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Morphometric Analysis and Proximate Nutrition several Commercial Fish Species from Mesangat wetland, Muara Ancalong, Kutai Timur, East Kalimantan, Indonesia

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Abstract. Mesangat wetland has a high diversity of fish, which is traded for consumption by the community. The types of fish consumed have different sizes with unknown morphometric analysis and nutritional content. The purpose of this study was to determine the morphometric measurement (total weight and length, weight of visceral, fin, head, bone, fillet, and gills) and evaluate the proximate content of several commercial fish species from the Mesangat wetland, Muara Ancalong, Kutai Timur. The method used was direct sampling from the field for morphometric measurement, while fish was sampled for further proximate analysis and the results was compared to Standard National Indonesia (SNI). The results found that several species of fish used as consumption have a size that was classified as not in a good growth pattern, namely *Channa striata*, *Notopterus chitala*, *Pangasiodon hypophthalmus*, and *Hemibagrus nemurus*. Meanwhile, *Channa micropeltes*, *Anabas testudineus*, and *Helostoma temminckii* were found in a good growth pattern category. Furthermore, proximate analysis for sampled fish were in standard such as water content, protein, fat, and fibre. However, ash content was not in a standard. In conclusion, several sampled fish for consumption which was found in the Mesangat wetland are in a good growth condition and nutrition composition.

Keywords : morphometric, proximate, wetlands, fish.

1. Introduction

Indonesia has a rich biodiversity in fish fauna which is widely distributed in various ecosystem such as marine, lake, mangrove, and river [1-5]. Mesangat river is located in the area of Mesangat wetland at Muara Ancalong, Kutai Timur, Indonesia. Mesangat wetland which is a 6,000-hectare wetland is connected from Kedang Kepala Village to Kelinjau Village. This wetland is a wetland with an abundance of diverse flora and fauna. Besides being famous for its crocodile, one of the rich fauna contained in this wetland are several types of fish that are the biggest source of livelihood and food by residents around the Mesangat wetland [6]. Stuebing et al. [7] revealed that fish which are found in Mesangat wetland has a high diversity. Mainly, the fish are consumed by local residents around the Mesangat wetland. Small



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and several fish with a large size that are found in the wetland area are caught for consumption, apart from being used as feed for crocodiles.

Furthermore, the size of the fish can be determined by morphometric measurement which to be used to evaluate the diversity of a particular species [8, 9]. The morphometric information obtained is also useful to evaluate the diversity of shapes that caused by geographical differences. In addition, this morphometric analysis is usually used to help to identify fish species and describe their characteristics [10]. Previous research by Rehman *et al.* [11] performed morphometric measurement on some fish to identify relative abundant and their relationship with physico-chemical parameters of water. Meanwhile, Acharya *et al.* [12] successfully defined an identification characteristic of *Carassius auratus* L. using morphometric measurement followed by morphometric characters.

Fish which is used as consumption material contains useful ingredients for cell tissues, regulating metabolic system and supplying energy source in the body [13]. Further, fish ingredients can be evaluated through proximate analysis. The proximate analysis is an assay to determine the nutrient composition of raw material such as fish muscle. Proximate composition is an amount of macro content of substances that is important to obtain proximate information on a food ingredient, the composition of the foodstuff, and the nutritional content [14]. In example, a proximate analysis of Sibero fish (*Hampala macrolepidota*) was previously conducted by Lubis *et al.*, [15] in North Sumatra, who analyzing ash content, protein content, fat content and carbohydrates.

Though some research have been conducted on morphometric measurement and proximate analysis of some fish, limit study was done on seven important of fish-consumed which found on Mesangat wetland at Muara Ancalong, Kutai Timur, Indonesia. Thus, present research was conducted to determine the morphometric measurement and proximate analysis of seven important fish (*Channa micropeltes*, *Channa striata*, *Anabas testudineus*, *Hemibagrus nemurus*, *Helostoma temminckii*, *Notopterus chitala*, and *Pangasianodon hypophthalmus*) that was collected from seven different spot locations at Muara Ancalong wet land. The benefit of this results is important for building strategy to domesticate fish that could reduce overfishing practice from native habitat and as a guide to specific nutritional feed that related to food security.

2. Materials and Methods

2.1. Study Area

Present study was carried out in Mesangat river of Muara Ancalong, Kutai Timur, East Kalimantan, Indonesia. N 00° 31'06" dan E 116° 41'47", Observation sampling area station consisted of seagrass beds associated with mangrove and seagrass beds associated with the coral reef (Figure 1). Seagrass beds at high tides were found in the range of 1 to 1.5 m and at the lowest tide were exposed to temporal exposure. The distance between seagrass and mangrove forest range was from 250 to 800 m. Seagrass at highest tide was found in the depth range of 0.5-1.5 m and at lowest tide experiencing temporal exposure. The distance between seagrass and coral reefs ranged from 10-50 m. The research was performed from August 2019 to January 2020.

2.2. Sampling method

Data was collected two times, in January and August 2019. Sampling was carried out by catching several fish species (*Channa micropeltes*, *Channa striata*, *Anabas testudineus*, *Hemibagrus nemurus*, *Helostoma temminckii*, *Notopterus chitala*, and *Pangasianodon hypophthalmus*) which commonly consumed and sold as commercial fish by the local community. In addition, water quality measurements such as pH, temperature, ammonia, and nitrite content were also measured using a pH meter, nitrite, and ammonia test kit.

2.3. Morphological measurement and Analysis proximate preparation

The fish sample was measured for total length, standard length, and total weight using a caliper, and digital scales. The fish were then dissected and visceral part such as gills, head, and all of their fins were

also taken, continuing by weighing all of their fins. The fish was also filleted, and the bones were separated. Both fillet and the bones were weighed. After weighing, the fillet of the fish samples was put into a plastic clip and then stored in a refrigerator before analyzing the proximate content. Meanwhile, proximate analysis such as water content, ash, protein, fat, and crude fiber content were performed following National Standardization Agency, 1992 [16].

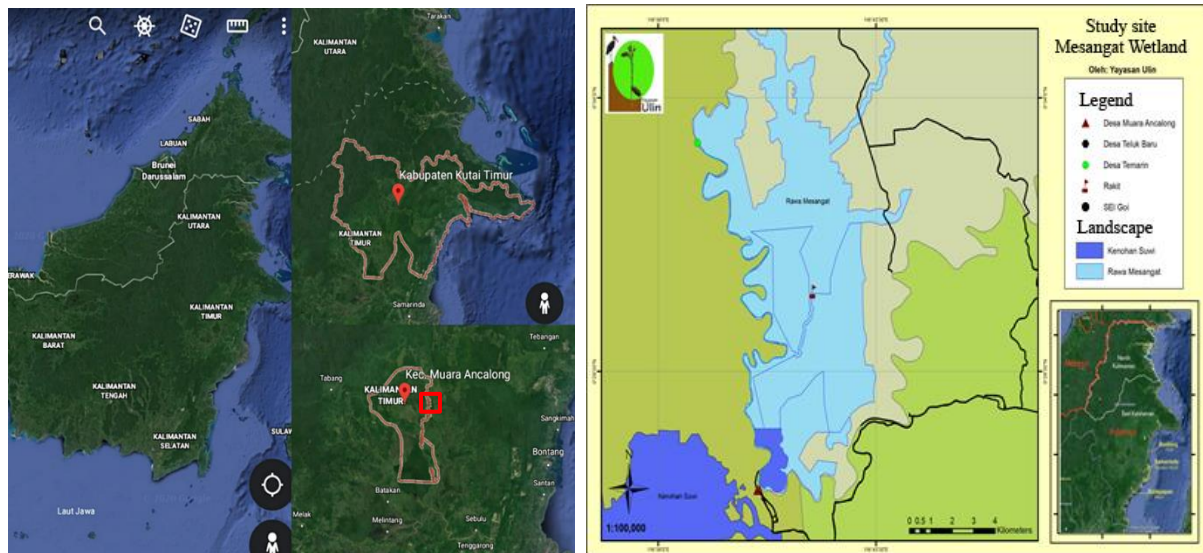


Figure 1. Site study at Mesangat wetland, Muara Ancalong, Kutai Timur, Indonesia

3. Results and discussion

The fish species in the Mesangat wetland have a high diversity, but only few fish species was found, as a consumption by the people around the Mesangat wetland. Present results found that several species of consumption fish from Mesangat wetland were toman fish (*Channa micropeltes*), haruan fish (*Channa striata*), papuyu fish (*Anabas testudineus*), baung fish (*Hemibagrus nemurus*), biawan fish (*Helostoma temminckii*), belida fish (*Notopterus chitala*), and catfish (*Pangasianodon hypophthalmus*) (Figure 2).

The water quality is a pivotal parameter which influence for several fauna to live and support the ability to survive and the growth. Temperature and pH are the most important factors to determine whether the waters are suitable for fish and other aquatic species to live [17]. Present findings revealed that the water quality at the sampling point has been stated sufficient to support habitat for fish species because it meets the pH (6.5-7.0) and temperature (27-29°C) criteria. Meanwhile, nitrite and ammonia value were in average 0.1 mg L⁻¹ and 0.5 mg L⁻¹. Some fish have specific optimal temperature and pH range to survive and in steady stated condition, for example: *Channa micropeltes* (25-28°C and pH 7-8), *Channa striata* (23-28°C and pH 7-8), *Anabas testudineus* (22-30°C and pH 4-8), *Hemibagrus nemurus* (25°C and a pH of 7-8.2), *Helostoma temminckii* (22-28°C and a pH of 6-8), *Notopterus chitala* (24 - 28°C and pH 6-8), and *Pangasianodon hypophthalmus* (22-28°C and a pH of 6.5-8). Besides being influenced by temperature and pH, the growth of fish in Mesangat wetland is also influenced by ammonia and nitrite levels in the water. Current results found that the ammonia level obtained at all water sampling points to measure the quality of the water was 0.5 mg L⁻¹ and the nitrite content was 0.1 mg L⁻¹. Hendrawati *et al.* [18] stated that the ammonia level suitable for aquatic habitats is less than 0.13 mg L⁻¹ and the nitrite level is not more than 0.06 mg L⁻¹. This condition affected the growth of the fish, as well as other organisms that were used as feed for the fish.

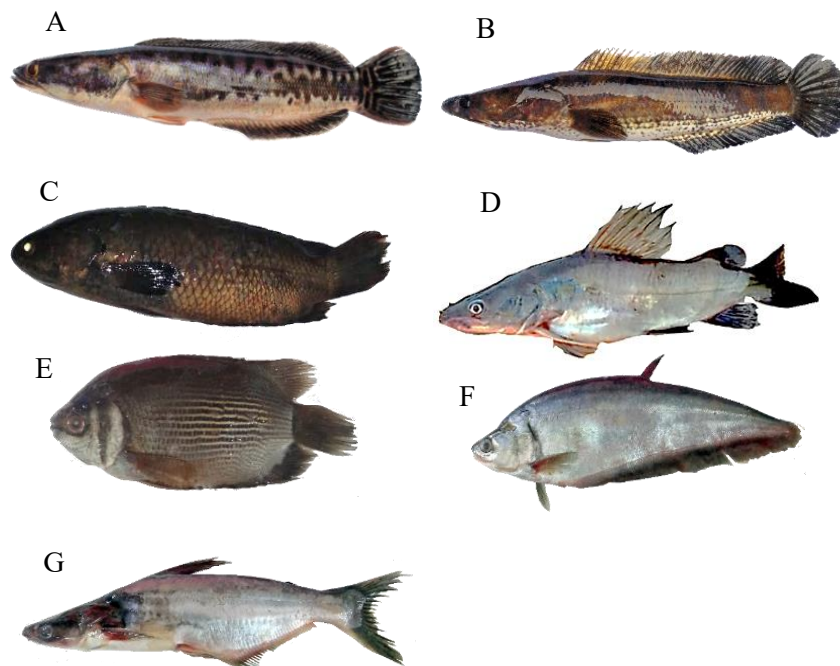


Figure 2. Seven consumed fish found in Mesangat wetland. Muara Ancalong Kutai Timur, Indonesia. A = *Channa micropeltes*, B = *Channa striata*, C = *Anabas testudineus*, D = *Hemibagrus nemurus*, E = *Helostoma temminckii*, F = *Notopterus chitala*, and G = *Pangasianodon hypophthalmus*

Further, it was found that fish with the highest average weight was *Channa micropeltes*, while the smallest average weight was *Anabas testudineus*. The following is data regarding the carcass weight of seven fish species found in Mesangat wetland (Table 1).

Table 1. Morphometric measurement of seven fish species consumed by local community in Mesangat Wetland, Muara Ancalong

Characteristics (g)	<i>Channa micropeltes</i>	<i>Channa striata</i>	<i>Anabas testudineus</i>	<i>Hemibagrus nemurus</i>	<i>Helostoma temminckii</i>	<i>Notopterus chitala</i>	<i>Pangasianodon hypophthalmus</i>
Average weight (g)	1368.80±137.03	402.00±20.95	134.42±16.46	239.33±49.6	149.86±15.95	143.28±29.38	213.33±13.41
Total length (cm)	53.80±3.99	34.56±1.17	20.45±0.72	31.50±3.17	25.7571±1.5	20.41±1.47	31.43±0.64
Standard length (cm)	45.38±3.64	29.14±0.52	16.80±0.71	26.03±3.0	23.66±1.7	16.41±1.2	25.47±0.49
Visceral weight (g)	63.86±7.66	15.06±1.86	5.14±1.28	10.67±3.55	5.44±1.12	9.20±1.74	11.19±1.14
Head weight (g)	251.60±21.66	69.12±5.34	16.18±4.91	53.08±11.99	14.64±1.32	22.57±4.04	32.07±5.07
Fin weight (g)	31.22±3.77	9.62±0.79	3.63±0.81	7.71±2.27	4.15±0.27	4.67±0.78	5.60±0.5
Bone weight (g)	97.81±23.56	25.58±1.92	22.23±2.85	23.14±5.79	22.16±2.78	22.42±4.07	22.37±2.74
Gills weight (g)	26.12±3.06	19.60±6.23	1.82±0.57	7.03±1.54	2.20±0.33	3.37±0.71	4.54±0.47
Fillet weight (g)	832.60±104.35	227.00±16.58	60.48±6.48	118.88±25.43	90.6429±11.81	77.91±13.6	121.63±6.53

Channa micropeltes from Mesangat wetland, Muara Ancalong, Kutai Timur had the highest in all morphometric value measurement compare to other commercial fish found in this study. The *Channa micropeltes* reached in a good growth to be consumed as revealed by Roberts [19] which the best total length of *Channa micropeltes* is between 50-130 cm. Present results also stated that the size of *Channa micropeltes* in Mesangat wetland had an average total length of 53.8 cm, the standard length was 45.38 cm and the weight was 1368.94 g. On the other hand, total length of *Channa striata* (34.56 cm) was not categorized as in a good condition in length growth based on the previous study by Pethiyagoda [20], stating that the maximum length growth of *Channa striata* for consumption is 100 cm. Meanwhile, the growth of *Anabas testudineus* (Total length 20.45 cm) in Mesangat wetland was classified in good condition. Talwar & Jhingran [21] mentioned that the length growth of the *Anabas testudineus* is close

to the maximum length at size of 25 cm. Similar growth condition was also measured in *Helostoma temminckii* in Mesangat wetland that has an average total length of 25.76 cm which is classified as close to the maximum growth [22]. However, total length of *Hemibagrus nemurus* (31.50 cm) and *Notopterus chitala* (20.41 cm) was not categorized as good condition in length growth, based on the previous study by Rainboth [23] and Roberts [24], stating that the maximum length growth of *Hemibagrus nemurus* reaches 65 cm, while *Notopterus chitala* is 122 cm. Moreover, the *Pangasiodon hypophthalmus* which caught in Mesangat wetland has an average total length of 31.43 cm and it was far from maximum length growth for *Pangasiodon hypophthalmus* that can reach 130 cm [25].

From the data obtained, it is known that there were variations in the size of the consumption and commercial fish in Mesangat wetland, Muara Ancalong, Kutai Timur. Some of these fish species were classified as in a good growth and some of them did not experienced in a good growth in their habitat. This variation might be due to the water quality such as temperature, pH, nitrite, and ammonia content which are the pivotal point in supporting their growth.

Proximate analysis was carried out to determine their nutritional content and identified whether the fish consumed by the local community around Mesangat wetland had met the criteria for consumption fish based on the nutritional content. Present findings also stated that most of seven commercial fish species consumed by local community in Mesangat wetland met the nutritional standards for fresh fish based on SNI (Standard Nasional Indonesia or Indonesian National Standard) [26] (Table 2). It was revealed that the highest water content (83.3%) was found in *Pangasianodon hypophthalmus*, while the lowest (77.38%) was *Anabas testudineus*. For the value of ash content, the highest (13.97%) was found in *Notopterus chitala*, while the lowest (4.5%) was in *Pangasianodon hypophthalmus*. In terms of protein content, it is known that the highest protein content (22.05%) was found in *Anabas testudineus*. Meanwhile, *Pangasianodon hypophthalmus* had the lowest in ash (4.5%), and protein (10.5%), but high in water content (83.3%).

Table 2. Proximate analysis of seven fish species consumed by local community in Mesangat Wetland, Muara Ancalong

Species	Proximate analysis (%)				
	Water	Ash	Protein	Fat	Crude fiber
<i>Channa micropeltes</i>	80.25	5.89	17.54	0.11	0.31
<i>Channa striata</i>	80.55	5.09	17.26	9.29	0.10
<i>Anabas testudineus</i>	77.38	5.50	22.05	0.33	0.29
<i>Hemibagrus nemurus</i>	81.29	5.51	21.27	0.05	0.02
<i>Helostoma temminckii</i>	81.8	12.12	17.1	0.30	0.7
<i>Notopterus chitala</i>	82.1	13.97	14.1	0.30	1.2
<i>Pangasianodon hypophthalmus</i>	83.3	4.5	10.5	0.45	0.1
SNI 01-2354.4-2006	max 76	<2	17-18	min 4.5	-

According to SNI 01-2354.2-2006 [26], water content in fish for consumption is about 76%. Kantun et al. [27] stated that high water content in fish caused white fish flesh. Recent study revealed that seven consumed-fish by local community which found in Mesangat wetland. the water content was above the water content standard (77.38 - 83.3%) based on the Indonesian National Standard for the water content (76%) of fresh fish. The increase of water content in the fresh fish samples might be caused by mucus on the outside of their body. In addition, the remaining of mucus and water outside the fish's body increased deterioration and enhanced the water content [27].

In ash content, SNI 01-2354.1-2006 revealed that the ash content of fresh fish should no more than 2%. Current results found that all ash content obtained from seven fish species that was caught from Mesangat wetland had the ash content value above 2%. Previous research stated that the mean value of the ash contents for the *Clarias gariepinus*, *Selar crumenophthalmus*, *Scomber scrombus*, and *Pseudotolithus senegalensis* is about 1.45 (g/100g) [28]. Meanwhile, another report found that the ash content in *Oncorhynchus mykiss* is in range 1.35 - 1.66% [29], and 0.95 - 2.50% for *Bagrus bajad* [30]. The variation of ash content in the fish could be due to differences in age, sex, and environment [31].

Water quality in the habitat of aquatic organisms is one of the determinants of the ash content in fish. If the levels of ammonia and nitrite do not match, the growth in fish will not be good, as well as the ash content in it [18].

Based on SNI 01-2354.4-2006, protein content for fresh fish is in the range of 17-18%. Current findings revealed that *Channa micropeltes*, *Channa striata*, and *Helostoma temminckii* have protein content in the range of the standard, while *Anabas testudineus*, *Hemibagrus nemurus*, and *Pangasianodon hypophthalmus* were above the standard. However, *Notopterus chitala* was not met the protein content standard. Further, fat content standard for fresh fish to be consumed is about 4.5% [26]. Present research stated that all seven fish species which was caught from the Mesangat wetland have a fat content below 4.5%. Thus, all these seven fish species found in the Mesangat wetland were categorized as low-fat fish. Similar to fat content, all seven fish species had crude fiber below 10%, which means good for consumption. Fresh fish which has crude fiber content more than 10% decreased digestibility, absorption, and water quality, but increased metabolic waste in the body of consumers [32].

4. Conclusion

Seven fish species was found as the main consumed and commercial fish by local community of the Mesangat wetland. Mesangat wetland has an appropriate water quality such as temperature and pH that suitable for fish life. However, ammonia and nitrite level did not meet the water quality standards for these fish. The several consumed and commercial fish species analysed in this research are high varieties in morphometric values and in a good growth. The proximate analysis for several consumed and commercial fish species in the Mesangat wetland also shows as a good for protein source but low in fat and crude fiber content. The obtained data from this study will supplement the information on the Muara Ancalong fish nutrient composition which also benefit for food security.

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