CHAPTER – I

INTRODUCTION

Background

Fisheries occupy a prominent place in the economy of the world as the fish is one of foods of vast majority of people. Fish not only provides proteins but also contains fat, inorganic substances and vitamins. Fish protein is easily digestible and it contains considerable proportion of soluble proteins. It is more valuable for human especially for a population whose staple food is rice. Besides, fisheries help in generating employment and revenue and raising nutritional level.

Now the world fish production has reached to 140475 thousand tones in 2004 from 19755 thousand tones in 1950. Nearly 76.45 per cent of it is contributed by marine sources and the remaining from inland sources like reservoirs, tanks and ponds, lakes and rivers etc. Indian fisheries also consist of marine and inland fisheries. The marine fisheries include three sectors, viz., traditional, modern and ultra modern. The traditional sector accounts for over 67.00 per cent followed by modern (32.00 %) and ultra modern sector (1.00%). The inland fisheries are also consisted of three sections viz., capture, capture-cum-culture and culture fisheries. Capture fisheries is mainly composed of riverine fisheries. A capture-cum-culture fishery is of reservoir & lake fisheries and culture fisheries of fresh water fisheries in ponds and tanks and brackish water.

The share of India to World's total fish production is just 4.33 per cent and 2.78 per cent and 9.38 per cent to world's marine and inland fish production respectively (table No. 1.1). Indian fisheries are an important component of the world fisheries as well as a very important place in the socio-economic development of the country for three reasons. Firstly, it is the source of livelihood to over 14.48 million people largely belonged to socially and economically poor group. Secondly, fishery products are a high quality protein subsidiary food, which is at reasonable prices. Thirdly, fisheries

have large export potential. The country have a long coastline of 8118 kilometres, 2.2 million square kilometres of Exclusive Economic Zone (EEZ) and covering approx. 0.53 million square kilometers of continental shelf area around the Andaman and Nicobar Islands, which is highly suitable for fisheries.

Table No. 1.1: Contribution of India to World Fish Production

('000 tonnes)

Year	World Production			Contribution of India			In % terms		
	Total	Marine	Inland	Total	Marine	Inland	Total	Marine	Inland
1950	19755	17521	2234	730	520	210	3.70	2.97	9.40
1955	28641	24968	3673	839	596	243	2.93	2.39	6.62
1960	36691	32665	4026	1162	880	282	3.17	2.69	7.00
1965	51229	46141	5088	1331	824	507	2.60	1.79	9.96
1970	67280	61277	6003	1759	1086	673	2.61	1.77	11.21
1975	68341	61481	6860	2267	1482	785	3.32	2.41	11.44
1980	75586	67953	7633	2446	1555	891	3.24	2.29	11.67
1985	91553	80888	10665	2839	1747	1092	3.10	2.16	10.24
1991	98261	84664	13597	4045	2390	1655	4.12	2.82	12.17
1995	116411	96220	20191	4951	2754	2197	4.25	2.86	10.88
2000	130433	101831	28602	5689	2852	2837	4.36	2.80	9.92
2001	131002	101550	29452	5897	2930	2967	4.50	2.89	10.07
2002	133651	102953	30698	5924	3107	2817	4.43	3.02	9.18
2003	133187	101828	31359	6025	3107	2918	4.52	3.05	9.31
2004	140475	107390	33085	6088	2986	3102	4.33	2.78	9.38

Source: Handbook of Fisheries Statistics (2006), MoAHD&F, GoI

The data presented in table 1.2 revealed that contribution of fisheries sector to gross domestic product has been increased from the gross value of Rs. 245 crores in 1970-71 to Rs. 17026 crores in 2003-04. In percentage terms it raised to 4.70 in 2003-04 from 1.46 in 1970-71. It is important to note here that with the inception of five year plans, Government of India as well as the State Governments has substantially increased the outlays for fisheries development under different plans. The data shown in table No. 1.3 revealed that the outlays have increased from Rs. 5.13 crores in 1st Five Year Plan to Rs. 2126.40 crores in 10th Five Year Plan. Moreover, the data on plan wise percentage of utilization over the plan outlays were ranging between 54.19 per cent in first plan to 92.78 per cent in ninth Plan. In fact the expenditure on some schemes is shared equally/partially between the Central and State Governments whereas some schemes/programmes are implemented by the states as centrally sponsored schemes and some are states' owned schemes.

Table No. 1.2: Contribution of Fisheries Sector to Gross Domestic Product (Current Prices 2003-04)

(Rs. Crores)

Year	Total GDP	GDP From Agriculture, Forestry & Fishing	GDP From Fisheries	GDP From Fisheries as % of	
				Total GDP	GDP From Agriculture, Forestry & Fishing
1970-71	39708	16821	245	0.62	1.46
1980-81	122427	42466	921	0.75	2.17
1990-91	475604	135162	4556	0.96	3.37
1991-92	551552	162317	5300	0.96	3.27
1992-93	627913	184536	6649	1.06	3.60
1993-94	781345	241967	8679	1.11	3.59
1994-95	917058	278773	10602	1.16	3.80
1995-96	1073271	303102	11866	1.11	3.91
1996-97	1243547	362606	14083	1.13	3.88
1997-98	1390148	387008	17269	1.24	4.46
1998-99	1598127	442494	18156	1.14	4.10
1999-00	1761838	461964	20017	1.14	4.33
2000-01	1902998	468480	22535	1.18	4.81
2001-02	2081474	510568	24843	1.19	4.87
2002-03	2254888	507863	27093	1.20	5.33
2003-04	2519785	575283	27026	1.07	4.70

Table No. 1.3: Outlays and Expenditure for Fisheries Development over Plans

Plan	Outlay/ Expenditure	Central Sector Scheme	Centrally Sponsored Schemes	State Schemes	Total	% of utilization Over total Outlays
First Plan	Outlay	1.00	@	4.13	5.13	
	Exp.	0.38	@	2.40	2.78	54.19
Second Plan	Outlay	3.73	@	8.53	12.26	
	Exp.	1.80	@	7.26	9.06	73.89
Third Plan	Outlay	6.72	@	21.55	28.27	
	Exp.	3.03	@	20.29	23.32	82.49
Fourth Plan	Outlay	28.00	6.00	48.68	82.68	
	Exp.	8.11	5.17	40.83	54.11	65.44
Fifth Plan	Outlay	51.05	17.00	83.19	151.24	
	Exp.	39.93	4.07	71.11	115.11	76.11
Sixth Plan	Outlay	137.10	36.62	197.42	371.14	
	Exp.	75.54	28.80	182.61	286.95	77.31
Seventh Plan	Outlay	156.58	60.75	329.19	546.52	
	Exp.	116.93	53.26	307.40	477.59	87.38
Eighth Plan	Outlay	139.00	300.00	766.39	1205.39	
	Exp.	161.01	268.02	689.43	1118.46	92.78
Ninth Plan	Outlay	240.00	560.00	1269.78	2069.78	
	Exp.	124.97	273.18	1016.26	1414.41	68.33
Tenth Plan	Outlay	417.36	388.50	1320.54	2126.40	
	Exp.(2002-07)	223.25	397.17	N.A	----------	-----

@ Figures given under Central Sector include those of Centrally Sponsored Schemes
Note: Figures for Seventh Plan include the figures for Fishery Survey of India and Trawler development Fund which was transferred to Ministry of Food Processing Industries.

Till the 9th Plan, various schemes were in operation for the overall development of fishery sector. In order to have a comprehensive and focused approach, the schemes

with new and existing modified components were brought under two umbrella during the 10th Plan i.e.;

- *Development of Inland Fisheries and Aquaculture*
- *Development of Marine Fisheries, Infrastructure and Post-Harvest Operations.*

The inland macro scheme cover all aspects related to inland fisheries such as brakish water, ponds, reservoirs , canals, use of waterlogged areas/alkaline and saline soils etc. for development of fisheries. The main objectives of the scheme envisages to encourage leasing of water area, expand aquaculture by construction of new ponds, create a cadre of trained fisheries, to popularize fish farming, to utilize vast brackish water land for fish culture, to provide suitable technology package for promotion of cold water fisheries, to utilize saline/alkaline soil for raising commercial crops of fish, increase fish production in capture as well as to involve Fish Farming Development Agencies (FFDAs) fully for development and delivery of sustainable aquaculture throughout the country. The centrally sponsored scheme for the 10th Plan renamed as **DEVELOPMENT OF INLAND FISHERIES AND AQUACULTURE** had the following components, which has been continued in 11th Plan also:

i. *Development of Freshwater Aquaculture*
ii. *Development of Brackish water Aquaculture*
iii. *Development of Coldwater Fisheries and Aquaculture in the Hilly Regions.*
iv. *Development of Water-logged Areas into Aquaculture Estates*
v. *Utilization of Inland Saline/Alkaline Soils for Aquaculture*
vi. *Inland Capture Fisheries (Reservoirs/Rivers, etc.)*

As in the case of Inland fisheries and aquaculture, the existing components as well as new components especially to propagate deep sea fisheries were brought under the umbrella scheme for Development of Marine Fisheries, which has the following components:

i. *Development of Coastal Fisheries*
ii. *Development of Deep Sea Fishing*
iii. *Development of Infrastructure Facilities*
iv. *Development of Post-harvest Infrastructure*

This way the government has initiated many development projects for fisheries and aquaculture during the plans.

Review of Literature

Fishing or Fisheries is an ancient activity of mankind. It has developed throughout World the centuries till today. Almost all countries and World institutions has fishery development programmes. In 1981 FAO asserted that a resolution has occurred in the potential of fisheries to contribute to a new international order --- its intention to take a lead – by helping the developing countries to secure their rightful place in World fisheries. Its gradual development has opened up new dimension of research particularly relevant to the policy makers and other stakeholders.

In India, the process of transformation of the fishery sector from subsistence to commercial status and subsequently the growing scope of linking with the global market has opened up interests. Fishery is a key allied sector of agriculture providing income, employment and the much-needed nutritional security. Since natural fishing in coastal waters has reached maximum sustainable yield, further growth in fishery has to come through commercial aquaculture. Technological progress in commercial aquaculture has substantially diminished the level of production risk, compared to traditional fishery *(Kokata & Upare, 2005).* The contributions in production and marketing economics as well as the resource economics have emerged as an important branch of applied economic research in 1980s and onwards. Recent research relating to socio-economic nature revealed that the income, price and supply elasticities vary substantially across fish species and it is wrong to group them together in any policy analysis *(Kumar, 2004).* Impressive growth in inland fish production in West Bengal is attributed to higher profitability (Rs. 22227/ha) by *Kar & Kumar (2004). Mishra (1997)* analyses fish production and marketing structure in community ponds of Chhattisgarh and found that the yield per ha was 1538/kg for medium farm size, which was the highest and sold at a price of Rs. 23.8/kg. The marketed quantity was equally distributed between local and outside markets. In Punjab producer's share in consumer rupee varied between 38.00 to 45.00 per cent of fresh fish *(Godara, et. al, 2006). Singh & Pandey (2004)* analyze marketing efficiency of fish in Uttar Pradesh and observe that the producer's share ranged from 28.00 to 38.00 per cent. The Fisher's share was 44.00 per cent when the fish was sold through co-operatives in reservoirs of Himachal Pradesh indicating the

high marketing cost of fish from remote areas and the relative absence of the competitive market. *Kant et. al (2000)* in a study of Azamgarh district (UP) found that the CB ratio was strong positive indicating 1:3.14 in production of fish per acre and thus concluded that fishery enterprise is most profitable proposition. An Evaluative Study of *NABARD (2000)* in Punjab on Inland fisheries development indicate that net income per acre of fish pond was Rs. 26141 as compared to Rs. 10,100 from the competing crops. The BCR worked out to 1.47:1, 1.86:1 and 1.73:1 for small, large and average ponds respectively. The study suggests timely and adequate supply of quality fingerlings, encouragement to private hatcheries, ensure competitive price for fish production, fixation of loan as per the requirement of the fish farmers vis-à-vis size of pond, etc. *Singh & Singh (2004)* in their study on **"Stocking Density and Species mix in Composite Fish Culture in North Bihar: A Techno Economic Analysis**" found that the stocking rate in fish production is much higher in North Bihar. The reason for high stocking rate may be traced from the use of small size of fish seeds. Inadequate supply of quality seeds and unawareness about scientific modern method of fish production emerged as two main reasons for low level of adoption of modern of fish production technologies in North Bihar. As a result the indigenous species of fish are still preferred for stocking in North Bihar.

In fact, very few literatures are available on the potentialities, prospects and problems of fish production, which have socio-economic implications particularly in Bihar. Thus, the present investigation was proposed by this Centre and perhaps keeping its relevance in the state's economy the Ministry of Agriculture, Government of India has assigned the study to the Centre. Accordingly the Centre has taken up this study entitled **Problems and Prospects of Fish Farming in Bihar and Jharkhand.**

Objectives of the Study

The main objectives of the study are:

i. *To estimate the cost of cultivation and production of fish.*
ii. *To identify the various channels and system of fish marketing.*
iii. *To identify the existing constraints of fish farming in the area.*
iv. *To examine the future prospects of fish farming in the area.*
v. *To suggest policy measures for the development of fish farming in the area.*

Methodology

This study has been conducted in both the states viz., Bihar & Jharkhand. The data was collected from both the sources viz., primary and secondary. The primary data was collected with the help of duly structured fish farmers' schedule. The selection of respondent fish farmer was made through a multi-stage stratified sampling method. At the first stage, the selection of one district was made from each of the agro-climatic sub-zones of both the states on the basis of highest number of total ponds (government jalkars and private ponds) in the district among the districts of respective sub-zones. Accordingly, Madhubani (5183 ponds), Purnea (2864 ponds) and Bhagalpur (1423 ponds) districts were selected from North Bihar Plains, North East Plains and South Bihar Plains respectively in Bihar and Dumka (4704 ponds) and West Singhbhum (4474 ponds) districts from Chhotanagpur North Eastern Hills and Plateau and Chhotanagpur South Hills Plateau respectively in Jharkhand. Similarly, one anchal from each of the sample districts were selected. Benipatti, Dagarua and Sahkund anchals were selected from Madhubani, Purnea and Bhagalpur districts respectively in Bihar ad Sarayahat and Jagarnathpur anchal from Dumka and West Singhbhum districts respectively in Jharkhand .Subsequently lists of jalkars of the sample anchals along with the names of the settles of those jalkars were obtained from the office of District Fisheries Officer (DFO) of the respective sample districts and duly classified the fish farming households into three popular categories viz., small (up to 0.5 ha), medium (0.5 to 2 ha) and large (above 2 ha). A sample of 150 fish farming households were selected randomly covering both the states for in- depth investigation. The secondary data was collected

from the Directorate of Fisheries and its district level offices of the respective states and from different published and unpublished sources. The details are in table 1.4.

Table No. 1.4: Distribution of Sample Fish Farming Households

State	Agro-Climatic Zone	Districts	Anchals	Size of Fish Farming Households			
				Small	Medium	Large	Total
A. Bihar	i. North-Bihar Plains	Madhubani	Benipatti	08	13	09	30
	ii. North-East Plains	Purnea	Dagarua	08	12	10	30
	iii. South-Bihar Plains	Bhagalpur	Sahkund	14	12	04	30
			Total-	**30 (33.33)**	**37 (41.12)**	**23 (25.55)**	**90 (100.00)**
B. Jharkhand	i. Chotanagpur North-Eastern- Hills & Plateau	Dumka	Saraiyahat	09	12	09	30
	ii. Chotanagpur South-Hills- Plateau	West-Singhbhum	Jagnnathpur	16	13	01	30
			Total-	**25 (41.67)**	**25 (41.67)**	**10 (16.66)**	**60 (100.00)**
All			**Grand Total (A+B) -**	**55 (36.67)**	**62 (41.33)**	**33 (22.00)**	**150 (100.00)**

In parenthesis percentage figures are shown

Reference Year

The reference year of the primary data collection is 2007-08. However, the secondary data are pertained to the latest one available in the offices of the Department of Fisheries of respective sample districts.

CHAPTER – II

FISHERIES IN BIHAR AND JHARKHAND

Part – I: Bihar

Introduction

After the bifurcation of erstwhile Bihar state into two states viz., (i) Bihar and (ii) Jharkhand, a sizeable number of medium and large reservoirs as well as substantial number of ponds and tanks of different sizes have come under the Jharkhand State. In fact, Bihar is one of the few states with large inland fisheries and aquaculture resources. It has large untapped water resources for fisheries. Even then it depends on states like Andhra Pradesh for the supply of about half of its annual fish demand. On the other hand till 1970, Bihar used to supply fresh fish in neighbouring states. It is most surprising and unfortunate that around 1990, the inflow of fishes from other states started gravitating into the fish markets of Bihar. Despite the fact that North Bihar has vast potential for production and is famous as a major fish producing area, unfortunately people of the state have become dependent on imported fish from Andhra Pradesh. The fish production initiatives in Bihar have now come to a stage at which one now experiences a dearth of locally produced fishes. Now there is an acute scarcity of locally grown fish even in the remotest villages of Bihar.

Fish Consumption Pattern

The annual consumption of fish within the state is nearly 4.5 lakh tones, against the present annual production of around 2.25 to 2.50 lakh tones. The NSSO (1999-2000) data on consumption pattern of fish in the state indicate that 455 households/thousand in rural and 300 households/thousand in urban areas were non- vegetarian against the all India average of 336 households/thousand and 285 households/thousands respectively. The per capita/annum consumption of fish was estimated at 54.75 kg and 36.50 kg in rural and urban areas respectively whereas that of 76.65 kg and 80.30 kg at

all India level. It revealed that the state has the larger the number of non-vegetarian population than all India averages but have lower the rate of per capita consumption.

Fishery Resources

As regards the fishery resources in the state is concerned, it has 3200 kilometres rivers and canals, 0.60 lakh ha reservoirs, 0.95 lakh ha tanks and ponds, 0.05 lakh has flood plain lakes and derelict water and 1.60 lakh ha total water bodies representing 1.60 per cent, 2.06 per cent, 3.93 per cent, 0.62 per cent and 2.17 per cent respectively of the total of all India's inland fishery resources *(Annexure – I).*

Fishermen Population

Accordingly to the 17th Livestock Census, 2003 the state has the largest fishermen population of about 49.60 lakh, accounts 34.23 per cent of India's fishermen population. Of the total population 28.06 per cent, 25.54 per cent and 46.40 per cent are males, females and children respectively *(Annexure – II).* Since the state has more than one-third of total fishermen population thus, the development of fisheries sector in the state will benefit at large chunk of the fishermen population.

Fishermen Co-operative Societies

Fishermen Co-operative Societies continue to play an important role in fisheries development as well as the development of fishermen. It is mandatory that jalkars are to be settled on determined reserve deposits to the fishermen co-operative societies at the block/anchal level, which are either registered under Bihar Co-operative Societies Act, 1935 or Self-reliant Co-operative Societies Act, 1996. The members of societies will be only from fishermen community. It has now become the law of the state after enactment of **Bihar Jalkar Pravandhan Act, 2006.** The data presented in *(Appendix – III)* revealed that the state has 532 primary societies with the membership of nearly 40,000 fishermen.

Outlay and Expenditure

During 5th Plan period the expenditure for fisheries development was Rs. 213 lakh, accounts for 77.73 per cent over the outlays of 274 lakh and in subsequent plan

periods, the expenditure had increased to Rs. 630 lakh in 6th Plan period, Rs. 1050.73 lakh in 7th Plan, Rs. 725 lakh in 8th Plan periods and 672 lakh in 9th Plan periods. The percentage of expenditures over outlays during different Five Year Plans varied widely ranging from 27.00 per cent in Eighth to 110 per cent in Seventh Five Year Plans. The table 2.1 furnishes the details of expenditure for fisheries under state scheme in Bihar.

Table No. 2.1: Outlay and Expenditure on Fisheries under state sector schemes in Bihar

(Rs. Lakh)

Plan	Outlay	Expenditure	% of Expenditure Over outlay
Fifth Plan	274.00	213.00	77.73
Sixth Plan	696.00	630.39	90.65
Seventh Plan	950.00	1050.73	10.60
Eight Plan	2605.00	725.00	27.83
Ninth Plan	1000.00	672.00	67.20
Tenth Plan	1895.00	NA	--

Source: Handbook of Fisheries 2006, MOA, GOI.

Fish Production

The present annual fish production in the state is around 2.60 lakh tones. It increased substantially from 2.40 lakh tones in 2001-02 to 2.67 lakh tones in 2006-07. However, the growth in production has been adversely affected over the past two years due to deficient rainfall and floods in 2007. The data presented in table No. 2.2 showed the production of fish by species during the year 2000-01 to 2003-04. It revealed that nearly 50.00 per cent of total production is contributed by major carps. To reach self-sufficiency levels in production annual production levels would need to rise from the current 2.60 lakh tones to 4.50 lakh tones. Programmes are being run to increase productivity of developed ponds to 2500 kgs for which fish producers in the state are being sent to Andhra Pradesh for special training programme. To make proper use of water bodies in the state the government is also contemplating the ideas handing over 20 chaurs/mauns under the fisheries department in order to develop them for fish production.

Table No. 2.2: Inland Fish Landings by Species

Sl No	Variety	2000-01	2001-02	2002-03	2003-04
1.	Major Carps (Catla, Rohu, Mrigal & Calbasu)	113087 (49.00)	124641 (49.00)	117506 (49.00)	125625 (49.00)
2.	Minor Carps	50774 (22.00)	55961 (22.00)	52758 (22.00)	56404 (22.00)
3.	Exotic Carps (Common, Silver & Grass Carp)	4616 (2.00)	5087 (2.00)	4796 (2.00)	5128 (2.00)
4.	Murrels (Ophiocephalus Spp.)	16155 (7.00)	17806 (7.00)	16787 (7.00)	17947 (7.00)
5.	Catfishes (Wallagoattu, Pangaslus, bagarius)	2308 (1.00)	2572 (1.02)	2425 (1.02)	2564 (1.00)
6.	Other fresh water fishes	43850 (19.00)	48303 (18.98)	45538 (18.98)	48712 (19.00)
7.	Others	-	-	-	-
8.	**Total**	**230790 (100.00)**	**254370 (100.00)**	**239810 (100.00)**	**256380 (100.00)**

Source: Handbook of Fisheries, MoAHD&F, GOI, 2006.
In parenthesis percentage figures are shown.

Fish Seed Production

The major portion of fish production in the state is from ponds and tanks and of the total ponds and tanks only 30.00 per cent are well managed including the quality seeds, a vital input of the production. At present the average production of fish seed is just around 350 million fry/ annum against the requirement of 600 million fry/annum (table No. 2.3). If we include open water areas of riverine command into culture based fisheries, the additional annual demand would be around 200 million fry.

Table No. 2.3: Fish Seed Production

Year	Production *(In Million fry)*
1994-95	321.16
1995-96	332.21
1996-97	492.00
1997-98	405.49
1998-99	451.39
1999-00	449.11
2000-01	358.57
2001-02	329.95
2002-03	367.99
2003-04	346.11
2007-11 (Estimated)	550.00

Culture Fisheries

The major portion of fish production in Bihar is from ponds and tanks. In fact, the main culture fishery resources lie in over 40 thousand number of ponds and tanks of variable sizes covering a total area of over 68 lakh hectare (table No. 2.4).

Table No. 2.4: District-wise Number of Ponds and Water Area in Bihar

Sl No.	Zones/Districts	Number of Ponds			Water Spread Area (Ha)		
		Govt.	Pvt.	Total	Govt.	Pvt.	Total
	I. North-Bihar Plains						
1.	Darbhanga	1623	2301	3924	3176.52	967.50	4144.02
2.	**Madhubani**	**3430**	**1753**	**5183**	**2051.50**	**1357.00**	**3408.50**
3.	Samastipur	607	157	764	1215.55	170.58	1386.13
4.	Sitamarhi	1354	1582	2936	1430.72	968.00	2398.72
5.	Sheohar	232	105	337	114.00	175.30	0289.30
6.	Muzaffarpur	744	187	931	1473.92	348.18	1822.10
7.	Vaishali	667	438	1105	704.00	268.69	972.69
8.	Saran	908	1300	2208	530.00	1000.00	1530.00
9.	Siwan	630	564	1194	639.92	171.74	811.66
10.	Gopalganj	209	30	239	929.68	68.20	997.88
11.	East Champaran	519	341	860	3622.97	380.57	4003.54
12.	West Champaran	1813	1100	2913	2272.00	2940.00	5212.00
Sub. Total		**12736 (63.02)**	**9858 (55.70)**	**22594 (55.76)**	**18160.78 (40.02)**	**8815.76 (47.98)**	**26976.54 (39.20)**
	II. North-East Plains						
13.	Kishanganj	N.A.	N.A.	N.A.	N.A.	N.A.	358.85
14.	**Purnea**	**691**	**1773**	**2864**	**1308.98**	**2138.87**	**3447.85**
15.	Araria	N.A.	N.A.	634	N.A.	N.A.	390.00
16.	Katihar	212	1445	1657	3722.90	452.99	4175.89
17.	Madhepura	79	357	436	1358.63	150.54	1509.17
18.	Saharsa	81	860	941	411.56	645.57	1057.13
19.	Supaul	147	447	594	335.35	1206.80	1542.15
20.	Khagaria	158	115	273	3068.20	72.00	3140.20
21.	Begusarai	150	80	230	503.00	530.96	1033.96
Sub. Total		**1918 (9.50)**	**5077 (28.68)**	**7629 (18.83)**	**10708.62 (23.60)**	**5197.73 (28.29)**	**16655.20 (24.20)**
	III. South-Bihar Plains						
22.	Patna	739	411	1150	2101.82	74.55	2176.37
23.	Nalanda	225	905	1175	2598.00	868.00	3466.00
24.	Bhojpur	701	174	875	1235.20	107.20	1242.00
25.	Buxar	456	125	581	500.00	75.00	575.00
26.	Rohtas	385	297	682	1150.00	235.00	1385.00
27.	Kaimur	N.A.	N.A.	N.A.	N.A.	N.A.	2469.00
28.	Gaya	1106	N.A.	1106	2175.60	400.00	2575.60
29.	Jehanabad	N.A.	N.A.	275	N.A.	N.A.	520.40
30.	Arwal	N.A.	N.A.	295	N.A.	N.A.	656.06
31.	Nawada	N.A.	N.A.	511	1831.50	1352.50	3184.00
32.	Aurangabad	444	N.A.	444	1187.00	220.00	1407.00
33.	**Bhagalpur**	**771**	**652**	**1423**	**393.36**	**412.00**	**805.36**
34.	Banka	N.A.	N.A.	850	N.A.	N.A.	775.61
35.	Munger	645	167	812	2642.00	200.00	2842.00
36.	Lakhisarai	83	35	118	300.00	30.00	330.00
37.	Jamui	N.A.	N.A.	N.A.	280.00	300.00	580.00
38.	Sheikhpura	N.A.	N.A.	N.A.	115.00	85.00	200.00
Sub. Total		**5555 (27.48)**	**2766 (15.62)**	**10297 (25.41)**	**16509.48 (36.38)**	**4359.25 (23.73)**	**25189.40 (36.60)**
Gr. Total		**20209 (100.00)**	**17701 (100.00)**	**40520 (100.00)**	**45378.88 (100.00)**	**18372.74 (100.00)**	**68821.14 (100.00)**

In parenthesis percentage figures are shown.

Amongst three sub-zones in the state North-Bihar plains, comprising 12 districts of Bihar, is the most potential region of the state in terms of total number of ponds (55%) and the water spread area (39.20%) followed by South Bihar plains (25.41% and 36.60%) respectively and North East Plains (18.83% and 24.20%) respectively. Thus, above status of the fisheries in the state clearly indicate that there is no dearth of potentiality rather serious efforts are more required to tap the existing potentiality.

Part – II : Jharkhand

Introduction

Jharkhand came into existence in November 2000. The state has advantage of having a sizeable number of medium and large reservoirs as well as substantial number of ponds and tanks of different sizes. But the resources are largely untapped and thus, the state depends on the supply line of Andhra Pradesh and West Bengal, which usually met nearly half of its annual fish demand. However, the state also exports fishes to West Bengal particularly from the districts/regions nearer to Kolkata market. The annual consumption of fish within the state is nearly 83 thousand MT, against the present annual production of around 62 thousand MT, having a shortfall of nearly 21 thousand MT annually.

Fishery Resources

The state has 4298 Kilometres Rivers and its tributaries, 0.94 lakh ha reservoirs, 0.29 lakh ha tanks and ponds and 1.23 lakh ha water bodies representing. 2.15 per cent, 3.23 per cent, 1.20 per cent and 1.67 per cent respectively of the total of all India's inland fishery resources *(Annexure – I)*. In regard to rivers and tributaries, these all are seasonal in nature.

Fishermen Population and Co-operatives Societies

According to the 17th livestock Census, 2003 the state has the second largest, next to Bihar fishermen population of about 19.30 lakh, accounts for 34.23 per cent of India's fisherman population. Of the total 29.93 per cent, 29.60 per cent and 40.47 per cent are

males, females and children respectively *(Annexure – II).* The state has 66 primary societies with the membership of 9150 *(Annexure – III).*

Outlay and Expenditure

The state bifurcated from Bihar during the ninth plan period (1997-02) and thus, during the last year of 9th Plan, the state made an expenditure of Rs. 312 lakh on fisheries development. In subsequent plan (10th), the state had an outlay of Rs. 2075 lakh (table 2.5).

Table No 2.5: Outlay and Expenditure on Fisheries under state sector schemes in Jharkhand

Rs in Lakh

Plan/Year	Outlay	Expenditure	% of Expenditure Over Outlay
9th Five Year Plan	-	312.00	--
10th Five Year Plan	2075	N.A.	--

Source: Handbook of Fisheries, 2006, MOA, GOI.

Fish Production

The present annual fish production in the state is around 83 thousand MT. It increased substantially from 43 thousand MT in 2000-01. The data presented in table No. 2.6 showed the production of fish by species during the year 2000-01 to 2003-04. It revealed that more than 90.00 per cent of the total inland fish production is being contributed by major carps viz., catla, rohu, mrigal, etc. Moreover, to meet the annual shortfall of nearly 22-23 thousand MT, has initiated several developmental programmes including training and subsidized fish seeds to scheduled castes and scheduled tribes, etc.

Table No. 2.6: Inland Fish Landings by Species in Jharkhand (*In tonnes)*

Sl No	Variety	Year			
		2000-01	2001-02	2002-03	2003-04
1.	Major Carps (Catla, Rohu,Mrigal & Calbasu)	41380 (95.09)	42200 (95.56)	43275 (95.36)	15150 (84.17)
2.	Minor Carps	558 (1.28)	610 (1.38)	695 (1.53)	1100 (6.11)
3.	Exotic Carps (Common, Silver & Grass Carp)	1220 (2.80)	1240 (2.81)	1280 (2.82)	1490 (8.28)
4.	Murrels (Ophiocephalus Spp.)	-	-	10 (0.02)	10 (0.06)
5.	Catfishes (Wallagoattu, Pangasius, bagarius)	360 (0.83)	10 (0.02)	75 (0.17)	100 (0.56)
6.	Other fresh water fishes	-	100 (0.23)	45 (0.10)	150 (0.83)
	Total	**43518 (100.00)**	**44160 (100.00)**	**45380 (100.00)**	**18000 (100.00)**

Source: Handbook of fisheries, 2004.
In brackets percentage figures are shown.

Fish Seed Production

The present level of fish seed production in the state is 92 million fry whereas the requirement is 400 million fry. So there is big gap between the availability and requirement. The state has 52 departmental fish seed farms, which have 25 ha nursery space, 15 ha rearing space and 22 ha stocking tank. There are 7 government seed hatcheries and 3 hatcheries in private sector holding a capacity of 2100 lakh spawn and 1000 lakh spawn respectively. The present level of requirement of fish seed is mostly met by West Bengal.

Culture Fisheries

The major portion of fish production in Jharkhand is from tanks and reservoirs. It lie in over 94 thousand ha and 29 thousand ha respectively (table No. 2.7). Amongst two sub-zones in the state, Chhotanagpur North-Eastern Hills and Plateau is leading, which accounts for nearly 69.00 per cent of the area under tanks and 52.00 per cent of the area under ponds.

Table No. 2.7: Zone-wise/District-wise number of Ponds & Water Area in Jharkhand.

Sl No	Zone/Districts	No. of Ponds			Area of Ponds (ha.)			No. of Tanks	
		Govt.	Pvt.	Total	Govt.	Pvt.	Total	No.	Area (ha.)
I. Chhotanagpur North-Eastern Hills & Plateau									
1.	Godda	505	478	983	431	295	726	01	300
2.	Sahibganj	909	1569	2478	557	651	1208	-	-
3.	**Dumka**	**2932**	**1772**	**4704**	**663**	**639**	**1302**	**05**	**6500**
4.	Deoghar	1295	1433	2728	918	804	1722	17	3400
5.	Dhanbad	1120	387	1507	1400	247	1627	08	14000
6.	Giridih	356	383	739	1020	486	1506	03	2000
7.	Hazaribagh	454	539	993	2025	941	2966	25	27451
8.	Chatra	300	200	500	500	300	800	06	7500
9.	Kodrama	151	100	251	300	200	500	-	-
10.	Bokaro	1636	540	2176	1904	350	2254	04	1000
11.	Garwa	250	600	850	800	140	940	03	2800
Sub Total		**9908 (77.44)**	**8001 (50.19)**	**17909 (62.32)**	**10518 (53.00)**	**5053 (50.28)**	**15551 (52.06)**	**72 (39.78)**	**64951 (69.05)**
II. **Chhotanagpur South-Hills & Plateau**									
12.	Gumla	349	297	646	2256	131	2387	08	2500
13.	Lohardaga	116	119	235	2108	62	2170	10	5000
14.	Ranchi	508	802	1310	1811	1766	3577	20	8000
15.	East Singhbhum	700	1500	2200	1000	1300	2300	04	3600
16.	**West Singhbhum**	**959**	**3515**	**4474**	**1156**	**1528**	**2684**	**08**	**6500**
17.	Palamu	255	1706	1961	995	209	1204	59	3514
Sub Total		**2887 (22.56)**	**7939 (49.81)**	**10826 (37.68)**	**9326 (47.00)**	**4996 (49.72)**	**14322 (47.94)**	**109 (60.22)**	**29114 (30.95)**
Gr. Total		**12795 (100.00)**	**15940 (100.00)**	**28735 (100.00)**	**19844 (100.00)**	**10049 (100.00)**	**29873 (100.00)**	**181 (100.00)**	**94065 (100.00)**

Source Directorate of Fisheries, Govt. of Jharkhand
In parenthesis percentage figures are shown.

Thus, the status of fisheries' resources in the state clearly indicates that the state has large aquatic resources as well as human resources; the major concern is the management of resources.

CHAPTER – III

STUDY AREA AND THE SAMPLE RESPONDENTS

This chapter presents the details about the sample districts and respondents of both the states in two parts viz., Part – I: Bihar and Part – II: Jharkhand.

Part – I: Bihar

Area, Population, Literacy and Workers

Madhubani district covers an area of 3501 Sq. km, constituting 3.72 per cent of state's total area (94163 Sq. km). Its total population is 3.57 million and the population density is 1020 per Sq. km. The percentage of rural population is 96.52 per cent and the sex ratio is 942 females per 1000 males. The percentage of scheduled castes and tribes population is 13.48 and 0.04 respectively. As regards the workers, the district has 12.27 lakh (34.42% of total population) total workers. The proportion of main and marginal workers is 24.5 per cent and 9.8 per cent respectively. Out of the total workers, the proportion of cultivators is 30.50 per cent, agricultural labourers 52.80 per cent, workers in household industries 3.40 per cent and other workers 13.30 per cent. The overall literacy rate is 42.00 per cent. However, it is in case of males 56.80 per cent, females 26.30 per cent, scheduled castes 22.20 per cent and Scheduled Tribes 35.80 per cent. The Gross District Domestic Product (GDDP) is estimated at Rs. 2598.60 crores in 2004-05. The per capita GDDP is Rs. 6851, which is below the state's average of Rs. 7434. The CD percentage of Commercial Banks (CBs) and Regional Rural Banks (RRBs) are 31.50 and 25.40 in 2007 (table No. 3.1).

Purnea district covers an area of 3229 Sq. km constituting 3.43 per cent of state's total area. Its total population is 2.54 million and the population density in 787 per Sq. km. The percentage of rural population is 91.26 per cent and the sex ratio is 915

females/1000 males. The percentage of Scheduled Castes and Tribes population is 12.27 per cent and 4.40 per cent respectively. As regards the workers, the district has 9.60 lakh (37.76% of total population) total workers. The proportion of main and marginal workers is 30.80 per cent and 7.00 per cent respectively. Out of the total workers, the proportion of cultivators is 22.90 per cent, agricultural labourers 63.30 per cent, household industries 1.7 per cent and other workers 12.10 per cent. The overall literacy rate is 35.10 per cent. However, it is in case of males 45.60 per cent, females 23.40 per cent, Scheduled Castes 18.50 per cent and Scheduled Tribes 24.50 per cent. The Gross District Domestic Product (GDDP) is estimated at Rs. 1549.90 crores in 2004-05. The per capita GDDP is Rs. 5600, which is much below the state's average of Rs. 7434. The CD percentages of Commercial Banks (CBs) and Regional Rural Banks (RRBs) are 52.30 and 56.60 in 2007 (table No. 3.1).

Bhagalpur district covers an area of 2569 Sq. km, constituting 2.73 per cent of state's total area. Its total population is 2.42 million and the population density is 946 per Sq. km. The percentage of rural population is 81.33 per cent and the sex ratio is 876 females per 1000 males. The percentage of Scheduled Castes and Scheduled Tribes population is 10.51 and 2.29 respectively. The district has 85.53 lakh (35.30% of total population) total workers. The proportion of main and marginal workers is 24.00 and 11.30 per cent respectively. Out of total workers, 19.90 per cent are cultivators, 48.20 per cent agricultural labourers, 7.4 per cent workers engaged in household industries and 24.50 per cent other workers. The overall literacy rate is 49.50 per cent. However, it is 59.20 per cent in case of males, 38.10 per cent in case of females, 33.70 per cent in case of Scheduled Castes and 37.20 per cent in case of Scheduled Tribes. The Gross District Domestic Product (GDDP) is estimated at Rs. 2129.30 crores in 2004-05. The per capita GDDP is 8268, which is higher than the state's average of Rs. 7434. The CD percentages of Commercial Banks (CBs) and Regional Rural Banks (RRBs) are 35.60 and 51.70 in 2007 (table No. 3.1)

Table No 3.1: Demographic and other Macro Indicators of the Sample Districts in Bihar

Particulars	Madhubani	Purnea	Bhagalpur	Bihar
Area (Sq. kms)	3501	3229	2569	94163
Population (Million)	3.57	2.54	2.42	83.00
Population Density (per sq. km)	1020	787	946	831
Rural Population (%)	96.52	91.26	81.33	89.54
Sex Ratio (F/1000 M) - All	942	915	876	919
Sex Ratio (0-6 yrs)	939	967	966	942
Scheduled Caste Population (%)	13.48	12.27	10.51	15.72
Scheduled Tribe Population (%)	0.04	4.40	2.29	0.91
Sectoral Distribution of Main Workers (%)				
- Cultivators	30.55	22.92	19.63	29.30
- Agricultural Labourers	52.82	63.38	48.39	48.00
- Household Industries	3.33	1.68	7.43	3.90
- Other Workers	13.30	12.02	24.54	18.80
- All Workers	100.00	100.00	100.00	100.00
Literacy (%)				
- All	42.00	35.10	49.50	47.00
- Male	56.80	45.60	59.20	59.70
- Female	26.30	23.40	38.10	31.10
- SC	22.20	18.50	33.70	28.50
- ST	35.80	24.50	37.20	28.20
Gross District Domestic Product (In Rs. Crore 2004-05)	2598.60	1549.90	2129.30	65908.60
Per Capita GDDP in (In Rs.)	6851	5600	8268	7434
Number of Households	656858	492491	412080	13744130
Household Size	05	05	06	06
CD Ratios (2007)				
- CBs	31.5	52.3	35.6	30.9
- RRBs	25.4	56.6	51.7	39.9
Work Participation Rate (%)	34.3	37.8	35.3	33.38

Source: Census of India, 2001 & Economic Survey: 2007-08, Government of India.

Land Use Pattern

The land use statistics of the sample districts revealed that out of the total geographical area in Madhubani, Purnea and Bhagalpur, the share of forest is almost negligible. While the share of land put to non-agricultural use is 24.08 per cent, 14.01 per cent and 26.38 per cent respectively. Fallow lands are 4.27 per cent, 11.47 per cent and 6.30 per cent respectively. The net sown area is 64.02 per cent, 66.88 per cent and 54.72 per cent respectively. The cropping intensity is 141.67 per cent in Madhubani, 135.15 per cent in Purnea and 120.53 per cent in Bhagalpur. In fact the changes in land utilization pattern are very slow unless propelled by revolutionary changes in environment or in production system. It is marginal but yet significant (table No. 3.2).

Table No. 3.2: Land Use Pattern in Sample Districts (In Lakh ha)

Particulars	Madhubani		Purnea		Bhagalpur		Bihar	
	Area	%	Area	%	Area	%	Area	%
Total Geographical Area	3.53	100.00	3.14	100.00	2.54	100.00	93.60	100.00
Forests	0.00	0.00	0.001	0.03	0.0007	0.03	6.16	6.38
Barren & Unculturable	0.02	0.57	0.12	3.82	0.22	8.66	4.37	4.52
Land put to Non-Agri. Use	0.85	24.08	0.44	14.01	0.67	26.38	16.35	16.93
Culturable Wasteland	0.005	0.14	0.011	0.35	0.02	0.79	0.48	0.50
Permanent Pasture	0.015	0.42	0.004	0.13	0.006	0.24	0.18	0.19
Area Under Misc. Trees & Groves	0.23	6.52	0.09	2.87	0.07	2.76	2.30	2.38
Other Fallow	0.034	0.96	0.048	1.53	0.038	1.50	1.41	1.46
Current Fallow	0.117	3.31	0.312	9.94	0.122	4.80	5.95	6.16
Net Sown Area	2.26	64.02	2.10	66.88	1.39	54.72	56.38	58.36
Total Cropped Area	3.19	90.37	2.84	90.45	1.67	65.75	80.26	83.08
Area Sown more than once	0.940	26.63	0.73	23.25	0.28	11.03	23.58	24.42
Cropping Intensity (%)	141.67	--	135.15	--	120.53	--	142.36	--

Source: Economic Survey: 2007-08, Government of Bihar.

Irrigation

Irrigation is key variable determining the health and prosperity of Agriculture in general. In sample districts tanks and tube wells are the main sources of irrigation. The relevant data are presented in table No. 3.3. In Madhubani, 138120 thousand ha is irrigated and out of it the major area is irrigated by tube wells (50.15%) followed by tanks (46.57%) and other sources (3.28%). While in Purnea 160387 thousand ha (94.61%) is irrigated by tube wells and remaining by canals (5.39%). Tube well (78.12%) is the major source of irrigation in Bhagalpur followed by other sources (13.22%), other wells (5.09%) and tanks (3.56%).

Table No. 3.3: Irrigational Status -- Source wise in Sample Districts (In '000 ha) : 2002-03

Sources	Madhubani		Purnea		Bhagalpur		Bihar	
	Area	%	Area	%	Area	%	Area	%
Canal	--	--	9144	5.39	--	--	1259338	27.55
Tank	64316	46.57	--	--	2834	3.56	149071	3.26
Tube Wells	69262	50.15	160387	94.61	62147	78.12	2965410	64.87
Other Wells	--	--	--	--	4050	5.09	18260	0.40
Other Source	4542	3.28	--	--	10520	13.22	179503	3.92
Total	138120	100.00	169531	100.00	79551	100.00	4571582	100.00

Source: Directorate of Statistics & Evaluation, Govt. of Bihar.

Jalkars/Ponds in the Study Area

As stated earlier in methodology section of Chapter – I that the study has been undertaken in Benipatti Anchal of Madhubani District, Dagarua Anchal of Purnea District

and Sahkund Anchal of Bhagalpur District due to larger number of ponds/tanks and of course, the water area, in respective agro-climatic sub-zones. The data presented in table No. 3.4 clearly revealed that there are 3555 jalkars distributed across 21 Anchals in 1853.21 ha of water spread area in Madhubani district; the largest in number and water area in the state. Purnea district has 691 jalkars distributed across 13 Anchals in 848.42 ha of water spread area whereas that of in Bhagalpur is 781 jalkars distributed across 12 Anchals in 871.68 acre of water spread area. These ponds/jalkars are leased out for short and long periods.

Table No. 3.4 Anchal wise Distribution of Jalkars in Sample Districts (Area in ha)

SN	Madhubani			Purnea			Bhagalpur		
	Name of the Anchals	No. of Jalkars	Water Area	Name of the Anchals	No. of Jalkars	Water Area	Name of the Anchals	No. of Jalkars	Water Area
1.	Rahika	78	35.63	Purnea East	77	85.99	Kahalgaon	77	70.18
2.	Rajnagar	94	49.57	K Nagar	75	131.99	Goradih	74	70.53
3.	**Benipatti**	**473**	**197.19**	Dhamdaha	57	70.54	Jagdishpur	28	28.52
4.	Basopatti	134	74.02	Bhawanipur	26	40.74	Sabour	30	283.54
5.	Lokhee	305	105.22	Rupauli	58	55.76	Sultanganj	61	63.09
6.	Khutauna	220	105.90	B. Kothi	27	29.74	Nathnagar	28	26.06
7.	Andharatarhi	212	134.36	Banmankhi	57	203.54	Naugachia	28	2.04
8.	Ladania	126	76.20	Baisa	42	53.24	Gopalpur	23	--
9.	Babubarhi	246	116.38	Kasba	64	64.20	Bihpur	39	--
10.	Jainagar	15	8.32	Jalalgarh	32	19.41	Pirpainti	34	34.73
11.	Khajauli	20	9.59	Amour	42	76.20	**Sahkund**	**198**	**176.19**
12.	Kaluaahi	30	11.32	Bagsi	55	124.35	Sanhaula	161	116.98
13.	Phulparas	255	127.98	**Dagarua**	**79**	**154.84**	--	--	--
14.	Ghoghardiha	238	127.28	**--**	**--**	**--**	--	--	--
15.	Harlakhi	276	162.61	**--**	**--**	**--**	--	--	--
16.	Madhavapur	212	200.53	**--**	**--**	**--**	--	--	--
17.	Pandaul	117	68.58	**--**	**--**	**--**	--	--	--
18.	Jhanjharpur	103	68.44	**--**	**--**	**--**	--	--	--
19.	Bisfi	165	69.53	**--**	**--**	**--**	--	--	--
20.	Madhepur	73	38.32	**--**	**--**	**--**	--	--	--
21.	Lakhnaur	163	66.14	**--**	**--**	**--**	--	--	--
	Total	**3555**	**1853.21**	**--**	**691**	**948.42**	**--**	**781**	**871.68**

Source: District Fisheries Office of Respective Districts, Government of Bihar.

Number of Private Ponds In Benipatti Anchal - 37

Number of Private Ponds in Dagarua Anchal - 112

Number of Private Ponds in Sahkund Anchal - 22

Socio-Economic Characteristics of the Sample Respondents Households

As mentioned earlier 30 fish farming households per selected 3 districts in Bihar formed the total sample. So this section is devoted to examine the socio-economic characteristics of 90 fish farming households (table No. 3.5). Out of total 51.11 per cent

of the fish farmers are belonged to the age group of 46 to 60 years followed by 31 to 45 years (36.67%), 18 to 30 years (6.67%) and 61 years and above (5.55%). Of the total 96.67 per cent were married. Nearly 95.00 per cent of them were belonged to Hindu religion. Majority of the respondents have attained the secondary level of education (51.11%) followed by primary (36.67%), graduation and above (8.89%) and intermediate level (3.33%). It seems that about 90.00 per cent of the households have attained up to the secondary level of education. Among the castes groups 93.33 per cent dominated with intermediate castes (particularly gorhi, nishad, etc.). Of the selected 90 fish farming households as high as 79 (87.78%) reported that fishery was their main occupation and remaining 12.22 per cent reported agriculture. The most important subsidiary occupation was agriculture (63.33%).

Table No. 3.5: Socio-Economic Features of the Sample Respondents in Bihar

Particulars	Madhubani (N 30)		Purnea (N 30)		Bhgagalpur (N 30)		Overall (N 90)	
	No.	%	No.	%	No.	%	No.	%
Age								
i. 18-30 Yrs	-	-	04	13.33	02	6.67	06	6.67
ii. 31-45 Yrs	11	36.67	07	23.33	15	50.00	33	36.67
iii. 46-60 Yrs	19	63.33	16	53.34	11	36.67	46	51.11
iv. 61 yrs and above	-	-	03	10.00	02	6.67	05	5.55
Educational Level								
i. Primary	10	33.33	12	40.00	11	36.67	33	36.67
ii. Secondary	16	53.34	14	46.67	16	53.34	46	51.11
iii. Intermediate	-	-	02	6.66	01	3.33	03	3.33
iv. Graduate & above	04	13.33	02	6.67	02	6.67	08	8.89
Social Group								
i. Scheduled Castes	-	-	-	-	-	-	-	-
ii. Scheduled Tribes	-	-	-	-	-	-	-	-
iii. Intermediate Castes	27	90.00	28	93.33	29	96.67	84	93.33
iv. General	03	10.00	02	6.67	01	3.33	06	6.67
Occupation (Primary)								
i. Fishery	30	100.00	22	73.33	27	90.00	79	87.78
ii. Agriculture	-	-	08	26.67	03	10.00	11	12.22
Occupation (Secondary)								
i. Agriculture	27	90.00	19	63.33	11	36.67	57	63.33
ii. Fishery	-	-	08	26.67	03	10.00	11	12.22
iii. Petty Business	-	-	-	-	02	6.67	02	2.22
iv. Don't	03	10.00	03	10.00	14	46.66	20	22.23
Marital Status								
i. Married	30	100.00	29	96.67	28	93.33	87	96.67
ii. Unmarried	-	-	01	3.33	02	6.67	03	3.33
Religion								
i. Hindu	30	100.00	28	93.33	27	90.00	85	94.44
ii. Muslim	-	-	02	6.67	03	10.00	05	5.56

The total population is 1254 of 13.93 members per family. It is comprised of 647 (51.59%) males and 607 (48.41%) females. Out of the total 826 (65.87%) are adult members whereas 428 (34.13%) children (table No. 3.6). The sample fish farming households have an owned area of 98.61 hectare. In addition they leased in 5.60 hectare. There were no leased out area. Thus, the total cultivated/operated area came to 104.21 hectare. Of the total operated area irrigated area is 91.61 hectare, giving the percentage of irrigated area of 87.91 per cent (table No. 3.7).

Table No. 3.6 Population of the Family Members of the Sample Respondents

Population	Madhubani (N 30)	Purnea (N 30)	Bhagalpur (N 30)	Overall (N 90)	
				No	%
Total Adult	216	323	287	826	100.00
Male	123	188	160	471	57.02
Female	93	135	127	355	42.98
Total Children	138	158	132	428	100.00
Male	71	81	75	233	54.44
Female	61	77	57	195	45.56
Grand Total	354	481	419	1254	100.00
Male	200	212	235	647	51.59
Female	154	269	184	607	48.41

Table No. 3.7: Land Holding Account of the Sample Respondents (In ha)

Land Particulars	Madhubani (N 30)		Purnea (N 30)		Bhagalpur (N 30)		Overall (N 90)		Total
	Irrig.	Unirrig.	Irrig.	Unirrig.	Irrig.	Unirrig.	Irrig.	Unirrig.	
Owned	26.65	3.15	43.93	7.67	15.43	1.78	86.01	12.60	98.61
Leased-in	2.15	-	2.45	-	1.00	-	5.60	-	5.60
Leased-out	-	-	-	-	-	-	-	-	-
Operated Area	28.80	3.15	46.38	7.67	16.43	1.78	91.61	12.60	104.21
In %	90.14	9.86	85.81	14.19	90.23	9.77	87.91	12.09	100.00

In parenthesis percentage figures are shown.

Cropping Pattern of the Sample Households

A perusal of the table No. 3.8 reveals that out of the three sample districts, the total cropped area of the sample households is higher in Purnea (82.12 ha) followed by Madhubani (45.85 ha) and Bhagalpur (29.04 ha). At the overall level it is 157.01 hectare. Paddy remained the most prominent crop accounting for 42.16 per cent of the GCA followed by wheat (26.57%), maize (9.71%), jute (8.17%), mainly grown in Purnea district; vegetables & others (4.87%), lentil (3.44%), gram (2.64%) and mustard (2.44%).

The data revealed that taking together the area of paddy, wheat and maize; it comes to 78.44 per cent of the GCA, which showed the concentration of cereal crops in the region.

Table No. 3.8: Cropping Pattern of the Sample Households

Crops	Madhubani (N 30)		Purnea (N 30)		Bhagalpur (N 30)		Overall (N 90)	
	Area	%	Area	%	Area	%	Area	%
Paddy	13.85	30.21	40.20	48.95	12.15	41.84	66.20	42.16
Maize	4.15	9.05	8.56	10.42	2.53	8.72	15.24	9.71
Wheat	19.80	43.18	12.52	15.25	9.40	32.37	41.72	26.57
Gram	1.50	3.27	0.75	0.91	1.90	6.54	4.15	2.64
Lentil	3.45	7.52	0.60	0.73	1.35	4.65	5.40	3.44
Mustard	1.20	2.62	1.90	2.31	0.73	2.51	3.83	2.44
Jute	-	-	12.83	15.63	-	-	12.83	8.17
Vegetables & Others	1.90	4.15	4.76	5.80	0.98	3.37	7.64	4.87
Gross Cropped Area	**45.85**	**100.00**	**82.12**	**100.00**	**29.04**	**100.00**	**157.01**	**100.00**

Part – II: Jharkhand

Area, Population, Literacy and Workers

Dumka (Santhal Pargana) covers an area of 5518.20 Sq. km constituting 7.28 per cent of state's total area (75834.29 Sq. km). Its total population is 1.75 million and the population density is 318 per Sq. km. The percentage of rural population is 83.15 per cent and the sex ratio is 961 females per 1000 males. The percentage of scheduled castes and tribes population is 3.75 and 39.89 per cent respectively. As regards the workers the district has 44.42 per cent workers of the total population. The proportion of main and marginal workers is 26.84 per cent and 17.59 per cent respectively. Out of the total workers the proportion of cultivators is 47.16 per cent, agricultural labourers 34.65 per cent, workers engaged in household industries 4.21 per cent and other workers 13.98 per cent. The overall literacy rate is 47.94 per cent. However, it is 62.86 per cent in case male and 32.35 per cent in case of female (table No. 3.9).

West Singhbhum covers an area of 8012 Sq. km constituting 10.57 per cent of the state's total area. Its total population is 2.08 million and the population density is 260

per Sq km. The percentage of rural population is large. The sex ratio is 975 female per1000 males. The percentage of scheduled castes and tribes population is 4.88 and 53.26 per cent respectively. The district has 44.21 per cent workers of the total population. The percentages of main and marginal workers are 25.80 and 18.40 respectively. Out of the total workers the share of cultivators is 41.29 per cent, agricultural labourers 31.41 per cent, workers engaged in household industries 5.45 per cent and other workers 21.85 per cent. The overall literacy rate is 50.17 per cent. It is 65.60 per cent in case of males and 34.37 per cent in case of females (table No. 3.1).

Table No 3.9: Demographic and other Macro Indicators of the Sample Districts in Jharkhand

Particulars	Dumka	West Singhbhum	Jharkhand
Area (Sq. kms)	5518.20	8012.00	75834.29
Population (In Million)	1.75	2.08	26.90
Population Density (per sq. km)	318	260	338.00
Rural Population (%)	83.15	93.47	77.75
Sex Ratio (F/1000 M) - All	961	975	941
Sex Ratio (0-6 yrs)	976	968	966
Scheduled Caste Population (%)	7.35	4.88	9.62
Scheduled Tribe Population (%)	39.89	53.26	22.46
Sectoral Distribution of Main Workers			
- Cultivators	47.16	41.29	38.59
- Agricultural Labourers	34.65	31.41	28.26
- Household Industries	4.21	5.45	4.15
- Other Workers	13.98	21.85	29.00
- All Workers	100.00	100.00	100.00
Work Participation Rate(%)	44.42	44.41	37.64
Literacy (%)			
- All	47.94	50.17	54.13
- Male	62.86	65.60	67.94
- Female	32.35	34.37	39.38
- SC	-	-	16.99
- ST	-	-	40.70
Per Capita Income	-	-	4161
Number of Households	331318	412080	4105000
Household Size	05	06	6.5

Source: Census of India, 2001, Series-21, Jharkhand.

Land Use Pattern

Table 3.10 shows the proportion of land utilization in both the sample districts as well as in Jharkhand. At the state level, a mere 9.9 per cent of the total land area is under non-agricultural uses, while forest comprised more than 29 per cent. In regard to sample districts the area under non-agriculture use is 11.3 per cent in Dumka and 6.4 per cent

in West Singhbhum. The forest coverage is mere 11.27 and 23.33 per cent respectively. The proportion of fallow land is about 28.00 per cent in Dumka and 13.50 per cent in West Singhbhum. The net sown area is 29.47 per cent and 25.09 per cent respectively, which are higher to the state's average (22.68%). The cropping intensity is 114.38 per cent in the state. In nutshell, Dumka and West Singhbhum districts roughly follow the state averages except in case of forest coverage.

Table No. 3.10: Land use Pattern in Sample Districts (In Lakh ha)

Particulars	Dumka		West Singhbhum		Jharkhand	
	Area	%	Area	%	Area	%
Total Geographical Area	5.58	100.00	7.99	100.00	79.70	100.00
Area under Non-agricultural Uses	0.63	11.27	0.51	6.34	7.88	9.89
Forests Area	0.63	11.27	3.23	40.44	23.33	29.27
Barren & Uncultivable Land	0.34	6.07	0.71	8.89	5.73	7.19
Permanent Pastures and Other Grazing Lands	0.27	4.90	0.04	0.56	0.88	1.10
Land under Misc. Trees Crops & Groves	0.10	1.77	0.08	1.03	1.10	1.38
Cultivable Waste Land	0.34	6.18	0.33	4.17	2.77	3.48
Fallow Land	0.69	12.42	0.48	5.95	7.79	9.78
Current Fallow	0.87	15.53	0.60	7.53	12.13	15.22
Net Sown Area	1.64	29.47	2.01	25.09	18.08	22.68
Area Sown more than Once	0.01	0.20	0.24	2.97	2.61	3.27
Gross Cropped Area	1.66	29.67	2.44	28.06	20.68	25.95
Cropping Intensity (%)	**--**	**101.22**	**--**	**111.44**	**--**	**114.38**

Source: Agriculture Report of 2002-03, Government of Jharkhand.

Irrigation

Irrigation has a catalic role in transforming the agriculture in general. The agricultural economy of Jharkhand is characterized by its dependence on nature. More than 90 per cent of the cultivated area is unirrigated. Out of the total irrigated area in the state, 29.38 per cent is irrigated through wells,the largest source of irrigation followed by other sources (25.77%) like lift irrigation, traditional structures (ahar, pyne, etc.) tank/pond (19.07%), canal (17.53%) and tube well (8.25%). In case of Dumka district, the most common and largest source is well (34.17%) followed by tank/pond (22.11%), others (21.85%), tube well (12.72%) and canal (9.15%). In West Singhbhum the usual method of irrigation consists of embankments and bunds across the line of trench i.e., the upper end of a depression and others (32.44%), tube well (18.84%), well (17.19%) etc. (table No. 3.11).

Table No. 3.11: Irrigational Status – Source wise in Sample Districts (In ha)

Sources	Dumka		West Singhbhum		Jharkhand	
	Area	%	Area	%	Area	%
Canal	973	9.15	1457	17.42	34858	17.53
Tank/Pond	2350	22.11	1180	14.11	37921	19.07
Tube well	1352	12.72	1575	18.84	16405	8.25
Well	3632	34.17	1437	17.19	58422	29.38
Others	2323	21.85	2713	32.44	51244	25.77
Total Irrigated Area	**10630**	**100.00**	**8362**	**100.00**	**198850**	**100.00**

Source: Compiled to the Authors.

Jalkars/Ponds/Tanks in the Study Area

As stated earlier that the study has been undertaken in Saraiyahat anchal of Dumka district and Jagnnathpur Anchal of West Singhbhum district due to larger number of ponds/tanks and water area in respective agro-climatic sub-zones. The data presented in table No. 3.12 showed that there are 658 jalkars/ponds distributed across 10 Anchals in 380.16 ha of water spread area in Dumka district. Similarly, there are 500 jalkars/ponds distributed across 15 Anchals in 688.66 ha in West Singhbhum district. These ponds/tanks are leased-out for short and long periods.

Table No. 3.12: Anchal wise Distribution of Jalkars in Sample Districts (Area in ha)

SN	Dumka			West Singhbhum		
	Name of Anchals	No of Jalkars	Area	Name of Anchals	No of Jalkars	Area
1.	Dumka	63	55.27	Sonua	56	53.09
2.	Masalia	56	19.50	Bandgaon	16	35.14
3.	Raneshwar	67	22.65	Chakradharpur	48	83.05
4.	Jama	80	16.83	Khuntpani	39	62.29
5.	Saraiyahat	105	119.29	Tonto	46	42.95
6.	Jarmundi	47	71.58	Jhinkpani		
7.	Kathikund	28	12.29	Chaibasa	44	71.78
8.	Gopikandar	09	3.30	Tantnagar	45	56.79
9.	Shikaripara	114	28.52	Manjhari	29	64.62
10.	Ramgarh	89	30.93	Jagnnathpur	64	97.35
-	--	--	--	Manoharpur	23	38.32
-	--	--	--	Goilkera	10	8.50
-	--	--	--	Kumar Dungi	21	24.03
-	--	--	--	Manjhgaon	41	32.46
-	--	--	--	Noamundi	18	18.30
	Total	**658**	**380.16**	**Total**	**500**	**688.66**

Source: District Fishery Office of respective districts.

Socio-Economic Characteristics of the Sample Households

The data presented in table No. 3.13 is relating to the socio-economic characteristics of 60 fish farming households constituting 30 fish farming households from each of the sample districts. The figures revealed that out of the total, 51.66 per cent of the sample households are belonged to the age group of 46 to 60 years followed by 36.67 per cent in 31 to 45 years group, 6.67 per cent in 18 to 30 years group and 5.00 per cent in 61 years and above group. All of them are married and belonged to Hindu religion. Nearly 48.33 per cent have attained the education of primary level, 45.00 per cent secondary level and 6.67 per cent intermediate level. It revealed that 92.33 per cent have attained up to the secondary level education. Among the social groups, 73.34 per cent are from intermediate castes (fisherman community), 23.33 per cent Scheduled Tribes and only 3.33 per cent Scheduled Castes. Of the total 75.00 per cent of the sample households have reported that their primary occupation is fishery and remaining 25.00 per cent agriculture. Fishery is also a leading secondary occupation of 43.33 per cent sample fish farming households.

Table No. 3.13: Socio Economic Features of the Sample Respondents in Jharkhand

Particulars	Dumka (N 30)		West Singhbhum (N 30)		Overall (N 60)	
	No.	%	No.	%	No.	%
Age						
i. 18-30 Yrs	04	13.33	-	-	04	06.67
ii. 31-45 Yrs	09	30.00	13	43.33	22	36.67
iii. 46-60 Yrs	14	46.67	17	56.67	31	51.66
iv. 61 yrs and above	03	10.00	-	-	03	05.00
Educational Level						
i. Primary	12	40.00	17	56.67	29	48.33
ii. Secondary	17	56.67	10	33.33	27	45.00
iii. Intermediate	01	03.33	03	10.00	04	6.67
iv. Graduate & above	-	-	-	-	-	-
Social Group						
i. Scheduled Castes	-	-	02	6.66	02	03.33
ii. Scheduled Tribes	-	-	14	46.67	14	23.33
iii. Intermediate Castes	30	100.00	14	46.67	44	73.34
iv. General	-	-	-	-	-	-
Occupation (Primary)						
i. Fishery	28	93.33	17	56.67	45	75.00
ii. Agriculture	02	06.67	13	43.33	15	25.00
Occupation (Secondary)						
i. Agriculture	15	50.00	04	13.33	19	31.67
ii. Fishery	02	06.67	24	80.00	26	43.33
iii. Petty Business	10	33.33	02	06.67	12	20.00
iv. Service (Casual Level)	03	10.00	-	-	-	-
v. Do't	-	-	-	-	-	-
Marital Status						
i. Married	30	100.00	30	100.00	60	100.00
ii. Unmarried	-	-	-	-	-	-
Religion						
i. Hindu	30	100.00	30	100.00	60	100.00
ii. Muslim	-	-	-	-	-	-

The total population of the 60 fish farming households is 743 of 12.38 members per family. It is comprised of 55.85 percent males and 44.15 percent females. Of the total 325 (43.75%) are children (table No. 3.14). The sample households have 31.15 hectare owned area. In addition they have leased-in 0.50 ha and leased-out 1.95 hectare. Overall they possess 29.70 hectare and out of it 43.80 per cent is irrigated and 56.20 per cent unirrigated (table No. 3.15).

Table No. 3.14 Population of the Family Members of the Sample Respondents

Population	Dumka (N 30)	West Singhbhum (N 30)	Overall (N 60)	
			No	%
Total Adult	**235**	**183**	**418**	**100.00**
Male	132	96	228	54.55
Female	103	87	190	45.45
Total Children	**172**	**153**	**325**	**100.00**
Male	108	79	187	57.54
Female	64	74	138	42.46
Grand Total	**407**	**336**	**743**	**100.00**
Male	240	175	415	55.85
Female	167	161	328	44.15

Table No. 3.15: Land Holding Account of the Sample Respondents (In ha)

Land Particulars	Dumka (N 30)		West Singhbhum (N 30)		Overall (N 60)		Total
	Irrig.	Unirrig.	Irrig.	Unirrig.	Irrig.	Unirrig.	
Owned	8.36	2.70	6.10	13.99	14.46	16.69	31.15
Leased-in	0.50	-	-	-	0.50	-	0.50
Leased-out	1.95	-	-	-	1.95	-	1.95
Operated Area	6.91	2.70	6.10	13.99	13.01	16.69	29.70
In %	71.90	28.10	30.36	69.64	43.80	56.20	100.00

Source: In Parenthesis percentage figures are shown.

Cropping Pattern of the Sample Households

A perusal of the table No. 3.16 reveals that out of two sample districts viz., Dumka and West Singhbhum; the total cropped area is higher in West Singbhum (23.27) ha compared to Dumka district (13.19%). At the overall level, the data showed that paddy remained the most important crop, accounting for 60.97 per cent of the Gross Cropped Area (GCA) followed by wheat (17.69%), mustard (7.41%), maize (6.31%), etc. It revealed that kharif crops are mainly grown in the state. In fact due to undulated

topography of the state, the agriculture is mainly dependent on monsoon for irrigational purposes.

Table No. 3.16: Cropping Pattern of the Sample Households

Crops	Dumka		West Singhbhum		Overall	
	Area	%	Area	%	Area	%
Paddy	5.31	40.26	16.92	72.71	22.23	60.97
Maize	1.80	13.65	0.50	2.15	2.30	6.31
Wheat	3.70	28.05	2.75	11.82	6.45	17.69
Gram	0.30	2.27	-	-	0.30	0.82
Lentil	0.90	6.82	-	-	0.90	2.47
Mustard	0.60	4.55	2.10	9.02	2.70	7.41
Vegetables & Others	0.58	4.40	1.00	4.30	1.58	4.33
Gross Cropped Area	**13.19**	**100.00**	**23.27**	**100.00**	**36.46**	**100.00**

CHAPTER – IV

ECONOMICS OF FISH FARMING

This chapter discusses the fishing enterprise of the sample households and its economics in both the states. Various aspects concerned with the size of ponds, ownership, area of ponds, cost and return of fish cultivation, production and disposal of fish credit etc. are discussed.

Part – I: BIHAR

Nature and Area of Ponds/Tanks

As stated earlier, 90 fish farming households forms size of the sample in Bihar constituting 30 (33.33%) from small ponds (up to 0.5 ha), 37 (47.11%) medium ponds (0.5 to 2 ha) and 23 (25.54%) large size ponds (above 2 ha). These sample households were operating altogether 107 ponds comprising 95 (88.78%) government jalkars and 12 (11.22%) private ponds. The sample households had 1.307 hectare of ponds per household. However, it was higher in Purnea (1.644 ha/household) followed by Bhagalpur (1.378 ha/household) and Madhubani (0.898 ha/household). The average size of pond was estimated at 1.994 ha at overall level. However, it was higher in Purnea (1.644 ha) followed by Madhubani (0.898 ha) and Bhagalpur 0.879 ha). It showed that there are small and medium size fisheries in the state (table No. 4.1).

Table No. 4.1: Details of Ponds Area, Nature and Jambandi of Sample Households

	Particulars	Madhubani	Purnea	Bhagalpur	Overall
A.	**Distribution of Ponds**				
	Small (up to 0.5 ha)	14 (15.57)	8 (8.88)	8 (8.88)	30 (33.33)
	Medium (0.5 to 2 ha)	12 (13.33)	12 (13.33)	13 (14.45)	37 (47.11)
	Large (Above 2 ha)	4 (4.44)	10 (11.12)	9 (10.00)	23 (25.54)
	Total	30 (33.34)	30 (33.33)	30 (33.33)	90 (100.00)
B.	**Nature of Ponds**				
	Govt. Ponds (Jalkars)	27 (25.23)	27 (25.23)	41 (38.32)	95 (88.78)
	Private Ponds	3 (2.80)	3 (2.80)	6 (5.62)	12 (11.22)
	Total	30 (28.03)	30 (28.03)	47 (43.94)	107 (100.00)
C.	**Area of Ponds (In ha)**				
	Govt. Ponds (Jalkars)	24.46	46.70	38.87	110.03
	Private Ponds	2.50	2.63	2.48	7.61
	Total Avg. (Per Hh)	26.96 0.898	49.33 1.644	41.35 1.378	117.64 1.307
D.	**Rent/Jambandi (In Rs./ha/annum**	1484.81	845.25	1369.56	1233.21
E.	**Avg. Size of Pond (In ha)**	0.89	1.64	0.87	1.09

In parenthesis percentage figures are shown.

Deposits/Jamabandi

Ponds were either owned or leased in. Leasing of ponds are made for short term (up to 3 years) and long term (up to 10 years) by a statutory committee of the District Fisheries Office exclusively to the Co-operatives of the fishermen on rent basis, which is popularly called as jambandi. Among the selected fish farming households only 8 (8.89%) had owned pond and remaining 82 households had leased in ponds. So far as the lease amount (jambandi) is concerned it was Rs. 1233.21 per hectare per annum at overall level. The details of ponds and jambandi have been presented in table No. 4.1

Input Structure

The main inputs were lime, manure, fertilizer, seeds, feeds, medicines, hired labour, harvesting charges, family labour, watch/guard and of course, the interest of the variable costs. The data presented in table No. 4.2 showed the quantum of above inputs used at total farms. With the start of the season, ponds' water is treated with lime, which is used on an average 1.08 quintal/ha. After preparation of ponds and treatment of water, seeds are used which is the most important input. Farmers

preferred a mixture of two or more varieties of seeds and the most common mixture was Rohu, Katla, Mrigal, Silver, Common Carp, etc. which are bought from local seed traders. In fact there is no functional hatcheries in the state either in public or private sectors,. Traders used to purchase seeds from West Bengal to ensure the supply. On an average 1.27 quintal/ha of fish fingerlings/seeds are used.

Feeds included dry feed, green, oil cakes, brans, etc. It also includes fertilizers and manures, which are used on an average 2.13 trailers/ha and 1.28 qtl/ha respectively. On occurrence of diseases, medicines are given in consultation with the fishery officer/experts but their services are one or other way charged. It was reported that on an average 0.62 litre/ha of medicine used. Labour utilized per ha was 108 man days. Out of it 74 man days (68.52%) was of hired labour and 34 man days (31.48%) family labour. In addition to labour on an average one guard or watchman is also used. Harvesting charge is mostly paid in terms of fish, which is prevalent on an average in the ratio of 8:1.

Table No. 4.2: Input Structure of Total Farms

Inputs	Qty (Per ha)	Value (In Rs.)
Lime	1.08 qtl	760.91
Manure	2.13 trailer	1280.04
Fertilizer	1.28 qtl	641.38
Fingerlings/Seeds	1.27 qtl	31539.10
Feeds	6.78 qtl	2750.96
Medicines	0.62 litre	251.39
Hired Labour	74 mandays	4473.03
Harvesting charges	$1/8^{th}$ of the produce	1949.64
Family Labour (Inputed)	34 mandays	2002.98
Watch/Guard	1	2303.00
Interest on Variable Costs	@ 8-9% pa	2224.71
Total Value/ha	**--**	**50177.14**

Cost-Benefit Analysis

For calculation of cost, the concept of cost included both fixed and variable costs. Fixed cost includes rent paid for the leased-in ponds. However, in case of private ponds the rental value of land has been taken into consideration. Variable costs included all cash and kind expenses incurred for production. On the selected total farms the total cost came to Rs. 51410.35/ha. Out of it the share of variable costs was Rs. 50177.14/ha

i.e., 97.62 per cent and fixed cost Rs. 1233.21/ha i.e., 2.40 per cent. In case of private ponds the rental value of land/ponds area was Rs. 2052/ha. Of the variable costs the value of fingerlings/seeds was highest constituting 61.35 per cent (Rs. 31539.10/ha). The next important item was labour constituting 8.70 per cent hired labour and 3.90 per cent inputed value of family labour; followed by feeds Rs. 2750.96/ha (5.35%), watch and guard Rs. 2303/ha (4.48%), interest on purchase of all inputs Rs. 2224.71/ha (4.32%), harvesting Rs. 1949.64/ha (3.79%) etc. The total return was estimated at Rs. 93088.36/ha and the net return (total return minus total cost) came to Rs. 41678.01/ha on overall farms. Per quintal cost of production was calculated at Rs. 2481.19 and the yield of fish was 20.32 qtl/ha on overall farms. The average price per quintals was received by Rs. 4581.12. The Cost Benefit Ratio (CBR) was 1:1.81 (table No. 4.3). It is almost of similar in all three sample districts. The farm wise data have been presented in table nos. 4.4, 4.5 and 4.6, which revealed that there is very little or no relationship between the Cost Benefit Ratios and the size of fish farms.

Table No. 4.3: Per Hectare Cost and Return of Fish Farming of Total Farms

Costs	Madhubani	Purnea	Bhagalpur	Overall *(In %)*
A. Fixed Cost (In Rs.)				
Surakshit Jama or	1484.81	845.25	1369.56	1233.21 (2.40)
Rental Value of Land	3725.00	1790.00	1015.00	2052.00
B. Variable Cost (In Rs.)				
Lime	816.12	522.94	944.34	760.91 (1.48)
Manure	1082.61	1783.34	974.16	1280.04 (2.49)
Fertilizer	229.17	992.65	793.31	641.38 (1.25)
Fingerlings/Seeds	32299.80	32395.84	30921.66	31539.10 (61.35)
Feeds	2038.00	2676.40	3538.46	2750.96 (5.35)
Medicines & Other Chemicals	366.67	230.84	256.66	251.39 (0.49)
Hired Labour	4245.34	4267.08	4906.66	4473.03 (8.70)
Harvesting	2140.91	1194.67	2513.33	1949.64 (3.79)
Family Labour (Imputed)	1918.28	2572.00	1518.66	2002.98 (3.90)
Watch/Guard	2409.00	2086.67	2413.33	2303.00 (4.48)
Interest on Variable Cost	1618.48	2788.07	2267.56	2224.71 (4.32)
Total	44761.85	51510.50	51048.13	50177.14
Grand Total (A+B)	**46246.66**	**52355.75**	**52417.69**	**51410.35 (100.00)**
Gross Return (In Rs.)	87406.18	89754.00	98193.06	93088.36
Net Return (In Rs.)	41159.52	37398.25	45775.37	41678.01
Cost of Production/Qtl	2041.79	2845.42	2484.25	2481.19
Yield of Fish (Qtl)	22.65	18.40	21.10	20.32
Cost Benefit Ratio	**1:1.89**	**1:1.71**	**1:1.88**	**1:1.81**

Table No. 4.4: Per Hectare Cost and Return of Fish Farming of Small Farms

Costs	Madhubani	Purnea	Bhagalpur	Overall (In %)
B. Fixed Cost (In Rs.)				
Surakshit Jama or	1218.17	810.10	1272.40	1092.72 (2.11)
Rental Value of Land	3219.00	1785.50	918.00	1952.00
B. Variable Cost (In Rs.)				
Lime	742.19	501.70	870.70	714.17 (1.38)
Manure	614.00	1413.55	932.00	962.55 (1.86)
Fertilizer	610.50	719.45	742.00	681.56 (1.33)
Fingerlings/Seeds	31714.00	30170.00	29890.66	30152.33 (58.33)
Feeds	1273.00	2092.00	3210.70	2172.17 (4.20)
Medicines & Other Chemicals	272.87	110.25	214.00	207.70 (0.40)
Hired Labour	3190.00	3014.00	4140.33	3467.10 (6.71)
Harvesting	5200.00	4780.00	2990.40	4115.85 (7.96)
Family Labour (Imputed)	3960.00	4250.00	1790.00	3390.00 (6.56)
Watch/Guard	1780.50	2110.00	2009.50	1942.80 (3.76)
Interest on Variable Cost	2790.80	3140.00	2988.00	2792.93 (5.40)
Total	52147.86	52300.95	49778.29	50599.16
Grand Total (A+B)	**53366.03**	**53111.05**	**51050.69**	**51691.88 (100.00)**
Gross Return (In Rs.)	92765.00	94317.75	88995.35	90110.00
Net Return (In Rs.)	39398.97	41206.70	37944.66	38418.12
Cost of Production/Qtl	3581.61	3238.48	2868.02	3123.38
Yield of Fish (Qtl)	14.90	16.90	17.80	16.55
Cost Benefit Ratio	**1:1.74**	**1:1.78**	**1:1.35**	**1:1.74**

Table No. 4.5: Per Hectare Cost and Return of Fish Farming of Medium Farms

Costs	Madhubani	Purnea	Bhagalpur	Overall (In %)
C. Fixed Cost (In Rs.)				
Surakshit Jama or	1492.15	882.00	1242.00	1192.70 (2.23)
Rental Value of Land	3709.50	1792.00	1175.50	2272.65
B. Variable Cost (In Rs.)				
Lime	782.15	572.17	810.79	707.69 (1.32)
Manure	919.75	1802.10	1412.47	1292.18 (2.41)
Fertilizer	629.10	743.87	817.17	742.04 (1.39)
Fingerlings/Seeds	32050.00	31903.00	34392.81	32171.1 (60.12)
Feeds	1275.50	3492.71	3716.12	2911.19 (5.44)
Medicines & Other Chemicals	269.70	169.00	292.40	249.42 (0.47)
Hired Labour	3775.42	4245.00	4972.47	4334.69 (8.10)
Harvesting	5285.69	1225.50	2418.75	2876.17 (5.37)
Family Labour (Imputed)	3145.00	2449.78	1603.90	2281.40 (4.26
Watch/Guard	2415.00	2175.00	2219.79	2283.40 (4.27)
Interest on Variable Cost	2792.47	2020.17	2439.81	2473.19 (4.62)
Total	53339.78	50798.30	55096.48	52322.54
Grand Total (A+B)	**54831.93**	**51680.30**	**56338.48**	**53515.24 (100.00)**
Gross Return (In Rs.)	104372.00	90305.50	98672.72	97012.00
Net Return (In Rs.)	49540.22	38625.20	42334.24	43496.76
Cost of Production/Qtl	2636.15	2887.17	3061.87	2719.27
Yield of Fish (Qtl)	20.80	17.90	18.40	19.68
Cost Benefit Ratio	**1:1.90**	**1:1.75**	**1:1.75**	**1:1.81**

Table No. 4.6: Per Hectare Cost and Return of Fish Farming of Large Farms

Costs	Qty/No	Madhubani	Purnea	Bhagalpur	Overall (In %)
D. Fixed Cost (In Rs.)					
Surakshit Jama or	P/a	1404.70	892.00	1075.25	1103.79 (2.12)
Rental Value of Land	P/a	3682.00	1540.70	988.00	2171.18
B. Variable Cost (In Rs.)					
Lime		819.00	569.90	870.70	724.32 (1.39)
Manure		1272.11	1718.70	1318.75	1386.00 (2.66)
Fertilizer		687.10	702.17	811.10	718.25 (1.38)
Fingerlings/Seeds		30892.75	32154.10	32171.00	30897.3 (59.29)
Feeds		1390.40	3419.11	3816.25	2879.00 (5.52)
Medicines & Other Chemicals		290.87	253.00	272.40	281.14 (0.54)
Hired Labour		4015.15	4272.00	5045.00	4384.00 (8.41)
Harvesting		3807.41	1080.00	2570.25	2681.70 (5.15)
Family Labour (Imputed)		2175.00	1790.75	1210.00	1682.00 (3.23)
Watch/Guard		2817.70	2210.00	2515.25	2504.10 (4.81)
Interest on Variable Cost		2914.25	2815.50	2260.74	2871.19 (5.50)
Total		51081.74	50985.23	52861.44	51009.12
Grand Total (A+B)		**52486.44**	**51877.23**	**53936.69**	**52112.91 (100.00)**
Gross Return (In Rs.)		92950.00	92762.50	98260.00	93890.00
Net Return (In Rs.)		40103.56	40885.27	48663.31	41777.09
Cost of Production/Qtl		2664.28	2866.14	2318.48	2548.31
Yield of Fish (Qtl)		19.70	18.10	22.80	20.45
Cost Benefit Ratio		**1:1.76**	**1:1.79**	**1:1.82**	**1:1.80**

Production and Disposal of Fish

The total production of fish on total farms was 2390.79 quintals. It was found that the output per hectare was lower (18.40 qtl) in Purnea whereas that of 21.10 qtl in Bhagalpur and 22.65 qtl; the highest in Madhubani district. Out of total production 2328.18 quintals (97.38%) was marketed and 62.61 quintals (2.62%) used in home consumption. It revealed that a very high percentage of produce in marketed (table 4.7).

Table No. 4.7: Production and Disposal of Fish of Total Farms (In qtl.)

Districts	Total Area (In ha)	Total Production	Yield Rate (In qtl/ha)	Disposal	
				Domestic Consumption	Marketed
Madhubani	26.96	610.64 (100.00)	22.65	19.04 (3.11)	591.60 (96.89)
Purnea	49.33	907.67 (100.00)	18.40	11.70 (1.28)	895.97 (98.72)
Bhagalpur	41.35	872.48 (100.00)	21.10	31.87 (3.65)	840.61 (96.34)
Total	**117.64**	**2390.79 (100.00)**	**20.32**	**62.61 (2.62)**	**2328.18 (97.38)**

In Parenthesis percentage figures are shown.

Marketing System and Channels

There are different ways of marketing of the produce. These are mainly as below:

i. Spot sell/sell at farm
ii. Local haat/market
iii. Sell to retailers
iv. Sell to wholesalers

As indicated in table No. 4.7 a total quantity of 2328.18 quintals of the produce was marketed. In fact, it was marketed by way of three identified marketing channels, which are as below:

i. Zero Level : Producer – Consumer
ii. One Level : Producer - Retailer – Consumer
iii. *Two Level : Producer – Wholesaler – Retailer – Consumer*

The data presented in table No. 4.8 revealed that out of the total marketed quantity of total farms 1135.15 quintals was marketed through the channel No. – II i.e., one level (48.76%) followed by 876.58 quintals by channel No. – III, i.e., two level (37.65%) and 316.45 quintals by channel No. – I (13.59%). However, above pattern was not similar in all the three sample districts. In Madhubani and Purnea districts, out of the total marketed quantity, channel No. – III prominently figured at 50.63 per cent and 48.31 per cent followed by channel No. – II i.e., 35.61 per cent and 40.73 per cent and channel No. – I i.e., 13.76 per cent and 10.96 per cent respectively. In case of Purnea district, the largest quantity was sold through channel No. – II (64.97%), followed by channel No. – III (19.08%) and channel No. – I (15.95).

Table No. 4.8: Quantity Marketed through different Channels (Qty in Qtl).

Districts	Zero Level (PC)	One Level (PRC)	Two Level (PWRC)	Total
Madhubani	81.40 (13.76)	210.65 (35.61)	299.55 (50.63)	591.60 (100.00)
Purnea	142.90 (15.95)	582.10 (64.97)	170.97 (19.08)	895.97 (100.00)
Bhagalpur	92.15 (10.96)	342.40 (40.73)	406.06 (48.31)	840.61 (100.00)
Total	**316.45 (13.59)**	**1135.15(48.76)**	**876.58 (37.65)**	**2328.18 (100.00)**

In parenthesis percentage figures are shown.

PC : Producer – Consumer
PRC : Producer-Retailer-Consumer
PWRC : Producer-Wholesaler-Retailer-Consumer

Credit Status

Credit is a critical input in fish farming. On the other hand, fish farming is a capital as well as labour intensive. Capital is needed at every stage of farming i.e., from leasing of ponds and/or preparation of ponds to marketing of the produce. As discussed earlier that cost per hectare on total farms came to Rs. 50177.14. Since majority of the fish farmers belonged to fishermen community who came from small size holding groups and most backward castes (BBCs), they were not able to meet the entire cash requirements of fish farming out of their own pockets or sources. They, therefore, seek credit either from formal or informal agencies or many times from both the agencies. The credit status of the total sample farms may be seen in table no. 4.9.

Table No. 4.9: Credit Status of Total Fish Farmers

Particulars	Madhubani (N=30)	Purnea (N=30)	Bhagalpur (N=30)	Total (N-90)
No. of Hhs received the loan (In %)	12 (40.00)	9 (30.00)	5 (16.67)	26 (28.89)
Avg. Amount of loan (In Rs.)	40416.67	33333.34	50000.00	41250.00
Avg. Amount of Repayment (In Rs.)	17916.67	19222.23	18000.00	18379.63
Avg. Amount of outstanding (In Rs.)	22500	14111.11	32000.00	22870.37

In brackets percentage figures are shown

It may be observed from the table that out of the total selected farmers only 28.89 per cent of them were taken loan from different sources. The average amount of borrowing was Rs. 41250/-. Out of the total borrowers, six have repaid their loan amount, 19 have repaid partially and one has not yet started to repay the amount. Thus the average amount of repayment was estimated at Rs. 18379.63 and the outstanding amount at Rs. 22870.37.

Part – II: Jharkhand

Nature and Area of Ponds/Tanks

As discussed in chapter – one, 60 fish farming households forms size of the sample in Jharkhand state comprising 25 (41.67%) from small ponds (up to 0.5 ha), 25 (41.67%) from medium farms (0.5 to 2 ha) and 10 (16.67%) large size ponds (above 2 ha). These sample households were operating altogether 60 ponds constituting 53 (88.33%)

government ponds/tanks and 7 (11.67%) private ponds. On an average the sample households had 1.08 hectare of ponds per household. It was 1.48 ha/household in Dumka whereas that of in West Singhbhum 0.76 ha. It clearly revealed that there are almost small and medium size fisheries in the state (table No. 4.10).

Deposits/Jamabandi

Government ponds/tanks are leased-in to the fisherman societies against which lessee have to pay rent, commonly known as Jamabandi or Reserve deposits. There are two periods of leasing viz. short period (up to 3 years) and long term (for 10 years). Most of the ponds were found leased in for short period. Among the selected fish farming households, only 7 had owned ponds and remaining were operating leased in ponds. The overall rent was fund at Rs. 2244.55 per ha per annum (table No. 4.10.)

Table No. 4.10: Details of Ponds Area, Nature and Jambandi of Sample Households

	Particulars	Dumka	West Singhbhum	Overall
A.	**Distribution of Ponds**			
	Small (up to 0.5 ha)	9 (15.00)	16 (26.67)	25 (41.67)
	Medium (0.5 to 2 ha)	12 (20.00)	13 (21.67)	25 (41.67)
	Large (Above 2 ha)	9 (15.00)	1 (1.66)	10 (16.66)
	Total	30 (50.00)	30 (50.00)	60 (100.00)
B.	**Nature of Ponds**			
	Govt. Ponds (Jalkars)	30 (50.00)	23 (38.33)	53 (68.33)
	Private Ponds	---	7 (11.67)	7 (11.67)
	Total	30 (50.00)	30 (50.00)	60 (100.00)
C.	**Area of Ponds (In ha)**			
	Govt. Ponds (Jalkars)	42.30	18.01	60.31
	Private Ponds	--	4.69	4.69
	Total Avg. (Per Hh)	42.30 1.41	22.70 0.76	65.00 1.08
D.	**Rent/Jambandi (In Rs./ha/annum)**	2136.43	2498.48	2244.55

In parenthesis percentage figures are shown.

Input Structure

The main inputs were lime, manure, fertilizer, fingerlings, feeds, medicines, water, labour, guard, etc. The data given in table No. 4.11 showed the quantum of inputs used on overall farms. Lime @ 0.76 quintal/ha is used for treating the pond's water. After preparation of ponds

and treatment of water fingerlings are dropped on the onset of monsoon. It is usually given @ 1.12 quintals per hectare and preferred in mixtures of two or more varieties. The most common varieties are Katla, Rohu, Silver Carp, Grass Carp, Mrigal, Common Carp, etc. These are bought from the local traders who used to purchase from West Bengal. It means the supply line of fingerlings is West Bengal. In fact there is no functional hatchery in the state either in public or private ownership. Feeds included dry feed, green, oil cakes, brans etc. It also includes fertilizers and manures, which are used on an average 1.07 qtl/ha and 17.50 qtl/ha respectively. In the event of diseases, medicines are also given on the advice of local so called technicians and the Fisheries Extension officers. But they are not always readily available for diagnosis. Jharkhand, having the undulated topography many times water table goes much deep in summer and sometimes also in pre-monsoon periods also thus, water is also given in the ponds subject to the availability of tubewells or other sources of water in nearby area. On hiring or purchasing of water from informal water market on an average@ Rs.60/ hour is charged. Labour is an important input which are hired and family both. On an average 53 mandays of labour utilized. In addition to labour a guard or watchman is also required for safety of the ponds. Harvesting is popularly done on sharing basis, which is on an average one-sixth of the produce. Interest is also paid on borrowings, which are used for purchase of inputs.

Table No. 4.11: Input Structure of Total Farms

Inputs	Qty (Per ha)	Value (In Rs.)
Lime	0.76 qtl	489.00
Manure	17.50 qtl.	1344.17
Fertilizer	1.07 qtl	326.17
Fingerlings/Seeds	1.12 qtl	15119.50
Feeds	3.14 qtl	1697.02
Medicines	0.40 litre	390.84
Water	@ Rs. 60/ hr.	293.52
Hired Labour	37 mandays	1882.97
Harvesting charges	$1/6^{th}$ of the produce	651.94
Family Labour	16 mandays	1097.67
Watch/Guard	01 (One)	483.86
Interest on Variable Costs	@ 8-9 %	1163.31
Total Value/ha	**--**	**24939.98**

Cost – Benefit Analysis

The concept of cost included both fixed and variable cost. Fixed Cost includes rent paid for leased in ponds or rental value of land in case of private ponds. Variable Costs include all cash and kind expenses incurred for production. On the selected total farms, total cost was estimated at Rs. 26785/ha. Out of it, the share of fixed cost was Rs. 1845.27, which accounts

for 6.89 per cent of the total cost. Total variable cost was calculated at Rs. 24939.98, accounts for 93.11 per cent of the total costs. Of the total cost, the cost of fingerlings/seeds was highest constituting 56.45 per cent (Rs. 15119.50/ha) followed by labour (11.12%) comprising 7.03 per cent (Rs. 1882.97/ha) for hired labour and 4.09 per cent (Rs. 1097.67/ha) for family labour, feeds (6.34%) manure (5.02%), interest on variable cost (4.34%) etc. The total return was calculated at Rs. 40640.95 and the net return came to Rs. 13855.70/ha. The cost of production of per quintal of fish was estimated at Rs. 2248.97 and yield rate was 11.91 qtl./ha. The average price realized out of the sale was Rs. 3412.33 per required, indicating the Cost-Benefit Ratio (CBR) 1:1.52. The costs and returns trend were almost similar in both the sample districts. However, the district wise and farm wise analysis have been presented in table Nos. 4.12, 4.13, 4.14 and 4.15 which also revealed that there is no significant relationship between the CBRs and farm sizes.

Table No. 4.12: Per Hectare Cost and Return of Fish Farming of Total Farms

Costs	Dumka	West Singhbhum	Overall (In %)
A. Fixed Cost (In Rs.)			
Surakshit Jama or	2166.67	1523.86	1845.27 (6.89)
Rental Value of land	--	-	-
B. Variable Cost (In Rs.)			
Lime	416.95	561.03	489.00 (1.83)
Manure	751.67	1936.67	1344.77 (5.02)
Fertilizer	326.17	---	326.17 (1.22)
Fingerlings/Seeds	15696.67	14542.33	15119.50 (56.45)
Feeds	1717.05	1677.00	1697.03 (6.34)
Medicines & Other Chemicals	336.67	445.00	390.84 (1.46)
Water	160.03	427.00	293.52 (1.09)
Hired Labour	2621.67	1144.27	1882.97 (7.03)
Harvesting	606.67	697.20	651.94 (2.43)
Family Labour (Imputed)	1776.67	404.67	1097.67 (4.09)
Watch/Guard	66.67	901.05	483.86 (1.81)
Interest on Variable Cost	1259.21	1067.40	1163.31 (4.34)
Total	25736.10	23803.62	24939.98
Grand Total (A+B)	**27902.77**	**25327.48**	**26785..25 (100.00)**
Gross Return (In Rs.)	44345.89	36939.07	40640.95
Net Return (In Rs.)	16443.12	11611.59	13855.70
Cost of Production/Qtl	2032.25	2965.75	2248.97
Yield of Fish (Qtl)	13.73	8.54	11.91
Cost Benefit Ratio	**1:1.59**	**1:1.46**	**1:1.52**

Table No. 4.13: Per Hectare Cost and Return of Fish Farming of Small Farms

Costs	Dumka	West Singhbhum	Overall (In %)
B. Fixed Cost (In Rs.)			
Surakshit Jama or	1742.05	1481.30	1611.68 (6.49)
Rental Value of Land	--	--	--
B. Variable Cost (In Rs.)			
Lime	312.70	506.00	409.35 (1.65)
Manure	711.08	1792.30	1251.69 (5.04)
Fertilizer	316.70	--	316.70 (1.28)
Fingerlings/Seeds	14750.50	13380.80	14065.65 (56.65)
Feeds	1508.00	1572.10	1590.05 (6.20)
Medicines & Other Chemicals	341.06	385.55	363.30 (1.46)
Water	147.00	360.85	253.93 (1.02
Hired Labour	2270.00	1070.45	1670.23 (6.73)
Harvesting	503.00	389.50	446.25 (1.80)
Family Labour (Imputed)	1892.00	348.70	1120.35 (4.51)
Watch/Guard	--	772.00	772.00 (3.11)
Interest on Variable Cost	1027.75	987.50	1007.63 (4.06)
Total	23779.79	21565.75	23217.13
Grand Total (A+B)	**25521.84**	**23047.05**	**24828.81(100.00)**
Gross Return (In Rs.)	39094.52	33785.00	37739.79
Net Return (In Rs.)	13572.68	10737.95	14140.74
Cost of Production/Qtl	2033.61	3028.52	2546.54
Yield of Fish (Qtl)	12.55	7.60	9.75
Cost Benefit Ratio	**1:1.53**	**1:1.46**	**1:1.52**

Table No. 4.14: Per Hectare Cost and Return of Fish Farming of Medium Farms

Costs	Dumka	West Singhbhum	Overall (In %)
C. Fixed Cost (In Rs.)			
Surakshit Jama or	2192.70	1670.40	1931.55 (6.85)
Rental Value of Land	--	--	--
B. Variable Cost (In Rs.)			
Lime	448.55	520.18	484.37 (1.72)
Manure	707.15	1107.40	907.28 (3.22)
Fertilizer	340.17	789.75	564.96 (2.00)
Fingerlings/Seeds	14980.00	15701.25	15340.63 (54.39)
Feeds	1870.80	1542.00	1706.40 (6.05)
Medicines & Other Chemicals	317.00	418.00	367.50 (1.30)
Water	210.00	370.00	290.00 (1.03)
Hired Labour	2855.00	2540.00	2697.50 (9.56)
Harvesting	870.50	709.25	789.88 (2.80)
Family Labour(Imputed)	1581.00	1380.00	1480.50 (5.25)
Watch/Guard	125.75	775.00	450.38 (1.60)
Interest on Variable Cost	1280.15	1109.25	1194.70 (4.23)
Total	25586.07	26962.08	26274.10
Grand Total (A+B)	**27778.77**	**28602.48**	**28205.65 (100.00)**
Gross Return (In Rs.)	44818.70	42331.67	44000.81
Net Return (In Rs.)	14539.93	13729.19	15795.16
Cost of Production/Qtl	2104.45	3306.45	2611.63
Yield of Fish (Qtl)	13.20	8.65	10.80
Cost Benefit Ratio	**1:1.61**	**1:1.48**	**1:1.56**

Table No. 4.15: Per Hectare Cost and Return of Fish Farming of Large Farms

Costs	Dumka	West Singhbhum	Overall (In %)
D. Fixed Cost (In Rs.)			
Surakshit Jama or	2092.50	1553.50	1823.00 (6.39)
Rental Value of Land	--	--	--
B. Variable Cost (In Rs.)			
Lime	422.17	598.55	510.36 (1.79)
Manure	789.20	2215.45	1502.33 (5.26)
Fertilizer	408.10	417.15	412.63 (1.45)
Fingerlings/Seeds	15881.50	15309.00	15595.25 (54.64)
Feeds	1749.27	1870.80	1810.03 (6.34)
Medicines & Other Chemicals	386.42	526.25	456.33 (1.60)
Water	166.17	617.50	391.8 (1.37)
Hired Labour	2819.50	2215.00	2517.25 (8.82)
Harvesting	817.50	717.40	767.45 (2.69)
Family Labour (Imputed)	1210.00	445.52	827.61 (2.90)
Watch/Guard	218.30	1250.00	734.15 (2.57)
Interest on Variable Cost	1311.40	1072.15	1191.77 (4.18)
Total	26179.53	27254.47	26717.00
Grand Total (A+B)	**28272.03**	**28807.97**	**28540.00 (100.00)**
Gross Return (In Rs.)	45235.25	42923.88	44237.00
Net Return (In Rs.)	16963.22	14115.91	15697.00
Cost of Production/Qtl	2005.11	3165.71	2613.55
Yield of Fish (Qtl)	14.10	9.10	10.92
Cost Benefit Ratio	**1:1.60**	**1:1.49**	**1:1.55**

Production and Disposal of Fish

The total production of fish on total farms was estimated at 774.64 qtl. The overall per hectare yield rate was 11.91 qtl. It was 13.73 qtl/ha in Dumka district whereas that of in West Singhbhum 8.54 qtl/ha. In regard to the disposal of the produce, the data shown in table No. 4.16 revealed that of the total 50 quintals (6.45%) is consumed at home and 724.64 quintals (93.55%) marketed, indicating marketing of high percentage of production.

Table No. 4.16: Production and Disposal of Fish of Total Farms (In qtl.)

Districts	Total Area (In ha)	Total Production	YieldRate (In qtl/ha)	Disposal	
				Domestic Consumption	Marketed
Dumka	42.30	580.78	13.73	36.20 (4.67)	544.58 (70.30)
West Singhbhum	22.70	193.86	8.54	13.80 (1.78)	180.06 (23.24)
Total	**65.00**	**774.64**	**11.91**	**50.00 (6.45)**	**724.64 (93.55)**

In Parenthesis percentage figures are shown.

Marketing System and Channels

There are different ways of marketing of the produce. These are mainly as below:

i. Spot sell/sell at farm
ii. Local haat/market
iii. Sell to retailers
iv. Sell to wholesalers

As indicated in table No. 4.17 a total quantity of 724.64 quintals of the produce was marketed and the system of marketing works under three identified marketing channels, which are as below:

i. Zero Level : Producer – Consumer
ii. One Level : Producer - Retailer – Consumer
iii. Two Level : Producer – Wholesaler – Retailer – Consumer

The data presented in table No. 4.17 revealed that out of the total marketed quantity of total farms 554.76 quintals (76.56%) was marketed by the marketing channel No. – I wherein producer directly sells the produce to the consumer, followed by one level, accounts for (16.85%) of the marketed quantity and 6.59 per cent (47.76 quintals) through channel No. two. Produce marketed through channel No. – II reveals that producers sell their marketable quantity in the hands of retailers who used to sell directly to the consumers. Channel No. – III signified that there are two intermediaries between the producers and consumers. Those are wholesalers and retailers. However, the pattern of marketing of the producer was a little different in selected districts. In Dumka district, out of the total marketed quantity channel No. – I was prominently figured at 75.61 per cent followed by channel Nos. – II (19.51%) and III (4.88%). In case of West Singhbhum district, the largest quantity was sold through channel No. – I (79.41) followed by III (11.77%) and II (8.82%).

Table No. 4.17: Quantity Marketed through different Channels (Qty in Qtl).

Districts	Zero Level (PC)	One Level (PRC)	Two Level (PWRC)	Total
Dumka	411.78 (75.61)	106.24 (19.51)	26.56 (4.88)	544.58 (100.00)
West Singhbhum	142.98 (79.41)	15.88 (8.82)	21.20 (11.77)	180.06 (100.00)
Total	**554.76 (76.56)**	**122.12 (16.85)**	**47.76 (6.59)**	**724.64 (100.00)**

In parenthesis percentage figure are shown.

PC : Producer – Consumer
PRC : Producer-Retailer-Consumer
PWRC : Producer-Wholesaler-Retailer-Consumer

Credit Status

Fish farming is a capital as well as labour intensive and thus, credit is an important input. It is needed at every stage of fish farming. But it is not easy to get for common fishermen and so it is a starved input. Among the sample households in Jharkhand State 11 households (18.33%) could availed it and of them, only 7 households have received it from the formal sources and remaining from informal sources. Since all the fish farmers are belonged to either most backward castes or scheduled castes or scheduled tribes, who are generally not able to meet the entire cash requirements of fish farming out of from their own pockets or sources. Thus, they need credit. The credit status of the sample farms may be seen from the table No. 4.18. The data from the table revealed that the average amount of borrowing was Rs. 15700.96 on total farms. Among the borrowers, one has repaid the full amount, 3 have paid partially and 7 are yet to start repayment. The average amount of repayment was Rs. 6187.36 on total farms and the outstanding Rs. 9513.60.

Table No. 4.18: Credit Status of Total Fish Farmers

Particulars	Dumka (N=30)	West Singhbhum (N=30)	Total (N-60)
No. of Hhs received the loan	7 (23.33)	4 (13.33)	11 (18.33)
Avg. Amount of loan (In Rs.)	14225.15	18281.25	15700.96
Avg. Amount of Repayment (In Rs.)	3219.00	11382.00	6187.36
Avg. Amount of outstanding (In Rs.)	11006.15	6900.25	9513.60

In brackets percentage figures are shown

CHAPTER – V

PROBLEMS AND PROSPECTS OF FISH FARMING

Constraints Faced by the Sample Households

The beneficiary members of fish farming co-operative society who received ponds/tanks on lease and started fish farming are not free from the constraints. Information about various opinions of sample farmers regarding constraints faced by them was elicited, which are given in table No. 5.1.

Table No. 5.1: Constraints faced by the Sample Households (In %)

SN	Problems	Madhubani (N=30)	Purnea (N=30)	Bhagalpur (N=30)	Overall (N=90)
i.	Jalkars Management Act, 2006 do't encourage professionalism in Fisheries	10.00	20.00	6.67	12.22
ii.	Fishery Department mainly involved in collection of Revenue & settlement of Jalkars	23.33	13.33	30.00	22.22
iii.	Lack of Capital/Credit	40.00	30.00	56.67	42.22
iv.	Lack of Quality Fingerlings (Seeds)	23.33	36.67	26.67	28.88
v.	Insecurity of the Ponds/theft of Fish	13.33	20.00	36.67	23.33
vi.	Fish Diseases	46.67	33.33	30.00	36.67
vii.	Silted Ponds/Tanks	56.67	40.00	46.67	47.77
viii.	Lack of proper boundary/area of ponds	26.67	20.00	13.33	20.00
Ix	Grabbing of Ponds by the dominant people of the area	6.67	10.00	13.33	10.00
x.	Lack of Transportation & Marketing Facilities	20.00	16.67	30.00	22.22
xi.	Lack of Technical Guidance	23.33	46.67	40.00	36.67

The data presented in above table revealed that altogether eleven constraints which have been identified by the sample households with their varying degrees/percentages. On an average 47.77 per cent sample households reported to have faced problems of siltation of ponds/tanks, which have not been cleaned for several years; 42.22 per cent have difficulties of capital/credit; 36.67 per cent have reported about lack of technical guidance and same numbers for fish diseases (mostly in neck and tail); 28.88 per cent reported about lack of quality fingerlings; 23.33 per cent have difficulties of fish theft/insecurity of ponds from anti-social elements; 22.2 per cent reported about lack of proper transportation and marketing facilities; 22.22 per cent said about the fishery

department, which is mainly involved in leasing out of the jalkars and collection of revenue rather than facilitating the prospective fish farmers; 20.00 per cent complained about lack of proper boundary around the ponds, which sometimes create social tension; 12.2 per cent were of the views that Jalkar Management Act, 2006 is no doubt a welcome step of the Government but it did not promote professionalism in fisheries rather it has socially empowered to the fishermen community and 10.00 per cent reported about the ill wills of dominant people of the area for grabbing the ponds.

Prospects of Fish Farming

In spite of various constraints faced by the sample households, the state is blessed with vast and varied fisheries and aquaculture resources. The current situation of disappointing fisheries development can be mainly attributed to poor institutional set-up, almost non-existence extension services, lack of adequate resources and infrastructural facilities devoid of conducive policy environment, defunct fisheries co-operative, lack of professionalism among fisheries personnel, fragmented social set up, poverty and illiteracy among the primary producers etc. *(Report of the STF, Government of India, 2008).* The state is endowed with vast potentiality, which includes 69000 ha ponds and tanks, 9000 ha oxbow lakes, 7200 ha reservoirs, 3200 km rivers and about 1.00 lakh hectare of riverine and other flood plains wetlands. At present the annual production is about 2.61 lakh MT against the demand of 4.56 lakh MT. Thus, it is necessary to double the production to bridge the gap for which a work plan popularly known as ***Road Map for Fisheries*** has been prepared by the government for 11th Plan period. It aims at implementing following main activities:

- *Conservation of water bodies like ponds and tanks*
- *Intensive and semi-intensive fish culture in ponds*
- *Construction of inlet and outlet for easier passage in mauns for culture based fisheries*
- *Culture up to an optimism size*
- *Raising annual production of fry up to 65 crores from the present level of 35 crores*
- *Developing the market system to support farmers for different price.*

Proposed Interventions in Road Map

There is much scope for developing culture based fisheries in mauns and bringing ponds into intensive and semi-intensive culture to attain the desired level of 4.56 lakh tones of annual fish production. In addition, it will create employment to fishermen community, which is at present 23 lakh in the state, constituting 50 per cent of the total fishermen population of the country and thus, various supporting schemes would also continue. These schemes are follows:

- Arrangement of fingerlings as seeds --- The annual requirement of fingerlings is around 40 crores. To support fish seed production “Brood Banks” would be established.
- Fish Seed Farms are proposed to be developed as fry and fingerlings production Centres.
- Intensive/Semi intensive fish culture in ponds – As per the present estimate 69000 ha water area is available as ponds/tanks. Renovation of ponds is being done in NREGP. The present achieved mean fish productivity in developed ponds in the state is about 2.2 mt/ha/year. Addressing 50,000 ha of ponds area for development in a mission mode, it is planned to enhance the productivity of 3 tonnes/ha year in 30,000 ha and 5 tonnes/ha/year in 20,000 ha.
- Ponds have been divided into three categories namely; A, B, C and D depending up on the productivity. Ponds owners/lessee would be provided fingerlings in adequate numbers to stock their ponds.
- Culture based fisheries in oxbow lakes --- mauns or oxbow lakes are cut off portions of meandering rivers. They are very productive and their annual fish production potential ranges between 1500-2000 kg/ha as estimated by ICAR. Their number in the state is nearly 100 and presently mauns are mostly being utilized for capture fisheries. Present level of production is 60-70 kg/ha/year. Some of the lakes, which have been developed, are giving production up to 400-500 kg/ha/year. This depicts that oxbow lakes can give production many folds if they are utilized in culture pattern. About 5000 ha of mauns can be brought under culture based fisheries.

- Development of fisheries in water logged area – Mostly water logged areas suitable for fish culture in private sector. At present there is a centrally sponsored scheme for fisheries development in water logged areas.
- Feed Production --- Feed is an important input for fisheries. The government is contemplating to establish 150 feed mills by the end of the 11th Five Year Plan through private sectors, fisheries co-operatives and their federations.
- Post Harvesting Marketing – the scheme is proposed to build the market linkages and infrastructure for safe, fast and hygienic transport, developing cold chains to reach fish to different parts of the state and beyond.
- Training of Farmers --- Training is an essential part for carrying technology to farm and field. Presently the department of fisheries is dependent up on ICAR institutes for quality training of farmers. Farmers are being sent to Kakinada Centre of CIFE for 10 days training. The government has planned to impart outstate state training to 1000 farmers every year and arrange training of 2000 farmers at division and state training centres.
- Para Extension Workers Scheme – Presently this scheme is being implemented in 10 districts. Para Extension Workers are selected, given training and are supposed to work with farmers and their consultants. Initially they are paid Rs. 2000/- month for 3 months to prepare a working field for them. This scheme is being expanded to al the districts in the state.
- Survey of ponds for building authentic and update database for effective planning. At present, 10 districts have been covered under the scheme but during 11th Plan period, it is being expanded to all the districts.
- Strengthening of Extension System is also being done for effective communication and sharing views with stakeholders.
- Group Accident Insurance Security to Active Fishermen --- Fishermen work in some of the most hazardous area prone to accidents. Presently 50,000 active fishermen are covered under the national scheme for welfare of fishermen. The government has extended insurance coverage to more active fishermen. Janshree Bina Yojana is going to be implemented.

- Model Fisherman Village is going to private to poor fishmen under National Scheme of Welfare of Fishermen.
- Demonstration of Integrated Fish Farming is proposed to reduce the cost on feed in commodities integrate one or more than one commodities with aquaculture.
- Training Centre at Patna --- The Government is contemplating to establish a Training Centre at Patna. At present there is no fisheries training centre in the state.
- Strengthening of Fish Farmers' Development Agencies (FFDAs) – There are 33 FFDAs operational in the state. Presently their financial activity is very limited and they are not working as independent organization. To make them effective and for operationally strengthening them it is proposed to provide them a working capital of Rs. 10 lakh, which will provide speedy implementation of development schemes. With this FFDAs will manage their own business. This fund would be used a "Revolving Fund."
- Matsya Krishak Samman Yojana – Under the scheme, farmers would be given fisheries and aquaculture instruments to those farmers who have attained an annual production level of 3000 kg fish/ha.

Suggestions given by the Sample Households

In addition to the constraints, the sample households have also suggested the measures to solve the problems with a view to make the occupation remunerative and sustainable. Details may be looked in table No. 5.2:

Table No. 5.2: Suggestions given by the Sample Households (In %)

SN	Suggestions	Madhubani (N=30)	Purnea (N=30)	Bhagalpur (N=30)	Overall (N=90)
i.	Availability of Fingerlings be ensured	40.00	30.00	36.67	35.55
ii.	Professionalism in Fisheries be encouraged	13.33	10.00	20.00	14.44
iii.	Extension backup should be strengthened	53.33	36.67	43.33	44.44
iv.	Renovation of ponds be made	50.00	40.00	30.00	40.00
v.	Availability of Credit facility be made	40.00	30.00	20.00	30.00
vi.	Availability of Quality feeds be made	16.67	23.33	26.67	22.22
vii.	Measurement of Ponds' area should be made	10.00	13.33	23.33	15.56
viii.	Training and Follow-up of Training should be made	26.67	13.33	6.67	15.56
ix.	Fish Festival be Celebrated	6.67	3.33	13.33	7.78
x.	Fish Diagnostic Centres (FDCs) be established	10.00	16.67	6.67	11.11
xi.	Social Security measures for fisherman (like; Insurance, Pension, Housing, etc.) be taken up	26.67	36.67	13.33	25.25
xii.	Transportation and Marketing facilities be extended	26.67	26.67	10.00	21.11

The table reveals that the sample households were largely of the view that the extension back up should be strengthened (44.44%). Besides they suggested for renovation of old ponds (40.00%), whose beds are mostly silted; availability of fingerlings be ensured (35.55%); availability of credit (30.00%), provision of social security measures due to risks in the occupation (25.55%); availability of quality feeds (22.22%); transportation and marketing facilities (21.11%); measurement of ponds' area to avoid to dispute (15.56%); imparting quality training and its follow measures (15.56%), etc. were the prominent.

PART – II: JHARKHAND

Constraints Faced by the Sample Households

On receipt of patta, the first operation is pond preparation. This included desilting/ clearing of weed, treatment of water and repairs of bunds. Thereafter fish fingerlings are procured and dropped in the ponds. Feeding is done, which have various kinds as manures, fertilizer, oil cakes, etc. The fish and pond needed continuous observation and maintenance. Medicines are also applied for various diseases. Harvesting of fish and then marketing are done. All stages require credit. The entire operations posed many problems, which have also been identified amongst the sample households. These may be seen in table No. 5.3.

Table No. 5.3: Constraints faced by the Sample Households (In %)

SN	Problems	Dumka (N=30)	West Singhbhum (N=30)	Overall (N=60)
i.	High mortality rate of fingerlings	33.33	26.67	30.00
ii.	Due to undulated topography water stays in the ponds for very short period	36.67	43.33	40.00
iii.	Ponds' water are forcibly used for irrigating field crops	20.00	10.00	15.00
iv.	Lack of capital/credit	40.00	43.33	41.67
v.	Due to naxalism and poverty pre-mature harvesting is commonly done	10.00	30.00	20.00
vi.	Lack of infrastructure for fishing and marketing	6.67	23.33	15.00
vii.	Theft of Fish/lack of Security	20.00	10.00	15.00
viii.	Poor socio-economic conditions of the fisherman (like illiteracy, poverty, etc.)	36.67	43.33	40.00
Ix	Lack of Technical and Extension backup	23.33	13.33	18.33
x.	Lack of Co-operation of Matsya Mitra	10.00	23.33	16.67

The data presented in above table revealed that lack of capital/credit (41.67%), poor socio-economic status of fishermen (40.00%), shortage of water in the ponds (40.00%), high mortality of fingerlings (30.00%), lack of technical and extension back-up (18.33%), etc. were prominent constraints faced by the sample households. Besides, lack of co-operation of Matsya Mitra (16.67%), forcible use of ponds' water by the strong people for irrigating the fields adjoining the ponds (15.00%), lack of infrastructures like net, van, etc. (15.00%) and theft of fish (15.00%). In fact non-staying of water in the ponds throughout the fish calendar is main hurdle in the state. Water recedes fastly during the summer due to undulated topography of the state. In most of the ponds/tanks water stays up to 6 or 7 months which hurdle the growth of fish and thus, fishes are harvested below the optimum size. It is the most serious problem in the state. It means natural factor/impediment is the main bottleneck in development of fisheries in the state. Besides, socio-economic constraint is also a vital factor. Fisheries require capital and labour both. Institutional factors like non co-operation of Matsya Mitra, who are supposed to help the poor fishermen in maintaining the calendar and guide properly for application of inputs as well as institutional assistance; lack of technical and extension back up are one of the serious constraints faced by the sample households.

Prospects of Fish Farming

Jharkhand has rich inland fishery resources in the form of rivers and its tributaries (42.98 kilometres), reservoirs (94000 ha) and tanks (29900 ha). It has 16 Fish Farmers Development Agencies (FFDAs) and 66 fisherman co-operative societies. The average fish production in ponds under FFDA is 9.5 quintal/ha/year. The state produces 62000 MT against the demand of 1 lakh MT. There are various constraints for realizing higher production levels like access to inputs including seed and feed in production areas, low stocking of seasonal reservoirs, lack of market connectivity, etc. The contribution from reservoir of the state in total fish production is very low, having average productivity level of 5 to 6 kg/ha. Based on the nutrient status of these reservoirs vis-à-vis scientific technologies available in the country the production levels of 30 to 35 kg/ha in large, 50 to 60 kg/ha in medium and 250 to 750 kg/ha in small reservoirs could be easily achieved by judicious and systematic efforts. There are few intricate issues, particularly

managerial and financial. Sick Fisheries Co-operative Societies (FCS), lack of adequate harvest, post harvest and market infrastructure facilities should be circumvented for raising the production level from these water bodies from abysmally very low level at present. Some other measures that should be put in place are strict enforcement of management rules, observation of closed season, providing training and fishing tools to fishermen, intensive extension practices and observing ethics of responsible fisheries.

Government Interventions

In view its potentiality, the government is contemplating many schemes, which are as below:

- Production of fish fingerlings/ seed – The government has achieved the production level of nearly 250 lakh fingerlings till 2005-06 and targeted to produce 850 lakh in 2006-07.
- Training to Fishermen --- On an average the government is sponsoring training programme to nearly 1000 fishermen every year.
- Mix Fisheries --- Undertaking nearly in 40 hectare.
- Subsidy for construction of ponds.
- Subsidy for renovation of ponds.
- Housing scheme for fishermen
- Stocking of fingerlings in reservoirs.
- Honorarium to fish fingerlings/seeds producing fishermen.
- Construction of Hatcheries in public sector.
- Construction of state level fish laboratories
- Training Centre for fish farmers; etc.

Suggestions given by the Sample Households

The sample households have suggested some measures to solve the problems in fish farming, which are presented in table No. 5.4. the data revealed that unavailability of water in the ponds/tanks throughout the fish calendar is one of the most important problems among the fish farming households in the state, thus they suggested to make

available water in the ponds/tanks (36.67%) and strengthening of extension back-up (36.67%), which is equally important for sustainable development of fisheries in the state. Nearly 35.00 per cent of the sample households suggested for availability of credit; 33.33 per cent for taking of social security measures for fishermen; incentivization of 'Matsya Mitra' (31.67%); who are the only informal or formal extension worker at the village level; renovation of old ponds (26.67%), financial assistance to the poor fishermen should be given so that pre-mature harvesting could be checked (21.67%), rearing of fingerlings be promoted (15.00%) etc. Out of interactions and interviews, celebration like; Kisan Mela, Fish Festival was also suggested by 15.00 per cent of the sample households.

Moreover, lack of appropriate leasing policy has been one of the major factors of the ineffective utilization and development of water bodies available in the state. Thus, it needs to be prepared and implemented effectively at the village level. Besides some horizontal and vertical expansion should be the future strategy for the development of fisheries in the state. Horizontal expansion means bringing un-utilised cultivable/fallow lands under scientific extensive/semi-intensive farming and creation of new ponds whereas vertical expansion means, improving the production of the existing extensive and semi-intensive area.

Table No. 5.4: Suggestions given by the Sample Households (In %)

SN	Suggestions	Dumka (N=30)	West Singhbhum (N=30)	Overall (N=60)
i.	Availability of Fingerlings be ensured	30.00	43.33	36.67
ii.	Financial assistance to the fishermen be given to stop the pre-mature harvesting	23.33	20.00	21.67
iii.	Availability of credit facility be made	30.00	40.00	35.00
iv.	Renovation of ponds be made	23.33	30.00	26.67
v.	Matsya Mitra should be incentivized to propagate the new techniques	36.67	26.67	31.67
vi.	Strengthening of Extension back-up	43.33	30.00	36.67
vii.	Rearing of fingerlings be promoted	13.33	16.67	15.00
viii.	Fish calendar be maintained	6.67	16.67	11.67
ix.	Fish festival be arranged	10.00	20.00	15.00
x.	Social Security measures for fishermen be taken	36.67	30.00	33.33

CHAPTER – VI

SUMMARY & CONCLUSIONS

Introduction

Fish is one of the foods of vast majority of people. It provides proteins and contains fat, inorganic substances and vitamins. It is more valuable for human, especially for a population whose staple food is rice. Besides, it helps in generating employment and revenue. Its production in the world has increased from 19755 thousand MT in 1950 to 140475 thousand MT in 2004, indicating more than seven folds' increase during the last five decades. Out of total production nearly 76.45 per cent is contributed by marine and remaining by inland fisheries in the world,. Indian fisheries contribute only 4.33 per cent to world's total fish production and consisted of marine and inland fisheries. It is the source of livelihood to over 14.48 million people largely belonging to socially and economically backward groups. It contributes 4.70 per cent (2004) to the country's GDP. During the last 10 Five Year Plans, Government of India has substantially increased the outlays for fisheries development. It rose to Rs. 2126.40 crores in the 10th Plan from Rs. 5.13 crore in the First Five Year Plan. During the Fourth Plan (1969-74), on the recommendation of a Technical Committee set up by Government of India, a pilot scheme of **Fish Farmers' Development Agencies (FFDAs)** was launched for development of fisheries and delivery of sustainable aquaculture throughout the country, which was renamed as Development of Inland Fisheries and Aquaculture in the 10th Plan, and it has been continuing in the 11th Plan also.

Review of Literature

Fishery is an ancient activity of mankind. It has developed throughout the world from centuries till today. Almost all countries and world institutions have fishery development programmes. In 1981, FAO asserted a resolution that occurred in the potential of fisheries to contribute to a new international order --- its intention to take a lead – by helping the developing countries to secure their rightful place in world fisheries. Its

gradual development has opened up new dimension of research, particularly relevant to the policy makers and other stakeholders.

In India, the process of transformation of the fishery sector from subsistence to commercial status and subsequently the growing scope of linking with the global market have opened up interests. Fishery is a key allied sector of agriculture providing income, employment and the much-needed nutritional security. Since natural fishing in coastal waters has reached maximum sustainable yield further growth in fishery has to come through commercial aquaculture. Technological progress in commercial aquaculture has substantially diminished the level of production risk, compared to traditional fishery *(Kolkata & Upare, 2005).* The contributions in production and marketing economics as well as the resource economics had emerged as important branch of applied economic research in 1980s and onwards. Recent research relating to socio-economic nature revealed that the income, price and supply elasticities vary substantially across fish species and it is wrong to group them together in any policy analysis *(Kumar, 2004).* Impressive growth in inland fish production in West Bengal is attributed to higher profitability (Rs. 22227/ha) by *Kar & Kumar (2004). Mishra (1997)* analyzed fish production and marketing structure in community ponds of Chhattisgarh and found that the yield per ha was 1538/kg for medium farm size, which was the highest and sold at a price of Rs. 23.8/kg. The marketed quantity was equally distributed between local and outside markets. In Punjab producer's share in consumer rupee varied between 38.00 to 45.00 per cent of fresh fish *(Godara, et. al, 2006). Singh & Pandey (2004)* analyzes marketing efficiency of fish in Uttar Pradesh and observed that the producer's share ranged from 28.00 to 38.00 per cent. The Fisher's share was 44.00 per cent when fish was sold through co-operatives in reservoirs of Himachal Pradesh indicating the high marketing cost of fish from remote areas and the relative absence of the competitive market. *Kant et. al (2000)* in a study of Azamgarh district (UP), found that the CB ratio was strong positive ratio indicating 1:3.14 in production of fish per acre and thus concluded that fishery enterprise is most profitable proposition. *An Evaluative Study of NABARD (2000)* in Punjab on Inland fisheries development indicate that net income per acre of fish pond was Rs. 26141 as compared to Rs. 10,100 from the competing crops.

The BCR worked out to 1.47:1, 1.86:1 and 1.73:1 for small, large and average ponds respectively. The study suggests timely and adequate supply of quality fingerlings, encouragement to private hatcheries, ensure competitive price for fish production, fixation of loan as per the requirement of fish farmers vis-à-vis size of pond, etc. *Singh & Singh (2004)* in their study on **"Stocking Density and Species mix in Composite Fish Culture in North Bihar: A Techno Economic Analysis**" found that the stocking rate in fish production is much higher in North Bihar. The reason for high stocking rate may be traced from the use of small size of fish seeds. Inadequate supply of quality seeds and unawareness about scientific modern methods of fish production emerged as two main reasons for low level of adoption of modern fish production technologies in North Bihar. As a result, the indigenous species of fish are still preferred for stocking in North Bihar.

In fact, very few literatures are available on the potentialities, prospects and problems of fish production, which have socio-economic implications particularly in Bihar & Jharkhand states. Thus, the present investigation was proposed by this Centre and perhaps, keeping its relevance in the states' economy the *Ministry of Agriculture, Government of India* has assigned the study to the Centre. Accordingly the Centre has taken up this study entitled **Problems and Prospects of Fish Farming in Bihar and Jharkhand.**

Objectives of the Study

i. *To estimate the cost of cultivation and production of fish.*
ii. *To identify the various channels and system of fish marketing.*
iii. *To identify the existing constraints of fish farming in the area.*
iv. *To examine the future prospects of fish farming in the area.*
v. *To suggest policy measures for the development of fish farming in the area.*

Methodology

This study has been conducted in both the states viz., Bihar & Jharkhand. The data was collected from both the sources viz., primary and secondary. The primary data was collected through duly structured fish farmers' schedule. The selection of the

respondent was made through a multi-stage stratified sampling method. At the first stage, the selection of one district was made from each of the agro-climatic sub-zones of both the states on the basis of highest number of total ponds (government jalkars and private ponds) in the district among the districts of respective sub-zones. Accordingly, Madhubani, Purnea and Bhagalpur districts were selected from North Bihar Plains, North East Plains and South Bihar Plains respectively in Bihar and Dumka and West Singhbhum districts from Chhotanagpur North Eastern Hills & Plateau and Chhotanagpur South Hills Plateau respectively in Jharkhand. Accordingly one anchal from each of the sample districts were selected. Similarly Benipatti, Dagarua and Sahkund anchals were selected from Madhubani, Purnea and Bhagalpur districts respectively in Bihar ad Saraiyahat and Jagarnathpur anchals from Dumka and West Singhbhum districts respectively in Jharkhand. Subsequently, on the basis of the lists of jalkars of the sample anchals, along with the names of the lessee of those jalkars obtained from the offices of District Fisheries Officer (DFO) of the respective sample districts and classified the fish farming households into three popular categories viz., small (up to 0.5 ha), medium (0.5 to 2 ha) and large (above 2 ha). A total of 90 fish farming household from Bihar and 60 fish farming households from Jharkhand were selected randomly for in depth investigation. The secondary data was collected from different published and unpublished sources. The reference year of the primary data collection is 2007-08.

Fisheries in Bihar & Jharkhand

Bihar

Bihar is one of the few states with large inland fisheries and aquaculture resources. Till 1970, Bihar used to supply fresh fish in neighbouring states, but around the year 1990 the inflow of fishes from other states, particularly Andhra Pradesh, started gravitating the fish markets in the state. At present, the annual consumption of fish in the state is nearly 4.5 lakh MT against the annual production of around 2.25 to 2.50 lakh MT. The state has larger number of non-vegetarian population, but has lowered the rate of per capita consumption than all India averages of both accounts. The state has a stretch of 3200 kilometers rivers & canals, 0.60 lakh ha reservoirs, 0.95 lakh ha tanks and ponds,

0.05 lakh ha flood plain lakes and derelict water and 1.60 lakh water bodies constituting 1.60 per cent, 2.06 per cent, 3.93 per cent, 0.62 per cent and 2.17 per cent respectively of the total of all India's inland fishery resources. The state has the largest fishermen population (49.60 lakh), which accounts for 34.23 per cent of country's fishermen population. It has 532 primary fishermen co-operative societies with membership of nearly 40,000 fishermen at the primary level. The major portion of fish production is realized from ponds and tanks, which are over 40 thousand in numbers covering total areas of 68 lakh ha. Out of 3 agro-climatic sub-zones in the state, North-Bihar plains is the most potential region in terms of total number of ponds (55.00 %) and the water spread area (39.20%) followed by South Bihar plains (26.42% and 36.60%) and North-East plains (18.33% and 24.20%) respectively.

Jharkhand

Jharkhand has advantage of having a sizeable number of medium and large reservoirs and substantial number of ponds and tanks of different sizes. But, these resources are largely untapped and thus, the state depends on the supply line of Andhra Pradesh and West Bengal, which usually meet its annual fish demand. The annual consumption of fish in the state is nearly 83 thousand MT against the present annual production of nearly 62 thousand MT, having a shortfall of 21 thousand MT (25.30%) of the total annually. The state has a stretch of 4298 kilometres rivers and its tributaries, 0.94 lakh ha reservoirs, 0.29 lakh ha tanks and ponds and 1.23 lakh ha water bodies accounting for 2.15 per cent, 3.23 per cent, 1.20 per cent and 1.67 per cent of the total of all India's inland fishery resources respectively. In regard to rivers and tributaries, these are seasonal in nature. The state has the second largest fishermen population (19.30 lakh), next to Bihar accounts for 13.32 per cent of India's fishermen's population. The state has 66 primary fisherman co-operative societies with membership of 9150. The major portion of fish production comes from tanks and reservoirs, which are spread over 94 thousand ha and 29 thousand ha respectively. Amongst two agro-climatic sub-zones in the state, Chhotanagpur North Eastern Hills and Plateau leads, which accounts for nearly 69.00 per cent of the area under tanks and 52.00 per cent under ponds.

Study Area and the Sample Respondents

Bihar

Out of three sample districts, Madhubani district covers an area of 3501 Sq. km, constituting 3.72 per cent of state's total area (94163 Sq. km). It's total population is 3.57 million and the population density is 1020 per Sq. km. The percentage of rural population is 96.52 per cent and the sex ratio is 942 females per 1000 males. The percentages of scheduled castes and tribes population are 13.48 and 0.04 respectively. The district has 12.27 lakh (34.42% of total population) total workers. The proportions of main and marginal workers are 24.5 per cent and 9.8 per cent respectively. Out of the total workers, the proportion of cultivators is 30.50 per cent, agricultural labourers 52.80 per cent workers in household industries 3.40 per cent and other workers 13.30 per cent. The overall literacy rate is 42.00 per cent. The Gross District Domestic Product (GDDP) was estimated at Rs. 2598.60 crores (2004-05). The per capita GDDP is Rs. 6851, which is below the state's average of Rs. 7434. The CD percentages of Commercial Banks (CBs) and Regional Rural Banks (RRBs) were 31.50 and 25.40 in 2007.

Purnea district covers an area of 3229 Sq. km constituting 3.43 per cent of state's total area. It's total population is 2.54 million and the population density is 787 per Sq. km. The percentage of rural population is 91.26 per cent and the sex ratio is 915 females/1000 males. The percentages of scheduled castes and tribes' population are 12.27 per cent and 4.40 per cent respectively. The district has 9.60 lakh (37.76% of total population) total workers. The proportions of main and marginal workers are 30.80 per cent and 7.00 per cent respectively. Out of the total workers, the proportion of cultivators is 22.90 per cent, agricultural labourers 63.30 per cent, household industries 1.7 per cent and other workers 12.10 per cent. The overall literacy rate is 35.10 per cent. The Gross District Domestic Product (GDDP) was estimated at Rs. 1549.90 crores (2004-05). The per capita GDDP is Rs. 5600, which is much below the state's average of Rs. 7434. The CD percentages of Commercial Banks (CBs) and Regional Rural Banks (RRBs) were 52.30 and 56.60 respectively in 2007.

Bhagalpur district covers an area of 2569 Sq. km, constituting 2.73 per cent of state's total area. The population of the district is 2.42 million and the population density is 946 per Sq. km. The percentage of rural population is 81.33 per cent and the sex ratio is 876 females per 1000 males. The percentages of scheduled castes and scheduled tribes' population are 10.51 and 2.29 respectively. The district has 85.53 lakh (35.30% of total population) total workers. The proportions of main and marginal workers are 24.00 and 11.30 per cent respectively. Out of total the workers, 19.90 per cent are cultivators, 48.20 per cent agricultural labourers, 7.4 per cent workers engaged in household industries and 24.50 per cent other workers. The overall literacy rate is 49.50 per cent. The Gross District Domestic Product (GDDP) was estimated at Rs. 2129.30 crore (2004-05). The per capita GDDP is Rs. 8268, which is higher than the state's average of Rs. 7434. The CD percentages of Commercial Banks (CBs) and Regional Rural Banks (RRBs) were 35.60 and 51.70 in 2007.

The land use statistics of the sample districts revealed that out of the total geographical area in Madhubani, Purnea and Bhagalpur, the share of forest is almost negligible. While the share of land put to non-agricultural use is 24.08 per cent, 14.01 per cent and 26.38 per cent respectively. Fallows lands are 4.27 per cent, 11.47 per cent and 6.30 per cent respectively. The net sown area are 64.02 per cent, 66.88 per cent and 54.72 per cent respectively. The cropping intensity is 141.67 per cent in Madhubani, 132.15 per cent in Purnea and 120.53 per cent in Bhagalpur. In fact, the changes in land utilization pattern are very slow unless propelled by revolutionary changes in environment or in production system. It is marginal but significant.

Irrigation is key variable determining the health and prosperity of Agriculture in general. In sample districts, tanks and tube wells are the main sources of irrigation. In Madhubani, 138120 thousand ha is irrigated and out of it the major area is irrigated by tube well (50.15%) followed by tanks (46.57%) and other sources (3.28%). In Purnea 160387 thousand ha (94.61%) is irrigated by tube wells and remaining by canal (5.39%). Tube well (78.12%) is the major source of irrigation in Bhagalpur followed by other sources (13.22%), other wells (5.09%) and tanks (3.56%).

There are 3555 jalkars distributed across 21 Anchals in 1853.21 ha of water spread area in Madhubani district; the largest in number and water area in the state. Purnea district has 691 jalkars distributed across 13 Anchals in 948.42 ha of water spread area whereas that of in Bhagalpur, there are 781 jalkars distributed across 12 Anchals in 871.68 ha of water spread area. These ponds/jalkars are leased out for short and long periods.

Out of the total sample respondents, 51.11 per cent of the fish farmers belonged to the age group of 46 to 60 years followed by 31 to 45 years (36.67%), 18 to 30 years (6.67%) and 61 years and above (5.55%). Of the total 96.67 per cent were married 95.00 per cent belonged to Hindu religion. Majority of the respondents have attained the secondary level of education (51.11%) followed by Primary (36.67%), Graduation and above (8.89%) and intermediate level (3.33%). Among the caste groups 93.33 per cent dominated with intermediate castes (particularly gorhi, nishad, etc.). Nearly 87.78 per cent reported that fishery was their main occupation and remaining 12.22 per cent under took agriculture as main occupation. The most important subsidiary occupation was agriculture (63.33%). The total population is 1254 of 13.93 members per family. The sample fish farming households have an owned area of 98.61 hectare. In addition they leased in 5.60 hectare. There were no leased out area. The total cultivated/operated area was 104.21 hectare. Of the total operated area irrigated area is 91.61 hectare, giving the percentage of irrigated area at 87.91 per cent.

The total cropped area of the sample households is higher in Purnea (82.12 ha) followed by Madhubani (45.85 ha) and Bhagalpur (29.04 ha). At the overall level it is 157.01 hectare. Paddy remained the most prominent crop accounting for 42.16 per cent of the GCA followed by wheat (26.57%), maize (9.71%), jute (8.17%), lentil (3.44%), gram (2.64%) and mustard (2.44%). The data revealed that taking together the area of paddy, wheat and maize; came to 78.44 per cent of the GCA, which showed the concentration of cereal crops in the region.

Jharkhand

Out of the two sample districts, Dumka (Santhal Pargana) covers an area of 5518.20 Sq. km constituting 7.28 per cent of state's total area (75834.29 Sq. km). Its total population is 1.75 million and the population density is 318 per Sq. km. The percentage of rural population is 83.15 per cent and the sex ratio is 961 females per 1000 males. The percentages of scheduled castes and tribes' population are 3.75 and 39.89 per cent respectively. The district has 44.42 per cent workers of the total population. The proportions of main and marginal workers are 26.84 per cent and 17.59 per cent respectively. Out of the total workers the proportion of cultivators is 47.16 per cent, agricultural labourers 34.65 per cent, workers engaged in household industries 4.21 per cent and other workers 13.98 per cent. The overall literacy rate is 47.94 per cent.

West Singhbhum covers an area of 8012 Sq. km constituting 10.57 per cent of the state's total area. Its total population is 2.08 million and the population density is 260 per Sq km. The sex ratio is 975 females 1000 males. The percentages of scheduled castes and tribes' population are 4.88 and 53.26 per cent respectively. The district has 44.21 per cent workers of the total population. The percentages of main and marginal workers are 25.80 and 18.40 respectively. Out of the total workers, the share of cultivators is 41.29 per cent, agricultural labourers 31.41 per cent; workers engaged in household industries 5.45 per cent and other workers 21.85 per cent. The overall literacy rate is 50.17 per cent.

The area under non-agricultural use is 11.3 per cent in Dumka and 6.4 per cent in West Singhbhum. The forest coverage is mere 11.27 and 23.33 per cent respectively. The proportion of fallow land is about 28.00 per cent in Dumka and 13.50 per cent in West Singhbhum. The net sown area is 29.47 per cent and 25.09 per cent respectively, which are higher then the state's average (22.68%). The cropping intensity is 114.38 per cent in the state. In nutshell, Dumka and West Singhbhum districts roughly follow the state averages except in case of forest coverage.

In Dumka district, the most common and largest source is well (34.17%) followed by tank/pond (22.11%), others (21.85%), tube well (12.72%) and canal (9.15%). In West Singhbhum the usual method of irrigation consists of embankments and bunds across the line of trench i.e., the upper end of a depression and others (32.44%), tube well (18.84%), well (17.19%) etc.

There are 658 jalkars/ponds distributed across 10 Anchals in 380.16 ha of water spread area in Dumka district. Similarly, there are 500 jalkars/ponds distributed across 15 Anchals in 688.66 ha in West Singhbhum district. These ponds/tanks are leased-out for short and long periods.

Out of the total, 51.66 per cent of the sample households belonged to the age group of 46 to 60 years followed by 36.67 per cent in 31 to 45 years group, 6.67 per cent in 18 to 30 years group and 5.00 per cent in 61 years group. All of them are married and belonged to Hindu religion. Nearly 48.33 per cent have attained the education up to primary level, 45.00 per cent secondary level and 6.67 per cent intermediate level. Among the social groups, 73.34 per cent are from intermediate castes (fisherman community), 23.33 per cent Scheduled Tribes and only 3.33 per cent Scheduled Castes. Of the total 75.00 per cent opted fishery as primary occupation and remaining 25.00 per cent mainly on agriculture. Fishery is also leading secondary occupation for 43.33 per cent sample fish farming households.

The total population of the 60 fish farming households is 743 comprising 12.38 members per family. The sample households owned 31.15 hectare. In addition, they had leased-in 0.50 ha and leased-out 1.95 hectare. Overall they possess 29.70 hectare and out of it 43.80 per cent is irrigated and 56.20 per cent unirrigated.

The total cropped area was 23.27 ha in West Singbhum and 13.19 ha in Dumka district. Paddy remained the most important crop, accounting for 60.97 per cent of the Gross Cropped Area (GCA) followed by wheat (17.69%), mustard (7.41%), maize (6.31%), etc. It revealed that kharif crops are mainly grown in the state. In fact, due to undulated

topography of the state, agriculture is mainly dependent on monsoon for irrigational purposes.

Economics of Fish Farming

BIHAR

Out of 90 fish farming households, 30 (33.33%) had small ponds (up to 0.5 ha), 37 (47.11%) medium ponds (0.5 to 2 ha) and 23 (25.54%) large size ponds (above 2 ha) and operating altogether 107 ponds comprising 95 (88.78%) government jalkars and 12 (11.22%) private ponds. The sample households had 1.307 hectare of ponds per household. However, it was higher in Purnea (1.644 ha/household) followed by Bhagalpur (1.378 ha/household) and Madhubani (0.898 ha/household).

Ponds were either owned or leased in. Leasing of ponds is made for short term (up to 3 years) and long term (up to 10 years). Among the selected fish farming households only 8 (8.89%) had own ponds and remaining 82 households had leased in ponds. On an average the rent was Rs. 1233.21 per hectare per annum at overall level.

The main inputs were lime, manure, fertilizers, seeds, feeds, medicines, hired labour, harvesting charges, family labour, watch/guard and of course, the interest of variable costs. With the start of the season, ponds' water is treated with lime, which is used on an average 1.08 quintals/ha. After preparation of ponds and treatment of water, seeds are used which is the most important input. Farmers preferred a mixture of two or more varieties of seeds and the most common mixture was Rohu, Katla, Mrigal, Silver, Common Carp, etc. which are bought from local seed traders. In fact there are no functional hatcheries in the state either in public or private sectors. Traders used to purchase seeds from West Bengal to ensure the supply. On an average 1.27 quintals/ha of fish fingerlings/seeds are used.

Feeds included dry feed, green, oil cakes, brans, etc. It also includes fertilizers and manures, which are used on an average @ 2.13 trailers/ha and 1.28 qtl/ha respectively. On occurrence of diseases, medicines are given in consultation with the fisheries

officer/experts but their services are in one or other way charged. It was reported that on an average 0.62 litre/ha of medicine is used. Labour utilized per ha was 108 man days. Out of it 74 man days (68.52%) was of hired labour and 34 man days (31.48%) family labour. In addition to labour on an average one guard or watchman is also used. Harvesting charge is mostly paid in terms of fish, the prevalent ratio of which at an average is 8:1.

The concept of cost included both fixed cost and variable costs. Fixed cost includes rent paid for the leased-in ponds. In case of private ponds the rental value of land has been taken into consideration. Variable costs included all cash and kind expenses incurred for production. On the selected total farms the total cost came to Rs. 51410.35/ha. Out of it the share of variable costs was Rs. 50177.14/ha i.e., 97.62 per cent and fixed cost Rs. 1233.21/ha i.e., 2.40 per cent. In case of private ponds the rental value of land/ponds area was Rs. 2052/ha. Of the variable costs the value of fingerlings/seeds was highest constituting 61.35 per cent (Rs. 31539.10/ha). The next important item was labour constituting 8.70 per cent hired labour and 3.90 per cent imputed value of family labour; followed by feeds Rs. 2750.96/ha (5.35%), watch and guard Rs. 2303/ha (4.48%), interest on purchase of all inputs Rs. 2224.71/ha (4.32%), harvesting Rs. 1949.64/ha (3.79%) etc. The total return was estimated at Rs. 93088.36/ha and the net return (total return minus total cost) came to Rs. 41678.01/ha on overall farms. Per quintal cost of production was calculated at Rs. 2481.19 and the yield of fish was 20.32 qtl/ha on overall farms. The average price received per quintal was Rs. 4581.12. The Cost Benefit Ratio (CBR) was 1:1.81. It is almost similar in all the three sample districts and there is very little or no relationship between the Cost Benefit Ratio and the size of fish farms.

Total production of fish on total farms was 2390.79 quintals. It was found that the output per hectare was lower (18.40 qtl) in Purnea whereas it was 21.10 qtl in Bhagalpur and 22.65 qtl the highest in Madhubani district. Out of total production 2328.18 quintals (97.38%) were marketed and 62.61 quintals (2.62%) were used in home consumption. It revealed that a very high percentage of produce is marketed.

A total quantity of 2328.18 quintals of the produce was marketed through three identified marketing channels. These are *(i) Producer – Consumer, (ii) Producer - Retailer – Consumer and; (iii) Producer – Wholesaler – Retailer – Consumer.* Out of the total marketed quantity, 1135.15 quintals was marketed through the channel No. – II, i.e., one level (48.76%) followed by 876.58 quintals by channel No. – III, i.e., two level (37.65%) and 316.45 quintals by channel No. – I, (13.59%) i.e., zero level. In Madhubani and Purnea districts out of the total marketed quantity, channel No. – III, prominently figured at 50.63 per cent and 48.31 per cent followed by channel No. – II at 35.61 per cent and 40.73 per cent and channel No. – I at 13.76 per cent and 10.96 per cent respectively. In case of Purnea district, the largest quantity was sold through channel No. – II (64.97%), followed by channel No. – III (19.08%) and channel No. – I (15.95%).

Out of the total selected farmers, only 28.89 per cent took loans from different sources. The average amount of borrowing was Rs. 41250/-. Out of the total borrowers, six have repaid their loan amount, 19 have repaid partially and one has not yet started repayment of the amount. Thus, the average amount was repayment was estimated at Rs. 18379.63 and the outstanding amount of Rs. 22870.37.

JHARKHAND

Out of the 60 fish farming households, 25 (41.67%) constitute from small ponds (up to 0.5 ha), 25 (41.67%) medium farms (0.5 to 2 ha) and 10 (16.67%) large size ponds (above 2 ha). On an average the sample households had 1.08 hectare of ponds per household. It was 1.48 ha/household in Dumka whereas 0.76 ha in West Singhbhum It clearly revealed that there are almost small and medium size fisheries in the state. Government ponds/tanks are leased in to the fisherman societies against which lessee have to pay rent, commonly known as Jamabandi or Reserve deposits. There are two periods of leasing viz. short period (up to 3 years) and long term (for 10 years). Most of the ponds were found leased in for short period. Among the selected fish farming

households, only 7 had owned ponds and remaining were operating leased in ponds. The overall rent was fund at Rs. 2244.55 per ha per annum.

The main inputs were lime, manure, fertilizer, fingerlings, feeds, medicines, water, labour, guard, etc. Lime is used @ 0.76 quintal/ha for treating the pond's water. After preparation of ponds and treatment of water fingerlings are dropped on the onset of monsoon. It is usually given @ 1.12 quintals per hectare and preferred in mixtures of two or more varieties. The most common varieties are Katla, Rohu, Silver Carp, Grass Carp, Mrigal, Common Carp, etc. These are bought from the local traders who used to purchase the same from West Bengal. Feeds included dry feed, green, oil cakes, brans etc. It also includes fertilizers and manures, which are used on an average 1.07 qtl/ha and 17.50 qtl/ha respectively. In the event of diseases, medicines are also given on the advice of local so called technicians and the Fisheries Extension officers. But they are not always readily available for diagnosis. Jharkhand, having the undulated topography many times water table goes much deep in summer and sometimes in pre-monsoon periods also thus water is also given in the ponds subject to the availability of tube wells in nearby area or own borings. On hiring or purchasing of water from informal water market or an average@ Rs.60/ hour is charged Labour is an important input which are hired any family both on an average 53 mandays of labour utilized. In addition to labour a guard or watchman is also required for safety of the ponds. Harvesting is popularly done on sharing basis, which is on an average one-sixth of the produce.

The concept of cost included both fixed and variable costs. Fixed cost includes rent paid for leased in ponds/ rental value of land incase of private ponds. Variable Costs include all cash and kind expenses incurred for production. On the selected total farms, total cost was estimated at Rs. 26785.25/ha. Out of it, the share of fixed cost was Rs. 1845.27, which accounts for 6.89 per cent of the total cost. Total variable cost was calculated at Rs. 24939.98, accounts for 93.11 per cent of the total costs. Of the total cost, the cost of fingerlings/seeds was highest constituting 56.45 per cent (Rs. 15119.50/ha) followed by labour (11.12%) comprising 7.03 per cent (Rs. 1882.97/ha) for hired labour and 4.09 per cent (Rs. 1097.67/ha) for family labour, feeds (6.34%) etc. The total return was calculated at Rs. 40640.95 and the net return came to Rs.

13855.70/ha. The average price realized out of the sate was Rs. 3412.33/ qtl, indicating the Cost-Benefit Ratio (CBR) 1:1.52. The costs and returns trend were almost similar in both the sample districts. The district wise and farm wise analysis revealed that there is no significant relationship between the CBRs and farm sizes.

The total production of fish on total farms was estimated at 774.64 qtl. The overall per hectare yield rate was 11.91 qtl. It was 13.73 qtl/ha in Dumka district whereas that of in West Singhbhum 8.54 qtl/ha. In regard to disposal of the produce, the data revealed that of the total 50 quintals (6.45%) is consumed at home and 724.64 quintals (93.55%) marketed, indicating marketing of quite higher percentage of the total quantum of produce. A total quality of 724.64 quintals of the produce was marketed. For marketing the produce, three marketing channels were identified, viz.: *(i) Producer – Consumer, (ii) Producer - Retailer – Consumer, and; (iii) Producer – Wholesaler – Retailer – Consumer.* Of the total marketed quantity, 554.76 quintals (76.56%) was marketed by the channel No. – I, followed by channel – II (16.85%) and channel – III (47.76 qtl). In Dumka district, out of the total marketed quantity channel No. – I (75.61%) was prominently used followed by channel Nos. – II (19.51%) and III (4.88%). In case of West Singhbhum district, the largest quantity was sold through channel No. – I (79.41) followed by III (11.77%) and II (8.82%).

Among the sample households 11 households (18.33%) could avail credit and out of them only 7 households have received it from the formal sources and remaining from informal sources. The data revealed that average amount of borrowing was Rs. 15700.96 on total farms. Among the borrowers, one has repaid the full amount, 3 have paid partially and 7 are yet to start repayment. The average amount of repayment was Rs. 6187.36 on total farms and the outstanding was found to be Rs. 9513.60.

Problems and Prospects of Fish Farming

BIHAR

Constraints as perceived by the sample household are siltation of ponds/tanks (47.77%), 42.22 per cent difficulties of capital/credit; 36.67 per cent lack of technical

guidance and same for fish diseases 28.88 per cent lack of quality fingerlings; 23.33 per cent had difficulties of fish theft/insecurity of ponds from anti-social elements; 22.20 per cent reported about lack of proper transportation and marketing facilities; 22.22 per cent said about the fishery department, which is mainly involved in leasing out of the jalkars and collection of revenue rather than facilitating the prospective fish farmers; 20.00 per cent complained about lack of proper boundary around the ponds, which sometimes creates social tension; 12.20 per cent were of the view that **Jalkar Management Act, 2006,** is no doubt a welcome step of the Government but it did not promote professionalism in fisheries rather it has socially empowered to the fishermen community and 10.00 per cent reported about the ill wills of dominant people of the area in regard to grabbing of ponds.

In spite of various constraints faced by the sample households, the state is blessed with vast and varied fisheries and aquaculture resources. The current situation of disappointing fisheries development can be mainly attributed to poor institutional set-up, almost non-existence of extension services, lack of adequate resources and infrastructural facilities, devoid of conducive policy environment, defunct fisheries co-operatives, lack of professionalism among fisheries personnel, fragmented social set up, poverty and illiteracy among the primary producers etc. In view of the vast potentiality present abundantly in the state a Road Map for fisheries has been prepared by the government for 11^{th} Plan period, which aimed at implementing activities like: conservation of water bodies like ponds and tanks, intensive and semi-intensive fish culture in ponds, construction of inlet and outlet for easier passage in maun for culture based fisheries, culture up to an optimism size, raising annual production of fry up to 65 crores from the present level of 35 crores, and; developing the market system to support farmers for different price.

There is much scope for developing culture based fisheries in mauns and bringing ponds into intensive and semi-intensive culture to attain the desired level of 4.56 lakh tones of annual fish production. In addition, it will create employment to fishermen community, which is at present 23 lakh in the state, constituting 50.00 per cent of the

total fishermen population and thus, various supporting schemes would also continue. These schemes are:

- *Arrangement of fingerlings as seeds.*
- *Fish Seed Farms are proposed to be developed.*
- *Intensive/Semi intensive fish culture in ponds*
- *Ponds have been divided into three categories namely; A, B, C and D depending up on the productivity.*
- *Ponds owners/lessee would be provided fingerlings in adequate numbers to stock their ponds.*
- *Culture based fisheries in oxbow lakes.*
- *Development of fisheries in water logged area.*
- *Feed Production.*
- *Post Harvesting Marketing.*
- *Training of Farmers.*
- *Para Extension workers Scheme.*
- *Survey of ponds for building authentic and update database for effective planning.*
- *Strengthening of Extension system.*
- *Group Accident Insurance Security to Active Fishermen.*
- *Model Fisherman Village.*
- *Demonstration of Integrated Fish Farming.*
- *Training Centre at Patna.*
- *Strengthening of Fish Farmers' Development Agencies (FFDAs).*
- *Matsya Krishak Samman Yojana*

Suggestions

In the light of the emerging scenario and empirical inputs following suggestions are given:

(i) Strengthening of Extension Services *(Attn: Directorate of Fisheries, Government of Bihar).*

(ii) Renovation of old ponds should be made *(Attn: Directorate of Fisheries, Government of Bihar).*

*(iii)*Availability of credit should be ensured *(Attn: Department of Institutional Finance, Govt. of Bihar & NABARD).*

*(iv)*Social Security Measures for Fishermen be taken up *(Attn: Directorate of Fisheries, Government of Bihar).*

(v) Availability of fingerlings should be ensured ((Attn: Directorate of Fisheries, Government of Bihar).

(vi) Availability of quality seeds should be ensured *(Attn: Directorate of Fisheries, Government of Bihar).*

(vii) Transportation and Marketing facilities should be made *(Attn: Directorate of Fisheries, Government of Bihar).*

(viii) Measurement of ponds' area should be taken up *(Attn: Directorate of Fisheries, Government of Bihar).*

(ix) Fish festival should be celebrated *(Attn: Directorate of Fisheries, Government of Bihar).*

(x) Fish Diagnostic Centres should be established *(Attn: Directorate of Fisheries, Government of Bihar).*

(xi) Training Programme should be extended to all fishermen/fish farming households *(Attn: Directorate of Fisheries, Government of Bihar).*

(xii) Professionalism in Fisheries should be encouraged *(Attn: Directorate of Fisheries, Government of Bihar).*

JHARKHAND

The constraints as perceived by the sample farmers are lack of capital/credit (41.67%), poor socio-economic status of fisherman (40.00%), shortage of water in the ponds (40.00), high mortality of fingerlings (30.00%), lack of technical and extension back-up (18.33%), lack of co-operation of Matsya Mitra (16.67%), forcible use of ponds water by the strong people for irrigating the fields adjoining to the ponds (15.00%), lack of infrastructural facilities like net, van, etc. (15.00%) and theft of fish (15.00%).

Prospects of Fish Farming

Jharkhand has rich inland fishery resources in the form of rivers and its tributaries (42.98 kilometres), reservoirs (94000 ha) and tanks (29900 ha). It has 16 fish farmers development agencies (FFDAs) and 66 **Fisherman Co-operative Societies (FCS).**

The average fish production in ponds under FFDA is 9.5 qtl/ha/year. The state produces 62000 MT against the demand of 1 lakh MT. There are various constraints for realizing higher production levels like access to inputs including seed and feed in production areas, low stocking of seasonal reservoirs, lack of market connectivity, etc. The contribution from reservoir of the state in total fish production is very low, having average productivity level of 5 to 6 kg/ha. Based on the nutrient status of these reservoirs vis-à-vis scientific technologies available in the country the production levels of 30 to 35 kg/ha in large, 50 to 60 kg/ha in medium and 250 to 750 kg/ha in small reservoirs could be easily achieved by judicious and systematic efforts. There are few intricate issues, particularly managerial and financial. Sick **Fisheries Co-operative Societies (FCS),** lack of adequate harvest, post harvest and market infrastructure facilities should be circumvented for raising the production level from these water bodies from abysmally very low levels at present. Some other measures that should be put in place are strict enforcement of management rules, observation of closed season, providing training and fishing tools to fishermen, intensive extension practices and observing ethics of responsible fisheries.

In view its potentiality, the government is contemplating many schemes, which are:

- *Production of fish fingerlings/ seed.*
- *Training to Fishermen.*
- *Mix Fisheries.*
- *Subsidy for construction of ponds.*
- *Subsidy for renovation of ponds.*
- *Housing scheme for fishermen.*
- *Stocking of fingerlings in reservoirs.*
- *Honorarium to fish fingerlings/seeds producing fishermen.*
- *Construction of Hatcheries in public sector.*
- *Construction of state level fish laboratories.*
- *Training Centre for fish farmers; etc.*

Suggestions

In the light of the emerging scenario and empirical inputs following suggestions are given:

(i) Availability of water in the ponds/tanks should be ensured (Attn: Department of Water Resources, Govt. of Jharkhand)

(ii) Strengthening of Extension Back up should be made *(Attn: Directorate of Fisheries, Government of Jharkhand).*

*(iii)*Availability of credit should be ensured *(Attn: Department of Institutional Finance, Govt. of Jharkhand & NABARD).*

*(iv)*Social Security Measures for Fishermen be taken up *(Attn: Directorate of Fisheries, Government of Jharkhand).*

(v) Incentivization Programme for Matsya Mitra should be taken up (*Attn: Directorate of Fisheries, Government of Jharkhand).*

*(vi)*Renovation of old ponds should be made *(Attn: Directorate of Fisheries, Government of Jharkhand).*

(vii) Financial Assistance to poor fishermen should be given *(Dept. of Social Welfare, Govt. of Jharkhand)*

(viii) Stocking or rearing of fingerlings should be promoted *(Attn: Directorate of Fisheries, Government of Jharkhand).*

*(ix)*Fish festival should be celebrated *(Attn: Directorate of Fisheries, Government of Jharkhand).*

(x) Fish calendar should be maintained *(Attn: Directorate of Fisheries, Government of Jharkhand).*

*(xi)*Professionalism in Fisheries should be encouraged *(Attn: Directorate of Fisheries, Government of Jharkhand).*

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Inland Fishery Resources by States and Union Territories

SN	State/UTs	Rivers & Canals (Kms.)	Reservoirs (Lakh Ha)	Tanks & Ponds (Lakh Ha)	Floodplain Lakes & Derelict Water (Lakh Ha)	Brackish Water (Lakh Ha)	Total Water Bodies (Lakh Ha)
1.	Andhra Pradesh	11514	2.34	5.17	-	0.60	8.11
2.	Arunachal Pradesh	2000	-	2.76	0.42	-	3.18
3.	Assam	4820	0.02	0.23	1.10	-	1.35
4.	**Bihar**	**3200**	**0.60**	**0.95**	**0.05**	**-**	**1.60**
5.	Goa	250	0.03	0.03	-	Neg.	0.06
6.	Gujarat	3865	2.43	0.71	0.12	1.00	4.26
7.	Haryana	5000	Neg.	0.10	0.10	-	0.20
8.	Himachal Pradesh	3000	0.42	0.01	-	-	0.43
9.	Jammu & Kashmir	27781	0.07	0.17	0.06	-	0.30
10.	Karnataka	9000	4.40	2.90	-	0.10	7.40
11.	Kerala	3092	0.30	0.30	2.43	2.40	5.43
12.	Madhya Pradesh	17088	2.27	0.60	-	-	2.87
13.	Maharashtra	16000	2.79	0.59	-	0.10	3.48
14.	Manipur	3360	0.01	0.05	0.04	-	0.10
15.	Meghalaya	5600	0.08	0.02	Neg.	-	0.10
16.	Mizoram	1395	-	0.02	-	-	0.02
17.	Nagaland	1600	0.17	0.50	Neg.	-	0.67
18.	Orissa	4500	2.56	1.14	1.80	4.30	9.80
19.	Punjab	15270	Neg.	0.07	-	-	0.07
20.	Rajasthan	5290	1.20	1.80	-	-	3.00
21	Sikkim	900	-	-	0.03	-	0.03
22.	Tamil Nadu	7420	5.70	0.56	0.07	0.60	6.93
23.	Tripura	1200	0.05	0.13	-	-	0.18
24.	Uttar Pradesh	28500	1.38	1.61	1.33	-	4.32
25.	West Bengal	2526	0.17	2.76	0.42	2.10	5.45
26.	A and N Islands	115	0.01	0.03	-	1.20	1.24
27.	Chandigarh	02	-	Neg.	Neg.	-	0.00
28.	Dadra & Nagar Haveli	54	0.05	-	-	-	0.05
29.	Daman and Diu	12	-	Neg.	-	Neg.	0.00
30.	Delhi	150	0.04	-	-	-	0.04
31.	Lakshadweep	-	-	-	-	-	0.00
32.	Pondicherry	247	-	Neg.	0.01	Neg.	0.01
33.	Chhattisgarh	3573	0.84	0.63	-	-	1.47
34.	Uttaranchal	2686	0.20	0.01	0.00	-	0.21
35.	**Jharkhand**	**4200**	**0.94**	**0.29**	**-**	**-**	**1.23**
Total		195210	29.07	24.14	7.98	12.40	73.59

Source: Handbook on Fisheries Statistics, 2006.

Annexure- II

Fishermen Population- 2003

SN	State Name	Male	Female	Children	Total
1.	Andhra Pradesh	249386	250877	393102	893365
2.	Arunachal Pradesh	1650	1376	1373	4399
3.	Assam	131312	97986	161082	390380
4.	**Bihar**	**1391166**	**1266997**	**2301353**	**4959516**
5.	Chhattisgarh	621607	529697	760064	1911368
6.	Goa	5521	4863	3586	13970
7.	Gujarat	134475	129900	228880	493255
8.	Haryana	5910	3322	7259	16491
9.	Himachal Pradesh	1537	1372	2713	5622
10.	Jammu & Kashmir	9628	7593	13232	30453
11.	**Jharkhand**	**577908**	**571584**	**781428**	**1930920**
12.	Karnataka	55809	52898	50245	158952
13.	Kerala	224007	317758	206072	747837
14.	Madhya Pradesh	213888	200607	302479	716974
15.	Maharashtra	63354	46603	61873	171830
16.	Manipur	25009	24091	21368	70468
17.	Meghalaya	525	504	1354	2383
18.	Mizoram	5498	5312	7097	17907
19.	Nagaland	5762	5519	3581	14862
20.	Orissa	70971	48334	60721	180026
21.	Punjab	2150	1874	5061	9085
22.	Rajasthan	2638	1693	2985	7316
23.	Sikkim	9893	8353	8568	26814
24.	Tamil Nadu	171992	156107	148519	476618
25.	Tripura	15966	13177	17590	46733
26.	Uttar Pradesh	70373	48892	59799	179064
27.	Uttaranchal	32	23	35	90
28.	West Bengal	587214	205198	119210	911622
29.	A and N Islands	9859	7693	0	17552
30.	Chandigarh	198	109	172	479
31.	Dadra and Nagar Haveli	0	0	0	0
32.	Daman and Diu	7649	7756	10080	25485
33.	Delhi	485	475	1555	2515
34.	Lakshadweep	10408	2621	0	13029
35.	Pondicherry	12378	12799	12797	37974
Total		**4696158**	**4033963**	**5755233**	**14485354**

Source: 17th Live Stock Census, 2003.

Structure of Fisheries Co-operatives National Level Cooperative Federation (National Federation of Fishermen's Co-operatives LTD.) State-wise Position

S. No.	State/UTs	State Federation	Central Societies	Primary Societies	Membership
1.	Andhra Pradesh	1	10	3646	359021
2.	Arunachal Pradesh	-	-	4	300
3.	Assam	1	-	456	3909
4.	**Bihar**	**1**	**5**	**532**	**40000**
5.	Delhi	-	-	2	239
6.	Goa	1	-	10	1000
7.	Gujarat	1	4	385	80000
8.	Haryana	-	-	59	1005
9.	Himachal Pradesh	-	1	28	7096
10.	Jammu & Kashmir	-	-	-	-
11.	Karnataka	1	3	296	76136
12.	Kerala	1	16	292	200000
13.	Madhya Pradesh	1	7	1001	62571
14.	Maharashtra	1	21	2024	208273
15.	Manipur	1	-	181	9182
16.	Meghalaya	-	-	58	2569
17.	Mizoram	-	-	36	808
18.	Nagaland	-	-	168	4285
19.	Orissa	1	4	482	120000
20.	Punjab	-	-	4	60
21.	Rajasthan	1	-	107	4624
22.	Sikkim	-	-	-	-
23.	Tamil Nadu	1	10	675	444866
24	Tripura	1	-	129	14225
25.	Uttar Pradesh	1	5	110	41000
26.	Uttaranchal	-	-	-	-
27.	West Bengal	1	20	1072	160000
28.	A and N Islands	-	-	45	3812
29.	Chandigarh	-	-	1	-
30.	Dadra and Nagar Haveli	-	-	-	-
31.	Daman and Diu	-	-	6	2993
32.	Lakshadweep	-	6	2	-
33.	Pondicherry	1	2	36	28754
34.	Chhattisgarh	-	-	-	31427
35.	**Jharkhand**	-	-	-	**9150**
Total		**17**	**108**	**11847**	**1917305**

Handbook on Fisheries Statistics, 2006

Appendix-I

Comments on the study entitled " Problems and Prospects of Fish Farming in Bihar & Jharkhand"

Chapter	Page No.	Table No.	Comments
			List of table is lacking
Chapter I	8		Methodology is lacking with the nature of data, method of data collection, tools of analysis and concepts of terms used in the study.
	9		References should be given in the end of the study i.e. after Summary & Conclusions
Chapter II			Excellent and clear
Chapter III		3.4	Unit of the table given in acre. It should be in ha as given in other tables
		3.5	Lacking with unit
		3.8	The cropping pattern may be divided in two seasons i.e. *kharif* and *rabi* in which these crops are grown
Chapter IV			May incorporate the system of marketing also in the study as given in the objectives.
		4.1 to 4.9	Repetition of the number of tables it should be as 4.10 to 4.19
	53-56	5.1 & 5.2	Repetition of the number of tables it should be as 5.3 & 5.4
Chapter V	57-76		Summary and conclusions may be given in condense form without repetitions in the chapter I to IV and recommendation suggestions relevance to the study be recorded by the investigator.

Sd/-
(P.K. Mishra)
Honorary Director
Agro-Economic Research Centre
JNK Vishwavidyalaya
Jabalpur (MP)

Appendix-II

Action Taken Report (ATR)

Chapter	Page No.	Table No.	Report
Chapter I	---	---	Incorporated.
	8	---	Elaborated appropriately.
	9	---	Placed at the end.
Chapter II	---	---	No action is needed.
Chapter III	---	3.4	Converted in hectare.
	---	3.5	No action is needed.
	---	3.8	Season wise data could not be obtained.
Chapter IV	---	---	Incorporated
		4.1 to 4.9	Numbering of tables arranged.
	53-56	5.1 & 5.2	Numbering of tables arranged.
Chapter V	57-76	---	Incorporated.

Rosline Kusum Marandi
Co-Project Leader

Ranjan Kumar Sinha
Project Leader