Biological aspects of lontok fish (*Ophiocara porocephala*) in an Indonesian tidal lake

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Abstract. Research on aspects of fish biology is very important in the fisheries management perspective. Lontok fish (*Ophiocara porocephala*) is one of the economically important fish species found in Siombak Lake. This study aims to determine several aspects of the biology of lontok fish including: population distribution, growth, reproduction, food and feeding habits. Data were collected from September 2018 to August 2019 using survey methods and direct observation in the field. There were eleven sampling stations representing inlet, outlet and around the lake. Lontok fish was captured by gillnet and trap, both on high tide and low tide. The results showed that the relationship between the length and weight of female lontok fish followed the equation $W = 0.124eTL^{0.439}$ and had a negative allometric growth pattern ($b < 3$), while male fish $W = 0.0096TL^{3.1269}$ and had a positive allometric growth pattern ($b > 3$). This result is thought to have been influenced by the availability of food. Lontok fish is included in the carnivore group with the types of food that have been found in its digestion are shrimp, crab and shellfish. The highest gonadosomatic index that was found in lontok fish was 0.75% with the first size of first gonad maturity 18.4 cm total length (TL). Small lontok fish (< 10 cm TL) were caught in January and February 2019 when it was suspected that early recruitment occurred at that time. Based on the size of the fish and the feeding habits of Lontok fish in Lake Siombak, it is indicated that this lake is a feeding ground for lontok fish. Considering that, it is necessary to monitor it systematically and sustainable in long term.

Key Words: allometric, carnivore, first maturity, *Ophiocara porocephala*, Siombak Lake.

Introduction. Siombak lake is one of the tropical tidal lakes in Indonesia. The lake has an area of 29 ha with an average depth of 5.26 m at high tide and 2.96 m at low tide (Muhtadi et al 2020a). The influence of sea tides causes this lake to be an estuary, so the organisms in the lake are very diverse, from freshwater, brackish water and marine organisms (Leidonald et al 2019), including the presence of mangrove trees that grow on the edge of the lake (Leidonald et al 2019; Muhtadi et al 2020b). The spangled gudgeon or locally known as lontok fish (*Ophiocara porocephala* (Valenciennes, 1837)) is one of the economically important fish in Lake Siombak (Muhtadi et al 2020c), including in Belawan estuary (Manullang & Khairul 2020), and Lake Tondano (Mamangkey et al 2019). In fact, lontok fish live in estuary and mangrove waters (Kottelat 2013) so that its abundance in Lake Siombak and Belawan estuary is quite high (Manullang & Khairul 2020; Muhtadi et al 2020c). This lake is unique because the flow of rivers entering the lake through the Belmera River along 7.5 km from Belawan (Malacca Strait) is still affected by tides. However, the fish can be found in fresh water, such as those found in Lake Limboto (Suryandari & Krismono 2011) and Lake Tondano (Satria & Kartamihardja 2011). This fish is widely distributed in the waters of the Indo West Pacific (Kottelat 2013).

At this time, lontok fish production still relies on natural fishing both in Lake Siombak and the Belawan River, including other waters in Indonesia (Satria &

Kartamihardja 2011; Suryandari & Krismono 2011; Manullang & Khairul 2020). However, the information obtained shows that the catch of lontok fish tends to decrease both in number and in size. This is based on the results of interviews with several fishermen who live on Siombak Lake's coast, where it is very difficult to get large size lontok fish and it turns out that the Belawan River shows the same thing (Manullang & Khairul 2020). If this is allowed, it will threaten the existence and preservation of lontok fish in the waters, especially Siombak Lake. In order to maintain its sustainability, the utilization process must be carried out appropriately by considering the precautionary principle. Therefore, biological indicators and fish population dynamics can be used as a basis for management considerations (Satria & Kartamihardja 2011; Suryandari & Krismono 2011; Yonvitner et al 2020a). Knowledge of aspects of fish biology is the basis for fish stock analysis (Yonvitner et al 2020a). Fish biology information is needed as input in making decisions regarding fisheries resource planning (Yonvitner et al 2020a).

Until now, research on the biologic aspects of lontok fish is still limited. Several studies related to lontok fish refer to aspects of reproduction and eating habits (Satria & Kartamihardja 2011; Suryandari & Krismono 2011; Syahputra et al 2016). However, comprehensive research related to aspects of growth, reproduction and eating habits has not been reported. Whereas these three aspects are very important in the study of fish biology to determine the condition and status of fish stocks, such as mortality and exploitation rates. For this reason, this study aims to examine the biological aspects of lontok fish which include aspects of growth, reproduction and eating habits in the waters of Lake Siombak.

Material and Method

Description of the study sites. This research was conducted in Siombak Lake, Medan City, North Sumatra Province, Indonesia. Data collection was carried out every month from September 2018 to August 2019. Sampling of lontok fish was carried out at eleven stations representing the inlet, outlat and middle of the lake (Figure 1).

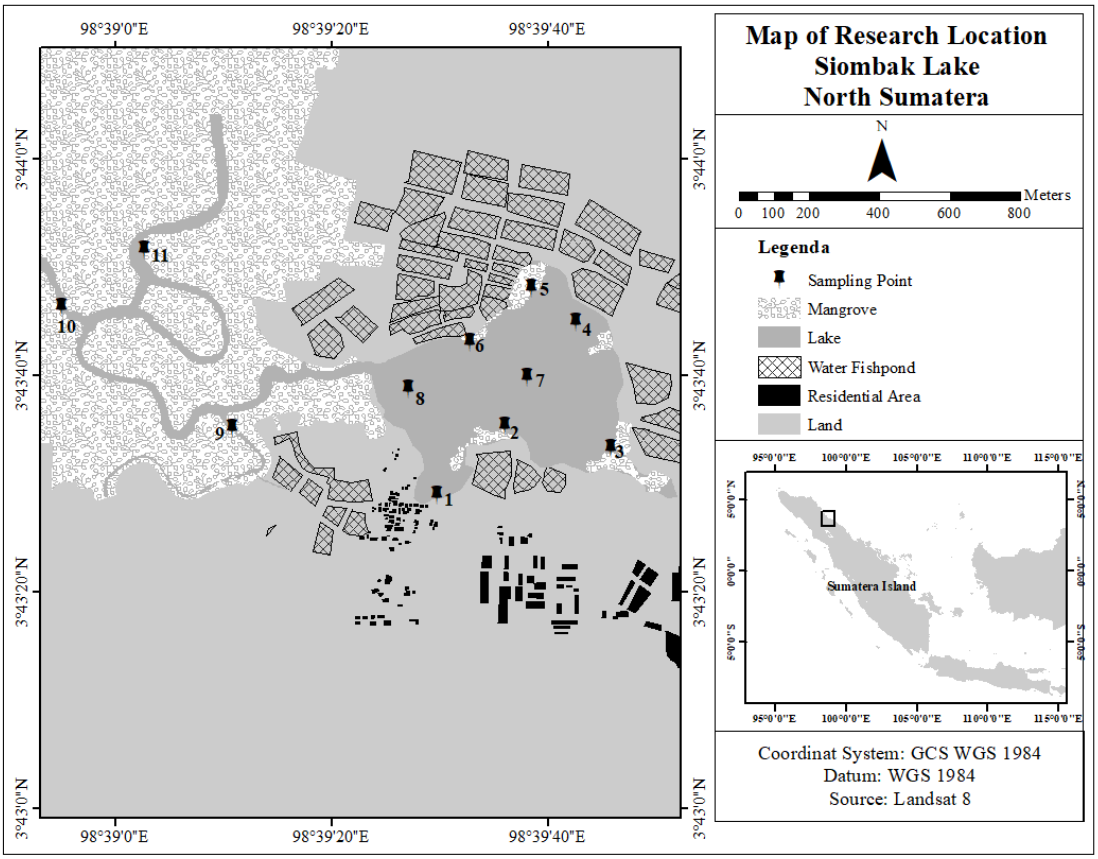

Figure 1. Research station in Siombak Lake, North Sumatra Indonesia.

Collecting data procedures. Lontok fish was captured using gill nets and traps. Installation of nets and traps was carried out; 1) just before high tide (samples at high tide), and 2) just before low tide (samples at low tide). After identifying the fish samples, their length and weight were measured. Then, surgery was performed to determine the gonadal development stage (GDS) and the intestineswere stored with 70-80% ethanol to identify the type of food.

Data processing and analysis procedures

1. Abundance distribution. It was analyzed descriptively based on catch data both spatially and temporally.
2. Relationship between length-weight relationship and growth pattern. Analysis of the relationship between length and weight is by referring to Effendie (2006):

$$W = a L^b$$

where: W = weight of fish (g);
L = total length (mm);
a = intercept;
b = estimator of length-weight growth pattern.

To get a linear or straight-line equation, we used the following equation:

$$\text{Ln } W = \text{Ln } a + b \text{ Ln } L$$

3. Gonadosomatic index (GSI) and first prediction of gonad maturity. The gonadosomatic index is to determine fish groups that spawn from a certain proportion of fish, that entering the maturity level of gonads 3 and 4. The gonadosomatic index was analyzed to determine the success rate of spawning with the potential sex ratio for both male and female fish. GSI was calculated as follows (Effendie 2006):

$$GSI = \frac{S_{34}}{S_t}$$

where: GSI = gonadosomatic index;
S_{34} = the number of fish at GDS 3 and 4;
S_t = the number of fish at GDS 2, 3, and 4.

S is the number of fish entering the maturity stage of the gonads, with the criteria used, namely if:
GI > 0.50 = fish tend to be spawning;
GI 0.30-0.50 = fish experience maturation process;
IG < 0.30 = fish gonad underdeveloped.

To determine the size of the fish when the gonads first ripen we used the Spearman-Karber method, according to the formula (Udupe 1986):

$$M = \left[xk + \left(\frac{x}{2}\right) - (x \sum pi)\right]$$

$$M = antilog\left[m \pm 1.96\sqrt{x^2 \sum \frac{pi * qi}{ni - 1}}\right]$$

where: m = log length of fish at first maturity;
x_k= log of the mean value of the last long class of fish that have matured gonads;
x = log of length increases at the mean;
p_i = the proportion of fish that are cooked gonads in the long class i to the number of fish in the long interval i;
n_i = the number of fish in the long class i^{th};
q_i = 1 - p_i;
M = length of fish first maturing gonads.

Results. The lontok fish obtained during the study had a darker colour than fish from the waters of Amassoma Flood Plains, Niger Delta, Nigeria (Figure 2) reported by Ogamba &

Abowei (2013). The total number of samples of lontok fish that has been obtained is 91 fish, consisting of 48 fish caught at high tide and 43 at low tide. The lontok fish in Lake Siombak could only be caught on January-June 2018. In January-March this fish could be caught at high tide or low tide, while in April-June it could only be caught at low tide (Figure 3). The results showed that lontok fish had a total length range of 0.7-19.5 cm (Figure 4) and a weight range of 0.3-5 grams.

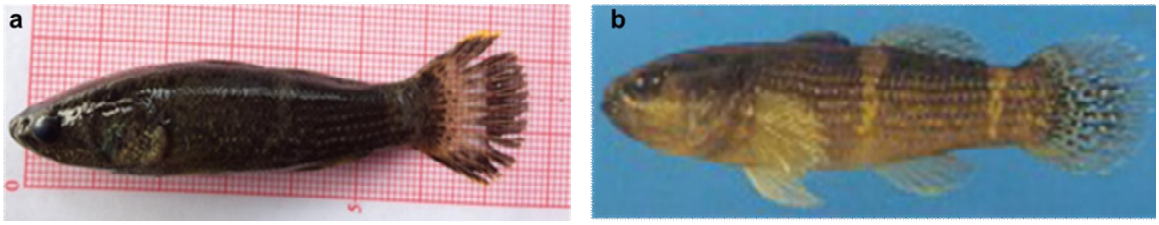

Figure 2. a. Lontok fish (*O. porocephala)* from Lake Siombak (primary data); b. Lontok fish from the waters of Amassoma Flood Plains, Niger Delta, Nigeria (Ogamba & Abowei 2013).

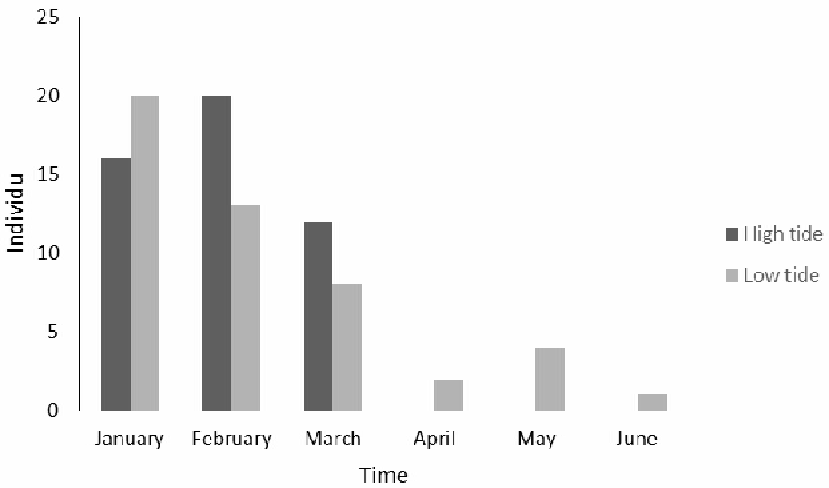

Figure 3. The temporal distribution of lontok fish (*O. porocephala*) caught in Siombak Lake.

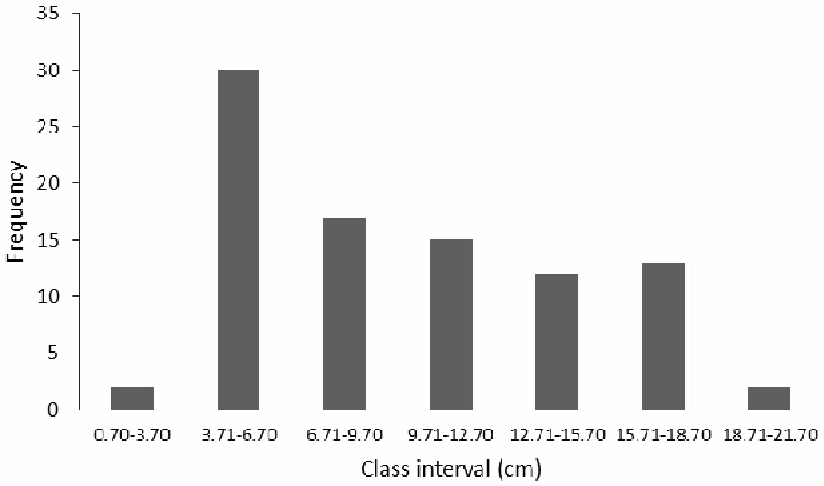

Figure 4. The lenght frequency distribution of lontok fish (*O. porocephala*) in Siombak Lake.

The results of the analysis of the length and weight relationship showed that the growth pattern of male lontok fish followed the equation $W = 0.0096\ TL^{3.126}$, while female lontok fish followed the equation $W = 0.124e\ TL^{0.439}$ (Figure 5). Based on the results of the t-test on the b (slope) value of male and female lontok fish at the 95% confidence interval ($\alpha = 0.05$), it shows that the value of b is significantly different from the value of 3 ($b > 3$). This means that the overall growth pattern of lontok fish is positive allometric.

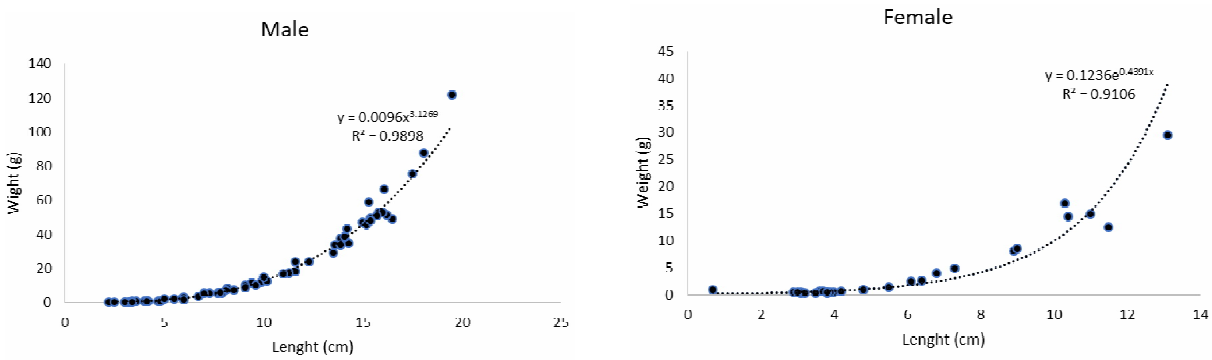

Figure 5. Length-weight relationship of lontok fish (*O. porocephala*) caught in Siombak Lake.

The food habits found in the stomach of Lontok fish consist of shellfish, crab, shrimp, fish and Cladocera (Figure 6). Cladocera is a type of food that is mostly found in the stomach of lontok fish (40%) while the least is fish (1%).

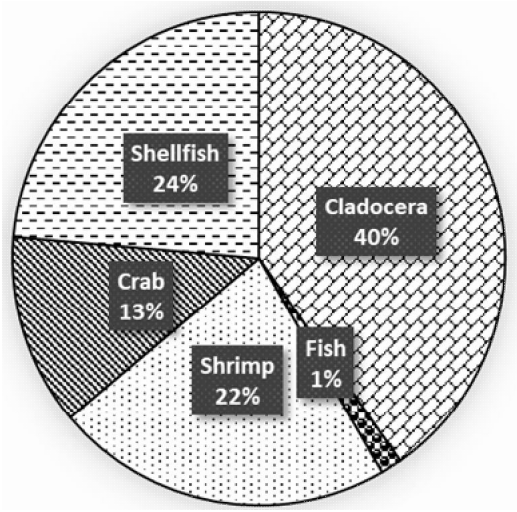

Figure 6. Food habits of lontok fish (*O. porocephala*) caught in Siombak Lake.

Discussion. The research results of Figure 3 shows that there has been a decrease in the catch of lontok fish in Lake Siombak. Lontok fish are not caught during the months of July-December. Soeroto (1990) reported that lontok fish can spawn throughout the year, with peaks in July, September and December. This condition indicates that lontok fish do not spawn in Lake Siombak. It is suspected that the fish migrated to other waters to spawn. This is also reinforced by the results of observations of lontok fish gonads, which almost all fish samples have undientified gonad development. During the study, only one fish was found at gonad maturity level 3 (GSI = 0.75). The results also showed that the size of the first maturity lontok fish was 18.14 cm. The catch of lontok fish which is dominated by young fish supports this finding. Lontok fish in Lake Siombak have a larger gonad maturity size than payangka fish (*O. aporos*) found in Lake Tondano. This is due to differences in species and their habitats (Yonvitner et al 2020a).

The results showed that the maximum length of lontok fish was 19.5 cm. According to Kottelat et al (1993), lontok fish can reach a size of more than 30 cm, but during the study this fish size was not found. The length class interval mode of lontok fish caught during the study was 3.71-6.70 mm. The fish size class hose is the Yuana group or fish fry (young fish). This is consistent with Satria & Kartamihardja (2002) that Llontok fish have a length range of 1.2-6.6 cm (Figure 4). The large number of yuana of lontok fish in Lake Siombak shows that the lake is a foraging habitat for lontok fish.

The analysis of the length-weight relationship of fish is intended to measure the variation in expected weight for a certain length of fish individually or in groups of individuals as an indicator of obesity, health, gonad development, and so on (Merta 1993). The growth of lontok fish is positive allometric, namely the increase in body

weight of the fish is faster than the increase in body length (fish tend to be fat). This positive allometric growth pattern of lontok fish is different from the results reported by Susanto et al (2017) which showed that lontok fish in the waters of Lake Tondano, Minahasa Indonesia had a negative allometric growth pattern. Fish growth is influenced by internal and external factors. Generally is difficult to control internal factors which include heredity, sex, age, parasites, and disease. The main external factors that influence fish growth are food availability and water temperature (Effendie 2006). The difference in growth patterns in this study is possible due to differences in food availability due to different waters.

The results showed that the eating habits of lontok fish were carnivorous. The results of this study are in line with research conducted by Suryandari & Krismono (2011) on lontok fish food in Limboto Lake (Gorontalo), which consists of shrimp, fish, gastropods and insects. The results showed that the main food of lontok fish in Siombak Lake is Cladocera. This indicates that there are quite a lot of Cladocera available in Lake Siombak. Muhtadi et al (2020c) found out that the zooplankton, especially Cladocera, is very abundant throughout the year in Lake Siombak. According to Simanjuntak & Rahardjo (2001), fish preference for a type of food is influenced by the availability of this food in nature. Furthermore, Yonvitner et al (2020b) states that differences in the proportion of food can be caused by unequal distribution factors, food availability, factors from the fish itself and other factors that affect waters. Effendie (2006) also states that differences in the number of organisms eaten by fish occur due to differences in the distribution of these organisms in each region. In general, fish eating habits are influenced by several factors, namely their habitat, preferences for certain types of food, season, food size, food color and age of the fish. Changes in food supply in a water body caused by changes in the aquatic environment will change the eating habits of fish.

Conclusions. This study succeeded in documenting baseline data on growth of lontok fish *Ophiocara porocephala*, positive allometrics and distribution between catch size classes of young fish that were below the first maturity. Lontok fish is a carnivorous fish that has a food habit of shellfish, crab, shrimp, fish and Cladocera with Cladocera as its dominant food. This study of the biological aspects of lontok fish in Lake Siombak is the first reported for the tidal lake. With the tendency of increasing pressure of the Lake Siombak ecosystem by domestic activities and ponds as well as overfishing, the number and size of this fish catch has decreased. Considering that Lake Siombak is a feeding ground for lontok fish, it is necessary to do long term monitoring for its sustainability.

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References

Effendie M. I., 2006 [Fisheries biology]. Yogyakarta: Yayasan Pustaka Nusantara, 163 pp. [in Indonesian]

Kottelat M., 2013 The fishes of the inland waters of Southeast Asia: a catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. Raffles Bulletin of Zoology 27:1-663.

Leidonald R., Lesmana I., Muhtadi A., Desrita, 2019 Biodiversity of flora and fauna in tropical tidal lake. IOP Conference Series: Earth and Environmental Science 260:012105.

Ogamba E. N., Abowei J. F. N., 2013 An estimation of the size composition and condition factor of *Ophiocara porocephala* from Amassoma Flood Plains, Niger Delta, Nigeria. Research Journal of Applied Sciences, Engineering and Technology 6(3):366-372.

Mamangkey J. J., Rogahang F. H. N., Adil E., 2019 Analisis struktur populasi dan tingkat kemantangan gonad ikan payangka (*Ophieleotris aporos*) di Danau Tondano Sulawesi Utara. Jurnal Frontiers 2(3):211-219.

Manullang H. M., Khairul, 2020 Monitoring biodiversitas ikan sebagai bioindikator kesehatan lingkungan di ekosistem sungai Belawan. Jurnal Ilmu Alam dan Lingkungan 11(2):1-7. [in Indonesian]

Merta I. G. S., 1993 Hubungan panjang berat dan faktor kondisi ikan lemuru, *Sardinella lemuru* Bleeker 1853) dari perairan Selat Bali. Jurnal Penelitian Perikanan Laut 73: 35-44. [in Indonesian]

Muhtadi A., Yulianda F., Boer M., Krisanti M., Rahmadya A., Santos, 2020a Hydrodynamics of tropical tidal lake waters, Lake Siombak, Medan, Indonesia. AACL Bioflux 13(4):2014-2031.

Muhtadi A, Yulianda F., Boer M., Krisanti M., 2020b Spatial distribution of mangroves in tidal lake ecosystem. IOP Conference Series: Earth and Environmental Science 454:012131.

Muhtadi A., Pulungan A., Nurmaiyah, Fadhlin A., Melati P., Sinag R. Z., Uliya R., Rizki M., Rohim N., Ifanda D., Leidonald R., Wahyuningsih H., Hasani Q., 2020c The dynamics of the plankton community on Lake Siombak, a tropical tidal lake in North Sumatra, Indonesia. Biodiversitas Journal of Biological Diversity 21(8):3707-3719.

Satria H., Kartamihardja E. S., 2002 Distribusi panjang total dan kebiasaan makan yuwana ikan payangka (*Ophiocara porocephala*). JPPI 8(1):41-50. [in Indonesian]

Soeroto B., 1988 Makanan dan reproduksi ikan *Ophieleotris aporos* (Bleeker) di Danau Tondano. Dissertation, Fakultas Pasca Sarjana, Bogor, IPB, 206 pp. [in Indonesian]

Simanjuntak C. P. H., Rahardjo, M. F., 2001 Kebiasaan makanan ikan tetet (*Johnius belangerii*) di perairan mangrove pantai Mayangan, Jawa Barat. Jurnal Iktiologi Indonesia 1(2):11-17. [in Indonesian]

Suryandari A., Krismono, 2011 Beberapa aspek biologi ikan payangka (*Ophiocara porocephala*) di Danau Limboto, Gorontalo. Proceedings of the VIII Annual National Seminar, Fisheries and Marine Research Results. Gajah Mada University, Yogjakarta on July 16, 2011, pp. 1-10. [in Indonesian]

Susanto M. K., Bataragoa N. E., Moningkey R. D., 2017 Distribusi ukuran dan pertumbuhan ikan payangka muda *Ophieleotris aporos* (Bleeker) di Danau Tondano. Jurnal Ilmiah Platax 5(2):189-197.

Syahputra A., Muchlisin Z. A., Defira C. N., 2016 Kebiasaan makan ikan lontok (*Ophiocara porocephala*) di perairan sungai iyu, kecamatan bendahara, Kabupaten Aceh Tamiang, Provinsi Aceh. Jurnal Ilmiah Mahasiswa Kelautan dan Perikanan Unsyiah 1(2):177-184. [in Indonesian]

Udupe K. S., 1986 Statistical method of estimating the size at first maturity in fishes. Fishbyte 4(2):8-10.

Yonvitner, Setyobudiandi I., Ernawati Y., Zairion, Mashar A., Rangkuti A. M., Akmal, S. G., 2020a [Fisheries biology and management]. Bogor: IPB Press, 304 pp. [in Indonesian]

Yonvitner, Setyobudiandi I., Ernawati Y., Zairion, Mashar A., Akmal S., 2020b Penuntun praktikum biologi perikanan. Bogor: IPB Press, 85 pp. [in Indonesian]

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