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RESEARCH ARTICLE

IMPACT OF STOCKING DENSITY ON GROWTH AND PRODUCTION PERFORMANCE OF WALKING CATFISH, *CLARIAS BATRACHUS* (LINNAEUS,1758) AND PABO CATFISH, *OMPOK PABO* (HAMILTON,1822)

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ABSTRACT

This study evaluated the production performance of two species of catfish - Pabo Catfish (*Ompok pabda*) and Walking Catfish (*Clarias batrachus*) in six months of semi-intensive rearing. A three-time replica of each stocking density of *O. pabda* and *C. batrachus* was conducted. Fingerlings of *O. pabda* and *C. Batrachus* were stocked 15000 numbers/ha in Treatments (T) 1 (1.5: 1), 2 (1: 1) and 3 (1: 1.5), respectively. In T1, T2 and T3, the fish production was 3876 ± 94, 3992 102 and 4538 ± 112 kg / ha/ 180 days, respectively. Similarly, all treatments employed the same feed twice a day of the initial stocking of fry. The initial weight of both *O. pabda* and *C. batrachus* were 5±0.00g and initial lengths were 7.0 cm and 4.0 cm respectively. The average highest final weight recorded was in T3 (32 ± 3.43) g in *O. pabda* and *C. Batrachus* respectively. The average highest final length was observed in T3 (22 ± 0.05 cm) and (21.30 ± 0.09 cm) in *O. pabda* and *C. Batrachus* respectively. The survival rate of the stocked *O. pabda* and *C. Batrachus* was recorded 64 and 88% in T1; 69 and 90% in T2; 72 and 93.00 % in T3.

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INTRODUCTION

In polyculture, different species are stocked in their own niches in the water to maximize their food production and feeding habits, as well as to exploit all the natural food in the environment and to increase the amount of fish that are produced (Wahab et al., 2001). Carp polyculture is common in ponds, but we have no references to the practice of polyculture of Pabo Catfishes (*Ompok pabda*) and Walking Catfishes (*Clarias batrachus*). There are many commercially significant native fish species that are being threatened, such as the Pabo Catfish (*O. pabda*) and Walking Catfish (*C. batrachus*). From their nutritional values and taste, Pabo Catfish are well-liked by regulars. A logistical approach for conservation is often based on captive breeding and hatchery production, together with sensible aquaculture in controlled environments. It has been developed in India to breed catfishes in captivity and produce them in hatcheries (Chakarbarti et al., 2009).

In the absence of other employment opportunities in rural fisher people, farm-based alternative living has become a major issue for sustaining rural youth (Ghosh et al., 2017). In relation to indigenous high value fish polyculture, at least two factors make it clear that research should be conducted. We have to standardize the density of the stockings first.

The next step in the research will be to determine whether there is an established link between the growing influx of income and the increase in supply of these species spontaneously in the market. Therefore, the purpose of present finding was to evaluate and analysis fish-growth, survival through the culture period and production performance of *O. pabda* and *C. batrachus* at different stocking densities in polyculture system with the combination of *O. pabda* and *C. batrachus*.

MATERIALS AND METHODS

Description of the experimental units: In order to conduct experiments, nine ponds were selected at Balurghat, Dakhin Dinajpur Krishi Vigyan Kendra, Dakhin Dinajpur district, West Bengal, India for three treatments (T1, T2, and T3). The experiment was conducted between May and November of 2019. The standard pond area was 0.1 ha, and the depth of the water ranged from 1.1 to 1.35 meters. During the experiment, all ponds were identically sized, in terms of depth, basin, construction and outline, as well as water supply. An inlet and outlet structure was installed to ensure that the level of water and the quality of water was maintained throughout scheduled exchanges. Aquatic vegetation and flooding were not present in the ponds. After being exposed to sunlight, they were dried. A shallow tube well provided water for the ponds. Following this, the research ponds were fenced with bamboo sticks and nylon net. Lime was applied to the ponds at a rate of 250 kg per hectare. Following the application of lime for five days, cow manure was applied at the rate of 2,000 kilograms per hectare to the ponds. During the culture trial, every month all the ponds were limed at the rate of 125 kg/ha to maintain pH and water qualities.

Stocking of fry: Before stocking the fry in the experimental ponds *O. pabda* fries were reared about forty five days in a nursery pond when the fry become about average 7.0 ± 0.05 cm in length and weight about 5g. *C. batrachus* fries were reared about 28 days when the fry become about average 4.0cm in length and weight about 5 g. In the morning, both were stocked in the ponds (Table.1). After the fry was released into the ponds, the initial measurements were made (length and weight). The fishes were measured for length and weight using a measurement scale and a field electronic weight meter, respectively.

Feeding Strategy: At the beginning of the experiment feed was supplied at the rate of 20% of the body weight of reared and gradually it was weaned to 15% (46-59 days), 12% (60-69 days), 10% (70-79 days), 7% (80-89 days), 5% (90-99 days), 4% (100-109 days) and 3% (110-180 days). The similar feed was used in all treatments (Table.2) two times daily from the beginning of the fry stocking at every 8 hours intervals through tray feeding method.

Monitoring and data collection: Growth monitoring was carried out from the first day of culture (DOC 1) till the 180th day. A random sample of 20 fishes from each pond was used to measure the length and weight. Weight and length were taken using a weighing scale (Sartorius) and a centimetre scale, respectively. Dewatering the ponds after 180 days of rearing allowed the fish to be harvested. Their survival, growth, and production were assessed by counting, measuring, and weighing them during harvest.

Analysis of experimental data on growth performances: All statistical analysis was done by using the SPSS (Statistical Package for Social Science) version-20.The following parameters were used to evaluate the growth, survival and production of the fishes.

a) Mean weight gain (g) = Mean final weight (g) – Mean initial weight (g)
b) Mean length gain (g) = Mean final length (cm) – Mean initial length (cm)

$$\text{c) Percent weight gain (g)} = \frac{\text{Mean final weight (g)} - \text{Mean initial weight (g)}}{\text{Mean initial weight (g)}} \times 100$$

d) Specific growth rate (SGR %)

SGR (% day) of the fishes of each species in each treatment was calculated as –

$$\text{SGR (\% day)} = \frac{\log W_2 - \log W_1}{T_2 - T_1} \times 100$$

Here, W_2 = The final live body weight (g) at time T_2 day, W_1 = The initial live body weight (g) at time T_1 day, T_2 = Time duration at the end of the experiment, $T_2 - T_1$ = Duration of the experiment (day).

$$\text{Survival (\%)} = \frac{\text{Number of fish harvested}}{\text{Number of fish stocked}} \times 100$$

f) Production of fishes
Net production= No. of fish caught × average final weight (g).

Water quality parameters: The pond water quality parameters such as surface water temperature, dissolved oxygen and pH was measured weekly using a Celsius thermometer, a portable dissolved oxygen meter (HI 9142, Hanna Instruments, Portugal) and a portable pH meter (HI 8424, Hanna Instruments, Portugal).

RESULTS

The growth characteristics of *O. pabda* and *C. batrachus* were examined under a variety of stocking densities. In treatments T1, T2 and T3, the total stocking density was 2500 fish per hectare. Treatment T1 had a stocking density of 1.5: 1; treatment T2 had a stocking density of 1: 1, and treatment T3 had a stocking density of 1.5: 1. A higher level of production was found in T3, followed by T2 and T1 (Table 3). The initial weight of *O. pabda* and *C. batrachus* at the stocking time was 5±0.05g. The average weight gain of *O. pabda* and *C. batrachus* were recorded as 23.0 ± 2.22, 27.15 ± 3.05, 32.65 ± 3.43g and 91.5 ± 1.27, 93.5 ± 1.15, 100.32 ± 2.04 g in T1, T2 and T3 respectively. On average, O. pabda gained 18.60 ± 0.09, 20.10 ± 0.02 and 22 ± 0.05 cm in length over a period of 12 months (Table 3). During the stocking period of C. batrachus, the initial length was 4.0 ± 0.10 cm, and the average length gain was calculated to be 15.90 ± 0.07, 18.30 ± 0.07, and 21.30 ± 0.09 cm (Table 3). It was found *that O. pabda* showed significant ($p<0.05$) differences between the three treatments. *C. batrachus* also gained significantly different amounts of weight ($p<0.05$) between treatment groups. Across all treatments, the SGR% for *C. batrachus* was high, while the SGR% for *O. pabda* was low (Fig. 1). A survival rate of 68.8% and 88% were found for *O. pabda* and *C. batrachus* in the first experiment; 69.5% and 90% in the second; and 73.5% and 93% in the third (Fig. 1). As a result of the experiment, the production was 3876 ± 94; 3992 ± 102; and 4538 ± 11 kg/ha in T1, T2, and T3, respectively (Table 3). The temperature of the water during the study period varied from 26.0°C to 31.4°C. Temperatures of 31.4 degrees Celsius were recorded in T3. T2 was found to have a minimum temperature of 26.8 °C.

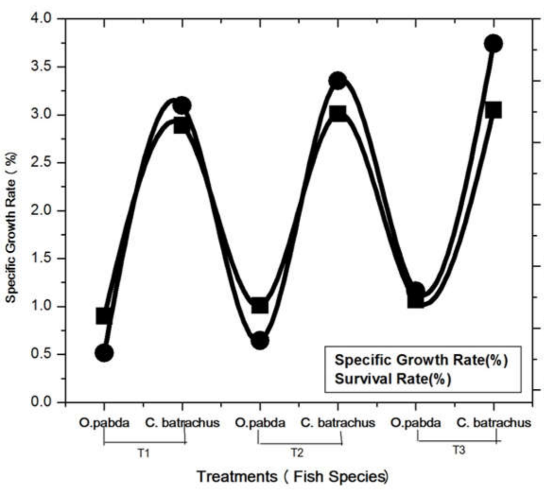

Fig. 1. Specific growth rate and survival rate of O.pabda and C. batrachus under different treatments

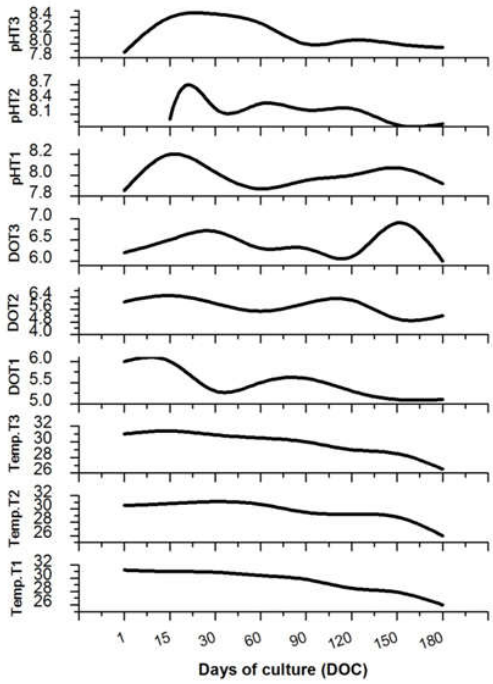

Fig.2. Variation of water quality parameters during the period of experiment under T1, T2 and T3. Where Temp. denotes temperature (ºC), DO denotes dissolved oxygen (mg/l) and pH

Water temperatures were measured as follows (Table 4), 29.46 ± 1.25, 29.58 ± 1.40 and 29.73 ± 1.44 in T1, T2 and T3, respectively. Treatment T1 had the lowest dissolved oxygen concentration of 5.0 mg / l in 150 DOC, and treatment T1 had the highest dissolved oxygen concentration of 6.9 mg / l in 150 DOC. The mean values of dissolved oxygen were recorded 5.48 ± 0.32, 5.81 ± 0.15 and 6.37 ± 0.55 in T1, T2 and T3 respectively (Fig. 2). The dissolved oxygen content of the selected ponds was ranged from 4.9 to 7.0 mg / l. The values of pH were ranged from 7.87 to 8.45 during the study period. The mean (± SD) values of pH were recorded 8.0 ± 0.31, 8.10 ± 0.09 and 8.12 ± 0.21 in T1, T2 and T3 respectively (Fig. 2, Table 4).

DISCUSSION

The *C. batrachus* was obtained highest weight gain in T3, where *O. pabda* was stocked at lowest density than the *C. batrachus*, could be the lack of competition for food. On the other hand, the lowest weight gain was observed in T1 where *O. pabda* were stocked in highest density. The overall was affected by the inclusion of *O. pabda* high density. This might be due to the fact that *O. pabda* specific growth rate and survival was less than the *C. batrachus*. The highest weight and length gained both types of fishes in T3 in which total stocking density was 1:1.5 of *O. pabda* and *C. batrachus*. The lowest weight and length gained both types of fishes in T1 in which total stocking density was 1.5:1 of *O. pabda* and *C. batrachus*. Weight gain was slightly varied among the three treatments. Similar results were observed by Ali *et al.* (2016); and Haq *et al.* (2017). Stocking density was an important parameter which directly affects the growth of fish and its production (Backiel & Lecren, 1978). Present findings evidently showed that highest weight was attained at the lowest stocking density and growth gradually decreased with increase in density, which similar with the findings of Kohinoor *et al.,* (2006). Similar results were observed by Haq *et al.* (2017). In the present experiment the highest survival rate of *O. pabda* and *C. batrachus* were found at the end of the experiment which were 73% and 93% in T3. The survival rate of *O. pabda* and *C. batrachus* were higher in T3 at lower stocking density of *O. pabda*. Similar results were observed by Haq *et al.* (2017).

Lakshmanan *et al.,* (1971) and Chowdhury *et al.,* (1978) stressed out the significance of the present factors in primary for the survival. Kohinoor *et al.* (2006) recorded an average production from semi-intensive culture of *O.pabda* with *Puntius gonionotus* and *Cypinus carpio* in six months culture period as 2,932 kg / ha where the contribution of *O. pabda* was only 15.27 %, while temperature also plays role in respect of fish production. In present study, the temperature variation was significant among the three treatments but those values were within the acceptable ranges for fish culture. Takur and Das (1986) reported that water temperature 25 °C to 35 °C is suitable for fish culture and Akhteruzzaman (1988) found water temperature 25.5 °C to 30.0 °C is favourable for fish culture. Similar results were also observed by Patra (1993); Flura *et al.,* (2015); Chowdhury *et al.* (2015) and Wahab *et al.* (2001) and the present experiment. Successful fish culture depends on the careful management of dissolved oxygen at optimum level. Chakraborty and Mirza (2008) reported that the range of dissolved oxygen content for fish culture should be 5.0-8.0 mg / l. In the treatment T3, dissolved oxygen level was fine and was not varied significantly due to continuous water flow.

According to Rahman *et al.,* (1982) dissolved oxygen content should be 5 mg/l or more for a productive pond. It can be concluded that dissolved oxygen level in T3 was impressive and very much productive for fish culture. Similar results were observed by Flura *et al.* (2015) and Chowdhury *et al.* (2015). pH is considered as an important factor in aquaculture and treated as the productivity index of a water body. For pond based fish culture, the suitable ranges of pH are 6.5 to 8.5 (Byod, 1992). From a research, Chakraborty *et al.,* (2008) recorded that the pH value ranged from 6.24 to 8.88. From this context, it could be discussed that the research ponds were suitable for fish culture on the basis of pH value. Higher production was obtained from T3 which might be due to higher number of *C. batrachus*. The mean weight gain both (*O. pabda* and *C. batrachus*) in T3 was highest and similarly total production was also highest in T3 which might be due to proper density of the selected fishes.

Table 1.Protocol of trial indicating stocking ratios of *O. pabda* and *C. batrachus* culture system

Treatment	Pond size (ha)	Species	Stocking weight (g)	Stocking Length (cm)	Stocking density/ ha	Total fish stocked	Total stocking density/ha
T1	0.1	*O.pabda*	5±0.05	7.0±0.30	15000	1500	2500
	0.1	*C. batrachus*	5±0.05	4.0±0.10	10000	1000	
T2	0.1	*O.pabda*	5±0.05	7.0±0.30	12500	1250	2500
	0.1	*C. batrachus*	5±0.05	4.0±0.10	12500	1250	
T3	0.1	*O.pabda*	5±0.05	7.0±0.30	10000	1000	2500
	0.1	*C. batrachus*	5±0.05	4.0±0.10	15000	1500	

Table 2. Proximate composition of starter and grower fish feed used during the experiment

Constituents	Amounts (%)	
	Starter	Grower
Moisture	12.20	11.10
Protein	33.10	33.00
Lipid	11.40	12.50
Ash	15.90	15.00
Fabre	6.60	6.10
Carbohydrate	20.80	22.30

Table 3. Growth, Survival and Production of *O.pabda* and *C. batrachus* under different treatments

Treatments	Species	Initial weight(g)	Final weight (g)	Initial length g)	Final length (g)	Survival (%)	Total Production (kg/ha)
T1	*O.pabda*	5±0.05	$23.0\pm2.\ 22_{bc}$	7.0±0.30	$18.60\pm0.09_{bc}$	68	$3876\pm94_{b}$
	C. batrachus	5±0.05	$91.5\pm1.\ 27_{b}$	4.0±0.10	$15.90\pm0.07_{c}$	88	
T2	*O.pabda*	5±0.05	$27.15\pm3.05_{b}$	7.0±0.30	$20.10\pm0.02_{c}$	69	$3992\pm102_{bc}$
	C. batrachus	5±0.05	$93.5\pm1.\ 15_{c}$	4.0±0.10	$18.30\pm0.07_{a}$	90	
T3	*O.pabda*	5±0.05	$32.65\pm3.43_{a}$	7.0±0.30	$22\pm0.05_{bc}$	73	$4538\pm11_{a}$
	C. batrachus	5±0.05	$100.32\pm2.04_{a}$	4.0±0.10	$21.30\pm0.09_{a}$	93	

Figures in the same column having the same superscripts for each species are not significantly different (P>0.05).

Table 4. Variation of water Temperature, Dissolved oxygen and pH during the period of experiment under different treatments

Parameters	Treatment	Days of culture (DOC)								Average values(Mean ± SD)
		1DOC	15DOC	30DOC	60DOC	90DOC	120DOC	150DOC	180DOC	
Temperature(ºC)	T1	31.2	31	30.9	30.4	29.8	28.5	27.9	26	29.46±1.25
	T2	30.5	30.8	31.1	30.7	29.5	29.2	28.8	26	29.58±1.40
	T3	31	31.4	30.9	30.5	30	29	28.5	26.5	29.73±1.44
Dissolved oxygen(mg/l)	T1	6	6	5.3	5.5	5.6	5.3	5.1	5.1	5.48±0.32
	T2	6.1	6.5	6	5.5	6	6.2	5	5.2	5.81±0.15
	T3	6.2	6.5	6.7	6.3	6.3	6.1	6.9	6	6.37±0.55
PH	T1	7.85	8.2	8.03	7.87	7.95	8	8.07	7.92	8.0±0.31
	T2	7..80	8	8.22	8.32	8.19	8.22	7.89	7.91	8.10±0.09
	T3	7.88	8.4	8.45	8.31	8	8.06	8	7.95	8.12±0.21

The present study showed that the highest growth rate was found in T3, in which production was also highest than the T2 and T1. But experiment emphasized that using same area to maximize output. For doing this job successfully farmers have to concentration on the management issues. From the present experiment it can be concluded that higher stocking density of *C. batrachus* is better economically than the lower density. The production obtained in the present study was not very encouraging, but the small indigenous fish like as *O. pabda* and C. *batrachus* culture would add social benefit in that the fish farmer may get a chance to consume them readily than sale them in to the consumers dish. It was also revealed that the small and shallow water bodies may be used for small indigenous fish species culture, indicating the feasibility of attaining a good production.

CONCLUSION

The highest production was found from T3 in which stocking density was high and lowest production was found in T1. The production was not significantly varied between the treatments but more varied between treatments T3 to rest two treatments (T1 and T2). The highest weight also obtained from T3 followed by T2 and T1. From the above discussion it can be concluded that *O. pabda* and *C. batrachus* culture with high stocking density may be done to get high production and growth. Here concerned is that the culture should be intensive and adopting appropriate management tactics. It was also revealed that the small and shallow water bodies may be used for small indigenous fish species culture, indicating the feasibility of attaining a good production of it.

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REFERENCES

Akheteruzzaman, M. 1988. A study on the production of koi fish (*Anabas testudineus*) under semi-intensive culture system. Journal of Zoology 3, 39-43.

Ali, M.M., Asif, A.A., Shabuj, M.A.I., Vaumik, S., Zafar, M.A. Sharif, B.M.N. 2016. Status of polyculture *pangasius hypophthalmus* with carps in Jhikargacha upazila of Jessore district, Bangladesh. International Journal of Fisheries and Aquatic Studies, 4, 423-430.

Asif, A.A., Samad, M.A., Rahman, B.M.S., Rahman, M.A., Rahman, M.H., Yeasmin, S.M., Nima, A. 2014. Study on management of fish fry and fingerling marketing of jessore in Bangladesh. International Journal of Business, Social and Scientific Research, 2, 127-135.

Backiel, T. Lecren, E.D. 1978. Some density relationship for the population parameters. In: SD Jerking (Editor), Ecology of freshwater fish production. Blackwell Scientific Publications, Oxford. 279-302.

Boyed, C.E. 1982. Water quality management for fish culture. Elsevier Science Publisher, The Netherlands. 318.

Chakarbarti, P.P., Chakarbarti, N.M. Mondal, S.C. 2009. Breeding and seed production of butter catfish, *Ompok pabda* (Siluridae) at Kalyani centre of CIFA, India. Aquaculture Asia, 14, 33-35.

Chakraborty, B.K. Mirza, M.J.A. 2008. Growth and yield performance of threatened Shingi (*Heteropneustes fossilis*, Bloch) under semi intensive aquaculture. Journal of The Fisheries Society of Taiwan, 35, 117-125.

Chowdhury, A.A., Uddin, M.S., Vaumik, S. Asif, A. A. 2015. Aqua drugs and chemicals used in aquaculture of Zakigonj upazilla, Sylhet, Asian Journal of Medical and Biological Research, 1, 336-349. https://doi.org/10.3329/ajmbr.v1i2.25628

Flura, M.A., Alam, M.A., Rahman, T. A. & Roy, K.C. (2015). Ecology and water quality parameters of Ballabeel in Moulovibazar district of Bangladesh. *Asian Journal of Medical and Biological Research,*1,198-208. https://doi.org/10.3329/ajmbr.v1i2.25612

Ghosh, S., Manna, S., Sahu, N.C., Dutta, A. Goswami, R. 2017. Social, economic and production characteristics of freshwater prawn, *Macrobrachium rosenbergii* (De Man, 1879) culture in West Bengal, India. Aquaculture International, 25, 1935-1957. https://doi.org/10.1 007/s 10499- 017-0165-7

Haq, M.E., Rahman, M., Hossain, A., Asif, A.A., Rahman, H., Chwakravorty, P., Satter, A. Islam, M.S. 2017. Comparative growth performance between monosex and natural XY male tilapia in Noakhali region, Bangladesh. *Asian Journal of Medical and Biological Research,* 3, 391-397. https://doi.org/10.3329/ajmbr.v3i3.34529

Kohinoor, A.H.M., Islam, A.K., Jahan, D.A., Zaher, M. Hossain, M.G. 2006. Monoculture of climbing perch, Thai koi (*Anabas testudineus*, Bloch) under different stocking densities at on-farm management. Bangladesh Journal of Fisheries Research, 11, 173-180.

Lakshmanan, M.A.V., Sukumaran, K.K., Murty, D.S., Chakaraborty, D.P. Philipose, M.T., 1971. Preliminary observations on intensive fish farming in freshwater ponds by the composite culture of Indian and exotic species. Journal of Inland Fisheries Society of India, 3, 2-21.

Patra, B.C. 1993. Satiation time, appetite and daily pattern of feed intake and faces release by an air breathing fish, Anabas testudineus (Bloch). Journal of Aquaculture, 8, 41-46.

Rahman, M.A., Gheyasuddin, H., Rasid, M.H., Choudhury, M.F.Z. 1982. Proximate composition and native quality of freshwater Zeol fishes of Bangladesh. Bangladesh Journal of Fisheries Research, 25, 37-38.

Takur, N.K. Das, P. 1986. Synopsis of biological data on catfish (*Heteropneustes fossilis*) and koi (*Anabas testudineus*) (Bulletin number39 and 40), Barrackpore, India, ICAR-CIFRI, press 32 - 45.

Wahab, M.A., Azim, M.F., Kohinoor, A.H.M. Haque, M.M. 2001. Optimization of stocking density of Thai silver barb (*Barbodes gonionotus*) in the duckweed-feed four species polycultue system. Bangladesh Journal of Fisheries Research, 5, 13-18.

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