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FOOD HABITS OF LUNDU FISH (*Mystus gulio* Hamilton, 1822) IN THE WATERS OF SUNGAI DUA VILLAGE, RAMBUTAN DISTRICT, BANYUASIN REGENCY, SOUTH SUMATER

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Abstract *:*
The research about food habits of Lundu fish (Mystus gulio Hamilton, 1822) in the waters of Sungai Dua Village, Rambutan District, Banyuasin Regency, South Sumatra. The sampling was conducted in five times in December 2016; January, February, March and April 2017. Identification of the samples was in Laboratory of Animal Taxonomy, Biology Department, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Indralaya. The purpose of the research was to analyze the food habits of Mystus gulio Hamilton, determine the relationship of length-weight, determine the conditions, analyze the gastric fullness index. The results of this research showed that the food habits of Mystus gulio Hamilton is plankton, like Cyanophyta, Chlorophyta, Diatomae, Desmidiacae, Euglenophyta, Pyrrophyta, Ciliata, Rhizopoda, Rotaria, and Entomostraca.

Keywords: food, habits, Mystus gulio, waters, Sungai Dua

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1. Introduction

The waters of Sungai Dua Village are located in Rambutan District, South Sumatra Banyuasin Regency. The waters of Sungai Dua Village have potential natural resources potential in the fisheries sector. The waters of Sungai Dua Village have a length of ± 6 km surrounded by vegetation, trees, people's houses, rice fields and there are also rice mills. Downstream area of Sungai Dua waters is dominated by the vegetation water and natural trees, whereas on the upstream areait is dominated by activity of the people who live on the outskirts of the river and there is a rice milling plant.

One species of fish caught by fishermen on Sungai Dua waters is *Mystus gulio* Hamilton. *Mystus gulio* Hamilton is a species of fresh water fish that is consumed, and it has a flat blackish brown body shape. *Mystus gulio* Hamilton comes from South and Southeast Asian waters . *Mystus gulio* Hamilton has body lengths range from 9.3 to 16.4 cm.[2] Growth of *Mystus gulio* Hamilton is relatively faster on juvenile stage. More mature, growth of *Mystus gulio* Hamilton will decline.

Mystus gulio Hamilton incubates the eggs in the mouth of the female parent. Larvae of *Mystus gulio* Hamilton in the early hatched one will live from the yolk. On the third day, the egg yolk starts to run out. After 26 hours, the mouth starts to open and at the age of 52 hours the larvae will start eating, so that the movement of larvae is increasingly active in food finding.[7]

The long-weight relationship of *Mystus gulio* Hamilton is positive allometric (b> 3) . Growth of *Mystus gulio* Hamilton is faster in weight growth than in body length growth. The value of long-weight relationship reflects physiological conditions such as body shape and growth rate.

Based on the sex of *Mystus gulio* Hamilton, the male is isometric (b = 3). On isometric growth, the male fish growth is proportional in weight gain to growth in body length . The female of *Mystus gulio* Hamilton has positive allometric growth. Almost all female fish of *Mystus gulio* Hamilton containing the eggs, thereby the eggs weight affecting their weight growth.[15]

The factors that influence fish growth include the availability of natural foods. Food habits is included species, food quality that is eaten by fish. The order of the food habits of the fish are distinguished into four categories based on the biggest percentage of food part. It is consisting of a main foods that are eaten in large amounts; complementary foods are the foods found in the digestive tract in smaller amounts; and additional food is the foods with very little amounts in digestive tract. In addition there are also substitute foods namely foods that are only consumed when the main food is not available.[12]

The presence of *Mystus gulio* Hamilton in the waters of Sungai Dua Village has begun to decline due to the activities of communities around the river such as washing clothes, washing dishes, bathing, dumping garbage directly into the river so that it disturbs the quality of the waters, and fishing activity in that location continuously. To maintain sustainability into the availability of fish, it needs to be done through the fish culture. For fish culture, one of them is needed information about the food habits of fish.

2. Materials and Methods

This research was conducted in December 2016 to April 2017. Samples were taken from the waters of Sungai Dua, District of Rambutan, Banyuasin, South Sumatera with 6 sampling points. Sampling locations were included Pucung river (downstream of Sungai Dua), central area of Sungai Dua, rice plant area, waters of alternative rice cultivation, settlement and Teriti rivers (upstream of Sungai Dua), Figure 1.

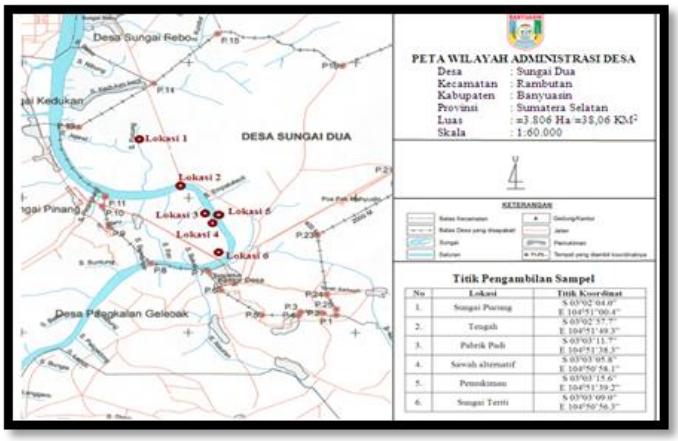


Figure 1. Location of sampling

2.1. Sampling Technique

Mystus gulio Hamilton was captured using a fishing rod and Tangkul (the horizontal/lift nets).

2.2. Procedure

2.2.1. Sampling

The sample collection of *Mystus gulio* Hamilton was carried out in the Sungai Dua Waters of Rambutan District, Banyuasin Regency, South Sumatra. Sample collection was carried out in 6 sampling locations, namely in the Pucung River (upstream of Sungai Dua), downstream side of Sungai Dua, rice mill, alternative rice cultivation, settlement and Teriti river (upstream of Sungai Dua). *Mystus gulio* Hamilton samples which were caught were put into a bottle containing 40% formalin, then the fish was wrapped in a cloth that served to absorb formalin. On the left and right sides of the cloth are tied using rubber, then put into the *coolbox*. Food analysis and identification of fish samples were carried out at the Biology Laboratory of Animal Taxonomy, Sriwijaya University.

2.2.2. Measurement of Aquatic Physics and Chemistry Parameters

Observations and measurements of physical and chemical parameters of the waters were carried out simultaneously with fish sampling. Measurement of physical parameters, namely temperature using a digital thermometer, salinity using a refractometer and brightness using *Secchi disk*. Measurement of chemical parameters, namely pH using a pH meter and dissolved oxygen using DO meter.

2.2.3. Analysis in the Laboratory

Mystus gulio Hamilton which has been preserved with 40% formalin, the cloth is opened and washed with running water. After that, samples were measured the length and weight. The total length of the fish was measured from the tip of the front head to the tip of the back of the tail fin using a calipers with a precision of 0.1 cm. The fish total weight was measured using digital scales with accuracy of 0.01 gram.

After measurement of length and weight, the fish were dissected using surgical scissors, starting from the anus to the upper part of the abdomen along the dorsal to the back of the operculum then ventral to the base of the abdomen. The digestive tract was separated from other organs. The stomach and fish intestines were measured by weight and then put into a

sample bottle to be preserved using gilson solution.

The part of the stomach and intestine that has been preserved, dissected then the contents of the stomach are removed using a scalpel. Then all gastric contents were weighed using a digital scale. The entire contents of the stomach were put into a 10 ml measuring cup for measuring food volume. Furthermore, observations were made using a microscope. The organisms obtained from the gastric of fish, were identified by using the identification books as identification tools, also including Fisheries Biology.[4]

2.3. Data Analysis

2.3.1. Food Habit Analysis

The food composition and everything included in *Mystus gulio* Hamilton's gastric were analyzed as follows : the gastric were opened, the contents were measured and the frequency of gastric contents were written down . To know the kind of food eaten is used Important Relative Index.[4]

$$IRI = (N + V)F$$

Notes:
N = Percentage of total from one kind of food (%)
V = Percentage of volume from one kind of food (%)
F = Frequency of one kind of food in gastric (%)
IRI = Relative Important Index

2.3.2. Length-Weight Relation

The relations between fish length and weight were analyzed using Effendie's formula[3] , namely as follows:

$$W = aL^b$$

Notes :
W = Fish body weight (gr)
L = Fish body length (cm)
a and b = Constants

2.3.3. Condition Factor

The condition factor be specified by length and weight of the fish. If the value of b ≠ 3, then the condition factor was calculated using the calculation formula according to:[17]

$$K_n = \frac{W}{aL^b}$$

Notes :
K = Relative condition factor of each fish
W = Fish weight (gram)
L = Fish total length (mm)
a and b = constants

2.3.4. Index Stomach Content (ISC)

Gastric fullness index calculation carried out to know eating activities of fish by calculating the ratio between the weight of gastric contents and a total weight of fish (in %) . This analysis aimed to determine feed consumption percentage of samples, evaluated using the calculation formula according to[17], namely:

$$ISC(\%) = \frac{SCW}{BW} x100(\%)$$

Notes :
ISC= Index Stomach Content (%)
SCW = Weight of gastric contents (gr)
BW BW= Weight of individual fish (gr)

3. Results and Discussion

3.1. Food Habits of *Mystus gulio* Hamilton

According to[3] fish food habits concern the quantity and quality of food eaten by fish. The main food of *Mystus gulio* Hamilton consists of phytoplankton including Cyanophyta, Chlorophyta, Diatomae, Desmidiacae, Euglenophyta, Pyrrophyta. In addition to eating phytoplankton, Mystus gulio Hamilton also consumes organisms from the zooplankton group including Ciliata, Rhizopoda, Rotatoria and Entomostraca (Table 1). Lundu fish are classified as omnivores or fish that eat all kinds of food. Lundu is classified as demersal fish that are actively looking for food during the day.[1] According to[20] that fish generally will adjust food kind to the size of their mouth openings. Larger fish will prey on larger foods and make choices about the kind of food. Research[14] on Lundu fish in India succeeded in identifying the kind of food contained in the stomach of Lundu fish, including filamentous algae, diatoms, plant residues, rotifers, calanoids, insects and prawn.

Table 1. The Food Habits of *Mystus gulio* Hamilton

Food Kind	December	January	February	March	April
Fitoplankton					
Cyanophyta	4 Individual	18 Individual	36 Individual	37 Individual	23 Individual
Chlorophyta	38 Individual	185 Individual	141 Individual	66 Individual	28 Individual
Diatomae	12 Individual	77 Individual	80 Individual	78 Individual	39 Individual
Desmidiacae	1 Individual	6 Individual	23 Individual	20 Individual	17 Individual
Euglenophyta	0 Individual	1 Individual	0 Individual	0 Individual	0 Individual
Pyrrophyta	1 Individual	7 Individual	3 Individual	2 Individual	4 Individual
Zooplankton					
Ciliata	0 Individual	1 Individual	1 Individual	0 Individual	1 Individual
Entomostraca	1 Individual	0 Individual	0 Individual	2 Individual	1 Individual
Rhizopoda	0 Individual	0 Individual	2 Individual	0 Individual	0 Individual
Rotatoria	0 Individual	1 Individual	0 Individual	6 Individual	1 Individual

3.2. Food Composition of *Mystus gulio* Hamilton

The food composition of the *Mystus gulio* Hamilton can be determined by analyzing the contents of the digestive tract. The total digestive tract analyzed was 121. The sample was taken during the five months of capture (December 2016, January, February, March and April 2017). The general food habits of *Mystus gulio* Hamilton are presented in Figure 2.

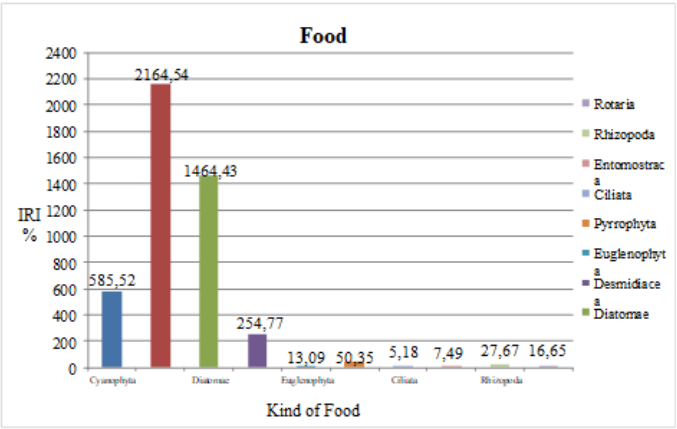


Figure 2. Food Composition of *Mystus gulio* Hamilton in Sungai Dua Waters

Figure 2 shows that in the intestine of *Mystus gulio* Hamilton, organisms that found belongs to the phytoplankton group namely: Cyanophyta, Chlorophyta, Diatomae, Desmidiacae, Euglenophyta and Pyrrophyta while the Zooplankton group consists of Ciliata, Rhizopoda, Rotaria and Entomostraca. The results of the analysis of the stomach contents and the calculation of the Importance of Relative Index indicate that the composition of *Mystus guilo* Hamilton food in Sungai Dua waters is phytoplankton and zooplankton. Based on the food composition, Lundu fish in this research were classified as phytobentic eaters. The main food is dominated by phytoplankton, namely Cyanophyta at 585.52%, Chlorophyta at 2164.54%, Diatomae at 1464.43%, Desmidiacae, Euglenophyta at 13.09%, Pyrrophyta at 50.35%. While from the zooplankton group, Ciliata was found at 5.18%, Entomostraca at 7.49%, Rhizopoda at 27.67%, Rotaria at 16.65%.

Food variations in the form of plankton both phytoplankton and zooplankton that are eaten by Lundu fish are thought to be related to the waters of the upstream habitat. Food composition in habitats such as in this research has fewer variations compared to estuarine areas because according to[13], estuarine areas especially around mangrove forest waters that have a greater variety of organisms, especially plankton compared to open waters.

Determination of food habits based on size class is done to see the kind of food eaten by *Mystus gulio* Hamilton on each different month in Sungai Dua waters. Determination of these food habits based on the value of Important of Relative Index every month, is presented in Figure 3.

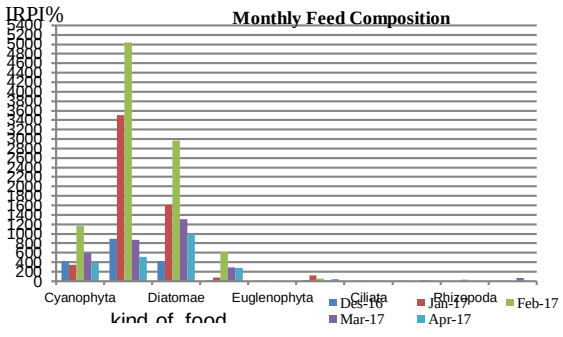


Figure3. Important of Relative Index *Mystus gulio* Hamilton in Sungai Dua Waters

In December 2016, January and February, March and April 2017 the food composition of the *Mystus gulio* Hamilton, namely Cyanophyta with IRI range from 348.03 to 1160.58%, Chlorophya with IRI range from 509.08 to 5044.98%, Diatomae with IRI range from 428.7-2966.1%, Desmidiacae with IRI range from 19.13-613.97%, Euglenophyta with IRI range from 0-13.09%, Pyrrophyta with IRI range from 14.86-122.57% , Ciliata with IRI range from 0-10.48%, Entomostraca with IRI range from 0-16.83%, Rhizopoda with IRI range from 0-27.67%, Rotaria with IRI range from 0-66.92%.

Figure 2 shows that *Mystus gulio* Hamilton eats fluctuatively every month of the Cyanophyta, Chlorophyta and Diatomae groups. This is possible because the presence of phytoplankton that available is also fluctuating based on time. According to[19] that the planktonic nature that often flattens due to the influence of wind and currents causes distribution areas. The existence of plankton eaters at a location so that one day in the waters a lot of plankton. In addition, Lundu forage in the bottom waters.[10] In addition to eating the rest of the organism, other particles deposited in the bottom are also consumed by Catfish, including Lundu fish, because these fish are kind of demersal fish that can noticed from its mouth position.[5]

3.3. Length-Weight Relation of *Mystus gulio* Hamiltton

Length-weight relation of *Mystus gulio* Hamilton can be seen in Figure 4 .

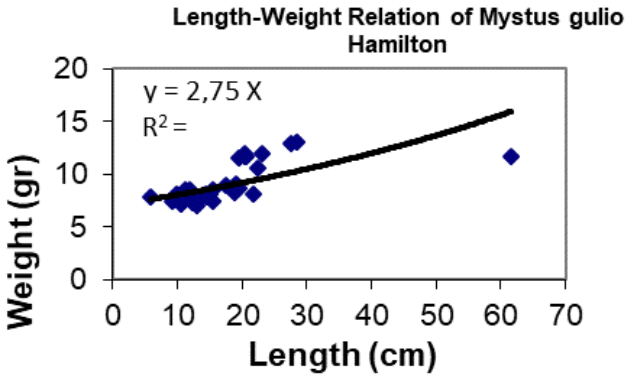


Figure 4. Length-weight relation of *Mystus gulio* Hamilton

Based on the analysis of the *Mystus gulio* Hamilton length-weight relation is $W = 2,75 \times L^{64,53}$ with b value of 64.53. Value of b greater than 3 indicates a fish where the weight gain is faster than the length increase.[3] However, different results are shown in the research of[18] which obtained b value <3 which means it has the negative allometric relation. Whereas the research found an isometric relation where the value of b = 3.[9] Some factors that can affect the value of b is environmental factors, different stock of fish in the same species, the stage of fish development, sex, gonad maturity level, and even the time difference in days due to changes in stomach contents. The difference in the relation pattern of the length-weight of the fish can also be caused by fluctuating environmental conditions.[18] Biologically the value of b is related to the condition of the fish; while the condition of fish depends on food, age, sex and gonad maturity.[3]

The value of the *Mystus gulio* Hamilton correlation coefficient approaches 0 with an r of 0.432867961. This shows the correlation coefficient between the length-weight variables do not have a strong relation or the absence of a relation between the length and weight of *Mystus gulio* Hamilton.

3.4. Condition factor of *Mystus gulio* Hamilton

The condition factor of a fish species is not fixed in nature. According to[11] if in a waters suddenly change in the condition of a fish can affect the fish. The condition of fish is influenced by the availability of food in the waters. If the availability of food is abundant, it will support physical capacity for fish survival and reproduction.
Determination of the condition factors based on the size class (cm) is carried out to determine the physical state of the fish at each different class size. Factor values based on the size class are presented in Figure 5.

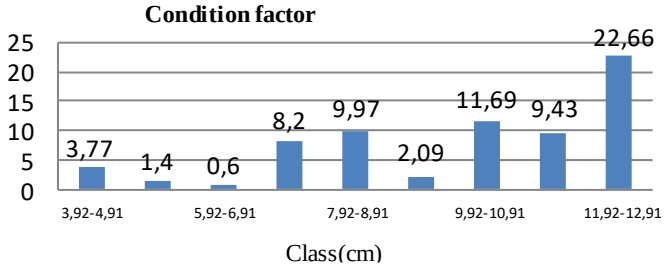


Figure 5. Condition factor of *Mystus gulio* Hamilton

Based on Figure 5, the highest condition factor values at interval of sizes 11.92-12.91 cm at value 22.66 and the lowest condition factor value at interval of sizes 5.92-6.91 cm at value 0.6. According to [8], the difference in the value of the condition factors shown in the results of the analysis is due to the availability of food that is relative to a waters. Variation in the value of condition factors other than food availability and sex, is also thought to be caused by differences in fish age where young fish spend energy for somatic growth, while adult fish, in addition to somatic growth, are also used for gonadic growth.

The need for fish at a young age for food is quite high which is useful for survival and sustained growth so that the condition of small-sized fish is relatively high and will decrease when the fish get bigger. According to [11], every fish that grow will experience changes in body weight and length, the comparison of the two things will have an impact on changes in body shape and condition of the fish.

Table 2. Physical and Chemical Water Parameters

differences.

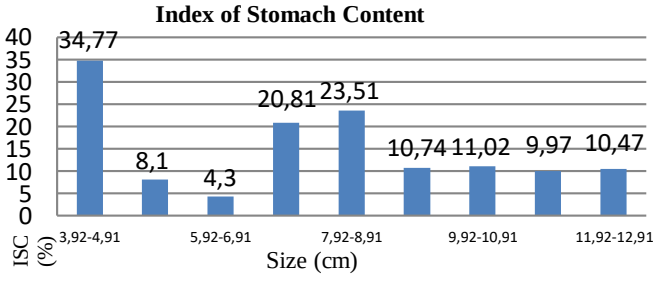
3.6. Physical and Chemical Water Parameters

Physical and chemical parameters of waters which include temperature, brightness, pH, DO, salinity, flow velocity, depth, phosphate and nitrate at six sampling locations including Teriti river (upstream waters of Sungai Dua village), middle of Sungai Dua river, Pucung river (downstream waters of Sungai Dua village), waters in alternative rice field, waters near rice mills and waters near settlements obtained data as presented in Table 2.

Parameters	Unit	Sampling :ocation					
		Teriti river	Middle of Sungai Dua	Pucung river	Alternative Rice Field	Near Rice Mill	Near Settlement
Temperature	(ºC)	30.1	30.2	30.1	29.9	29.4	20.9
Brightness	Cm	30	60	60	30	30	30
pH	-	5.4	6.1	5,5	6.1	6.1	5.2
DO	mg/L	5.3	5.2	5,2	5.3	4.5	5.2
Salinity	%	0	0	0	0	0	0
Depth	M	2.2	5.1	1.3	1.5	2.6	3.5
Current	(m/dt)	0.14	0.27	0.27	0.07	0.06	0.31
Phosfat	(mg/L)	1.104	0.048	0.224	0.064	0.576	2.576
Nitrat	(mg/L)	0.225	Ttd	0.090	Ttd	0.315	0.203

3.5. Index of Stomach Content of *Mystus gulio* Hamilton

Calculation of Index of stomach content is used to determine the level of relative food consumption. Different size of fish can affect the pattern of fish consumption of food resources. Determination of the Index of Stomach content can be seen based on the interval of size class. Fish size welding is done to see the activity of fish in finding and eating food in each size class. Value of relative food consumption level based on size class is presented in Figure 6.



Gambar 6. Index of Stomach Content of *Mystus gulio* Hamilton

Based on Figure 6. the average value of the relative food consumption of *Mystus gulio* Hamilton with a small size of 3.92-4.91 cm has a high relative food consumption value of 34.77% while the *Mystus gulio* Hamilton with a large size of 11 , 92-12.91 cm has a low relative consumption value of 10.47%. According to[17] that the Index of Somatic Content is influenced by several factors namely the activity of fish to meet nutrition needs, different body weight and size, fish body condition and habitat

Based on Table 2, it is known that the waters at the sampling location show water temperatures ranging from 20.9 - 30.2. According to [16] that the temperature range of 20-30 is still good for fish life, even if in the waters there are no toxic compounds oxygen content of 2 ppm is sufficient to support aquatic life. Based on [6], Lundu fish are primarily a brackish water fish that enters and lives in fresh water. In freshwater, adults occur mainly in larger water bodies (rivers and streams) with mud or clay substrates, and rarely found in smaller streams.

4. Conclusion

Based on the research that has been carried out, the following conclusions are obtained:

1. Important of Relative Index value of each kind of food namely Cyanophyta at 585.52%, Chlorophyta 2164.54%, Diatomae 1464.43%, Desmidiacae 254.77%, Euglenophyta 13.09%, Pyrrophyta 13.09% 50.35%, Ciliata 5.18%, Entomostraca 7.49%, Rhizopoda at 27.67%, Rotaria 16.65%.
2. The growth patterns of *Mystus gulio* Hamilton in December 2016, January, February, March and April 2017 are positive allometric.
3. Factor values for the *Mystus gulio* Hamilton condition range from 0.6-22.66 g/cm.
4. *Mystus gulio* Hamilton Index of Stomach Content with the small size of 3.92-4.91 cm have the high relative food consumption value of 34.77% while *Mystus gulio* Hamilton with the large size of 11.92-12.91 cm have the value of relatively low feed consumption 10.47%.

5. Acknowledgement

There is no conflict of interest for this publication of the research.

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