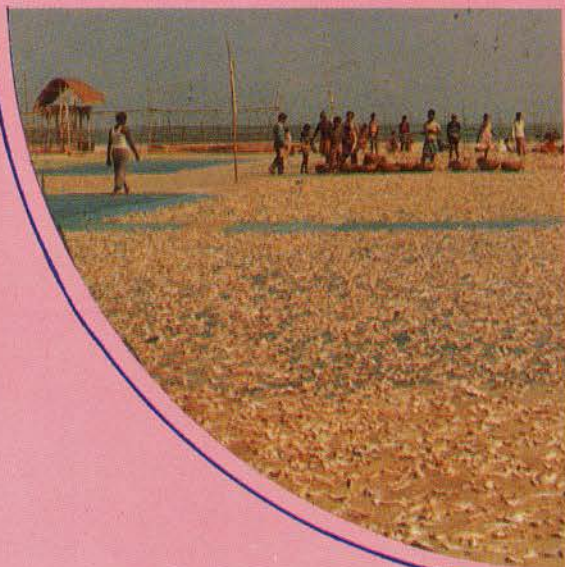


WINTER MIGRATORY BAGNET FISHERY OF THE HOOGHLY ESTUARY - AN ECONOMIC EVALUATION

*S. Paul, P.M. Mitra, D.K. De, H.K. Sen
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Foreword

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Riverine fisheries in general and estuarine fisheries in particular have been rarely subjected to economic evaluation in terms of fishing intensity, levels of employment and income of those who toil on such open waters. The present work viz., *Winter Migratory Bagnet Fishery of the Hooghly Estuary - An Economic Evaluation* is a modest but bold effort by a team of researchers of CIFRI who have tried to fill this gap to an appreciable extent by analysing input-output relationship in relation to cost constituents and remunerativeness of this fishing operation of immense importance in Hooghly estuary. Further, development implications coupled with recommendations for thrust areas for future research are likely to provoke animated debate with the twin objectives of development and conservation. A note of caution has also been sounded for not treating estuarine fisheries merely as an extraction activity.

I hope that his publication will be a welcome addition to literature on winter fisheries of Hooghly estuary which contributes significantly to the extent of about 67% of total estuarine fish landings and will act as catalyst for proliferating such studies in respect of other river systems so as to promote ecologically sound fishery development without affecting adversely the income of toiling fishermen.

I record my deep sense of appreciation for the project leader and his associates for the work done.

M. Sinha
Director

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WINTER MIGRATORY BAGNET FISHERY OF THE HOOGHLY ESTUARY - AN ECONOMIC EVALUATION

1. Introduction

Fishery exploitation by migratory stationary bag-net units, locally known as 'been-jals', is a typical feature of the lower zone of the Hooghly estuary during winter season. A large number of fishermen in groups of fishing parties migrate from different areas of the estuary during winter season and establish transitory fishing camps at suitable spots on the sea face in the lower zone of the estuary and remain engaged in bagnet fishing during 3 ½ winter months (from the end of October to early February). This fishery is commonly known as winter migratory bagnet fishery. The two main concentrations of such migratory fishing parties are on Sagar Island at the mouth of the estuary and the other around Frasergunj, Bakkhali, Kalisthan and Jamboodwip island (Upper and Lower). The transitory fishing camps are commonly known as "Khuties". The importance of this fishery lies in its high total fish catch from the lower zone as well as from the whole estuary.

Three and half month's seasonal fishery accounts for an average estimated catch of 25636 t. constituting about 67.2% of the total annual fish yield from the entire estuary during the period 1984-85 to 1993-94 compared to only 32.7% about one and half decades ago during the period 1970-71 to 1974-75 (Mitra *et. al.*, 1997). The current catch by winter migratory bagnet fishery (1993-94 to 1996-97) is about six times more than that of the period 1970-71 to 1974-75. The pronounced fish abundance in winter fishery is also reflected by higher catch per unit effort (CPUE) compared to other seasons and areas of the estuary. The tremendous increase of fish yield in winter fishery catch may be attributed mainly to the deployment of mechanised boats, larger number of bagnets and higher number of fishermen involved in fishing operation during recent years. The increase in catch is so high in recent years that Jamboodwip (Upper and Lower) island, one of the most productive centres, which was completely uninhabited except the season about one and half decades ago, is now inhabited by a large number of fishermenfolk. Furthermore, the exploitation by bagnets and fishing activity during winter season is so intense in recent years that it can be compared as a seasonal industry in the sense that Jamboodwip island, which was without electricity is now flooded by lights during night by installing high powered generator to carry out the fishing activity. The location of Frasergunj, Bokkhali

and Kalisthan at the western flank of delta in Sunderbans facing the sea is shown in Fig. 1. It is close to the main channel of the Hooghly, being separated from it by Sagar Island and Muriganga River, the latter being an arm of the main channel. The fishermen have to incur relatively heavy expenditure for sustaining themselves in these remote places. However, several factors make this migratory fishing economical. During winter, a calm weather prevails in the extreme lower stretches of the estuary at the seafloor favourable for the operation of stationary bagnets. This condition prevails till the onset of south wind which starts about the middle of February making the sea rough and the operation of these nets then becomes difficult or rather impossible. Secondly, the availability of fish vulnerable to bagnets at these fishing centres during November to January ranges from about 15 to 30 times more than the average availability at the upper

estuary throughout the year. In the upper areas fishing at all tides is not a regular feature, whereas in the migratory fishery it is the general rule to operate the nets at all tides thereby increasing the frequency of operation of nets. The catch landed during this season is mostly sun-dried barring the more economic species. Thirdly, there is a good market demand within and outside the country for the dried fish of the varieties caught in appreciable quantities. The fisheries aspect of the aforesaid fishery have been studied in detail and reported by many workers (Dutta *et. al.*, 1975; Saigal *et. al.*, 1987; Mitra *et. al.*, 1997). But no attempt has ever been made to find out the economics of this fishery with regard to input-output relationship at market prices. With this object in view it was felt necessary to work out the financial viability of the aforesaid fishery. Accordingly, a survey was conducted during the period 1992-93 to 1996-97 in which a pilot survey was undertaken during 1992-93 taking only one centre. The present communication deals with annual fish production and corresponding sale proceeds as output after examining cost constituents i.e. operational cost such as annual capital cost of fishing inventory, wage cost on manpower deployed, depreciation and maintenance cost of crafts and gears, fuel expenditure as input to arrive at an annual net receipts.

2. Material and Methods

Prior to the commencement of winter migratory bagnet fishing operations, an inventory of the number of migratory fishermen, their holdings in terms of bagnets and boats was undertaken by field visits to individual fishing camps at all centres. Information pertaining to total fish catch and CPUE was collected by direct observations at all the camps at a site adopting a three day sampling procedure in a month. The days of observation were selected following a systematic sampling plan to estimate total catch and effort in a month. A few random samples from the catches by the fishing camps were examined to ascertain species composition. As regards to operational cost data pertaining to cost of varying sizes

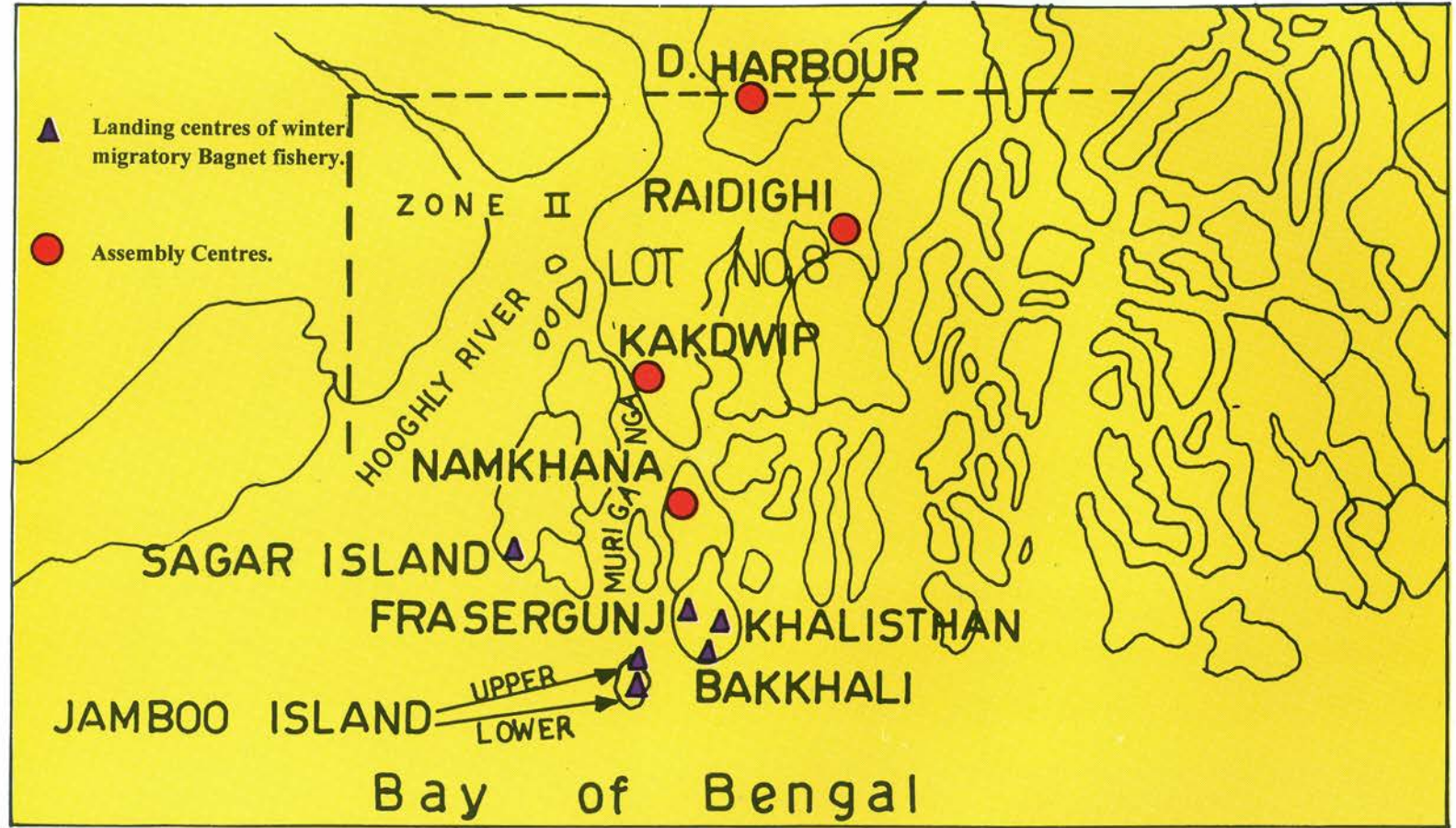


Fig. 1 : Mouth of the Hooghly Estuary showing the landing centres of winter migratory bagnet fishery.



BAGNETS IN OPERATION



LANDING OF FISH CATCH

of nets, boats (mechanised and non-mechanised), average life span of nets and boats to work out depreciation cost of nets and boats, wage cost on manpower deployed, maintenance costs of nets and boats, fuel expenditure for operation of mechanised boats were collected from fishing camp by visiting all centres. Winter bagnet catches mainly consist of small sized fishes which are mostly sun dried except the highly economic species like *Polynemus paradiseus*, *Stromateus cinereus*, landed in smaller quantity, are sold out locally to fish merchants in the area. The dried fishes are stocked in the fishing camps and periodically sent to marketing centres by boats through dry fish traders. As such, data on the ratio of dried to live fish of *Harpodon nehereus*, *Pama pama*, *Setipinna* spp. *Trichiurus* spp., *Tachysurus jella* and prawns were collected. The ratio of dried fish to live fish was found to be 0.1375 in case of *H. Nehereus* and 0.225 in case of other species. These species along with *P. Paradiseus* and *S. cinereus* account on the average about 80% of the total catch. Further, the aforesaid dried species fetch good market value. The other species are clubbed as "miscellaneous". The market prices of live fish of *P. paradiseus* and *S. cinereus* were observed to be on average Rs. 25/- and Rs. 80/- respectively. The average price of dried fish of other species were observed to be as follows:

Species	Price (Rs.)
<i>H. nehereus</i>	23.00
<i>P. pama</i>	17.50
<i>Setipinna</i> sp.	13.50
<i>Trichiurus</i> sp.	21.00
<i>T. jella</i>	9.50
Prawn	27.50
Misc.	7.50

Prices of dried fish were collected at the fishing camps and were verified at dried fish markets. For convenience, winter fisheries being an activity extending to three and half months, catch for the last week of October has been carried forward to the subsequent month of Novemebr and negligible catch for 4/5 days in early February has been added to the previous month of January.

3. Results

a) *Fish yield and CPUE*

The number of fishing camps set up at different centres, the fishermen population migrating to different centres, the number of bagnets possessed by them and the number of mechanised and non-mechanised boats put into operation during the year 1993-94 to 1996-97 are presented in Table 1 and Table 2. Centre-wise catch (in t) and CPUE (in Kg) are presented in Table 3. It may be observed that the number of fishing camps, nets, boats and migrant fishermen have generally been increasing over the years. Total catch also showed an increasing trend during the period under report. The low yield and CPUE at Frasergunj, Bokkhali and Sagar Island compared to other centres is due to operational problem in placing nets. The fishermen at these centres operate nets in shallow coastal water and do not go deep for fishing which results in low yield and CPUE. Bar diagram (Fig. 2) shows total catch (live fish) during 1993-94 to 96-97. The species wise (live) average landing is depicted by the pie-chart (Fig. 3). Fig. 4 depicts centre-wise live fish catch during 1993-94 to 96-97.

Table 1. Centre-wise concentration of fishing camps and migrant fishermen during 1993-94 to 1996-97

Year: Centres	1993-94		1994-95		1995-96		1996-97	
	Fishing camps (No.)	Migrant Fishermen (No.)	Fishing camps (No.)	Migrant Fishermen (No.)	Fishing camps (No.)	Migrant Fishermen (No.)	Fishing camps (No.)	Migrant Fishermen (No.)
Frasergunj	26	211	39	308	39	273	43	270
Bokkhali	27	149	24	149	30	176	38	309
Upper Jamboo	31	1896	24	1284	32	1468	35	1863
Lower Jamboo	8	505	9	498	12	1000	13	1385
Kalasthan	20	811	22	1356	22	983	25	1337
Sagar Island	114	1012	74	580	96	845	128	1084
Total	226	4584	192	4175	231	4745	282	6248



A HAUL OF CATCH



DRIED FISH

Table 2. Centre-wise concentration of bagnets and boats during 1993-94 to 1996-97

Year/ Centres	1993-94		1994-95		1995-96		1996-97	
	Bagnets (No.)	Boats (No.)	Bagnets (No.)	Boats (No.)	Bagnets (No.)	Boats (No.)	Bagnets (No.)	Boats (No.)
Frasergunj	86	38 (17)	120	55 (23)	118	54 (23)	131	65 (30)
Bokkhali	78	31 (3)	82	30 (8)	95	40 (17)	132	57 (29)
Upper Jamboo	332	114 (47)	187	76 (32)	257	97 (41)	359	110 (59)
Lower Jamboo	84	24 (8)	114	40 (20)	221	54 (26)	312	74 (44)
Kalasthan	169	67 (31)	204	81 (44)	201	71 (32)	231	87 (47)
Sagar Island	465	160 (32)	246	104 (39)	355	139 (42)	464	172 (59)
Total	1214	434 (138)	953	386 (166)	1247	455(181)	1629	565(268)

Figures in parenthesis indicate the number of mechanised boats.

Table 3. Centre-wise catch (in t) and CPUE (in kg) during 1993-94 to 1996-97

Year/ Centres	1993-94		1994-95		1995-96		1996-97	
	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE
Frasergunj	847.1	42.06	981.1	34.49	902.2	29.92	1162.5	34.28
Bokkhali	276.2	20.63	385.3	26.00	529.1	25.85	1006.1	34.84
Upper Jamboo	8291.7	101.07	7148.8	122.76	9916.2	126.10	11725.3	109.40
Lower Jamboo	2852.4	139.57	2896.3	93.44	8984.8	130.51	9584.9	97.11
Kalasthan	4140.9	108.07	7206.2	131.86	5577.0	104.60	7784.2	120.25
Sagar Island	1284.9	24.72	2202.9	62.91	2276.6	35.77	4581.6	32.77
Total	17693. 2	78.19*	20820.6	93.72*	28185.9	89.46*	35844.6	75.75*

* Average CPUE for all centres combined together

b) *Different variants of output*

Total quantum of live fish sold, live fish dried and dry fish produced, sale proceeds on live and dried fish in different years are presented in Table 4. It is revealed from the table that although the fish catch in 1995-96 is 35% higher compared to 1994-95 the combined catch of *P. paradiseus* and *S. cinereus* (live fish sold) is lower by 12% in 1995-96 compared to 1994-95 and consequently the sale proceeds from live fish show a decline by 33%. The species-wise dry fish produced and sale proceeds thereof are presented in Table 5.

Table 4. Quantum of different variants of output during 1993-94 to 1996-97

Year	Live fish sold (in t)	Live fish dried (in t)	Dry fish produced (in t)	Sale proceeds		
				Live fish (in Rs. crores)	Dried fish (in Rs. crores)	Total (in Rs. crores)
1993-94	224.0	17469.0	3540.9	1.59	5.82	7.41
1994-95	436.9	20383.7	4173.0	3.08	6.55	9.63
1995-96	383.2	27802.7	5499.1	2.07	10.14	12.21
1996-97	701.3	35143.3	6939.2	4.86	13.38	18.24



DRYING THE FISHES AFTER SORTING

Table 5. Species-wise dried fish produced and sale proceeds during the period 1993-94 to 1996-97

Name of species	1993-94		1994-95		1995-96		1996-97	
	Dried fish produced (in t)	Sale proceed (in Rs. lakh)	Dried fish produced (in t)	Sale proceed (in Rs. lakh)	Dried fish produced (in t)	Sale proceed (in Rs. lakh)	Dried fish produced (in t)	Sale proceed (in Rs. lakh)
<i>H. nehereus</i>	306.9	143.88	649.5	152.62	1188.8	297.20	1521.1	380.28
<i>P. pama</i>	326.4	62.88	811.7	142.05	741.2	148.24	750.0	150.01
<i>Trichiurus</i> spp.	363.3	121.68	407.3	85.53	985.0	216.69	1642.8	361.41
<i>Setipinna</i> spp.	359.1	123.05	850.6	114.84	960.0	144.01	1141.0	171.15
<i>T. jella</i>	13.8	0.58	51.4	4.88	80.9	8.09	76.0	7.60
Prawn	139.6	68.16	250.8	68.97	348.1	104.43	558.0	167.39
Miscellaneous	363.8	61.83	1151.7	86.38	1195.0	95.60	1250.3	100.02
Total	1872.9	582.06	4173.0	655.27	5499.0	1014.26	6939.2	1337.86
Live fish sold (qty. in t)								
<i>P. paradiseus</i>	2.1	9.20	75.6	18.91	199.2	59.77	165.9	58.05
<i>S. cinereus</i>	117.7	149.77	361.3	289.00	183.9	147.14	535.4	428.34
Total	119.8	158.97	436.9	307.91	383.1	206.91	701.3	486.39
Grand total	-	741.03	-	963.18	-	1221.17	-	1824.25

c) *Operational (input) cost*

Average life span of a mechanised boat, a non-mechanised boat and a net have been taken as 20 years, 15 years and 5 years respectively and the depreciation costs have been determined accordingly. Operational cost includes i) Wage cost on manpower deployed, ii) Depreciation costs on crafts and gears, iii) Costs on maintenance and repair of crafts and gears and iv) Cost incurred on fuel for operation of mechanised boats. Table 6 depicts these figures in different years. Average wage per fisherman, average cost of a mechanised and a non-mechanised boat and average cost of a bagnet in different years are presented in Table 7.

Table 6. Total operational (input) cost during 1993-94 to 1996-97

Year	Wage expenditure (Rs. in crores)	Depreciation cost (Rs. in crores)	Maintenance cost (Rs. in crores)	Fuel expenditure (Rs. in crores)	Total (Rs. in crores)
1993-94	1.34	0.28	0.10	0.07	1.79
1994-95	1.26	0.26	0.07	0.07	1.66
1995-96	1.95	0.35	0.14	0.08	2.52
1996-97	2.82	0.50	0.14	0.26	3.72

Table 7. Average operational cost (input) during 1993-94 to 1996-97

Year	Average wage/ fisherman (in Rs.)	Average cost of a mechanised boat (in Rs.)	Average cost of a non- mechanised boat (in Rs.)	Average cost/net (in Rs.)
1993-94	2948	79,662	17,587	7601
1994-95	3020	92,198	19,909	8339
1995-96	4105	1,10,856	19,938	8737
1996-97	4517	1,23,004	22,017	9116

d) *Net profit*

Centre-wise net profit, profit per net, depreciation cost on nets and boats and total operational cost viz. wage, maintenance cost, expenditure on fuel etc. during the years 1993-94 to 1996-97 are presented in Table 8, 9, 10 and 11. Net profit and profit per net are maximum at the centres, Jamboodwip (upper and lower) and Kalisthan and are minimum at the centres, Bokkhali, Frasergunj and Sagar Island, and that coincides with the CPUE values of each centre showed in Table 3.

Table 8. Centre-wise operational cost, total sale proceeds and net profit during 1996-97

(Rs. in lakh)

Centre	OPERATIONAL COST								Total sale proceed	Net profit	Profit per net
	Wage	<i>Depreciation cost</i>				Maintenance cost	Fuel expenditure	Total			
	MB*	NMB**	Net	Total							
Frasergunj	12.20	1.84	0.51	2.39	4.74	1.21	1.23	19.38	53.71	34.33	0.26
Bokkhali	13.96	1.78	0.41	2.41	4.60	1.22	0.98	20.76	46.17	25.41	0.19
Upper Jamboo	84.15	3.63	0.75	6.54	10.92	3.08	8.33	106.48	578.70	472.22	1.32
Lower Jamboo	62.56	2.71	0.44	5.69	8.84	2.31	6.21	79.92	473.13	393.21	1.26
Kalishthan	60.39	2.89	0.59	4.21	7.69	2.18	6.88	77.14	382.94	305.80	1.32
Sagar Island	48.97	3.63	1.66	8.46	13.75	3.84	2.20	68.76	289.61	220.85	0.48
Total	282.23	16.48	4.36	29.70	50.54	13.84	25.83	372.44	1824.26	1451.82	0.89***

* Mechanised boat

** Non-mechanised boat

*** Average for all centres combined together

Table 9. Centre-wise operational cost, total sale proceeds and net profit during 1995-96

(Rs. in lakh)

Centre	OPERATIONAL COST								Total sale proceed	Net profit	Profit per net
	Wage	MB*	Depreciation cost		Maintenance cost	Fuel expenditure	Total				
			NMB**	Net	Total						
Frasergunj	11.21	1.27	0.41	2.06	3.74	1.30	0.75	17.00	35.98	18.98	0.16
Bokkhali	7.22	0.94	0.31	1.66	2.91	1.16	0.56	11.85	22.98	11.13	0.12
Upper Jamboo	60.26	2.27	0.74	4.49	7.50	2.94	2.32	73.02	433.72	360.70	1.40
Lower Jamboo	41.05	1.44	0.37	3.86	5.67	1.92	1.47	50.11	393.93	343.82	1.56
Kalisthan	40.35	1.77	0.52	3.51	5.80	2.09	1.81	50.05	236.22	186.17	0.93
Sagar Island	34.69	2.33	1.29	6.20	9.82	4.11	1.37	49.99	98.37	48.38	0.14
Total	194.78	10.02	3.64	21.78	35.44	13.52	8.28	252.02	1221.20	969.18	0.78***

* Mechanised boat

** Non-mechanised boat

*** Average for all centres combined together

Table 10. Centre-wise operational cost, total sale proceeds and net profit during 1994-95

(Rs. in lakh)

Centre	OPERATIONAL COST								Total sale proceed	Net profit	Profit per net
	Wage	MB*	Depreciation cost		Total	Maintenance cost	Fuel expenditure cost	Total			
			NMB**	Net							
Frasergunj	9.30	1.06	0.42	2.00	3.48	0.78	0.60	14.16	43.52	29.36	0.24
Bokkhali	4.50	0.37	0.29	1.37	2.04	0.45	0.21	7.20	15.37	8.17	0.10
Upper Jamboo	38.78	1.47	0.58	3.12	5.17	1.34	1.82	47.11	332.77	285.66	1.53
Lower Jamboo	15.04	0.92	0.27	1.90	3.09	0.68	1.14	19.95	135.62	115.67	1.01
Kalasthan	40.96	2.03	0.49	3.40	5.92	1.52	2.50	50.90	323.73	272.83	1.34
Sagar Island	17.52	1.80	0.86	4.10	6.76	1.86	1.02	27.16	112.17	85.01	0.35
Total	126.10	7.65	2.91	15.89	26.45	6.63	7.29	166.47	963.18	796.71	0.84***

* Mechanised boat

** Non-mechanised boat

*** Average for all centres combined together

Table 11. Centre-wise operational cost, total sale proceeds and net profit during 1993-94

(Rs. in lakh)

Centre	OPERATIONAL COST								Total sale proceed	Net profit	Profit per net
	Wage	Depreciation cost				Mainten- ance cost	Fuel expendi- ture	Total			
	MB*	NMB**	Net	Total							
Frasergunj	6.22	0.68	0.25	1.31	2.24	0.83	0.49	9.78	44.74	34.96	0.41
Bokkhali	4.39	0.12	0.38	1.18	1.63	0.62	0.09	6.73	7.77	1.04	0.01
Upper Jamboo	55.89	1.87	0.79	5.04	7.70	2.88	2.36	68.83	357.43	288.60	0.87
Lower Jamboo	14.89	0.32	0.19	1.28	1.79	0.67	0.40	17.75	122.96	105.21	1.25
Kalisthan	23.91	1.23	0.40	2.57	4.20	1.80	1.56	31.47	162.16	130.69	0.77
Sagar Island	29.84	1.27	1.50	7.07	9.84	3.58	1.56	44.82	45.98	1.16	<0.01
Total	135.14	5.49	3.46	18.45	27.40	10.38	6.46	179.38	741.04	561.66	0.46***

* Mechanised boat

** Non-mechanised boat

*** Average for all centres combined together

4. Discussion

During 1993-94 cost constituents such as annual capital cost of fishing inventory, wage bill, fuel expenditure on mechanised crafts etc., the total operational cost approximated to Rs. 1.79 crores (Table 6). Out of about 17,700 t of live fish 224 t of live fish were sold directly fetching a sale proceeds amounting to Rs. 1.59 crores and rest of live fish being dried amounted to 354 t. and fetched a sale proceeds amounting Rs. 5.82 crores i.e a gross sale proceeds approx. Rs. 7.41 crores with a net profit of Rs. 5.62 crores (Table 4).

This trend firmed up during 1994-95 when total live catch of 20,820 t was netted out by 192 fishing camps and in terms of dried weight 4173 t of fish valued at Rs. 6.55 crores was realised. Besides this 437 t of live fish valued at Rs. 3.08 crores contributed to gross sale proceed amounting Rs. 9.63 crores as against total operational cost of Rs. 1.66 crores (profit Rs. 7.97 crores). During 1995-96 winter bagnet catch was estimated to be 28186 t. with an average CPUE of 89.5 kg compared to 20820 t. with an average CPUE of 93.7 kg during the corresponding period of 1994-95. The reasons for marked increase in catch may be attributed to higher concentration of bagnet (30.8%) and consequent increase in effort by 41.8% despite a little decrease in average CPUE compared to winter months of 1994-95. Total live catch of 28186 t. was netted out by 231 fishing camps and in terms of dried weight 5499 t valued at Rs. 10.14 crores alongwith 383 t of live fish valued at Rs. 2.07 crores contributed to gross sale proceeds amounting Rs. 12.21 crores (approx.) as against operational cost of Rs. 2.52 crores (net profit Rs. 9.69 crores).

During 1996-97, the earlier trend of increase in CPUE was reversed though the total catch increased by 27% as compared to 1995-96 whereas CPUE decreased from 89.5 kg to 75.75 kg (15.4%). In absolute terms total quantity of 35844 t was netted out by 282 fishing camps. Concentration of nets increased from 1247 to 1629, an increase of 30.6% of the total nets deployed in 1995-96. Out of 35,844 t., 35143 t. live fish were dried. 6939 t of dried fish valued at Rs. 13.38 crores and 701 t of live fish valued at Rs. 4.86 crores contributed to gross sale proceeds amounting Rs. 18.24 crores, an increase of 49.4% compared to corresponding period of last year, with an operational cost of Rs. 3.72 crores (net profit Rs. 14.52 crores).

5. Wage-paid employment generation

Being an owner operator production relationship income of fishermen by way of wage paid employment is more stable in winter fisheries as compared to their counterparts in riverine fisheries whose income is uncertain due to violent fluctuations in fish production. There has been a discernible trend towards increased employment from 4548 fishermen in 1993-94 to 6248 fishermen in 1996-97, the wage rate being Rs. 4,517 per fisherman for a period of three months. Winter fisheries being highly labour intensive activity wage component for the recent years has been roughly 75 to 78% of total cost. With increased entry of more fishing units employment prospects may improve but much will depend on productivity levels. The downward trend of overall average CPUE during 1995-96 and 1996-97 (Table 3) is a warning signal indicative of over exploitation.

6. Development implications & relevant inferences/recommendation

Data/information in respect of winter migratory fishery have been collected by field visits. Data parted with by khuti owners and price intelligence statistics from commercial sources have the same limitations as in case of inland fisheries data base in general. At best, figures used may be treated as broad economic indicators for identifying priority areas in estuarine fishery research. The following inferences may merit attention for determining thrust areas for future research.

- i) Contrary to subsistence character of riverine fisheries of freshwater zone, winter migratory fishery seems to be a pronounced activity at highly remunerative levels and it needs to be studied in depth from various bio-economic angles such as population dynamics of popularly transacted varieties of fish, value addition due to processing and existing post harvest facilities. So far these aspects have received scanty attention.
- ii) The pronounced remunerativeness of winter bagnet fishing operation witnessed during the year 1994-95, 1995-96 and 1996-97 is a potent production incentive to khuti owners but it is apprehended that current levels of commercial exploitation may not be sustainable in the long run as revealed by decreasing trend of overall average CPUE.
- iii) The fishing intensity in recent years has been on the increase as is revealed by rising number of fishing units from 953 in 1994-95 to 1247 in 1995-96 and further to 1629 in 1996-97. The profitability though serving as a production incentive sounds also warning signals for future as high levels of extraction over the years

may ultimately result in deminishing returns or increasing costs. Therefore, it needs to be examined by fishery experts on the sustainability of existing levels of commercial exploitation and the likely possibility of afflicting perceptible damage to stock of natural population necessary for self perpetuation particularly in the wake of lax implementation of conservation laws if any, relating to mesh size. Therefore, a meaningful relationship through stock assessment studies of popularly transacted varieties of fish need to be taken up in the interest of sustainable fishery on long term basis.

- iv) The mechanisation of this sector has so far not displaced manpower but accelerating pace of mechanisation and upgradation of gear technology may adversely affect in near future prospect for additional employment.
- v) Fish prices being fairly stable for popularly transacted varieties of winter bag net fishery producers hardly face any market risk and present marketing mechanism is reasonably efficient.

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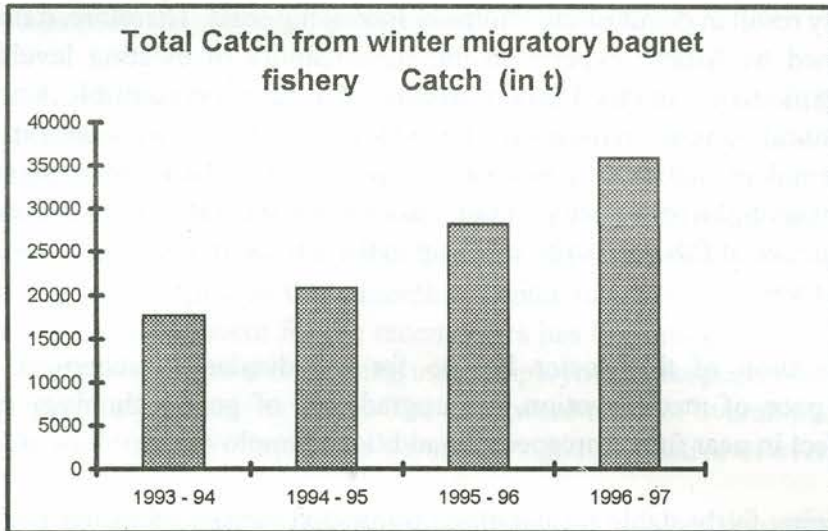
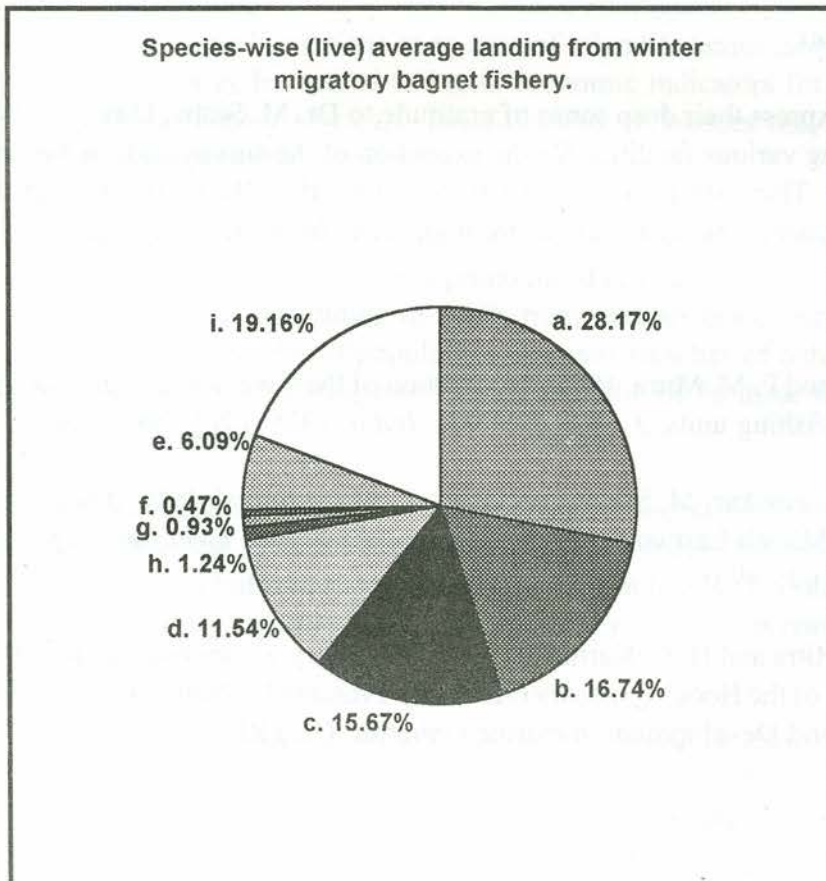


Fig. 2



- a. *H.nehereus*
- b. *Setipinna* spp
- c. *Trichiurus* spp
- d. *P.pama*
- e. Prawn
- f. *P.paradiseus*
- g. *T.jella*
- h. *S.cinereus*
- i. Misc.

Fig. 3

Centre-wise live fish catch (in t) from winter migratory bagnet fishery

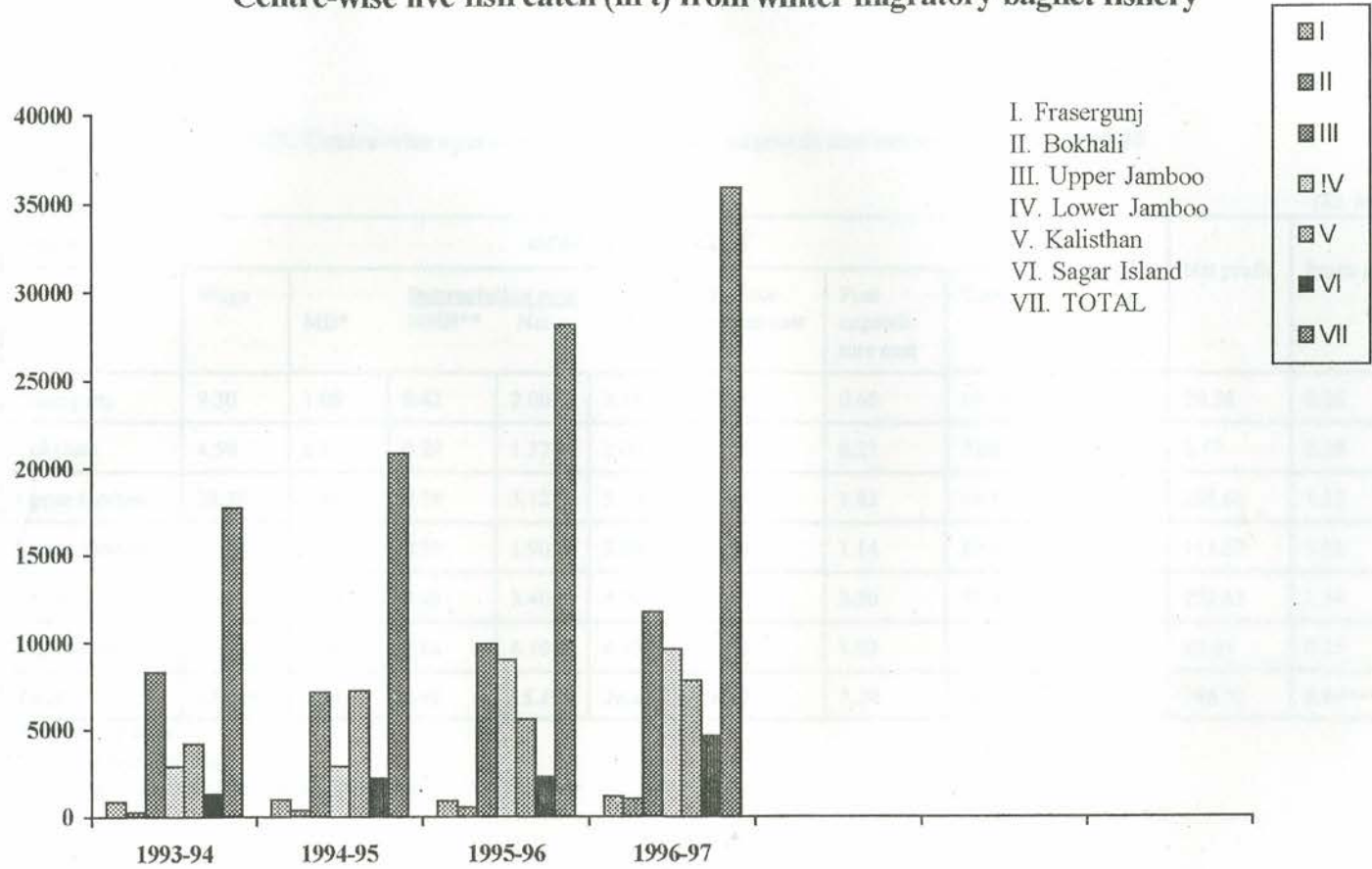


Figure 4