Macrothink Institute™

Journal of Environment and Ecology
ISSN 2157-6092
2013, Vol. 4, No. 2

Analysis on the Feeding Habit of Tilapia *(Oreochromis Niloticus)* Cultured in Silvofishery Pond in Semarang

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Received: July 1, 2013 Accepted: August 2, 2013 Published: October 25, 2013

doi:10.5296/jee.v4i2.3950 URL: http://dx.doi.org/10.5296/jee.v4i2.3950

Abstract

Silvofishery application in Semarang was expected to provide several advantages for aquaculture activity, such as its support to the availability of natural food for Tilapia. This research aimed to analyze the suitability of Tilapia fish stomach content and the composition of plankton in the silvofishery pond in Semarang. Data collection included plankton abundance in A. marina and R. mucronata silvofishery plot and stomach content of Tilapia fish. Data were collected through field sampling occupying 6 silvofishery plot (3 for each vegetation type) and 6 fish samples (3 from each vegetation types). Water sampling was conducted by filtering 10 litres of water to 100 ml. Plankton identification was conducted in the laboratory. The result showed there were 7 plankton species found in the stomach content of Tilapia fish. Six similar species were found in the A. marina pond and only 5 similar species were found in R. mucronata pond. There was no similarity on the community structure of plankton found in the A. marina pond, R. mucronata pond and stomach content of Tilapia fish. The plankton abundance of A. marina plot was higher than the plankton abundance of R. mucronata plot.

Keywords: Feeding habbit, Tilapia, Silvofishery, Plankton, Community structure

1. Introduction

Silvofishery had been applied in many regions as the strategy to support aquaculture activity and preserve mangrove sustainability (Mwaluma, 2002). The silvofishery system had been applied partially in Semarang coastal area. Only some aquaculturists who realized the importance of mangrove existence in coastal area would apply the silvofishery system, but some other denied it since their negative perception of silvofishery. For some aquaculturists, mangrove growing in the culture plot would support the growth of pests.

According to Primavera (2000), silvofishery system provide optimized economic provitability since the system allowed natural recruitment of wild juvenile. Another advantage of silvofishery system was mentioned by Bush *et al.* (2010) such as minimization of contamination by pond effluent. Vaiphasa *et al.* (2007) explained that mangroves integration in silvofishery had the function as biofilters of pond effluent. Primavera and Esteban (2008) added that mangrove within pond would provide shading and food for cultured biota.

Tilapia fish had been a lot cultured in freshwater embankment. But, in some region in Indonesia, Tilapia fish are cultured in brackish water pond. According to Suresh and Lin (1992), Tilapia fish could grow well in salinity up to 25 ppt. Tilapia fish also cultured in silvofishery pond. The advantage of silvofishery pond in aquaculture is that the primary productivity of mangrove would provide nutrients for plankton which then to provide food for higher trophic levels.

Tilapia, an omnivore fish, consumed phytoplankton and zooplankton. Such studies were conducted concerning natural food of Tilapia fish such as Fattah *et al.* (2008) which showed that natural food of tilapia included phytoplankton (blue-green algae, green algae, *Bacillariophyceae*, *Cyanophyte*) and zooplankton (*Copepod*, Cladocera, *Rotifera*, *Ostracoda*). While Abdel-Tawwab and El-Marakby (2004) added that Tilapia fish also consumed *Euglenophyceae*, while *Cyanobacteria* and *Euglenophyceae* were the most food found in the stomach of Tilapia.

The application of silvofishery was expected to provide sustainable natural food for cultured organism. Gatune *et al.* (2012) mentioned that utilization of artificial food had lead to the increase of ecosystem pollution and decline of wild fish stocks. Hence, an alternative natural food should be provided to supply the aquaculture. Here, the rule of mangrove in pond culture was proven to support the needs. Mirera (2011) had shown that silviculture provided natural food for cultured organism. The primary productivity of the mangrove supported the growth of *lumut* and *lab-lab* (a complex mat of blue green algae, diatoms and associated invertebrates) within the pond (Mirera, 2011).

The silvofishery applied in Semarang utilized mangrove *A. marina* and *R. mucronata* as vegetation to integrate with Tilapia fish culture. But, how silvofishery could support the Tilapia culture had not been known. Similarity of stomach content of Tilapia fish and aquatic organism (phytoplankton and zooplankton) had been considered as the technique to provide information concerning feeding habit of Tilapia fish and the environment (silvofishery pond) support to the growth of the fish. This research aimed to analyze the suitability of Tilapia fish stomach content and the composition of plankton in the silvofishery pond in Semarang.

2. Methodology

The research was conducted in District Tugu, Semarang. Samples are included plankton composition and abundance and stomach content of Tilapia fish. Sampling of plankton was conducted by filtering 10 litres of pond water to 100 ml of bottle sample. Water sample was collected from 6 silvofishery pond occupying *A. marina* and *R. mucronata* (3 plots for each vegetation). Identification and analysis were conducted in the laboratory. Tilapia fish sample was taken from the culture activity conducted in the same silvofishery plot. Three fish samples were taken respectively from *A. marina* and *R. mucronata*. The identification and analysis of Tilapia fish stomach content were conducted in the laboratory as well. Statistical analysis was conducted through Chi-Square test to compare the similarity of plankton structure in the silvofishery plot (occupying *A. marina* and *R. mucronata*) and the stomach content of Tilapia fish.

3. Result and Discussion

The analysis result showed there were 7 plankton species found in the stomach content of Tilapia fish which were available in the pond. Complete information concerning the proportion of plankton identification in silvofishery pond and in the stomach content of Tilapia fish is shown in and Figure 1, while the abundance of plankton in silvofishery pond is shown in Table 1.

Table 1. Abundance of Plankton in Silvofishery Pond

No	Plankton Species	Abundance (ind/l)	
		R. mucronata	*A. marina*
1	*Netrium* sp	-	17
2	*Diatoma* sp	86	165
3	*Navicula* sp	185	175
4	*Nitzschia* sp	173	276
5	*Stauroneis* sp	-	35
6	*Synedra* sp	51	156
7	*Melosira* sp	34	-
	Total	529	824

Plankton species identified included *Melosira* sp, *Nitzschia* sp, *Netrium* sp, *Stauroneis* sp, *Synedra* sp, *Diatoma* sp *and Navicula* sp. Of all the plankton identified, the proportion of *Melosira* sp was the highest among others, later *Nitzschia* sp. While the least proportion was *Navicula* sp and *Diatoma* sp. The proportion of Melosira sp observed in *R. mucronata* stand was only 6,43%, which was much lower than in the stomach content of Tilapia fish. While in the *A. marina* stand, none of *Melosira* sp was found.

The proportion of *Nitzschia* sp in *R. mucronata* stand was 32,7% while in *A. marina* stand was 33,5%. Compared to the proportion in the stomach content of Tilapia fish (14,29%), the abundance of *Nitzchia* sp in both silvofishery pond showed the potency of its utilization as natural food for Tilapia fish. Some other plankton species were also quite abundant in the silvofishery pond including *Synedra* sp, *Diatoma* sp and *Navicula* sp. But, the abundance was not aligned to the proportion of the stomach content of Tilapia fish. This showed that those planktons were not the preferred food for Tilapia fish.

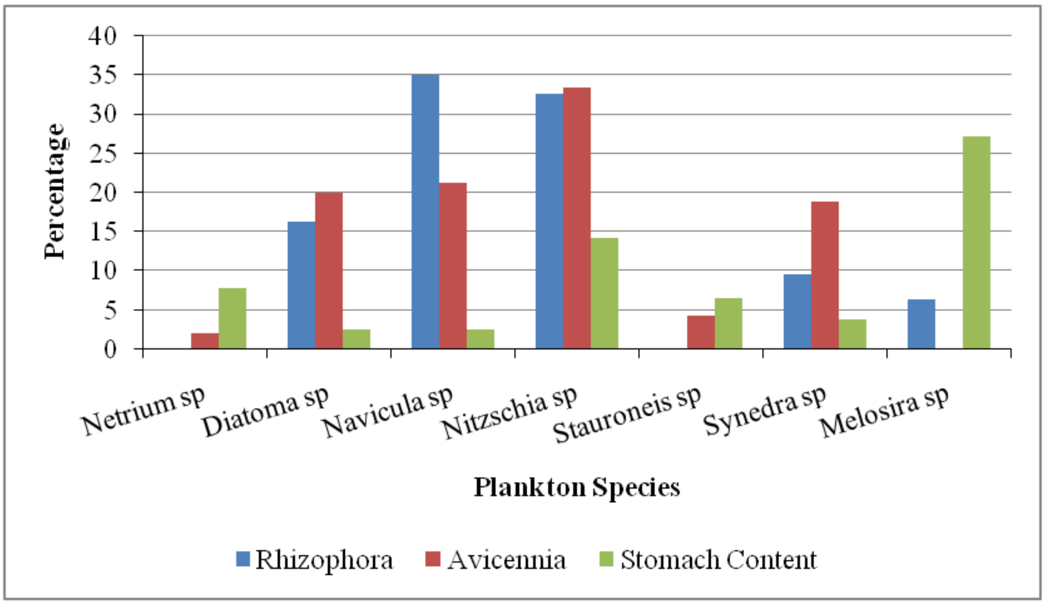

Figure 1. The Proportion of Plankton Species in the Silvofishery Pond and in the Stomach Content of Tilapia Fish

Statistical analysis by Chi-Square showed there was no similarity of the plankton structure identified in *A. marina* pond, *R. mucronata* pond and the stomach content of Tilapia fish. Partial analysis showed that there was no similarity of plankton structure between *A. marina* and *R. mucronata*, between *A. marina* and stomach content of Tilapia, and between *R. mucronata* and stomach content of Tilapia. This showed that silvofishery occupying different mangrove vegetation would result in a difference on plankton community structures. The difference of plankton structure in silvofishery pond and the stomach content of Tilapia showed that not all plankton species were consumed by Tilapia fish.

The abundance of plankton in the silvofishery pond was related to the its litter production. Bernini and Rezende (2010) mentioned that different vegetation species produce different rate of litterfall. The production rate showed in the research was 3.59 $\pm$ 3.18 g/m^2/d for A. germinans and 4.26 $\pm$ 2.84 g/m^2/d for R. mangle. The decomposition rate was also different where A. germinans was noted as 5.1 x 10^{-3} while R. mangle was 2.7 x 10^{-3} (Barroso-Matos *et al.*, 2012). Hence, the different litter production and decomposition would effect on the growth of plankton and related food chain in the ecosystem.

The analysis on the stomach content showed that not all plankton species were consumed by Tilapia fish. Abdel-Tawwab and El-Marakby (2004) showed that Tilapia fish consumed Cyanobacteria and Euglenophyceae as the main food. Figueredo and Giani (2005) mentioned that the selection in fish feeding was determined by the capability of feed capture. Turker *et* *al.* (2003) added that Tilapia fish could not capture alga species smaller than 8 µm. Attayde and Menezes (2008) mentioned that Tilapia fish were shifting their feeding behavior. Fish larvae consumed zooplankton whereas the adult one shift its feeding habit into filter feeding. The feeding habit of aquatic organisms effected on the availability and abundance of plankton in the culture plot.

Analysis on the abundance of plankton showed that plankton abundance in the *A. marina* pond was higher than in *R. mucronata* pond. This related to the availability of nutrient as mentioned by Ornolfsdottir *et al.* (2004) where plankton structure was driven by nutrient dynamic. The availability and abundance of natural food in the silvofishery pond would effect on the growth rate of cultured fish (Rosenfeld *et al.*, 2005).

4. Conclusion

There were 7 plankton species found in the stomach content of Tilapia fish including *Melosira* sp, *Nitzschia* sp, *Netrium* sp, *Stauroneis* sp, *Synedra* sp, *Diatoma* sp *and Navicula* sp. However, there were only 6 specieses were found in *A. marina* pond and 5 species in *R. mucronata* plot. The structural composition of plankton among *A. marina* pond, R. marina pond and stomach content of Tilapia fish were significantly different. It means that there was no similarity of plankton composition. The abundance of plankton in the silvofishery plot showed a higher abundance of plankton in the *A. marina* pond than in *R. mucronata* pond.

Acknowledgement

Field experiment was conducted by support of Mr. Olis, Mr. Aan and Mr. Ficka providing protection and daily monitoring and feeding to the culture activity.

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