SCOPE FOR SCIENTIFIC AND COMMERCIAL FISH FARMING IN WEST BENGAL

—— A.V. NATARAJAN

BULLETIN NO. — 37

CENTRAL INLAND FISHERIES RESEARCH INSTITUTE

(Indian Council of Agricultural Research)

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The Central Inland Fisheries Research Institute over the years has developed fish seed production technologies relating to major carps, freshwater giant prawn, brackish-water tiger shrimp, mahseer, hilsa, catfish, etc. Of these carp seed production through efforts of the Central and State Governments as well as private sector is reaching the scale of commercial dimension. CIFRI would soon be launching pilot-scale hatchery projects on seed production of giant freshwater prawn as well as tiger shrimp in a couple of States, proposal for which has already been sent to the Government of India. Package of practices for scientific fish farming has been developed for carps, air-breathing fishes, paddy-cum-fish culture, integrated fish farming and brackishwater fishes and prawns. The carp culture technology developed by CIFRI is largely based on quality fish seed, fertilization for increased pond productivity and supplementary feeding largely based on agricultural and agro-industrial byproducts or residues. The technology developed by CIFRI for carp culture can be adapted

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* Talk delivered at the Workshop on "Prospects for Agro-Based Industries in West Bengal" organised by the Bengal Chamber of Commerce and Industry, Calcutta, on 18 February 1985.

at various levels of production, namely 2,000-2,500 kg/ha; 4,000-5,000 kg/ha; and 9,000-11,000 kg/ha. It may be pointed out that under this technology, the output is a function of monetary inputs and as such can be utilised by small fish farmers, small entrepreneures as well as big Houses. In addition, the Institute has also evolved suitable techniques for Pen culture as well as Cage culture for intensive fish cultivation. Management practices have been evolved for beel fisheries to achieve a production rate of 1,000 kg/ha. Similar management practices have been developed for reservoir fisheries. Management practices have also been evolved for brackishwater tiger shrimp (Penaeus monodon) to produce 1 tonne per hectare in three crops and 2,000 kg of fish per hectare under dug-out brackishwater fish farming system. A much larger target of production can be easily achieved in estuarine swamps (bheries) where the natural productivity is of a very high order. Many of the above technologies have considerable production potential as well as commercial dimension and their relevance to West Bengal is briefly discussed below.

West Bengal is ecologically well endowed for inland water fisheries. It is in the monsoon belt, has an annual average precipitation of 1,000 mm. It has extensive inland water resources in the form of hill streams, rivers, canals, estuaries, estuarine wetland in the form of bheries, fresh-water wetland in the form of beels, reservoirs, khals, ponds and tanks. The data-base on various categories of inland water resources in West Bengal is rather inadequate as in other States, though efforts are now underway to estimate these resources suitable for fish culture through

the Central Sector Scheme on Inland Fisheries Statistics. According to the West Bengal State statistics, the following are water resources available in the State.

Total tank area	...	2,73,000 ha
Culturable area	...	1,92,000 ha
River	...	1,74,000 ha
Beels & baors	...	42,000 ha
Reservoirs	...	17,000 ha
Khal	...	81,000 ha
Bheries	...	30,000 ha

The State has population size of the order of 55 million (by 1981 census). Going by the nutritional requirements for a balanced diet at the rate of 30 g of fish/head/day, State's requirement of fish would be of the order of 5 lakhs tonnes per annum. But going by food habits of people of West Bengal, a larger share of fish in total protein consumption is indicated. Thus the State has a compulsive demand of 8 lakh tonnes of fish per annum. The State, however, produces about 4 lakhs tonnes indigenously. The shortfall is made up to an extent by import of fish from other States. Local fish consumption is picking up in these States resulting in reduced supply. The city's fish demand including the areas covered by agglomeration is of the order of 300 t/day. As per the estimate available, the daily supply of fish in the city of Calcutta is only 50 tonnes. The shortfall is clearly reflected by the high price which is further compounded by the intervention of middlemen through hoarding and other practices.

We will now examine the scope for scientific and commercial fish farming in West Bengal (category by category). West Bengal has an estimated water spread area of 2,70,000 ha in ponds and tanks. A detailed sample survey carried out by CIFRI during 1978-81 in 24-Parganas District revealed that ponds of sizes less than 0.4 ha are predominant with an average size at 0.1 ha. Only 33% of the water area covered by ponds is presently exclusively used for fish cultivation while 64% of ponds (by area) are used for various other purposes including fish cultivation, while 3% are remaining fallow. It is further observed that only traditional system of carp culture is practiced dominantly yet in Bengal and various technologies developed by CIFRI have yet to perculate at farmers level in any significant manner. It is further observed that multiple ownership, dis-interested attitude, want of capital and poaching are some of the major factors that come in the way of fish cultivation in West Bengal on modern scientific lines. Going by sample estimate in 24-Parganas, it is generalised that pond sizes having water areas in the range of 0.1 to 0.4 ha occupy 60% of the total pond area in West Bengal and this can be developed scientifically to achieve an average production rate of 3,000 kg/ha under carp culture. It is pointed out here that CIFRI carp culture technology is as much relevant for small water bodies as it is for big water bodies upto 5 ha. Ponds of less than 0.1 ha, which form nearly 40% by area, can be utilised for nursery. A small percentage of larger ponds may be used for bathing, cattle washing, etc. Such seggregation of ponds would assist in intensive fish culture especially in context of the fact that the number of ponds in each village is very large. This implies communal sprit and communal adjustment for a common purpose. By this

reckoning, it is possible to produce 5 lakhs tonnes of fish per annum from tanks and ponds. This requires stocking rate of 3,000 fingerlings/ha. Since West Bengal is leading in carp seed production with an estimated production at 2.5 to 3.5 thousand million fry/fingerlings/yr, there is hardly any problem in meeting the seed requirements in pond culture operation for semi-intensive culture.

The catch, catch structure and productivity of the riverine and estuarine stretches of River Hooghly between Nabadwip and Sagar Island has been evaluated by CIFRI through periodic sample survey covering a period of over 2 decades. The annual fish production in this stretch is approximately 10,000 tonnes during the period between 1963-73. Subsequent to the construction of the Farakka Barrage there has been regulated water discharge causing changes in ecology in certain respects and resulting in an increased production of the order of 15,000 tonnes per annum. This increase is largely contributed by some of the estuarine fishes like Harpodon nehereus, Trichiurus spp., Setipina phasa, Pama pama, etc. But there is no change in the hilsa landings which remains at 2,000 tonnes per year except for peak production in 1971 and 1981. These peaks are largely attributable to diversion of fish stocks from other estuaries on the Indian coast. Such a phenomenon of peaked catches has also been observed in other estuaries/lagoons in India for similar reasons. The Farakka Barrage has, however, nearly eliminated the fisheries of hilsa above Farakka. The increase in estuarine catches in Hooghly may also be attributed to mechanised fishing in the lower estuarine zone by bag nets especially during winter. There is hardly any scope for

higher production in riverine and estuarine stretches of River Hooghly. However, it is possible to take up large-scale seeding of hilsa in Hooghly which may augment hilsa production considerably. This is now possible because of the breakthrough achieved by the Institute in hilsa breeding.

The State of West Bengal has extensive fluviatile lakes (Ox-bow lakes) locally known as 'beel' with an estimated water spread area of 42,000 ha. Nearly 50% of these beels are located in the Districts of 24-Parganas, Hooghly and Nadia. According to available estimate, production from these water bodies is only of the order of 100 kg/ha. These beels are extremely rich in nutrients as reflected by rich organic carbon and high level of available nitrogen and phosphorous in the soil. But the nutrients are locked up largely in the form of large aquatic plants, especially water hyacinth, which are not readily available as food for fishes. A proper management involving eradication of unwanted weeds and proper stocking oriented to detritus which is a major source of fish food in the beels would enhance fish production enormously. The management of beels, therefore, largely centres round elimination of unwanted floating weeds as well as stocking largely made of Rohu, Mrigal and Common carp (the last however should not be stocked in live beel for its possible escape into River Ganga). Studies carried out by CIFRI in Kulia Beel revealed that removal of floating weeds generated large burst of bloom of plankton which favoured stocking of Catla also in addition to species mentioned above. At a stocking rate of 8,000 per ha in Kulia beel in Nadia District under technical supervision of CIFRI, the production rose from 250 kg/ha/yr to 1,000 kg/ha/yr. If beels of

West Bengal are properly managed, an annual production of 40,000 tonnes at the current level on technology developed by CIFRI, can be achieved. Where manual clearance of weeds is not possible, the same can be carried out by application of chemical weedicide like 2, 4-D sodium salt @ 10 kg/ha. The cost of this weedicide is approximately Rs.500.00 for clearance of weeds of 1 ha. In the case of live beels it is also possible to augment fish production further by intensive culture in Pens that can be set up at the peripherial area. The CIFRI has already developed a technology to raise 4 tonnes of fish in Pens of 1 ha area in six months in an Ox-bow lake at Muzaffarpur in Bihar with a possibility of two crops in a year, i.e. nearly 8 tonnes per year per ha of Pen area. The Pens could be in units of 0.1 ha area and is made of bamboo screen. This technology can be adopted in West Bengal as the physiography of the beels in Bihar and West Bengal are quite similar. However, to achieve this objective there is need for change in management. The beels in West Bengal are largely owned by Government and leased to private parties or Society. Many of the Cooperatives due to lack of proper resources and expertise are not taking up development in the manner it is required. By proper capital investment, extension services and effective management it is possible to achieve the target production as mentioned above. Perhaps the Fisheries Development Corporation could take up a few beels for commercial scale production of fish in West Bengal.

The deltaic West Bengal are ecologically well-suited for development of commercial scale production of brackishwater fishes and prawns. The Hooghly estuary as well as other estuarine inlets and tidal streams along

with their distributaries have rendered a good part of low lying Sunderbans into saline swamps which over the years through embankments and other development processes have been reclaimed into productive bheries. The deltaic zone of West Bengal has an estimated 2 lakhs ha swampy area considered suitable for brackishwater aquaculture. This figure needs to be suitably supported by proper micro level survey giving due ecological consideration to conservation of forest areas, protection of mangrove eco-system, protection of nursery areas of fish and prawns etc. As against the present cultivated area of 30,000 ha under bheries it is quite possible to reclaim another 20,000 ha of new saline marshy areas for commercial scale production of brackishwater fishes and prawns.

In the existing culture systems the following species are encountered in the bheries :

Fishes

	Scientific name	Local name
1	Lates calcarifer	Bhetki
2	Mugil parsia	Parse
3	Mugil tade	Bhangon
4	Mugil speigleri	Parse
5	Mugil corsula	Khorsula
6	Mystus gulio	Nona tengra
7	Eleutheronema tetradactylum	Gurjaoli
8	Anguilla bengalensis	Ban
9	Scatophagus argus	Paira chanda
10	Odontomblyopus rubicundus	Chengo
11	Glossogobius giuris	Bele
12	Setipinna phasa	Phasa

Prawns

	Scientific name	Local name
1	*Penaeus monodon*	Bagda Chingri
2	*Penaeus indicus*	Chapra Chingri
3	*Metapenaeus monoceros*	Hony Chingri
4	*Metapenaeus brevicornis*	Chamne Chingri
5	*Macrobrachium rosenbergii*	Golda or Mocha Chingri
6	*Palaemon rudis*	Goda Chingri
7	*Leander styliferus*	Ghora Chingri
8	*Acetes spp.*	Ghuso Chingri
9	*Parapenaeopsis spp.*	Nona Chingri

Crab

1	*Scylla serrata*	Nona Kankra

Observations made by CIFRI in bheries in West Bengal showed that existing production rate is about 600 kg/ha of which nearly one-third is shrimp. It is possible to enhance the production rate through proper management to 3,000 kg/ha with one-third as prawn component. Ecology of the bheries reveals a very high productivity in the high saline bheries which are very rich in phosphate and other inorganic nutrients while the medium and low saline bheries are rich in nitrate and other inorganic nutrients in soil. The bheries, in general, are extremely rich in phytobenthos (dominated by blue green algae) which is crucial for high rate of production. In addition many bheries are also marked by floating filamentous algae. The rather low production achieved in bheries in West Bengal is largely attributable to the fact that the aquacultural practices followed by farmers leave much to the desired. Culture of *P. monodon* (tiger shrimp), *P. indicus* as well as locally available mullets in right proportion at optimum stocking density supported by supplementary feeding is likely to enhance production to 3,000 kg/ha of which 1,000 kg would be in terms of *P. monodon* or

P. indicus. It is possible to achieve with proper management of bheries an annual production of 90,000 tonnes from existing 30,000 ha water area of which 30,000 tonnes would be tiger shrimp and other shrimps. West Bengal is well endowed with uncommon abundance of P. monodon seed to achieve this target. This can be further supplemented by hatchery-produced seed. By using the sewage enriched tidal water in low saline bheries in Basirhat/Barasat Sub-Divisions, the productivity of the bheries could be further enhanced through proper regulation of intake of tidal sewage water besides proper desilting of bheries and feeder canals at periodic intervals. In the absence of such management measure the productivity will diminish as it is today. There is scope for addition to existing bheri area by reclamation of another 20,000 ha in lower Sunderbans by proper survey of deltaic areas. This would mean an additional annual production of fishes and prawns of 60,000 tonnes with prawn component of 20,000 tonnes. The technology of brackishwater aquaculture is simple enough and it is based largely on right species mix, right stocking density and supplementary feeding where it is required. Already paddy-cum-fish culture is practised in low and medium saline wetlands. The mono crop of paddy cultivation is practised during 'Kharif' season. In addition, farmers in Basirhat and Barasat Sub-Division are also taking up summer cultivation of brackishwater fishes and prawns in paddy plots by taking tidal water during February-March. There is hardly any indication that this practice has reduced productivity of paddy cultivation in any manner. The CIFRI has also taken up detailed studies of summer cultivation of brackishwater fishes and prawns during February-June in experimental paddy plots in high saline zones in Canning area.

Studies carried out for the past 3 years have not shown any adverse impact of saline water on soil quality in terms of salinity or nutrients. But further studies covering another 3-4 years would further strengthen in regard to utilisation of paddy fields in high saline areas for cultivation of brackishwater fishes and prawn in fallow summer period. In areas like West Bengal receiving very high monsoon precipitation of the order of 1,000 mm and above, the saline accretion on account of intake of tidal water in summer months for brackishwater aquaculture will be flushed or leached out. What needs to be recognised is that deltaic Sunderbans is ecologically well suited for brackishwater aquaculture in low, medium as well as in high saline tracts and this would also help additional employment for local people. While mono crop agriculture will provide employment for 3 months, integration of fish culture will give employment of another 7 months. Thus from the point of view of additional employment generation and augmented economic income, paddy-cum-fish culture should be encouraged in saline swampy tracts where such a practice is practicable. In addition to cultivation of brackishwater fishes and prawns in summer months which includes P. monodon, L. parsia, L. tade, etc. it is also advantageous to go for simulteneous cultivation of paddy, fish and prawns during 'Kharif' season with giant freshwater prawns as a major component.

West Bengal reservoir water resources are comparatively of low order and cover water area of about 16,000 ha. Under proper management, a production of 600 tonnes can be achieved from these water bodies at the rate of about 40 kg/ha. However, some of the reservoirs in West Bengal

are suitable for largescale cage culture. CIFRI has already developed production techniques using floating cages at experimental level. A production of 150 tonnes per hectare can be achieved in floating cages at the rate of about 150 kg/10 sq.m. area. Common carp, silver carp and catla have been found amenable for this type of culture. Various designs of cages have been adopted in different countries utilising diverse materials for cages, net clothing and following appropriate floatation and anchorage systems. The Institute is planning to take up a pilot scale project on cage culture in one of the reservoirs for intensive fish culture.

The foregoing observation reveal that under effective management, inputs and extension services, and credit facilities, it is possible to achieve an annual production of 8 lakh tonnes within the State utilising the existing technologies.

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