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Sustainable Use of Water Resources in the Form of Pisciculture to Generate Income in West Bengal -A study report.

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Abstract
Though the two-third of earth's volume is comprised of water the world is facing the problem of scarcity of fresh- water. Because most of the water is sea water which is salt in nature. It is the modern day tragedy that due to the scarcity of these valuable lives saving natural resources life will exist no more. So the sustainable use of this resource is very much important today. India was blessed with vast inland natural water resources. But Indian Economy faces the problem of proper utilization of these huge water resources spread over its vast stretches of land. A proper policy for utilization of these resources would become a governing direction of economic growth. The role of fisheries in the country's economic development is amply evident. It generates employment, reduces poverty, generates income, increases food supply and maintains ecological balance between flora and fauna. Scientists have shown that 3 bighas forest areas are equivalent to 1 bigha plank origin in water bodies which create more O_2. This paper intends to develop a scientific plan use of water with a view to sustainable management of water resources to generate income from fishery in the field of pisciculture by using the scarce water resources in a sustainable eco-friendly manner.

Keywords: Ecology, Growth, Perishable, Pisciculture, Pollution, Project, Sustainable development, Composite fish culture

1. Introduction

According to 2001 Census India is the second (next to China) largest populous country in the world about 17.5% of world populations live in India which covers only 2.4% (Dutt R. and Sundharam K.P.M. 2009*)* of geographical land area. The density of population is 324 persons per sq. km. If the current growth rate of population (i.e. 2.11% per annum) continues within 2030 India will be the most populous country in the world creating a food scarcity and a huge amount of unemployment in a massive scale. About 68% of total population spends their livelihood from agriculture and the per capita income is very low. Water scarcity is too much related to food scarcity. Hence it is very crucial to develop a scientific plan of water use with a view to sustainable management of water resource. Management of shortage of water and management of water pollution are complex task. These issues have drawn the attention of the developed and developing countries as well as the various national and international organizations including the Johannesburg Summit 2002, Year 2003 has been declared as year of Fresh -Water. But in India there are huge prospect to utilize the unused fresh water resources for pisciculture which can play an important role in this aspect. Realizing its importance during the 5th - five year plan the Government of India introduced

beneficiary-oriented programme in the form of a pilot project entitled 'Fish Farmers Development Agency' (FFDA) to provide self employment, financial, technical and extension support to fish farming in rural areas. In 1974-75 this Programme was further extended under World Bank-assisted, Inland fisheries project to cover about 200 districts of various states in India.

2. Sustainable development and Pisciculture

Sustainable development is a pattern of resource use that aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for future generations. The term was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". It is usually noted that this requires the reconciliation of environmental, social and economic demands - the "three pillars" of sustainability. This view has been expressed as an illustration using three overlapping ellipses indicating that the three pillars of sustainability are not mutually exclusive and can be mutually reinforcing. Sustainable development ties together concern for the carrying capacity of natural systems with the social challenges facing humanity. As early as the 1970s "sustainability" was employed to describe an economy in equilibrium with basic ecological support systems [Wikipedia]. A primary goal of sustainable development is to achieve a reasonable and equitable distributed level of economic well being that can be perpetuated continually for next generation. Thus the field of sustainable development can be broken into three constituent parts i.e. environmental, economic and social sustainability. It is proved that socio-economic sustainability is depended on environmental sustainability because the socio- economic aspects, like agriculture, transport, settlement, and other demographic factors are born and raised up in the environmental system. All the environmental set up is depended on a piece of land where it exists.

Water is a renewable natural resource and is a free gift of nature. In the early days the supply of water was plenty in relation to its demand and the price of water was very low or even zero but in course of time the scenario has totally changed (Bairagya R. and Bairagya H. 2011). Water is a prime need for human survival and also an essential input for the development of the nation. For sustainable development management of water resources is very important today. Due to rapid growth of population, expansion of industries, rapid urbanization etc. the demand of water rises many-fold which is unbearable in relation to its resources in the earth. All the environmental set up is depended on a piece of land where it exists. So, to get sustainable environmental management, sustainable land management is necessary. As a result the use of water resources in the form pisciculture in a sustainable manner may gain priority.

4. Importance of the study

Social scientists have always identified the rural areas for investigation. In the case of India to a large number of studies have been carried out in rural situations including panchayats and co-operative societies. Though many research works have been done in the biological and marine sciences, the economic investigations of pisciculture have not yet been done so far. In this respect the present study has a clear economic importance for the upliftment of the rural economy at the grass root level. Thus pisciculture has a positive effect on ecology and hence to maintain ecological balance a meaningful use of unused water resources has an important role. Scarcity of water is a modern day tragedy human society will exist no more

due to these scarce resources. So a meaningful use of this resources in the form of pisciculture to generate income of the rural poor gain topmost priority.

The state of West Bengal plays an important role for the implementation of the programme. Though the two districts Burdwan and Birbhum of W.B. are primarily agricultural districts, there is huge scope for pisciculture. A few studies have been undertaken by several experts, notably, D. Prasad (1968), R. Charan (1981), A.V. Natarajan (1985), K. M. B. Rahim (1992,93), A Chakravorty (1996), I Guha and R. Neogy (1996), P.K. Ghosh (1998) and others on the economic evaluation of pisciculture. Though these are useful guides to researchers, yet there is ample scope for further works relating to pisciculture in the rural areas of W.B. Besides, there is the necessity of developing studies concerning the impact of these programmes on the rural economy. The present study is a modest attempt in remedying this inadequacy.

4.1 Objectives

This pilot study was conducted on the following objectives i) To generate employment in rural India. ii) To rise in food supply and reduce mal-nutrition. iii) For proper utilisation of unused water resources. iv) To maintain ecological balance in a sustainable manner. V) Identification of fish farmers suitable and willing to develop fish farming in ponds.vi) Arranging training in organized manner and ensuring extension services to fish farmers.

4.2 Methodology of the study

4.2.1 Selection of study area

The present study was confined to survey the rural areas of Burdwan and Birbhum districts of W. B. in respect of implementation of the programme of Fish Farmers Development Agency (Mishra S. 1987). In the selection of districts following considerations weighed most: i) Both the districts are covered with water areas constituting half of the total inland water resources. ii) There is a heavy concentration of tanks and ponds in both the districts. iii) Both the districts are considered as having one homogeneous agro-climatic zone in view of the broad similarities of soils, climate and other features. Since they are also neighboring districts a suitable comparison can easily be made. iv) In both the districts, the FFDA programmes are being implemented in full fledged form by the Government authority. v) Data from both the districts can be obtained because of my personal knowledge about the two districts.

4.2.2 Selection of sample

Keeping in view the time factor, limited fund and limited ability it was not possible to collect data from all the recorded fish farmers of the two districts. At first 5 blocks from each district have been purposefully selected. Then 10 recorded fish farmers from each block have been selected purposefully. Thus 50 fish

farmers from each district have been selected for interview. For comparative analysis of data each farmer was taken as the unit. For this study data have been collected on different aspects of the programme such as farmers' income, water area, finance, total production, product price, cost of production, profit, duration of training period etc. The data have been collected by personal interview method through a questionnaire. Thus the collected data are entirely primary in nature.

4.2.3 Location map of the study area

The state of West Bengal lies between latitude $21^0 38^/$ to $27^0 10^/$ North and longitude $85^0 38^/$ to $89^0 50^/$ East. The district Burdwan lies between $22^0 56^/$ and $25^0 53^/$ North latitude and $86^0 48^/$ and $88^0 25^/$ East longitude. The district Birbhum lies between $23^0 32^/ 30^{//}$ and $24^0 35^/ 00^{//}$ North Latitudes and $88^0 01^/ 40^{//}$ and $87^0 05^/ 25^{//}$ East Longitudes shown in figure-1.

5. Fisheries in India

Indian fisheries can broadly be divided into two categories: i) Inland fisheries & ii) Marine fisheries. Further Inland fisheries can be classified into two types: i) Capture & ii) Culture. Capture fisheries consist of rivers, lakes canals etc. where farmers do not cultivate fishes. Natural breeding process is the common phenomenon there. On the other hand, culture fisheries consist of ponds, tanks, swamps, marshes etc. In this case, farmers have to sow fish seeds, nurse it and send it to proper size before harvesting. India is the third largest producer of fish in the world and the second in inland fish production. Indian fishing resources comprising of 2 million sq.km.of EEZ for deep sea fishing, 7,520 km. of coast line, 29,000 km. of Rivers, 1.7 million Ha. of reservoirs, 1 million Ha. of brackish water and .8 million Ha. of ponds, lakes and tanks for inland and marine fish production (Giriappa S. (ed) 1994) . About 14 million fishermen draw their livelihood from fishery. During the period 1981 to 2002 the contribution of fishery to GDP has increased from Rs.1230 crores to Rs.32060 crores. The fish production increased from 0.7 million tons in1951 to 6.8 million tons in 2006.

5.1 Fisheries in West Bengal

West Bengal has a vast water resource potentiality. By utilizing these water resources there is a huge prospect of pisciculture (Chakraborty S. K.1991). These resources can be divided into two categories: i) Inland water resources and ii) Marine water resources. Inland resources constitute ponds, rivers, marshy lands, canals, reservoirs etc. Water Resources of West Bengal shown in figure-2.

It should be noted that tanks/ponds occupy the major share i.e. 46.70% of total inland water resources. But out of 2, 76,202 Ha. area under ponds and tanks only 2, 20,000 Ha. i.e. 79.65% are presently used for pisciculture which means 20.35% remains unused. Moreover, out of 5, 91,476.71 Ha. total inland water resource only 2.87000 Ha. water area is brought under pisciculture i.e. 48.56% are presently used and 51.44% remains unused. These unused water resources can be brought under pisciculture through proper utilization.

In West Bengal marine fishery has a substantial share amounting to a coast line of 158 km. inshore area up to 10 fathoms depth is 770 sq. km. (Mamoria C.B. 1979), offshore area (10-40) fathoms depth is 1813 sq. km. and a continental shelf up to 100 Fathom is 17,049 sq.km. Out of 19 districts of West Bengal only two districts East- Midnapur and South 24-Parganas are coastal. West Bengal is on the top of the list in fish production in the country. With the passage of time, more and more people are getting themselves involved in fishery. As fish constitutes the staple food of the people efforts are being made to augment fish production.

From the period 1986 to 2000, the total fish production increased from 424000 tons to 1045,000 tons (i.e. 2.46 times). At the same period the inland fish production increased 2.25 times and marine fish production increased 4.50 times. In the year 1986, the share of inland and marine fisheries to total fish production were 91% and 9% respectively. But in the year 2000, the share of inland and marine fisheries to total fish production are 83% and 17% respectively. Thus we see that during the period 1986 to 2000, the share of inland fish to total production declined (from 91% in 1986 to 83% in 2000) and the share of marine fisheries increased (from 9% in 1986 to 17% in 2000).

Not only in fish production but also in the demand for fish West Bengal is the highest in the country. The domestic demand for fish in West Bengal is high because almost all the people of West Bengal are fish-eating. But the state has a higher demand for fish than its production of fish i.e. this state has a deficit in fish supply. To meet this gap the state West Bengal has to import fish from other states like Andhra Pradesh, Tamil Nadu etc. At the same time various efforts have been made to augment fish production to bridge this gap.

5.2 Fisheries in Burdwan district

The district of Burdwan is mainly an agricultural district though it is also well advanced in industrial production. It is called the ‘granary’ of West Bengal. The district is filled with well fertile productive land. Not only that, the district is also well endowed with a large number of water bodies in the form of rivers, ditches, canals, marshy lands, ponds, tanks etc. The principal rivers are Ajoy, Damodar and Kunur etc. There is a good prospect of pisciculture by utilizing these water resources. The distribution of total water resources in Burdwan district (i.e. 66480.82 Ha.) is shown in figure-3.

Though the district has huge water resources, during the period 1982-1998 only 50% of this water area was brought under scientific pisciculture. In the year 1999, the district’s total fish production was 55,500 metric tons while demand in that year was 65,000 metric tons. Thus there was a deficit of 9,500 metric tons. To meet this demand the district had to import fish from neighboring states. The district will be self-sufficient in fish production if the unused 50% water resources are brought under pisciculture.

5.3 Fisheries in Birbhum district

The district of Birbhum is a part of Rarh area. The district is well-drained by a number of rivers and rivulets. The principal rivers of this district are: Ajoy, Brahmani, Dwarka, Kopai, Mayurakshi etc. But most of the rivers remain dried up during a greater part of the year. Due to this adverse natural factor pisciculture has not made any significant progress in this district. Agriculture is the main occupation of the common people of this district. The main water areas for pisciculture of this district are rivers, tanks, ponds, khals, Bills, baors, reservoirs etc. The distribution of total water resources in Birbhum district (i.e. 45215.81 Ha.) is shown in figure-4.

The figure-4 shows that this district has a large number of water resources. But during the period 1980-1999, only 46% of this water area was brought under pisciculture through FFDA. So there is a huge prospect of pisciculture by utilizing these unused water resources. In the year 1999 total number of fish farmers in this district was 2, 00747 out of which 56.5% were males and 43.5% were females. The total number of fisherman family in this district was 4,975. The average fish production of this district was 21,000 metric tons and the annual demand was 24,000 metric tons. Thus the district had a deficit (3000 mt) in fish production. To meet its own demand the district has also to import fish from the neighbouring states.

6. Findings

6.1 Income distribution of sample fish farmers before and after assistance from FFDA

It was observed that 26 farmers in Burdwan district & 32 farmers in Birbhum district have pisciculture as the main occupation while others have pisciculture as a subsidiary occupation. Their basic occupations are agriculture, business and service and have various types of incomes from those occupations. But as income generation scheme only income from fishery was taken into account i.e. income means income earned from selling fishes. From sample survey we have collected two sets of income data (one showing income before and other showing income after the assistance of FFDA) for each fish farmer. Thus the amount of income reveals the income of the fish farmer before the receipt of assistance of FFDA and the income after the assistance of FFDA. In this regard the income comparison has done in two areas (namely within the district, between the district and the overall change of income) and‘t’ (Gujarati D.N. 2009) test was used for statistical analysis. Now the various types of incomes distribution of fish farmers of the two districts are shown in terms of four tables.

From table- 1 it is clear in both the districts the average income of most of the fish farmers (i.e. 89 out of 100 fish farmers of the two districts taken together) has monthly income before assistance below Rs. 4000 i.e. they are basically come from poor family income group

i) From the field survey we get that the per capita availability of fish in Burdwan district is 24 kg. per head per year while in Birbhum district it is 23.5 kg. per head per year. Now the world’s per capita availability of fish is 11.5 kg. per head per year and for developed countries it is 25 kg. per head per year. But India has a low per capita availability of 3.5 kg. per head per year only. Thus we see that the fishermen have a standard level of per capita fish consumption. The point is very important to reduce mal-nutrition (which is a common phenomenon for the country) by means of intensive pisciculture. But India has a poor per capita

availability of fish of only 3.5 kg per head per year. Thus we see that the per capita availability of fish for these 100 farmers' families of these two districts are much higher than that of India and world's average and even equal to the standard of the developed countries.

ii) It was found that the average monthly income of fish farmers before the assistance of FFDA in Burdwan district was Rs. 2680 and in Birbhum district it was Rs. 2045. But after the assistance of FFDA the average monthly incomes of the fish farmers of the two districts increased to Rs.3935 and Rs.3721 respectively. Thus we see that the average monthly income of fish farmers of Burdwan district has increased 1.47 times and in case of Birbhum district it has increased 1.8 times. The result indicates that the average income of fish farmers of Burdwan district was higher than the average income of those of Birbhum district in respect of both before and after the assistance of FFDA. However, the rate of increment was higher in Birbhum than that of Burdwan district. Thus we can say that the incomes of the fish farmers have improved due to pisciculture.

iii) Statistical methods were adopted is to judge whether the change of income of the sample fish farmers before and after the assistance of FFDA was significant or not. This has been done in two areas: - a) Change of income within the district and b) Overall change of income of the two districts.

6.2 Change of income within the district

Burdwan district- It is seen that the value of't' = 3.31 is significant at .01 level, meaning thereby that the change income of sample fish farmers of Burdwan district is significant. The gain is in favor of the assistance of FFDA. It may be concluded from the result that there is a positive impact of assistance on fish farming (i.e. the production of fish). It may also be concluded that production has increased significantly in Burdwan district.

Birbhum district-The result indicates that "t" is significant at .01 level. Hence it may be said that in Birbhum district the change of income of fish farmers is significant.

6.3 Overall change of income taking the two districts together

It is seen from the above table that the value of't' is significant at .01 level which indicates that the income of fish farmers before and after assistance differ significantly. The result reveals that the mean income after assistance is significantly greater than that before assistance. It may be concluded from the overall results considering both the districts that the impact of assistance on fish production is significant.

The finding of these results was that the assistance of FFDA programme has raised the fish farmer's income undoubtedly in both the districts. Not only that the change of income was statistically significant but also the result revealed that there was a positive impact of FFDA assistance on fish production (i.e. fish

production has significantly increased). Moreover, it was also found that the gain of income of fish farmers of Birbhum district was higher than that of Burdwan district. Thus we can conclude that in case of the implementation of the programme of FFDA the district Burdwan has more successful achievements than the district of Birbhum.

7 Suggestions

7.1 General suggestions

i) In pisciculture, fishermen are not only directly employed in fishing but also some other alternative occupations like net making, marketing of fish seed and fishery product , transport, boat making etc. many rural people earn income. Since fish is a perishable commodity proper marketing channels should be established. Hence to reduce pressure from agriculture pisciculture may be alternative occupations for generating income and employment for a large number of poor people. ii) In Burdwan district there are some open caste pits (OCP) in Ranigang coal belt and in Birbhum district also such pits are available at Khoirasole block, calamines at Md.Bazar block. Fish production may increase by utilizing these water resources for pisciculture purposes.iii) The urban waste (i.e. garbage) may be **recycled** as fish feed (to those ponds and water areas lying near the towns) to raise fish production and to prevent the environmental pollution in those areas. v) To make financial support for the poor fishermen Bank should grant loan on a long-term basis and at a low rate of interest in proper amount and in proper time.vi) the selection of actual beneficiary is very much essential and it should be made on the basis of need and neutrally not in politically. vii) Since fish is a perishable commodity storage facilities should be provided such that the fishermen are not forced to sell their product at a lower price. Prices of organic manures and fish seeds should be kept as low as possible or the Government should give more subsidies in the case of chemical fertilizers so that the poor fish farmers can buy them. viii) For welfare measures of the rural poor fishermen some Group and Personal Insurance Schemes, Old- Age Pension Schemes should be taken and the Fishery Dept. should issue **"Identity Card"** to each fisherman. ix) Since both the districts are agricultural based we should interlink agriculture with pisciculture shown in **figure-5**. Along with pisciculture in ponds other allied culture can be inter-linked in composite farming. The concept of composite farming e.g. in the pond- there are pisciculture and on one side of the pond mulberry trees can be cultivated for the development of sericulture industry-from there silk industry can be grown. Thus the final products (i.e. silk yarn and silk cloth) come to the market and their waste materials are drained off to the pond and used as fish feed. In the same pattern on another side of the pond animal husbandry can be practiced (e.g. poultry, duccary and piggery). Their waste can be used as a valuable manure for fish feed and the residual can be utilized for agricultural production. The excreta of the animal husbandry can also be used in the bio-gas plant for fuel and light. The products of animal husbandry e.g. milk, meat and egg come to the market directly. On another side of the pond some fruit plants such as papine, guava, mango etc. can be cultivated by using the excess manure of animal husbandry and the products can be sold in the market.

x*) Composite fish culture:* Stocking of various species should be in a certain proportion such that various types of fishes live in various layers and eat the entire food organism (so called Polyculture or Composite Fish Culture). Stocking is an important factor to raise fish production. On an average the survibility of stocking is 80% (Jhingran V.G. 1991). This means that 20% of stocking is lost for various reasons such as improper handling, netting and also eaten by preratory animals like snakes, frogs etc. The main species cultured in India are Rahu, Catla, Mrigel, Silver Carp (S.C.), Grass Carp (G.C.), Cyprinus Carpio (Cy, Ca.)

and Bata etc. In polyculture (where various fishes are cultured simultaneously) (Agarwal S.C. 1990) system all these species are cultured in certain ratios. It is found that all of these species do not generally live in the same layer. In mixed (or polyculture or composite culture) culture all these fishes are cultured in such a way that all layer's feed are used. If we divide the whole layer into 3 parts i.e. upper, middle and lower layers, then Cattla and S.C live in the upper layer, Rahu and G.C. live in the middle layer and Mrigel and Cy. Ca. live in the lower layer. It is also to be noted that these two species in the same layer are not competitors of each other. In their feed habit one eats waste weeds and the other eats green weeds. Hence in polyculture all the pond's feed are used scientifically and economically. The production of Big head and Big head African giant hybrid magur are totally banned because their food habits are too much and hamper the foods of other common species. Suppose 1000 fish seed is cultivated in the pond. Then the stocking ratios for various fishes are Rahu: Catla: Mrigel: S.C.: G.C.: Cy.Car $= 3:1:1.5:1.5:1:2$ Thus the number of seeds are, Rahu = 300, Catla = 100, Mrigel = 150, S.C = 150, G.C. = 100, Cy. Ca. = 200. Now the survibility rate is 80%.Thus the number of produced matured fishes are Rahu = 240, Catla = 80, Mrigel = 120, S.C. = 120, G.C. = 80, Cy.Car. = 160. Fishes are cultivated for 9-12 months. The culture period may extend up to 18 months with partial harvesting between. Moreover, the general annual growth of these fishes are, Rahu = 1kg, Catla 1.5 kg. Mrigel 0.75kg, SC. = 0.8 kg, G.C. = 1.5 kg, Cy. Car. = 0.8 kg. The fish farmers collect fish seeds from private traders or from Government fish farm.

xi) Since training is a necessary ingredient to raise fish production the Government has initiated some special training programmes for fish farmers. Moreover to motivate the poor fish farmers some amount of remuneration or stipend is paid to the participant during training. The amount of remuneration depends upon the kind of training, place of training organization and duration of the training programmes conducted by the FFDA. To attend the district level training programmes for the farmers of distant villages, traveling allowances are also paid.

xii) It is very essential to use **mahua** cake because it has dual roles in pisciculture. It firstly acts as a pesticide but later it acts as organic manure and produces a desired quantity of fish food organism for the baby fishes. The presence of 'Saponin' in mahua cake kills the pre-ratory animals / fishes of the pond. This poisonous effect continues about 10-15 days and after that it acts as manure. On the other hand, the use of pesticides has a negative long-term effect to **ecological** balance. So the pesticides are not generally used though they are cheaper. The mahua cake should be applied at the rate of 333.33kg/ Yr. / bigha.

7.2 Limitations of the study

The following are the limitations of the study: i) Regarding the change in the level of income before and after the assistance of FFDA, the statements of the fish farmers have been taken into consideration on good faith. ii) Due to limited time, ability and resource constraints, data have been collected from a small number of fish farmers of the two districts and results are assumed to be the representative for the district as a whole. Iii) Due to difficulties in getting responses from the sample fish farmers sometimes we had to rely on the different FEOs' opinions and also on different official records on good faith. iv) The observations made on the basis of collected data are obviously particularistic in nature in so far as these data relate to micro-study like the present one (i.e. only 100 fish farmers from the two districts were taken into consideration). Micro-studies do not attempt to build general theories but the utility of this type of study is that large number micro-studies may, in course of time, be helpful in constructing meaningful generalizations. Moreover, it is an explorative study which seeks to explore the conditions of fish farmers

before and after the assistance of FFDA programme. A much larger study may be undertaken to vindicate the results obtained from this explorative study.

8. Conclusion

The study indicates that the introduction of the programme of FFDA had a clear positive impact on the rural economy through employment and income generation and also raising the standard of living and socio-economic performances of the rural community of the two districts. It is environmentally viable, sustainable and eco-friendly in nature. So for sustainable use of the scarce water resources it is very essential in the present context. Unemployment is a curse for the society today and pressure of population on agricultural sector is rising day by day. Thus fish farming may be an alternative occupation for those unemployed people and undoubtedly generate income in a viable method. Therefore it is recommended that the present programme should be further spread in the rural areas by means of proper planning, adequate supervision, effective implementation and better monitoring in a sustainable manner.

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Tables and Figures:

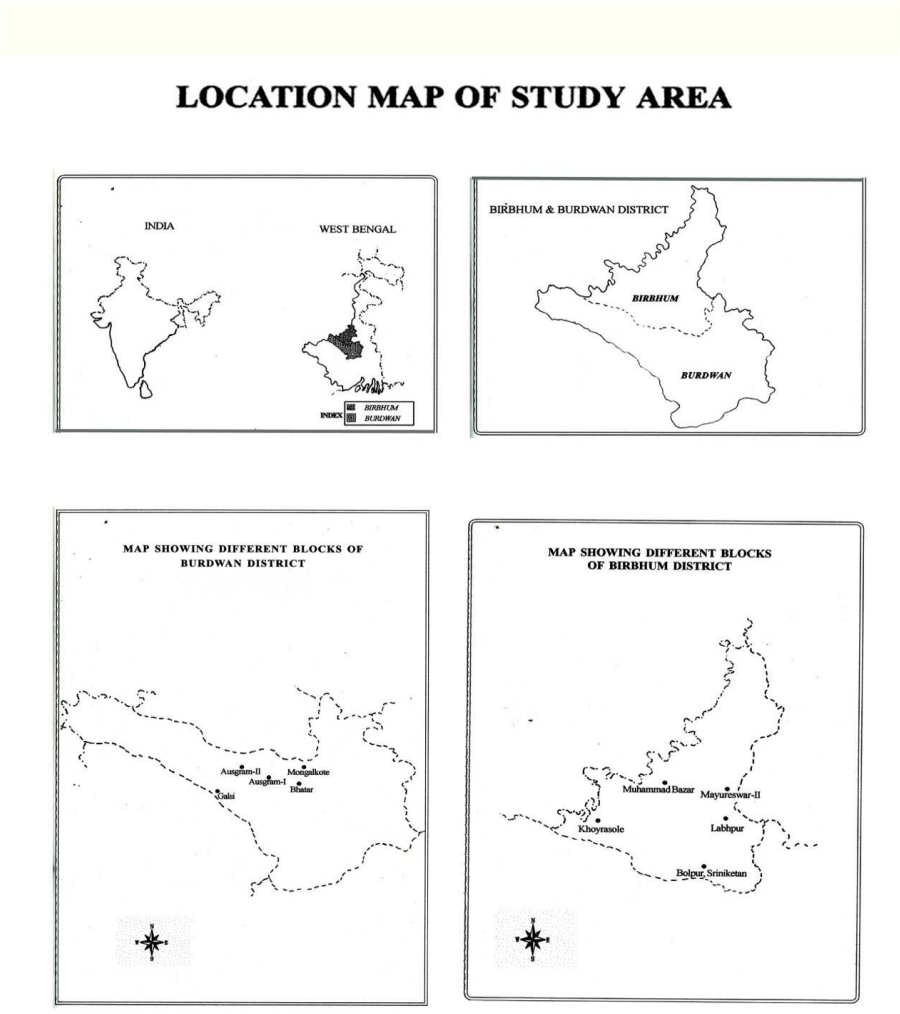
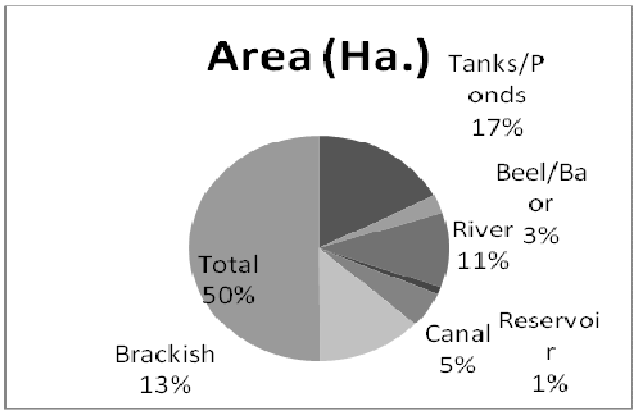


Figure-1

Inland

Inland	Area (Ha.)
Tanks/Ponds	2,76,201.90
Beel/Baor	41,781.65
River	1,72,586.36
Reservoir	16,738.80
Canal	80,085.71
Brackish	2,10,000.00
Total	8,01,477.42



Marine-

Depth (in Mtrs)	Area (Sq. Km.)
0-20	13,380
20-50	2,690
50-100	3,040
100-200	8,210
200-300	4,000
Total	3,15,320

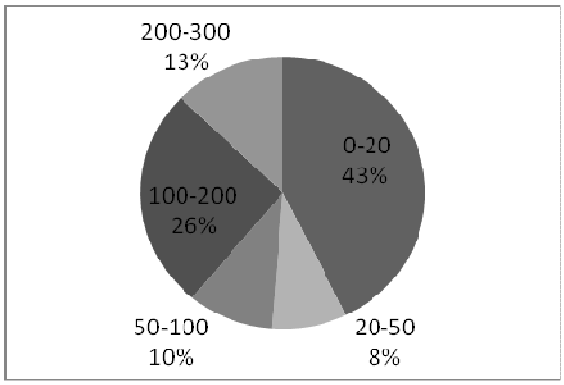
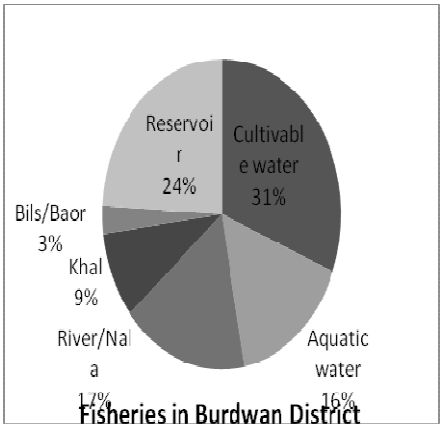


Figure-2



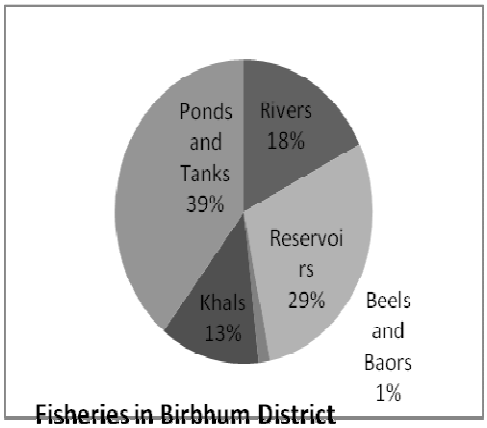


Figure-3

Figure-4

Table -1 Change of income distribution of Burdwan.

Farmer's Monthly Income (In Rs.)	No. of fish farmers of Burdwan district		
	Before assistance	After assistance	Total
Up to 1000	5	1	6
1001 – 2000	19	3	22
2001-3000	11	8	19
3001 – 4000	8	18	26
4001-5000	4	7	11
5001-6000	1	7	8
Above 6000	2	6	8
Total	50	50	100

Table -2 Change of income distribution of Birbhum district

Farmer's Monthly Income (In Rs.)	No. of fish farmers of Birbhum district		
	Before assistance	After assistance	Total
Up to 1000	20	1	21
1001 – 2000	15	19	34
2001-3000	3	12	15
3001 – 4000	8	5	13
4001-5000	0	2	2
5001-6000	2	7	9
Above 6000	2	4	6
Total	50	50	100

Table--3 Classification of sample fish farmers according to their monthly incomes after the assistance

Farmer's Monthly Income (In Rs.)	No. of fish farmers		
	Burdwan (f)	Birbhum (j)	Total =f + j
Up to 1000	5	20	25
1001 – 2000	19	15	34
2001-3000	11	3	14
3001 – 4000	8	8	16
4001-5000	4	0	4
5001-6000	1	2	3
Above 6000	2	2	4
Total	50	50	100

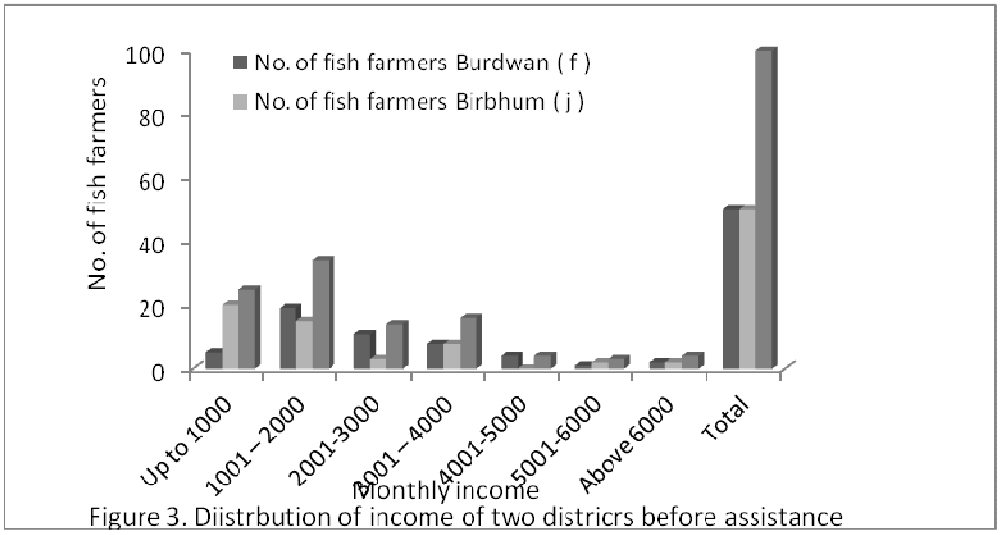


Figure 3. Diistrbution of income of two districrs before assistance

Table- 4 Classification of sample fish farmers according to their monthly incomes after the assistance

Monthly Income (In Rs.)	No. of fish farmers		
	Burdwan (f)	Birbhum (j)	Total = f + j
Up to 1000	1	1	2
1001 – 2000	3	19	22
2001-3000	8	12	20
3001 – 4000	18	5	23
4001-5000	7	2	9
5001-6000	7	7	14
Above 6000	6	4	10
Total	50	50	100

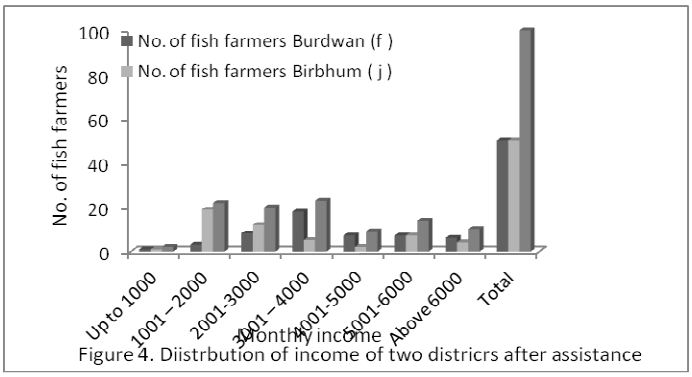
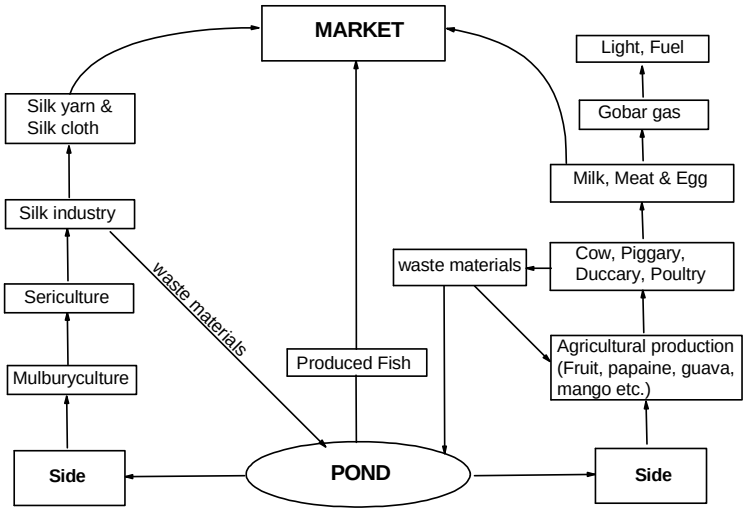


Figure 4. Diistrbution of income of two districrs after assistance

Source: All tables data sources are computed from field survey.



Circular flow of pisciculture and other allied culture

Figure: 5