

Seasonal yield and composition of an inland artisanal fishery in a humic floodplain ecosystem of Central Kalimantan, Indonesia

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Abstract. Gumiri S, Ardianor, Syahrinudin, Anshari GZ, Komai Y, Taki K, Tachibana H. 2018. Seasonal yield and composition of an inland artisanal fishery in a humic floodplain ecosystem of Central Kalimantan, Indonesia. *Biodiversitas* 19: 1181-1185. Seasonal yield of an inland artisanal fishery was studied in 2015 in the Takapan Floodplain Lake located along the Rungan River of Central Kalimantan Province-Indonesia. Record on daily fish catch consisting weight data and species composition was made *in situ* along with a one-year rainfall data that was collected from the nearest Meteorological Station located in Palangka Raya City airport. Results showed that throughout the year, total annual yield of captured fishes reached 4.8 tons comprised of 34 commercial freshwater fish species. Seasonal yield varied considerably in which fish capture was higher during the rainy season than on the dry season. The transition period from rainy to dry season was found to be the peak period of fish capture in the floodplain. Of the 34 fish species, the most abundant species was *Channa striata* that accounted to almost 50% of total annual fish yield. The two most abundant fishes, *Channa striata*, and *Kryptopterus palembangensis* were a top predatory *blackfish* and an omnivorous surface water *whitefish*, respectively. This result indicated that the studied floodplain habitat was still in good condition, however, conservation is needed to maintain the sustainability of freshwater fish resource in the future. □

Keywords: Artisanal, fishery, floodplain, yield, sustainability

INTRODUCTION

Palangka Raya City is the capital city of Central Kalimantan Province, Indonesia. The city covers an area of 2,678.51 km² inhabited by only 244,500 people or with the population density is only 91 people/km². Although it is a provincial capital, the city often said to have three faces: the city face, the village face and the forest. About 93% of its area is still considered as the forested area (Anon 2014a).

The city is flowed by two big rivers namely the Kahayan River, 550 km long, and the Rungan River, 750 km long (Anon 2014b). Along these rivers, 104 oxbow lakes were found with their size ranging from less than one hectare up to several hectares. These lakes were surrounded by tropical peat swamp forest. The rivers, lakes and this tropical peat swamp forest were interlinked forming a floodplain ecosystem. During rainy season, the rise of water level caused the oxbow lakes to expand and the peat swamp area was inundated and then dried up during the dry season (Gumiri and Iwakuma 2005).

These seasonal hydrological dynamics was the major determinant of the seasonal dynamics of water quality of this floodplain ecosystem. Ardianor et al. (2014) reported

that values of physicochemical parameters both in the river and its adjacent lakes varied greatly between dry season and wet season periods. During dry season, the water from both of the adjacent lakes and the Rungan River exhibited very low pH values. This low pH is probably due to the decrease of water discharge from upstream and the water bodies are then filled with the water released from the acidic groundwater from the surrounding peatland. On the other hand, during rainy season the increase of water discharge from upstream, the pH values will increase due to the dilution. However, the turbidity values were higher during dry season and lower during rainy season. The concentrations of dissolved oxygen were also higher during dry season than during rainy season.

The floodplain ecosystem of Palangka Raya was also characterized by relatively low concentrations of anions and cations. The anion concentrations tended to increase significantly during the transition period between dry and rainy season, whereas the cation concentrations were relatively stable throughout the year. The periodic fluctuation of cation concentrations during this transition period is presumably due to the sudden increase of water discharge that might be bringing more organic inputs to the system. □

Despite the fact that this humic floodplain ecosystem of Palangka Raya is physicochemically poor in nutrient content (Tachibana et al. 2003), it supports high diversity and production of inland fisheries. There were more than 300 freshwater fish species had been recorded in Central Kalimantan Province (Anon 2010). It has been reported that even a single lake with less than 3 ha in size could harbor more than 100 species of freshwater fish (Buchar et al. 2007). The annual yield of inland captured fisheries in Palangka Raya City in 2013 was 1,340.5 tons (Anon 2014a). This high production of inland fisheries is probably partly due to the existence of riparian forest that provides fishes with natural food during rainy season (Gumiri et al. 2009).

The inland fishery catch in Southeast Asia was mostly under-reported including in Indonesia the official figures reported may not be based properly on recorded data (Coates 2002). In the present study, we attempt to provide a more accurate information of the inland fishery yield and species composition from the floodplain ecosystem of Central Kalimantan Province, Indonesia.

MATERIALS AND METHODS

Study area

The study was conducted in floodplain ecosystem surround Takapan Lake, a 53 ha humic floodplain oxbow lake located at the Rungan River, Sub-district of Pahandut, Palangka Raya City, Central Kalimantan, Indonesia (02 9' 2.86" S; 113 55' 1.17 E) (Figure 1).

The lake area was inhabited by a small number of subsistent local fishermen families in which they relied on their income solely from catching fish from the forested floodplain ecosystem of Rungan River watershed either

from the river, lake or the swamp forest area around the lake. Data collection was made for one year period from January until December 2015. Fish record was made by treating a local fisherman household operated in the lake as a defined unit effort as suggested by Coates (2002). This was possible because the fisherman was the only one buyer of all landed fishes in the lake. This daily bulk of catches was then usually sold to local market in Palangka Raya City. The fisherman was asked to record the daily fish catch consisting of number of fish types or local fish name and their weight. The fisherman's record was then collected every month by visiting the lake. Naming the scientific names of the caught fishes based on local names was made according to Kotellat et al. (1993) and Roberts (1989). Along with the fish record, rainfall data were also collected from the Airport Meteorological Station located in Palangka Raya City, located c.a 20 km from the study site. The fish data were then tabulated and presented in the form of tables and graphs.

RESULTS AND DISCUSSION

Results

Throughout the year the daily fish yield fluctuated considerably (Figure 2). In most cases, the daily fish catch was less than 25 kg per day, but during high yield period, the catch could reach more than 75 kg per day. More fish was captured between December and July, whereas between August and November were the months with the lowest catch. This trend somewhat coincided with the rainy events in the region. High rainfall periods occurred between February and May, and between October and December. It seemed that the high fish yield periods were preceded by those of high rainfall periods. □



Figure 1. Study site in Takapan Lake, Palangka Raya City, Central Kalimantan, Indonesia. Arrow indicates the fish landing point where fish record was made

Although the fish catch quiet high in certain periods (Figure 3.A), the number of fish species was relatively low (Figure 3.B). During high yield days, the number of fish species was mostly less than 5, and even during the two highest yields periods on mid of May and mid of July, the species caught consisted of only one species. This indicated that some particular species were abundant only during particular periods of the year. □

Throughout the year, the number of commercial fishes caught in the lake was 34 species with the total yield reached 4.8 tons (Table 1). The most abundant and common species caught was *Channa striata* that contributed to almost 50% of the total catch and captured in 198 days out of 365 days. The second high fish catch was *Kryptopterus palembangensis* with the total yield over 1 ton, and caught in 89 days per year. *Mystus nemurus*, *Trichogaster trichopterus*, *Osteochilus melanopleura* and *Mystus nigriceps* were the next abundant fish caught respectively.

Throughout the year, trends of monthly catch of the top five most abundant species varied (Figure 4). The yield of *Channa striata* peaked during May and June. The variation of its catch was very similar with the trend of the rainfall events but it seemed that the high yields happened just after the heavy rainfall period or during the transition period between the rainy and the dry season. The highest season of *Kryptopterus palembangensis* and *Mystus nemurus* were of January and February, respectively. Their yield variations somewhat coincided with the seasonal variation of rainfall events in the region. On the other hand, other two abundant species: *Trichogaster trichopterus* and *Osteochilus melanopleura* yield did not seem to have any correlation to the rainfall events.

Discussion

In the current study, the data were based on a whole one year period of inland artisanal fishery yield record. Since the study was conducted in a floodplain ecosystem where this type of inland fishery usually covers full spectrum of gears, the bulk of catches was difficult to see and monitor (Coates 2002). However, since all of the captured fishes were usually landed and sold to a local fisherman who then resells them on daily basis to Palangka Raya City, so we claim that our record represents the bulk catches of fish in this floodplain ecosystem. □

The total number of species found during the present study was 34 species. Although the species richness was similar, the species composition differed considerably with fish species found in other studied tropical inland water ecosystems in Kalimantan and Sumatera (Utomo and Prasetyo 2005; Kartamiharja et al. 2011; Kasim et al. 2015; Rupawan and Rais 2016). This difference supports the common scientific view that high diversity of freshwater fish species occurs mostly in the equatorial countries including Indonesia (Ng et al. 2017). □

Similar to fish caught in other tropical floodplain ecosystems (de Merona 1990; Baran 2005; Freitas et al. 2002), fish yield in the studied floodplain ecosystem fluctuated considerably throughout the year. We found that

high yields occurred during the rainy season and during the transitional period, from rainy to the dry season. This yield pattern could be attributed to fish migration behaviors in this typical ecosystem (Junk et al. 1989; Coates 2002). It has been well documented that adults of many tropical freshwater species migrate up tributaries and on to flooded plains to spawn, lake dwelling species move into tributary streams and other riverine species migrated upriver to headwater regions in anticipation of seasonal rains (Helfman et al. 2009). In this type of inland fishery, local fishermen have adapted to apply more appropriate and efficient fishing gears to capture more fishes as floodwater recede (Coates 2002). □

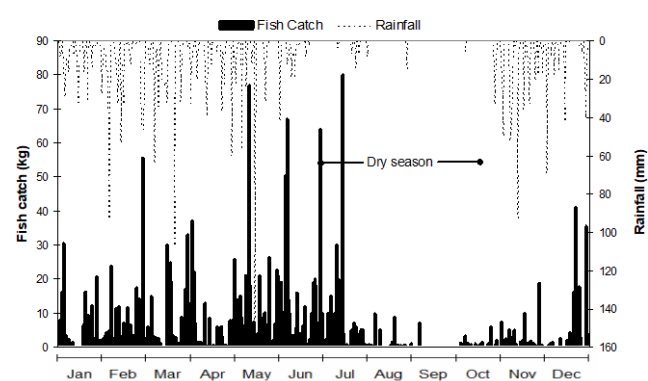


Figure 2. Seasonal variation in fish yield during the period from January until December 2015

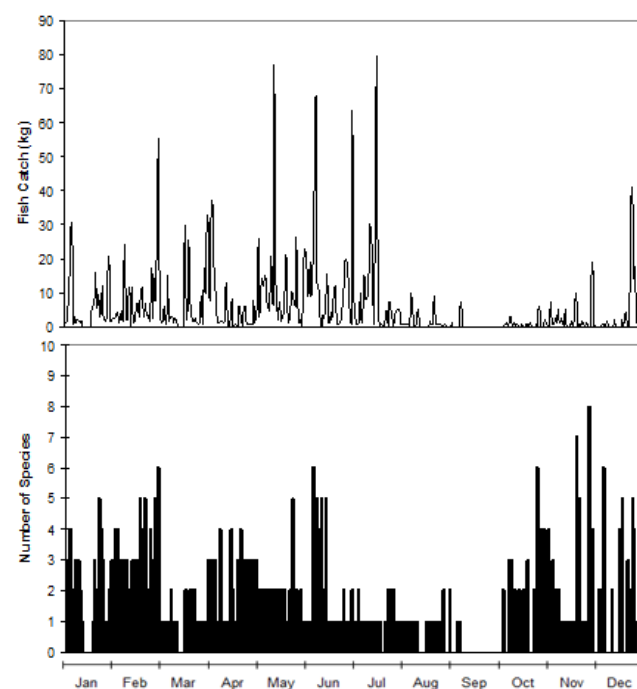


Figure 3. A. Daily number of fish yield, B. The number fish species caught

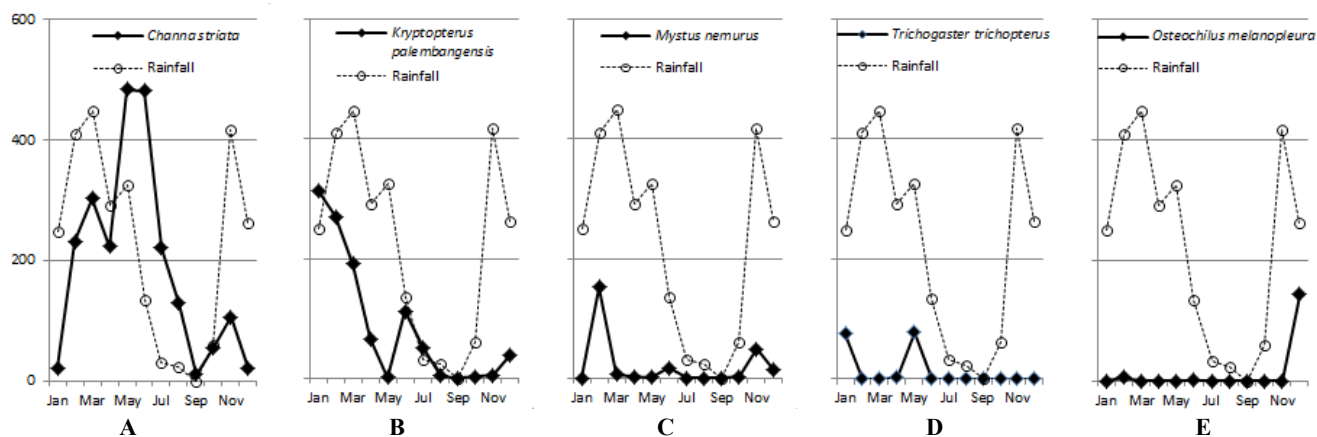


Figure 4. Trends of yield of five most abundant species: A. *Channa striata*, B. *Kryptopterus palembangensis*, C. *Mystus nemurus*, D. *Trichogaster trichopterus*, and E. *Osteochilus melanopleura*. Units of Y-axis were kg for fish catch and mm for rainfall

Table 1. List of commercial captured fish species, their yields and catching days during the period from January until December 2015

Local name	Scientific name	Annual catch (kg)	Catching days
Haruan	<i>Channa striata</i>	2,289.5	198
Lais baji	<i>Kryptopterus palembangensis</i>	1,056	89
Baung	<i>Mystus nemurus</i>	242	30
Sapat	<i>Trichogaster trichopterus</i>	155.1	30
Tauman	<i>Channa micropeltes</i>	116	22
Biawan	<i>Helostoma temminckii</i>	128	19
Kapar	<i>Belontia hasselti</i>	61.7	15
Puyau	<i>Osteochilus hasselti</i>	54.4	14
Kalabau	<i>Osteochilus melanopleura</i>	149.9	12
Pantikan	<i>Mystus nigriceps</i>	144.7	12
Karandang	<i>Channa pleurophthalma</i>	28	12
Udang	<i>Macrobrachium sp</i>	11.7	12
Saluang	<i>Rasbora oxygastroides</i>	39.5	10
Tauman alas	<i>Channa micropeltes</i>	28.6	8
Lili	<i>Mastacembelus nothophthalmus</i>	22.5	8
Papuyu	<i>Anabas testudineus</i>	12.8	7
Puhing	<i>Cyclocheilichthys apogon</i>	26.3	5
Lais tabirin	<i>Belodontichthys dinema</i>	25.3	5
Mihau	<i>Channa melasoma</i>	16.4	5
Tauman karamba	<i>Ophiocephalus micropeltes</i>	47.6	4
Manangin	<i>Elops machnata</i>	30.3	4
Kalui	<i>Osphronemus goramy</i>	11.2	4
Pipih	<i>Chitala lopis</i>	7.7	4
Patin	<i>Pangasius djambal</i>	11.1	3
Lawang	<i>Pangasius polyuranodon</i>	6.5	3
Pentet	<i>Clarias batrachus</i>	3.3	3
Lais besar	<i>Kryptopterus parvanalis</i>	13.5	2
Tapah	<i>Wallago leeri</i>	6.3	2
Jelawat	<i>Leptobarbus hoeveni</i>	2.4	2
Lais bamban	<i>Kryptopterus cry</i>	1.9	2
Lais bantut	<i>Ompok hypophthalmus</i>	17.5	1
Darap	<i>Mystus olyroides</i>	8	1
Sanggi	<i>Mystus sp</i>	2.5	1
Kakap	<i>Lates calcarifer</i>	1	1
Total annual catch		4,779.2	

Of the almost 4.8 tons of total annual fish yield, 48% of the catch composed of snakehead (*Channa striata*). This species is considered as a native freshwater fish species of Borneo (Roberts 1989). The very high production of this top predatory fish can be an indicator that this floodplain ecosystem is still healthy because these predatory fishes depend largely on the production in floodplain (Junk et al. 1989).

The variation in time of peak yields of the five most abundant species could be attributed to the reproductive adaptations of these species to the seasonal dynamics of the ecosystem. The study area was a typical floodplain freshwater ecosystem consisted of river, lake, and floodplain to form a so-called river-floodplain system (Junk et al. 1989). This system is interconnected during rainy season and disconnected at dry season (Gumiri and Iwakuma 2005). During the rise of river water, these expanded interconnected ecosystems become a common spawning and nursery grounds for many riverine fishes. These fishes have reproductive cycles that coincide with seasonal inundation of gallery forest and swamps, perhaps cued by rainfall or rising water levels (Helfman et al. 2009). This high recruitment of riverine fishes could be due to the fact that food supply in fertile floodplains during the flood phase can be so abundant (Junk et al. 1989). The importance of peat swamp forest ecosystem as habitat of freshwater fish community in the region was reported by Thornton (2017) in which of the 55 fish species found in Sebangau floodplain ecosystem, 29 species of them were captured in the forest.

The dominance of predatory species *Channa striata* could be attributed to the abundance of juvenile of other fishes during the rainy season. It has been well documented that worldwide predatory fish species often spawn earlier than their prey, thus assuring a food source for young predators (Helfman et al. 2009). The coincident trend of *Kryptopterus palembangensis* catches with the rainfall events in this study perhaps due to its both migration and reproductive strategies which utilised the expanded floodplain habitat, since members of this *Siluridae* was

found as an omnivorous surface water fish that feed mostly on terrestrial insects falling from the swamp forest or riparian vegetation (Handayani et al. 2009; Minggawati 2009).

To conclude, the present study has attempted to provide a more reliable data on bulk catches of inland artisanal fishery in a humic tropical floodplain ecosystem. In this complex system, the rainfall events tended to govern the high seasonality of fish yield and composition. The dominance of *Channa striata* and *Kryptopterus palembangensis* as a top predatory *blackfish* and an omnivorous surface water *whitefish* respectively, indicate that their habitats are still in good condition to maintain the sustainability of freshwater fish resource in the studied floodplain ecosystem.

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