PLANKTON AND MACROBENTHOS DENSITY AT MULTIPLE LOCATIONS TEST OF AQUAPHONIC APPLICATION BASED ON NILE TILAPIA (*Oreochromis niloticus*) CULTURE

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ABSTRACT

The aquaponic system is principly a culture technique combining an aquaculture and hydroponic in which fish and plant are reared together in a one system to improve the productivity and benefit of fish culture. In this research, the aquaponic system is made up of nine (9) units of ponds with vegetables substrate as biofilter. Ipomea aquatica (Kangkung) used as a economic vegetable in this system. The test used Multiple location of land tophografis which is : a).High, b) midle and c) low land. Differences of land tophografis apparently biodiversity of water plankton and water invertebrate which is important in food chain and ecologis balanced. In this research, plankton and macrobenthos samples taken regulary each week. 4% formaldehide use to conserved sample for laboratoies identification. Species identification, Diversity index (H') and Heterogeneous species (E) from Shannon-Weaner use as indicator of biodiversity. All data experiment are analyzed descriptively. Nile tilapias (Oreochromis niloticus) were stocked 100/m2, feeted with dry pellet in dosis of 5% to the total biomass, was given two times a day. Fish rearing done on 2 moths. Result shown that plankton species from all test location are similar which is Chlorophyceae dominated the fitoplanton. Zooplanton was found in low number such as Rotifer and Enteromostraca. Plankton density in range of mesotrophic to eutrophic (2000-5000 cel /l). , Diversity index (H') 0.75-1.57, Heterogeneous species (E)indicated low while Lemnaea sp dominated species of macrobenthos in range of 1 – 6 ind/m^2 in size of 2 – 14 cm length. Aquaphonic system be stable at each location.

Key word : multiple location, plankton and macrobenthos density, aquaphonic application

1. INTRODUCTION

Aquaculture development has been expecting as fish protein resources. In the other hand, land use on aquaculture compete with residencial, industrial and transportation. Decreasing water productivity, as it is reflected by a declining value of water use is a current phenomenon of water resource crisis. This crisis can be solved by application of aquaponic based on fish culture (Kusdiarti, *et al*.,2006 ; Ahmad *et al*., 2007).

The aquaponic system is principly a culture technique combining an aquaculture and hydroponic in which fish and plant(s) are reared together in a one system in order to increase the productivity of water and pond. This system enables optimizing utilisation of disposed nutrients from fish farming to produce crop (vegetable). It is deemed to be environment friendly because

of it's capacity to reduce the waste of farming into minimum level and profitable (Widyastuti *et all*., 2008a ; Widyastuti *et all*., 2008b ; Nugroho, E. and Sutrisno, 2008).

Application of aquaphonic system based on Nile tilapia (*Oreochromis niloticus*) culture at different land tophografis apparently biodiversity of water plankton and macrobenthos. Plankton and macrobenthos as an important role of food chain on life cycle and water quality parameters in fish culture (Pennak, 1978) are part of water ecologies on aquaphonic. Nutrients enrichment through feeding on aquaponic system suppose influences on plankton and macrobenthos diversity. When water rich on nutrient for the growth of plankton and macrobenthos diversity its mean that those water is sufficient on water quality parameters. Knowledge of species composition and density of plankton and macrobenthos on the application of aquaphonic system provide balancing ecologies of fish culture environment. Species identification, diversity and heterogeneous index are used as indicator of alteration on which aquaponics system is stable.

This research was done to carried out of plankton and macrobenthos diversity based on aquaponic application pond in order of ecosystem corelation .

2. MATERIALS AND METHODS

The experiment was conducted at multiple locations with different tophografis, low, middle and high tophografis. Fish farm at Cisolok, Sukabumi, (±10m of sea water level/SWL) as low tophografis, Research and Development Institute for Freshwater Aquaculture, Bogor (± 246 m SWL) as middle tophografis and fish farm at Cipanas, Cianjur (± 1008 m SWL) as high tophografis. All experiments places are located in West Java, Indonesia.

The aquaponic system was designed in concrete ponds (20 m^3 of volume) provided with vegetable substrate as a filter. The unit was arranged in recirculation system and water flow continuous through charcoal filter and as substrate of vegetable *Ipomea aquatica* ('Kangkoong') in 25% of total width pond. The tested was three times repeatedly at each location. Nile tilapia (*Oreochromis niloticus**)*** were stocked with an initial weight ± 1.0 gram and 100 fish per m^2. Feed with dry pellet in dosis of 5% to the total biomass, given 2 times in a day. Fish growth observation was done every 14 days on 10% of sample populations. Total production of vegetable calculated on each harvesting time.

Plankton diversity was monitored . Sample was taken every 2 weeks from the fish pond, used plankton net. In the middle time of experiment sample plankton was taken every 3 days to find out the amount progress of plankton density. Formaldehide 4% used for sample preservation and used microscope for species identification.

Macrobenthos sample was taken every 2 weeks from the fish pond, used plastic core. Different sizes (0.5 ; 1.0 ; 1.5 and 2.0 mm) of mesh sift were used. Sifting, selecting, indentifying and counting of species was done on laboratory. Formaldehide 4% used for sample preservation and alcohol 70% used on identification. Macrobenthos identification was conducted according Fitter and Manuel (1986) and Pennak (1978). Diversity and heterogeneous index from Shannon-Weaner were used, on which:

$H' = - \sum p_j \ln p_j$,

where pj as the speceis proporsion and H' as diversity index.

$E = H'/\ln S$,

where S as total species and E as heterogeneous index.

Parameters of water quality, these are pH, dissolved oxygen, and temperature observed every 2 weeks.

The different species founded and macrobenthos diversity among the treatments were tested using standard deviation at 95% convidence interval.

3. RESULTS AND DISCUSSION

Density, diversity and heterogeneous of plankton in this experiment are summarized in Table 1.

Table 1. Density, Diversity and Heterogeneous of plankton

Parameters	**Low**	**Midle**	**High**
Density (ind/l)	2.750-19.125	2.750-34.875	5.250-9.250
Catagories	mesotrophic to eutrophic	mesotrophic to eutrophic	mesotrophic to eutrophic
Diversity index (H')	1.16-1.57	0.75-1.53	1.01-1.16
Heterogeneous species (E)	low	low	low

. Density range from 2.750 to 34.875 individu/l. Its indicate that aquaphonic system has mesotrophic to eutrophic level of pond productivity. Water enrichment on tilapias culture assume to provide that condition. Uneaten feed and metabolic waste of fish could be danger according to increasingly the ammonia level .An aquaphonic system solved those problem while vegetable substrate as a filter. Plant absorb rich water nutrient.

Based on diversity index (H'),, aquaponic system in this research was middle or quite good on diversity of plankton . Total number and species composition from all locations are not significanly different (P>0.05).

Chlorophyceae dominate plankton composition among location. Aquaphonic system at middle location has better densely plankton than another location. Species composition in all location as shown in the Table 2.

Table 2. Species composition of plankton in all location.

No	PLANKTON SPECIES	
	Phytoplankton	**Zooplankton**
	Chlorophyceae	***Rotifera***
1	Chlorella	Brachionus *sp*
2	Coelastrum	
3	Hydrodicton	***Enteromostraca***
4	Pediastrum	Daphnia
5	Oocystis	
6	Scenedesmus	
7	Zygnema	
8	Ulothrix	
9	Closterium	
10	Microspora	
11	Volvox	
12	Botryococus	

Zooplanton was found in low number such as Rotifer and Enteromostraca. The population and community of those plankton relations on the number of phytoplankton .

Macrobenthos species founded on this experiment were gastropoda : *Lymnaea* spp and *Pomacea* and larvae of chironomide. In all aquaphonis application place shows small number of macrobenthos with range from 1 to 6 ind./ m^2 in size of 2 to 14 cm length of shell. Anatomical of a typical *Lymnaea* shell has a spiral or discoidal coiled shell (Pennak, 1978). Total number and species of macrobenthos in this experiment revealed in Tabel 3.

Table 3, Total number and species of macrobenthos.

Tophografis	Total number (ind/m^2)	Range Size (cm)
Low	2 to 4	4 to 13
Midle	3 to 6	3 to 14
High	1 to 5	2 to 14

The range size and macrobenthos life stages (Table 3) founded demonstrated that aquaponic pond as a ecosystem of macrobenthos (Ward and Whipple,1966; Wilson and Mc Gill, 1982).

Fresh water macrobenthos life on debrise, rock,logs, sediment or stick on aquatic plants during some period in their life. As a food chain, macrobenthos has important roles as monitor of water quality. Greater taxa richness indicates better water quality. Some species are sensitive on pollutant. Worm is one example of macrobenthos which is tolerant on polluted water.

. Based on diversity index of founded macrobenthos, aquaponic system in this research was low. Total number and species composition from both ponds in the first experiment not significanly different (P>0.05). It's shown too that aquaponic ponds has rare community of macrobenthos suggested that operational of aquaponic system were only 10 weeks. According Dodds, 2002, heterogeneous community shall has E index more than 0.75.

Water quality values among treatment at fish pond are shown in Table 4. Its shown that all parameters of water quality supported sufficiently for fish to grow.

Table 4. Range of water quality parameters

Parameter	**Tophografis**		
	Low	**Midle**	**High**
pH	7-8.5	7-8.5	7-8.5
DO (ppm)	0.41 - 6.2	0.41 - 8.46	0.82-2.45
Temperature (0C)	29 - 30	29 - 30	28 - 29

4. CONCLUSION

Total number and species of plankton and macrobenthos composition from all location experiments are not significanly different (P>0.05). Dominant species of plankton was Chlorophyceae while Macrobenthos species founded : Lymnaea spp, Index diversity (H') was low and aquaponics pond showed less of heterogeneous species (E) however based on the size of founded macrobenthos, aquaponics system become an ecosystem of macrobenthos live cycles. It is also shown that water quality parameters supported sufficiently for fish to grow..The experiment has confirmed that aquaponisc system be stable at each location .

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