FISHERY RESOURCES
OF THE
HOOGHLY-MATLAH ESTUARINE SYSTEM

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INTRODUCTION

The estuarine region of the Hooghly-Matlah river system essentially comprises the portion of the estuary of the Ganga river lying within India (Fig.1). Its principal components are the main channel known as Hooghly along with the Rupnarayan tributary and the rivers Saptamukhi, Thakuran, Matlah, Gosaba, Haribhanga, Ichamati and Raimangal. The rivers; like, Saptamukhi, Thakuran, Matlah and Gosaba, although originally connected with the main channel or its distributaries, are long disconnected from the latter due to silting up at the upper regions and have changed their course of water flow. Since they do not receive any spill directly from any major river, they may be considered as estuarine inlets of the sea. The Hooghly (main channel) is a positive estuary where the influx of freshwater is sufficient and a pattern of increasing salinity towards the mouth of the estuary in the mixohaline range is observed [i.e. salinity 30(40) to 0.5‰ (Reid, 1961)]. Because of this, the salinity in the Hooghly estuary is always lower than that in the other distributaries of the estuarine system in the Sunderbans region. Transition to marine ecology is naturally not complete at the lowest land-fringe of the estuary and as noted by Sewell and others, estuarine conditions prevail in the northern section of the Bay of Bengal immediately south of the mouth of the estuarine system.

Tidal effect in the Hooghly is practically absent above Nabadwip. Based on the gradual variation in salinity and catch estimation purpose, the Hooghly-Matlah estuarine system has been divided into the following zones: (I) an upper zone (Fig.1) having only traces of salinity during the entire year, extending from Nabadwip to Khusigoli (the two stations being 149 and 40 Km upstream of Calcutta respectively) on the main channel; (II) a middle zone between Khusigoli and Diamond Harbour on the main Hooghly river where salinity ranges from traces to about 10‰;

(III) a lower zone including the entire estuarine area of the Sunderbans and the tract below Diamond Harbour on the main channel, where salinity varies from 10‰ to nearly neritic values; (IV) another zone containing the Rupnarayan tributary which joins the main channel about 19 Km above Diamond Harbour and has salinities similar to the middle zone(II) and (V) a small zone in the Matlah estuary, comprising the local area about Port Canning. Zones I, II and IV together constitute the upper estuary.

The Hooghly-Matlah estuarine system, particularly its zone III, supports important commercial fisheries. The fluctuations in abundance of the important economic species in the estuary in relation to effort and allied aspects have been studied from 1961-62 to November '71 and this report incorporates the results that have been obtained. The project also envisaged studies on the prevalent sizes in commercial catches. The study of size groups were previously made by workers studying the biology of individual species. Since no staff for studying the biology, was attached to the project, the study of size groups had to be postponed. However, studies on size group were completed prior to 1968 for quite a number of species; e.g., Mugil tade (Pillay,T.V.R. 1954) Mugil parsia (Sarojini, K.K. 1957), Sillago panijus (Gopalakrishnayya, Ch. 1963); Polynemus paradiseus (Gupta, M.V. 1968); Pama pama (Pantulu, V.R. and S. Jones 1951), Hilsa ilisha (Pillay, T.V.R. 1958), Coilia borneensis (Verghese, T.J. 1961); Pangasius pangasius (Pantulu, V.R. 1962), Osteogeneiosus militaris(Pantulu, V.R. 1963), Trichiurus pantului and T. savala (Gupta, M.V. 1968)/ Harpodon nehereus (Gopalakrishnayya, Ch. /and 1968). For H. ilisha, the workers carrying on the investigation on hilsa fishery are continuing their observations; since the pattern of exploitation or amount of harvest has not undergone any violent shifts for the other species, the prevalent sizes obtained in the previous studies still continue to give good indications for any conclusions to be made in this respect.

ESTIMATION PROCEDURE

The main landings from the Hooghly-Matlah estuarine system are made from the fishing grounds of the lower Sunderbans. From the remote fishing grounds extending from the lowest part of the Hooghly, the main channel, on the West to the Harinbhanga river on the east, the catches come, mostly by country boats (sometimes by launches), to various assembly points situated upstream which are connected with Calcutta (including its suburbs) by road or rail. The main assembly points are Namkhana, Diamond Harbour, Kakdwip, Raidighi, Port Canning, Hasnabad and Kalinagore. Company Tek, Domkal and Nalua, near Raidighi and Basirhat market are also smaller assembly points. An enumerator was posted at each of the assembly centres to record the landings in prescribed proforma (Form D) classified according to gear and species. The estimate of quantity is based on eye-estimation supplemented by weighment data when available. Since the catch is landed usually in standard size baskets or packing boxes of specific capacities, the estimation is usually sufficiently accurate for ordinary purpose. Larger specimens and economic species are usually sorted out. However, for smaller specimens and uneconomic varieties, particularly relating to bag-net catches, difficulties are experienced at Namkhana and Kakdwip in winter. Because, in winter some temporary small arats (fish-godowns) are set up in the lowermost islands (Frasergunj, Jamboo, Bakkhali etc.) and the landings received by them are brought usually to Namkhana in ice-packed boxes. Estimates relating to these catches, particularly those made by bag-nets, have to be made by enquiring from the person bringing the fish to the centre. These data were supplemented by sampling the boxes at Sealdah wholesale market, 2 days in a week, as regards species-composition. Temporary arats are also set up in winter at places; like, Lot No.8 (between Diamond Harbour and Kakdwip) and Falta (near Budge Budge) mainly to receive the landing of H. ilisha. Lot No.8 and Falta were covered in winter by direct observation. Company Tek, Nalua and Domkal were covered on sampling basis from Raidighi, Basirhat had also been covered similarly.

A bag-net fishery is operated in the lowest part of the estuary during winter by migratory fishermen who camp on the islands of Frasergunj, Jamboo and Bakkhali. In each

of the years, a survey-team camped at Fraserganj during the period of continuance of this fishery and collected information on required items by visiting the different centres periodically in the course of each fortnight. Preparation of a full inventory on the number of migrant men and bag-nets by camp to camp visit at each of the sites was done at the start of the season. Effort in-put and catch/per/unit effort for the observed days(generally 3 consecutive days/centre/fortnight) were noted for all camps at a site as also the number of operating days, while for ascertaining composition, catches of 2 to 3 'Khuties' were sampled taking about 10 Kg of fish per Khuti which was examined in detail. Upto '65-66, total catch was not estimated for each Khuti of a centre separately, but the catch of a centre was estimated as a whole from the average daily catch of all 'Khuties' at a centre. From '66-67 onwards, the monthly estimates of catch has been made for each 'Khuti' separately. Species composition has been studied for the centre as a whole. The estimate of catch made for the migratory fishery may be considered to be very satisfactory in view of the detailed observations on which it is based. Thus for the lower zone of the estuary, except for the migratory bag-net fishery of winter and landings at Company Tek, Domkal and Nalua, a system of total enumeration has been followed. Due to the intensive programme of survey, quite reliable extimates have been obtained for the winter migrating fishery also.

For the small area around Port Canning designated as zone V, the estimates are based on 3 days observation per fortnight and the monthly catch for any type of unit is estimated as catch per unit effort multiplied by average number of units operating per day multiplied by number of operating days in the month. A similar procedure is also adopted for the small local catches at Itindaghat, sampling it one day in each fortnight.

Estimation of catches from the upper stretches of the estuarine system are comparatively difficult and subject to more sampling fluctuations. On both banks of the river in these zones, which are well inhabited, almost every village has some fishermen population with some concentration of gears. Because of the fact that the consuming area is situated very near the producing regions,

every village in these zones usually has a landing point or ghat of its own where the catch is landed. It is impossible to cover, all these landing points at the same time in any enumeration programme and so a sampling plan has been adopted for these zones. Prior to the introduction of this scheme, a complete inventory of craft, tackle and fishermen population in the villages on both banks of the river in the different zones was prepared by actual village to village enumeration conducted during 1955 through 1957. The sampling plan adopted utilized this inventory as a frame and also for final estimation. Although estimates of total landing were attempted from 1956-57, they were not very reliable due to gaps in coverage. The coverage was gradually improved in each of the 3 succeeding years and a somewhat stable and satisfactory position was reached by 1959-60. From 1959-60, the species that contributed not less than 1% of the total catch were listed as being commercially important and this list has been followed up to-date with the only addition of Stromateus cinereus. During earlier years (1959-60), from each zone a few villages were selected based on the following consideration for sampling observations.

(i) Travelling expense to cover the villages periodically from a regional survey centre kept as low as possible, subject to reliability of the estimates being unaffected.

(ii) Villages were roughly classified as being prosperous, medium and poor on the basis of concentration of fishing units. As far as possible, all these groups were represented in the samples.

From 1963-64, the following considerations were also included :

(iii) The villages were more or less distributed within the entire zone.

(iv) All types of gear available in the zone as a whole were available in the selected villages.

(v) Subject to the above conditions, maximum number of units were attempted to be sampled at a given cost.

The villages selected earlier generally satisfied these criteria also. The fishing units which were ultimately brought under the purview of the sample may be considered to constitute a random sample of the total number of fishing units in the zone. Each sampling centre (i.e., village) was observed on two consecutive days per fortnight for information on various items. The clusters of days were randomly selected except for the fact that clusters at a gap of 15 days were not used (to eliminate the effect of tidal periodicity related to lunar phase). On the sampling day a surveyor noted the number of each type of unit operating at the centre and recorded the catch per unit effort of all or a sample of them depending on the number operating and purchased a sample of the catch from each type of unit operating, which was later analysed to derive the species-composition.

If for any sampled village

$\bar{u}$ = average no. of units of type A operating on a day of operation.

$\bar{c}$ = average C.P.U.E. for type A units *

n = No. of operating days of type A units in the month

$\bar{u} \times \bar{c} \times n$ gives an estimate of the monthly total catch at the centre from gear-type A. Let C be the total of monthly catches from type A gears of all sample centres. Then:

$C \times N/n$ where N and n are the no. of type A gears in the zone and in the set of sampled villages respectively, gives an estimate of zonal catch from the gear. (The villages which have been used for samples during 1966-'67 to date are indicated in table 8, along with the raising factors N/n for different types of gears). The sampling variation in these estimates is naturally contributed by centres, days within centres and units within days. An analysis of variance of the data on catch per unit effort for bag-nets for zone I, which has the longest stretch and more

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* C.P.U.E. = Catch per unit effort.

sampling centres than others, made for a recent year (1970-71) showed that centres and days contribute the majority of the variation. However these sampling fluctuations apply to a part of the total estimates only and through all these years the estimates from the zone other than zone III have remained within 20 to 30% of total.

A point about coverage : In winter (November to February) the catches made at Digha as well as some catches from areas; like, the Subarnarekha estuary and further southwest, are landed at Digha. The landings at Digha region only were estimated by periodically visiting the site and collecting necessary data. These are given in tables 16 and 17. However, of these, only H. ilisha landings are included in our estimate for the Hooghly estuary system for reasons explained later. Besides, large seine (Kochal jal, Jangla jal etc.) and drift-gills (Chhandi jal) to catch shoaling hilsa, shore-seines (Sarang jal) and other seines (Ghanakochal jal) are operated at Digha at this time.

REMARKS ON THE LANDINGS

Fishing in the estuary continues all through the year, although the catches begin to increase from August and reaches a peak during the winter months of November to January (Table 2, 7(i) to 7(v) & Fig.3). Besides prawns, 25 species are mainly represented in the commercial catches, A few other species individually command less than 1% of the total catch during most of the years and they are clubbed as "miscellaneous". The important species are listed alongwith their annual landings since 1961-62 in table 3 (Fig.4). The succeeding tables 6(i) to 6(iv) give the annual landings of the species in the whole estuary and each zone for the years 1966-1967 to 1970-1971. From the data presented, it will be seen that presently (66-67 to 70-71), annual landings from the estuary vary between 6 to 11 thousand tonnes (Fig.2). In the earlier reports issued on this project, the catches made at Digha area were included in the total estimates. The landing figures in this report, however, exclude the figures for Digha except for hilsa. The reasons for including hilsa catch are explained else-where in this report. A bumper crop of H. ilisha (5741.4 tonnes) during monsoon of 1971, unprecedented in the years under review, has shifted the upper limit of annual

landing quite beyond 11 thousand tonnes. Generally the predominent species are the Bombay-Duck - H. nehereus (14-27%); Indian shad - H. ilisha (14-22%), prawns (14-17%), Anchovies - Setipinna phasa and S. taty (5-9%), Ribbon fishes - T. savala and T. pantului (3-5%); P. indicus, S. biauritus and T. jella in that order. The more priced species are H. ilisha, P. paradiseus, L. calcarifer, E. tetradactylum, S. phasa and S. taty, M. tade, M. parsia, P. indicus and prawns. The prawn fishery of the Hooghly-Matlah estuarine system involves about 19 species (Rao, 1969). Of these, Parapenaeopsis sculptilis, Palaemon tenuipes, Metapenaeus brevicornis form the bulk of the catches, and occur mostly in the lower estuary. Among the freshwater prawns Macrobrachium mirabile has some appreciable contribution. The prawn species, Macrobrachium rosenbergii, M. malcolmsonii, M. villosimanus and Penaeus indicus have good market value. About 75% of the total landing of all species are made from zone III (table 5).

A variety of gears are operated in the estuary. Some of them are selective for a particular species; but mostly a gear catches a number of species, constituting what is known as "mixed fisheries" or "multispecies fisheries". A list of gears with their local names, types, areas of usual operation and main species caught are given in table I. The more important gears of the estuary are bag-nets, seines, gill nets, long lines, trawls and barrier nets. Since the gears of the estuary have been described by earlier workers /Hornell (1922-29), Naidu (1952) and Mitra (1952)/, they are not further elaborated here. The gearwise partition of the annual catch is shown in table 4. It will be seen that bag nets lead (50-65% of the total catch) others so far as the catches are concerned, followed by seines, drift nets, hooks and lines, trawls and set barriers, in the order mentioned. The bag nets are used in all parts of the estuary where tidal force is sufficient for their operation. The main gears that are operated in the lower estuary (zone III) are Been jal, Atone jal, (Bag net), Sele jal, Chhandi jal, Bhasa jal (drift gill net), Nangar jal, Barang jal (set gill net), Kochal jal, Jangla jal, Ber jal (seines), Pata jal (set barriers) and long lines. Been jal and Ber jal catch varied types of fish. Atone and Barang have bhetki (L. calcarifer) as their main catch. Chhandi jal, Bhasa jal, Nangar jal, Kochal jal and Jangla/are used mainly for catching hilsa. Sele jal is/jal

used to catch P. indicus chiefly. Long line catches consist of cat fishes, perches, polynemids, sciaenids and anchovies.

The availability of the species in the different seasons can be judged from table 9 while their availability in different zones can be seen from table 6.

TRADE CUSTOMS AND MODES OF DISPOSAL

In the lower zone of the Hooghly estuary where fishing is done by parties often in remote areas involving a few days absence from the landing spots (assembly centre), the trade is essentially contorlled by middlemen known as 'Aratadars' (Godown owners). The fishermen take loans from the 'Aratdars' for maintenance of their craft and tackle and for their sustenance during the period of fishing on hyphothecation of their catches. That is, in addition to repayment of the loan, the fisherman has to dispose his catches through the 'Aratdar' who has advanced money to him. This enables the 'Aratdar' to get a commission, usually 0.05 to 0.06 paise per rupee, on the sale proceeds. Ice for preserving the fish and Lorry for transportation are arranged by the 'Aratdar' for which the cost is deducted from the sale proceeds alongwith an instalment towards repayment of the loan. In spite of this undesirable influence, the 'Aratdar' at present, appears a necessity for the poor and weary fisherman.

The fishermen operate their nets in the remote areas of the lower region of estuary and the catches are brought by them or sometimes by other carrier parties, to the landing centres which are connected by rail, road or both to Calcutta. The main landing centres are Namkhana, Diamond Harbour, Kakdwip, Port Canning, Raidighi, Hasnabad and Kalinagore.

The catches are iced at the landing centres (sometimes icing is also done at the fishing grounds) and kept in boxes and despatched to markets in and around Calcutta. Sealdah and Patipukur are the two important wholesale markets for fish in Calcutta; but many of the suburban

and urban markets which are located on the arterial route from the Sunderbans to Calcutta also receive the fish directly from the landing centres. Most of the assembly centres do not have ice factories and the necessary ice is, therefore, brought usually by the lorry returning after delivering the fish catches in Calcutta, This creates inconvenience in case of sudden heavy landings when lack of readily available ice leads to bad condition of the fish and cases are on record when huge quantities of arrivals at assembly centres had to be abandoned because they could not be preserved. An ice factory located at Diamond Harbour, however, is to a good extent catering to the needs of Kakdwip, Raidighi, Diamond Harbour and Namkhana assembly centres.

The quantities of landings at the assembly centres are given in tables 13, 14 and 15. Besides these quantities shown, the centres; like, Port Canning, Raidighi, Kalinagar and Hasnabad, also receive a good amount of catches from the 'bheries',(brackishwater impoundments). Considerable time is taken by the carrier crafts(country boats using sail) whose speed generally depends on favourable tides, to take the fish from the fishing ground to the assembly centres.

The catches from the main channel of the Hooghly, Saptamukhi and Muriganga rivers come mostly to Namkhana, Kakdwip and Diamond Harbour. The catches from the Thakuran river and adjoining channels come to Raidhigi. Port Canning receives the catches made in the Matlah estuary. The catches made east of the Matlah river come to Hasnabad and Kalinagar. Namkhana and Diamond Harbour appear to receive more catches than the other centres (Table 13). During winter season, fishing activity increases because of favourable conditions in the bay south of the Sunderbans. The hilsa catches made during this period in the coastal waters at Digha and south of the Sunderbans come to Namkhana, Kakdwip, Diamond Harbour, Lot No.8 and Falta, the last two being temporary centres functioning in winter only.

In winter, the fabourable conditions induce large number of bag net fishing parties to migrate to the lower islands around Frasergunj and Sagardwip. Thecatches

made by these parties do not come to any of the assembly centres, but are mostly dried on the beach and then sent directly by boats, cheifly to the wholesale market at Uluberia (West Bengal).

FISHERY OF HILSA ILISHA

This is the most important fishery of the estuary and is seasonal in nature. The two main seasons of the fishery are monsoon (July/August to October) and winter (November to February) when the fish ascends up the river. In the monsoon, catches are made mostly through gill nets (Chhandi jal; Nangar jal etc) and winter catches in inshore areas of lower regions (Digha) are made mostly through large seines (Kochal jal, Jangla jal etc.) as well as by drift gill nets (Chhandi jal). In upper zones (I & IV) besides gill nets, small purse nets (Sanglo jal) are also operated in both the hilsa seasons. Generally the annual landings of hilsa from the estuary have varied between 1,400 and 1,700 tonnes. In some years; like, 1965-66, 1966-67 and 1968-69, they have dropped to about 700 to 900 tonnes. During the last five years (1966-67 to 1970-71), they formed 14 to 22% of the total fish landings. However, during 1971(Table 18)an unprecedented heavy landing of H. ilisha occurred. The total catch of the species during July to October was 5,741.4 tonnes as compared to 793.1 tonnes in 1970 and 742.5 tonnes in 1969 during the corresponding period. This heavy catch was mostly made from the upper and middle zones of the Hooghly river by drift gill nets and appears to be linked with the heavy and early rains leading to unprecedented freshwater discharge.

The hilsa fishery is selective with regard to species (during the hilsa season) and very young fish is not generally caught. However, the fish spawns in the upper estuary and young fry and fingerlings form a substantial part of the catches of fine meshed seine nets (Chatber jal) that are operated cheifly between Nabadwip and Kalna. These particular nets undoubtedly take a heavy toll on the young ones of the species.

Generally, it is felt that the abundance of the ascending fish in monsoon is largely linked with the volume of freshwater discharge down the river and

influence of previous exploitation on the stock is of lesser importance. Although the main determining influence for the magnitude of the winter run is yet to be known, it appears that the characteristics of the environment have an important role to play in the same.

It is now generally established that the hilsa ascending the different Indian estuaries are distinct stocks. It is also suggested, particularly for Hooghly-hilsa, that this may not be truly anadromous in that prior to the ascent it normally resides in the inshore areas and is not a truly marine species. Hence, corresponding to an estuarine stock of hilsa, there may be an inshore area close to the confluence which is the abode of the species and so far as the study of exploitation of the stock is concerned the catch from this area should be taken into account. According to Pillay (1958) "the lower estuaries and the inshore areas of the sea form their natural home, from where they migrate up the river for purposes of spawning". Hence the inclusion of the catch at inshore areas close to the confluence of the estuary with the sea is meaningful for hilsa, as we are including the same fish when it is caught up the river while ascending. In the case of the Hooghly estuary, the Hilsa landed in winter, at places like Diamond Harbour, Lot No.8, Falta and Kakdwip include a large amount caught at Digha. Hilsa caught from the Subarnarekha estuary and further south-west (Orissa Coast) are also often brought to these centres but they have, however, been excluded by enquiry since they almost certainly relate to different stocks.

Hilsa being a very economic species, its fishery, in seasons of availability, greatly replaces the other fisheries. There occurs a fall in intensity of operation of other gears, when hilsa-gears increasingly appear in the field particularly in upper areas. Hilsa being a highly economic fish, the Hilsa fishery continues almost as long as ascending or descending hilsa is available in the estuary in the seasons (winter or monsoon). Hence the abundance of the winter or monsoon runs can to a fair extent be judged from the catches of hilsa during these seasons. Indeed, as pointed out by Rounsefell and Everhart (1956, pp.68) total catch can also be utilized as an indicator of population size, particularly when it is justified by other background knowledge. However,

for the anadromous species of H. ilisha, the strength of runs may not reflect the abundance of the stock for the following reasons. The upstream migration of hilsa, particularly in monsoon, appears to be determined to a large measure by the volume of freshwater discharge and generally monsoon runs are stronger. Although the behavioral cues to migration of the winter run is not exactly known, physico-chemical conditions; like, temperature and salinity have been suggested (Jones and Sujansinghani, 1951) by some workers as possible governing factors. However, the point of relevance for abundance studies that emerges from the above discussions is that actual fluctuation of H. ilisha may not be reflected in the flutuations of the strength of runs which latter are reasonably indicated by the seasonal catches of H. ilisha. Pantulu in an unpublished report submitted in 1966-67 pointed out that in the years posterior to the construction of the D.V.C. dams (about 1955), the level of harvest by the hilsa fishery had a consistent fall compared to that obtained prior to the construction of these dams. He also referred to loss of spawning areas caused by withholding the run-off through the Damodar as having an adverse effect on the stock. The main key to the improvement of the hilsa fishery is, therefore, to be sought not in the regulation of present exploitation; but in other measures; like, improvement of habitat ensuring sufficient water discharge etc. As noted elsewhere in this report, modification of exploitation might be necessary in so far as it relates to killing the youngs by raising the minimum size-limit from zero to some reasonable value.

It has already been noted earlier that in the monsoon season of 1971 the hilsa fishery had been very highly revived.

MIGRATORY BAG-NET FISHERY

A special feature of the Hooghly estuary is the migration of a large number of fishing parties during the winter season, to suitable spots near the sea-face in the lower zone, where they set up fishing camps and remain engaged in bag net fishing during the four months, November to February. Two main concentrations of such parties are common, one on Sagar Island at the mouth of the Hooghly estuary and the other in the Frasergunj,

Bokkhali, Kalisthan, and Jamboodwip complex. The migration of the fishermen, mostly from the upper zones of the estuary, starts towards the close of October and is usually complete before the first week of November, These perties set up temporary fishing camps known as "Khunti". The number of men migrating to the different centres, the number of bag nets possessed by them and the number of "Khunti" set up, during the years 1966-67 to 1970-71 are given in the table 10. The factors which induce this migratory fishing are the following. In winter, a calm weather prevails in the extreme lower reaches of the estuary favourable for the operation of fixed bag nets. This condition prevails till the south wind starts about the middle or end of February. Secondly, the catch per unit effort (CPUE) at these winter fishing centres during November to January ranges between 30 and 130 Kg as against the average of about 2 to 3 Kg in the upper and middle zones. Plankton production particularly phytoplankton reaches a peak in this regions in the winter months [Shetty, Saha and Ghosh, 1961; and Saha, Ghosh and Gopalakrishnan 1970]. The capture by the migratory bag net fishery during the four months accounts for 30-50% of the total production from the zone III and 22-38% of the total production of the whole estuary (Table 12). Bombay Duck (H. nehereus) anchovies (S. phasa and S. taty), ribbon fishes (T. savala and I.pantului) and and prawns dominate the catches (table 11), the respective percentages during 1966-67 to 1970-71 varing between 40 and 55%, 7 and 14%, 10 and 12% and 4 and 10%. Generally November and December are the months of peak landing when 70 to 80% of the harvest is made. An important question is whether the high rate of yield may continue if the fishing is done in this region by suitable mechanised vessels even after February. So far as these particular fishing grounds are concerned, the rate of yield may not be maintained as is evident from an examination of the monthly catch per unit effort as shown below:--

C.P.U.E. values in (Kg) for migratory bag net fishery (averages in 64-65 to 68-69)

	November	December	January	February	Average
TOTAL CATCH	71.17	65.45	41.47	31.11	52.30
H.nehereus	37.28	30.96	15.64	13.09	24.24
S.phasa & S.taty	5.53	7.61	5.19	6.77	6.28

T. savala & T. pantului	4.74	6.28	5.02	3.19	4.81
Prawn	7.34	4.25	1.98	2.09	3.92

However, the position may be different when we think of areas further south of the above fishing grounds, or the areas from which the feeding migration of species to the above fishing grounds takes place. If it would be possible to exploit these regions with suitable vessels, the rate of yield might be expected to be maintained.

Among the different centres, C.P.U.E. values on the average for 1964-65 to 1968-69) are higher at Bakkhali (85 Kg) which is followed by Kalisthan (56 Kg), Jamboo (35 Kg) and Fraserganj (32 Kg). However, over the years, the concentration of nets has steadily increased in Jamboo and fallen in Kalisthan. It appears that remoteness and comparative lack of safety are probably the reasons for which Kalisthan is being disfavoured by the fishermen. Preference for a spot appears to be based on several considerations; like, higher availability of fish, space for camping and drying, facility of landing close to the camping spot, general safety and proximity to the market for purchase of essential commodities and to the source of drinking water.

The different centres exhibit some variation in the size composition of the nets also. The nets generally, belong to the medium and large groups characterized by "800 to 1,000"/meshes at the net-mouth respectively, a higher percentage being of the medium group. Nets of the large category (i.e. number of meshes above 1,000) are usually of more frequent at Bokkhali.

/ and above 1000

Short phase observations in 1970-71 and 1971-72 revealed that among 61 "Khunti" established in Sagar Island in 1970-71, 49 which were surveyed, possessed 126 nets with 529 men. In 1971-72, 43 "Khunti" were established in all with 123 nets and 533 men. This fishery appears to cease to operate shortly after the 'Gangasagar mela', usually taking place in the first fortnight of January. The catch by this fishery is not included in the estimates presented in this report, as the same could not be covered in sufficient detail.

FLUCTUATIONS IN ABUNDANCE AND STOCK ASSESSMENT

Most of the fisheries of the Hooghly-Matlah estuarine system are multi-species fisheries, involving a number of species. Further, the number of species commercially exploited is also quite large. Under such circumstances, analysis by individual species is an unwieldy task and the only practical method is to treat the species-complex as a whole. For fisheries based on a large number of species the only practicable analysis, as has been pointed out by Gulland (1970), is one that treats the species complex as a whole, examining the overall catch per unit effort and relating this to the total effort and hence determining emperically (as done for a single species) the relation between total effort and the combined catch of all species. However, before applying any empirical relationship or any model of dynamic-pool type (Beverton Holt) or of logistic type (Graham Schaefar), the criteria of unit-stock and unit fishery must be satisfied, whether for an individual species or for the totality of species under consideration. Unfortunately these criteria are not satisfied for most of the estuarine fisheries, except probably for a few species. Majority of the fish species available in the estuary are marine forms with sufficient tolerance for salinity variations. Distributions of the stocks involved extend beyond the exploited limits of the estuary and evidence to date indicates that the greater parts of the stocks are included in the marine areas. Most of these areas are not exploited at present with the result that local abundance in these areas and consequently over-all stock-abundance in the entire area cannot be known. Under such conditions, measurement of over-all abundance or effective effort from the knowledge of the exploited portions of the stocks is justified only under the assumption that the exploited areas include constant fractions of the total stocks at all times. [Beverton and Parrish (1956)]. Such an assumption is not likely to be justified particularly for the species-complex as a whole. This was also borne out when a logistic-type model was attempted to be fitted to the present data by Schaefer's procedure. On such an attempt values of the constants a, M, K_2 etc. involved in fitting Schaefer's equilibrium line come out to be unrealistic indicating that the basic assumptions are not satisfied by the data. The abundance of fish in the estuarine compartment is not, therefore, necessarily related to the exploitation of the species within the estuarine limit. The greater

Table 4. Gearwise composition of landings (March to February) at the Hooghly-Matlah estuary in different years

Gears	1961-62 Kg	1962-63 Kg	1963-64 Kg	1964-65 Kg	1965-66 Kg	1966-67 Kg	%	1[illegible] Kg	%	1968-69 Kg	%	1969-70 Kg	%	1970-71 Kg	%	Average (1966-67 to 1970-71) Kg	%
rawl	62073	163037	121628	47584	89073	161610	2.74	1[illegible]2422	1.[illegible]6	142732	1.88	216034	2.71	210869	1.96	170733	2.10
eine	619107	1158302															
(a) large			1531716	745263	917403	757119	12.83	737[illegible]91	[illegible].81	392636	5.17	1275033	15.9[illegible]	1318344	12.26	896395	11.04
(b) small			228323	249412	203255	329895	5.59	335093	4.00	495285	6.52	515207	6.[illegible]	[illegible]07204	4.72	436537	5.38
urse	42417	38668	15403	27580	27862	25521	0.43	12230	0.15	100[illegible]0	0.13	14[illegible]21	0.18	34035	0.32	19433	0.24
rift	541129	372988	95037	100401	97460	149496	2.53	[illegible]	[illegible]	968450	12.75	1272955	15.96	1180274	10.97	891164	10.97
ift	137370	41962	75466	57436	75548	38759	0.66	[illegible]0957	[illegible]	97966	1.29	122100	1.53	2201[illegible]	2.12	115596	1.42
ast	17091	21669	29615	20937	18418	16035	0.27	35[illegible]1	[illegible].42	26342	0.35	2[illegible]155	0.[illegible]5	32209	0.30	27593	0.34
ag	2093516	2352174	3177535	4238349	4081312	3688413	62.51	5390749	64.34	4934500	64.99	[illegible]74704	[illegible].97	[illegible]	60.69	4882891	60.13
et-gill	30793	60500	221039	432344	147887	161316	2.73	290821	3.47	69152	0.91	[illegible]610	1.[illegible]1	130106	1.28	149617	1.84
et-barrier	221134	241834	326612	347723	231476	164535	2.79	1317[illegible]	1.57	137[illegible]83	1.[illegible]1	164369	2.[illegible]6	172417	1.60	154[illegible]38	1.90
raps	10663	45304	12290	10791	112	23474	0.40	44264	0.53	26350	0.35	50[illegible]24	0.64	55[illegible]17	0.53	40307	0.50
ooks & lines	136707	300369	183368	211842	245107	284104	4.81	231860	2.77	240709	3.17	290754	3.64	321169	2.99	273715	3.37
nknown & unclassified	242166	347976	53974	755366	219039	100560	1.70	69820	0.83	50917	0.67	63964	0.80	27572	0.26	62567	0.77
[illegible]	4162446	5160371	6072[illegible]06	7245[illegible]70	6353952	5900837	99.99	8376700	100.00	7592258	100.00	7978117	100.00	10754937	100.00	8120586	100.00

. catches (March to February) from the Hooghly-Matlah estuary

(Kilograms)

-64	1964-65	1965-66	1966-67	%	1967-68	%	1968-69	%	1969-70	%	1970-71	%	Average (66-67 to 70-71)	%
70	7850	7714	6716	0.11	8697	0.10	9501	0.13	14335	0.18	23805	0.22	12629	0.16
99	39197	59065	47622	0.81	51372	0.61	49631	0.63	57193	0.72	69805	0.65	55125	0.68
07	25658	29756	20551	0.35	21263	0.25	19694	0.26	28335	0.36	35397	0.33	25048	0.31
08	43958	23570	22203	0.38	24044	0.29	37727	0.50	31485	0.39	56428	0.52	34377	0.42
65	56619	46389	40107	0.68	33988	0.41	42545	0.56	65837	0.83	81300	0.76	52755	0.65
56	137147	91483	84791	1.44	221635	2.65	224824	2.96	247141	3.10	184307	1.71	192540	2.37
08	17303	17331	15415	0.26	20622	0.25	18635	0.25	27187	0.34	43747	0.41	25121	0.31
41	94062	24902	148599	2.51	107471	1.28	192647	2.54	192318	2.41	304193	2.83	189006	2.33
53	6377	5965	7898	0.13	7652	0.09	11516	0.15	12201	0.15	11392	0.11	10132	0.12
46	138011	175709	115975	1.97	135115	1.61	183069	2.41	149834	1.88	197747	1.84	156348	1.93
64	1475575	887764	799189	13.54	1337517	15.97	678038	8.93	1753001	21.97	1731139	16.10	1259777	15.51
44	21851	7480	8663	0.15	27052	0.32	15919	0.21	16344	0.20	20925	0.19	17781	0.22
53	39010	85145	61266	1.04	62955	0.75	103376	1.36	122953	1.54	216373	2.01	113385	1.40
33	55040	106649	86005	1.46	85436	1.02	62054	0.82	90577	1.14	131549	1.22	91124	1.12
07	1385	12918	31906	0.54	2588	0.03	4515	0.06	8335	0.10	7871	0.07	11043	0.14
38	95834	147024	287576	4.87	407093	4.86	648650	8.54	484553	6.07	804055	7.48	526306	6.48
05	264313	289067												
05	55352	48747	58299	0.99	94734	1.13	94505	1.24	126177	1.58	171002	1.59	108943	1.34
18	183558	244625	147335	2.50	116363	1.39	197038	2.60	260381	3.26	145590	1.53	173343	2.13
92	25282	6690	11948	0.20	5902	0.07	18619	0.25	31212	0.39	21405	0.20	17818	0.22
93	2737	9385	10252	0.17	6460	0.08	6747	0.09	21206	0.27	37250	0.35	16383	0.20
08	39669	390891	149923	2.54	348256	4.13	391512	5.15	256040	3.21	404901	4.32	322178	3.97
34	146005													
97	2053941	1505860	1326882	22.49	2268317	27.00	1924250	25.35	1103133	13.83	1920891	20.54	1766312	21.75
	5200	11671	9658	0.16	92954	1.11	81012	1.07	38057	0.48	79493	0.74	60485	0.74
29	979693	856383	1022844	17.33	1263782	15.09	1051274	13.97	1220895	15.30	1575003	14.64	1228574	15.13
23	1234393	1261769	1379414	23.38	1625512	19.40	1515611	13.96	1618303	20.29	2130962	19.81	1653973	20.37

is the relative size of the estuarine portion compared to the whole stock, the more is likely to be the influence of estuarine exploitation on the entire stock.

Although over-all stock-abundance or effective effort relative to the total stock cannot be estimated except where the conditions of a unit fishery on a unit stock are satisfied, abundance within a specified region for which relevant information is available can always be indicated and effective effort relative to the stock-abundance within this region can also be indicated. The indices of abundance taking the species-complex as a whole and the corresponding effective effort in the sense just referred to as estimated from available data are given below for the different years :

Year	Index of abundance /C.P.U.E.(Kg)/	Effort (Net-tides)	Actual catch* (Kg)
1960-61	17.91	189752	3398457
1961-62	23.91	129824	3104090
1962-63	13.83	264397	3656611
1963-64	15.54	299797	4658852
1964-65	17.86	323040	5769503
1965-66	14.04	389330	5466188
1966-67	16.87	302409	5101648
1967-68	19.50	360988	7039263
1968-69	22.86	302459	6914220
1969-70	16.73	372093	6225116
1970-71	21.34	422858	9023798

* Excluding hilsa

Reliable observations on catch per unit effort are comparatively less available for the lower estuary (zone III) except for the winter months. In winter however, C.P.U.E. for bag nets are available from a large number of data emanating from the migratory bag net fishery. In deriving the foregoing C.P.U.E. values the following procedure has been adopted:

Highly diverse type of gears are operated in the estuary and for finding abundance in terms of C.P.U.E. or for finding effective effort it poses a serious problem. Some principal gears are to be found and other forms of efforts may be scaled to terms of these gears. The gear that is operated in almost all parts of the estuary is bag net (Been jal). In normal years, this contributes the maximum among different gears, Further, almost all species are caught by bag nets though bigger specimens, particularly of H. ilisha, T. jella, P. indicus and P. canius are usually not caught. If any single gear is to be selected as the principal gear, undoubtedly, we have to select the bag nets. Hence the local abundances in the different zones are determined in terms of C.P.U.E. of bag nets. The relative areal magnitudes of the different zones are found approximately to be 15 (zone I), 10 (zone II), 230 (zone III), 8 (zone IV), 2 (zone V) by using a map (of scale 1 cm = Ca 2.5 km). Lower areas of zone III has generally a higher abundance than the upper areas of the same region and the areas of these two regions are approximately as $\frac{3}{5}$: $\frac{2}{5}$ (L : U).

From the available data C.P.U.E. values were calculated for zones I, II, IV, V, III (a) (lower region) and III (b) (upper region) for each month from which the annual C.P.U.E. values were derived by averaging. These annual values of local abundances were then combined into a weighted average using therrelative sizes of the regions as weights. These weighted averages are the C.P.U.E. values giving the over-all abundances in the estuarine area exploited (i.e. zones I to V). The annual catch (excluding H. ilisha) has been divided by the C.P.U.E. values to get the effective effort on the fish in the area. H. ilisha has been excluded because bag nets catch the species in comparatively small quantities and that too only the very young sizes. Further, hilsa contributes a high percentage in total landings mostly through gill and seine nets. (The relative contributions of H. ilisha in the C.P.U.E. of bag nets may be neglected, or can be deleted if further accuracy is desired). From the results it appears that index of over-all abundance has varied between 14 and 24 in the years under consideration. The figures of effective effort indicate more intensive fishing in the later years than in the first two years. But, it might also be due to slightly incomplete coverage possible during the initial years of the survey. Between

1963-64 and 1970-71, the effort has been confined between 3 and 4 lakh net-tides. As noted earlier, the fluctuations in abundance within the exploited area cannot be explained by the exploitation within the area only as the stocks are spread beyond these zones and the available knowledge do not enable us to use the unit stock and unit fishery concept in the present case except under very restrictive assumptions which do not appear to be justified from the results of the attempt to fit mathematical models for determining equilibrium catch at various levels of effort. However, it may be said from inspection of the series of effort and abundance values that increases in effort at any stage have not resulted in any appreciable decrease in C.P.U.E. in succeeding years; on the contrary, in several cases there had been an increase in C.P.U.E. As discussed earlier our exploitation is confined to a fraction of the stock-complex as a whole and from available evidences the fraction is appreciably less than 50%. It appears reasonable to conclude that there is much scope for increasing the fishing effort. As shown by Ricker (1958), when the fishing intensity is higher, it pays to catch the fish at a higher size to get the optimum yield. In fact it is well-known that many small sized fish of the estuary are at present being caught particularly by bag nets and small seines (e.g. Chatber jal) which give us a small yield resulting from uneconomic exploitation. With increase ineffective effort simultaneous with a higher minimum size-limit, gain in yield as well as quality may be expected. This has yet another implication of no small importance in that although most stocks available in the estuary extend beyond the estuarine limit exploited, there are however some species, the younger size-groups of which are mostly confined within the exploited limit. Studies already made have revealed that spawning areas of many species; like, H. ilisha, P. pama, P. paradiseus, E. tetradactylum etc. as well as areas harbouring their young ones are located well within the estuary. The present nature of effort is, to a substantial part, directed against these youngs with the consequent baneful effect on the entire stocks. Undoubtedly a better and larger crop can be obtained with increased effort if the minimum size-at-capture is raised to some higher values instead of being completely unrestricted as at present.

CONCLUSIONS AND RECOMMENDATIONS

1. Fluctuations in abundance in the estuary, not only for hilsa but also for many other species, appear to be related more to environmental causes rather than "predation by man", to use a term by Schaefer. The environmental causes; like, smaller water-discharge a condition imposed following the construction of the DVC dams, loss of spawning ground, elevation of river-bed, less flushing, greater pollutional load etc. appear to make the habitat less suitable for the commercial species. Most of the estuarine fishes are marine species with sufficient tolerance for salinity variations. Adverse effect on their stocks due to exploitation within the estuary will not generally be caused. The point in question is, what portion of the stocks lie within the exploited estuarine limit. The theory of stocks resident completely within the exploitation limit of the estuary may be brought in. But since the bulk of the catches are obtained from the lowest region of the estuary, and catches of the species having major share in the landings generally increase as one moves to the lower parts, stocks, completely resident within the estuary, even if existent, must be relatively small in size and at best have small effects on commercial landings. Attention should, therefore, be focussed to promote those causes which tend to make the estuary an improved habiat for the fish. The most direct and important influence may be had through increase in the volume of water discharge. The diversity in the wealth of fish fauna in a positive estuary depends upon the range of variation in ecological conditions caused by freshwater discharge on the one hand and tidal penetration on the other. The reduction in run-off and flushing in the stream has laid to heavy silt-deposition with consequent retardation of tidal penetration.

2. Exploitation can, however, affect the stocks of those species whose youngs are entirely located within the exploited region and are subjected to wanton destruction. The problem, however, admits of a satisfactory solution. As noted by Ricker (1958), a better yield can be obtained in such a case by increasing the fishing effort and at the same time raising the minimum size limits from zero (as exists at present) to some reasonable values. Very small meshed seines and other nets may be

prohibited in the upper areas where young fry of many species (H. ilisha, P. pama, E. tetradactylum, P. paradiseus etc.) are found to inhabit.

3. At present, the 'Aratdar' have a strangle-hold on the fishermen. Government controlled agencies should come forward to fill in those roles of the 'Aratdar' which are necessary for promoting the industry, so that the unwanted middlemen may be eliminited and the fisherman is able to get the proper fruits of his labour.

4. The evidence gathered during the course of this study suggests that the present exploitation is confined to less than 50% of the stock-complex as a whole and there is considerable scope for increasing the fishing effort provided the size-at-capture for a species is maintained at some suitable minimum value without being completely unrestricted as at present.

5. At present, the areas of higher abundance in the estuarine system can be fished only during the winter months. Powered boats may be introduced so that the lower areas can be fished during other seasons also. As stated by Pantulu (1964) immediate supply of mechanised boats will pose problems of finding trained persons to operate them; hence in the initial phase non-mechanised boats may be supplied in which in-board engines can be installed at a later date.

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FIG. 1. HOOGHLY-MATLAH ESTUARY AND ITS VARIOUS FISHING ZONES.

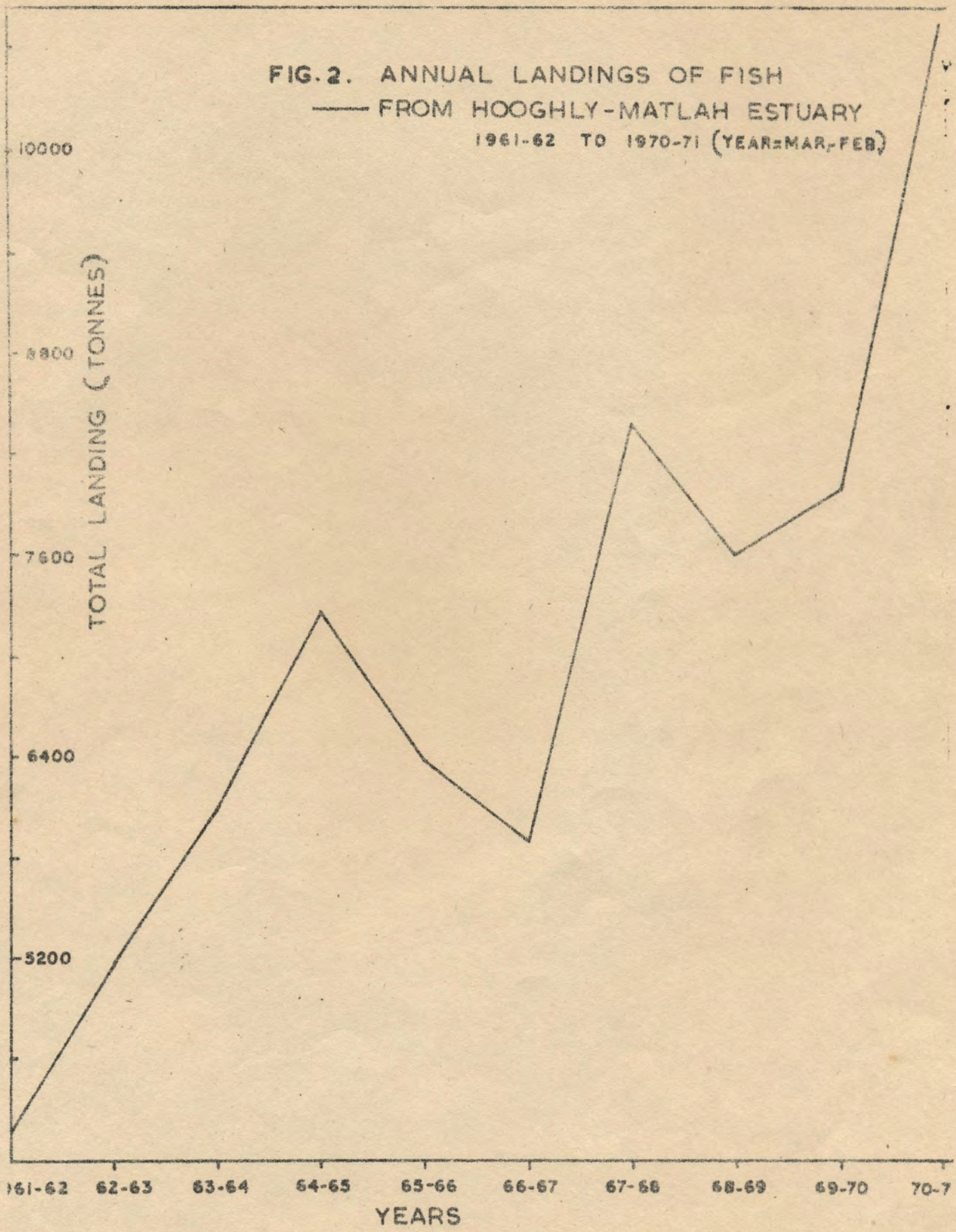
FIG. 2. ANNUAL LANDINGS OF FISH
—— FROM HOOGHLY-MATLAH ESTUARY
1961-62 TO 1970-71 (YEAR=MAR.-FEB.)
TOTAL LANDING (TONNES)
10000
8800
7600
6400
5200
61-62
62-63
63-64
64-65
65-66
66-67
67-68
68-69
69-70
70-7
YEARS

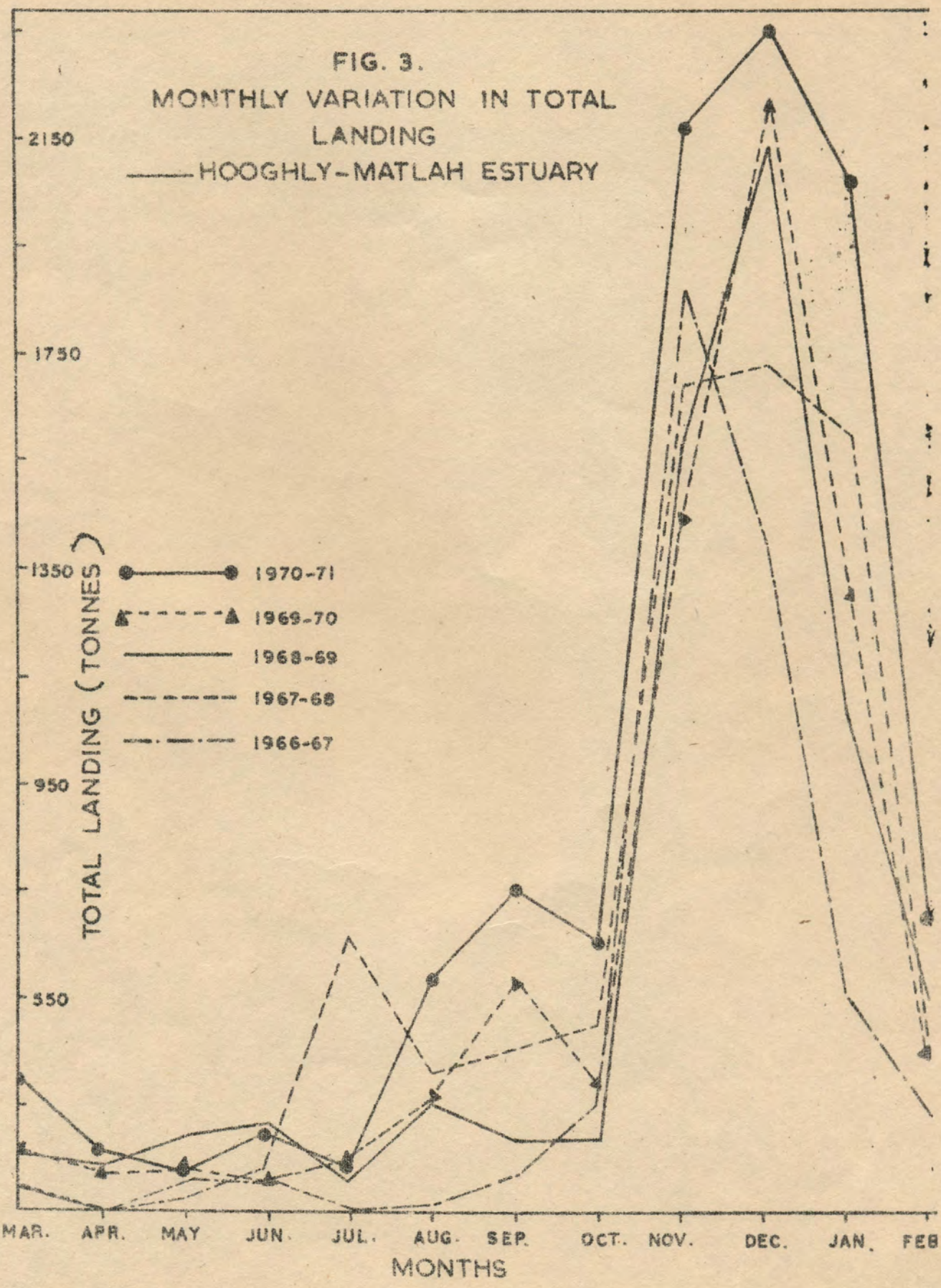
FIG. 3.
MONTHLY VARIATION IN TOTAL LANDING
——HOOGHLY-MATLAH ESTUARY
2150
1750
1350
950
550
TOTAL LANDING (TONNES)
1970-71
1969-70
1968-69
1967-68
1966-67
MAR.
APR.
MAY
JUN.
JUL.
AUG.
SEP.
OCT.
NOV.
DEC.
JAN.
FEB
MONTHS

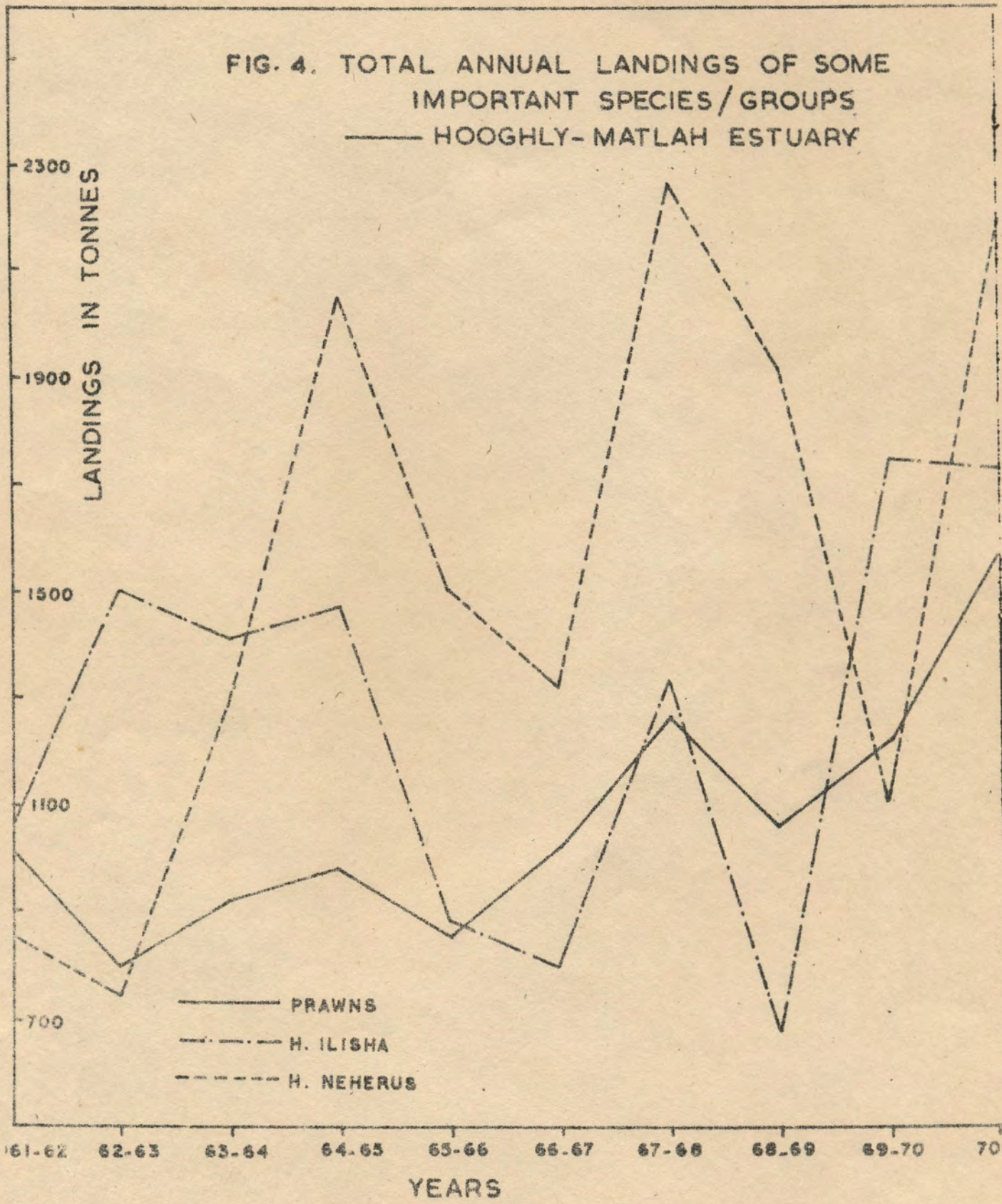
FIG. 4. TOTAL ANNUAL LANDINGS OF SOME IMPORTANT SPECIES / GROUPS
—— HOOGHLY-MATLAH ESTUARY
LANDINGS IN TONNES
2300
1900
1500
1100
700
PRAWNS
H. ILISHA
H. NEHERUS
61-62
62-63
63-64
64-65
65-66
66-67
67-68
68-69
69-70
70-
YEARS

Table 1. Principal gears operated

Type of gear	Local names	Main seasons of operation
Trawl nets	Moi, Kelta, Buro, Katni and Kachhi	November to June
Seine nets		
(a) Large	Jungla, Kachal and Jagatber	(a) November to February (Occasionally in monsoon)
(b) Medium & small	(1) Ber, (2) Charghers, (3) Kachal and (4) Chatber	(1) All seasons (2) All seasons (3) March to July (4) November to August
Purse nets	Sanglo, Dar and Khorke	July to October and January to March
Drift nets*	(1) Chhandi, (2) Dholi, (3) Kona (Bhasa-Kona, Ghai-kona, Ghalo-kona) (4) Shele and Bhasa-barang	(1) Monsoon and Winter - June to February (intensity greater in monsoon) (2) November to May (3) February to September (4) November to May
Lift nets	Bhesal, Gara-bhesal, Nauka-bhesal, Pata, Thela, Seitki, Thapa, Dhain, Tana, Char and Koli	All seasons
Cast nets	Bachari and Kepla	All seasons
Bag nets (Stationary)	(1) Been, (2) Behundi, (3) Thor (4) Atone and (5) Gopa	All seasons
Set gill nets	(1) Barang/Med-barang, Bhetki-barang, (2) Nangar (3) Khota, (4) Khuti, (5) Patang & (6) Geba-chandi	(1) Nearly all seasons (2) to (6) Monsoon & winter
Set-berrier nets	(1) Pata, (2) Char-para, (3) Khal-pata, (4) Khal-ghera and (5) Kumor	All seasons
Traps	Bitti, Dwar-bitti, Chaibitti and Bhasa-pata	Monsoon, May to October
Hooks and lines	Barsi	All seasons

* except (3) all are gill nets. (3) is a

in the Hooghly estuary

Area where usually operated	Main species caught
Upper and middle areas of Zone I	Prawns (also miscellaneous fishes)
Coastal region (close to confluence) of Zone III	H. ilisha, T. jella, P. pama, Setipinna spp. & S. biauritus
(1) Zone III(also IV) (2) Zone III(also upper areas of Zone I) (3) Upper areas of Zone I (4) Upper areas of Zone I	(1) Mullets, perches, polynemids and sciaenids (P. pama) (2) Mullets, perches (S. panijus), polynemids and sciaenids (P. pama), (3) H. ilisha (young) and miscellaneous fishes (4) H. ilisha (young), S. phasa, prawns and miscellaneous fishes.
Zone I (also Zone IV)	H. ilisha only
(1) Zone III, I, II & VI (2) Zone I (3) Zone I (4) Zone III	(1) H. ilisha, other clupeids (I. elongata, H. toli, Setipinna spp. etc.) and S. cinereus (2) H. ilisha & S. phasa (3) H. ilisha (4) P. indicus and S. biauritus
Zone I & V (also Zone III)	Mullets, I. elongata, Setipinna spp. and prawns
Zone I and III (areas supplying Hasanabad and Kalinagore)	P. paradiseus, P. pama, P.pangasius and prawns
(1) & (2) All zones (except upper end of Zone I) (3) Zone II (also main channel of Zone III and Zone V) (4) & (5) Zone III	(1),(2) & (3) Almost all species specially H. nehereus, prawns,P. pama, Trichiurus spp. Setipinna spp. I. elongata, mullets & S. panijus (4)&(5) L.calcarifer and S. biauritus.
(1) Zone III (2),(3) & (4) Zone III (4)&(5) Zone I, (6) Zone IV	(1) L. calcarifer and S. biauritus (2) to (6) H. ilisha and other clupeids
Zone III	All species, particularly prawns, M. parsia, Setipinna spp., P. pama, E. tetradactylum, L.calcarifer and I. elongata
Zone I	Prawns
Zones I, III & II	Catfishes, perches, polynemids, scianids and Setipinna spp.

labyrinth form of net which drifts.

Table 2. Monthly total landings during 1966-67 to 1970-71 from the Hooghly-Matlah estuary

(in kg.)

Year	March	April	May	June	July	August
1970-71	399691	263215	224824	298634	233539	589383
1969-70	260671	222230	226370	216023	252321	371914
1968-69	257910	230089	289344	314312	208318	354618
1967-68	194976	156057	180603	240355	659356	411864
1966-67	192556	154055	209895	219592	158806	164650
Average	261161	205129	226207	257783	302468	378486

	September	October	November	December	January	February
1970-71	755510	658105	2184133	2353783	2083645	706209
1969-70	587805	399185	1445366	2227757	1312390	453126
1968-69	281279	288172	1584772	2148733	1089550	559992
1967-68	456194	500555	1694001	1742544	1612674	508204
1966-67	220936	356266	1876946	1416866	567230	350650
Average	460345	440457	1757044	1977937	1333098	515636

The monthly break-up shown in table 2, 7 (iii) and 9 does not include Digha catches except February 1968-69 and October 1966-67. However, figures for entire Hooghly-Matlah estuary or its Zone III given elsewhere in this report include hilsa catches at Digha but are exclusive of other Digha catches.

Table 3. Specieswise composition of

Species	Local name	1961-62	1962-63
Mugil tade	Bhangone	4451	8194
Mugil parsia	Parse	22765	54491
Lates calcarifer	Bhetki	55492	45396
Sillago panijus	Tuladandi, Tulbele	29757	51005
Polynemus paradiseus	Topse	28632	28731
Polynemus indicus	Sele	62953	67469
Eleutheronema tetradactylum	Gurjaoli	11356	23027
Sciaena biauritus	Norebhola	28818	69455
Sciaena miles	Bhola	-	9243
Pama pama	Bhola	121286	170918
Hilsa ilisha	Ilish	1058356	1504260
Hilsa toli	Chandana ilish	26223	33426
Ilisha elongata	Dhala	3766	43622
Coilia ramcarati	Telchite, Amadi	33558	18266
Coilia borneensis	Telchite, Amadi	-	1335
Setipinna phasa	Phasa	79704	127864
Setipinna taty	Phasa	51635	126244
Pangasius pangasius	Pangas	55147	46125
Tachysurus jella	Medkanta	121200	234722
Osteogeniosus militaris	Aar-tangra	10540	16328
Plotosus canius	Kan-magur	7845	11993
Trichiurus savala	Rupavati	73648	41533
Trichiurus pantilui	Rupavati		81304
Harpodon nehereus	Nehere, Bomla, Lutea	851719	741969
Stromateus cinereus	Complet, Pomfret	-	-
Prawns	Chingri	1012592	797577
Miscellaneous		411003	8063?4
TOTAL		4162446	5160871

Table 5. zonewise annual landings (in kg) of fish during 1966-67 to 1970-71 at the Hooghly-Matlah estuary.

Years	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
1966-67	777250 (13.17)	136089 (2.31)	4442530 (75.29)	382996 (6.49)	161972 (2.74)	5900837 (100.00)
1967-68	831036 (9.92)	415101 (4.95)	5984215 (71.44)	1007486 (12.03)	138942 (1.66)	8376780 (100.00)
1968-69	823556 (10.85)	286938 (3.78)	5585694 (73.57)	779262 (10.26)	116808 (1.54)	7592258 (100.00)
1969-70	1015576 (12.73)	289242 (3.63)	5751612 (72.09)	801679 (10.05)	120008 (1.50)	7978117 (100.00)
1970-71	1033508 (9.61)	383068 (3.56)	8526676 (79.28)	692768 (6.44)	118917 (1.11)	10754937 (100.00)
Total						
Average (year)	896185 (11.04)	302088 (3.72)	6058145 (74.60)	732838 (9.02)	131329 (1.62)	8120586 (100.00)

Figures within brackets relate to %

Table 6(i). Specieswise composition of catches (in Kg) in various zones of the Hooghly-Matlah estuary

March, 1966 to February, 1967

Species	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
M. tade	-	-	6285	-	431	6716
M. parsia	-	70	44511	62	2979	47622
L. calcarifer	-	-	20364	33	154	20551
S. panijus	10714	327	8248	2432	482	22203
P. paradiseus	8310	755	14926	15788	328	40107
P. indicus	-	-	84617	-	174	84791
E. tetradactylum	27	174	15120	-	94	15415
S. biauritus	-	-	147461	-	938	148399
S. miles	-	38	5554	-	2306	7898
P. pama	11300	2118	90291	10589	1677	115975
H. ilisha	133170	27491	591871	46605	52	799189
H. toli	7	-	8410	229	17	8663
I. elongata	40	1204	59272	548	202	61266
C. ramcarati	3900	1288	75092	2315	3410	86005
C. borneensis	18	23	434	31070	361	31906
Setipinna			249214			287576
1. phasa	22616	1556		6873	6243	
2. taty	-	896		178		
P. pangasius	17009	12214	16028	9299	3749	58299
T. jella	-	-	147330	5	-	147335
O. militaris	-	385	11240	307	16	11948
P. canius	-	-	10108	121	23	10252
Trichiurus	-	600+171	145849		3281	149923
1. savala				22		
2. pantului				-		
H. nahareus	159	30882	1191549	26173	78119	1326882
S. cinereus	-	-	9187	-	471	9658
Prawns	301053	27451	553510	104431	36399	1022844
Miscellaneous	268927	28446	936059	125916	20066	1379414
TOTAL	777250	136089	4442530	382996	161972	5900837

Table 6(ii). Specieswise composition of catches (in Kg) in various zones of the Hooghly-Matlah estuary

March,1967 to February,1968

Species	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
M. tade	-	-	8207	-	490	8697
M. parsia	-	2346	42758	1978	4290	51372
L. calcarifer	-	8	18836	2099	320	21263
S. panijus	998	1544	12007	9069	426	24044
P. paradiseus	10253	834	9348	13262	291	33988
P. indicus	-	-	221376	-	259	221635
E. tetradactylum	35	228	19903	317	139	20622
S. biauritus	-	6779	98831	-	1861	107471
S. miles	-	322	5285	-	2045	7652
P. pama	8474	1450	79566	43749	1876	135115
H. ilisha	135561	187842	752174	261907	33	1337517
H. toli	-	-	26177	91	784	27052
I. elongata	-	112	62721	-	122	62955
C. ramcarati	2018	693	55032	24907	2786	85436
C. borneensis	235	-	501	1398	454	2588
Setipinna 1. phasa 2. taty	34353	3114	353754	11270	4602	407093
P. pangasius	7123	4070	42566	38692	2283	94734
T. jella	-	-	116363	-	-	116363
O. militaris	9	7	5781	86	19	5902
P. canius	-	59	6371	-	30	6460
Trichiurus 1. savala 2. pantului	-	669	345750	821	1016	348256
H. nehereus	4188	70992	2007606	115553	69978	2268317
S. cinereus	-	589	56774	35591	-	92954
Prawns	297521	72704	681590	188214	23753	1263782
Miscellaneous	330268	60739	954938	258482	21085	1625512
TOTAL	831036	415101	5984215	1007486	138942	8376780

Table 6(iii). Specieswise composition of catches (in Kg) in various zones of the Hooghly-Matlah estuary March 1968 to February, 1969

Species	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
M. tade	-	-	8906	-	595	9501
M. parsia	-	2471	39155	2563	5442	49631
L. calcarifer	-	167	19179	-	348	19694
S. panijus	1225	1378	21195	13683	246	37727
P. paradiseus	8982	4459	12865	15768	471	42545
P. indicus	-	47	224612	120	45	224824
E. tetradactylum	-	277	16859	1430	69	18635
S. biauritus	-	71	190962	905	709	192647
S. miles	-	11	11285	-	220	11516
P. pama	9824	3493	132649	36184	919	183069
H. ilisha	118576	148544	305367	105551	-	678038
H. toli	150	21	15142	422	184	15919
I. elongata	15	833	101708	664	156	103376
C. ramcarati	850	613	36951	22724	916	62054
C. borneensis	-	-	239	4175	101	4515
Setipinna 1. phasa 2. taty	41991	7839	576227	18249	4344	648650
P. pangasius	9166	3393	51813	28041	2092	94505
T. jella	-	-	197038	-	-	197038
O. militaris	-	-	17043	1576	-	18619
P. canius	-	-	5359	1298	89	6746
Trichiurus 1. savala 2. pantului	-	1073	386030	1537	2922	391562
H. nehereus	6943	34721	1617535	203732	61319	1924250
S. cinereus	-	6042	75266	4	-	81312
Prawns	332060	34089	476046	192679	25400	1060274
Miscellaneous	293774	37396	1046263	127957	10221	1515611
TOTAL	823556	286938	5585694	779262	116808	7592258

Table 6(iv). Specieswise composition of catches (in Kg) in various zones of the Hooghly-Matlah estuary

March, 1969 to February, 1970

Species	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
M. tade	-	-	13835	-	500	14335
M. parsia	-	1371	50466	3015	2341	57193
L. calcarifer	-	65	27936	-	334	28335
S. panijus	1598	806	18474	10304	303	31485
P. paradiseus	8760	1074	16729	38896	378	65837
P. indicus	-	18	246711	359	53	247141
E. tetradactylum	-	270	24367	2257	293	27187
S. biauritus	628	331	189892	546	921	192318
S. miles	-	-	8793	189	3219	12201
P. pama	12049	2231	89492	45320	742	149834
H. ilisha	155157	178210	1158404	261050	180	1753001
H. toli	120	-	15510	192	522	16344
I. elongata	277	133	121151	974	418	122953
C. ramcarati	3879	591	48905	35284	1918	90577
C. borneensis	-	51	267	8017	-	8335
Setipinna 1. phasa 2. taty	52296	3646	399621	24801	4194	484558
P. pangasius	7201	3542	78997	34037	2400	126177
T. jella	-	-	260381	-	-	260381
O. militaris	28	-	30023	1161	-	31212
P. canius	-	10	21043	6	147	21206
Trichiurus 1. savala 2. pantului	-	851	250969	753	3676	256249
H. Nehereus	585	33585	951758	58211	59054	1103193
S. cinereus	-	2519	36288	-	-	38807
Prawns	433947	31241	584876	145507	25319	1220890
Miscellaneous	339051	28697	1106724	130800	13096	1618368
TOTAL	1015576	289242	5751612	801679	120008	7978117

Table 6(v). Specieswise composition of catches (in Kg) in various zones of the Hooghly-Matlah estuary

March,1970 to February,1971

Species	Zone I	Zone II	Zone III	Zone IV	Zone V	Total
M. tade	-	-	23647	-	248	23895
M. parsia	-	5215	58184	3051	3355	69805
L. calcarifer	-	-	35069	-	328	35397
S. panijus	976	10259	30264	14365	564	56428
P. paradiseus	2486	3355	27315	47569	575	81300
P. indicus	-	-	183561	471	275	184307
E. tetradactylum	-	33	42600	857	257	43747
S. biauritus	-	32	303390	586	185	304193
S. miles	-	-	9197	1314	881	11392
P. pama	3692	24148	122377	46561	969	197747
H. ilisha	185907	204685	1263678	76828	41	1731139
H. toli	21	-	20572	234	98	20925
I. elongata	541	776	210767	4170	119	216373
C. ramcarati	827	1303	93650	33670	2099	131549
C. borneensis	-	50	53	7744	24	7871
Setipinna 1. phasa 2. taty	22345	1089	762816	15322	2474	804055
P. pangasius	6618	10093	121884	30014	2393	171002
T. jella	-	-	145598	-	-	145598
O. militaris	18	-	20227	1164	-	21409
P. canius	-	-	37106	4	140	37250
Trichiurus 1. savala 2. pantului	-	375	459692	1300	3534	464901
H. nehereus	2045	32356	1993436	113819	67260	2208916
S. cinereus	242	-	79393	3	55	79693
Prawns	364915	45436	979686	162907	22139	1575083
Miscellaneous	442866	43863	1502514	130815	10904	2130962
TOTAL	1033508	383068	8526676	692768	118917	10754937

Table 7(i). Monthly total landings at zone I of the Hooghly-Matlah estuary for the period March, 1966 to February, 1971 (in kg.)

Months	1970-71	1969-70	1968-69	1967-68	1966-67
March	145038	77179	69166	66516	72476
April	84136	77582	73507	55471	51840
May	80198	83237	77517	57917	62046
June	90227	61989	76546	52253	66109
July	51352	58055	37561	38736	37339
August	38551	47657	52843	38727	28406
September	62667	59932	30494	74275	40603
October	76110	60461	44112	56190	58009
November	80793	138323	84860	99436	129161
December	127617	138247	93819	120263	114134
January	106836	124008	110423	99299	65625
February	89983	88906	72708	71953	51502
TOTAL	1033508	1015576	823556	831036	777250

Table 7(ii). Monthly total landings at zone II of the Hooghly-Matlah estuary for the period March, 1966 to February, 1971 (in kg.)

Months	1970-71	1969-70	1968-69	1967-68	1966-67
March	10103	11935	12546	23454	9691
April	15233	11407	10749	17347	13071
May	11833	21369	21842	20342	9870
June	19954	15498	17593	21751	10077
July	45251	45341	48147	29226	11390
August	54664	39229	61183	43211	8747
September	90064	83210	30925	106256	8887
October	29014	17159	9636	45736	13494
November	21404	14565	8133	11687	14065
December	18156	12089	28789	33003	14208
January	29820	6495	22225	47905	11788
February	37572	10945	15170	15183	10801
TOTAL	383068	289242	286938	415101	136089

Table 7(iii). Monthly total landings at zone III of the Hooghly-Matlah estuary for the period March, 1966 to February, 1971 (in Kg.)

Months	1970-71	1969-70	1968-69	1967-68	1966-67
March	104927	101214	110051	60031	68776
April	103723	81342	55837	43018	52815
May	85575	46871	38995	39501	64637
June	123567	66470	61748	48015	95903
July	111144	94459	98551	494515	84867
August	478971	237594	208522	262590	105908
September	588837	347852	161170	169985	142960
October	533357	252188	198912	241174	241270
November	1993922	1121368	1423133	1521415	1650932
December	2126988	2008385	1938061	1526299	1217900
January	1820534	1126495	893342	1279010	448283
February	450856	264415	412204	279265	255890
TOTAL	8522410	5748653	5600526	5964818	4430141

Table 7(iv). Monthly total landings at zone IV of the Hooghly-Matlah estuary for the period March, 1966 to February, 1971 (in kg.)

Months	1970-71	1969-70	1968-69	1967-68	1966-67
March	125278	61764	55050	29881	30859
April	55631	43140	80230	29949	24596
May	37858	65138	142168	52366	57742
June	55471	61946	148313	106437	35980
July	15844	44848	15473	85857	9963
August	6868	36683	22393	55114	5827
September	4602	87983	50269	93326	15015
October	8528	57841	25373	144864	27766
November	78603	160457	58994	50487	69061
December	69678	58725	77484	49848	58392
January	115957	44225	51630	175404	29390
February	118450	78929	51885	133953	18405
TOTAL	692768	801679	779262	1007486	382996

Table 7(v). Monthly total landings at zone V of the Hooghly-Matlah estuary for the period March, 1966 to February, 1971 (in kg.)

Months	1970-71	1969-70	1968-69	1967-68	1966-67
March	9215	8579	11097	15094	10754
April	9622	8759	9766	10272	11733
May	9360	9755	8822	10477	15600
June	9406	10120	10112	11899	11523
July	9948	9618	8586	11022	15247
August	10329	10751	9677	12222	15762
September	9340	8828	8421	12352	13471
October	11096	11536	10139	12591	15727
November	9411	10653	9653	10976	13727
December	11344	10311	10580	13131	12232
January	10498	11167	11930	11056	12144
February	9348	9931	8025	7850	14052
TOTAL	118917	120008	116808	138942	161972

Table 8. Raising factors used for different gears and sampled villages in the upper stretch of the estuary

Gears	Raising factors for		
	Zone I	Zone II	Zone IV
Trawl	9.61	-	-
Small Seine	13.71	97.04	2.35
Purse	5.45	20.56	-
Drift	9.21	3.98	3.06
Lift	11.65	4.25	-
Cast	8.46	1.40	100.67
Bag	4.64	2.66	4.97
Set-gill	9.86	7.26	39.60
Traps	12.57	-	-
Hooks & lines	3.58	16.71	1.08

Sampled Villages :

Zone I : Nebutala, Ghoralia, Goberchor, Medgachi, Uchitpur, Khusigoli, Monirampore, Konnagar, Baranagar, Shyamgunj.

Zone II : Godakhali, Rajibpur, Nurpur, Kotalghat, Baikuntapur, Fuleswar.

Zone IV : Kolaghat, Sahapur, Denan, Birampur, Gobindapur, Anantapur, Jhumjhumi, Benia, Saibenia.

Table 9. Average monthly landings of different species

Species/Months	March	April	May	June
M. tade	971	855	852	809
M. parsia	3180	2746	3253	3398
L. calcarifer	2093	2318	1917	1851
S. panijus	2052	2201	2646	3152
P. paradiseus	758	902	3905	9861
P. indicus	5012	1266	1259	1232
E. tetradactylum	1537	1532	1321	1654
S. biauritus	7848	9077	1596	1457
S. miles	324	131	337	110
P. pama	9191	7032	7258	6865
H. ilisha	11749	6379	7173	26911
H. toli	592	160	3	106
I. elongata	3156	4369	3931	5077
C. ramcarati	4734	2474	2363	3581
C. borneensis	447	116	188	175
S. phasa / S. taty	21850	11515	11848	10551
P. pangasius	8914	6722	6792	9554
T. jella	1437	270	76	186
O. militaris	689	211	130	850
P. canius	1102	1213	1065	1123
T. savala / T. pantului	1986	1014	941	1124
H. nehereus	35799	28850	42168	41997
S. cinereus	3757	4694	1597	4413
Prawns	70933	54217	66088	61992
Miscellaneous	61054	54865	57499	59755
TOTAL	261161	205129	226207	257783

at the Hooghly-Matlah estuary during 1966-67 to 1970-71

(in Kg)

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
641	858	797	1930	1613	994	835	1549
3431	6701	5166	5404	7655	4141	5129	4968
1395	1736	2095	3942	2961	1582	1416	1741
879	1100	747	2983	5620	3985	6766	2591
2471	917	608	3452	14388	8831	4397	2265
977	1326	1345	1374	12780	65300	57044	43643
1160	1341	1462	1858	2991	4044	3508	2799
1001	972	682	1947	49559	63228	36523	15127
112	236	217	265	1695	3209	2960	537
4914	7766	8626	14760	20276	34311	21545	14369
160977	164447	236358	94098	133176	296605	69997	43285
1435	1137	1191	938	3523	4253	3215	1267
3922	4338	4870	6494	18907	27720	20072	10529
1730	4737	5319	13462	14833	14412	12748	10746
265	13	37	98	3637	3741	1801	507
9665	13507	17403	21612	123315	146327	104241	34590
4556	7381	9750	13539	11764	10259	11633	8080
1537	11153	30769	24202	28909	27470	37407	9996
70	96	130	94	3060	4086	4972	3456
1183	1303	1602	1759	1639	1272	1568	1552
1413	6537	7794	6494	86236	101390	94281	13166
20978	43249	31047	81038	600979	483403	297019	59814
3033	949	55	221	10630	12429	6181	13042
41423	53116	50440	61985	271169	238982	177324	80995
33299	43568	41832	76494	325749	415962	350515	135103
302468	378486	460345	440457	1757044	1977937	1333098	515636

Table 10. Number of migrant fishermen, khunties (fishing camp) and centre-wise concentration of bag-nets around Fresergang in winter during 1966-1967 to 1970-1971

	1966-67	1967-68	1968-69	1969-70	1970-71
Fishermen	955	1100	1354	1047	1029
Khunties	68	68	73	55	58
Bag-net	272	273	334	271	288
Bakkhali	73	83	104	44	39
Kalisthan	27	8	7	-	-
Freserganj	68	59	33	48	62
Jamboodwip	104	123	190	179	187

Table 11. Specieswise composition of catches from the Hooghly-Matlah estuary by migratory bagnet fishery in winter

Species	1970-71		1969-70		1968-69		1967-68		1966-67	
	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
M.parsia	634	0.02	239	0.01	56	*	-	-	2	*
S.panijus	364	0.01	706	0.04	216	0.01	1352	0.04	2136	0.12
P.paradiseus	7108	0.24	3247	0.18	4140	0.15	3194	0.10	4765	0.27
P.indicus	95	*	222	0.01	521	0.02	113	*	410	0.02
E.tetradactylum	105	*	-	-	-	-	-	-	245	0.01
S.biauritus	219685	7.37	76900	4.34	92531	3.24	55397	1.78	131391	7.41
S.miles	8566	0.29	8305	0.47	10703	0.37	4886	0.16	4942	0.28
P.pama	-	-	8076	0.46	10104	0.35	5976	0.19	2019	0.11
H.ilisha	21	*	613	0.03	2	*	39	*	60	*
H.toli	3268	0.11	1275	0.07	755	0.03	353	0.01	355	0.02
I.elongata	41030	1.38	20502	1.16	33417	1.17	16316	0.52	18793	1.06
C.ramcarati	1743	0.06	3215	0.18	575	0.02	1837	0.06	1703	0.10
C.borneensis	42	*	-	-	-	-	-	-	193	0.01
S.phasa & S.taty	420113	14.09	248722	14.05	457183	16.02	23086	7.43	117951	6.65
P.pangasius	325	0.01	175	0.01	1260	0.04	5350	0.17	252	0.01
T.jella	21477	0.72	3947	0.22	4908	0.17	3140	0.10	-	-
O.militaris	9651	0.32	7579	0.43	5907	0.21	-	-	9110	0.51
T.savala & T.pantului	331002	11.10	217429	12.28	353843	12.40	312554	10.05	84959	4.79
H.nehereus	1251728	41.97	660413	37.30	1263390	44.26	1725563	55.51	844164	47.61
S.cinereus	3600	0.12	-	-	173	0.01	1953	0.06	152	8.01
Prawns	173120	5.81	126979	7.17	112324	3.93	317068	10.20	142064	0.01
Miscellaneous	488530	16.38	382015	21.58	502481	17.60	422736	13.60	407419	22.98
TOTAL	2982207	100.00	1770559	99.99	2854485	100.00	3108690	99.98	1773085	99.98

M. tade, L. calcarifer and P. canius were absent in the bagnet catches from the Hooghly-Matlah estuary.

* less than 0.005%

Table 12. Monthly total landings and landings of major species by migratory bagnet fishery of winter during 1966-67 to 1970-71 (in Kg)

Months	H. nehereus	T. pantului & T. savala	S. phasa & S. taty	Prawns	Total catch	% Contribution to the total of zone III
1970-71						
November	506055	75183	174729	102382	1170505	39.25
December	283075	66077	106857	38910	723949	24.28
January	462598	189742	138527	31828	1087753	36.47
February	-	-	-	-	-	-
NOVEMBER-FEBRUARY					2982207	⁂ 34.98 (27.73)
1969-70						
November	258201	48285	43100	64889	531689	30.03
December	296793	114901	134217	35042	844010	47.67
January	105419	54243	71405	27048	394860	22.30
February	-	-	-	-	-	-
NOVEMBER-FEBRUARY					1770559	⁂ 30.78 (22.19)
1968-69						
November	478468	135611	122936	68779	1011517	35.44
December	561040	137410	223444	24681	1241497	43.49
January	185905	68832	80370	15135	485871	17.02
February	37977	11990	30433	3729	115600	4.05
NOVEMBER-FEBRUARY					2854485	⁂ 51.10 (37.60)
1967-68						
November	639779	68311	57724	173625	1079784	34.73
December	617516	118636	58703	91193	1069573	34.41
January	461779	112538	90746	49039	892051	28.79
February	6489	13069	23690	3211	67282	2.16
NOVEMBER-FEBRUARY					3108690	⁂ 51.95 (37.11)
1966-67						
November	582291	33303	52979	80047	1081365	60.99
December	191577	26002	28990	49198	480215	27.08
January	51707	23211	31369	10576	173610	9.79
February	18589	2443	4613	2243	37895	2.14
NOVEMBER-FEBRUARY					1773085	⁂ 39.91 (30.05)

The percentages within brackets are percentage contributions to thetotal landings of the whole estuary.

⁂ The percentage relates to the total of Zone III

Table 13. Volume of landings (in Kg) at assembly centres on the Hooghly-Matlah estuary

Centres	1970-71	1969-70	1968-69	1967-68	1966-67
Diamond Harbour	1396354	1403807	577653	579148	375636
Namkhana	2270030	962757	760801	895707	909067
Kakdwip	736993	841155	791511	785515	773031
Raidighi	148876	133079	58017	96624	44356
Canning	123777	72086	77534	73273	76733
Hasnabad	49796	70905	59807	63966	79139
Kalinagore	35201	94397	47895	55176	59877
Total for the above centres	4761027	3578186	2373218	2549409	2317839
Total for zone III	8526676	5751612	5585694	5984215	4442530

Table 14. Monthly landings (in Kg)

Centres	March	April	May	June	July	August
Canning						
1970-71	3437	2834	2576	2270	3071	2775
1969-70	2573	1247	1554	2002	1849	3658
1968-69	4419	2853	2540	2380	1520	3015
1967-68	6096	5297	4912	4284	3153	11002
1966-67	7762	5391	4746	4255	4544	3775
Diamond Harbour						
1970-71	13737	2725	2133	13574	18237	97987
1969-70	19965	31670	3012	9490	32069	84889
1968-69	3580	7163	1849	3980	34426	98661
1967-68	331	1085	1626	1744	193081	97105
1966-67	1262	2144	2113	25737	3865	4297
Hasnabad						
1970-71	1792	1104	660	862	1502	1419
1969-70	819	583	1278	1135	750	3421
1968-69	3859	1834	1521	883	553	1291
1967-68	1712	453	772	289	153	1613
1966-67	5178	4622	3445	3402	5425	5088
Kalinagar						
1970-71	15848	6451	4962	878	694	224
1969-70	4031	4089	4382	6553	9021	7179
1968-69	1560	5973	3268	3835	5299	6351
1967-68	5613	3354	3724	3710	4187	3992
1966-67	4278	4959	4096	5896	3510	3616
Kakdwip						
1970-71	6456	78	-	-	6482	39917
1969-70	7789	-	-	-	485	15186
1968-69	26781	-	-	-	956	15664
1967-68	8377	3089	-	-	80441	81737
1966-67	2775	2775	1911	1163	4340	32582
Namkhana						
1970-71	30868	25980	22667	54585	34625	278959
1969-70	40357	15630	19707	30765	36469	91753
1968-69	51008	25130	15130	23087	37255	59310
1967-68	26357	16322	13674	20041	173954	44963
1966-67	25946	15201	35761	43140	51113	46644
Raidighi						
1970-71	9009	15380	12600	14217	12059	17388
1969-70	6316	9162	4381	4944	2173	8011
1968-69	5150	3099	2532	5849	5589	7908
1967-68	2908	5468	6348	9699	31209	4846
1966-67	1807	1683	610	569	580	614

at assembling centres

September	October	November	December	January	February	TOTAL
3559	3796	3538	11151	82001	2769	123777
3980	4980	6775	28881	9891	4696	72086
4040	3456	5881	18054	18554	10822	77534
5671	3717	6297	10170	6640	6034	73273
7443	6477	6769	5470	12139	7962	76733
242216	110775	239706	458318	165836	31110	1396354
163471	17598	235506	524767	225738	55632	1403807
26859	6786	62393	142607	127365	61984	577653
49208	17562	29879	101449	69947	16131	579148
4430	1838	808	280655	25576	22911	375636
2105	1149	869	8924	25497	3913	49796
3099	3564	5813	19497	24749	6197	70905
3779	3083	6329	15851	15462	5362	59807
4111	3594	3898	16356	20379	10636	63966
2720	1736	9457	6911	12702	18453	79139
264	324	1470	2180	1714	192	35201
5353	4738	7344	17429	14283	9995	94397
4267	2263	5206	3703	2760	3410	47895
4438	2786	3372	5829	7507	6664	55176
5073	3336	1728	4454	15430	3501	59877
56230	37709	108743	288134	155162	38082	736993
46672	57686	140147	290213	237349	45628	841155
30140	54989	171016	320591	104560	66814	791511
39914	60775	129039	169129	138006	75008	785515
64595	70607	146183	263407	107417	75276	773031
236408	341509	366459	422668	201946	253356	2270030
78321	90910	127522	184027	148064	99232	962757
67192	102626	123006	76633	80739	99685	760801
46557	127235	181535	85342	85399	74328	895707
47119	128229	332425	59745	57316	66428	909067
13515	7771	8442	9459	16544	12492	148876
10525	23359	22252	25282	8248	8426	133079
6783	7545	3604	5115	2410	2433	58017
3816	7670	6020	7490	6784	4366	96624
3403	4381	9318	9726	7609	4056	44356

Table 15 (i) Annual specieswise landings at Canning assembling centre

Species	Kilogrammes				
	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	147	54	100	358	366
M. parsia	1241	1895	2656	2690	2885
L. calcarifer	4810	3750	2399	4099	2251
S. panijus	7	5	-	13	53
P. paradiseus	32	38	186	54	80
P. indicus	1276	788	926	1109	1403
E. tetradactylum	896	632	923	1670	2160
S. biauritus	946	783	766	1996	1174
S. miles	-	-	-	-	-
P. pama	753	1038	1090	1596	1874
H. ilisha	38	261	101	8047	191
H. toli	-	-	-	-	-
I. elongata	-	-	-	-	-
C. ramcarati	87	87	223	527	527
C. borneensis	-	-	-	-	-
S. phasa, S. taty	2414	1625	4050	4307	3136
P. pangasius	376	774	1115	656	974
T. jella	4069	1390	2535	651	1173
O. militaris	-	-	-	-	-
P. canius	1138	1804	1244	1656	1928
T. savala, T. pantului	769	548	735	944	40
H. nehereus	583	563	842	327	97
S. cinereus	-	-	-	-	-
Prawns	90186	37808	42386	20246	19708
Miscellaneous	14009	18243	15257	22327	36713
TOTAL	123777	72086	77534	73273	76733

Table 15 (ii) Annual specieswise landings at Diamond Harbour assembling centre

Species	Kilogrammes				
	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	629	2192	1023	417	121
M. parsia	389	154	131	303	83
L. calcarifer	172	166	670	711	149
S. panijus	3055	2305	3198	2879	1138
P. paradiseus	1202	3928	1071	532	752
P. indicus	81102	139567	101585	108964	13165
E. tetradactylum	5538	1806	936	3582	359
S. biauritus	8254	47618	9281	215	3095
S. miles	3	-	-	-	-
P. pama	24545	9142	45235	4989	6931
H. ilisha	1040870	991911	255329	363414	335290
H. toli	11244	5149	6640	13716	1708
I. elongata	3697	2500	12416	2120	1443
C. ramcarati	246	-	75	71	310
C. borneensis	-	-	-	-	-
S. phasa, S. taty	1218	1454	5965	3155	313
P. pangasius	5180	2401	1283	1023	15
T. jella	36236	171038	106430	6944	2406
O. militaris	81	3	17	742	-
P. canius	27	4	-	-	-
T. savala, T. pantului	33	-	187	91	7
H. nehereus	59	20	394	895	209
S. cinereus	573	3805	5415	4505	8
Prawns	5089	2806	1228	2720	2362
Miscellaneous	166412	15838	19144	57160	5772
TOTAL	1396354	1403807	577653	579148	375636

Table 15 (iii) Annual specieswise landings at Kakdwip assembling centre

Kilogrammes

Species	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	759	409	359	628	542
M. parsia	552	386	437	602	405
L. calcarifer	1751	808	272	599	487
S. panijus	2067	1333	613	160	794
P. paradiseus	996	948	915	1017	2105
P. indicus	49320	62779	77965	95912	54554
E. tetradactylum	15790	4629	3673	2651	4534
S. biauritus	17143	9951	75836	11225	3126
S. miles		-	-	20	50
P. pama	9873	17626	31771	23089	37846
H. ilisha	91879	40192	10971	134590	65895
H. toli	1310	1741	1201	229	1452
I. elongata	18599	16819	5340	16570	7489
C. ramcarti	5325	6237	2281	12389	13028
C. borneensis	10	246	61	458	118
S. phasa S. taty	31583	18735	20405	27070	13185
P. pangasius	800	959	370	95	1356
I. jella	69971	52922	63306	68061	111743
O. militaris	631	68	2768	3	46
P. canius	-	-	-	-	35
T. savala T. panulului	3765	4904	3351	3740	3090
H. nehereus	57010	93341	122392	74458	98560
S. cinereus	6936	3642	21565	6144	3198
Prawns	91497	147242	100803	102064	81946
Miscellaneous	259426	355238	244883	203741	267447
TOTAL	736993	841155	791511	785515	773031

Table 15 (iv) Annual specieswise landings at Hasnabad assembling centre

Species	Kilogrammes				
	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	81	20	74	120	212
M. parsia	169	450	264	333	369
L. calcarifer	1154	1095	1580	1134	2727
S. panijus	60	163	56	63	77
P. paradiseus	425	667	893	343	642
P. indicus	44	388	404	301	895
E. tetradactylum	110	76	85	115	261
S. biauritus	2577	1421	630	309	202
S. miles		-	-	-	
P. pama	153	2203	2223	1962	1717
H. ilisha	14	1	2	-	2
H. toli		-	-	-	
I. elongata		21	105	95	92
C. ramcarati	948	803	588	350	225
C. borneensis		5	5	14	12
S. phasa / S. taty	987	1738	1664	2819	2987
P. pangasius	4194	5230	3903	2092	2160
I. jella		831	1451	1402	1878
O. militaris	4	-	2	-	26
P. canius	167	63	225	306	758
T. savala / T. pantului	10	-	-	-	119
H. nehereus	180	6783	3455	3107	7679
S. cinereus			3		529
Prawns	31447	38362	31697	42083	41042
Miscellaneous	7072	10585	10498	7028	14518
TOTAL	49796	70905	59807	63966	79139

Table 15 (v) Annual specieswise landing at Kalinagar assembling centre

Species	Kilogrammes 1970-71	1969-70	1968-69	1967-68	1966-67
M.tade	958	2274	2101	1528	815
M.parsia	2328	5438	2447	2516	2968
L.calcarifer	1274	3562	3576	3463	3561
S.panijus	201	589	387	513	235
P.paradiseus	120	446	419	244	282
P.indicus	1419	2643	1559	1797	1527
E.tetradactylum	1412	4273	3563	3193	1405
S.biauritus	500	1299	927	1162	885
S.miles	97	476	334	247	201
P.pama	1213	4757	2715	2332	2780
H.ilisha	2	11929	5		2
H.toli		60	8	21	
I.elongata	1173	2760	1156	1625	1067
C.ramcarati	469	716	300	440	640
C.borneensis	1	16	23	28	2
S.phasa / S.taty	3121	7517	3007	4572	4168
P.pangasius	1059	2280	1248	1371	694
T.jella	670	2406	469	693	215
O.militaris	551	1619	1308	659	553
P.canius	873	2252	2154	2595	2454
T.savala / T.pantului	31	145	102	179	255
H.neherous	142	1040	1065	1214	2376
S.cinereus	3	10		49	
Prawns	6814	10740	6342	10017	23797
Miscellaneous	10764	25150	12680	14718	8495
TOTAL	35201	94397	47895	55176	59877

Table 15 (vi) Annual specieswise landings at Namkhana assembling centre (in kg)

Species	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	12608	1051	1408	569	472
M. parsia	33772	23576	24662	26003	23352
L. calcarifer	7342	3804	4319	2316	3077
S. panijus	16002	1621	1681	1098	1669
P. paradiseus	12489	4398	3251	1724	4027
P. indicus	8914	3689	10147	2000	2780
E. tetradactylum	5760	2365	3015	2804	1090
S. biauritus	32279	43284	10308	27532	3838
S. miles	-	11	242	99	-
P. pama	66165	26450	26986	30076	24526
H. ilisha	9468	56762	3473	158705	8384
H. toli	4738	7283	6206	11578	2296
I. elongata	42689	17699	19452	9824	24814
C. ramcarati	55445	6197	13796	17893	28174
C. borneensis	-	-	120	1	97
S. phasa / S. taty	243313	88352	68982	68812	97943
P. pangasius	38630	17309	6221	2324	2990
T. jella	12658	27825	17939	31542	26830
O. militaris	7856	20754	6729	769	1505
P. canius	588	50	70	68	1081
T. savala / T. pantului	113387	23213	24978	25094	55882
H. nehereus	603515	178461	172408	150020	231042
S. cinereus	36162	16749	24149	34616	3845
Prawns	500436	184125	137118	137096	194667
Miscellaneous	405814	207729	173141	153144	164686
TOTAL	2270030	962757	760801	895707	909067

Table 15 (vii) Annual species-wise landings at Raidighi assembling centre

(in kg.)

Species	1970-71	1969-70	1968-69	1967-68	1966-67
M. tade	2339	3292	1141	1971	2177
M. parsia	5093	6553	2447	3451	3411
L. calcarifer	5070	5220	1746	2887	2495
S. panijus	1261	1714	739	702	626
P. paradiseus	171	892	229	462	402
P. indicus	3100	3795	1345	1992	1811
E. tetradactylum	3438	4041	1376	2197	1585
S. biauritus	4902	3737	101	822	1117
S. miles		1			
P. pama	3890	4902	1794	2563	2135
H. ilisha	2980	9792	1187	37294	3920
H. toli		2		7	4
I. elongata	27600	19345	8067	5066	2393
C. ramcarati	4382	4608	1603	2538	1709
C. borneensis			1		2
S. phasa / S. taty	12586	10222	3359	2867	1839
P. pangasius	17628	13474	9384	8835	2220
I. jella		8			235
O. militaris	4				
P. canius	10467	5975	316	509	185
T. savala / T. pantului	912	1081	316	394	503
H. nehereus	135	52	169	43	16
S. cinereus	7961	3226	5135	3507	860
Prawns	5809	7073	2652	3611	5568
Miscellaneous	29148	24074	14906	14910	9143
TOTAL	148876	133079	58017	96624	44356

Table 16. Specieswise composition of landings (Kg) at Digha during the winters (1963-71)

Species	Nov'63 to Feb'64	Oct'64 to Feb'65	Nov'65 to Mar'66	Oct'66 to Feb'67	Nov'67 to Feb'68	Nov'68 to Feb'69	Nov'69 to Feb'70	Nov'70 to Feb'71
M.tade	-	416	164	868	787	1496	995	353
M.parsia	-	4627	684	1248	6314	2733	2686	5710
L.calcarifer	-	-	12	308	406	576	-	-
S.panijus	-	16389	1227	4053	11933	24033	9208	7590
P.paradiseus	-	-	-	-	-	589	-	-
P.indicus	-	-	-	-	113	164	2022	6078
E.tetradactylum	298	4169	1817	6010	4019	5799	674	11200
S.biauritus	-	7595	2198	8090	3337	743	383	838
S.miles	-	230	544	23009	5168	29325	-	280
P.pama	-	55131	10996	245089	44114	219150	2470	30995
H.ilisha	39	109563	8035	23474	19397	4990	2959	4266
H.toli	534	2690	304	3127	3680	2721	308	448
I.elongata	-	17667	2884	38549	259	-	413	6233
C.ramcarati	-	9338	-	-	-	1009	-	726
C.borneensis	-	5482	22	-	-	878	-	-
S.phasa & S.taty	269	35784	3892	98238	66350	21967	17348	28178
P.pangasius	-	722	-	-	2377	-	-	-
T.jella	1204	337141	45338	166019	40072	170179	120218	8864
O.militaris	-	3309	302	996	1308	1809	1837	4486
P.canius	-	-	-	28	-	-	-	-
T.savala & T.pantului	-	3694	2404	6396	10318	11631	1136	9394
H.nehereus	-	835	70	1052	1301	1789	-	5914
S.cinereus	-	39177	5332	20151	23437	15976	1555	6198
Prawns	6642	18116	991	26651	29421	7020	10081	30151
Miscellaneous	307362	605866	82963	215619	173980	163125	109417	74254
TOTAL	316348	3277941	170179	888975	448091	687702	283710	242156

N.B. Landings of catches from coastal regions further south-west of Digha are often made at Digha. Above figures refer only to catches made at Digha region.

Table 17. Gearwise landings (Kg) at Digha during winters (1963-71)

Gears	Nov.'63 to Feb.'64	Oct.'64 to Feb.'65	Nov.'65 to Mar.'66	Oct.'66 to Feb.'67	Nov.'67 to Feb.'68	Nov.'68 to Feb.'69	Nov.'69 to Feb.'70	Nov.'70 to Feb.'71
Seine	267257	1202739	86452	767674	408310	670245	280331	189110
Drift	-	296	6342	121301	39781	17457	3379	53046
Unknown	49091	2074906	77385	-	-	-	-	-
TOTAL	316348	3277942	170179	888975	448091	687702	283710	242156

N.B. Landings from the coastal regions further south-west of Digha are often brought at Digha. Above figures relate to the catches from Digha region only.

Table 18. Specieswise and gearwise composition of catches (Kg) from the Hooghly-Matlah estuary during March to November, 1971

Species	Catch	%	Gears	Catch	%
M.tade	7354	0.06	Trawl	61138	0.54
M.parsia	28200	0.25			
L.calcarifer	18892	0.17	Large seine	683971	6.00
S.panijus	25164	0.22			
P.paradiseus	27816	0.24	Small seine	272390	2.39
P.indicus	24070	0.21			
E.tetradactylum	19085	0.17	Purse	35225	0.31
S.biauritus	49471	0.43			
S.miles	2209	0.02	Drift	5794526	50.82
P.pama	64336	0.56			
H.ilisha	6371497	55.88	Lift	131434	1.15
H.toli	14993	0.13			
I.elongata	86167	0.76	Cast	26924	0.24
C.ramcarati	64898	0.57			
C.borneensis	3349	0.03	Bag	3960455	34.73
S.phasa & S.taty	380535	3.34			
P.pangasius	106772	0.94	Set-gill	85688	0.75
T.jella	40409	0.35			
O.militaris	5241	0.05	Set-barrier	92538	0.81
P.canius	26913	0.24			
T.savala & T.pantului	219220	1.92	Traps	77665	0.68
H.nehereus	1612383	14.14			
S.cinereus	35486	0.31	Hooks & Lines	166342	1.46
Prawns	1006522	8.83			
Miscellaneous	1161232	10.18	Unknown & Unclassified	13918	0.12
TOTAL	11402214	100.00	TOTAL	11402214	100.00