgements. We would like to thank Mrs. Monica Kusneti as the head of Yayasan Khatulistiwa Indonesia for supporting this study. We wish also to express our heartfelt gratitude to several people who assisted us in the field and for their outstanding contribution to the success of this preliminary survey.

References

- Abol-Munafi A. B., Tarn B. M., Ambak M. A., Ismail P., 2004 Effect of different diets on growth and survival rates of snakehead (*Channa striata* Bloch, 1797) larvae. Korean Journal of Biological Sciences 8:313-317.
- Ali A. B., 1999 Aspects of the reproductive biology of female snakehead (*Channa striata* Bloch) obtained from irrigated rice agroecosystem, Malaysia. Hydrobiologia 411:71-77.
- Bennett N. J., Dearden P., 2014 Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand. Marine Policy 44:107-116.
- Chandra S., Banerjee T. K., 2004 Histopathological analysis of the respiratory organs of *Channa striata* subjected to air exposure. Veterinarski Arhiv 74:37-52.
- Chokkalingam U., Kurniawan I., Ruchiat Y., 2005 Fire, livelihoods, and environmental change in the Middle Mahakam peatlands, East Kalimantan. Ecology and Society 10:26.
- Kottelat M., Whitten A. J., Kartikasari S. N., Wirjoatmodjo S., 1993 Freshwater fishes of Western Indonesia and Sulawesi. Periplus Editions, Jakarta, 293 pp.
- Kurniati H., 2008 [Mesangat Lake: last habitat of black badas Crocodyle, *Crocodylus siamensis*]. Fauna Indonesia 8:25-28 [in Indonesian].
- Likongwe J. S., 2005 A preliminary study on biodiversity of riverine fishes in Malawi and their aquaculture potential. African Crop Science Conference Proceedings 7:1293-1296.
- Marimuthu K., Haniffa M., 2004 Seed production and culture of snakehead. INFOFISH International 2:16-18.
- Mohanty S. S., Samantaray K., 1996 Effect of varying levels of dietary protein on the growth performance and feed conversion efficiency of snakehead *Channa striata* fry. Aquaculture Nutrition 2:89-94.
- Muchlisin Z. A., 2013 Potency of freshwater fishes in Aceh waters as a basis for aquaculture development program. Jurnal Iktiologi Indonesia 13(1):91-96.
- Muchlisin Z. A., Siti-Azizah M. N., 2009 Diversity and distribution of freshwater fishes in Aceh waters, Northern-Sumatra, Indonesia. International Journal of Zoological Research 5(2):62-79.
- Muchlisin Z. A., Akyun Q., Rizka S., Fadli N., Sugianto S., Halim A., Siti-Azizah M. N., 2015 Ichthyofauna of Tripa Peat Swamp Forest, Aceh province, Indonesia. Check List 11(2):1560.
- Noor I., 2011 [Regulation of the East Kutai regency: medium-term development plan for East Kutai regency year 2011-2015]. Available at: <https://id.scribd.com/doc/243302991/Perda-Kutim-No-11-RPJMD-Tahun-2011-2015-pdf>. Accessed: April, 2016 [in Indonesian].

- Partasasmita R., Nuari T., Erawan T. S., Iskandar J., 2015 The diversity of fish species and the disturbances in the Cikawung river, Cianjur, West Java, Indonesia. *Nusantara Bioscience* 7(2):171-176.
- Rizal Y., 2015 [The price of *Channa striata* in Banjarbaru 110.000 IDR]. Available at: <http://kalsel.antaranews.com/berita/23361/harga-haruan-banjarbaru-rp110-ribu>. Accessed: April, 2016 [in Indonesian].
- Saanin H., 1984 [Taxonomy and identification of fish]. Bina Rupa Aksara, Jakarta, Vol. I, 2nd ed. pp. 47-64. [in Indonesian]
- Song L. M., Munian K., Abd Rashid Z., Bhassu S., 2013 Characterisation of Asian snakehead murrel *Channa striata* (Channidae) in Malaysia: an insight into molecular data and morphological approach. *The Scientific World Journal* 2013, article 917506, 16 pp.
- Srivastava P. P., Dayal R., Chowdhary S., Jena J. K., Raizada S., Sharma P., 2012 Rearing of fry to fingerling of saul (*Channa striatus*) on artificial diets. *Online Journal of Animal and Feed Research* 2:155-161.
- Stuebing R., Sommerlad R., Staniewicz A., 2015 Conservation of the Sunda gharial *Tomistoma schlegelii* in Lake Mesangat, Indonesia. *International Zoo Yearbook* 49:137-149.
- Vidthayanon C., 2002 Peat swamp fishes of Thailand. Bangkok, Thailand, 136 pp.

Received: 24 November 2015. Accepted: 14 March 2016. Published online: 14 April 2016.

Authors:

Rudy Agung Nugroho, Animal Physiology, Development and Molecular Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Jl. Barong Tongkok No 4 Gn Kelua, 75123 Samarinda, Indonesia, e-mail: rudyagung.nugroho@fmipa.unmul.ac.id

Yusuf Galih G. Santoso, Animal Physiology, Development and Molecular Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Jl. Barong Tongkok No 4 Gn Kelua, 75123 Samarinda, Indonesia, e-mail: ygalih34@gmail.com

Firman M. Nur, Animal Physiology, Development and Molecular Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Jl. Barong Tongkok No 4 Gn Kelua, 75123 Samarinda, Indonesia, e-mail: Firmanmn19@gmail.com

Nova Hariani, Ecology and Animal Systematics Laboratory, Department of Biology, Faculty of Mathematics and Natural Sciences, Mulawarman University, Jl. Barong Tongkok No 4 Gn Kelua, Samarinda, Indonesia 75123, e-mail: ovaaja@yahoo.com

Suimah Solikin, Yayasan Konservasi Khatulistiwa Indonesia, Jl Cendana gg Jamrud 678 RT 19 No. 2, Samarinda, Indonesia, e-mail: soeimah@gmail.com

This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

How to cite this article:

Nugroho R. A., Santoso Y. G. G., Nur F. M., Hariani N., Solikin S., 2016 A preliminary study on the biodiversity of fish in the Suhui River, Muara Ancalong, East Kutai, Indonesia. *AAFL Bioflux* 9(2): 345-351.