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FOOD HABITS AND NICHE BREADTH OF THREE SPECIES OF FISH CATCHS IN ANEUK LAOT LAKE, SABANG ACEH

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Abstract: Aneuk Laot Lake becomes a source of livelihood for people who work as fishermen around the lake. This research was conducted in June 2020. The study aims to analyze the food habits, niche breadth, and niche overlap of tilapia (*Oreochromis niloticus*), mujair (*Oreochromis mossambicus*), and louhan (*Cichlasoma trimaculatum*) in Aneuk Laot Lake. The method used in this study is the survey method. Fishing is done with the use of ring trawls of 2 and 3 inches. Tilapia, Mujair, and Louhan fish that have been caught were dissected and their digestive organs were preserved using 10% NBF. The results showed that Tilapia (O. *niloticus*) are omnivorous with phytoplankton as their main food and an index of preponderance value of 54.72%, Mujair (*O. mossambicus*) are omnivorous with the main food in the form of phytoplankton and the index of preponderance value is 50.15%, and louhan (*C. trimaculatum*) is carnivorous with the main food in the form of small fish and the index of preponderance value is 99.35%. The value of the niche breadth of Tilapia is 2.89, Mujair is 2.66, and Louhan is 1.07. The niche overlap value of food between Tilapia and Mujair is 0.96, meaning that it has great potential to utilize the same type of food, whereas Louhan's niche overlap index with Nila and Mujair is 0.01, indicating that it has very little competition in using the same food.

Keywords: Aneuk Laot Lake; Trophic interaction; Niche breadth; Niche overlap

Abstrak: Danau Aneuk Laot menjadi sumber mata pencaharian bagi masyarakat yang berprofesi sebagai nelayan di sekitar danau. Penelitian ini dilaksanakan pada bulan Juni 2020 di Danau Aneuk Laot, Sabang. Penelitian ini bertujuan untuk menganalisis kebiasaan makan, luas relung, dan tumpang tindih makanan ikan nila (*Oreochromis niloticus)*, mujair (*Oreochromis mossambicus*), dan louhan (*Cichlasoma trimaculatum*) di Danau Aneuk Laot. Metode yang digunakan dalam penelitian ini adalah metode survei. Penangkapan ikan dilakukan dengan menggunakan pukat cincin ukuran 2 dan 3 inchi. Ikan Nila, Mujair, dan Louhan yang telah ditangkap dibedah dan organ pencernaannya diawetkan menggunakan NBF 10%. Hasil penelitian menunjukkan bahwa ikan Nila (*O. niloticus*) adalah omnivora dengan makanan utama fitoplankton dan nilai indeks preponderance sebesar 54,72%, Mujair (*O. mossambicus*) adalah omnivora dengan makanan utama berupa fitoplankton dan indeks nilai preponderance

adalah 50,15%, dan Louhan (*C. trimaculatum*) merupakan karnivora dengan makanan utama berupa ikan-ikan kecil dan indeks nilai *preponderance* sebesar 99,35%. Nilai luas relung Nila sebesar 2,89, Mujair sebesar 2,66, dan Louhan sebesar 1,07. Nilai tumpang tindih makanan antara Nila dan Mujair sebesar 0,96 artinya memiliki potensi yang besar dalam memanfaatkan jenis makanan yang sama sedangkan indeks tumpang tindih Louhan dengan Nila dan Mujair sebesar 0,01 yang berarti memiliki kompetisi yang sangat kecil dalam memanfaatkan makanan yang sama.

Kata Kunci: Danau Aneuk Laot; Kebiasaan Makan; Luas Relung; Tumpang Tindih Makanan.

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Introduction

Aneuk Laot Lake is located in Pulau Weh, Sabang City, Aceh Province. Aneuk Laot Lake is the main source of fresh water for the people of Sabang City. The activities around the lake include protected forests, residential areas, livestock and plantations (Edyanto, 2006). Aneuk Laot Lake has considerable fishery resources, this can be seen from the profession of the people around the lake as fishermen. In addition, Lake Aneuk Laot has the potential to develop aquaculture, there are several types of fish that have consumptive and economic value, such as tilapia, mujair, sepat siam, gourami, and snakehead fish (Khayra et al., 2016). The study of fish bioecology is very important, especially the food habit of fish as the basis for developing aquaculture which can optimize the available feed so that food does not overlap (Ajah and Udoh, 2012; Bhattacharjee and Chandra, 2016). On the other hand, information on fish food habits becomes the basis for evaluating the role and position of fish in the food chain (Soni & Ujjania, 2018).

Information on feeding habits forms the basis for sustainable fisheries management and is key in the selection of cultivable species. One aspect that affects the success of cultivation is the availability of food (Nurfadillah et al., 2019; Melisa et al., 2019; Munfaridzi et al., 2020). Utilization of the same food in nature forms a real competition (Purnamaningtyas & Tjahjo, 2013; Elinah et al., 2016; Tesfaye et al., 2020). Fish that have a great opportunity to develop and dominate are fish that can utilize the available resources in the waters so that it affects changes in the composition of the existing fish.

Research on the food habits of fish in Aneuk Laot Lake has never been reported, so it becomes important information because food is a determining factor in the development of fish populations (Fetahi et al., 2018). Several studies related to the food habits of fish in the lake that has been studied and reported include Hasri *et al.* (2012) in Laut Tawar Lake, Aceh Tengah stated that tilapia, nilem, plati pedang, relo, betok, and kawan fish use phytoplankton as the main food, research conducted by Siregar (2019) in Lake Siombak, North Sumatra

showed that the main food Mujair fish are phytoplankton, then research conducted by Nurnaningsih et al., (2005) in Djuanda Reservoir, Purwakarta stated that tilapia with different food compositions, namely plankton, plant pieces, insect larvae, fish pieces, and litter, and research by Warsa et al., (2016) in Jatigede Prainundasi Reservoir, Sumedang that the main food of tilapia is planted and its complementary food is phytoplankton and litter. In a study conducted by Vaslet et al. (2012) in the mangrove waters of Belize, Central America stated that the main food of louhan fish is small crustaceans and additional food, namely plants and detritus. Therefore, the purpose of this study was to examine the food habits, niche breadth and niche overlap of three types of fish caught in Aneuk Laot Lake, Sabang namely Tilapia, Mujair and Louhan fish.

Research Methods

Sampling Area

This research was conducted in June 2020 at Aneuk Laot Lake, Sabang City, Indonesia and observations of the digestive tract of fish were carried out at the Marine Biology Laboratory, Faculty of Marine Science and Fisheries, Universitas Syiah Kuala. The research location is presented in Figure 1.

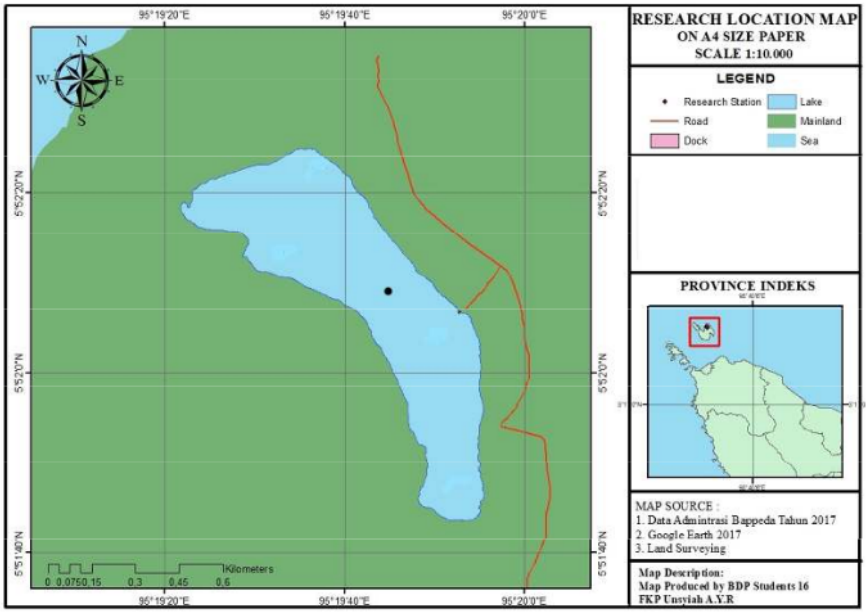


Figure 1. The Map of Research

A sampling of fish was carried out with the help of local fishermen using ring trawls with mesh sizes of 2 inches and 3 inches. The fish caught were measured for total length and weight. Observation of gastric contents of tilapia 15 fish, Mujair 12 fish and Louhan 11 fish.

To determine the volume of gastric contents of each type of fish food using the volumetric method which refers to Zuliani et al., (2016)

$$v=\frac{vi}{vt}\times 100\% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Description: v = Percentage volume a type of food (%), vi = volume a type of food (ml), vt = total volume a type of food (ml).

Furthermore, to identify all gastric contents using the frequency of occurrence method with the following formula (Zuliani et al., 2016)

$$\text{Frequency of occurrence}=\frac{\text{The number of occurrences of a type of food}}{\text{The number of gastric with some food}}\times 100\ \% \quad \ldots\ldots\ldots(2)$$

Then to determine and calculate the largest amount of food in the gastric using the Index of Prepopenderance method with the following formula (Zuliani et al., 2016):

$$IP=\frac{v_i\times o_i}{\sum v_i\times o_i}\times 100\% \quad \ldots\ldots\ldots\ldots\ldots \quad (3)$$

Description: IP = Index of Preponderance, V_i = percentage of the volume of typical food, O_i/FKM = percentage Frequency of occurrence of a type of food

Furthermore, the analysis of the niches breadth is used the following formula (Kreb, 1989):

$$B=\frac{1}{\sum P_j^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (4)$$

Description; B= niche breadth, $\sum P_j^2$ = Proportion of food organisms utilized by fish species *j*

Hurlbert (1978) states that the standardization of the value of the food niche area so that the value of 0-1 is calculated by the following formula:

$$B_A=\frac{B-1}{n-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\

Description: O_{jk} = niche overlap between species k and species j, P_{ik} = proportion of the food i in species k, P_{ij} = amount of the food i in species j

Result and Discussion

Food Habits of Tilapia (*Oreochromis niloticus*), Mujair (*Oreochromis mossambicus*), Louhan (*Cichlasoma trimaculatum*)

In this study, there were 3 types of fish caught and had varying body lengths. Tilapia fish has a body length ranging from 13.7 to 17.3 cm, mujair fish have a body length between 13.5 to 16.7 cm, and louhan fish have a body length between 14 to 20 cm. based on the analysis of food habits, tilapia is classified as an omnivorous fish. This can be seen from the index of preponderance, namely the main food consumed by tilapia is plants, besides that tilapia has a digestive tract length ranging from 65-129 cm. Data food habits of tilapia state that the main food is phytoplankton, litter, and zooplankton. Furthermore, other foods found were worms and ants (Table 1).

Table 1. Food Habits of Tilapia (*Oreochromis niloticus*)

Type of Food	Volumetric (Vi)		frequency of occurrence		Vi x Oi	IP (%)
	(ml)	(%)	Occurrence	(%)		
Phytoplankton	9.5	50.26	15	100	5026.45	54.72
Zooplankton	4.3	22.75	14	93.33	2123.38	23.11
Litter	3.7	19.57	15	100	1957.67	21.31
Small Worms	0.4	2.11	3	20	42.32	0.46
Ants	1	5.29	1	6.66	35.23	0.38
Total	18,9	100	15		9185.07	100

Previous research on tilapia (*Oreochromis niloticus*) in Djuanda Reservoir, West Java by Purnamaningtyas and Tjahjo (2013) that the main food type of the fish is phytoplankton, complimentary food in the form of detritus and plants. Based on research conducted by Hasri *et al.* (2012) in Lake Laut Tawar stated that tilapia utilize phytoplankton as the main food and detritus as additional food. Studies in Ethiopian water bodies reported that adult Nile tilapia feeds primarily on phytoplankton (particularly diatom) whereas juveniles are generally omnivore feeding on zooplankton and insect larvae (Tesfaye et al., 2020). The results of research by Nurfadillah *et al.* (2022) stated that the composition of plankton in the Aneuk Laot Lake consisted of 27 phytoplankton and 4 zooplankton genera with the highest class being Bacillariophyceae at 36%.

The results of the food habits analysis of mujair (*Oreochromis mossambicus*) showed that fish was classified as a herbivore with a range of intestine length of 50-120 cm longer than its body size which had a value of 13.5-16.7 cm. IP (index of preponderance) analysis shows that the main food of mujair fish is

phytoplankton (50.15%), additional foods are litter (31.79%) and zooplankton (18.04%) (Table 2).

Table 2. Food Habits of Mujair (*Oreochromis mossambicus*)

Type of Food	Volumetric (Vi)		frequency of occurrence		Vi x Oi	IP (%)
	(ml)	(%)	occurrence	(%)		
Phytoplankton	5.35	47.98	12	100	4798.21	50.15
Zooplankton	2.1	18.83	11	91.66	1726.33	18.04
Litter	3.7	33.18	11	91.66	3041.63	31.79
Total	11.15	100	12		9566.17	100

Kurnia et al. (2018) found that the Mujair fish that live in the Wadaslintang Reservoir have a main diet of phytoplankton, are herbivorous and tend to be omnivores because these mujair fish also eat other types of food, namely crustaceans.

Furthermore, based on the analysis of the louhan fish digestive apparatus, it showed that the length of the intestine was 12-17 cm, which is smaller than the body length with a value of 14-20 cm. this states that the louhan fish is a type of carnivorous fish. index of preponderance analysis showed that the main food types were small fish (99.35%) and litter (0.64%) as complementary foods (Table 3).

Table 3. Food habits of Louhan (*Cichlasoma trimaculatum*)

Type of Food	Volumetric (Vi)		frequency of occurrence		Vi x Oi	IP (%)
	(ml)	(%)	occurrence	(%)		
Small fish	7	96.55	11	100	9655.17	99.35
Litter	0.25	3.45	2	18.18	62.69	0.64
Total	7.25	100	11		9717.86	100

Hedianto and Sentosa (2019) found louhan fish that live in Lake Matano, South Sulawesi using gastropods, insects, shrimp, and macrophytes as their main food. Furthermore, Tharp (2020) stated that louhan fish in the waters of Tampa Bay, Florida that louhan fish are carnivorous fish that eat detritus and shellfish as their main food and snails as additional food.

Niche Breadth and Niche Overlap of Tilapia (*Oreochromis niloticus*), Mujair (*Oreochromis mossambicus*), Louhan (*Cichlasoma trimaculatum*)

The niche breadth of the 3 types of fish caught in Aneuk Laot Lake ranged from 1.07 to 2.89. Tilapia has a niche breadth of 2.89 means utilizing the types of food available equally (generalist) and having the ability to adapt well to the types of food available in these waters. On the other hand, the louhan fish has a narrow

food niche, meaning that the louhan fish is selective in choosing the type of food or selective for one type of food found in the waters (Table 4).

Table 4. Food Niche Breadth of Tilapia (*Oreochromis niloticus*), Mujair (*Oreochromis mossambicus)*, Louhan (*Cichlasoma trimaculatum*)

Species	Niche Breadth	Standardized
Tilapia	2.89	0.47
Mujair	2.66	0.83
Louhan	1.07	0.007

Species that have a low niche breadth characterize a specialist species, namely selecting food resources available in the waters, while a higher niche breadth indicates a generalist species (Corrêa et al., 2011). However, the variation in the availability of food that has a lot of water does not make the value of the niche area large, because the niche area is influenced by the ability of fish to utilize the available resources (Effendie, 1997; Hedianto et al., 2010). The niche breadth can determine the position of a species in the food chain (Krebs, 1989) and explain the level of food specialization in species groups (Segurado et al., 2011). Research by Herawati et al., (2020) found that the area of fish feed niches in the Jatigede Reservoir varies by season and location with a range of 0.00-1.00.

The value of niche overlap between tilapia and mujair is 0.96. This is caused by the type of food used by tilapia and mujair which are almost the same. While the overlapping value of louhan fish with tilapia and mujair is only 0.01 because the similarity of food used between louhan fish with tilapia and mujair is only a small amount of litter (Table 5).

Table 5. Food Niche Overlap of Tilapia (*Oreochromis niloticus*), Mujair (*Oreochromis mossambicus)*, Louhan (*Cichlasoma trimaculatum*)

Species	Tilapia	Mujair	Louhan
Tilapia	-	0.96	0.01
Mujair	0.96	-	0.01
Louhan	0.01	0.01	-

The three types of fish found in Aneuk Laot Lake showed that there was a tendency for a high level of competition to utilize food between tilapia and mujair because of the level of utilization of the same food. Meanwhile, between louhan fish and tilapia fish, the potential for competition is very small.

Kurnia et al. (2018) found in Wadaslintang Reservoir, Wonosobo that tilapia and tilapia fish have a high chance of competition because they have the same type of food. Then in a study conducted by Hedianto and Agus (2019) in Lake Matano, South Sulawesi, it was found that the louhan fish which is an invasive fish can take advantage of various types of food, so the chance of

competition between species is high. Nurfadillah et al., (2021) explained that there was no competition between tilapia, lemeduk, peres and depik fish species in the polyculture system.

Conclusion

Tilapia and mujair fish found in Aneuk Laot Lake are classified as omnivores, while Louhan fish are carnivorous fish. Tilapia and mujair fish have a high food niche breadth with many varieties of food. while the louhan fish has a narrow food niche breadth with a small variety of food. Tilapia and mujair have competition in utilizing the same type of food. While louhan fish did not show competition for food with other fish in the Aneuk Laot Lake.

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