Annexure 2

NOTES ON EXPERIMENTAL FISHING FOR HILSA SHAD IN 1985-86

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1. INTRODUCTION

One of the characteristic features of the commercial fishery for hilsa in Bangladesh is that it is predominantly carried out by drift gillnet, a selective gear, with a mesh size more commonly of 10.0 to 12.5 cm. In order to sample the popuiation to obtain growth/population parameters it is necessary to have a non-selective gear. But since hilsa has been found vulnerable to gillnets in all three environments, it was decided to fabricate a multi-panelled gillnet having a range of mesh sizes from 2.5 to 12.5 cm.

Four centres were selected for sampling — Cox's Bazar and Chittagong on the marine side, Khepupara for the estuarine sector and Chandpur for the riverine section.

2. MATERIAL AND METHODS

A local mechanized gillnetter of 13.7 m OAL fitted with a 33 hp Yanmar engine was employed for test fishing. The strength of the crew varied from 9 to 11 including the master fisherman.

The length of the multi-panelled sampling gillnet for marine and estuarine stations was 1250 m and each panel 50 m with a hanging ratio of 0.65 to 0.70. Each fleet of gillnet consisted of 5 panels of five different meshes, 2.5, 5.0, 7.5, 10.0 and 12.5 cm laced together and repeated five times. However, the depth of the net differed; it was deeper for the marine sector (15.0 m) and shallower for the estuarine station (10.5 m). The actual fishing depth was 11.5 m and 8.0 m respectively. For the riverine station the only difference was that the five different mesh panels were repeated only three times, thus making the total length of the net 750 m.

In view of the poor returns obtained from the sampling gear, and in order to obtain the required material for racial and biological studies, an experimental gear on the pattern of commercial gear, with 11 .O cm mesh size, was also operated since September 1985 from the marine stations. The length and depth of this net were 1000 m and 22 m, with a hanging ratio of 0.50. The broad specifications of both the sampling and experimental gear are given in Appendix 1.

After investigating the poor results from the sampling gear, the following modifications were made. For the marine sector, the panels of the smallest two mesh sizes i.e. 2.5 and 5.0 cm were removed from the remainder of the fleet of nets. In order to get the required length of gear, the two nets of Chittagong and Cox's Bazar were laced together. The length of each panel was reduced to 40 m to effect a little more slack. The total length of the gear having 7.5, 10.0 and 12.5 cm mesh size was thus 1,200 m with a hanging ratio reduced to 0.53. For estuarine and riverine sectors, the 2.5 cm mesh panels were detached, the depth of the gear reduced by 2 m and the sinkers rearranged so as to add a little more weight to the foot rope.

The days of sampling of each station were prefixed and were generally complied with except during emergencies. These days were fixed taking into consideration the requirements of sampling the commercial catches for collection of catch, effort and biological data. The prefixed days were :

Station	*Calendar days*
Cox's Bazar	7, 8, 9
Chittagong	13, 14, 15
Khepupara (Charfession)	20, 21,22
Chandpur	24, 25, 26

After initial trials at Khepupara (where it was found that the area of fishing was too shallow for operation of the sampling gear), the experimental fishing activity for the estuarine sector was shifted to the Charfession area.

The *pro forma* used for collecting data are given in Appendix 2. The principal data to be collected was oriented towards catch rates, the environmental features such as surface temperature, salinity, weather and tidal conditions, the size distribution in different mesh sizes and biological parameters.

A log book was kept on board to record the principal data and any special observations and also to list difficulties encountered and requirements for follow up.

Soaking time in this account is expressed as

$$T_S = \frac{T_t + T_w}{2}$$

where T_8 = Soaking time

T_t = Total time from the start of shooting the gear till the time of completion of hauling

T_w = Time interval between end of shooting and commencement of hauling.

3. RESULTS AND DISCUSSION

The catch rates of hilsa (number of fish per set) for different stations during different months in the sampling gear and experimental gear are shown in Table I. It may be seen that generally the catch rate was very low in the sampling gear at all stations, during all months. During the first six months there was practically no catch except occasionally. The situation improved somewhat during the next 6-7 months, yet it cannot be considered completely satisfactory. The results were more disappointing in the riverine and estuarine regions.

The poor catch was due to a combination of many factors. Some of them could be:

- inexperience of the crew in the operation of such poly-meshed gillnets and their inability to adjust themselves to the operations for riverine and estuarine environments (they were successful with the commercial type of gear used as experimental gear in the sea);
- reluctance to operate the gear at night, especially in the inland and estuarine waters, for fear of dacoity;
- problems and difficulties of the biologists facing fishing conditions from country craft for the first time;
- absence of a leader with knowledge of fishing methods and gear technology;
- rolling up of large-mesh panels since the contiguous small-mesh panels roll up due to water resistance.
- shorter effective length of the gear with such mesh sizes as most commonly used in the commercial sector; in other words, the effective length of 100/125 mm mesh sizes in the sampling gear was only 100 m after every 250 m of other small mesh sizes as compared to about 1500-1200 m employed in the commercial fishery;
- limited duration of fishing days (unlike the commercial operations when boats stay out for longer periods) and irregularities in the number, duration and timing of sets employed.

The experimental gear, which was a miniature commercial gear, performed much better and almost achieved the results obtained in the commercial fishery, thereby confirming some of the factors listed above as responsible for the poor performance of the sampling gear. The catch rate was the best, varying between 55 and 180 fish, during September and October which is the peak commercial season.

Besides *Hilsa* spp., quite a variety of species was caught off Cox's Bazar, of which the principal components were silver pomfret, croakers, cat fish, hard tail scad and anchovies. In the estuarine and riverine stations the anchovies and the cat fishes were the important ones.

Fig. 1 compares the catch rates obtained in the sampling and experimental gear with those recorded in the commercial sector at Cox's Bazar. Such a comparison could not be attempted for the other stations because of paucity or absence of data. The purpose was to see how far the results obtained in the experimental fishing were reflective of the trends seen in the commercial fishery. While the catch rate reckoned for the former two gears was catch in numbers per set, it was catch by weight per boat day for the commercial fishery. Although one is not strictly comparable with the other, in view of the limitations of experimental fishing data for the limited purpose in view, such a comparison can be partially justified. Broadly, it may be seen that there is a close correlation among the three sets of data. In all the sets of data, the peak is in October, reflecting the greater abundance of fish in the fishing grounds. After a decline between November and January, there is an indication of a rise during February-March, but the picture is not as distinct as in October.

Regarding environmental factors, a comparison of temperature and salinity records with catch records (Table II) indicates that there does not appear to be any correlation between the rise and fall in catches and rise and fall in temperature or salinity, except that one of the peak values of temperature in October coincides with peak catches, but the same was not true of the other peak in temperature in May, which may be due to emigration of fish to inland waters for spawning.

An attempt was made to find out whether increase in soaking time of the gear influenced the catches. The present data (Fig. 2) do not offer evidence of any relationship between the two. If the two highest values reiating to October and March were omitted as due to the general high density of the stocks in the fishing grounds, most of the values of catch rates are within 20 fish per set. A soaking time of four hours appears to be as good as that of 15 hours.

The tabulated records of catch rates of hilsa and other fishes obtained for day and night fishing at Cox's Bazar and Chittagong (Table III) indicate that generally the catch rates were higher during the night than during the day time both for hilsa and for other fishes. Perhaps the fishes are more vulnerable to the gear in the night because of poorer visibility. It would also partially explain the reason for the low catch rates of the sampling gear of the estuarine and riverine areas where no night fishing was undertaken.

A couple of instances of almost similar or higher catch rates during the day, off Chittagong, in September-October can be attributed to greater abundance of hilsa in the nearshore waters during that period.

Fig. 3 depicts the percentage frequency of length distribution of fish at Cox's Bazar for the three mesh sizes — 7.5, 10.0, and 12.5 cm. It may be seen that all sizes of hilsa ranging from 27 to 55 cm were caught in all the three types of panels. However, the 12.5 cm mesh size panels caught more of the larger sized fishes. The average sizes obtained in different months in the different mesh sizes at Cox's Bazar are listed in Table IV. It may be seen that the individual months do not give a clear picture of selectivity, but the overall picture for the data period shows that the mean sizes were larger with increasing mesh size. It appears that selectivity is not clearly projected in the size composition because fish are not only gilled but also entangled.

From length frequencies, selectivity curves were drawn for the data obtained from sampling gear at Cox's Bazar and from commercial gear at Chittagong and Khepupara, for different mesh sizes (Fig. 4). The optimum lengths obtained for different mesh sizes at these centres are indicated below:

Station	Mesh size (cm)			
	9.0	10.0	12.0	12.5
Cox's Bazar	—	29.7	—	37.2 (mixed with 11 .0 cm mesh of experimental gear)
Chittagong	34.7	39.0	—	—
Khepupara	—	—	42.7	44.5

Annexure 2

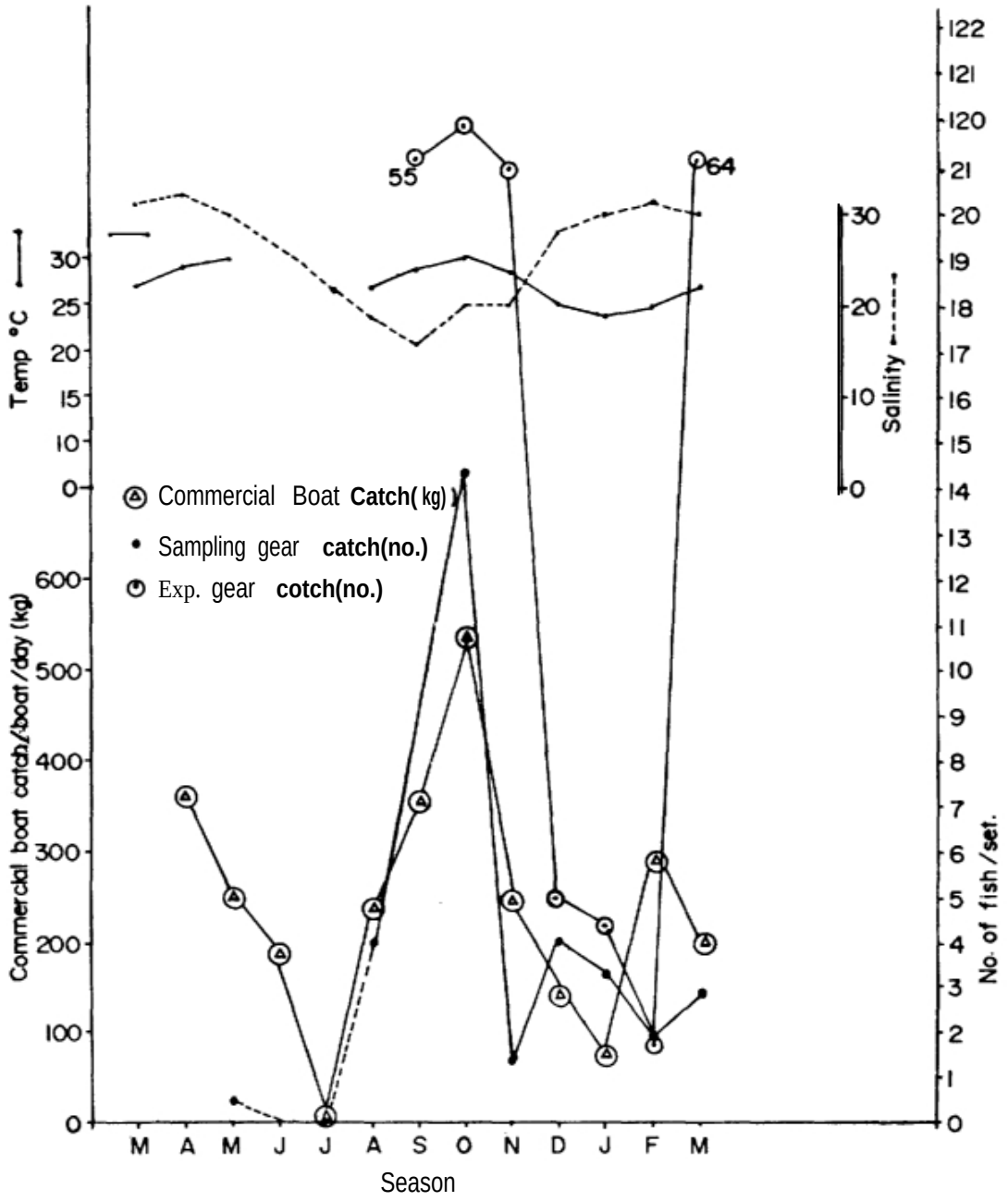

Fig. 1 Comparison of catch rates from commercial, experimental and sampling gear at Cox's Bazar.

Annexure 2

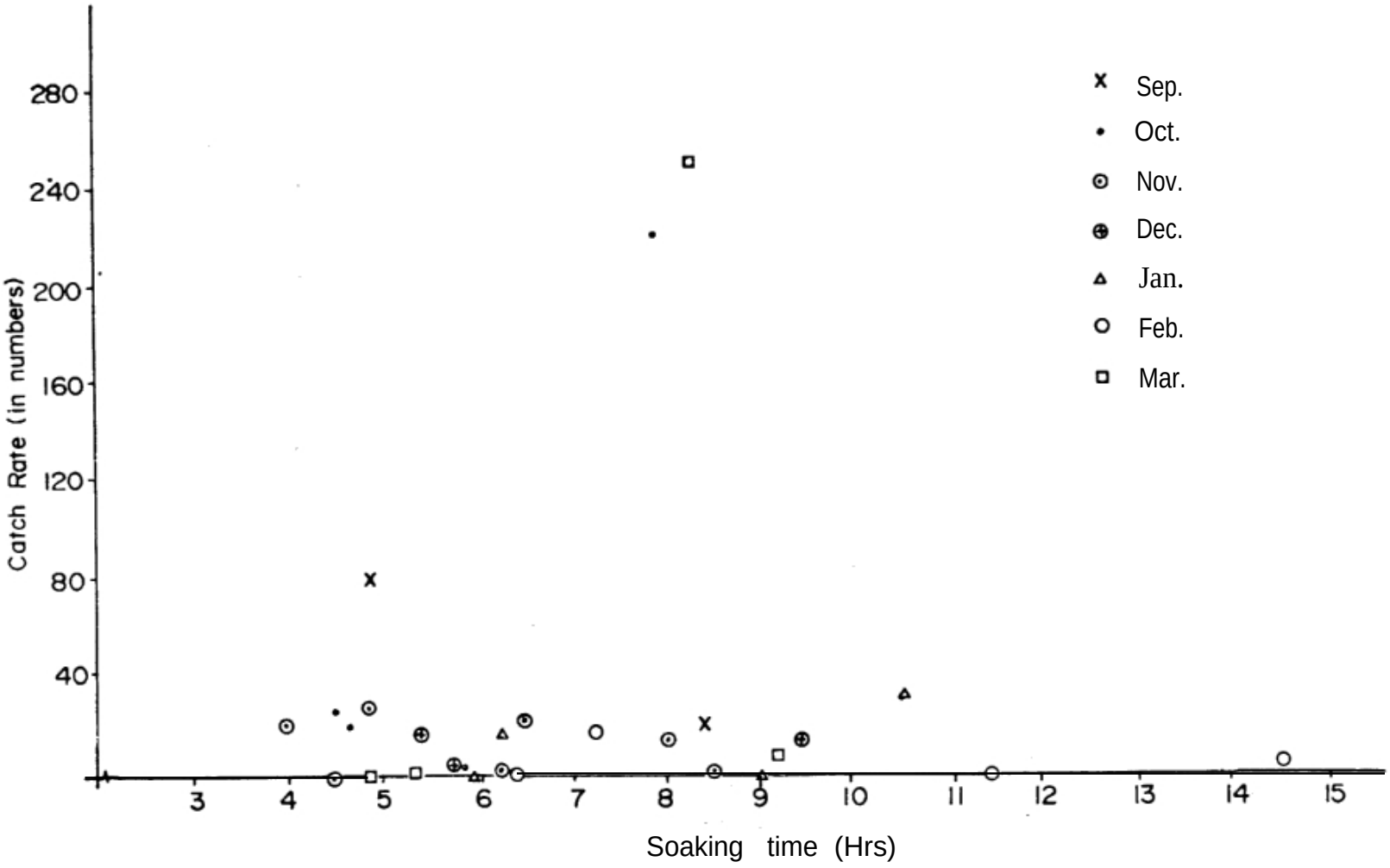

Fig. 2 Relationship between catch rate of *Hilsa ilisha* and soaking time of gilinets at Cox's Bazar.

Annexure 2

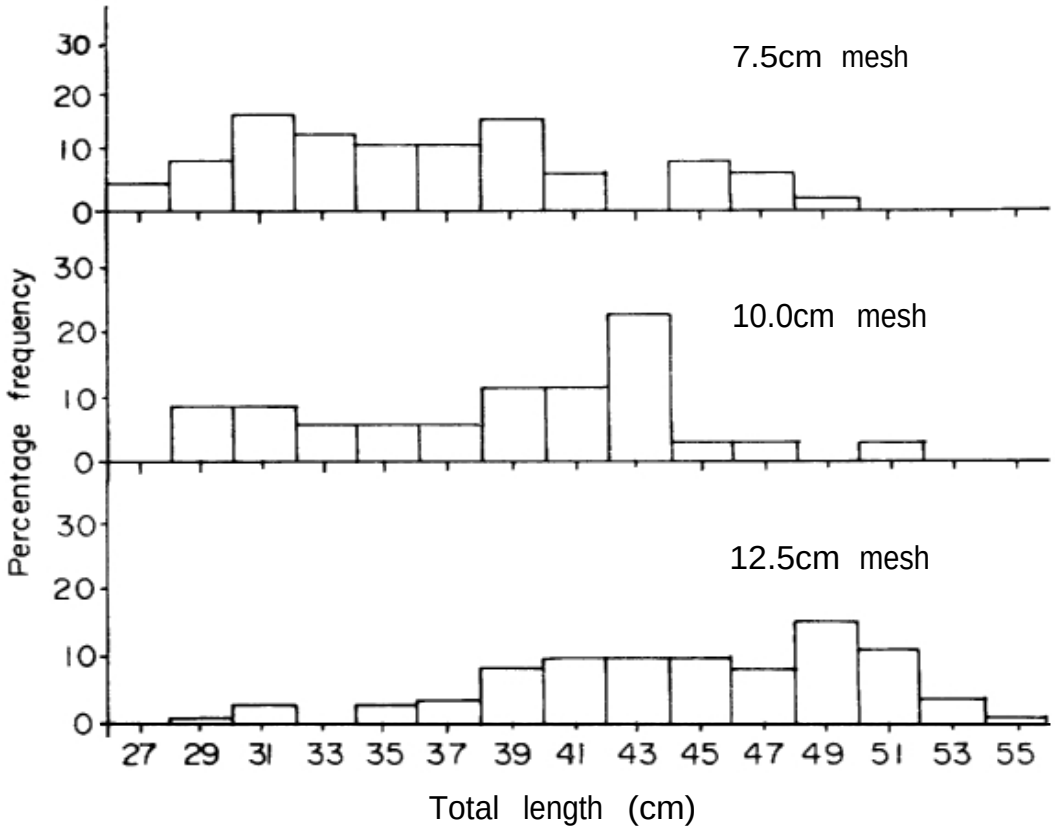

Fig. 3 Length frequency distribution of *Hilsa ilisha* in different mesh sizes in the sampling gear.

Annexure 2

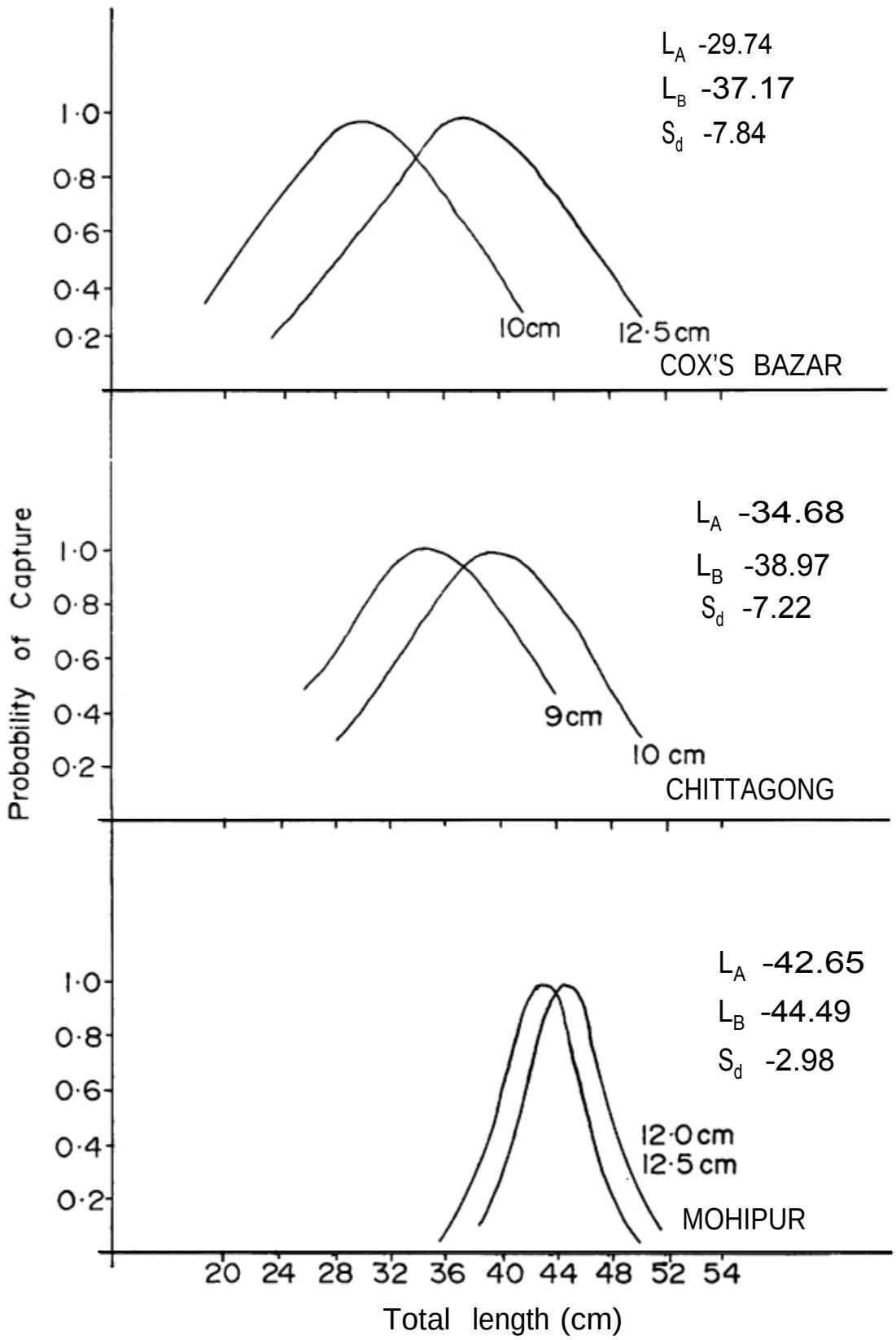

Fig 4. Selectivity curves for *Hilsa ilisha* caught in different mesh sizes of gilinets, c!ose to Cox's Bazar, Chittagong and Mohipur.

As far as data relating to Cox's Bazar is concerned, the optimum length obtained from the selection curve is lower than the mean sizes of fish caught (Table IV) in the respective mesh sizes.

The optimum lengths obtained for the same mesh sizes for two adjacent stations, Cox's Bazar and Chittagong as well as two distant stations, Cox's Bazar and Khepupara, can be seen to differ markedly. This could be due to the fact that size composition of hilsa occurring in the respective areas may be different and also due to the fact that hilsa not only get gilled but also get entangled.

It may be also noticed that the values differ by nearly 2 cm for a difference of only 0.5 cm in the mesh size. It was seen that this was also due more to the presence of different size composition in the fishing ground rather than due to mesh selectivity.

Entanglement results in wide variations in the size composition of fish caught by any specific mesh size and significant overlapping of the size composition of two different mesh sizes. As a result, the standard deviation of the size distribution for any two mesh sizes compared is larger than the difference between the optimum lengths observed. Thus the significance of using different mesh sizes in the commercial hilsa fishery is not evident from the results obtained during this brief period of investigation.

Considering the fact that the 10.0/12.5 cm mesh sizes caught relatively more fish than the 7.5 cm mesh panels, and that extremely negligible quantities of fish were caught in the 2.5 and 5.0 cm mesh sizes, it would probably indicate that the smaller sizes of fish were not available in the normal fishing grounds.

In February 1986 at Chandpur, the sampling panel of 2.5 cm mesh caught as many as 1262 juveniles with an average individual weight of 4.3 gm; this would further confirm the above observation that had there been juveniles in the fishing grounds, the sampling gear would have caught them.

4. SUMMARY

The commercial fishery for hilsa is predominantly carried out by a selective gear, drift gillnet, more commonly with mesh sizes of 10.0 to 12.5 cm. In order to sample the population at large to obtain growth and population parameters at roughly the same point of time in the different environments, rivers, estuaries and sea, sampling experiments were carried out from a local mechanized gillnetter employing a newly fabricated mesh panelled gillnet having a range of mesh sizes from 2.5 to 12.5 cm. The length and breadth of the net differed for the three environments. Each month, each of the stations was sampled on certain pre-fixed dates which were the same throughout.

In addition to the sampling gear, an experimental gear which was a miniature version of the commercial gear was also employed.

The results from the sampling gear were disappointing, more so in the riverine and estuarine areas. The experimental gear performed better. The reasons for the poor performance of the experimental fishing are many, but the main ones are:

- the inexperience of the crew in operating such multi-meshed, multi-panelled gillnets;
- difficulties of the biologists in withstanding the conditions of a fishing voyage and performing in a country craft;
- absence of a person with knowledge of fishing methods and gear technology.

A comparison of results between the catch rates of sampling gear, experimental net and the commercial gear at Cox's Bazar showed some consistent trends, at least during periods of peak abundance in the fishing grounds.

There were indications of correlation between the catch rates and the variations in temperature or salinity but firm conclusions could not be drawn.

The catches at night were found to be better than those in the day time.

There was no relationship between the soaking time of the gear and the number of fish caught. A soaking time of four hours was as good or as bad as a soaking of 10-15 hours.

A comparison of the length distribution of hilsa at Cox's Bazar in the three mesh sizes 7.5, 10.0 and 12.5 cm showed that all sizes of hilsa ranging from 27 to 55 cm were caught in all the three mesh sizes of the panels. Gillnet selectivity was not clearly projected in the size composition, because hilsa not only get gilled but also entangled.

From length frequencies, selectivity curves were drawn. Different optimum lengths were obtained for identical mesh sizes for two adjacent stations as well as two distant stations. This may be due to differences in size composition of hilsa occurring in the respective areas and also due to the fact that hilsa are not only gilled but also get entangled.

Table I

Hilsa Catch/Set (Number)

S — Sampling gear E — Experimental gear C-Combined both S & E

	COX'S BAZAR Mesh size (cm)						CHITTAGONG Mesh size (cm)							CHARFESSION Mesh size (cm)							CHANDPUR Mesh size (cm)					
	Net Type	2.5	5.0	7.5	10.0	11.0 12.5	Net Type	2.5	5.0	7.5	10.0	11.0 12.5	Total Catch	Net Type	2.5	5.0	7.5	10.5	12.5	Net Type	2.5	5.0	7.5	10.0	12.5
March	S	0	0	0	0	0	S	0	0	0	0	0			Not done						Not done					
April	S	0	0	0	0	0	S	0	0	0	0	2		S	0	0	0	0	0	s	0.8	0.3	0	0	0.8
May	S	0	0	0	0	0.5	s	0	0.4	6.6	5.4	1.4		S	0	0	0.3	0	0	s	0	0	0	0	0.2
June		Not operated					s	0	0	0	0	0		S	0	0	0	0	2.0	s	0	0	0.2	0	0
July		Not operated						Not operated						S	0.3	0	0	0	0.7	s	0.5	0	0	0	0.5
Aug.	S	0	0	0	0	4		Not operated							Not operated						Not operated				
Sept.	S	Not operated					S	0	0	0	0	5													
	E					55	E					180		S	0	0	0	0	0	s	0	0	0	1.0	0.7
	S	0	1.5	1.5	1.5	10																			
Oct.							C						150.1	S	0	0	0.2	0.2	2.0	s	0	0	0.3	0.3	0.3
	E					119																			
	S	0	0	0	1.3	0																			
Nov.							C						8.9	S	0	0	0	0	0.2	s	0	0	0.2	0	0
	E					21																			
	S	0	0	1.3	1.7	0.9	S	0	0	5	1	0.1													
Dec.														S	0	0	0	0.4	0	s	0	0	0	0	0
	E					5.0	E					0.5													
	S	0	0	1.0	1.5	0.8																			
Jan.							C						4.0	s	0	0	0	0.4	0	s	0	0	0.4	0	0
	E					4.4																			
	S	0	0	0.8	1.0	0.1	S	0	0	0	2	8.6													
Feb.														S	0.1	0	0	0.2	1.1	s	2.6	0.8	0.5	0	0.2
	E					0.2	E	0	0	0	0	34.4													
	S	0	0	0	1.0	1.8																			
March							C						5.0	s	0.3	0	0	0	0	s	0	0.8	1.4	0.7	0.4
	E					64																			

Table II

Comparison of catch rates with temperature and salinity at Cox's Bazar

Month	Catch Set (No) Sampling Gear	Catch Set (No) Experimental Gear	Commercial Catch,/Boat Day (kg)	Salinity °/00	Temperature (°C)
March 1985	00	00	—	31	27
April	00	00	368	34	29
May	0.5	00	256	30	30
June	—	—	243	—	—
July	—	—	8	—	—
August	4	**00**	243	14	27
September	—	155	357	11	29
October	14.5	119	542	20	30
November	1.3	21	248	20	28
December	3.93	5	142	28	25.27
January 1986	3.3	44	81	30	24
February	1.8	1.8	293	31	25
March	2.8	64	199	30	27

Table III

Comparison of catch rates by day and night

(Wherever there are two rows of figures, the top row relates to sampling gear and the bottom row to the experimental gear)

	Hilsa Average No./Set (kg)				Other Fish No./Set (kg)			
	Cox's Bazar		Chittagong		Cox's Bazar		Chittagong	
	Day	Night	Day	Night	Day	Night	Day	Night
March	00	00	—	—	7.5	8.0	—	—
April	00	00	—	—	20	13	—	—
May	00	1	26	11	20	25	5	25
June	—	—	2	—	—	—	6.5	—
July	—	—	—	—	—	—	—	—
August	—	4	—	—	—	4	—	—
September	80	21	6 / 207	4 / 128	10	87	8 / 145	4 / 130
October	—	15.5 / 119	150	156	—	95	153	161
November	— / 21	2 / 21	—	9	6.5	37	—	10
December	—	13	0	8	—	—	00	8
January	19	11	0	4	45	89	—	40
February	4	6		45	19	45	—	85
March	1	87	0	6	1	31	2	34

Table IV

Mean length of hilsa in the sampling gear during different months at Cox's Bazar

Mesh size:	7.5 cm	10.0 cm	12.5 cm
August	—	—	35.5
September	—	—	—
October	36.3	39.7	40.6
November	—	—	—
December	37.1	42.0	40.0
January	33.6	36.0	41.7
February	34.4	32.7	40.0
March	—	43.9	44.2
Average	35.9	38.8	43.0

Appendix I ,

BROAD SPECIFICATIONS OF SAMPLING AND EXPERIMENTAL GEAR

Sampling gear	*Marine*	*EstuarinelRiverine*
Material	**PA Multifilament Nylon**	**PA Multifilament Nylon**
Colour	**Natural white**	**Natural white**
Twine size denier	**210d3 (210d6 for 100 & 125 mm mesh)**	**210d3 (210d6 for 100 & 125 mm mesh)**
Stretched mesh size (mm)	**25/50/75/1 00/1 25**	**25/50/75/1 00/1 25**
Length (meshes)	**3000/1 500/1 000/750/600**	**3000/1 500/1 000/750/600**
Depth (meshes)	**600/300/200/150/120**	**420/210/1 40/1 05/85**
Experimental gear		
Material	**Multifilament 0, 15 x 6**	
Colour	**Blue**	
Mesh size (mm)	**110**	
Total length (m)	**1000**	
Total depth (m)	**22**	

Appendix II

EXPERIMENTAL FISHING RECORDS

Biologist:
Duration of fishing trip (Date and hour)
From:.
To:
Duration of fishing (in hours)

Station:
1st day
2nd day
3rd day

Environmental data for each fishing operation:

Set No.	Time of setting		Time of hauling		Approximate location	Setting	Hauling
	Start	End	Start	End			
1.					Surface temperature:		
2.					Surface salinity:		
3.					Socchi disc reading:		
					Weather:		

Total weight (kg) and No. of fish

Set No.		$S_{1.1}$	$S_{1.2}$	$S_{1.3}$	$S_{2.1}$	$S_{2.2}$	$S_{2.3}$	$S_{3.1}$	$S_{3.2}$	$S_{3.3}$
H. ilisha	Wt.									
	No.									
H. toli	Wt.									
	No.									
H. kelee	Wt.									
	No.									
Other species (specify)	Wt.									

Note(1) $S_{1.1}$ —first, $S_{1.2}$ —second, $S_{1.3}$ — third } of 1st day; $S_{2.1}$ -first, $S_{2.2}$ —second, $S_{2.3}$ —thirdset } of 2nd day; $S_{3.1}$ -first, $S_{3.2}$ —second, $S_{3.3}$ —thirdset } of 3rd day

Note (2) 1st set 0000—0400 hrs. Tidal situation:
2nd set 0800—1 200 hrs. Tidal situation: