

Food and Feeding Habits of Bilih Fish *Mystacoleucus padangensis* (Bleeker, 1852) In Naborsahan River, Toba Lake, North Sumatera

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ABSTRACT

The bilih fish (*Mystacoleucus padangensis*) is one kind of migratory fish from the lake to the river mainly supposed to spawn. This study aimed to determine food kinds and feeding time whenever they migrate. The study was conducted in Naborsahan River, Toba lake, North Sumatra. Sampling was conducted every 1 hour using Cast net. The results showed that *M. padangensis* keep doing the feeding activity and having diurnal when migrated. Natural food bilih fish that found in it intestine were phytoplankton include Rhizosolenia, Synedra, Gonatozygon, Closterium, Surirella, Pinnularia, Oscillatoria, Melosira, Gyrosigma, Aulacoseira and Zooplankton among others Creseis, Tubifex and Daphnia. The type of natural food that mostly found in *M. padangensis* intestines were phytoplankton from the genus Synedra sp (Bacilariopiceae) with Index of Preponderance (IP) is 97.9%. Based on the composition of the natural food that was dominated, *M. padangensis* Biwas categorized as the plankton feeder.

Keywords: bilih fish, diurnal, feeding habits, plankton feeder, Toba lake

1. Introduction

The bilih Fish (*Mystacoleucus padangensis*) is an endemic Cyprinidae fish from Singkarak Lake, West Sumatera that has been introduced to Toba Lake North Sumatera. (Umar & Kartamihardja, 2011; Kottelat et al., 1996). However, now *M. padangensis* could be found in the Toba Lake. This fish was not a native species in Toba Lake, but it was introduced from Singkarak Lake, West Sumatra.

M. padangensis has very similar body shape to the relatives, namely gengghek fish (West Java) or wader fish (Central Java and East Java) that *M. marginatus* many in the inland water of Sumatra, Java, and Kalimantan. This fish was also similar to wader cakul fish (Central Java and East Java), beunter fish (West Java) or porapora fish (North Sumatra) that *Puntius binotatus*. Porapora fish in Toba Lake was never caught again since the 1990s, then the community around Toba lake called bilih fish as the porapora fish. Pora-pora name which was actually a *M. padangensis* stuck and popular until now (Kartamihardja and Sarnita, 2010).

The bilih fish grown rapidly in Toba Lake. It was provided with the data of bilih fish that been caught reached 30,000 ton in 2010 (Kartamihardja and Sarnita, 2010). Growth and development of biota in aquatic were mostly determined by the availability of natural feed and fish species that used it. The poor quality of water causes the water of the river unreasonable to be used (Yuliati et al., 2017). Temperature, dissolved oxygen and pH are important water quality parameters related to the life of aquatic organisms (Effendi, 2003; Sinaga et al., 2016). The study of food and feeding habits bilih fish in Toba Lake and in Singkarak Lake has been done by Purnomo (2008), Purnomo and Sunarno (2009), Umar and Kartamihardja (2011). But this study only analyzed the types of main food, complements food and supplements food for *M. padangensis* that caught in the lake. The study of feeding periodicity *M. padangensis* has never been done, as well as the study of food habits bilih fish that caught in the river has not been done. This was important because bilih fish migratory from the lake to the river to spawning. Whether this bilih fish eaten when migratory to spawn become one of information that needs to be related to fisheries biology.

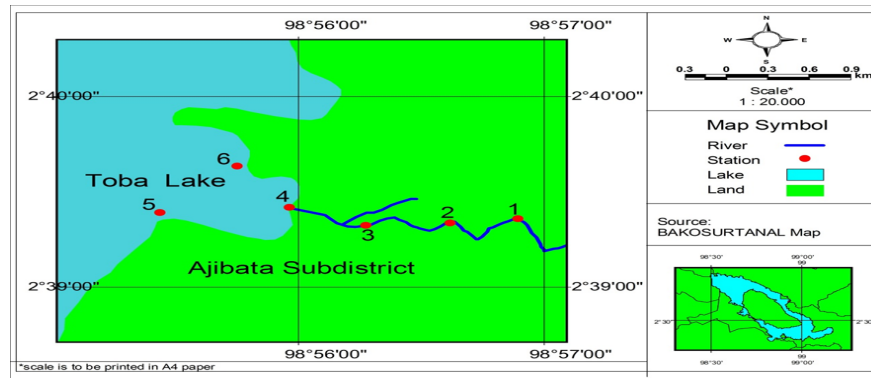


Figure 1. Sampling station at Naborsahan River Toba Lake North Sumatera

2. Materials and Methods

Time and location of research

This study was conducted in Naborsahan River, Toba Lake, Ajibata District, Toba Samosir Regency, North Sumatra. The sampling of the fish was carried out at six stations which were determined based on the river characteristics and bilih fish habitat (Figure 1). Sampling was carried out every month from April 2013 to May 2014. Sample analysis was done in Integrated Laboratory of Aquatic Resource Management Department, Faculty of Agriculture, University of North Sumatra.

Research procedures

The sampling was done once a month for 12 months. The sampling of bilih fish once every 1 hour performed three times for the analysis of bilih fish feeding periodicity. The *M. padangensis* samples caught with Cast net. Samples have immediately measured the weight, then 1 ml formalin 40% was injected to stop the metabolic rate of the fish. Furthermore, the sample was put in the bottle contain 10% formalin.

Food and feeding habits of the fish are determined by stomach analyses. Total length (mm), wet weight (g) and sex of each fish were recorded prior to the analysis of stomach. The digestive organs such as stomach (intestine) measured for length, weight and volume. After that, the intestinal contents of dissected fish is diluted with aquadest. Dilution is filtered and inserted into the sample bottle, and it is dropped by 4% formalin. Finally, observation of the intestinal contents is done using a stereoscopic microscope and then identified by using plankton identification book Sachlan (1982) and Edmonson (1959) until the taxa

most likely with 100x magnification observation and repeated 3 times.

Index Stomach Content (ISC) is determined to find out the level of feed intake relative fish samples. ISC is determined by using the calculation according to Hyslop (1980), the formula:

$$ISC = \frac{SCW}{BW} \times 100$$

Where, ISC = Index Stomach Content (%), SCW = Total stomach contents weight (g), BW = Total fish weight (g).

Diet composition and determination of main food components *M. padangensis* known content analysis digestive tract (intestine). Calculation of the contents of the digestive tract is done by calculating the index of preponderance for composition analysis fullness level of natural food in the digestive tract of bilih fish. According to Natarjan and Jhingran (1961), it is calculated using the formula:

$$IP = \frac{V_i \times O_i}{\sum (V_i \times O_i)} \times 100$$

Where, IP = the main index (index of preponderance), V_i = percent volume of a particular food, O_i = percent incidence of some types of food, $\sum (V_i \times O_i)$ = Total $V_i \times O_i$ of all kinds of food.

The abundance of plankton genus was counted at the station during the observation. Plankton abundance was calculated using an SRC with the following formula (APHA, 2005):

$$K = \frac{N \times A_t \times V_t}{A_c \times V_s \times A_s}$$

Where, K = abundance phytoplankton (cell L⁻¹) and zooplankton (indL⁻¹), N = number of plankton observed, As = volume of water that is filtered (L), At the surface SRC = cross-sectional area (mm²), Ac = area of observation (mm²), Vt = volume concentrates on the bottle sample (ml), Vs = volume of concentrate in SRC (ml)

3. Results and Discussion

The results of stomach analysis of all the samples at the six stations of the study (n = 2,592 tail) showed that all bilih fish that caught during the day in a state of food. Bilih fish that was caught in the night showed the empty stomach. Based on the identification results showed that stomach contents consist of phytoplankton, zooplankton, tubifex and detritus.

The result of the calculation of hourly sampling Index Stomach Contents (ISC) can be

seen in Figure 2. The value of ISC showed high percentages during the morning and low at night.

Based on Figure 2 indicates that the peak value of ISC on male and female fish that were in the morning is at 09:00 pm, based on observations in the field ISC rose from 06:00 pm and reached the peak at 09:00 pm and began to decline from at 10:00 to 11:00 pm. It tends to be stable at 11-15 pm and began to rise again at 16:00 to 18:00 pm. Stomach bilih fish at this time tend to be empty. This shows that bilih fish were diurnal, or active foraged during the day (diurnal). Stomach fullness index calculation is done to determine the relative food consumption of fish. Effendie (1997) stated that in normal conditions, the fish took food constantly. However, the intensity was not always the same because it depends on the index stomach contents. The fish that consumed intensively, then the stomach was always full while fish that consumed the food at any time, then the stomach would be filled in part.

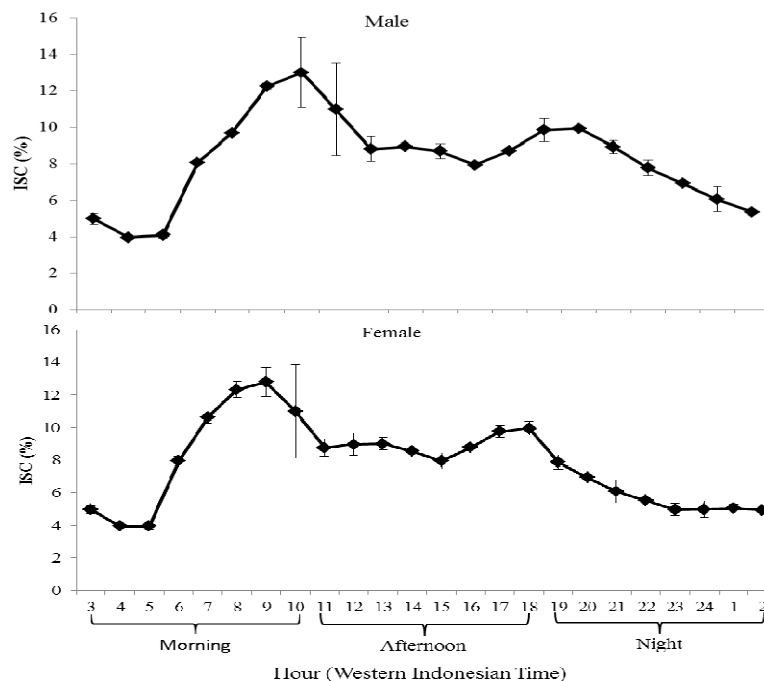


Figure 2. Index Stomach Contents (ISC) male and female *M. padangensis*

Figure 3 represent the results of the analysis of natural food in the stomach during research on the Naborsahan river, Index of Preponderance (IP) values obtained overall in the 2,592 sample bilih fish. Natural food was

phytoplankton from the Bacillariophyceae class, *Synedra* genus was the most natural food often found in the intestines of bilih fish. The results of the analysis of natural food bilih fish by sex could be seen in Figure 4. The male and female

bilih fish has the same kind of natural food in the form of phytoplankton (Bacillariophyceae Class). The Bacillariophyceae Class from

Genus *Synedra* was natural food types of bilih fish that often found in every research station

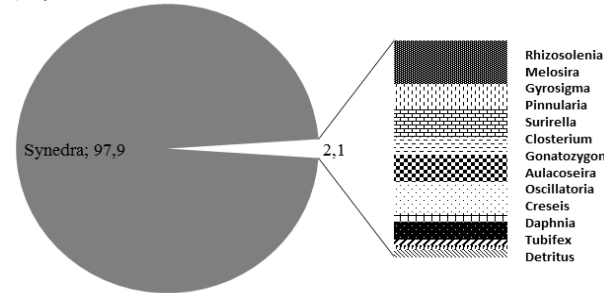


Figure 3. Composition of the natural food all sample *M. padangensis*

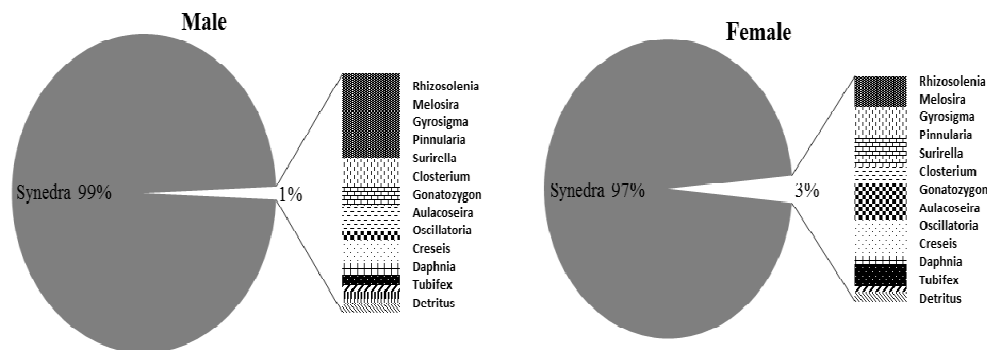


Figure 4. Composition of the natural food of *M. padangensis* by sex

Natural food of bilih fish on male and female fish was same (Figure 4). The difference on the percentage of each type of food naturally found in the intestines of *M. padangensis*. *Synedra* percentage dominate in fish intestines bilih both male and female. *Synedra* percentage in bilih fish males (99%) and females (97%). It showed that the *Synedra* as the main feed for bilih fish both male and female.

Figure 5 represents the *Synedra* percentage in intestines of bilih fish at the research station. The percentage *Synedra* in *M. padangensis* at Station 1 was 98%, stations 2,3, and 4 were 99%, station 5 was 97% and station 6 was 96%.

The food composition of *M. padangensis* in general (Figure 3, 4, 5) that found was groups of Bacillariophyceae which was the natural food in bilih fish's intestines. This is consistent with the statement Purnomo and Sunarno (2009) that the *M. padangensis* in Singkarak lake have the same natural food, such as phytoplankton most consumed by *M.*

padangensis are family Bacillariophyceae. IP value of the Bacillariophyceae of the *Synedra* genus amounted to 98.9%. This indicates that the Bacillariophyceae was the main food of bilih fish. Determination of the main food based on Nikolsky (1963) that $IP > 40\%$ was main food and $<40\%$ was a complement food for the organism.

IP value of bilih fish male and female of to Bacillariophyceae respectively 98.9% and 98.7%. Bacillariophyceae of the *Synedra* genus is a major food of *M. padangensis* (Figure 3, 4, 5). Males consumed the same food with the female fish. It showed no difference on natural food of *M. padangensis* male and female. This is along with Febriani (2010) which stated that a group of food from the digestive tract of male bilih fish not much different from the female *M. padangensis* Bacillariophyceae group consisted of plankton, Chlorophyceae, Cyanophyceae, and others (litter, detritus, and organisms were not identified).

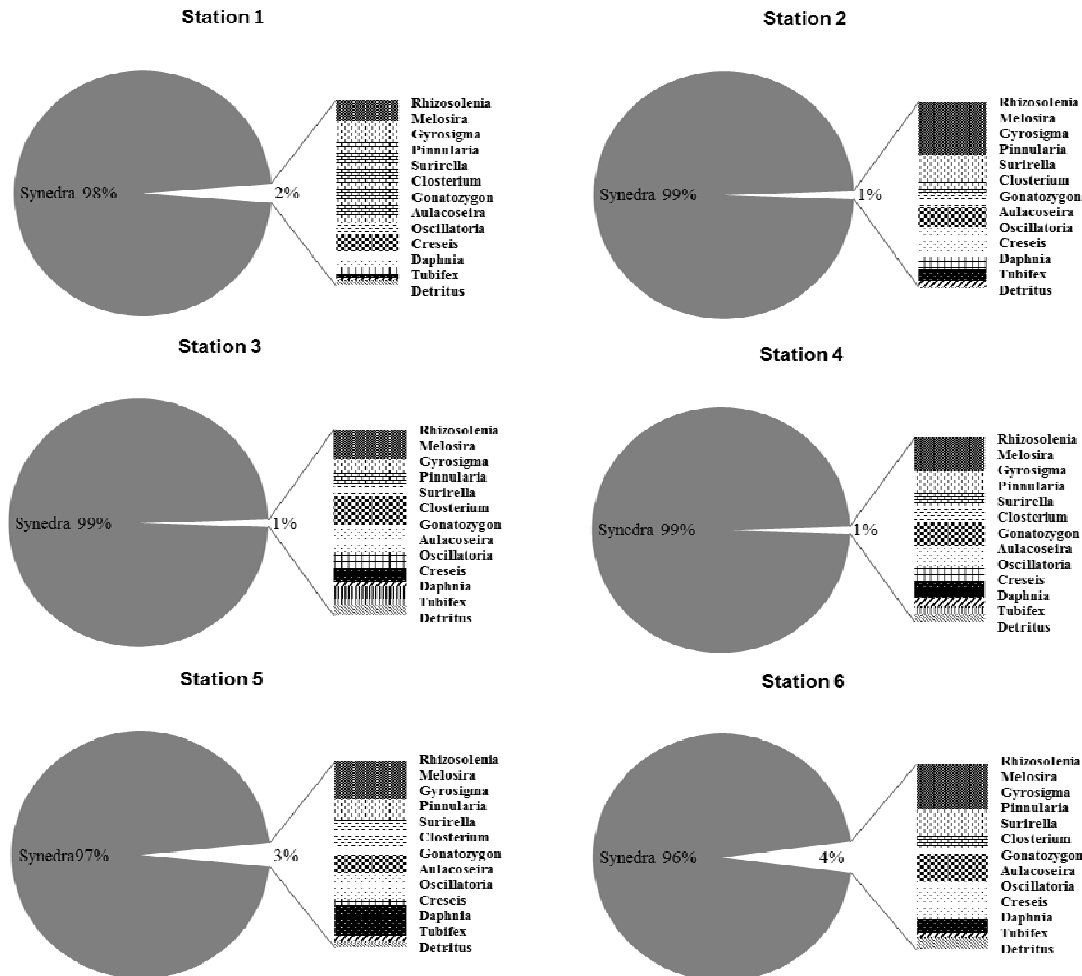


Figure 5. Composition of the natural food of *M. padangensis* at each research station

Figure 3 showed that the highest IP value in Bacillariopiceae Class was *Synedra* genus with IP value amounted to 98.9% and the lowest IP value for the Cladocera Class, *Daphnia* Genus with IP value of 0.001%. According to Nikolsky (1963) the fish food that has an IP value > 40% then the organism categorized as the main food. IP Values 4-40% then the organism was the supplement food. IP value <4% then these organisms was the complements food. Variations of *M. padangensis* food contained in Figure 3 and 4 showed that the main food of *M. padangensis* was a *Synedra* genus Bacillariopiceae Class which belong to the phytoplankton.

The results of this study were consistent with the results of Adjie (2009) on the same family of *M. padangensis*, for example, Semah Fish (*Tor* spp.). It showed the main food of Semah Fish form of moss with IP value by 80%. Furthermore, the results of Taufiqurohman et al. (2007) in Cyprinidae Family such as Nilem

Fish (*Osteochillus hasselti*) showed that Nilem Fish have the main food phytoplankton with IP value amounted to 76.63%. Tresna et al. (2012) reported food habits of some fish that belongs to the Cyprinidae family, which Paray Fish (*Rasbora aprotaenia*) have the main food phytoplankton with IP value amounted to 55.22% supplement in the form of detritus with IP value amounted to 21.11% of zooplankton with IP value amounted to 12.6% and parts of plants with IP value amounted to 11.11% carp (*Cyprinus carpio*) have the main food zooplankton with IP value amounted to 80.00% supplement in the form of phytoplankton with the IP of 12.22% and detritus with IP amounted to 7.78%, nilem fish have a main food phytoplankton value IP amounted to 79.00%, the supplement food form part of the plant with IP value amounted to 12.78% and food complements such as zooplankton and detritus with IP value <4%, Genggehek Fish (*M. marginatus*) was a genus of *M. padangensis*

have the main food phytoplankton with IP value of 62.78% and parts of plants with IP value amounted to 27.78%, complements food in the form of detritus with IP value of 8.33% and supplement food such as zooplankton with IP value of 1.11%.

The research result was slightly different from the results that reported by Umar and Kartamihardja (2011) which was the main food derived detritus (78.8%), with complement food such as phytoplankton (11.2%) and zooplankton (8.0%). Supplement food plant litter (1.9%). The results obtained from the analysis of stomach contents of *M. padangensis* to sampling in 2009 at Toba lake. The results of observations in August 2010 acquired the main food in the form of detritus (92.9%), complement food such as phytoplankton (4.9%) and food supplement such as plant litter (1.8%). Observations from the second period showed no difference on the type of fish bilih's food. The composition of *M. padangensis* food in Toba lakewas the same

with the previous year as well as from the original habitat in Singkarak Lake West Sumatra. However, it was slightly different from composition percentage (Umar & Kartamihardja, 2011).

The differences on the composition food were closely related to the age of the fish and the availability of natural food in the aquatic. The phytoplankton was a complementary food consumed was *Milosira* sp., *Eunotia* sp., and *Synedra* sp., from the Bacillariophyceae class (Umar & Kartamihardja, 2011). Research at Singkarak Lake obtained the same results, which is the most phytoplankton that consumed by bilih fish is Bacillariophyceae (Purnomo and Sunarno, 2009). This situation was supported by the availability or abundance in nature, where the abundance of plankton in Singkarak lake dominated by Bacillariophyceae families (48.6%) (Purnomo, 2008).

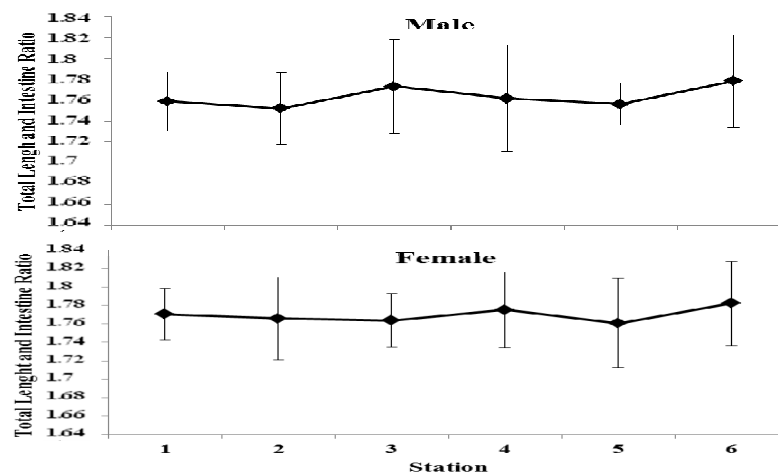


Figure 6. Total length and intestine ratio of bilih fish at each research station

Figure 6 indicates the ratio of the length of the intestine with a total length of bilih fish ranged 1.75-1.78. The results showed that bilih fish have an intestine length longer than the length of the body. According to Situmorang (2013), a fish that has anatomical structure intestine length longer than the length of the body was a kind of herbivorous fish. The results of the comparison length of the intestine with a body length of this further strengthened that *M. padangensis* is omnivorous fish that tend herbivores. Effendie (1997) stated that the herbivorous fish generally did not have the stomach or the false hull with a very long intestine size could be several times their body length.

The main food of *M. padangensis* male and female fish were relatively similar in the composition was a plant-based form of phytoplankton. The main *M. padangensis* food fish in the Naborsahan river was phytoplankton. Differences occur only in the composition of animal food in the stomach male and female fish allegedly due to differences in fish habitat and availability of food in the water. The similarity of fish food is influenced by the species, availability, and ease of getting food, sex and the shape and condition of the aquatic. The composition of foods was the same male with female fish food. Similar results was also found in fish *Leiognathus equulus* (Simanjuntak and Rahardjo, 2008).

Table1.The abundance of plankton at each research station

Class	Family	Genus	Abundance (cell ⁻¹)					
			st 1	st 2	st 3	st 4	st 5	st 6
Phytoplankton;1								
Bacillariophyceae	Bacillariophyta	Achnanthes	220	302	200	333	575	342
		Bacillaria	231	331	220	373	625	371
		Cymbella	162	287	160	264	500	257
		Epithemia	370	354	170	295	600	314
		Fragillaria	260	377	260	420	550	357
		Frustulia	430	356	230	404	600	357
		Navicula	250	352	280	467	775	357
		Nitzschia	256	281	210	264	375	285
	Chaetoceraceae	Rhizosolenia	400	659	400	623	1125	657
	Fragillariaceae	Synedra	450	953	450	934	1375	957
	Melosiraceae	Melosira	310	429	310	498	900	428
	Naviculaceae	Gyrosigma	260	347	260	358	725	342
		Pinnularia	280	527	280	529	800	528
	Surirellaceae	Surirella	320	408	320	389	600	400
Chlorophyceae	Chlorophyta	Pediastrum	200	387	200	467	575	385
		Scenedesmus	230	377	230	389	700	371
	Desmidiaceae	Closterium	210	348	210	451	475	342
	Gonatozygaceae	Gonatozygon	320	488	320	389	700	428
Coscinodiscophyceae	Aulacoseiraceae	Aulacoseira	250	378	250	389	700	371
	Bacillariophyta	Coscinodiscus	200	349	200	358	600	342
Cyanophyceae	Cyanobacteria	Anabaena	220	459	220	327	625	400
	Oscillatoriaceae	Oscillatoria	260	445	260	420	700	400
Zygnematophyceae	Streptophyta	Cosmarium	200	327	200	249	400	257
		Pleurotenium	180	245	180	234	450	285
unidentified			90	124	90	155	175	114
Zooplankton					Abundance (indL ⁻¹)			
Clacodera	Daphnidae	Daphnia	7	7	2	3	4	5
Macrozoobentos					Abundance (indL ⁻¹)			
Clitellata	Tubificidae	Tubifex	7	5	3	3	3	2
Gastropoda	Cavollinidae	Creseis	5	6	3	5	6	4
Total Abundance			6,578	9,908	6,121	10,002	1,6638	19,668

The abundance of plankton in the research station was represented in Table 1. The six research stations indicated that the highest abundance was at station 3 as many as 19,668 cell L⁻¹ and the lowest abundance was at stations 4 as much as 6,121 cell L⁻¹.The

research location was mostly rivers area the flow played an important role in determining the type and abundance of plankton. Current speed could also affect the types of plankton organisms that live in aquatic. The plankton that dominated the observations station was

Synedra. According Round (1964) in Wijaya (2009) that the type of aquatic communities that have current $<0.2-1 \text{ ms}^{-1}$ is dominated by plankton such as Nitzschia, Navicula, Synedra, Oscillatoria.

The results of the analysis in Figure 3, 4 and 5 showed the similarities of natural food in the intestines of *M. padangensis* with the availability of natural plankton in the aquatic (Table 1). It indicated that that bilih fish was not selective consuming food. Thus Bilih fish consumed natural food that was available in the aquatic.

4. Conclusion

Natural food of *M. padangensis* in Naborsahan River and Toba lake was the same that the phytoplankton of the Bacillariophyceae Class. *M. padangensis* when migratory still did meal activities. *M. padangensis* actively feed (feeding habits) during the day or diurnal. Natural food *M. padangensis* were phytoplankton, among others Rhizosolenia, Synedra, Gonatozygon, Closterium, Surirella, Pinnularia, Oscillatoria, Melosira, Gyrosigma, Aulacoseira and one Zooplankton is Daphnia and also Macrozoobentos among others Creseis and Tubifex. The type of natural foods that most commonly found was phytoplankton from the Synedra genus whose Index of Preponderance (IP) $> 40\%$, was 98.9%. Based on the composition of dominant food, *M. padangensis* was classified as plankton feeder.

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