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with a bearing on better utilization of capital investment; (4) Resource management studies for determining economically optimum fishing effort; (5) Economic efficiency studies at vessel level; (6) Evaluation of preservation and processing requirements; (7) Market structure, organisation and distribution studies; and (8) Studies relating to changes in tariffs on international trade.

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## SOME PROBLEMS OF FISH CULTURE IN WEST BENGAL —A CASE STUDY

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### I

#### *Introduction*

The present per capita fish availability in India is a little over 2 kgs. per annum, while in Japan and Thailand among Asian countries and Spain, Portugal and Norway among European countries it is about 35 to 40 kgs. per annum per head. Fish, along with molluscs and crustaceans are the most widely used form of animal protein in the world and fish is an especially important source of animal protein in countries where the level of nutrition is low.<sup>1</sup> During the Three Plan periods nearly Rs. 40 crores have been spent for the development of fish supply in India, and about one-fourth of this amount was spent on inland fisheries. But the supply response to these expenditures in India clearly lag behind the world trend of production and India's contribution to world production has gone down from 3.7 per cent to 2.7 per cent between 1951 and 1963.

Following the examples of Europe and the United States, more attention has hitherto been paid in our country to the development of marine fisheries and the prospect of inland fisheries has, in general, been overlooked.<sup>2</sup> But inland fisheries provide about one-eighth of the world's total production of fish every year. Their importance is greater than this figure might suggest, because they have been particularly developed in regions where fish provides the principal source of animal protein. They have an additional importance as they can be exploited at less capital cost than most marine fisheries, and they usually occur in or near well populated areas, so that distribution and marketing problems are simplified. Fresh water in tropical region has a higher rate of production per unit area than

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1. United Nations : Science and Technology for Development, Vol. III—Agriculture, New York, U.S.A., 1963, Chapter 13.

2. S. L. Hora in Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources, Vol. VII—Wildlife and Fish Resources, Department of Economic Affairs, United Nations, New York, U.S.A., p. 120.

the sea.<sup>3</sup> Moreover, inland fisheries, and particularly the pond culture can provide best opportunities for a rapid increase in fish supplies for the inland population with a common aversion for marine fishes.

The importance and scope for the development of inland fisheries were felt appreciably during the Third Plan period in India and several States were actively engaged in executing projects for development of fisheries. Particular importance was laid on the fact that vast areas of inland swamps both fresh and brackish are not in use at present. If properly developed and utilized these areas can add to production substantially.

Among the Indian States, West Bengal produces the largest quantity of fresh water fish, although the State does not hold that rank in terms of total production from all sources. About 60 per cent of the total production of fish in West Bengal come from fresh water fisheries in tanks and ponds. The Bhabatosh Dutta Commission has opined that there is a considerable scope for the development of fresh water fish culture in West Bengal. References may be made to the fact that about 0.25 million acres of water area have been developed and brought under fish culture so far in West Bengal out of an estimated 1.02 million acres suitable for fish culture.<sup>4</sup>

If proper attention be paid to the thousands of village tanks and ponds scattered all over the State and their specific problems are tackled with skill and sincerity the production of fish can be increased by several times within a comparatively short period. The objective of the paper is to underline, through a case study, various problems impeding the development of fish culture in respect of tanks and ponds in West Bengal. Along with their intrinsic potentialities, the main barriers for the development of such fisheries have been studied and remedial measures have been suggested.

## II

Goalpara, a village in the Birbhum district of West Bengal was specially chosen for the purpose of the case study. The village offers an average facility to its fish culturists—there is neither a large natural advantage nor any serious disadvantage. So, in respect of our specific purpose it is an ideal village to the extent it exhibits a condition of maximum occurrence.

### *The Village*

Goalpara is situated at a distance of 4 km. from the town Bolpur connected with it by an all-weather road. The total number of households in the village is 144 with a population of 748 of which 104 belong to the scheduled castes and 237 scheduled tribes. Literacy status of the village is neither low nor too high—nearly 24 per cent of the total population are literates. In respect of occupation structure it is typically an agriculture-based village as 85 per cent of the male

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3. Science and Technology for Development, Vol. III, *op. cit.*

4. Techno-Economic Survey of West Bengal, National Council of Applied Economic Research, New Delhi, 1962, Chapter 5.

working force are engaged in agriculture of which 27 per cent as cultivators and 58 per cent as agricultural labourers. Thus, in respect of location, population or occupation pattern, extensive fish culture is not disadvantageous to the villagers.

### *Water Resources of the Village and Their Ownerships*

The total water area in the village is a little above 30 acres while the total area of the village is 359 acres. Of the total of 27 tanks in the village, as many as 25 are used for fish culture and 9 for both irrigation and fish culture. Only 2 small ponds are left unutilized. Table I shows the total number of tanks in the village according to their size and usage. Tanks below the size of 0.33 acre have been shown as small, and those between 0.33 and 1.00 acre, and those above 1 acre are shown as medium and big respectively.

TABLE I—WATER RESOURCES OF THE VILLAGE

Use of the tanks	Number of tanks by size-groups (acres)			Total
	Small (below 0.33)	Medium (0.33–1)	Big (above 1)	
For irrigation .. ..	—	4	5	9*
For fish culture .. ..	5	9	11	25
Total (inclusive of unutilized tanks)	7	9	11	27
Average sizes .. ..	0.20	0.76	2.00	30.24

\* Nine tanks are used both for irrigation and fish culture.

Table II presents the ownership structure of the tanks according to their size-groups. Only 5 tanks are under the single ownership. The rest 22 tanks are under multi-ownership—9 are under a limited number of shareholders not exceeding 5 each, and 13 are owned by a large number of shareholders numbering up to 25 or even more. The shares of 3 big tanks are being held by outsiders also. Thus it is evident, that multi-ownership of its water area is a typical characteristic of the village.

TABLE II—OWNERSHIP OF TANKS

Form of ownership	Number of tanks			Total
	Small (below 0.33 acre)	Medium (0.33–1 acre)	Big (above 1 acre)	
Single ownership .. ..	2	2	1	5
Joint ownership (number of shareholders not exceeding 5) ..	2	4	3	9
Joint ownership (number of shareholders exceeding 5) .. ..	3	3	4	10
Shares of the tank held by outsiders	—	—	3	3
Total ..	7	9	11	27

*Average Fish Production and Recurring Cost*

The village is almost self-sufficient in respect of fish production as the entire need of the village, including on occasions like marriage and other ceremonies, are supplied from the village tanks. At the present production level, there is hardly any marketable surplus to be sold outside. Only one big tank has been leased out to a fish dealer who sends his whole produce to the nearby market for open sale.

Table III shows the annual expenditure and average production of the tanks by their size-groups. The ranges indicate the annual averages for the last 10 years so far as the villagers could recollect from their memories. Accordingly, the total fish production of all the tanks taken together remains within the range of 2,475 kgs. to 3,300 kgs. annually. The gross total income of the villagers from fisheries, imputed at the village rate,<sup>5</sup> ranges from Rs. 7,500 to Rs. 10,000 approximately per year.

TABLE III—COST AND PRODUCTION PER YEAR

	Small (below 0.33 acre)	Medium (0.33–1 acre)	Big (above 1 acre)
1	2	3	4
Average cost of fish culture (per tank) (Rs.) .. ..	50—70	75—100	100—150
Average annual fish production (per tank) (kgs.) .. ..	30—40	80—100	150—200
Average total cost per year (Rs.) .. ..	250—350	675—900	1,100—1,650
Average total production per year (kgs.) .. ..	150—200	675—900	1,650—2,200

The annual production cost includes the recurring expenditure on de-weeding, cleaning and stocking of the tanks with spawn and fries each year. The total production cost varies within the region of Rs. 2,000 and Rs. 2,900 per year, which is roughly a little above one-fourth (27 to 29 per cent) of the gross total income from fisheries.

Size of each fish	Price per maund including carrying cost (Rs.)
200 grams to 1 kg. .. ..	130
1 to 2½ kgs. .. ..	140
2½ to 5 kgs. .. ..	150
Above 5 kgs. .. ..	160

*Maintenance of Tanks and Their Ownerships*

The present rate of production, as given above (82.5 kgs. to 110 kgs. per acre) is far below the rate of annual production from fish culture in many parts of West Bengal which is known to be as large as 350 kgs. to 400 kgs. The State

5. Average fish price at the village.

Directorate of Fisheries has also envisaged a production of 450 kgs. an acre per year from fish culture.<sup>6</sup> The reason for the low production rate in Goalpara must be sought in the present deplorable condition of its tanks and their low level of maintenance. A large number of tanks are weed-infested semi-derelict, where due to the recurring deposition of slime the bottoms often dry up during the summer and the banks overspill during the monsoon. Immediate desilting of the tanks and eradication of excess vegetation and water hyacinth should be effected to maintain the mere existence of as many as two-thirds of the village tanks. Fish culture is seriously affected in these tanks and sometimes it is impossible to carry on as the water often dries up completely in the summer.

This leads one to enquire why the village tanks, bearing immense potentialities, are being neglected so much. It has been found that there exists a close relationship between the ownership pattern and condition of the tanks. Data given in Table IV clearly suggest that the higher is the number of shareholders, the less is the attention paid to the tanks. Two tanks recently improved and properly maintained are under the single ownership. Tanks under joint ownership are faced with various maintenance and management problems and with a large number of shareholders it is more difficult to procure the development

TABLE IV—CONDITION OF THE TANKS AND THEIR OWNERSHIP

Condition of the tanks	Number of tanks			
	Form of ownership			Total
	Single ownership	Few, number of shareholders not exceeding 5	Large, number of shareholders exceeding 5	
1	2	3	4	5
Category I (recently improved) .. ..	2	—	—	2
Category II (require improvement for better fish production) .. ..	2	3	2	7
Category III (require immediate improvement to save the existence of tank)	1	6	11	18
Total ..	5	9	13	27

expenditure. Shareholders, particularly with small shares are hardly ready to spend for the development of the tank although their expenditures are also proportionately small. As the benefit derived by them from the development is likely to be small, they are not only reluctant to share the expenditure, but rather create various troubles which ultimately discourage the persons holding major shares to spend on the development of the tanks. This behaviour is true even in the case of shareholders economically solvent to incur the development expenditure. In fact, the number of shareholders in each tank bears an inverse relation with the prosperity of the tank. While 6 tanks out of 9 under the ownership of limited shareholders are in a deplorable condition, 11 out of 13 under a large number of shareholders are in the same precarious condition.

6. Techno-Economic Survey of West Bengal, *op. cit.*

*Other Barriers for the Development of Tanks*

The prospect of the tanks in Goalpara, as shown above, depends largely on the immediate development and repairing of the tanks. Along with the multi-ownership of tanks the shortage of development funds is also a great problem with the villagers. The average cost for excavating and desilting of the tanks is between Rs. 3,000–5,000 per acre.<sup>7</sup> Thus the improvement cost of all the tanks, covering 30 acres of area, is much above Rs. 1 lakh. There are, however, a few big cultivators in the village who can spend for the development of their own tanks, but the majority are not in a position to do so. Hence the development works are being postponed indefinitely.

Apart from the above two problems such as, unequal economic condition of the shareholders and absentee shareholders, there is also the problem which arises not because the shareholders are unwilling to spend or all are too poor to spend but because they cannot plan and spend simultaneously.

*Measures Suggested*

It is often suggested that the desired development and expansion of fish culture can be hastened up through the agency of Fishermen's Co-operative with substantial financial aid by the Fisheries Directorate. This sometimes achieves good result, but it may not be an immediate answer where the development of fisheries is just beginning. The working of these co-operatives is largely dependent on the local leadership. With efficient leadership some co-operatives prosper within a short time but when this lead is no longer there the co-operatives decline rapidly. Their members prefer to work on their own account or organize themselves like artisans. It can, therefore, be concluded that the co-operative formula is premature.<sup>8</sup>

The village panchayats may also be given the responsibility of fish culture in the village tanks which are not properly managed by their private owners. Panchayats can also regulate the collection of fish spawn and control the fish breeder against indiscriminate sale. The importance of the role of panchayats in the production of more fish has been realized in many States such as Orissa, Andhra, Gujarat, etc., and they have enacted legislation giving powers to the panchayats to start fish culture and earn revenue from fisheries. But the Land Acquisition Act of West Bengal, under which the proprietary right of the land was vested in the State and the rights on water reservoirs were left with the original owners, has made it difficult for the panchayats in West Bengal to take over the village fisheries unutilized or mismanaged by their owners.<sup>9</sup>

In order to encourage fish culture, the State Fisheries Directorate of West Bengal started schemes for developing suitable tanks and small semi-derelict areas by grants of loans to fish culturists. Some private water areas obtained through requisition were developed departmentally and then leased out to fishermen's

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7. According to the villagers' own estimates.

8. United Nations : Science and Technology for Development, Vol. III—Agriculture, *op. cit.* Chapter 14.

9. S. N. Bhattacharya : Fisheries in Indian Economy.



organizations on easy terms. To increase the availability of fish seeds of suitable species the production of carp-fry has been encouraged by granting bonus to the culturists. Some demonstration fish farms have also been established with a view that the adoption of improved technique will lead to larger production and better return to the fish culturists. But the result of all these measures is not yet very much encouraging.

All the above measures aimed at the general well-being of the fisheries, but none of them could touch the problem of multi-ownership which is a serious obstacle for the development of inland fisheries in West Bengal. Adequate financial assistance from government, both in the form of grants and loans is, however, the primary necessity. But, in the place of traditional co-operatives of fishermen, a more realistic approach, perhaps through legislation, is necessary to build up an efficient management system for the multi-owned village fisheries.

It appears that some amount of business element should be introduced in the management of the fisheries aided by government. Where tanks with single ownership are suffering due to financial problem of the owners, government should provide loans only on the condition that the owner shall maintain a minimum production level and release at least a fixed quantity for open sale.

But in case where the number of shareholders is large and the tanks are suffering from lack of care and attention of the owners, government should intervene to initiate an effective management. The potential productivity of each tank should first be determined on the basis of probable government assistance and the tank should be leased out to a single person among the shareholders who will guarantee the production of the targeted quantum. The return to other shareholders should be distributed on the basis of that target. Any excess production should be treated as profit accruing to the person responsible for management as his entrepreneurial reward and any loss should also be borne by him as a guarantee against negligence. If more than one person is ready to accept the bid, the offer should go to the highest bidder. In case where nobody is ready to offer the highest bid, the next lower bid should be accepted and if the potential productivity of the tank is really higher, its bid value will automatically rise at the next call, say, after five years. In this way, the total fish production can be raised with guaranteed returns to all the shareholders, and profit expectation for the manager. Without first eliminating the problems of multi-ownership, mere financial assistance from government will simply deteriorate the condition by inviting corruption and various malpractices on the part of the joint owners.

After a thorough improvement and repairing of the tanks a proper fish culture is likely to multiply both the annual cost and production by nearly three times. Table V presents the annual cost of an ideal fish culture<sup>10</sup> and the potential yield according to the size-groups of the tanks.

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10. The average cost ratios of different items of activities for fish culture in ponds :				(per cent)
1.	De-weeding and cleaning of the tanks, annual de-watering and refilling of the tank and drying up of the bottom where possible ..	..	..	15
2.	Feeding of the fishes, fertilization of the pond ..	..	..	10
3.	Stocking of the pond with spawn and fries ..	..	..	70
4.	Guarding of the pond against fish pilfering ..	..	..	5

TABLE V—POTENTIAL COST AND PRODUCTION PER YEAR

	Small (below 0.33 acre)	Medium (0.33–1 acre)	Big (above 1 acre)
1	2	3	4
Number of tanks	5	9	11
Average cost of fish culture (per tank) (Rs.) .. .. .	75—100	100—150	150—250
Average annual fish production (per tank) (kgs.) .. .. .	75—100	200—250	500—700
Average total cost per year (Rs.) ..	375—500	900—1,350	1,650—2,750
Average total production per year (kgs.) .. .. .	375—500	1,800—2,250	5,500—7,700

*N.B.* : Two tanks are unutilized.

Experienced fish culturists of the village presented this account which fairly resembles the expert's accounts.<sup>11</sup> A mere comparison between the present (Table III) and the potential accounts (Table V) shows that the net profit from the fisheries can be increased by more than three times with proper attention to the fisheries and a substantial investment for their improvement.

## BENEFIT-COST RATIOS IN FISH CULTURE

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Of late, there has been great emphasis on the development of fishery in India to provide wholesome protective food containing animal protein in the dietary of our people. Besides providing nutritive value, fish culture has been considered by the policy-makers as an income-efficiency farm sector to be developed as a

11. C. F. Hickling : *Fish Farming in the Middle and Far East*, Fol. 161, pp. 748. Fish production from ponds in warmer countries: South China 4,000, Malaya 3,500, Hong Kong 2,000 to 4,000 and India 1,200 to 2,000 lbs./acre/annum.

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