Preliminary Studies On Food And Growth Of White Amur Fry And Fingerlings At Kota, Rajasthan, India

K. P. SHARMA and S. D. KULSHRESHTHA

Fisheries Development Officer and Post-graduate Department of Zoology, Government College, Kota (Raj.), India.

INTRODUCTION

The white amur (*Ctenopharyngodon idellus* Val.) is considered one of the most efficient plant-eating fish and is being employed as a combination biological weed control agent and food fish in a number of countries. Linchevskaya (3) and Hickling (2) report that the diet of white amur fry consists of algae, rotifers and crustaceans with occasional larvae of chironomids. Macrophyte material forms the main basis of the diet at 27 mm and from 30 mm onward the fish is vegetarian; the proportion of animal food consumed being negligible (6). However, in India, Singh et al. (11) found that the fry and young fingerlings (27 to 42 mm) accepted *Wolffia, Lemna,* and *Spirodella,* but preferred zooplankton.

Alikunhi and Sukumaran (1) reported better growth of fish with natural vegetation. Stevenson (12) found that the fish registered a five fold increase in weight during the first 3 months. Stott and Orr (13) estimated that the conversion rate of aquatic weeds (wet weight) to fish flesh by the white amur is about 224:1. Varghese et al. (14) studied the relative growth of white amur fed on *Utricularia* and a mixture of *Azolla* and *Lemna* and noted that the latter feed promoted a three fold increase over the former.

METHODS AND MATERIALS

Under the present study 30-day-old white amur fry obtained from the Central Inland Fisheries Research Sub-Station, Cuttack (India) was first weighed (initial weight) and reared at the Kaithoon Fish Farm, Kota in six rearing ponds and three cemented cisterns. Feeding and growth trials were conducted for a period of 111 days after which the fish were removed and weighed (gross weight). The difference between gross and initial weights is the net weight gained during the experimental period.

1. Ponds:

White amur fry were stocked in 0.028-ha ponds at a rate of 160,714, 125,000, and 89,286 fry per ha in ponds numbered 1 and 2, 3 and 4, and 5 and 6, respectively. Balls of a mixture of rice (*Oryza sativa* L.) bran and ground nut oil cake were given to the fry daily. *Potamogeton perfoliatus* Linn. collected from a nearby canal was also supplied to all the ponds. However, ponds 5 and 6 already contained naturally grown hydrilla (*Hydrilla verticillata* Royle), the quantity of which was calculated. In addition to above, ponds 1, 3, and 5 were also provided with yeast *cum* vitamin B-complex.

The artificial feed in the ponds was put in plastic tubs daily. These tubs rested on top of bamboo-pole tripods at a depth of about 0.305 m from water surface at specified places. Fresh *P. perfoliatus* was cut into small bits and put within triangular frames of bamboo sticks supported on top of three vertical poles fixed to the bottom. Thus the weed practically floated on the water surface.

2. Cisterns:

The three cemented cisterns with a size of 0.00012 ha each, were stocked with 333,333 fry per ha. Cistern 1 was

TABLE 1. CONSUMPTION OF VARIOUS FEEDS IN 0.028-HA PONDS STOCKED FOR 111 DAYS WITH 160,714, 125,000, AND 89,286 WHITE AMUR FRY PER HA IN PONDS NUMBER 1 AND 2, 3 AND 4, AND 5 AND 6, RESPECTIVELY.

	Feed consumed (kg)					
	Pond Number					
Food items	1	2	3	4	5	6
Rice bran & ground nut oil cake	58.00	64.00	31.40	43.00	25.00	20.20
Yeast	0.20	—	0.18	—	0.20	—
B-complex	0.08	—	0.07	—	0.08	—
Hydrilla	—	—	—	—	16.80	16.00
P. perfoliatus	23.00	28.40	9.40	11.80	17.80	14.00

provided with rice bran and ground nut oil cake pellets and hydrilla. Cistern 2 was given only rice bran pellets and hydrilla while cistern 3 yeast *cum* vitamin B-complex only.

Feed in cisterns was supplied in petri-dishes daily. Water of cisterns was changed weekly and fresh dechlorinated water replenished. No live plankton was supplied in the cisterns.

Feed which remained unconsumed both in the ponds and cisterns was removed the next day, dried in a hot air-oven at 105 C and then weighed. The figures so obtained were subtracted from the total quantity of feed supplied, thereby giving the weight of the feed consumed by the fish in a particular container (Tables 1 and 2).

Air and water temperatures, and dissolved oxygen content of the water were measured daily four times every 4 hr between 8.00 AM and 8.00 PM. Air temperatures were taken in the shade with a thoroughly dried thermometer bulb just above the surface of water. Water temperatures were measured by dipping the bulb of the thermometer in water. Dissolved oxygen content was determined in ppm as described by Needham and Needham (5).

RESULTS AND DISCUSSION

1. Growth Of White Amur In Ponds:

Average gain in net weight was 3.1 times the initial weight in all the six ponds at the end of the experimental period. Best growth occurred in pond 5 followed by ponds 1, 3, 6, 2, and 4 (Table 3).

The present study reveals that growth and consequently production are the net result of interaction amongst at least three major factors viz., nourishing diet, oxygen content, and stock density. Optimum conditions with regards to above have been congenial in augmenting production. However, growth suffered adversely when any of the above factors acted as a limiting factor.

TABLE 2. CONSUMPTION OF VARIOUS FEEDS BY WHITE AMUR FRY STOCKED IN 0.00012-HA CISTERNS FOR 111 DAYS AT A RATE OF 333,333 FRY PER HA.

	Amount consumed (kg)		
	Cistern Number		
Food items	1	2	3
Rice bran & ground nut oil cake	0.198	0.225	—
Yeast	—	—	0.008
B-complex	—	—	0.006
Hydrilla	0.144	0.112	—

TABLE 3. GROWTH OF WHITE AMUR FRY DURING AN 111-DAY PERIOD HELD IN 0.028-HA PONDS.

Pond Number	Stocking rate/ha	Weight (kg)		Production/ha (kg)		Cost/ha (Rs)
		Initial	Gross	Gross	Net	
1	160,714	4.5	16.25	580.2	419.4	2792.85
2	160,714	4.95	14.229	508.2	331.3	1995.71
3	125,000	3.5	13.104	468.0	343.0	1863.92
4	125,000	2.905	11.970	428.0	323.7	1403.21
5	89,286	2.5	17.640	630.0	540.7	1783.93
6	89,286	2.5	12.0	429.0	339.2	701.42

According to Schaeperclaus (9) yeast has major constituents of proteins and carbohydrates and its fermentative properties are helpful in digesting proteins. Pyatkin (8) found yeast to be effective in digesting carbohydrates also. Recent experiments by Mahajan and Sharma (4) and Sharma and Kulshreshtha (10) reveal that application of yeast *cum* vitamin B-complex enhances the survival and growth rate of the Indian major carp Rohu (*Labeo rohita* Ham.) and the common carp (*Cyprinus carpio* L.).

Yeast and vitamin B-complex in the diet are not only nourishing but an analysis of pond waters revealed that they had promoted growth of phytoplankters in ponds 1, 3, and 5, which synthesized sufficient amount of oxygen. Oxygen content also increased in ponds 5 and 6 by naturally grown hydrilla in them. It is well known that an optimum level of oxygen is conducive to good growth of aquatic organisms. Dissolved oxygen averaged 4.5, 4.2, 6.6, 6.1, 8.4, and 8.0 ppm in the ponds numbered 1, 2, 3, 4, 5, and 6, respectively, during the feeding trial.

Stocking rate has a profound influence on growth. Production is high in ponds where stocking rate is optimum, oxygen sufficient, and nutrient rich diet available. Under the present investigations, the highest stocking rate (160, 714 per ha) has enhanced production provided the other factors viz., nourishing diet and oxygen are not acting as limiting ones. However, for a given area where the number of stocked fry is large, the food and oxygen requirements are also high. Consequently in pond 1 where the stocking rate was 160,714 per ha the oxygen content was lower (4.5 ppm) in comparison to that of pond 5 in which the stocking rate is less (89,286 per ha) and therefore the oxygen could not act as a limiting factor.

Pond 5 shows the greatest growth because the fry was supplied with rice bran, ground nut oil cake and yeast *cum* vitamin B-complex. These last mentioned substances helped in digesting the maximum amount of food consumed by the fish. Since this pond contained naturally grown hydrilla, the oxygen content always remained high and it made the fish very active and healthy. This coupled with the low stocking rate of 89,286 per ha provided the fish with enough space for carrying on its life processes. This resulted in a high production of 540.7 kg per ha in the pond.

Pond 1 stands next in order of production. Here in this pond, although a larger amount of rice bran and ground nut oil cake was consumed along with yeast *cum* vitamin B-complex, yet all of it could not be converted into fish flesh since the oxygen content was quite low. This low concentration of oxygen was possibly due to the absence of naturally grown hydrilla as well as high stocking rate of 160,714 per ha in this pond. Therefore, it can be said that had the oxygen content been high in this pond production could have easily surpassed that of pond 5.

Production in ponds 3 and 6 is of the third order and also does not differ much from each other. In pond 3 the stocking rate is higher and consequently the food consumed is also more. Also yeast *cum* vitamin B-complex was supplied in this pond and therefore, production figures have gone a bit higher. However, in pond 6 where the stocking rate was less and the oxygen content high, production figures are almost equal to those of pond 3 but fall short by only 3.8 kg per ha.

Production in ponds 2 and 4 was very low since these ponds were not supplied with nutrient rich diet. In the former pond oxygen content was low on account of absence of naturally grown hydrilla. Sufficient quantities of phytoplankters also did not develop as yeast *cum* vitamin B-complex was not supplied in this pond. The stocking rate was also very high (160,714 per ha) with a low oxygen content, and consequently production was of a low order. Pond 4 was the least productive of all. Although oxygen content was not low in this pond the stocking density was less (125,000 per ha) in comparison to pond 2 and hence production was also lower.

2. Growth Of White Amur In Cisterns:

Average gain in net weight at the end of the experimental period was about 12 times more in comparison to that of initial weight in all the three cisterns (Table 4). Fish in all the cisterns stopped feeding and showed signs of stunted growth. In fact, growth stopped abruptly when the carrying capacity of the cisterns reached their maximum. Production figures of cisterns appeared high, but presumably this was not due to the good conversion of the food consumed but on account of the initial heavy stocking rate (333,333 per ha). Evidently 'space' had acted in cisterns as a limiting factor.

Production was in descending order in cisterns 2, 3, and 1. In cistern 2 production was 58 kg per ha more than in 1. This may be possibly due to the fact that the quantity of artificial feed consumed by the fish in the former was much more.

Cisterns 3 showed a production of second order, simply because the diet of yeast *cum* vitamin B-complex though extremely beneficial for digestion did not compete with the diet in cistern 2 presumably because it was not only lacking in quantity but in quality also. Therefore, had the yeast *cum* vitamin B-complex been supplemented with rice bran or ground nut oil cake or even hydyhdrilla, production would have easily surpassed that of cistern 2.

However, stocking rate was the same in all the three cisterns and oxygen content of the cisterns averaged 4.9 ppm during the 111-day feeding trial.

TABLE 4. GROWTH OF WHITE AMUR FRY IN CISTERNS.

Cistern Number	Weight (kg) Initial	Weight (kg) Gross	Production/ha (kg) Gross	Production/ha (kg) Net	Cost/ha (Rs)
1	0.050	0.113	943.0	525.0	666.66
2	0.050	0.112	1000.0	583.3	2166.66
3	0.052	0.120	1000.0	567.0	12833.00

PRODUCTION COST:

1. Ponds:

Investment in ponds ranges from Rs[1] 2792=85 (pond 1, production rate 419.4 kg per ha) to Rs 701=42 per ha (pond 6, production rate 339.2 kg per ha). However, when we compare investment of pond 5 showing highest production (production rate 540 kg per ha, costing Rs 1783=93) to that showing least investment (pond 6, costing Rs 701=42), we find an extra investment of Rs 1081=58 per ha more in pond 5. However, this extra investment is worthwhile since we are producing more fish flesh from the same area and with the same stocking rate (89,286 per ha). In fact fry and fingerlings are stages in the life cycle of the fish when growth is slow requiring more expenditure. Yet, it shall prove to be a wise investment since the growth rate of fish gains momentum in subsequent years. Therefore, some extra investment at this stage is sure to pay rich dividends in the long run.

2. Cisterns:

Production in cisterns does not convey the sense for which the connotation stands. Since experiments remained inconclusive in cisterns it is futile to compare the costs involved.

The present study reveals that the optimum stocking rate is 89,286 per ha in ponds provided other factors are also optimum or at least not limiting. However, the stocking rate of 33,333 per ha in cisterns has proved very high beyond 73 days. Incidently, the present study also confirms the observations of Prowse (7) that the fish suffers loss in weight in small ponds, cisterns, etc., and that this stress increases with increasing density and size of the fish.

SUMMARY AND CONCLUSIONS

Artificial feed in the form of ground nut oil cake, rice bran, yeast *cum* vitamin B-complex and aquatic weeds hydrilla and *P. perfoliatus* were variously administered to the fry and fingerlings of white amur contained in six rearing ponds and three cemented cisterns at the Kaithoon Fish Farm, Kota, India. It is inferred that the artificial feed consisting of yeast *cum* vitamin B-complex is superior to other feeds and stands only slightly costlier. However, this extra investment is supposed to bring enormous profit when the fish attains adulthood.

[1]1 Rs=$0.13

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