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RECORD FISH PRODUCTION WITH INTENSIVE CULTURE OF INDIAN AND EXOTIC CARPS

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FISH culture has a long history in India and the association of species of Indian major carps in pond fish culture has been known to the fish farmer. The productions, however, have been low because food niches of the pond remained under-exploited, and dependence was mostly on the natural fertility of the ponds to produce fish food. With the introduction at Cuttack of exotic species of fishes, the Chinese silver carp and grass carp and the common carp of Indonesian strain by the Pond Culture Sub-station of the Central Inland Fisheries Research Institute, true multi-species culture of the three exotic carps and indigenous major carps were undertaken in experimental ponds. Experience gained through experimentation led to the gradual increase of fish production in still-waters and a production as high as 7,500 kg/ha/annum has been recently obtained which is reported in the present communication. The production was achieved by intensive multi-species culture of fish employing a high stocking density in desirable proportion supported by judicious application of fertilizers and supplementary feeding. The highest production (net) recorded from India earlier to this was 6,286·1 kg/ha/yr (Jhingran, unpublished). Bardach *et al.* (1972) mentioned that under favourable circumstances productions of 7,500 to 8,000 kg/ha may be attained by polyculture in the Far East. Yashouv and Halevy (1972) have reported of productions as high as 10,620 kg/ha/yr with poly-culture of tilapia, common carp and silver carp. Chaudhuri (FAO, 1971) achieved fish production of 10,390 kg/ha in a year in Burma by culturing the Indian major carps together with small numbers of carp hybrids and gourami.

The experiments reported herein were undertaken in two ponds each 0·25 ha in area which resulted from renovation of a section of the moat of the Killa Experimental Fish Farm at Cuttack. This section had a poor record of fish production as the water sheet was rendered unsuitable for fish culture due to accumulation of coaltar flowing into the water from drums dumped nearby.

The ponds were poisoned with mahua oil cake applied @ 250 ppm which was followed by application of quicklime @ 100 kg/ha. Because of entry of some murrels from nearby sources the pond 6B had to be poisoned a second time after a month of the initial poisoning. Hereafter, the fingerlings for culture were released.

The ponds were stocked in September, 1972 with 2–3 month old fingerlings raised from fry of induced bred fish. The stocking density used for both the ponds was 10,540 fingerlings per hectare of the cultivated cyprinids which included the Indian major carps catla, rohu, mrigal, the Chinese silver carp and grass carp and the common carp stocked in the ratio of 1 : 3, 1 : 2, 1 : 2 respectively. To this was added 544/ha of miscellaneous fish in one and in the other 568/ha. The former pond has been denoted as 6A and the latter as 6B. Species comprising the miscellaneous category included *Notopterus chitala, Ompok bimaculatus, Mystus seenghala* and *Pangasius pangasius*. The purpose of introduction of these species was to further increase production by utilising the insects, shrimps, molluscs and weed fishes (inadevertent entry) which are not made use of by the cultivated carps but compete with them for food.

Fertilization was effected by means of inorganic (a mixture of urea and triple superphosphate) and organic (cowdung) fertilizers, the former applied once a month and the latter once a quarter. Fertilization was stopped when algal blooms persisted and fish appeared to be in distress particularly during early hours of the morning. The quantum of inorganic fertilizer used was 1,530 kg/ha/yr for 6A and 1,140 kg/ha/yr in 6B. Each of the ponds received cowdung @ 14.400 kg/ha/yr. The stocked fish were daily fed with artificial feed, which was a mixture of groundnut oil cake and rice bran, a fortnight onwards after stocking. The quantity of feed put in pond 6A was 12,852 kg/ha/yr and 13,340 kg/ha/yr in 6B. Feeding was suspended or reduced during periods of low water level in the ponds or when the ponds were having a thick bloom of *Microcystis*.

Feeding was undertaken by broadcasting the feed from the pond margin during the first half of the rearing period whereafter the feed was made into a dough and a number of balls of this material was placed in trays hung at different depths in the pond. Chopped bits of *Enhydra fluctuans* were mixed with the feed in the latter half of the culture period. Grass carp were given weeds particularly *Spirodela, Najas* and *Hydrilla* regularly.

Periodical removal of fish which had reached the marketable size of 1 kg was carried out in both the ponds and the remaining finally harvested after one year of culture. The earliest to be harvested

TABLE I

Average weights of fishes as computed from the total numbers recovered and total weights realised of each species

Species	POND 6 A			POND 6 B		
	Average weight in gm	Survival (%)	Contribution by weight (%)	Average weight in gm	Survival (%)	Contribution by weight (%)
Silver carp ..	1,152	30·85	13·07	1,032	65·90	19·04
Catla ..	1,197	67·92	15·00	1,179	71·69	11·94
Rohu ..	754	94·93	39·42	854	97·72	35·14
Grass carp 1st lot ..	1,106	76·60	15·63	1,219	68·68	11·84
Grass carp 2nd lot ..	..	..	..	1,542	89·00	7·30
Mrigal ..	766	94·33	13·39	654	100·00	9·54
Common carp 1st lot ..	1,516	0·41	2·30	1,772	1·17	0·86
Common carp 2nd lot ..	..	..	..	977	92·59	2·61
Ompok ..	79	32·00	0·07	102	60·00	0·01
Chitala ..	163	80·00	0·83	238	91·91	1·17
Mystus .	330	36·36	0·12	398	75·00	0·02
Pangas ..	733	60·00	0·14	742	100·00	0·03

were some grass carp and silver carp and a few common carp from both the ponds at the end of 5 months' rearing. Some catla could be harvested after 6 months. A second lot of 100 nos. of grass carp and 54 nos. of common carp were introduced in pond 6 B, in which fish were found to be growing better. The grass carp were introduced with the idea of raising a second crop of the species, which was realised; whereas the common carp were put as it was observed from the periodic samplings that the earlier introduced numbers of the species had disappeared either through mortality or poaching.

The experiments were concluded after one year when the fish were finally harvested. Table I denotes the average weights attained by the fish in the two ponds along with their survival percentages and also the contribution of each species as percentages of the total yield. The high survival despite the high stocking density obtained with rohu puts this species in the first place as regards species-wise contribution to the total gross production which in the case of pond 6A is 2,261·6 kg/ha and for 6B 2,638·6 kg/ha. The species that belied all expectations was the common carp which were almost absent from the fish harvested.

The gross and net productions recorded in pond 6B was 7,500 kg/ha/yr and 7,343 kg/ha/yr respectively and that in 6A 5,734 kg/ha/yr and 5,652 kg/ha/yr respectively and is the highest recorded yield in pond culture operations in India. The former figure can be considered as outstanding for a pond not having facilities for recirculation of water. This could truly be considered as intensive fish culture since the stocking density used was more than double the rate ordinarily followed in composite fish culture in India.

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