EFFECT AND COMPARISON OF RECYCLING AND STAGNANT FRESHWATER ON PERFORMANCES (GROWTH AND SURVIVAL RATES; FISH QUALITY) AND PROFITABILITY OF THE ORNAMENTAL FISH *Barbus schwanefeldi (*KAPIAT) REARED AT 4 DIFFERENT DENSITIES

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ABSTRACT

Comparing two different rearing systems in fish production through stagnant and recirculation water systems showed that recirculation system has several benefits such as reducing manpower, and minimize or eliminate in using antibiotics and also eliminate the grow out of diseases, increasing the profits due to increase in density of fish cultured in the system, and water quality remain stable in optimal condition.

KEYWORDS: barbus, kapiat, ornamental fish, recirculating, recycling

INTRODUCTION

Due to economic constraints in Indonesia, rearing systems in urban area should be more and more intensive, however juvenile of ornamental fish are mainly produced in stagnant water and this system seems to be at its maximum of the production control. Actually, the stagnant system does not allow increasing rearing density of fish because of a rapid degradation of the water quality and spread of pathologies.

The farming in stagnant water seems easy to manage and cheap, however this technique use generally; 1) a high quantity of water (changed until 75% of the total volume of water per day), it cost becomes finally more and more expensive in the present situation when quality and quantity of water are decreasing; 2) a lot of labor; 3) large quantities of antibiotic applied generally not well targeted or not administrated for the proper time.

One of the ways for increasing the production and decreasing the consumption of water, antibiotic and the cost of labor is to use recycling water system fitted with mechanical and biological filter and ultraviolet sterilization.

Objective

In this experiment two different rearing systems were compared in a real situation of production (collaboration with farmers). For ornamental fish species was tested at different densities (2.5 and 5 fish per L) aiming to compare their performances in term of survival rate and growth when reared in stagnant and recycling water system. Observations about fish quality (color) and behavior were done. And then, an economic study was carried out for highlighting the system which is more profitable (in term of financial input and output).

MATERIALS AND METHODS

- This experiment was carried out at Research Station of Freshwater Ornamental Fish Culture in Depok, for 86 days.
- *Barbus schwanefeldii* seed originated from Thailand and breed by fish farmer in Indonesia.

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- Facilities were set up indoor under natural photoperiod.
- Experiment started when species arrived from farmers.
- Experiment took place in 72-Liter aquarium in recycling water fitted with UV sterilization and 50-Liter aquarium in stagnant water.
- Initial fish densities were 1, 3, 4 and 6 fish per Liter, either 100 up to 400 fish per aquarium in recycling and 2 and 4 in stagnant water, either 100 up to 200 fish per aquarium.
- Each treatment was replicated 6 times. To avoid risky situation, the highest density was tested only in recycling water.
- Pellets were distributed in a little excess at the frequency of 5 times per day.
- Initial mean body mass was weighed at the beginning and every 15 days during experiment.
- Survival rate was calculated at the end of the experiment by counting remaining fish in each tank.
- Water temperature variations were recorded everyday with minimum-maximum thermometer.
- Water pH, dissolved oxygen, ammonia, nitrite and conductivity were measured once a week.

RESULT

See Figure 1, 2, and 3.

Water quality data measured in reticulating system is presented in Table 1. It is shown that the values of all the items are laid in optimal condition such as pH and temperature. The temperature remain stable between 26.1–27.9^{0}C

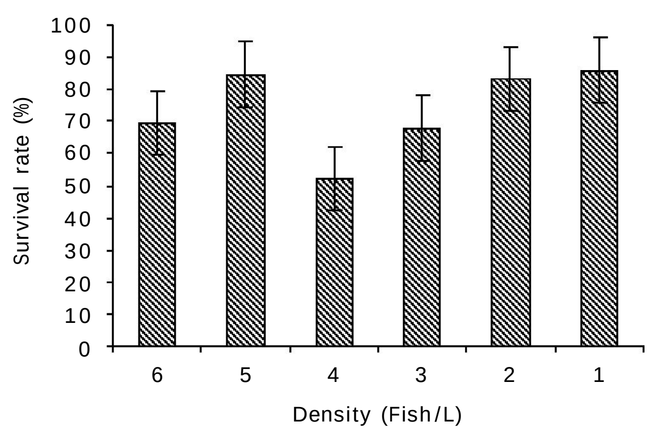
Compared to stagnant water system data (Table 2), the quality of water indicated that all values increased significantly and lay above the normal conditions. The temperature looks unstable shown by minimum and maximum difference roughly 4^{0}C.

Management

- Recycling and stagnant water were siphoned daily and the level of water was readjusted with clean water.
- Mechanical filter were cleaned once a week.
- 0.3% of salt was given every day, while antibiotics were given every 3 days (acriplafin = 0.01 mg/L and tetracycline = 250 mg in 100 L of water).

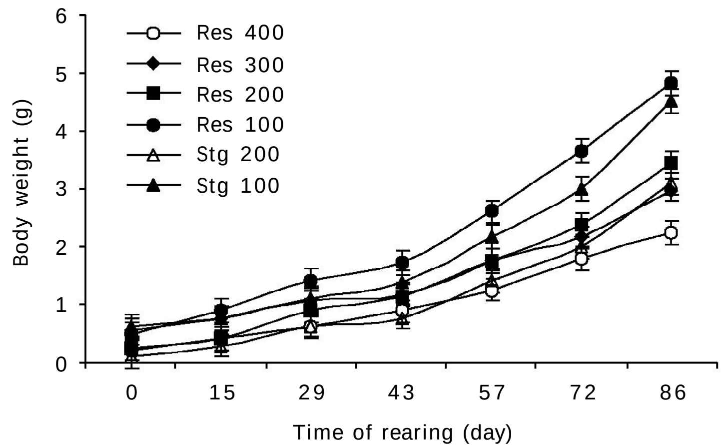
Financial analyze

- The quantity of food were measured accurately
- The volume of water used for each system was measured daily. For stagnant water system a minimal of 75% water was changed per day, and for recycled water was 0 (zero) %
- The duration of each task were measured and assessed



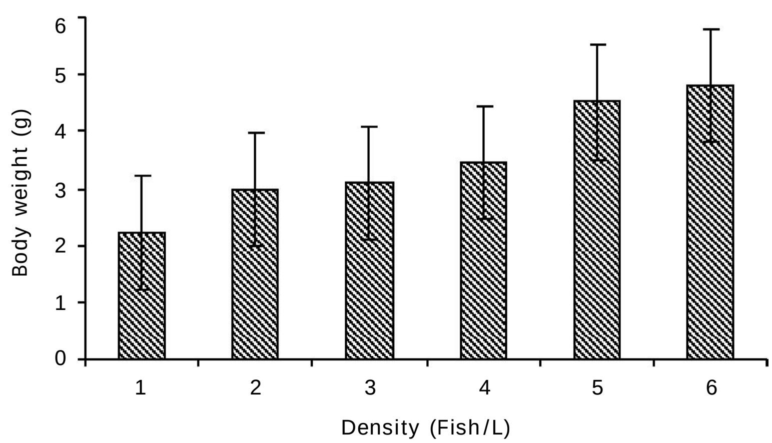
SR: the smallest in stagnant water (density 4 fish/L). In reticulating water relatively stable with a high density (>3 fish/L).

Figure 1. Survival Rate (SR) curve



Growth rate: density of 100 fish per aquarium was the fastest in both systems. No different between 200 and 300. And 400 fish/aq was the smallest.

Figure 2. Growth curve



Final weight: There was density influence below 2 fish/L.The smallest in water reticulating system (6 fish/L). There was no difference between 4 and 3 fish/L in both systems.

Figure 3. Growth curve based on densities

Table 1. Water quality data measured in recirculation system

NH3-N	0.01–0.42 mg/L
NH3-	0.01–0.36 mg/L
NH4+	0.01–0.54 mg/L
NO2-N	0.00–0.00 mg/L
NO2-	0.00–0.71 mg/L
Ph	7.15–7.96
O2	4.93–7.69 mg/L
Temp.	26.1–27.90 C
Conductivity	302–1553 μmhos

Table 2. Water quality data measured in stagnant water system

NH_3-N	0.03–8.60 mg/L
NH_3-	0.04–10.50 mg/L
NH_4+	0.04–11.10 mg/L
NO_2-N	0.00–10.14 mg/L
NO_2-	0.00–15.21 mg/L
pH	6.83–7.49
O_2	4.26–8.07 mg/L
Temp.	25.1–29.20C
Conductivity	203–1580 μmhos

Table 3. Comparison of stagnant and recirculation data

Technique	Number of fish	Fish stocking density Number.L^{-1}	Initial weight G	Final weight g	Survival rate %
Stagnant water	100	2	0.63	4.5 ± 0.4	83.0 ± 6.3
Stagnant water	200	4	0.11	3.1 ± 0.4	52.4 ± 8.3
recycled water system	100	1.4	0.5	4.8 ± 0.3	86.0 ± 6.5
recycled water system	200	2.8	0.25	3.5 ± 0.4	68.0 ± 5.6
recycled water system	300	4.2	0.56	3.0 ± 0.4	84.8 ± 14.0
recycled water system	400	5.6	0.2	2.2.± 0.3	69.6 ± 5.2

- Electricity consumed (for a pump)
- Surface occupy per number of fish (number of fish/m^2)
- Investment.

The summary of the experiment is presented in Table 3. These data were combined with the figures above to explain the result of the experiment.

CONCLUSIONS

Rearing of fish in recirculation system has several benefits compared to stagnant water system:

- Reducing manpower (man-day)
- Antibiotics are reduced significantly
- Quality of fish produced is higher
- Higher profit

REFERENCES

Spotte, S.H. 1969. Fish and invertebrate culture. Water management in closed system. Wiley-interscience. New York. 145 pp.

Boyd, C.E. and F. Lichtkoppler. 1979. Water quality management in pond fish culture. Auburn University. Auburn. Alabama. 30 pp.

FAO. 1986. Flow-through and recirculation systems. EIFAC Technical Paper 49. Rome. 100 pp.