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MIGRATORY WINTER BAG-NET FISHERY IN COASTAL WATERS OF THE HOOGLHY ESTUARY

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ABSTRACT

The migratory winter bag-net fishery is a typical feature of the coastal waters of the Hooghly estuary. 4,000 men with about 800 bag-nets migrated from different estuarine areas and established fishing camps in different islands during 1984-85 and 1985-86. Three and a half months seasonal fishery accounted for an average estimated fish yield of 17,872 t, forming about 71% of the total fish yield from the estuary as against 29% to 33% about 15 years ago. An average catch per unit of effort of 152 kg was about 18 to 36 times that obtained in the upper and middle stretches and about 3 times more than that 15 years ago in the lower coastal waters. *Harpodon nehereus*, *Trichlurus* spp., *Pama pama*, *Setipinna* spp. and different species of prawns dominated in the catches. The bulk of the catches are sundried and exported to marketing centres. The reasons for tremendous increase in the winter migratory bag-net catches have been discussed.

INTRODUCTION

The river Ganges prior to draining into the sea has given rise to an extensive estuarine system covering the southern parts of West Bengal and Bangladesh. This estuarine system support important commercial fisheries of a

number of fish and prawn species. The portion within the Indian territory in southern West Bengal comprises the Hooghly-Matlah estuarine system and has as its principal component, the main channel known as the Hooghly river which extends landwards for nearly 290 km from the confluence of the river in the Bay of Bengal.

The lower most portion of the Hooghly-Matlah system constitutes the estuarine net work formed by the main channel, its distributaries with their further sub-divisions and cross connections which flow into the sea and give rise to an extensive deltaic system in the process. The estuarine waters cutting through and adjoining this extensive deltaic region known as 'Sundarbans' support the richest fisheries in the whole estuary contributing about 90% to the total landings.

A unique feature of the Hooghly estuary is the migratory winter fishery consisting of stationary bag-nets locally known as 'Beenjals'. Large number of bag-nets fishing parties migrate from different areas of the estuary during winter to suitable spots near the sea face in the lower zone of the estuary. The fishing parties establish their camps and remain engaged in bag-net fishing operations during end of October to early February. The fishery has come to be known as migratory bag-net winter fishery. During 1984-85 and 1985-86 two major concentrations of such migratory fishing parties, one on Sagar Island at the mouth of the Hooghly estuary and the other around Fraser-gunj, Bokkhali, Kalisthan and Upper and Lower Jamboodwip complex were established. The fishing camps so established are commonly called 'Khunties'. The major importance of the migratory bagnet fishery of winter lies in its high share in the total landings from the lower zone and from the whole estuary in recent years. Investigation on winter migratory bag-net fishery except the centre Sagar Island was carried out and reported by Datta *et. al.*, 1975. But no information on this fishery is available for last one decade. The analytical information based on investigation and data collected during 1984-85 and 1985-86 winter and the important characteristics of the fishery revealed by it are embodied in this paper.

DATA BASE AND ESTIMATION PROCEDURE

An inventory of the total number of migratory fishermen, their holdings in terms of bag-nets, boats possessed by each fishing party was

undertaken prior to the commencement of winter bag-net fishery operations and this was done by visiting individual camps for eliciting information. Adopting a 4-day sampling procedure in a month based on direct observations, information pertaining to total fish catch, catch per unit of effort and species composition of the bag-net landings was recorded. The days of observation were selected following a systematic sampling plan. Total catch, effort input for the days of observation were noted for all the camps at a site. For ascertaining species composition, a few random samples from the catches from fishing camps were examined.

An estimated monthly total catch of a landing site is

$$\hat{Y} = \frac{N}{n} \sum_{j=1}^n \sum_{i=1}^n Y_{ij}$$

where Y_{ij} = total catch on j th day of the i th fishing camp

N = Number of fishing days in a month

n = Number of sampling days selected

Similarly, an estimated monthly total effort of a landing site is

$$\hat{X} = \frac{N}{n} \sum_{j=1}^n \sum_{i=1}^n X_{ij}$$

where X_{ij} = total effort on the i th day of the j th fishing camp

So, the average C. P. U. E. of a landing site is

$$\text{estimated as C. P. U. E.} = \frac{\hat{Y}}{\hat{X}}$$

The different spots where the fishing camps "Khunties" were set up on the western flank of deltaic Sunderbans facing the sea are shown in Fig. 1. The bag-net fishing parties from different areas of the southern West Bengal start migrating in the lower zone towards the end of October. Their migration is over by the end of first week of November and they start setting up fishing camps simultaneously. Each camp consists of a fair amount of enclosed area with a small hutment within the enclosure and is used as a shelter and for stocking the

RESULTS

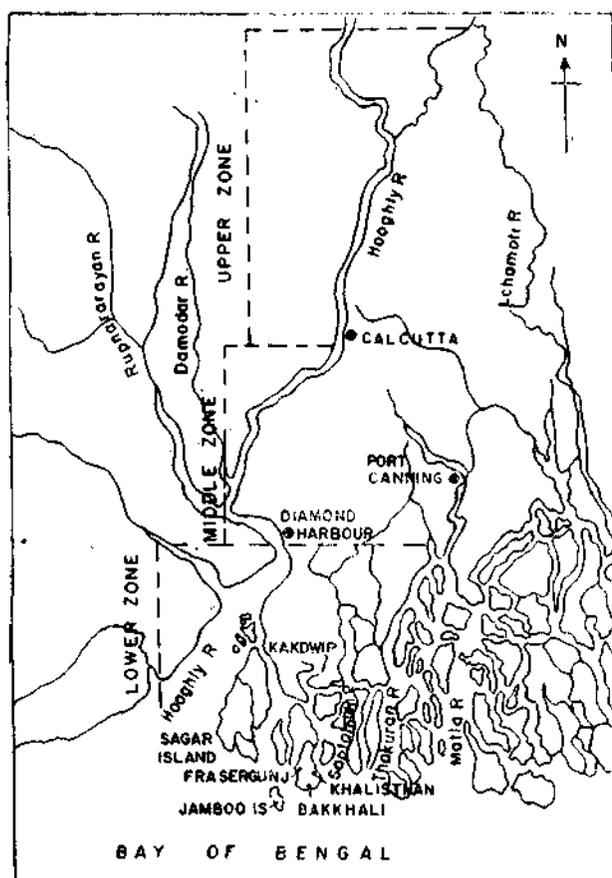


Fig. 1 Map of Hooghly estuary showing the fishing camps.

dried fish. The open space and the enclosure are utilised for drying the daily catch.

Inventory: The fishermen population migrating to various centres, the number of bag-nets possessed by them, the number of mechanised and non-mechanised boats put into operations and the number of fishing camps set up in 1984 and 1985 winter fishery operations are presented in Table 1. Each of the fishing camp at Bakkhali, Kalisthan and Jamboodwip complex had at least one mechanised boat. During earlier years deployment of mechanised boats was not resorted to for winter fishery operations. Distribution of bag-nets at different centres according to size (No. of meshes at the periphery of the mouth) is presented in Table 2. Size of a bag-net is normally indicated by the number of meshes at the periphery of the mouth. The nets are classified as medium, large and very large groups characterised by '800 to 1000', 'above 1000 to 1200' and 'above 1200' meshes at the mouth respectively. Majority of nets belonged to the large group. Except at Sagar Island nets operated at other centres belonged mainly to large and very large groups. A very few smaller nets with less than 800 meshes at the mouth were encountered at Sagar Island only.

TABLE 1

Centre-wise concentration of fishing camps, bagnets, boats, men engaged in winter migratory bagnet fishery in lower estuary during 1984-85 and 1985-86

Centre	Fishing camps		Bdgnet		Boat		Men engaged in fishing	
	1984-85	1985-86	1984-85	1986-86	1984-85	1985-86	1984-85	1985-86
Frazerganj	18	22	68	87	37(8)	46(10)	246	394
Bokkhali	19	13	110	76	59(19)	35(10)	699	367
Upper Jamboo	21	19	137	131	62(17)	61(16)	741	898
Lower Jamboo	28	18	189	142	86(26)	63(20)	1366	889
Sagar Island	83	82	243	267	103(2)	112(3)	777	812
Kalisthan	—	19	—	121	—	60(19)	—	597
Total	169	173	747	824	347(72)	377(78)	3729	3967

Figures in parenthesis indicate the number of mechanised boats

TABLE - 2

Distribution of bag net, according to size (no. of meshes at mouth) of winter migratory bag-net fishery during 1984-85 and 1985-86

Size (No. of meshes at mouth)	<800		800-1000		>1000-1200		>1200		Not available		Total	
	1984-85	85-86	1984-84	85-86	1984-85	85-86	1984-85	85-86	1984-85	85-86	1984-85	85-86
Frazerganj	—	2	6	8	25	16	37	61	—	—	68	85
Bokkhali	—	—	—	—	39	5	71	71	—	—	110	76
Upper Jamboo	—	—	2	—	36	—	99	131	—	—	137	131
Lower Jamboo	—	—	—	—	45	—	144	142	—	—	189	142
Kalasthan	—	—	—	—	—	—	—	121	—	—	—	121
Sagar Island	10	2	150	75	51	99	29	90	3	1	243	267
Total	10	4	158	83	196	120	380	616	3	1	747	824
Percentage of total	1.34	0.48	21.15	10.08	26.24	14.56	50.87	74.76	0.40	0.1	100	100

Centre-wise comparison in respect of total fish yields and C. P. U. E.: The total estimated winter bag-net fish landings amounted to 19,639.5 and 17581.4 t with an average CPUE of 133.4 and 169.8 kg in 1984-85 and 1985-86 respectively. Cyclonic storm and flood in

early winters of 1985 resulting in 24% less effort input compared to 1984 was mainly responsible for the decrease in catch during 1985-86. Thus despite higher CPUE value in 1985-86 the total yield decreased by about 10%. The catch abundance at different centres is

TABLE-3

Centre-wise estimated catch(t) in Winter migratory bagnet fishery in lower estuary during 1984-85 and 1985-86

Centre	1984-85			Total	1985-86			Total
	Mid. Oct. & Nov. 1984	December 1984	January & early Feb. 1985		Mid. Oct. & November 1985	December 1985	January & early Feb. 1986	
Frazerganj	436.6	110.5	201.5	748.6 (3.8)	399.1	397.7	192.1	988.9 (5.6)
Bokkhali	1109.6	803.6	2137.2	4050.4 (20.6)	760.5	607.1	586.8	1933.4 (11.2)
Upper Jamboo	1679.1	1129.1	1497.2	4305.4 (21.9)	1734.4	1443.8	1589.2	4772.4 (27.1)
Lower Jamboo	3454.3	3150.3	3472.9	10077.5 (51.3)	3216.0	1151.2	1046.5	5413.7 (30.8)
Kalasthan	—	—	—	—	1275.1	1306.0	842.4	3423.5 (19.5)
Sagardwip	250.8	96.6	110.2	457.6 (2.3)	530.2	403.8	85.5	1019.5 (5.8)
Total	6930.4	5290.1	7419.0	19639.5	7924.3	5314.6	4342.5	17581.4

Figures in brackets indicate percentages to total seasonal harvest by the fishery.

fairly consistent with the effort pattern. Among the six centres, Lower Jamboodwip has led in yield followed by Upper Jamboodwip, Bakkhali and Kalisthan (Table 3). The available effort potential in the form of concentration of nets at a centre has contributed in yield pattern to a large extent. However, the difference in concentration of nets is not the sole cause of differential yields at the centres which also depends on the differential catches per unit effort at the centres. This becomes clear from a comparison of yields at Bakkhali and Fraser-gunj centres in 1985-86, the former contributing almost twice the yield with a smaller number of operating unit. The low yield and CPUE at Sagar Island the centre which was first covered during 1984-85 in comparison to other centres may be attributed mainly to the deployment of non-mechanised boats and smaller sized bag-nets. Thus with a heavier concentration of operating units the total yield at Sagar Island is the least among the centres.

In terms of availability as measured by CPUE, Lower Jamboodwip, the centre with highest average CPUE value of 252.8 kg led the other centres followed by Kalisthan, Bokkhali and Lower Jamboodwip with average CPUE ranging from 203.4 to 196.3 kg (Table 4).

Species composition: The bag-net catches mainly comprise of small-sized fishes which are carried into these nets by the tidal flow and are unable to escape out of the nets. One complete bag-net operation usually consists of the effective part of one full tide. The species-wise landings of winter migratory bag-net fishery at different centres during 1984-85 and 1985-86 are presented in Table 5. The dominant species contributing to the fishery were *Harpodon nehereus*, *Pama pama*, *Trichiurus* spp., *Setipinna* spp., *Sciaena biauritus*, *Coilia* spp. and different prawn species. These species alone accounted for 79 to 82% of the landings. Removals of these species by the winter migratory fishery constituted over 90% of the total removals of the species from the estuary during the years. The size range of several species with their mean size is presented in Table 6.

COMPARISON OF THE RESULTS WITH PREVIOUS YEARS' DATA

The winter migratory bag-net fishery has a duration of about four months and formed 71% of the total landings from the estuary during 1984-85 and 1985-86; whereas its contribution to the fishery amounted to only 29 to 33% about one and a half decade back.

TABLE - 4
Centre-wise C. P. U. E. (Kg.) in Winter migratory bag net fishery in lower estuary during 1984-85 and 1985-86

Centre	1984-85				1985-86			
	Mid. Oct & Nov. '84	December 1984	January & early Feb. '85	Average	Mid Oct. & Nov. '85	December 1985	January & early Feb. '86	Average
Frazerganj	70.33	40.52	51.71	54.18	90.39	95.33	60.87	82.20
Bokkhali	113.92	205.25	273.12	197.43	242.13	199.84	149.73	195.23
Upper Jambo	173.04	179.57	101.27	151.29	276.09	252.62	216.81	248.51
Lower Jambo	185.75	312.25	244.37	247.46	455.91	195.18	123.32	258.14
Kalisthan	—	—	—	—	246.54	242.17	121.52	203.41
Sagardwip	8.67	9.43	32.2	16.77	22.43	48.14	24.08	31.55
Average	110.34	149.40	140.53	133.43	222.25	171.21	116.05	169.84

TABLE - 5

Centre-wise contribution of dominant fish species and prawns in (t) in Winter migratory bag net fishery in lower estuary during 1984-85 and 1985-86

Name of the species	Centre-wise contribution to total catch (in t)						Total	Percentage in total catch (%)
	Frezergeranj	Bokkhali	Upper Jamboo	Lower Jamboo	Ketiathan	Segar Island		
1	2	3	4	5	6	7	8	9
A : 1984-85								
<i>Harpodon nehereus</i>	151.2	707.8	975.6	1870.0	—	160.0	3864.6	19.68
<i>Pama pama</i>	112.1	850.6	874.0	1366.6	—	10.0	3213.3	16.36
<i>Setipinna</i> spp.	160.2	434.9	727.0	677.9	—	42.3	2042.3	10.40
<i>Trichiurus</i> spp.	92.5	758.6	140.1	3779.1	—	40.7	4811.0	24.50
<i>Sciaena blauritus</i>	—	—	—	—	—	0.3	0.3	—
<i>Coilia</i> spp.	30.0	159.0	186.1	217.4	—	8.7	601.2	3.06
<i>Tachysurus jella</i>	4.3	40.2	38.7	237.6	—	2.4	323.2	1.65
<i>Ilisha elongata</i>	15.3	85.9	52.7	175.7	—	0.7	330.3	1.68
<i>Stromateus cinereus</i>	1.1	—	5.2	—	—	0.2	6.5	0.03
<i>Polynemus paradiseus</i>	0.6	8.2	4.0	45.5	—	3.5	61.8	0.31
Prawns	94.3	229.2	376.1	727.5	—	107.9	1535.0	7.82
Others	87.0	775.9	925.9	980.1	—	80.9	2849.9	14.51
Total	748.6	4050.3	4305.4	10077.4	—	457.6	19639.4	100
B : 1985-86								
<i>Harpodon nehereus</i>	283.3	627.7	1197.1	1420.9	1170.1	191.9	4936.0	28.08
<i>Pama pama</i>	187.1	611.6	733.2	1174.2	827.1	20.8	3554.0	20.21
<i>Setipinna</i> spp.	159.5	185.0	670.0	447.4	318.2	83.4	1863.5	10.60
<i>Trichiurus</i> spp.	63.6	78.8	354.0	628.7	151.4	132.1	1408.6	8.01
<i>Sciaena blauritus</i>	3.4	40.8	242.9	95.3	176.4	10.6	569.4	3.24
<i>Coilia</i> spp.	52.9	32.7	108.2	83.7	68.9	56.0	392.4	2.23
<i>Tachysurus jella</i>	2.4	24.5	77.0	74.9	26.1	18.3	223.2	1.26
<i>Ilisha elongata</i>	3.8	15.4	24.3	117.0	39.4	0.2	200.1	1.14
<i>Stromateus cinereus</i>	1.0	8.2	44.0	47.2	6.8	0.9	108.1	0.62
<i>Polynemus paradiseus</i>	0.2	0.7	3.2	6.4	1.8	0.3	12.6	0.07
Prawns	46.8	58.7	370.6	283.4	165.7	311.3	1216.5	6.92
Others	184.9	234.3	947.9	1054.6	481.6	193.7	3097.0	17.62
Total	988.9	1963.4	4772.4	5413.7	3423.5	1019.5	17581.4	100

TABLE - 6

Mean size (mm) and range (mm) of some dominant species in winter migratory bag-net fishery

Species	Mean size	Range
<i>Harpodon nehereus</i>	217.6	80-340
<i>Pama pama</i>	115.4	20-280
<i>Setipinna phasa</i>	119.4	40-190
<i>Setipinna taty</i>	119.6	30-210
<i>Trichiurus</i> spp.	414.9	180-700
<i>Sciaena blauritus</i>	62.5	31-100
<i>Sciaena miles</i>	61.5	20-130
<i>Coilia ramearati</i>	136.0	70-270
<i>Coilia bornensis</i>	120.5	70-170
<i>Tachysurus jella</i>	87.2	50-180
<i>Stromateus cinereus</i>	62.5	41-90
<i>Polynemus paradiseus</i>	131.7	60-250
<i>Ilisha elongata</i>	166.8	101-270

The current bag net fishery (1984-85 and 1985-86) is 8 times and 4 times more than that of the period 1964-65 to 1968-69 and 1970-71 to 1974-75 respectively. The fish abundance in 1984-85 and 1985-86 winter bag-net fishery is also reflected by higher CPUE which is almost 2.5 to 3.5 times more than during the earlier periods (Table 7). This tremendous rise may be attributed to mainly the deployment of mechanised boats, large number of bag-nets under operation and involvement of larger number of fishermen in these operations during the recent years specially in Bokkhali and Jamboodwip (upper and lower) areas.

TABLE - 7

Comparative table of average nets, catch and C. P. U. E in winter migratory bag-net fishery during the period 1964 - 65 to 68-69, 1970-71 to 74-75 and 1984-85 to 1985-86.

Period	Nets (no.)	Men (No.)	Catch (t)	C.P.U.E. (kg)	Average % contribution to total annual catch of the estuary
1964-65 to 68-69	299	1120	2316.1	52.30	28.6
1970-71 to 74-75	289	1078	4152.8	71.26	32.7
*1984-85 to 85-86	530	3049	17871.9	181.98	70.0

* Excluding the centre, Sagar Island as it was not covered in earlier periods

DISPOSAL AND MARKETING OF CATCH

The catches landed during the season are mostly sundried except the economic species like Hilsa, *Hilsa ilisha*, *Polynemus paradiseus*, pomfrets (*Stromateus cinereus*) etc., which are landed in comparatively smaller quantities and are sold out locally to fish merchants in the area. The dried fishes stacked in the camps are periodically sent by boats to the marketing centres mainly to Uluberia from where further distribution to other markets takes place through dry fish traders.

DISCUSSION

The high rate of harvest of fishes by bag-net fishery is mainly due to the abundance of different fish species. This increased abundance may be due to winter blooms of plankton causing a feeding migration of fish and prawns. This induces migration of their predators as well. Large amount of organic matter, detritus and other washed off materials which are rich in nutrients are deposited below the mouth of the estuary during monsoons by the heavy inflow in the streams during that period. This brings about major food chains by inducing a rich growth of phyto-plankton during winter months. Such conditions are highly prevalent in the shallow sea-face regions of the bay where the migratory fishery operates.

The fishermen have to incur relatively heavy expenditure for sustaining themselves in these remote places. However, there are several factors which make this migratory bag-net fishery an economical venture. Prevailing calm weather conditions during winter in the extreme lower stretches of the estuary at the sea-face are highly favourable for the operation of stationary bag-nets. These conditions continue till the onset of south wind which start about the middle of February making the sea rough and the operations of these nets difficult and unsafe and the fishery comes to an end. The availability of fish vulnerable to bag-nets during November to January in the lower zone is much higher (18 to 36 times) than the average availability of fish in the upper and middle zones of the estuary during the whole year. In the upper and middle zone the average catch per unit effort remains about 0.92 to 7.27 kg during the year whereas in the winter fishery it ranges from 1677 to 258.14 kg. In upper and middle zones fishing during all the tides is not a regular feature whereas in the winter migratory fishery increasing the frequency of operations of nets is the general rule adopted.

Such a large scale drying of fish is not noticed in this estuary except at the migratory bag-net fishing centres in winter. The fishery is the mainstay of the important dry fish industry of the Hooghly estuary and supports a large

number of people directly or indirectly. Although some of the species which are caught in high abundance like *H. neherus*, *Trichiurus* spp. do not have much demand as fresh fish in the markets, there is a good market demand within and outside the country for the dry fish which are caught in appreciable quantities.

The impression that the winter bag-net fishery might have continued beyond the winter months but for the onset of the south winds, is not likely because of a number of considerations. The catch per unit of effort pattern indicates appreciable fall in February in respect of all the species and a similar situation is noticed in respect of the total catch also indicating that the margin of profit will fall appreciably in near future. Besides, the increased abundance of fish and prawn on account of plankton blooms setting in feeding migrations of fish and prawns, is also likely to decrease in the coming months, thus bringing about an end of the migratory bag-net fishery in the lower Hooghly estuary.

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