Investigation of predatory effect of african magur (*Clarias gariepinus)* and thai pangus (*Pangasius sutchi)* on thai sarputi (*Barbodes gonionotus)*.

S.M.R. Alam, M.F.A. Mollah[1], M.A.A. Faroque, A. Satter[2] and K.M.M. Hasan
Department of Fisheries, Bangladesh, [1]Department of Fisheries and Genetics, Bangladesh Agricultural University, Mymensingh-2202, [2]Sheikh Fazilatunnesa Mujib Fisheries College, Melandah, Jamalpur.

Abstract: The predatory effect of African magur (*Clarias gariepinus)* and Thai pangus (*Pangasius sutchi)* on Thai sarputi *(Barbodes gonionotus)* was investigated through two experiments conducted in nine aquaria (73 x 39 x 36 cm) for a period of 28 days each during August to September 2007 and July to September 2008, respectively, in the wet laboratory of the Department of Fisheries and Genetics, BAU, Mymensingh. Stocking ratio of predator and prey was 1: 2 in both experiments. Experiment 1 was carried out with the fingerlings 6.5 (± 0.4) cm of African magur and fry of Thai sarputi 2.5 (± 0.2) cm and experiment 2 was carried out with the fingerlings 6.61(± 0.13) cm of Thai pangus and fry of Thai sarputi 2.49(± 0.42) cm. Each experiment had three treatments with three replications. Fishes of treatment 1 (T_1) was fed with Tubificid worms, treatment 2 (T_2) with Sabinco feed and treatment 3 (T_3) was not fed. During the experiment, the water quality parameters measured periodically were almost similar. The predation rate of African magur was the highest in T_3 and the lowest in T_1. The predation rate of Thai pangus was the highest in T_3 and nil in T_1. Thus fishes under starved condition show the highest predation and fishes provided with live feed Tubificid worm showed the lowest predation. Growth rate of African magur was the highest in T_2 and the lowest in T_3. Growth rate of Thai pangus was the highest in T_1 and the lowest in T_3. Growth rate of Thai sarputi was the highest in T_1 and the lowest in T_3 in both the experiments.
Key words: Predatory effect, African magur (*clarias gariepinus)*, Thai pangus (*pangasius sutchi),* Thai sarputi (*barbodes gonionotus).*

Introduction

The water bodies of Bangladesh are abundant in 264 species of freshwater and 475 species of marine water fishes. Unfortunately the present fish production can not fulfill our demand and as a result there is a chronic deficiency in essential nutrients in the diet of the people of Bangladesh (Ahmed *et al*., 1977). Due to various natural factors and man-made interventions production of inland capture fishes is decreasing. To meet this demand high yielding exotic fishes has been introduced in our country since 1952 due to their better growth, easy culture system, high disease resistance, adoptability to over crowding and tolerance of a wide range of experimental parameters. African magur (*Clarias gariepinus),* Thai pangus (*Pangasius sutchi)* and Thai sarputi *(Barbodes gonionotus)* were introduced in our country for their palatability and high yielding potential. There is a believe that African magur has a severe predatory effect on other fishes. Consequently farmers have been losing their interest to culture this species though it is a high yielding variety. Thai pangus has also been reported to predate on other species. For these reasons it is assumed that polyculture with African magur and Thai pangus is not feasible in our country. Polyculture of some predatory fish is profitable by controlling the over population of another species (Chervinski, 1975). But still now there is very little information available on the predation of African catfish in polyculture system. For the above contradictory findings and assumption more study is essential on predatory effect of these fishes to find out the potential stocking ratio in polyculture system and to determine its feasibility. The present study was undertaken with aims to find out the predatory effect of two exotic catfishes and to determine the suitable combination and workable density of Thai pangus and African magur in polyculture system.

Materials and Methods

The experiments were conducted in the Wet Laboratory of the Department of Fisheries Biology and Genetics, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh during July 2007 to September 2008. Experiment 1 was continued for 28 days from 22 August to 20 September, 2007 to observe the predation of African magur on Thai sarputi and Experiment 2 was continued for a period of 28 days from 20 July to 18 August, 2008 to observe the predation of Thai pangus on Thai sarputi. Experiments were conducted in the laboratory in nine steel framed glass aquaria size 73x39x36 cm with water depth of 15 cm containing 42.7 litre of water that filled with sprinkler water supply through porous PVC pipe lines which ensured better oxygenation. For experiment 1 fry of Thai sarputi 2.5 (± 0.2) cm weighing 0.16 (± 0.01) gm were collected from a hatchery and fingerlings of African magur 6.5 (± 0.4) cm weighing 2.08 (± 0.03) gm were produced in the laboratory by artificial spawning. For experiment 2 fry of Thai sarputi 2.49 (± 0.42) cm weighing 0.151 (± 0.08) gm were collected from a hatchery and fingerlings of Thai pangus 6.61(± 0.13) cm weighing 2.06(± 0.12) gm were collected from fish-seed vendors. The number of predators and preys in each aquarium were 10 and 20 respectively. Each experiment had three treatments and each treatment had three replications. Fishes of treatment 1 (T_1) was fed with Tubificid worms, treatment 2 (T_2) with Sabinco feed once a day at 8 am and no feed was provided for treatment 3 (T_3). Water quality parameters (Temperature, dissolved oxygen and P^H) were recorded throughout the experimental period at 11 am at 7 days interval. Sampling was made four times at 7 days interval. The growth gained by the fish was calculated by subtracting the previous length and weight from the corresponding length and weight at each sampling. Disappearance of preys was considered as the result of predation. Proximate composition of the dietary ingredients and diets were determined by the standard methods given by Association of Official Analytical Chemists (AOAC, 1980). Data were analyzed as mean ± SD. Duncan's Multiple Range Test (Duncan, 1955) was done in order to determine the significant growth variations of fish among the treatments.

Results and Discussion

Water quality parameters: Temperature of water of experimental aquaria was more or less similar 27(±1°C) and 29(±1°C) throughout the experimental period for both

experiments. The dissolved oxygen content of aquarium water did not show much fluctuation 4.3-4.5 (±.2-.3 mg/L). The average p^H of water of the experimental aquaria was 7.4-7.8 which was slightly alkaline (Table 1).

Table1. Average ± SD of temperature, dissolved oxygen and p^H of water of the experimental aquaria.

Experiment	Treatment	Temperature (°C)	Dissolved oxygen (mg/L)	P^H
1	1	27(±1)	4.5(±0.2)	7.6(±0.35)
	2	26(±0.5)	4.45(±0.3)	7.4(±0.3)
	3	28(±0.7)	4.55(±0.4)	7.8(±0.2)
2	1	29(±1)	4.3(±0.3)	7.4(±0.2)
	2	28(±2)	4.5(±0.2)	7.5(±0.3)
	3	30(±1)	4.1(±0.2)	7.3(±0.4)

Table 2. Average initial weight, final weight, weight gain, initial length, final length and length gain of the predators (*C. gariepinus*) and the preys (*B. gonionotus*) and the predation rate of *C. gariepinus.*

Parameters	Treatment		
	1	2	3
Initial wt.(gm)			
a. *C. gariepinus*	2.08 ± 0.03*	2.08 ± 0.03	2.08 ± 0.03
b. B. gonionotus	0.16 ± 0.01	0.16 ± 0.01	0.16 ± 0.01
Final wt.(gm)			
a. *C. gariepinus*	7.07 ±1	9.11 ± 1.5	2.18 ± 0.02
b. B. gonionotus	0.64 ± 0.02	0.55 ± 0.06	0.15 ± 0.01
Weight gain(gm)			
a. *C. gariepinus*	4.99 A**	7.03 A	0.1 B
b. B. gonionotus	0.48	0.39	0.01
Initial length(cm)			
a. *C. gariepinus*	6.5 ± 0.4	6.5 ± 0.4	6.5 ± 0.4
b. B. gonionotus	2.5 ± 0.2	2.5 ± 0.2	2.5 ± 0.2
Final length(cm)			
a. *C. gariepinus*	10.11 ± 0.49	10.58 ± 0.32	6.6 ± 0.02
b. B. gonionotus	4.05 ± 0.05	3.74 ± 0.14	2.68 ± 0.34
Length gain(cm)			
a. *C. gariepinus*	3.61 A	4.08 A	0.01 B
b. B. gonionotus	1.55	1.24	0.18
Predation rate (%)			
C. gariepinus	40(±2) B	87(±3) A	92(±1) A

* Mean value ± SD, *** Figure in the same row having same letters are not significantly different ($p>0.05$)

Growth performance and predation rate of fish: In experiment 1, the average initial length and weight of the two species used in different treatments were almost same. Among the three treatments the weight gain of African magur was the highest ($p<0.05$) in T_2 (7.03 gm) which was provided with Sabinco feed, against the lowest weight gain in T_3 (0.1 gm) where no feed was provided (Table 2). This observation is supported by Ahmed *et al.* (1992) that the growth of catfish (species) was significantly higher in the pond provided with supplementary feed. Length (cm) gain of African magur was the highest ($p<0.05$) in T_2 (4.08 cm) where Sabinco feed was applied while the lowest was obtained from T_3 (0.1 cm) where no supplemental feed was provided (Table 2). Weight gain of Thai sarputi was the highest in T_1 (0.48 gm) which was provided with Tubificid worms and the lowest in T_3 (0.01gm) where no feed was provided. The reason may be the negative electivity of Thai sarputi for Sabinco feed and positive electivity for Tubificid worms. This agrees with the findings of Webster *et al.* (1991) who stated that paddle fish fed with live feed organisms were significantly larger than those fed with non-living diets. Length gain of Thai sarputi was the highest in T_1 (1.55 cm) and lowest in the T_3 (0.18 cm), although the variations are not statistically significant. The predation rate at different treatments varied from 40% to 92% (Table 2).

The predation rate of African magur on Thai sarputi was the highest in T_3 (92%) where they were not provided with supplemental food. The starved fish found no other alternative rather than preying on sarputi. Hecht and Appelbaum (1988) found that sibling cannibalism was negatively correlated to food availability. Ware (1972) stated that the rate of predation could be stimulated by increasing predator's hunger. Predation rate was the lowest in the T_1 (40%) which was provided by Tubificid worms. There was significant difference in the predation rate of African magur as obtained from T_1 (40%) and the T_2 (86.67%), where they were fed with Tubificid worms and Sabinco feed respectively. Probably the fish fed with live feed, lost their affinity for preys. Mollah and Hossain (1997) found the highest survival rate of African catfish larvae in the treatment which was provided with Tubificid worms.

In T_2, the average initial length and weight of the two species used in different treatments were almost same. Among all treatments the weight gain of Thai pangus was

the highest ($p<0.05$) in T_1 (1.83 gm) which was provided with Tubificid worms and the lowest weight gain in T_3 (0.12 gm) where fishes were not provided with any supplemental feed (Table 3). Probably the digestibility of Tubificid worms, a live feed was higher than the Sabinco feed, an artificial feed. Seidel *et al.* (1980) suggested that Atlantic silvermides cultured on an artificial diet exhibited poorer growth and survival rate than those cultured on a live brine shrimp diet. The variation in growth as obtained from T_1 and T_2 is significant. But due to positive electivity of pangus for Tubificid worms the growth pangus in T_1 was higher than in the T_2, where Sabinco feed was provided. Sardar *et al.* (1995) found that the growth of pangus was significantly higher in the diets prepared with locally available ingredients when compared with Sabinco feed, a commercial factory feed. Protein percentage is higher in Tubificid worms than in Sabinco feed. Kamarudin *et al.* (1987) found that the diet higher in protein percentage the higher is the growth rate of Thai pangus fingerling. Treatment to treatment variation in length gaining of Pangus was significant ($p<0.05$), the highest was obtained from T_1 (8.1 cm) which was provided by Tubificid worms while the lowest from T_3 (6.68 cm) where no supplementary feed was provided. Gain in weight and in length by Thai sarputi was the highest in T_1 (0.75 gm and 1.75 cm) and the lowest in T_3 (0.04 gm and 0.13 cm). The predation rate of Thai pangus on Thai sarputi varied from 0 to 65% (Table 3) and was the highest in treatment 3(65%) which was provided with no supplemental feed. Predation rate of Thai pangus was nil in T_1 which was provided with Tubificid worms and that in T_2 was only (5%) where Sabinco feed was used. It can be said that pangus is very much passive predator which shows its predatory action when there is no alternative way. This finding is similar to Chandra and Huq (1986) who described the *Pangasius pangasius* as a carnivore.

Table 3. Average initial weight, final weight, weight gain, initial length, final length and length gain of the predators (*P. sutchi*) and the preys (*B. gonionotus*) and the predation rate of *P. sutchi.*

Parameters	Treatment		
	1	2	3
Initial wt.(gm)			
a. *P. sutchi*	2.06 ± 0.12*	2.06 ± 0.12	2.06 ± 0.12
b. B. gonionotus	0.15 ± 0.08	0.15± 0.08	0.15± 0.08
Final wt.(gm)			
a. *P. sutchi*	3.89 ± 0.81	2.99 ± 0.4	2.18 ± 0.03
b. B. gonionotus	0.9 ± 0.14	0.67± 0.12	0.11 ± 0.02
Weight gain(gm)			
a. *P. sutchi*	1.83 A**	0.93 A	0.12 B
b. B. gonionotus	0.75	0.52	0.04
Initial length(cm)			
a. *P. sutchi*	6.61 ± 0.13	6.61 ± 0.13	6.61± 0.13
b. B. gonionotus	2.49 ± 0.42	2.49 ± 0.42	2.49 ± 0.42
Final length(cm)			
a. *P. sutchi*	8.1 ± 0.47	7.37 ± 0.38	6.68 ± 0.22
b. B. gonionotus	4.24 ± 0.21	3.81 ± 0.24	2.62 ± 0.31
Length gain(cm)			
a. *P. sutchi*	1.49 A	0.76 B	0.07 C
b. B. gonionotus	1.75	1.32	0.13
Predation rate (%)			
P. sutchi	Nil B	5 (±0.6) b	65 (±3) A

* Mean value ± SD, *** Figure in the same row having same letters are not significantly different ($p>0.05$)

Table 4. Proximate composition in the muscle of predators (wet weight basis)

Experiment	Treatment	Protein (%)	Lipid (%)	Ash	Moisture
African magur *(C. gariepinus)*	1	8 ± 0.5*	2.81 ± 0.25	2.66± 0.15	86 ± 2.0
	2	7 ± 0.5	2.41± 0.20	2.88 ± 0.12	88 ± 1.5
	3	5 ± 1	1.63 ± 0.12	3.40 ± 0.22	89 ± 3.2
Thai pangus *(P. sutchi)*	1	17 ± 0.6	3.6 ± 0.34	2.56 ± 0.3	77 ± 3.2
	2	15 ± 0.6	2.45 ± 0.31	2.74 ± 0.25	78.2 ± 2.1
	3	11 ± 1.0	0.59 ± 0.02	5.2 ± 0.42	80.2 ± 2.7

* Mean ± SD

Proximate composition: In experiment 1, protein and lipid content in the muscle of African magur of different treatments varied from 5% to 8% and 1.63% to 2.81% respectively. Both protein and lipid content was the highest in T_1 where the fishes were fed with Tubificid worms and lowest in T_3 where no supplemental feed was provided. During starvation African magur preyed upon Thai sarputi but it was very much insufficient and for this reason, to maintain metabolic activity the protein and lipid of the muscle was broken down to produce energy. This

agrees with the findings of Leger (1981) who found that weight loss of young rainbow trout was 5 mg/day/kg i.e. 18 and 34% of initial wet weight and dry weight respectively and the total lipid loss was 71% of the initial amounts during starvation. There was not much difference in protein and lipid content as obtained from T_1 and T_2 (Table 4).

In experiment 2, protein and lipid content in the muscle of Thai pangus belonging to different treatments varied from 11% to 17% and 0.59% to 3.6% respectively. Both protein and lipid content was the highest in T_1 where the fishes were provided with Tubificid worms and lowest in T_3 which was provided with no supplemental feed (Table 3). Muscle protein of Thai pangus was higher in T_1 than in T_2, mostly due to the protein content feed which were provided to the fishes. Protein content in the Tubuficid worms was higher than the Sabinco feed (Table 5). Love (1970) reviewed the chemical changes that occur during starvation in a number of species that when lipid store decreases, the fish begin to utilize protein for energy. Takeuchi *et al.* (1987) concluded that the fish use mainly visceral and muscle protein as energy source during winter starvation.

Table 5. Proximate composition of Tubificid worms* and Sabinco feed** on Dry weight basis

Element	Tubificid worms	SABINCO
Crude protein (%)	63.82	39
Crude lipid (%)	28.84	3
Ash (%)	7.95	18
Fibre (%)	-	6

*Source : Mollah and Ahmed (1989), ** Source : SABINCO (1991)

African magur (*Clarias gariepinus)* is a predatory fish, but from the present observation it can be concluded that they are passive predator. Predatory effect of Thai pangus (*Pangasius sutchi)* was significant when they were not provided with any other supplemental feed but they showed little or no predation if provided with supplemental feed. Thus it is suggested that Thai pangus is suitable for carp polyculture where supplementary feed is provided at satiation level. It is rather difficult to arrive to a conclusion on the basis of this investigation and more studied with variable size of predators and preys for a longer period are essential to arrive to a definite conclusion.

References

Ahmed, K., Hussain, M.A., Huda, N. and Abdullah, M. 1977. Nutritional survey of rural Bangladesh. Inst. Nutr. Food Sci. Dhaka Univ. 66 pp.

Ahmed, G.U., Karim, M.,Mollah, M.F.A. and Sarder, M.R. 1992. Predation of carp fingerling by African magur. Paper presented in a workshop on magur culture. Organized by DoF, Strengthening of the fisheries sector. FAO/UNDP Project. BGD/87/045: 16-17 February, 1992.

AOAC (Association of Official Analytical Chemistry). 1980. W. Horwitz, official methods of analysis. Association of Official Analytical Chemical, 13th edition, Washington D.C. 78 pp.

Chandra, K.J. and Huq, M.S. 1986. Food and feeding habits of freshwater fishes of Bangladesh. Bangladesh J. Agril. Sci. 13(2): 63-78.

Chervinski, J. 1975. Sea bases, *Dicentrarchus labrax* (Linn.) and *D. punctatus* (Bloch, Serranidae), a control fish in freshwater. Aquqculture. 6: 249-256.

Duncan, D.B. 1955. Multiple Range and Multiple F-tests. Biometrics. 11: 1-42.

Hecht, T. and S. Appelbaum. 1988. Observations on intraspecific aggression and sibling cannibalism by larval and juvenile *Clarias gariepinus* (Clariidae Piscus) under controlled conditions. J. Zool. 214(1): 21-44.

Kamarudin, M.S., Rahman, R.A., Aizam, S.S. and Hutagalung, R.T. 1987. Effects of four differentdiets on weight gain, growth, specific growth rate, feed conversion ratio and protein efficiency of *Pangasius sutchi* (Fowler) fingerlings. Tenth Annual Conference of the Malayasian Society of Animal Production, Pahang, Malayasia. pp. 192-196.

Leger, C. 1981. Effect of prolonged fasting on lipid and fatty acid composition in rainbow trout (*Salmo gairdneri*), Aquaculture 25: 195-206.

Love, R.M. 1970. The chemical biology of fishes. Academic Press, London. 547 pp.

Mollah, M.F.A. and Hossain, Z. 1997. Effects of different feeds on growth and survival of African catfish (*Clarias gariepinus*) larvae. Bangladesh J. Agril. Sci. 24(2): 13-17.

SABINCO, 1991. Scientific culture of tiger shrimp-feed directory (In bengali). saudi-Bangla Fish Feed Ltd. 3 pp.

Sarder, M.R.I., Ahmed, G.U., Mollah, M.F.A. and Kibria, M.G. 1995. Effects of supplemental diets on the growth of Pangas(*Pangasius pangasius* Ham.) in net cages. Bangladesh J. Agril. Sci. 22(2): 303-307.

Seidel, C.R., Schauer, P.S., Katayama, T and Simpson, K.L. 1980. Culture of Atlantic silversides fed on artificial diets and brine shrimp nauplii, Bull. Japan Soc. Sci. Fish. 46(2): 237-245.

Takcuchi, T., Watanable,T., Satos, S., Ida, T. and Yaguchi, M. 1987. Changes in proximate and fatty acid compositions of carp fed low protein high energy diets due to starvation during winter. Bull. Japan Soc. Sci. Fish. 53(8): 1425-1429.

Ware, D.M. 1972. Predation by rainbow trout (*Salmo gairdneri*): the influence of hungry, prey density and prey size. J. Fish. Res. B. Canada. 29(8): 1193-1201.

Webster, C.D., Mims, S.D., Tidwell, J.H. and Yancey, D.H. 1991. Comparison of live food organisms and prepared diets as first food for paddle fish, *Polyodon spathula* (Walbaum) fry. Aqua. Fish. Manage. 22:155-163.