Marine Fisheries Resources Survey
Demersal Trawling BGD/80/025/CR8

Survey Cruise Report No. 8, January 31 - February 11, 1985

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SUMMARY

Nighttime trawling was conducted on 49 randomly selected stations, ranging in depth from 15 to 113 metres, with an average overall catch rate of 137 kg/30 minutes trawling. The density decreased progressively between the shallow and deeper waters, the mean catch rate in the 10-20 metre depth zone being nearly four times that of the deepest zone.

The most abundant species in the overall catch were the round and hard tail scads, *Decapterus maraudsi* and *Megalaspis cordyla* respectively. These were followed by jewfish, hairtail. *Lepturacanthus savala*, Japanese threadfin bream, *Nemipterus japonicus*, catfish and goatfish, *Upeneus sulphureus*.

Approximately 33% of the total catch consisted of so called "pelagic" species of fish. Few species in the survey catch were of any commercial value, due to their type or size.

Penaeid prawns were poorly represented, contributing less than 1% to the total survey catch.

The overall demersal biomass calculated for the survey area was 220,000 m. t. although caution should be applied to any interpretation of this result, due to the large associated variance.

The estimate of prawn biomass was 3,700 m. t, but again, little confidence is attached to this value.

No surface schools of fish were observed.

The water over the survey area was somewhat clearer than during the previous cruise, although no significant change in the ocean conditions could be observed. The circulation pattern observed during earlier cruises appeared less pronounced.

CRUISE DETAILS

Cruise No.	:	9
Duration	;	11 days from January 31-February 11, 1985
No. of trawl stations completed	;	49
Cruise Leader	:	Dr T F White
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1 INTRODUCTION

In order to understand more about the abundance and distribution of the living marine resources within the Bangladesh continental shelf, the Bangladesh Government, with the assistance of FAO, commenced a comprehensive survey programme in September 1984.

Between September 1984 and the end of January, 1985 seven survey cruises were conducted to investigate the abundance and distribution of the demersal and pelagic resources, using a 32m research vessel and a high opening, demersal fish/shrimp trawl (see BGD/80/025/CR 1-7). All trawling carried out during these first cruises was conducted during the day, as it had been found during previous surveys that catch rates and species composition of the catch varied between day and night, due principally to the vertical migrations of certain species.

It was therefore decided to conduct two cruises trawling at night in order to qualify and quantify this difference between day and night catches. The commercial trawler fleet operates on a 24 hours basis. Commercial catch rates and particularly species composition of their catches, were therefore not directly comparable with the previous survey results. Cruises No. 9 and 10 were planned for this purpose. This report covers the results from cruise No. 9 (Note, cruise No. 7 was not a survey cruise and no report exists for this cruise).

2. MATERIAL AND METHODS

2.1 THE SURVEY AREA AND SELECTION OF TRAWL STATIONS

The survey area extended from the 10 metre depth contour in the north and east to the 200 metre depth contour in the south. A line drawn at 45° from the southern tip of St. Martins Island was considered to approximate the Bangladesh/Burmese marine border in the south east. In the west, the survey area extended to the Bangladesh/Indian marine border, but in practice no trawling was conducted west of the eastern edge of the "swatch of no ground". The survey area, together with the 10, 20, 30, 50, 100 and 200 metre depth contours is outlined on all Figures used in this report.

Fifty trawl stations were selected prior to the cruise on a random basis covering the entire survey area. Stations ranged in depth from 17 to 113 metres. The survey area and selected stations are shown on Figure 1.

Although the survey area theoretically extended to the 200 metre depth contour, previous surveys conducted on the shelf had indicated very low catch rates in depths below 80 metres or so. In order to maximise the amount of information obtained from the areas of interest to the commercial fleet, the deepest haul conducted during this survey was limited to 112 metres.

The most practical cruise track to cover these stations was selected by the captain of the research vessel in consultation with the cruise leader.

2.2 THE VESSEL AND GEAR

The survey vessel, the R/V "Anusandhani" is a 32,4 metre "multipurpose" research vessel, although principally designed for stern trawling, constructed in Japan in 1979. Details of the vessel are provided in Appendix A.

The trawl net used was an Engel high opening fish/shrimp trawl with a cod-end mesh size of 32mm. Details of the fishing gear are provided in Appendix B.

A Furuno FUV-11 echo sounder was run continuously throughout the survey cruise. In addition, a Furuno FH-103 sonar was operated occasionally when steaming in water deeper than 50 metres. The sonar beam was set at an angle of 10° to starboard and swept a forward area between 30° to port and 30° to starboard at an average beam range of 800 metres.

Secchi disc transparencies could not be taken at night, however some readings were made in the mornings and evenings. Surface water temperatures were recorded at all stations. These were recorded using a standard 30cm diameter white disc and 0-50°c thermometer and bucket respectively.

2.3 TREATMENT OF THE CATCH

All trawling was conducted at night between 1800 hrs and 0600 hrs. All hauls were of 30 minutes duration, the time commencing when the net reached the bottom, as determined by the net-sonde and terminating when hauling commenced. If trawls were discontinued within 15 minutes of shooting, they were considered invalid and the results discarded.

The catch was sorted into species and each weighed separately to the nearest 0.25 kg. In the event that the catch in a particular haul exceeded 500 kgs (approximately) then it was subjectively subdivided into two equal portions, one of which was sorted and the results then doubled. If the number of individuals of any species present in the catch was less than around 20 then the numbers of that species in the haul was counted in order to calculate the average weight of that species. If the number was greater than this, then a weighed sample was usually taken for length/frequency measurement and the average weight calculated in this manner.

In any event, samples of 50-200 fish were selected randomly for length measurement for most species in the catch, where the species were clearly identifiable. As the taxonomy of the catfish (Family Ariidae) and jewfish (Family Sciaenidae) was confused, no length measurements were made for these two Families. Lengths were in cms, fork length.

2.4 DATA ANALYSIS

All data were recorded on proforma sheets which are shown in Appendix C. A Hewlett Packard 86B microcomputer was used to store and analyse the catch, length frequency and oceanographic data, using programmes written specifically for the purpose. From these data, density and biomass estimates were calculated as described in Section 3.4.

For the analysis of the length frequency data, the survey area was subdivided into eight zones, as shown on Figure 2. For each species, samples taken from within the same zone were pooled and a single histogram produced for that zone. The histograms were then plotted onto the maps of the survey area on the position where the samples were taken.

3 RESULTS

3.1 GENERAL

Forty nine of the fifty randomly selected stations were successfully trawled. One station was found to be untrawlable due to the presence of large numbers of gill net vessels in the area.

The following is a summary of the stations successfully trawled by depth zone. The positions of these stations are shown on Figure 1.

Depth zone	No. of successful hauls
10-20 metres	6
21-30 ,,	5
31-50 ,,	5
51-100 ,,	29
100+ ,,	4
Total :	49

3.2 DISTRIBUTION AND ABUNDANCE OF THE MAJOR SPECIES

Table 1 below lists all Families or species groups caught during the survey cruise in order of their contribution to the combined total catch of the 49 stations. Their percentage contribution to the total catch of each depth zone is also illustrated on this Table. It may be seen that while some Families may have contributed relatively little to the overall catch they may have made up a significant proportion of the catch of a particular depth zone.

"Trash" here is defined as small fishes, which because of their size and variety could not be identified/sorted with reasonable accurancy, together with sponges, molluscs, small crustaceans etc.

TABLE 1

Percentage composition of the catch by family for each depth zone and for the total survey area. These are listed in order of occurrence in the total catch.

FAMILY	DEPTH ZONE (METRES)					TOTAL
	10-20	21-30	31-50	51-100	101-200	%
NEMIPTERIDAE (Threadfin bream)	.07	2.59	1.96	68.43		35.65
ARIIDAE (Catfish)	19.99	8.96	7.61	3.41		8.45
SCOMBRIDAE (Mackerels and tunas)	27.60	.08		2.89		8.01
GERREIDAE (Mojarras)	.02	1.92	48.29	.74		6.46
HAEMULIDAE (Grunts, Sweetlips)	20.63			1.44		5.62

FAMILY	DEPTH ZONE (METRES)					TOTAL %
	10-20	21-30	31-50	51-100	101-200	
SCIAENIDAE (Jewfish)	8.95	9.80	3.25			5.38
TRIACANTHODIDAE (Spike fish)	3.27	33.40				4.69
SYNODONTIDAE (Lizard fish)	1.58	9.91	9.18	3.30		4.34
Trash Fish	3.85	4.52	6.13	2.75	1.35	3.61
PRIACANTHIDAE (Bulls Eyes)	.02	.01	2.66	3.73	69.73	3.08
MULLIDAE (Goat fish)	.21	8.16	11.71	1.06		2.97
CARANGIDAE (Jacks, Scads, Trevallies etc)	5.39	4.46	.49	.84		2.29
CRUSTACEANS (Prawns)		5.68	3.92	1.28	14.42	1.97
CRUSTACEANS (Others)	.03	.07		1.28	14.50	.85
CLUPEIDAE (Herrings, Sardines, Shads etc,)	3.41	.07		.06		.85
CEPHALAPODA (Squid, Cuttlefish Octopus)	.12	1.57	1.31	.81		.79
POLYNEMIDAE (Threadfins)	1.02	.20	.01	.82		.69
TETRAODONTIDAE (Puffer fish)	.21	3.95				.51
TRICHIURIDAE (Hairtail)	.12	.18	.61	.66		.46
LUTJANIDAE (Snappers)		.35		.68		.39
EPHIPPIDAE (Sicklefishes)	1.08	.74	.20			.36
STROMATEIDAE (Pomfrets)	1.20	.21				.31
EXOECITIDAE		.49	.40	.30		.26
ENGRAULIDAE (Anchovies)	.48	.81	.03	.07		.25
SCORPIONIDAE (Scorpion fish)			.07	.47		.25
Sharks, Rays (mixed)				.45		.23

FAMILY	DEPTH ZONE (METRES)					TOTAL %
	10-20	21-30	31-50	51-100	101-200	
BOTHIDAE (Flounders)	.07	.42	.13	.17		.17
SPARIDAE (Sea breams)		.06		.29		.16
FISTULARIIDAE (Flutemouths, Cornet fishes)		.07	.56	.09		.12
MURAENESOCIDAE (Pike eels)	.14			.13		.10
LEIOGNATHIDAE (Ponyfish)			.67	.02		.09
RACHYCENTRIDAE (Cobia)	.10	.44				.08
PLATYCEPHALIDAE (Flat head)				.16		.08
SERRANIDAE (Groupers)		.45		.05		.08
BALISTIDAE (Trigger fish)			.29	.06		.07
APOGONIDAE (Cardinal fish)				.14		.07
SKATES AND RAYS	.07			.09		.06
TERAPONIDAE (Terapon Perches)	.17	.15				.06
PSETTODIDAE (Indian Halibuts)	.10	.04		.02		.04
FORMIONIDAE (Black Pomfrets)	.07	.14				.03
SPHYRAENIDAE (Barracudas)		.03	.03	.01		.01
CHIROCENTRIDAE (Wolf Herring)	.02	.07				.01
HOLOCENTRIDAE (Squirrel fish Soldier fish)				.02		.01
ARIOMMATIDAE				.02		.01
LACTRARIIDAE (False Trevallies)	.02					.00
CARCHARHINIDAE (Sharks)				.01		.00
ELOPIDAE (Tarpon)	.01					.00
	100%	100%	100%	100%	100%	100%

3.2.1 Bathymetric distribution

The average catch rates obtained during the survey are shown on Table 2. The "range" is 2 Standard Errors of the mean. The species composition of the catches in each depth zone are shown on Table 1.

TABLE 2

Depth zone (metre)	Average catch rate (Kg/30 minutes haul)	Range	No. of hauls
10-20	272	448	6
21-30	146	79	5
31-50	264	3,152	5
51-100	115	360	29
100+	19	26	4
Average	131	121	
			Total : 49

3.2.1.1 10-20 metre depth zone

The average catch rate of the six hauls conducted in this depth zone was 272 kg/30 minutes trawling. All of these hauls were conducted along the "northern" sector of this depth zone and none were along the eastern side. The abandoned station referred to in Section 3.1 above was on the eastern side.

Nearly half of the catch in this depth zone consisted of just two species, the Indian mackerel, *Rastrelliger kanagurta* (28% of the total catch), and the blotched grunter, *Pomadasys maculatus* (21% of the total catch) (Figure 7). All of the mackerel were caught in a single haul which produced 400 kg (Figure 10). Catfish (Family Ariidae) contributed a further 20%. The only other Family represented in any significant amount in the catches in this depth zone were the jewfish (Family Sciaenidae), which contributed 8% to the total.

3.2.1.2 21-30 metre depth zone

The averge catch rate in this depth zone was 146 kg/30 minutes trawling. One third of the catch consisted of the spike fish, *Triacanthus brevirostris*, most of which were caught in one haul (Figure 8). The fish has no commercial value.

Lizard fish (*Saurida elongata* and *S. tumbil*), goatfish (*Upeneus sulphureus*), catfish and jewfish were the next most abundant species/Families, each contributing between 8 and 10% of the total catch.

The only other group of any interest in this depth zone were the penaeid prawns, which represented nearly 6% of the total catch.

3.2.1.3 31-50 metre depth zone

The average catch rate in this depth zone was 264 kg/30 minutes trawling, almost the same as in the 10-20 metre zone. In this case however, nearly half of the total catch consisted of mojaras (Family Gerridae), which were virtually absent in the 10-20 metre depth zone.

Other species/Families of significance in the catches were goatfish, lizard fish and catfish, representing 12%, 9% and 8% of the catch respectively. Penaeid prawns represented 4% of the catch.

3.2.1.4 51-100 metre depth zone

The average catch rate in this depth zone was 115 kg/30 minutes trawling. Nearly 70% of the total catch consisted of the Japanese threadfin bream, *Nemipterus japonicus*. This species had only represented around 2% of the catches in the shallower depth zones.

No other species was present in any significant quantity, although the most common in the remainder of the catch were the bulls eye *(Priacanthus spp.)* lizard fish, catfish and jewfish.

3.2.1.5 101-200 metre depth zone

The deepest of the four hauls conducted in this depth zone was in 113 metres. The average catch rate was only 19 kg/30 minutes trawling.

As in the 51-100 metre zone, 70% of the catch consisted of just one species, however in this case it was not the Japanese threadfin bream, but the bulls eye. The remainder of the catch consisted of equal quantities of penaeid prawns and small "spider" crabs, the latter having on commercial value. These three species/groups mentioned represented practically the total composition of the catch.

3.2.1.6 Summary - Bathymetric distribution

A feature of the catches in all depth zones was the large percentage of the landings contributed by a single species or Family of fish and that these were different in each of the zones. For instance, 28% of the 10-20 metre zone catch consisted of Indian mackerel, 33% of the 21-30 metre zone catch consisted of spike fish, 48% of the 31-50 metre zone catch consisted of mojarras, 68% of the 51-100 metre zone catch consisted of Japanese threadfin bream and 70% of the 101-200 metre zone catch consisted of bulls eye.

The total catch rate in the shallower waters ranged from 145 kg/30 minutes trawling in the 21-30 metre depth zone to between 260 and 270 kg/30 minutes trawling in the 10-20 metre and 31-50 metre depth zones. This rate decreased by about 50% to 115 kg/30 minutes trawling when desending beyond the 50 metres depth contour and to less than 20% of this latter rate (19 kg/30 minutes trawling) in the deepest catches. This trend in catch rates had been observed during all previous survey cruises.

The relationship between the depth of trawling and catch rates for all species combined and for specific Families or species are illustrated on the following designated Figures :

	Figures
Total catch (all species combined)	3
Jewfish (Family Sciaenidae)	4
Bulls eye, *(Priacanthus sp.)*	5
Catfish (Family Ariidae)	6
Blotched grunter *(Pomadasys maculatus)*	7
Spike fish *(Triacanthus brevirostris)*	8
Japanese threadfin bream (*Nemipterus japonicus*)	9

	Figure
Indian mackerel *(Rastrelliger kanagurta)*	10
Longfin mojarra (*Pentaprion longimanus*)	11
Whipfin mojarra *(Gerres filamentosus)*	12
Goat fish *(Upeneus sulphureus)*	13
Lizard fish *(Saurida spp.)*	14
Penaeid prawns	15
Brown shrimp *(Metapenaeus monoceros)*	16
Brown shrimp *(Parapenaeopsis sculptilis)*	17

3.2.2 Geographical distribution

Catch rates obtained at the 49 survey stations are shown on Figure 18 plotted according to the locations of the respective stations. Catch rates have been arbitrarily subdivided into four categories, viz. under 50,51-100, 101-500 and greater then 500 kg/30 minutes trawling. This Figure provides a general overview of the distribution of the demersal stock over the survey area.

There was no obvious pattern to the distribution of total catch rates over the survey area, although catches made in the eastern sector were uniformly high, whereas those elsewhere were more sporadic, particularly in the deeper waters.

3.3 DISTRIBUTION AND ABUNDANCE OF MOST COMMON SPECIES IN THE CATCH

The following species/Families were most common in the survey catch. Not all are considered to be commercially important, although determination of which species have commercial importance and which do not must be subjective, influenced by the fish marketing situation in Bangladesh and the acceptability of these species on export markets. The size and type of the fish are both important factors to be considered.

This does not imply that other species not mentioned would not have some retail value, or at least be suitable for reduction to fish meal. However because of their size, abundance, or type it is considered that most trawler operators would consider them uneconomic to sort and handle and would discard them as "trash". The amount of fish considered as "trash" by this definition would be considerably higher than that categorised as "trash" on Table 1 on the basis of sorting during our survey activities.

3.3.1 Family Ariidae (catfish)

Catfish were present in most hauls made during the survey cruise in water less than about 60 metres depth, although they were occasionally present in some of the deeper hauls as well. One exceptional haul in 15 metres yielded nearly 250 kg, but on average, the shallower water catches yielded around 12 kg/30 minutes trawling (Figure 6).

Catfish were distributed throughout the entire survey area, although as mentioned, in limited amounts in the deeper waters. Overall, they represented 8.5% of the total survey catch.

Local markets in Bangladesh do not discriminate between the various species of catfish. Price is determined essentially by size (and condition), generally being somewhat higher for the larger (30 cm and above) fish. Most of the catfish landed during this cruise were "large" fish, in excess of 300 grams and are readily marketable in Bangladesh.

3.3.2 Family Sciaenidae (jewfish)

At least four separate "types" of jewfish are recognized on the Bangladesh markets (although these do not represent four species). In general, size is the main oriterion for price in the local markets, not species. No attempt was made to differentiate between species in the survey catches.

As with the catfish, jewfish were widely distributed throughout the survey area (Figure 19) particularly in depths less than about 50 metres. Catch rates decreased with increasing depth (Figure 4). Although the average overall catch rate was only 7 kg/30 minutes trawling, the rate in waters shallower than 30 metres averaged approximately 22 kg/30 minutes trawling.

More than half of the jewfish caught were less then 15 cm in length, and many were less then 10 cm. Thus although this Family contributed nearly 19% of the catch in the 21-30 metre zone and 25% of the catch in the 31-50 metre zone, they are of limited economic value due to their relatively small size. Jewfish of all sizes are marketable in Bangladesh, but prices offered for the smaller fish are generally very low.

3.3.3 Family Scombridae (mackerels)

The only representative of this Family caught during this cruises was the Indian mackerel, *Rastrelliger kanagurta.* Overall, they represented 8% of the total survey catch, although this is not a true indication of their relative abundance as practically all of the mackerel were caught in just two hauls. One in 15 metres of water yielded 400 kg and another in 57 metres produced 80 kg (Figure 10).

The mackerel were unimodal in size, with a mean length of 18.5 cm and a range from 16.5 to 21.5 cm (Figure 42),

3.3.4 Family Nemipteridae (threadfin bream)

Japanese threadfin bream, *Nemipterus japonicus* were generally restricted to the deepest parts of the survey area, beyond 80 metres depth. In the 80-100 metres depth range however, some very large catches of this species were made, up to 900 kg/30 minutes trawling (Figure 9). They represented nearly 70% of the total catch of the 51-100 metre depth zone with an average catch rate of 63 kg/ 30 minutes trawling. The highest catches were made in the central, deeper section of the survey area (Figure 24).

Threadfin bream are rarely encountered in the Bangladesh markets, principally because they occur in depths beyond the range of the traditional fishing gears and even the "usual" trawling depths of the prawn trawlers. There is a ready export market for larger fish, but as is apparent from Figure 31, the average total length (fork length) was only around 6-12 cm (although a larger group with a mean length of 22 cms was present in one area). Fish of these sizes are not easily sold on export markets,

3.3.5 Family Priacanthidae (bulls eye)

Bulls eye, *Priacanthus sp,* were a common component of the deeper water hauls. They were present in practically all hauls made in depths greater then about 70 metres and represented nearly 70% of the total catch in the 101-200 metre depth zone (Figure 5). Despite their relative abundance in this zone, the average catch rate was only 13 kg/ 13 minutes trawling. Bulls eye were present throughout the entire deeper water sections of the survey area (Figure 20).

Three size groups were generally present in the catches in varying proportions, a smaller group with an average length of 12 cm, an intermediate group at 22cm and a larger group at around 31cm. Presumably these represented three age classes (Figure 45) (Note that although Figure 45 in labeled "*P. hamrur*", there is still some uncertainly about the correct identity of these fish).

Bulls eye are practically unknown in Bangladesh, for the same reasons given in Section 3.3.4. They are not a popular eating fish overseas.

3.3.6 Family Triacanthidae (spike fish)

Spike fish, *Triacanthus brevirostris* represented one third of the total catch of fish in the 21-30 metre depth zone, although practically all were caught in one haul, which produced 240 kg of these fish (Figure 8). They were absent from all hauls made in depths greater than about 25 metres. This above mentioned haul and the few others that included spike fish were located in the north western sector of the survey area (Figure 23).

Spike fish have absolutely no value, rather they are a fish to be avoided by the trawlers as they entangle in the net meshes and a lot of time is wasted removing them.

3.3.7 Family Haemulidae (grunts)

Although this Family includes the silver lined grunter, *Pomadasys hasta* which grows to a relatively large size and is of some commercial importance, all catch of this Family on this cruise consisted of the blotched grunter, *P. maculatus,* which is smaller and of no commercial value.

The highest catches were made in the 10-20 metre depth zone, where they represented 21% of the total catch although they were occasionally caught at other depths also (Figure 7). The higher catches were made in the north central sector of the survey area (Figure 22) where the average catch rate was 82 kg/30 minutes trawling.

The fish in the shallower waters had a mean length of 8,5 cm while those in the deeper waters were larger, on average around 17 cm (Figure 44).

3.3.8 Family Gerridae (mojarras)

6.5% of the total catch and nearly 50% of the catch of the 31-50 metre depth zone consisted of these fish. Two species were represented, *Gerres filamentosus* and *Pentaprion longimanus* in approximately equal amounts. The average catch rate in the 31-50 metre depth zone was 360 kg/30 minutes trawling, although catches were quite variable, a common feature of schooling "pelagic" species such as these (Figures 11 and 12),

Mojarras have a limited commercial value in Bangladesh. They are known from the set bag net catches and are traditionally dried.

3.3.9 Family Synodontidate (lizard fish)

Lizard fish, principally *Saurida elongata* and *S. tumbil,* were present in practically all hauls made during the survey cruise (Figure 14). Except for two hauls in the deeper water, the majority of the higher yielding hauls of lizard fish were located on the eastern side of the survey area, south of Elephant Point (Figure 26). The average overall catch rate was only 4.6 kg/30 minutes trawling but this reached 20 kg/30 minutes trawling in the 31-50 metre depth zone.

The slender lizard fish, *S. elongata* was more restricted to the deeper waters. The fish were generally smaller than *S. tumbil,* between 10-20 cm in length and an average of around 12 cm (Figure 39). The greater lizard fish, *S. tumbil,* were conversely more common in the shallower catches. These fish tended to be multimodal in size, with the smallest group, which was the most abundant, ranging between 14-16 cm. The largest fish ranged in size up to 40 cm.

Lizard fish are not common in Bangladesh markets, as they are not commonly caught in the Hilsa gill nets. Larger fish are saleable on export markets.

3.3.10 Family Mullidae (goatfish)

Goatfish *(Upeneus sulphureus)* were present in about half the hauls throughout the survey cruise, although the catch rates decreased with depth (Figure 13). The highest average catch rate of 30 kg/30 minutes trawling occured in the 30-50 metre depth zone. As with the lizard fish (Section 3.3.9), the highest catch rates occured along the eastern side of the survey area (Figure 25).

The goatfish were unifrom in size throughout the survey area, having a mean length of around 10-12 cm (Figure 29). Although goatfish are popular in some European markets, fish of this size may be difficult to sell.

3.3.11 Penaeid prawns

Penaeid prawns are the most valuable marine resource in the Bay of Bengal and form the basis of the present Bangladesh marine trawl fishery. The survey cruise was not designed specifically to investigate prawns. The net is designed to catch both prawns and fish and the duration of the hauls was only 30 minutes. Commercial trawlers use low profile nets, which although not necessarily catching more prawns than the net used during the survey, would certainly catch less fish. However, in spite of the shorter hauls, different gear etc, the results do provide a relative insight into the abundance and distribution of penaeid prawns over the survey area. The major species captured were *Metapenaeus spp. Penaeus monodon, P. semisulcatus and Parapenaeopsis sculptilis.*

Overall, penaeid prawns represented only 2% of the total survey catch, but they represented 5.7% of the 21-30 metre depth zone catch, 3.9% of the 31-50 metre depth zone catch and 14.4% of the 101-200 metre depth zone catch. In general, some prawns were present in practically all hauls, the average catch rate decreasing with depth (Figure 15). The average catch rate in the 21-30 metre depth zone was 8kg/30 minutes trawling. The major apecies in the catch were *Metapenaeus monoceros,* and *Parapenaeopsis sculplilis.* The relationship between these species and depth are illustrated on Figures 16 and 17 respectively.

The prawns were concentrated in two main areas, one in the east, south of Elephant Point and the other in the north west (Figure 27). Those in the eastern area were predominantly *M. monoceros* (Figure 28) While those in the northern sector were mainly *Parapenaeopsis sculptilis.*

3.3.12 Other species

The above list does not exhaust the total number of species/Families that were landed during the survey. Others are shown on Table 1.

Length frequency distributions for some other species not specifically mentioned above are shown on the designated figures below.

Species	Figure
Threadfin (*Polynemus sextarius)*	30
Longspine seabream (*Argyrops spinifer*)	32
Red snapper (*Lutjanus sp.*)	33
Big eye Ilisha (*Ilisha megaloptera*)	34
Blackfin crevalle (*Alepes melanoptera*)	35
Kuweh trevally (*Atropus atropus*)	36
Spotted sicklefish *(Drepane punctata*)	37
White pomfret (*Pampus argenteus*)	38
Hard tail scad (*Megalaspis cordyla*)	41
Round scad (*Decapterus maraudsi*)	43

4 STOCK STANDING ESTIMATION

An estimate of the standing stock present in each of the above depth strata and for the total survey area was made using the "swept area" method. The results are presented on Table 3.

In order to reduce the variance, geometric rather than arithmetic means were used for these analyses (described by Pauly in the report prepared from the FAO Marine Fisheries Resources Survey and Exploratory Fishing Project in Burma FI/DP/BUR/77/003, Field Document 6)

An escapement factor of 50% was used for the calculation of biomass i. e. it was assumed that 50% of the fish in the path of the net avoided capture by escaping through or around the net. Trawls were generally conducted against the current whenever possible at the same engine revolutions and propelier pitch. The average trawling speed was calculated to be 3.0 knots.

As the majority of the catch consisted of "true" demersal species and generally small fish, the "herding" effect of the warps was considered negligible. Thus the average distance between the trawl wing tips, rather than the distance between the otter boards was used for the biomass calculations. This distance was 18.0 metres on average. Using this value, the area swept by the net during a 30 minute trawl was calculated to be 0.111km². As a result, the biomass estimation for the "pelagic" species in particular and by extension, the total biomass also, will be somewhat over estimated.

TABLE 3

Total Density and Biomass

Depth zone (Metres)	Area (Km²)	Density (Kg/Km²)	Density Range	Biomass (M.T.)	Range Biomass	No. of Hauls
10-20	6,861	10,884	17,926	74,676	122,993	6
21-30	3,369	5,821	3,160	19,610	10,646	5
31-50	3,400	10,550	125,988	35,868	428,360	5
51-100	17,710	4,611	14,383	81,667	254,732	29
101-200	10,880	771	1,026	8,388	11,169	4
Total/Average	42,220	5,216	4,826	220,210	208,743	49

Note the large variances associated with the calculations for the separate depth strata. This is particularly evident in the 31-50 metre depth strata. These large variances are due principally to the catches of the "pelagic" species which are usually large, but irregular. These was no abvious relationship between density and depth, although the highest density was found in the shallowest zone and the lowest in the deepest zone, the latter being only around 7% of the former. The average overall density over the survey area was 2.3 m.t. per km². The estimated biomass was 99,000 m.t. ∓ 91,000 m.t. i.e., between 8,000 m.t. and 190,000 m.t. This result is of little practical use.

Prawns demand special attention, as they are of considerable economic importance to Bangladesh. Density and biomass calculation are set out on Table 4 below.

TABLE 4

Density and Biomass — Penaeid prawns

Depth zone (Metres)	Area (Km²)	Density (Kg/km²)	Density Range	Biomass (M.T.)	Range Biomass	No. of Haul
10-20	6,861	0	—	0	—	6
21-30	3,369	147	97	496	327	5
31-50	3,400	108	68	365	230	6
51-100	17,710	17	7	298	119	29
101-200	10,880	46	76	501	830	4
Total/Average	42,220	39	11	1,661	452	49

Note that no prawns were caught in the 10-20 metre depth zone. There was a high variance associated with the calculations for all depth zones. The overall estimate of shrimp biomass present during the survey cruise was 1650 m.t. ∓ 450 m.t. i.e. between 1200 and 2100 m.t.

Discussion about the potential yield of fish and shrimp that could be extracted on a sustained basis from these stocks will be postponed until all cruises in the winter series are completed and a more comprehensive set of data are available upon which to base such a calculation. The above estimations of density, biomass etc should be used with caution, in view of the relatively small number of hauls involved.

5 PELAGIC FISH

The sonar was operated only intermittently during the survey due to the practical problems of maintaining watches at night. The echo sounder was run continuously. As the vessel was either anchored during daylight or drifting there was little opportunity for observing surface schools.

No schools were observed on the sonar. The echo sounder however recorded concentrations of fish and plankton in mid water at "interfaces" between water bodies. The fish rarely concentrated sufficiently at these interfaces to form dense schools, but nevertheless were identifible as discreet aggregations. This phenomenon was not observed during the day survey cruises. Two very large subsurface schools were seen on the echo sounder in the south east of the survey area, although the species concerned could not be established.

Many species of fish, particularly, "pelagic" species are known to make vertical migrations through the water between day and night, usually rising from the bottom at night and returning at morning. This migration was reflected in the catches, where practically no Carangids (scads), anchovies or sardines were caught and except for one large catch in shallow water of Indian mackerel, no Scombrids. All of these Families are generally considered as pelagic fish and are common in the daytime trawl survey catches (see BGD/80/025/CR 1-6). It would appear that these species had risen from the bottom, above the trawl net during this survey cruise.

6 OBSERVATIONS ON THE ACTIVITIES OF COMMERCIAL FISHING VESSELS

Trawling in all shallow coastal waters in Bangladesh, particularly in the areas to the west and south of Cox's Bazar was virtually impossible at night due to activities of several thousand gill net vessels. Trawling in north west section was also hampered by the presence of set bag nets.

Many trawlers were operating in areas less than about 40 metres depth, but particularly in a relatively narrow area off to the eastern coast, adjacent to Elephant Point. Their shoreward and northward movements were prevented by the gill net fleet.

The areas of activity of these commercial fishing vessels are shown on Figure 47. Most vessels were detected by radar.

7 OCEANOGRAPHY

Oceanography per se was not intended to be a major research activity of the survey programme. Nevertheless, as the distribution and abundance of fish in the survey area were likely to be influenced by the seasonable monsoonal discharge of the river systems in particular it was considered useful to measure certain parameters.

Turbidity, as determined using a standard secchi disc was measured at a few stations, at early morning and late afternoon, the vessel usually being anchored during the day. No stations could be sampled at night. The results are shown on Table 5 below and Figure 46. Too few samples were taken to be able to detect any pattern, but generaly the waters in the deeper sections of the survey area appeared to be relatively clear, visibility being 20 and 30 metres. The waters in north and eastern shallow areas were less clear, visibility being generally less than 7 metres.

Surface water temperatures were recorded at all stations. These are shown on Table 5 below. They ranged between 23.3°C and 25.6°C.

TABLE 5
Secchi disc and surface water temperature measurements
(see also Figure 46)

Date	Latitude Deg.	Min.	Longitude Deg.	Min.	Surface temp. (Deg C)	Secchi depth (M.)
010285	21	14	91	37	23.9	5.0
010285	21	2	91	12	24.6	
010285	20	22	91	14	23.9	
010285	20	53	91	10	24.4	
020285	20	56	90	48	24.0	
020285	21	2	90	50	23.6	
020285	21	8	90	54	23.4	
020285	21	11	90	53	24.2	4.0
020285	21	11	90	45	23.8	
020285	21	12	90	34	23.6	
030285	21	9	90	32	23.4	
030285	21	13	90	12	23.4	
030285	21	21	90	3	23.3	
030285	21	21	89	51	24.3	4.3
030285	21	29	89	41	24.0	
040285	21	7	89	45	25.0	
040285	21	9	89	58	23.6	
040285	20	52	89	56	24.5	26.0
040285	20	41	90	8	24.3	22.0
040285	20	40	90	14	24.2	
040285	20	45	90	19	24.6	
050285	20	48	90	22	24.8	
050285	20	50	90	22	24.6	
050285	20	54	90	21	23.6	
050285	20	42	90	30	24.4	28.0
050285	20	35	90	42	24.6	27.0
050285	20	31	90	55	24.7	
050285	20	27	90	57	24.8	
060285	20	32	90	58	24.7	
060285	20	40	90	57	24.1	
060285	20	42	91	3	24.3	28.0
060285	20	51	91	29	24.2	26.0

TABLE 5 (CONTD)

Date	Latitude Deg.	Min	Longitude Deg.	Min	Surface temp, (Deg C)	Secchi Depth (M)
060285	20	45	91	40	24.5	
070285	20	35	91	37	24.4	
070285	20	29	91	30	24.6	
070285	20	32	91	35	25.0	
070285	20	15	91	28	25.6	23.5
070285	20	10	91	16	25.1	
080285	20	14	91	30	25.4	
080285	20	7	91	34	25.3	
080285	20	15	91	44	24.0	
080285	20	38	92	3	24.0	7.0
080285	20	35	92	4	23.8	
090285	20	42	91	56	23.7	
090285	20	44	91	53	23.6	
090285	20	44	91	48	24.2	
090285	20	49	91	47	22.8	25.0
090285	20	55	91	57	23.5	6.0
090285	21	3	91	48	24.5	
090285	21	3	91	43	24.5	

8. COMPARISON WITH OTHER CRUISE RESULTS.

As this was the first night trawling cruise conducted there were no previous cruises with which to compare these results.

When compared with the most recent daylight trawling cruise, cruise No. 6 (cruise number 7 was a non scientific cruise), then several differences were apparent:

There were considerably less of the "pelagic" species present in the night hauls, as mentioned in Section 5 above. Also, individual species or Families tended to dominate the catches in each depth zone. This was also described in Section, 3.2.1.6. This situation had been observed during some of the daytime survey cruises, but in these cases, the species involved were generally schooling, pelagic species and was the result of one or two large hauls of that species. On this cruise, the species concerned were those usually associated with the bottom and their catch rates were more consistent.

The same relationship between depth and density was observed on both this and previous cruises.

Penaeid prawns were considerably more abundant during this cruise than on previous cruises. In fact, the average catch rate during this cruise was 12 times that of the most recent daylight cruise, Cruise No. 6. This is most probably due to a behavioural change in the prawns between day and night, rather than to any real change in abundance.

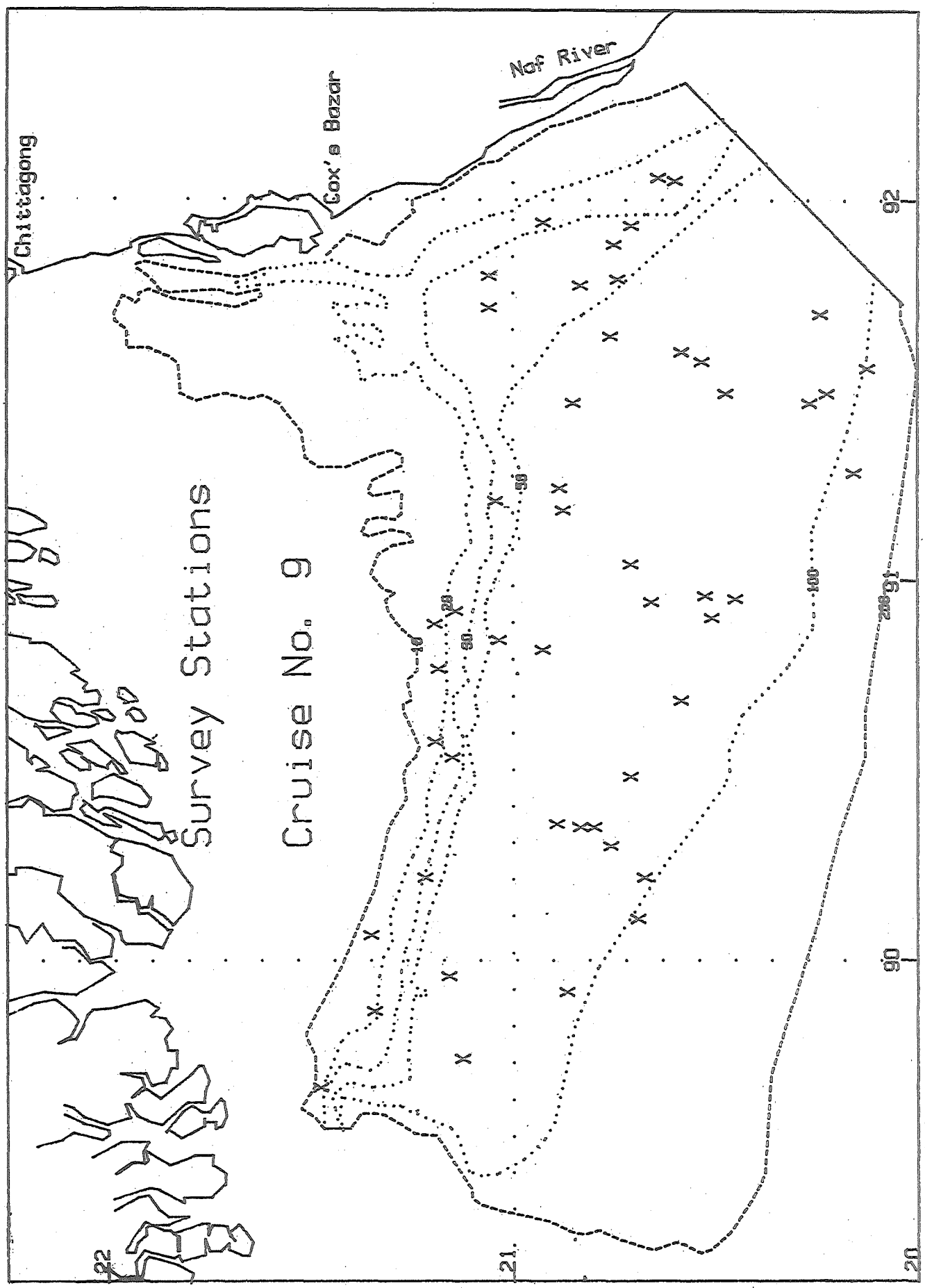

Chittagong
Cox's Bazar
Naf River
Survey Stations
Cruise No. 9
22
21
20
92
91
90
40
50
60
100
200

FIG.1

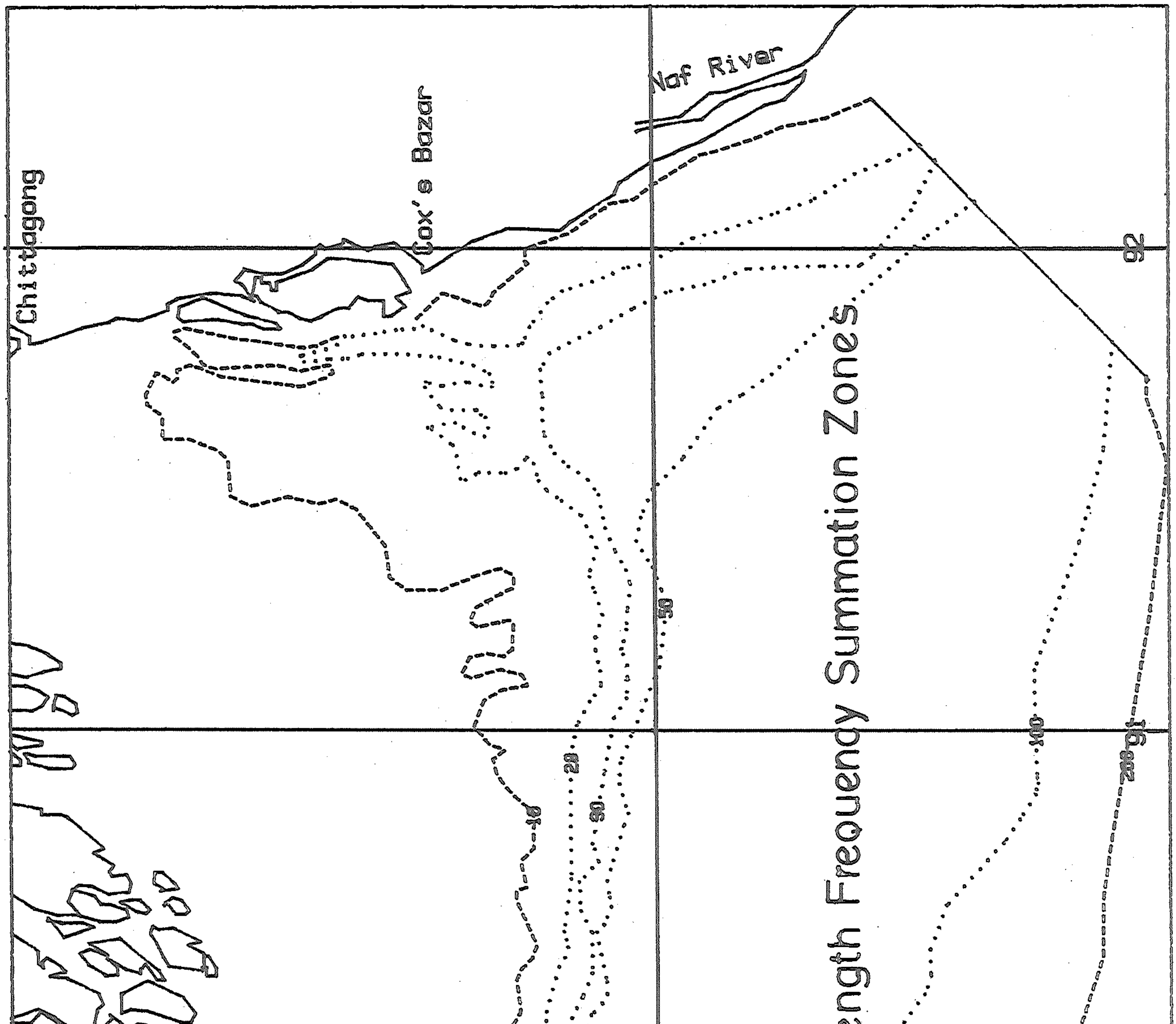

Chittagong
Cox's Bazar
Naf River
Length Frequency Summation Zones
Swatch of No Ground
10
20
50
50
100
200
92
91
90
22
21
20

FIG. 2

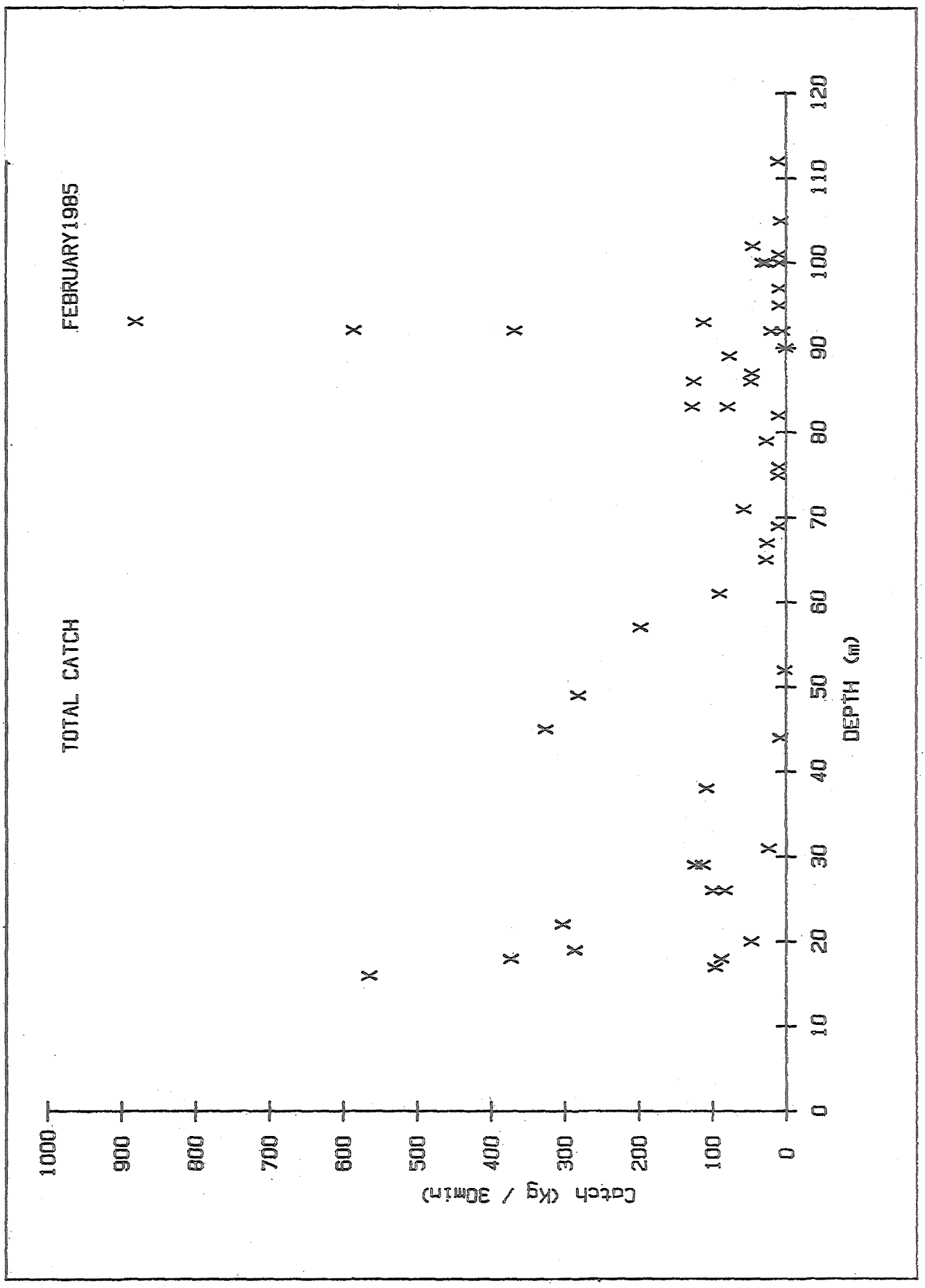

TOTAL CATCH
FEBRUARY1985
Catch (Kg / 30min)
1000
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
110
120
DEPTH (m)

FIG.3

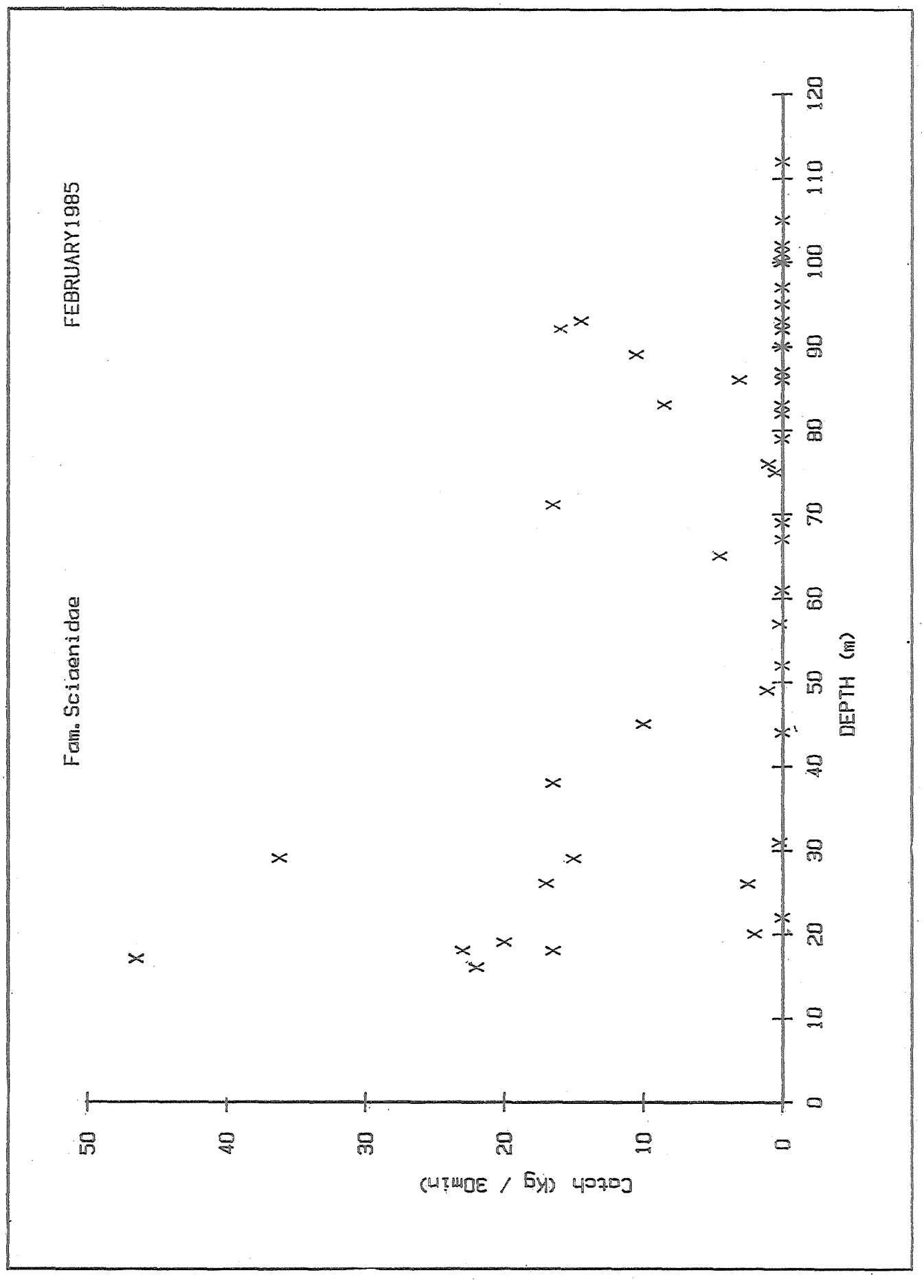

FEBRUARY1985
Fam. Sciaenidae
Catch (kg / 30min)
0
10
20
30
40
50
DEPTH (m)
0
10
20
30
40
50
60
70
80
90
100
110
120

FIG. 4

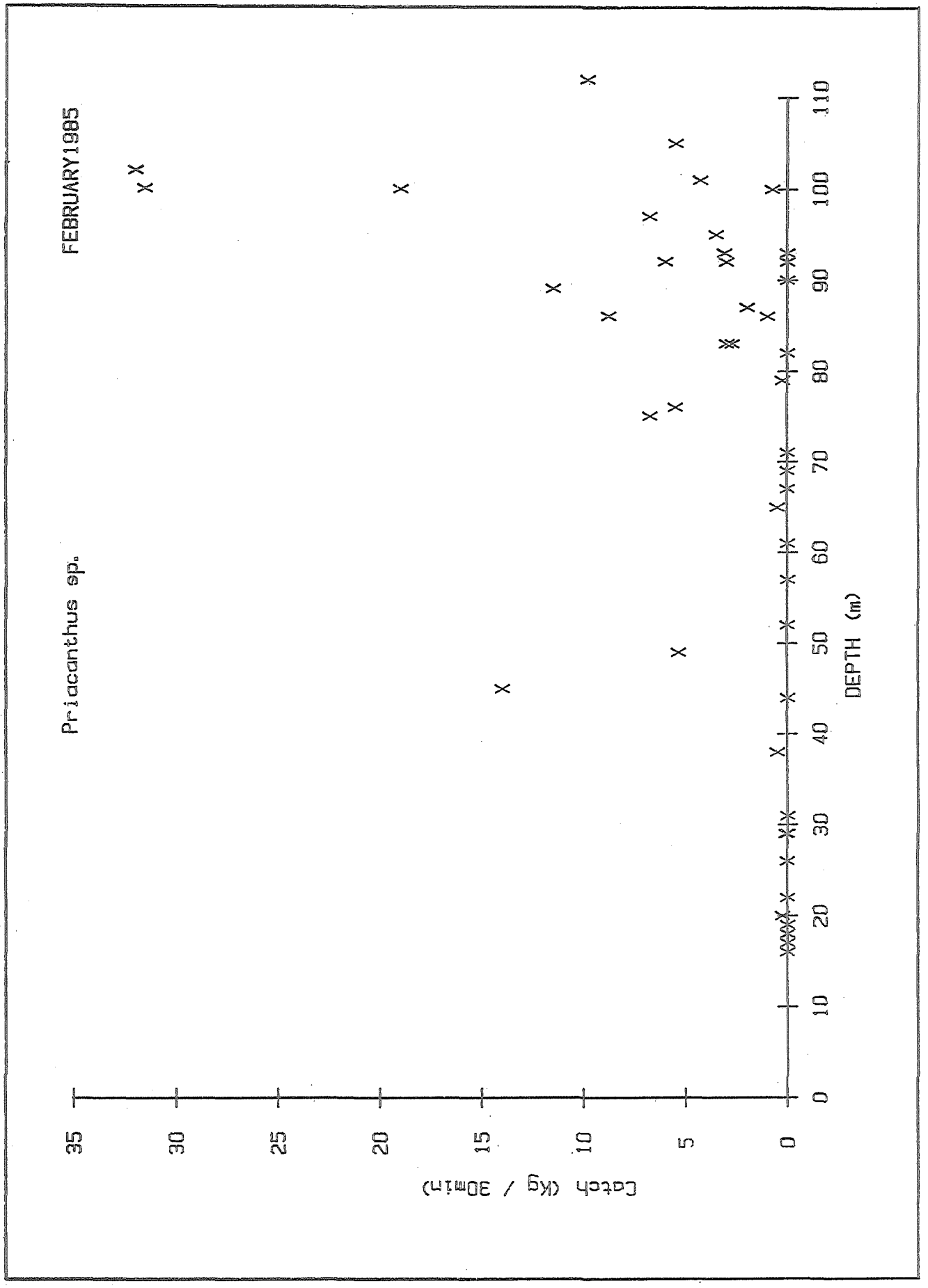

FEBRUARY1985
Priacanthus sp.
Catch (kg / 30min)
0
5
10
15
20
25
30
35
DEPTH (m)
0
10
20
30
40
50
60
70
80
90
100
110

FIG. 5

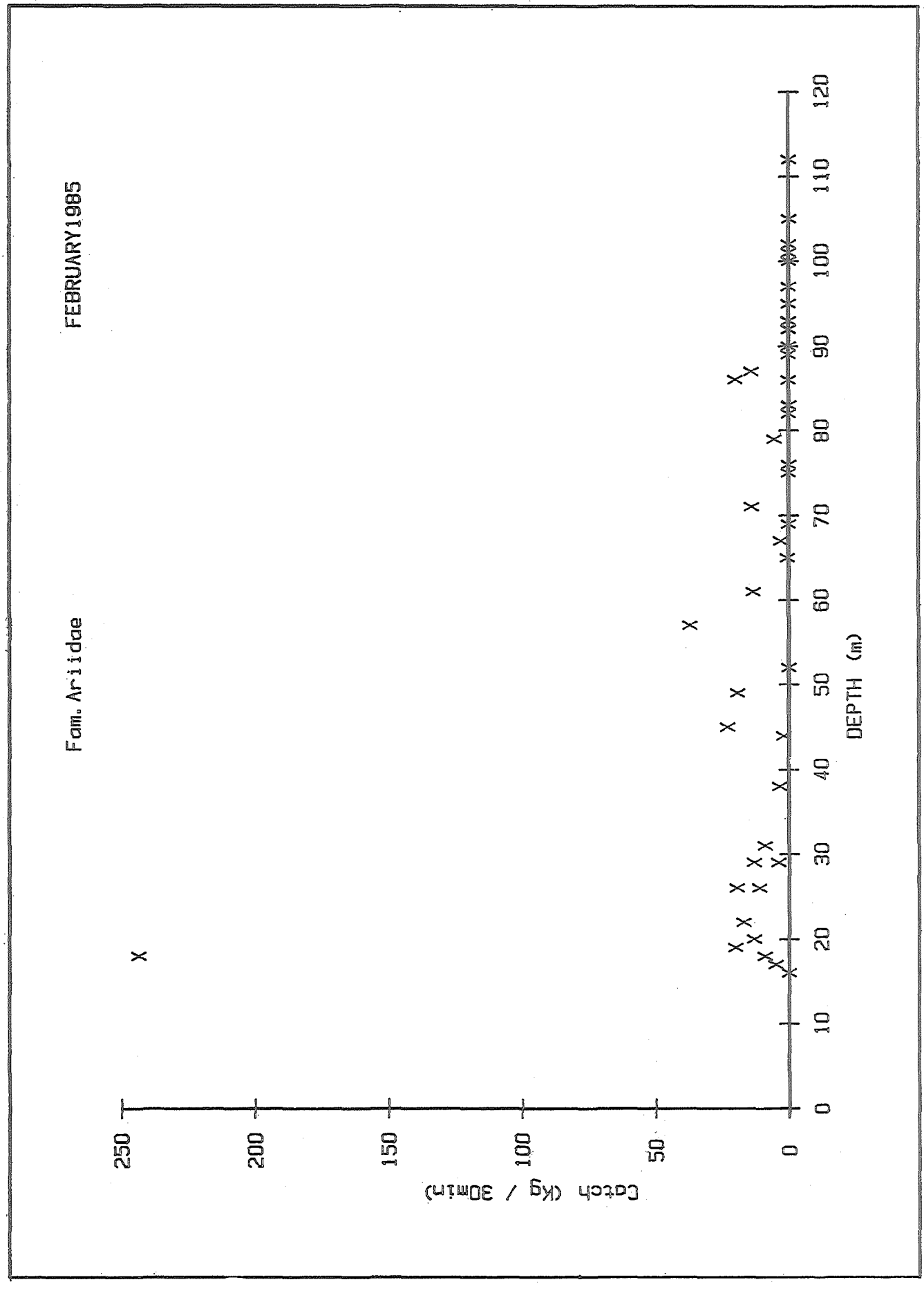

FEBRUARY1985
Fam. Ariidae
Catch (kg / 30min)
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
110
120
DEPTH (m)

FIG. 6

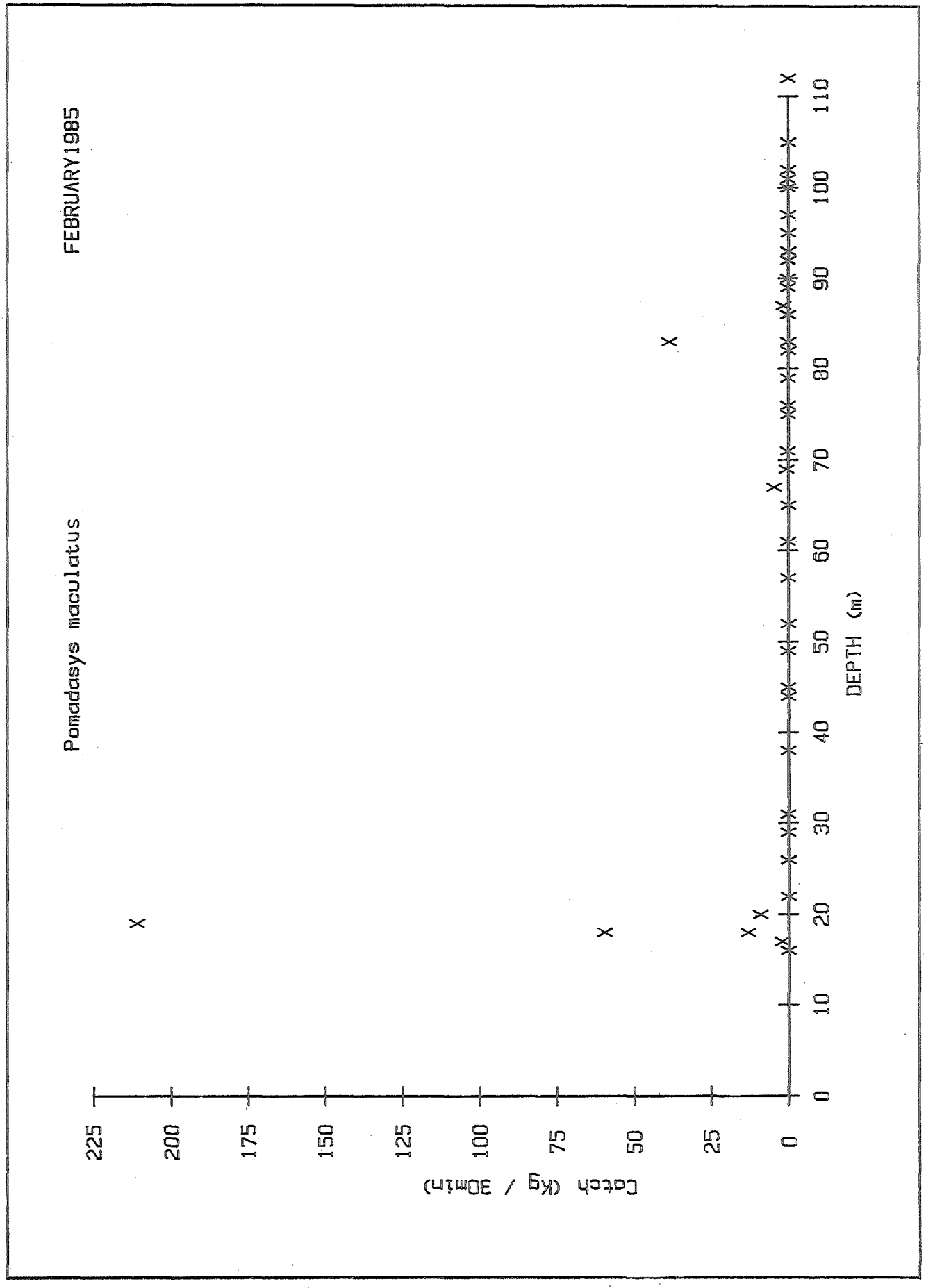

Pomadasys maculatus
FEBRUARY1985
Catch (kg / 30min)
225
200
175
150
125
100
75
50
25
0
0
10
20
30
40
50
60
70
80
90
100
110
DEPTH (m)

FIG.7

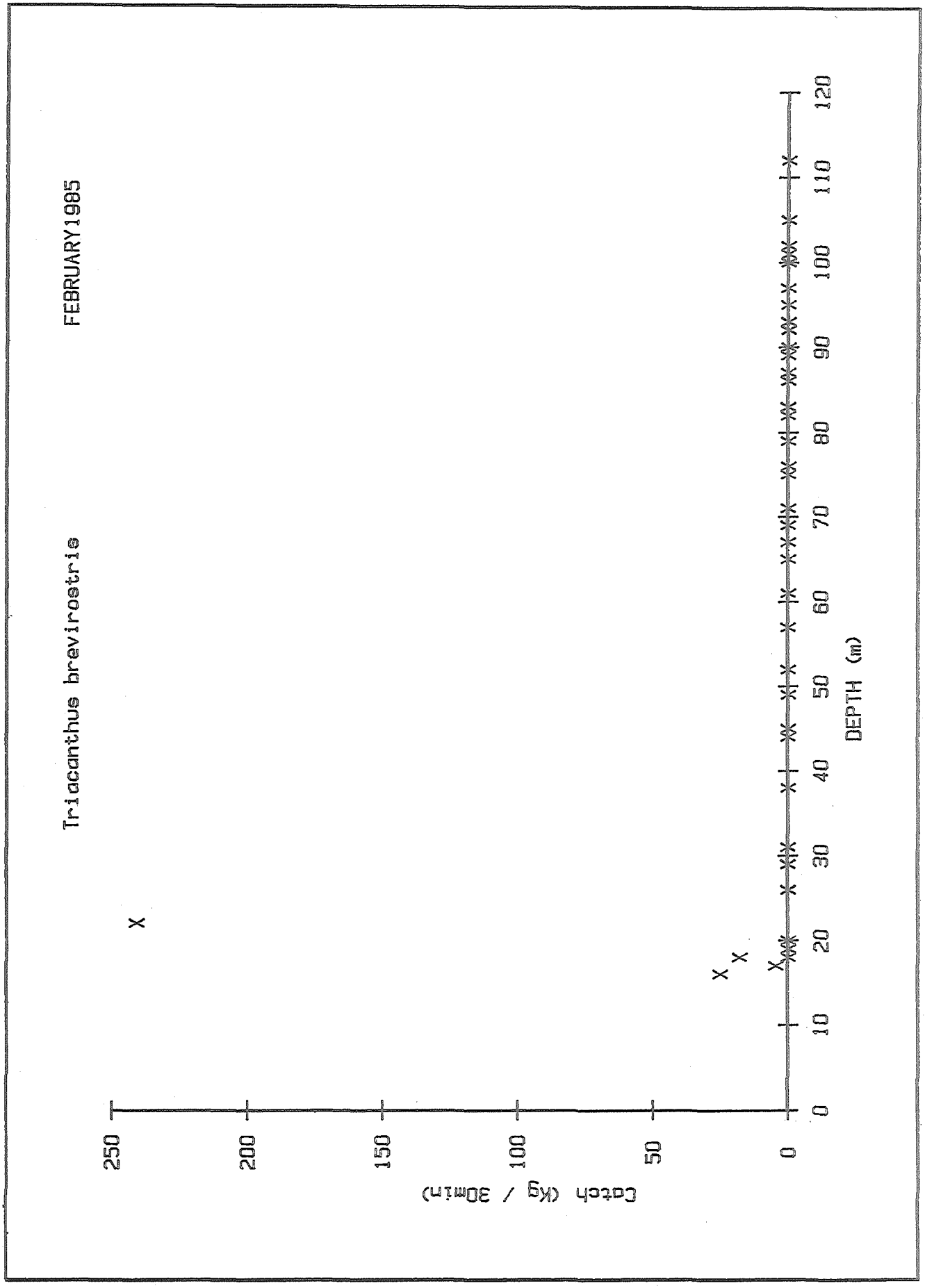

Triacanthus brevirostris
FEBRUARY1985
Catch (Kg / 30min)
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
110
120
DEPTH (m)

FIG. 8

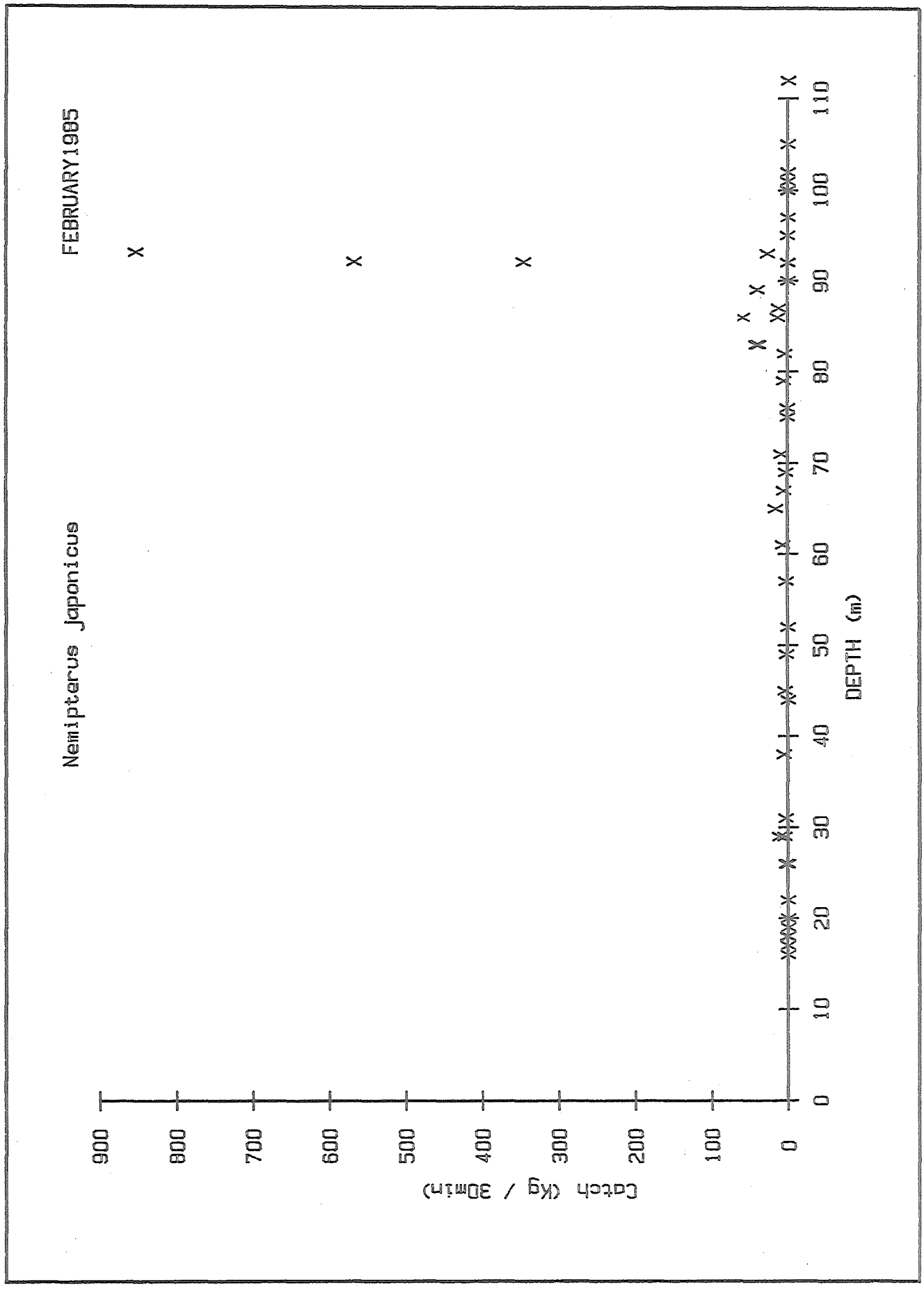

FEBRUARY1985
Nemipterus japonicus
Catch (Kg / 30min)
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
80
90
100
110
DEPTH (m)

FIG. 9

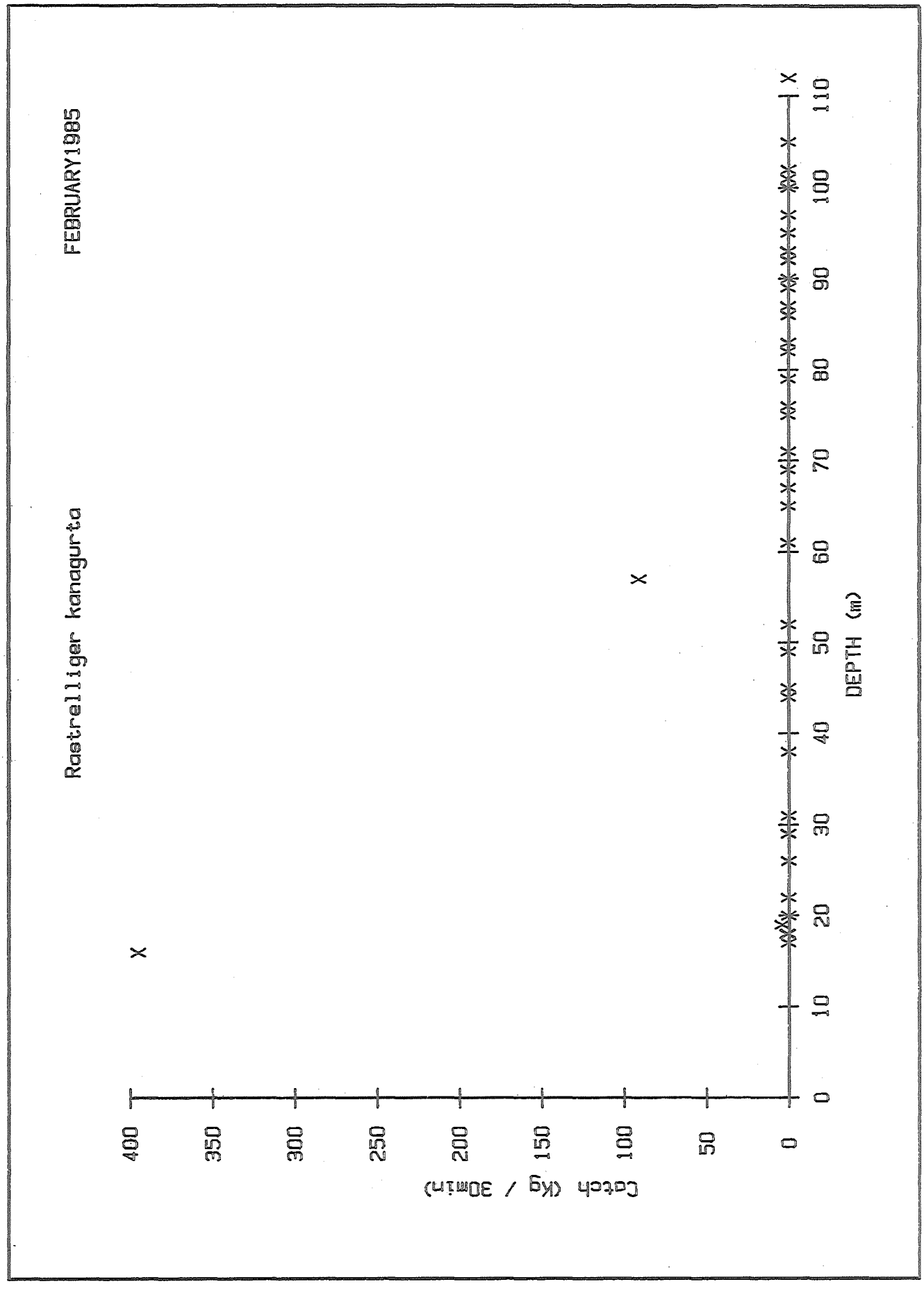

Rostrelliger kanagurta
FEBRUARY1985
Catch (Kg / 30min)
400
350
300
250
200
150
100
50
0
0
10
20
30
40
50
60
70
80
90
100
110
DEPTH (m)

FIG.10

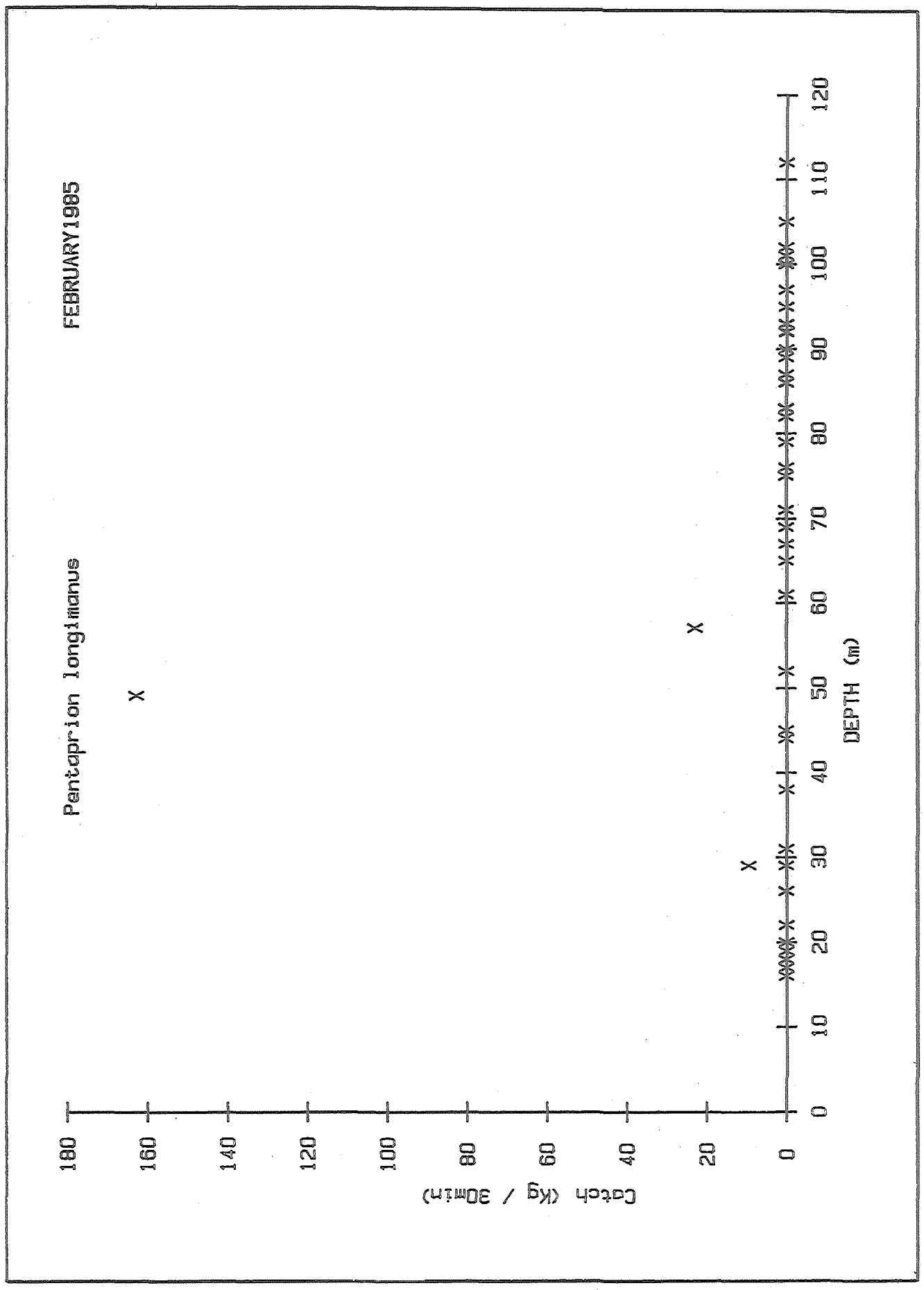

FEBRUARY1985
Pentaprion longimanus
Catch (kg / 30min)
DEPTH (m)
0
20
40
60
80
100
120
140
160
180
0
10
20
30
40
50
60
70
80
90
100
110
120

FIG. 11

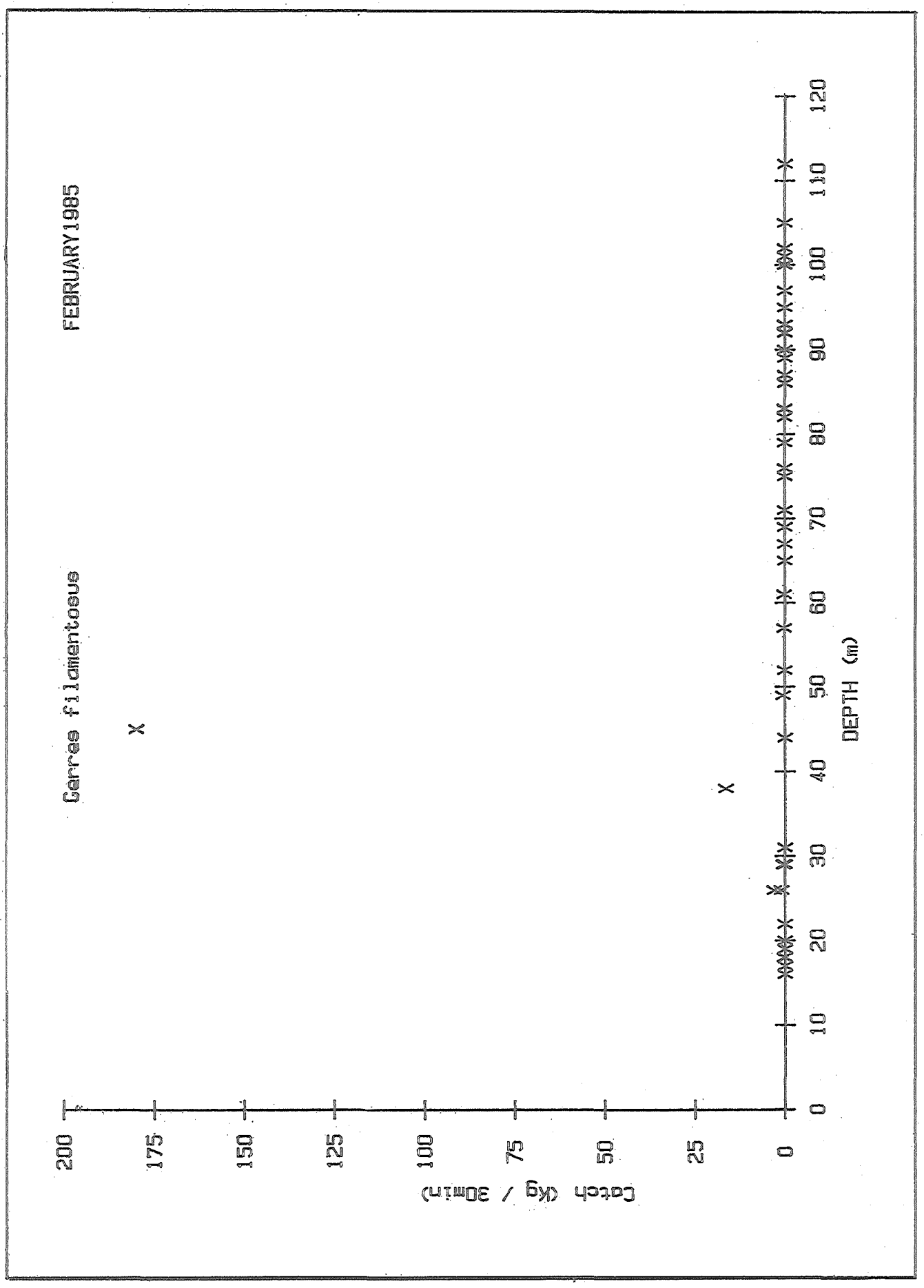

FEBRUARY1985
Serres filamentosus
Catch (kg / 30min)
DEPTH (m)
0
25
50
75
100
125
150
175
200
0
10
20
30
40
50
60
70
80
90
100
110
120

FIG.12

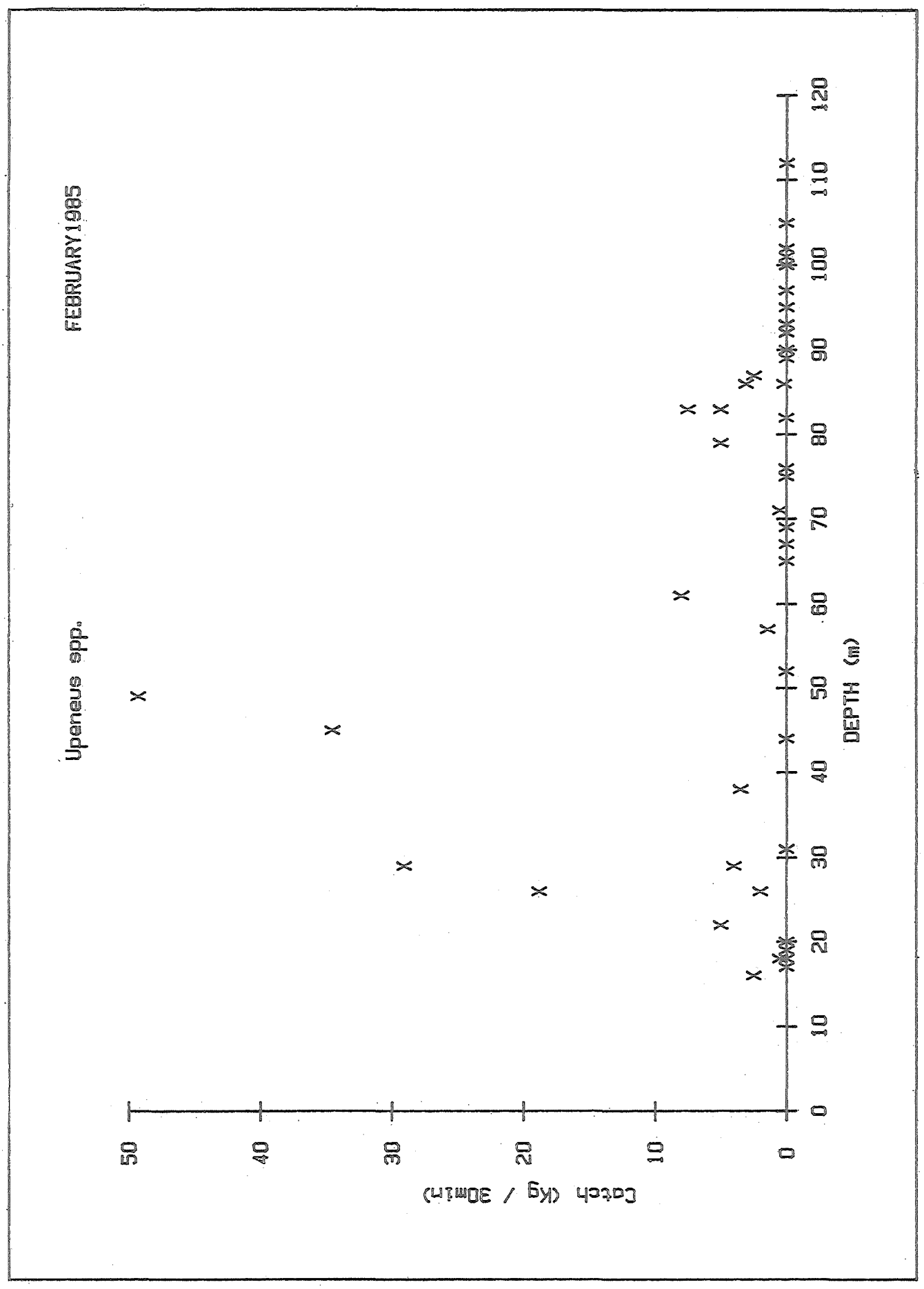

FEBRUARY1985
Upeneus spp.
Catch (kg / 30min)
0
10
20
30
40
50
DEPTH (m)
0
10
20
30
40
50
60
70
80
90
100
110
120

FIG.13

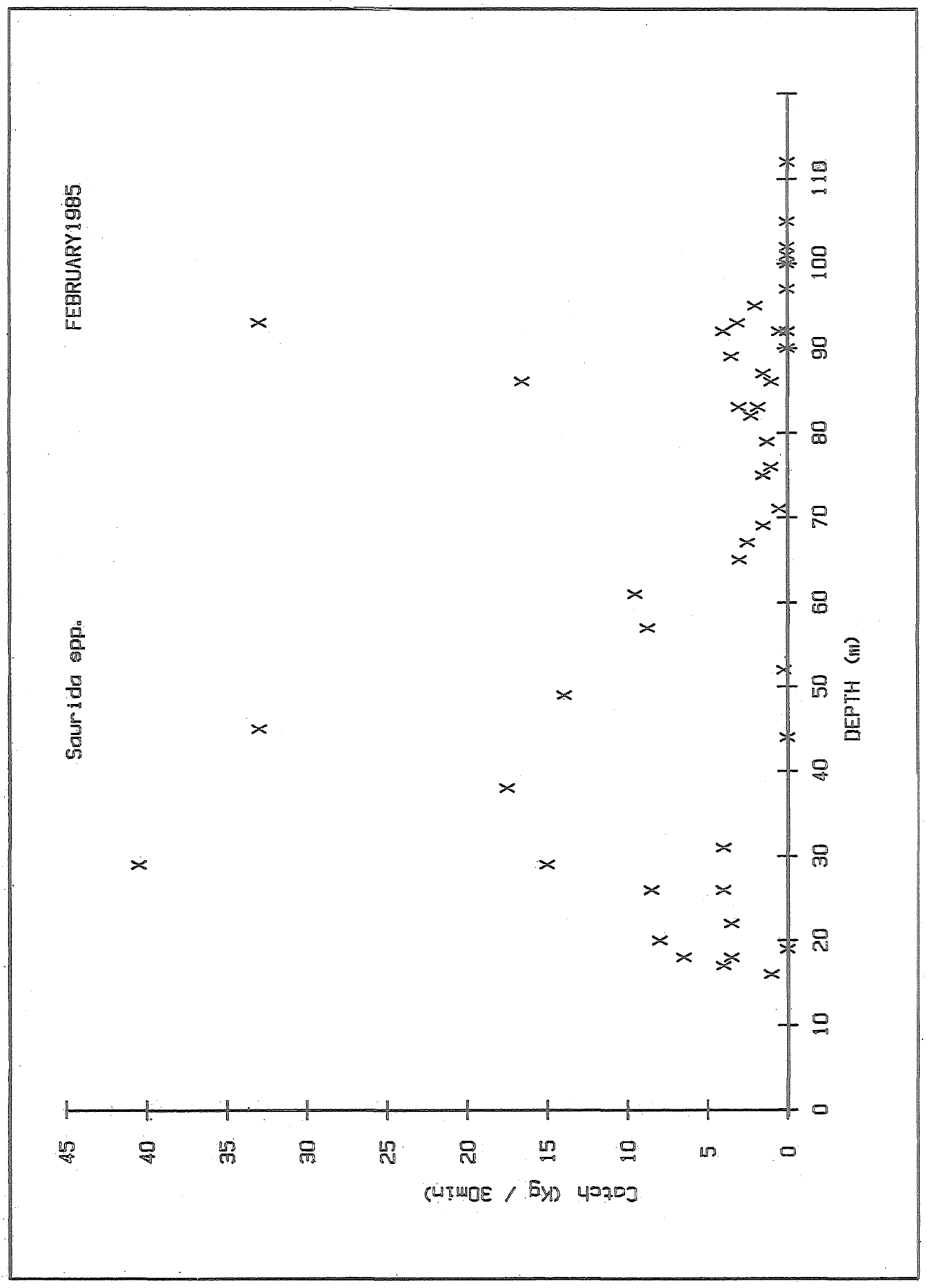

FEBRUARY1985
Saurida spp.
Catch (Kg / 30min)
DEPTH (m)
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90
100
110

FIG.14

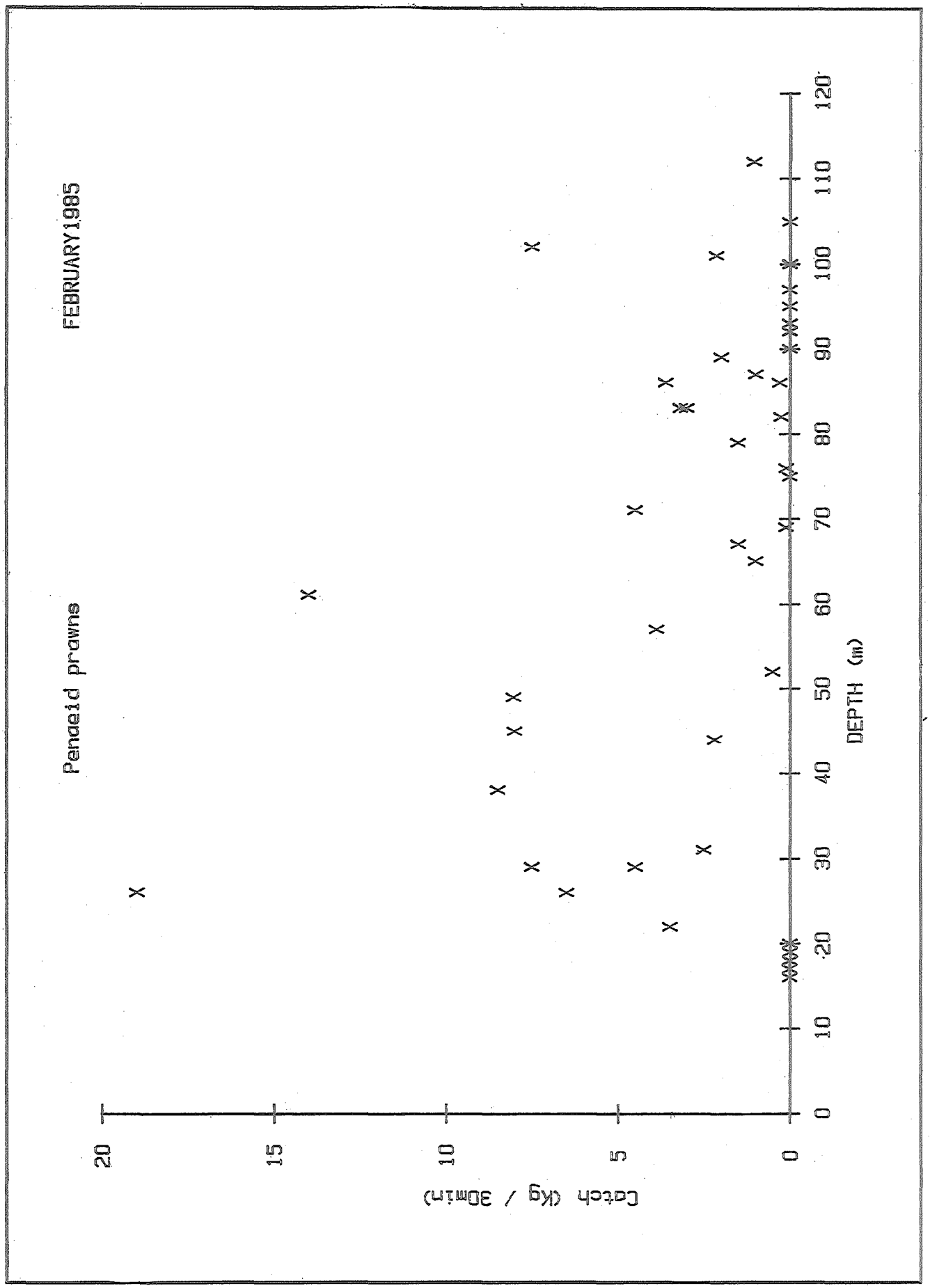

FEBRUARY1985
Pendeid prawns
Catch (kg / 30min)
0
5
10
15
20
DEPTH (m)
0
10
20
30
40
50
60
70
80
90
100
110
120

FIG.15

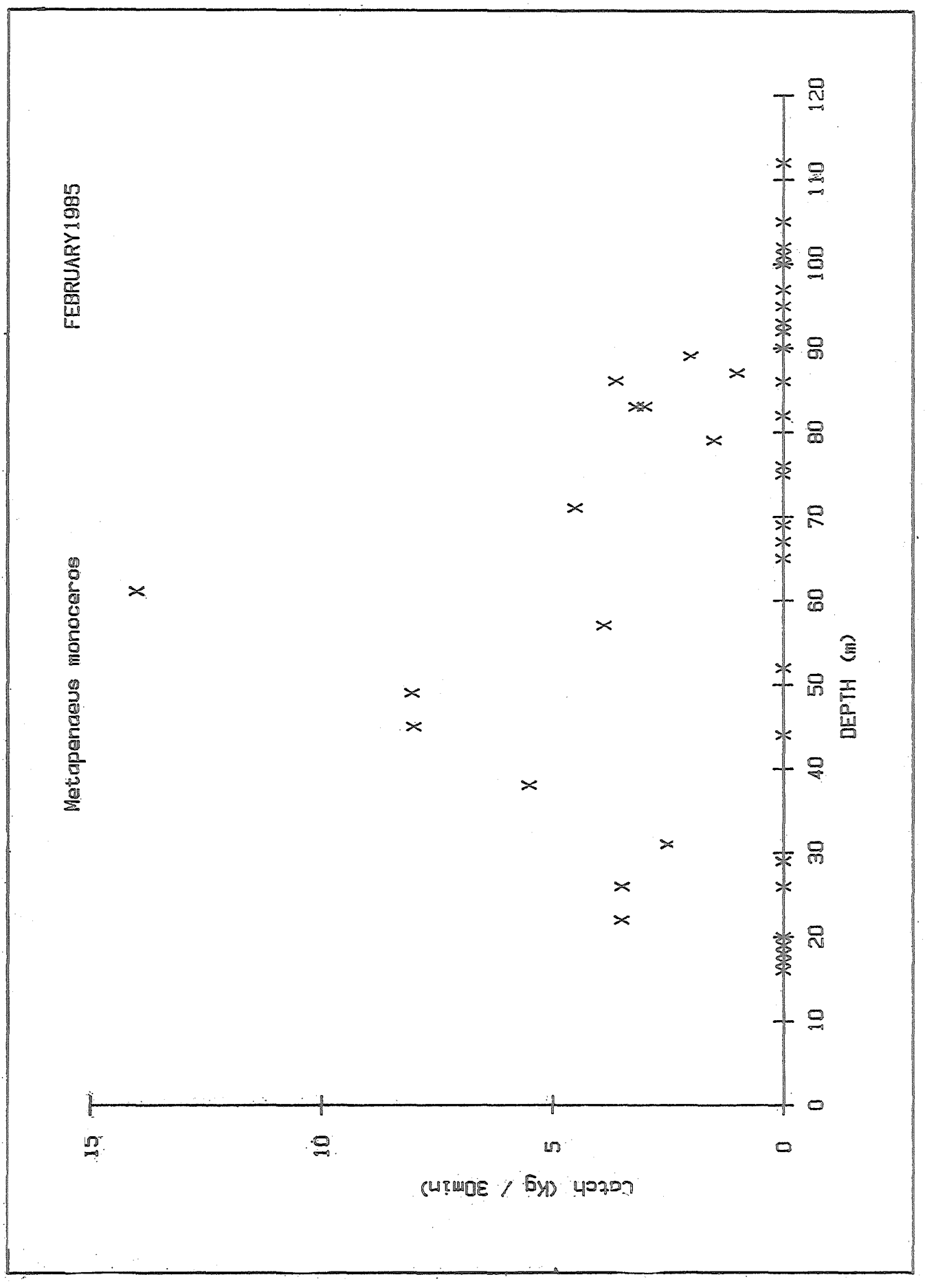

FEBRUARY1985
Metapenaeus monoceros
Catch (kg / 30min)
15
10
5
0
0
10
20
30
40
50
60
70
80
90
100
110
120
DEPTH (m)

FIG.16

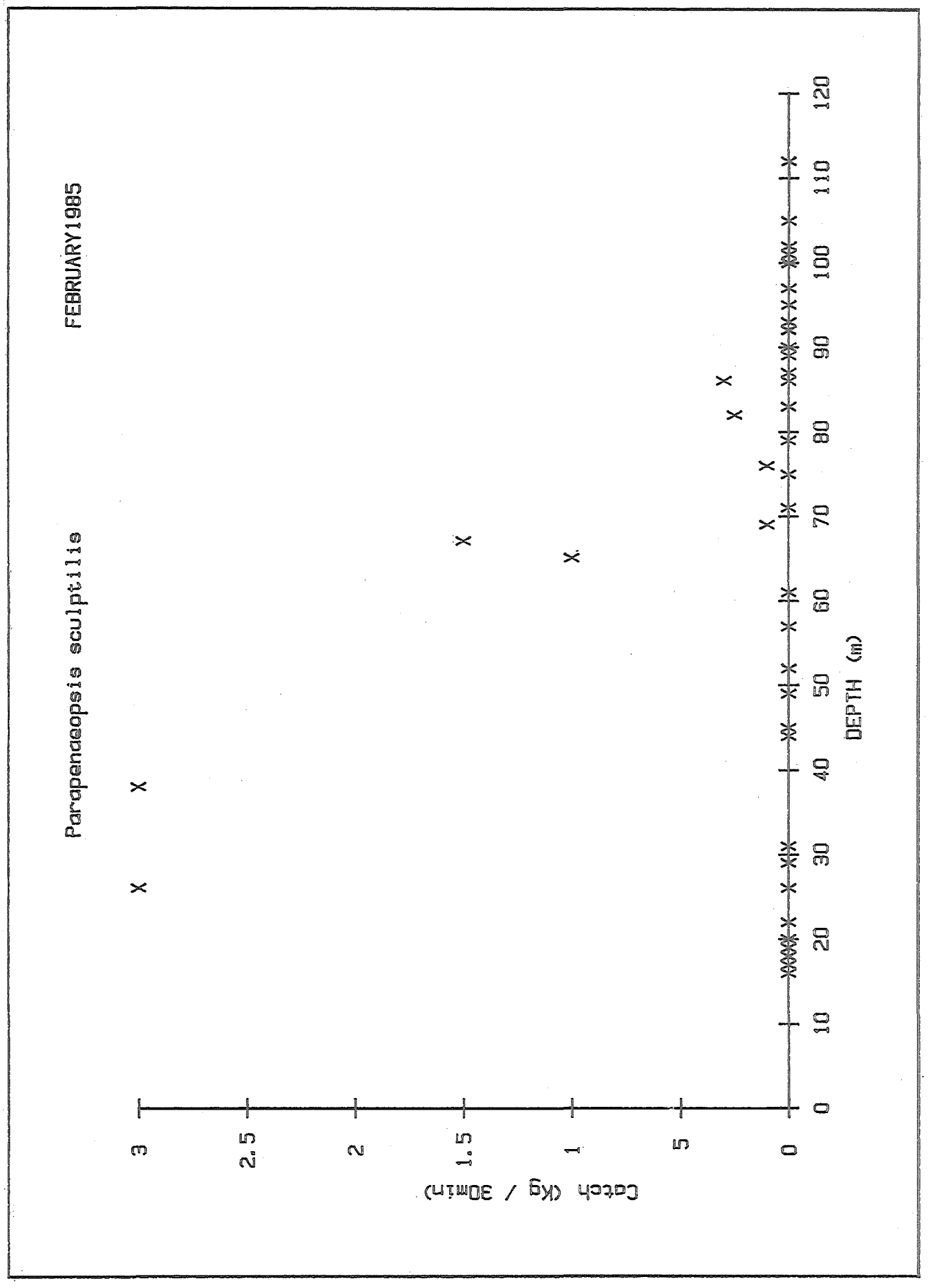

Parapercopsis sculptilis
FEBRUARY1985
Catch (Kg / 30min)
DEPTH (m)
0
10
20
30
40
50
60
70
80
90
100
110
120
5
1
1.5
2
2.5
3

FIG.17

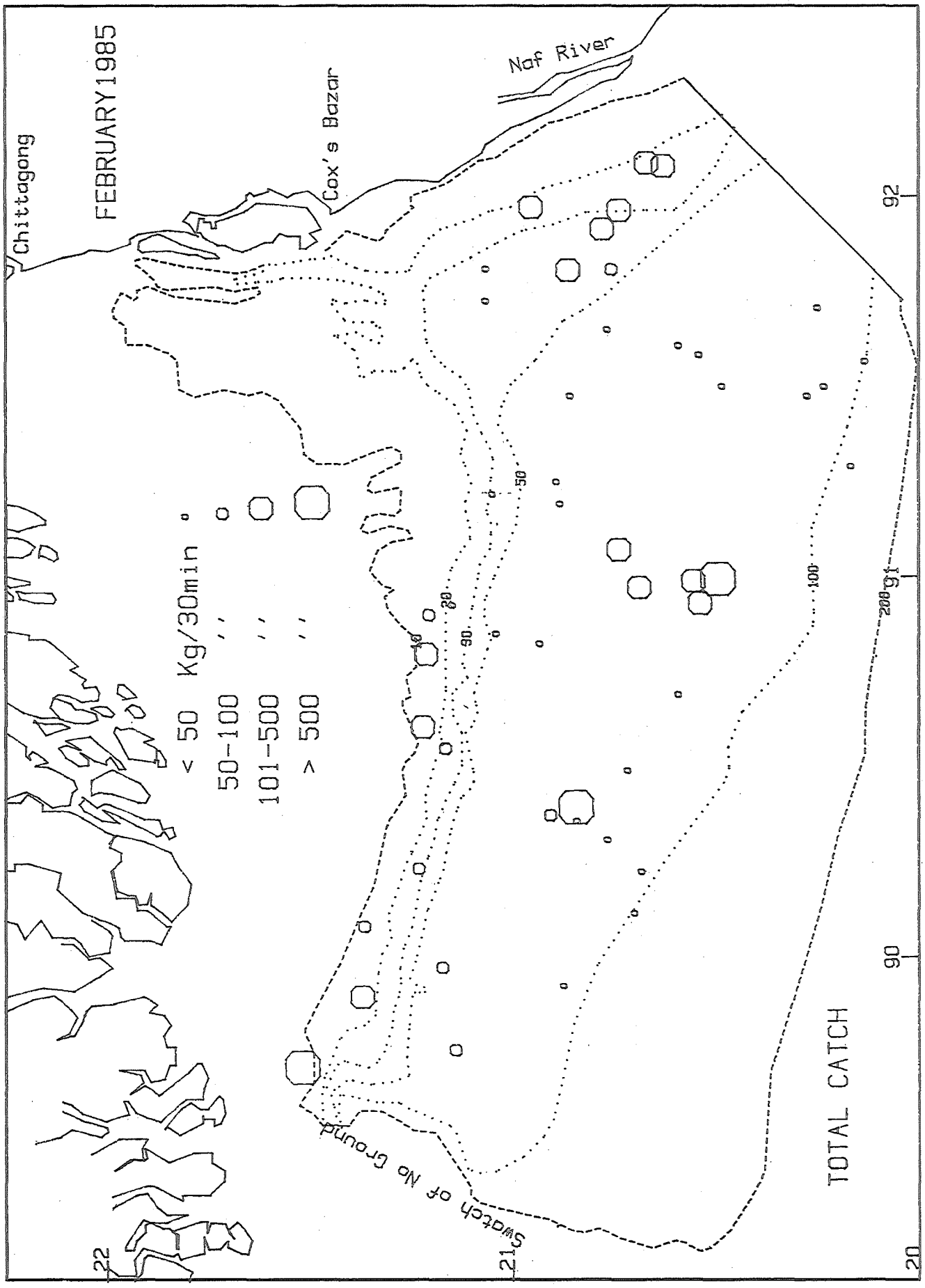

FEBRUARY1985
Chittagong
Cox's Bazar
Naf River
< 50 Kg/30min
50-100 ,,
101-500 ,,
> 500 ,,
Swatch of No Ground
TOTAL CATCH
92
91
90
20
21
22
50
80
90
100
200
gt

FIG.18

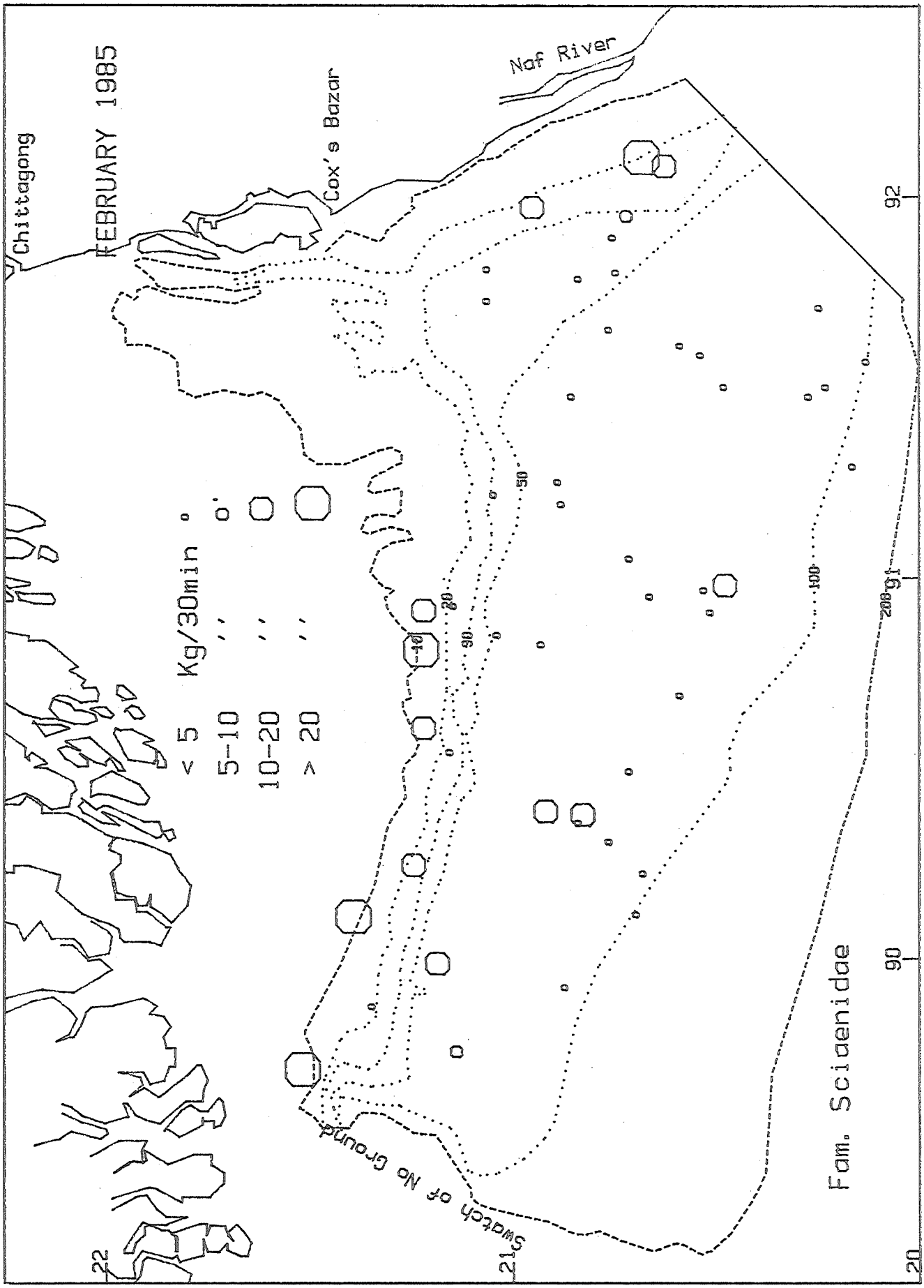

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 5 Kg/30min
5-10 ''
10-20 ''
> 20 ''
Fam. Sciaenidae
Swatch of No Ground
22
21
20
91
92
90
10
20
50
100
200

FIG.19

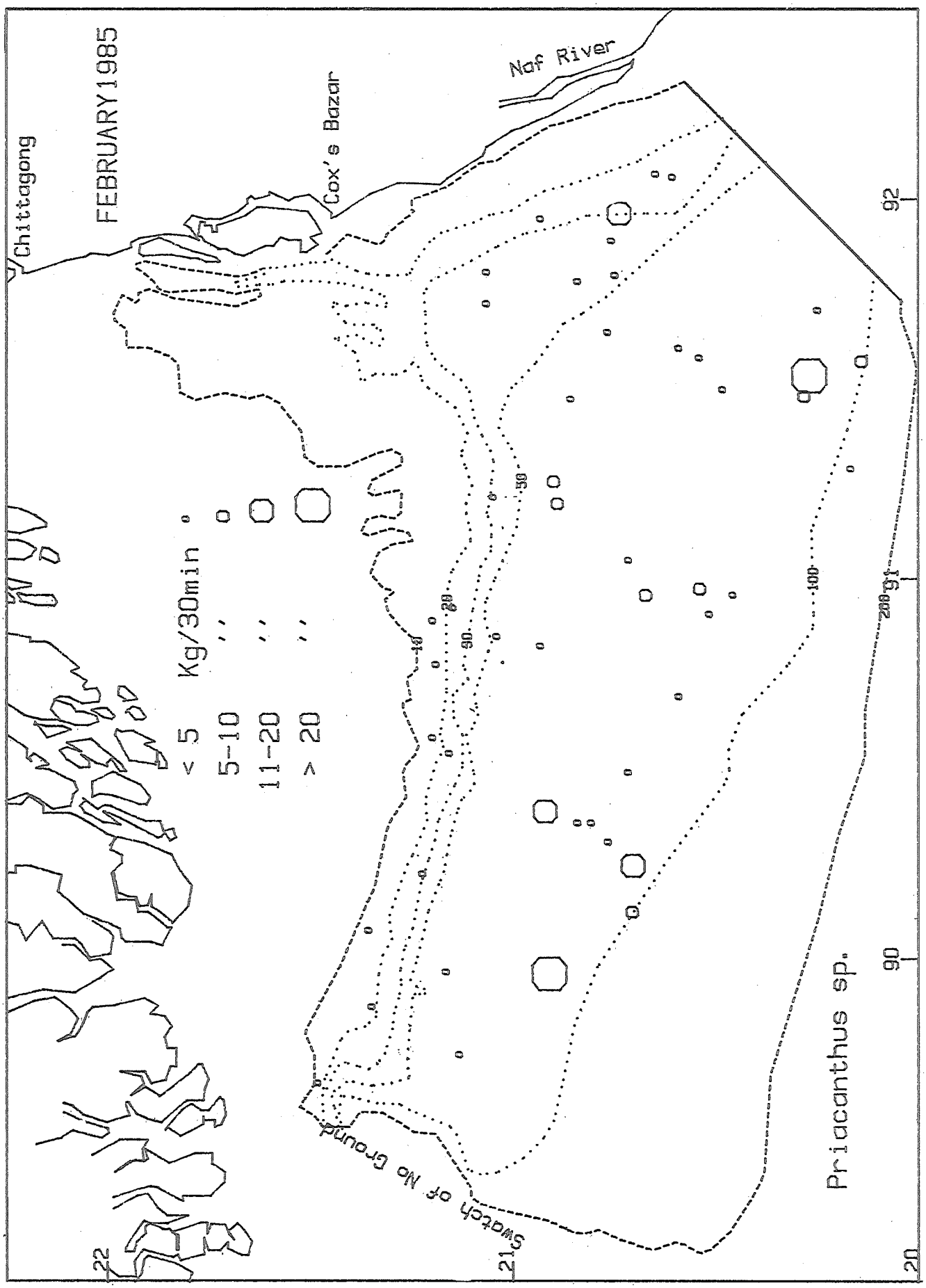

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 5 Kg/30min
5-10 ,,
11-20 ,,
> 20 ,,
Priacanthus sp.
Swatch of No Ground
22
21
20
92
91
90
10
20
30
50
100
200

FIG. 20

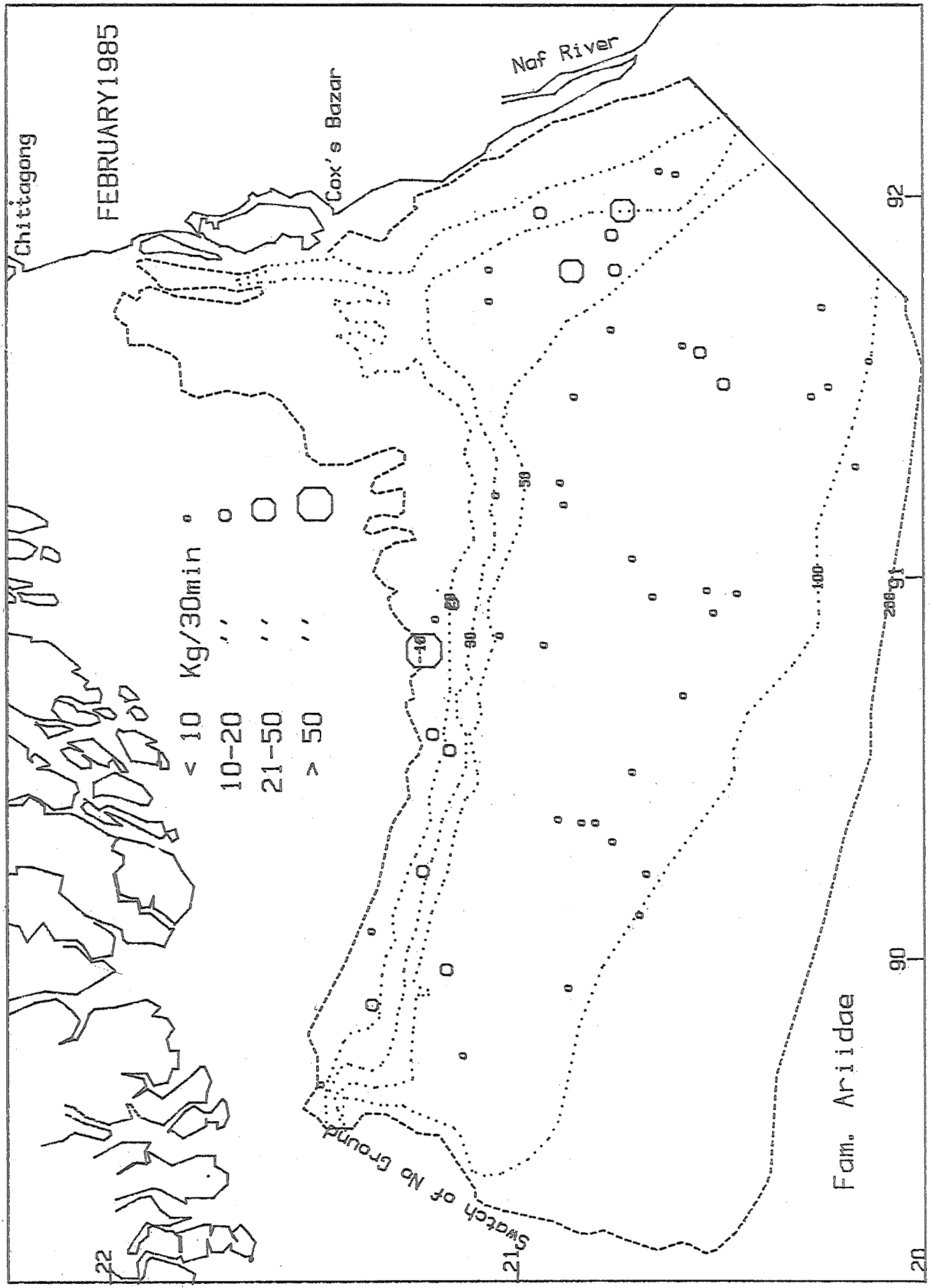

FEBRUARY1985
Chittagong
Cox's Bazar
Naf River
< 10 Kg/30min
10-20 ''
21-50 ''
> 50 ''
Swatch of No Ground
Fam. Ariidae
22
21
20
92
91
90
10
30
50
100
200

FIG. 21

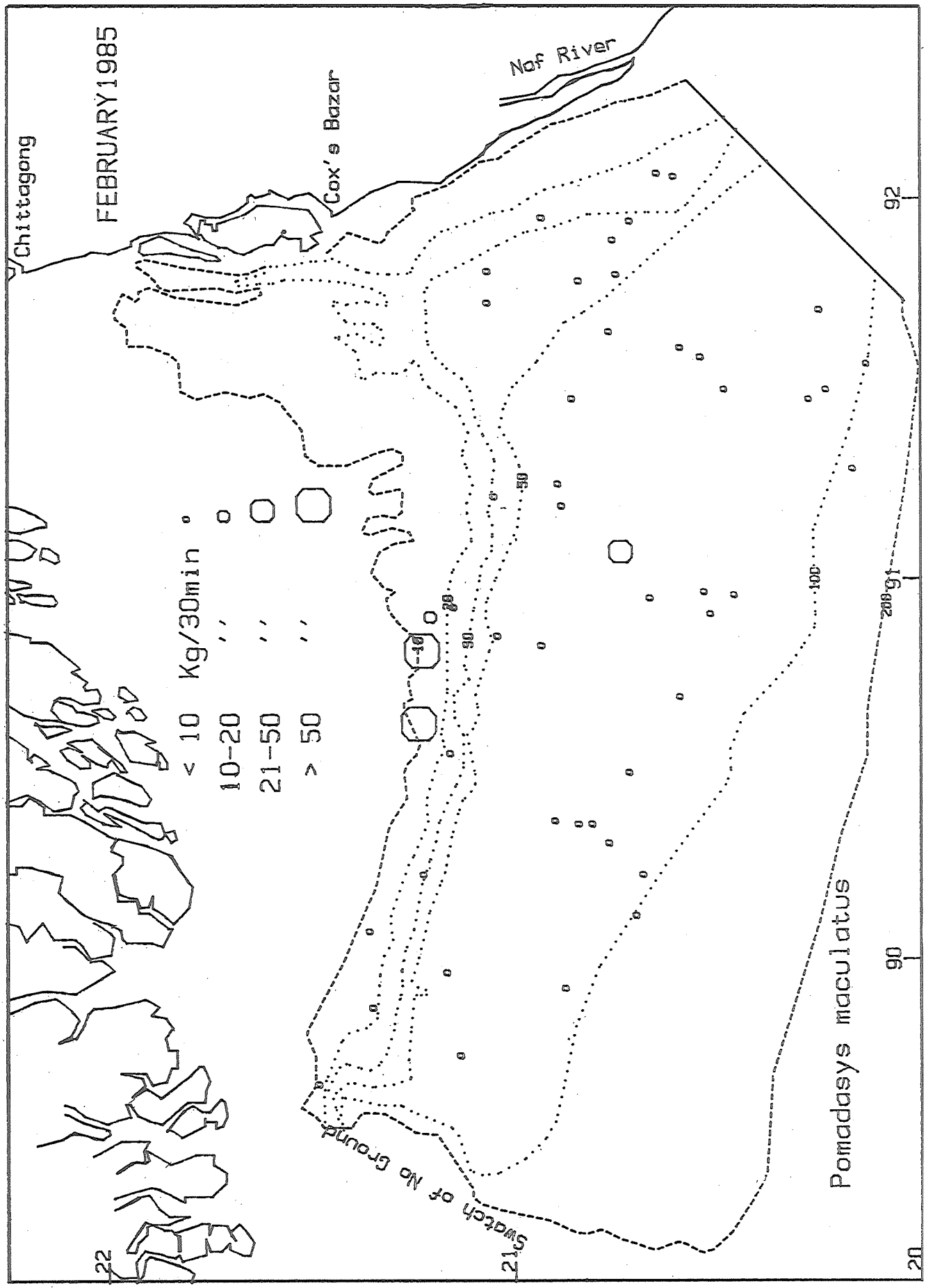

FEBRUARY1985
Chittagong
Cox's Bazar
Naf River
< 10 Kg/30min
10-20 ,,
21-50 ,,
> 50 ,,
Swatch of No Ground
Pomadasys maculatus
22
21
20
92
91
90
10
20
50
100
200

FIG. 22

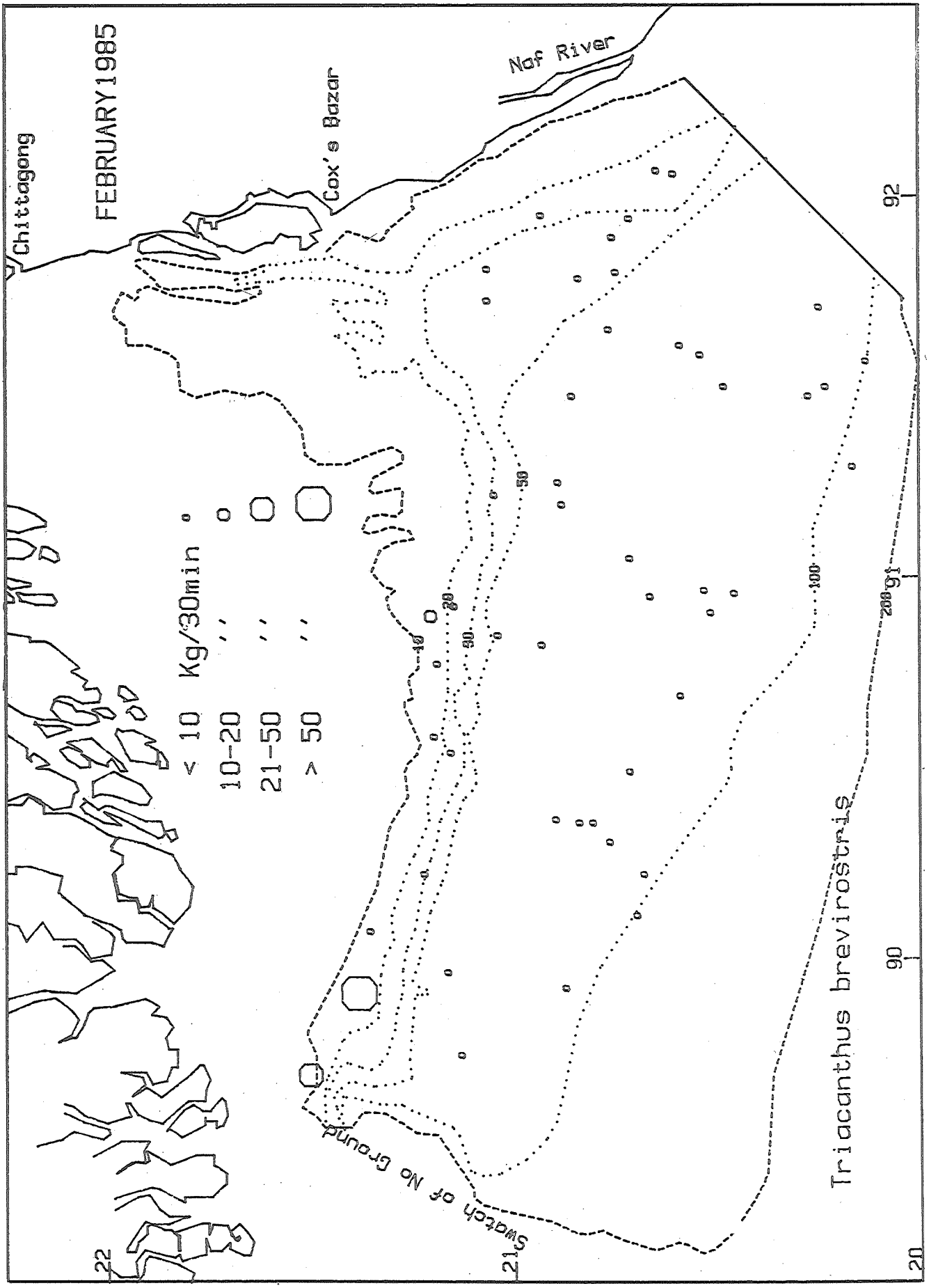

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 10 Kg/30min
10-20 ,,
21-50 ,,
> 50 ,,
10
20
50
100
200 gt
Triacanthus brevirostris
Watch of No Ground
22
21
20
90
92

FIG. 23

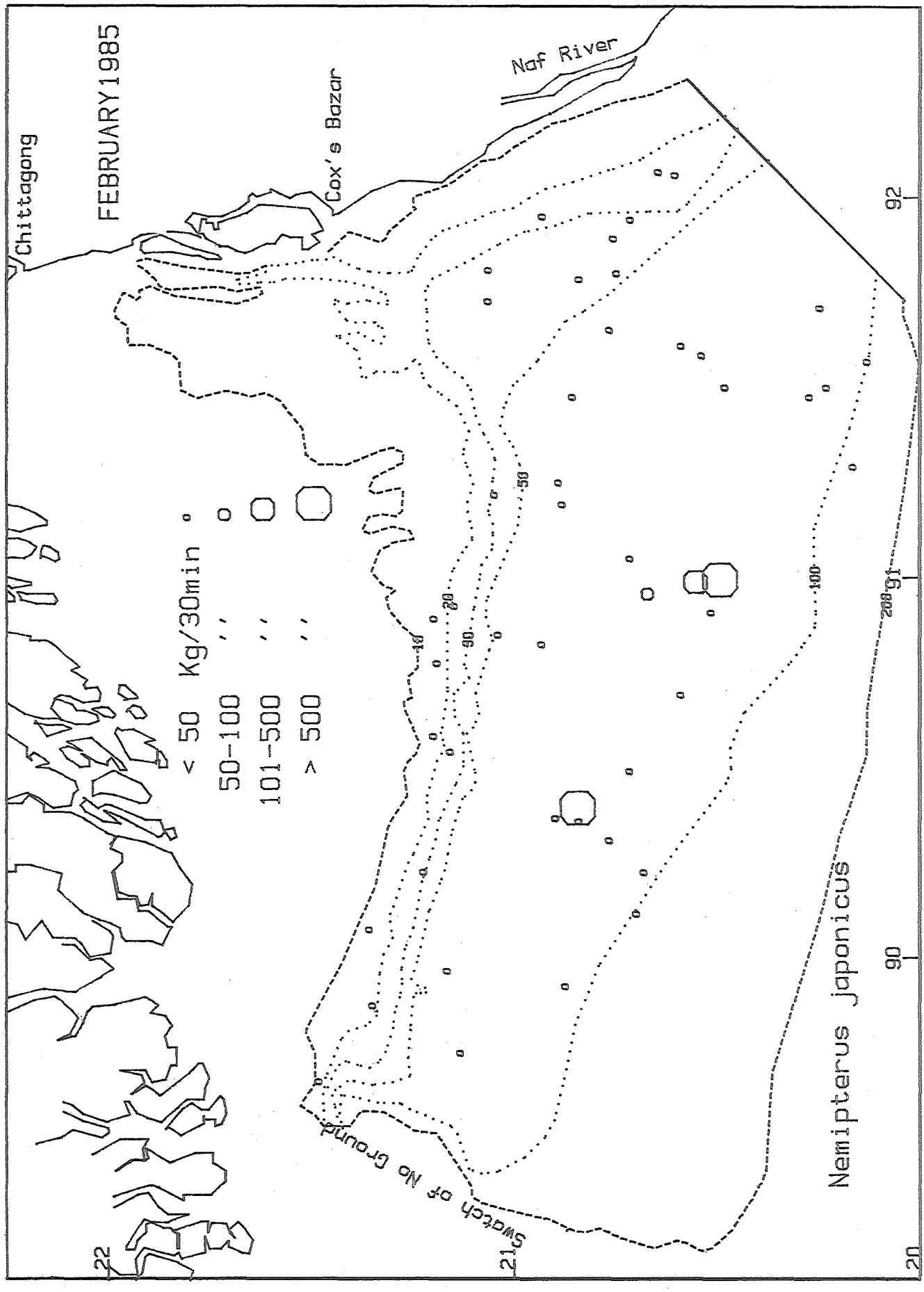

FEBRUARY1985
Chittagong
Cox's Bazar
Naf River
< 50 Kg/30min °
50-100 ,,
101-500 ,,
> 500 ,,
Swatch of No Ground
Nemipterus japonicus
22
21
20
90
91
92
10
20
50
100
200

FIG. 24

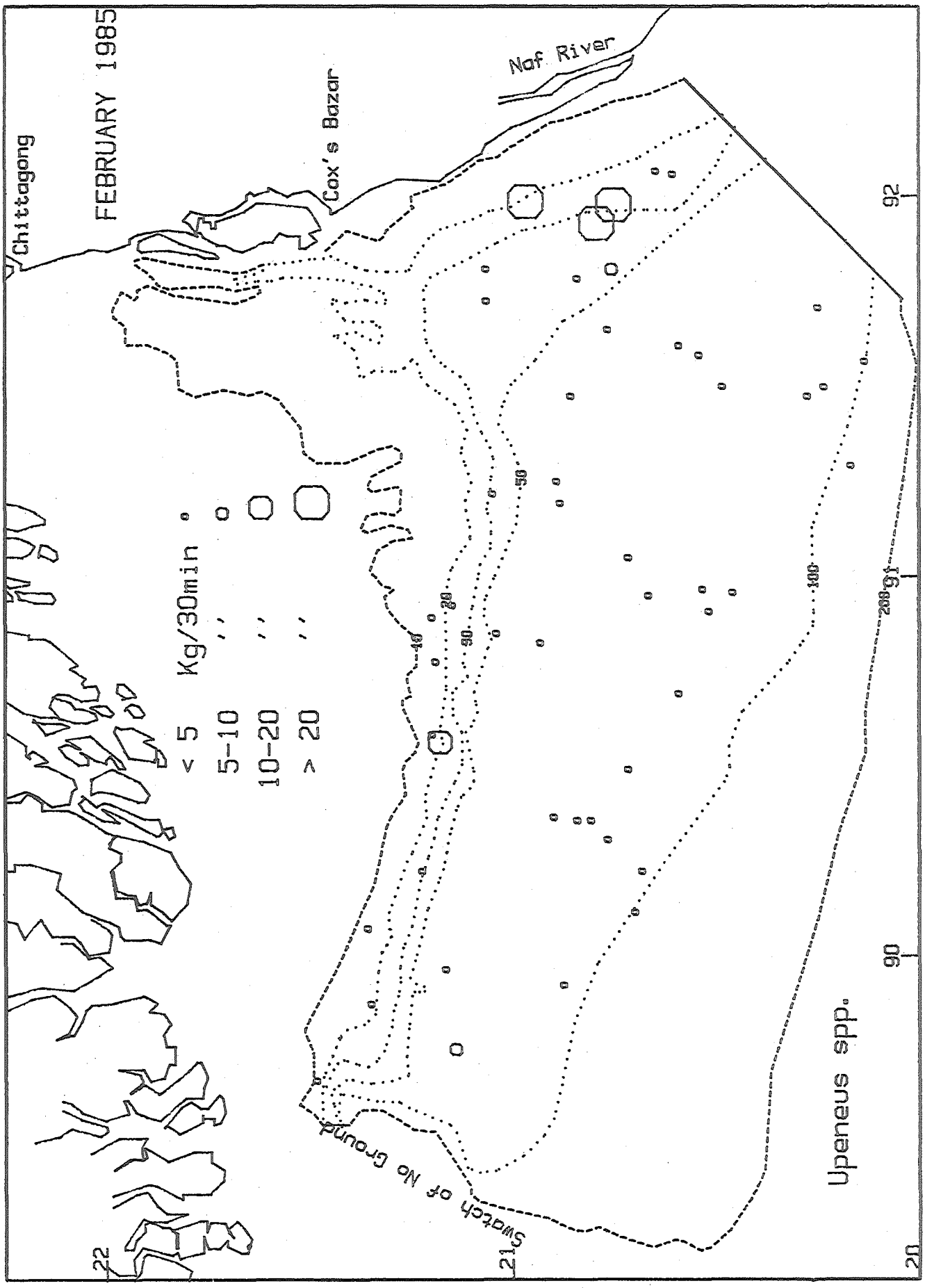

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 5 Kg/30min
5-10 ,,
10-20 ,,
> 20 ,,
Swatch of No Ground
Upeneus spp.
22
21
20
92
91
90
50
100
200

FIG. 25

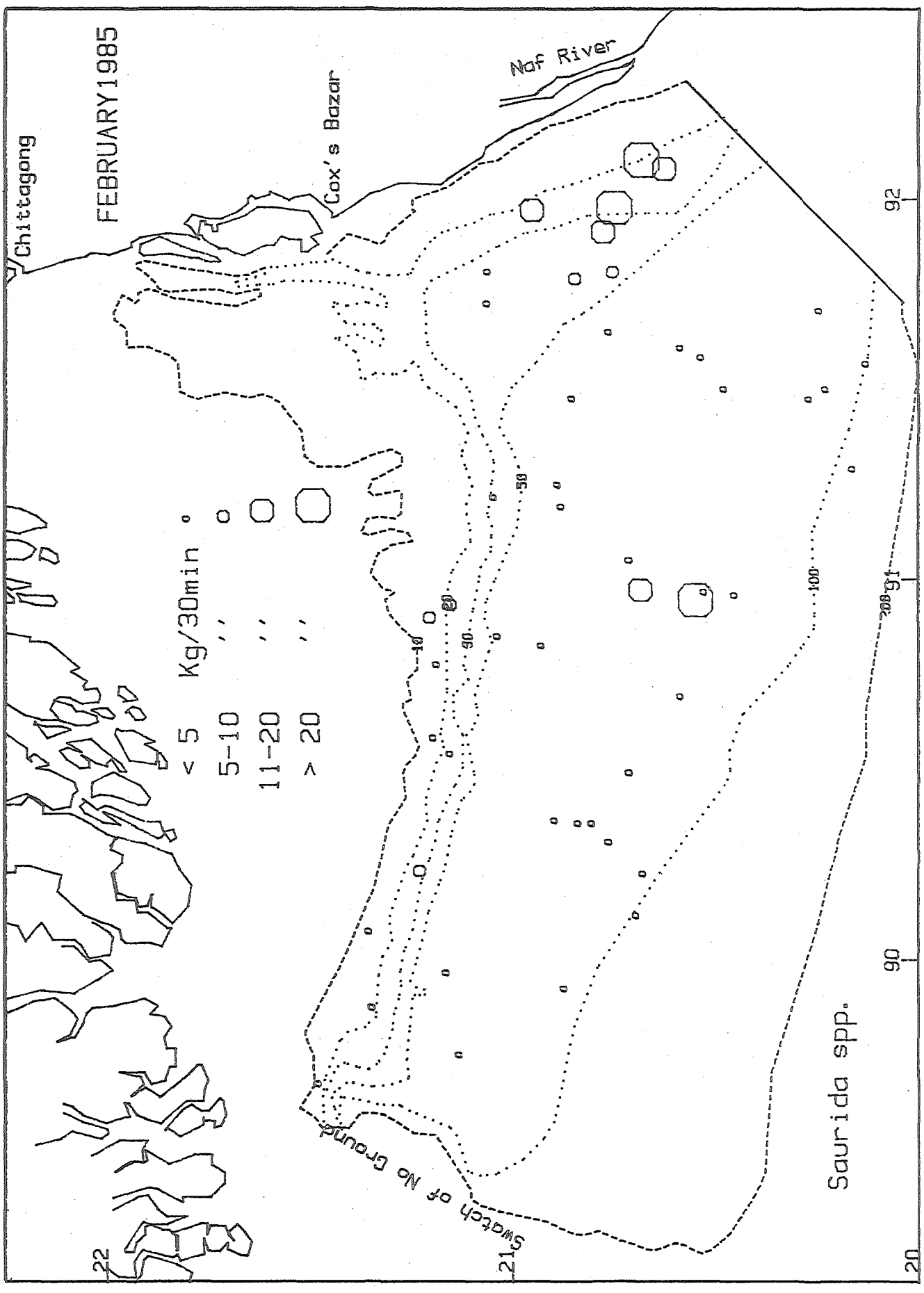

FEBRUARY1985
Chittagong
Cox's Bazar
Naf River
< 5 Kg/30min
5-10 ,,
11-20 ,,
> 20 ,,
Swatch of No Ground
Saurida spp.
22
21
20
90
91
92

FIG.26

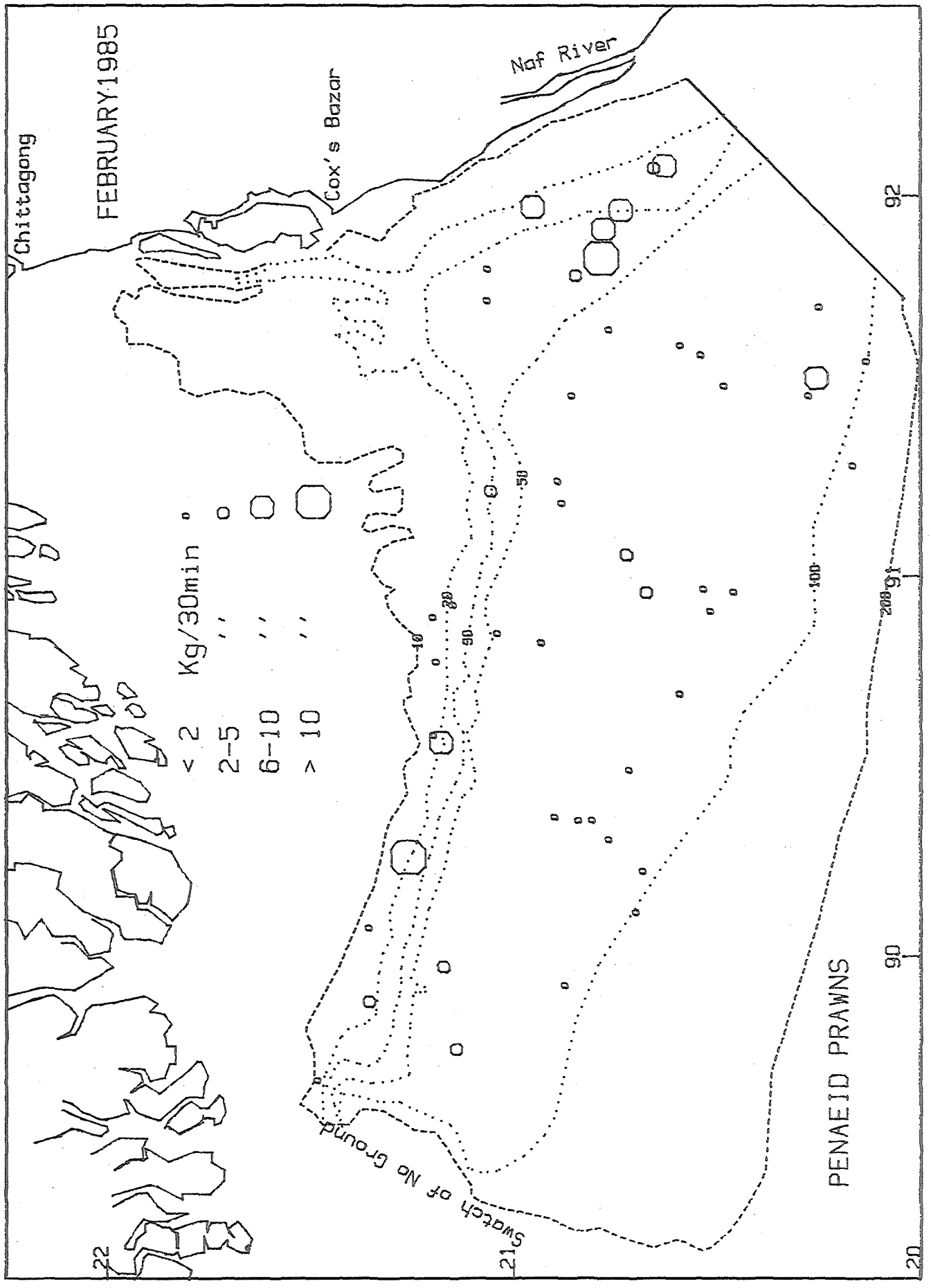

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 2 Kg/30min
2-5 ,,
6-10 ,,
> 10 ,,
10
30
50
100
200
Swatch of No Ground
PENAEID PRAWNS
22
21
20
90
91
92

FIG. 27

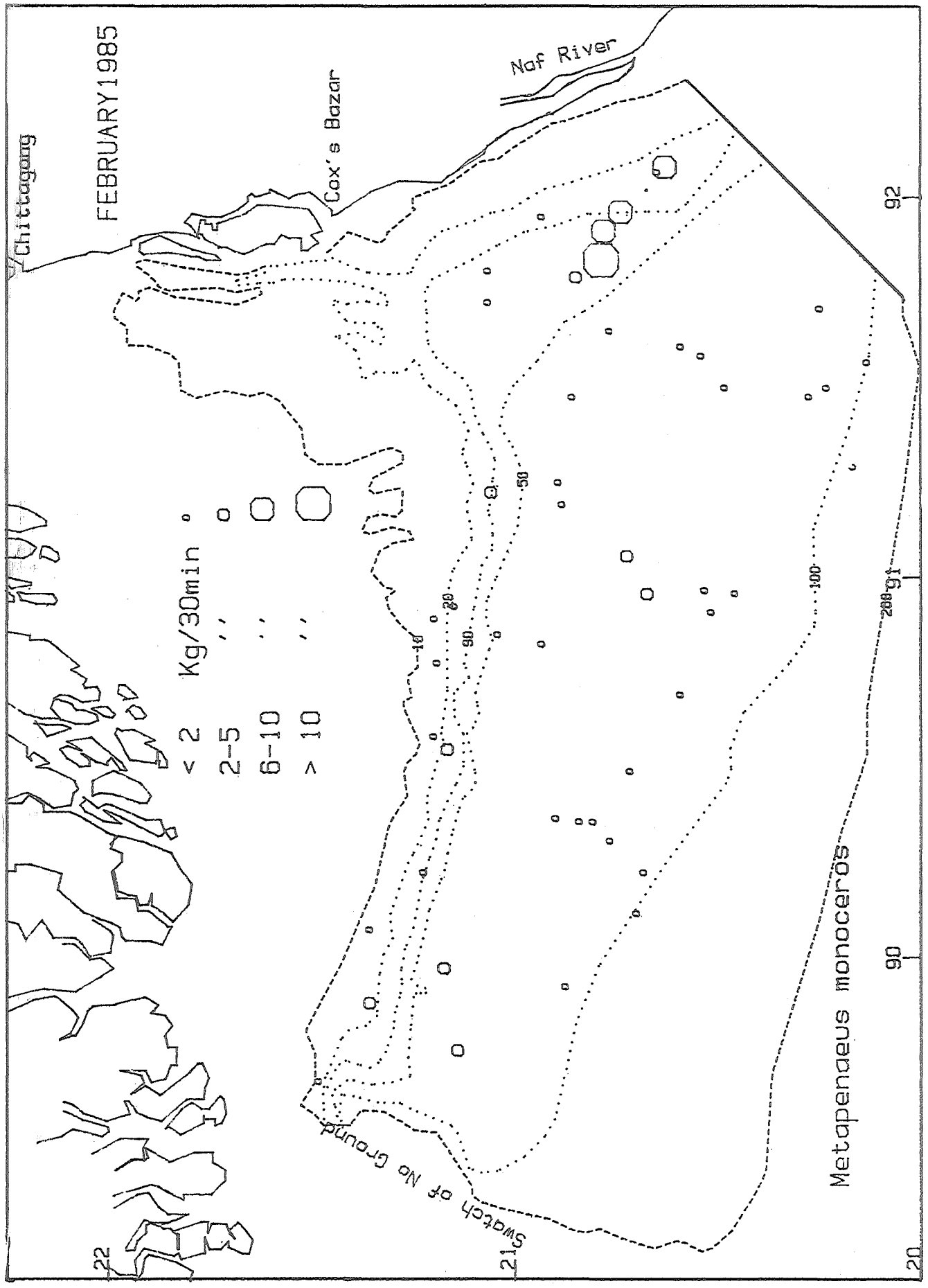

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
< 2 Kg/30min
2-5 ''
6-10 ''
> 10 ''
Swatch of No Ground
Metapenaeus monoceros
22
21
20
91
92
90
10
20
50
100
200

FIG. 28

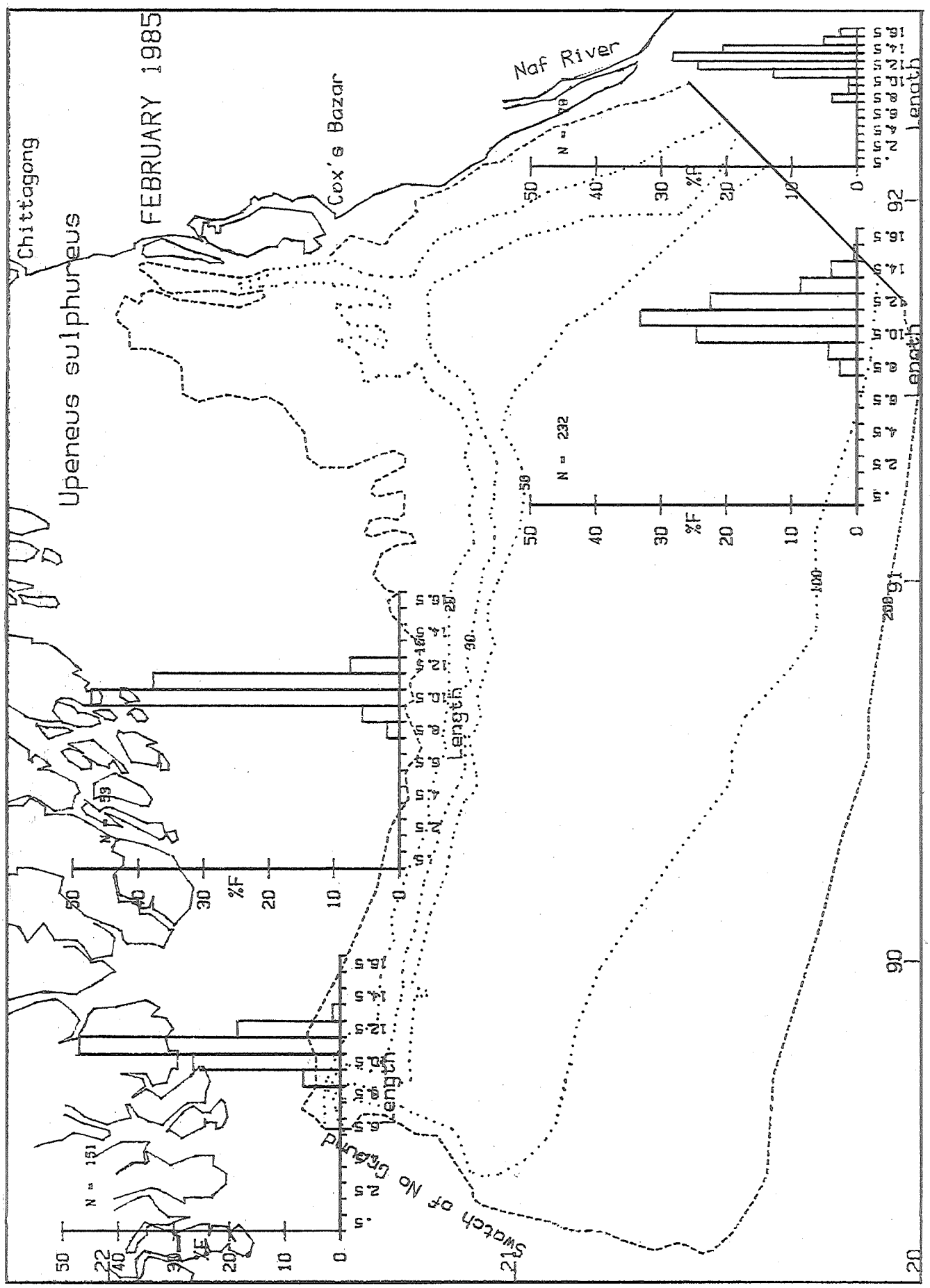

Upeneus sulphureus
FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
Swatch of No Ground
N = 151
N = 232
%F
Length
20
21
90
91
92

FIG. 29

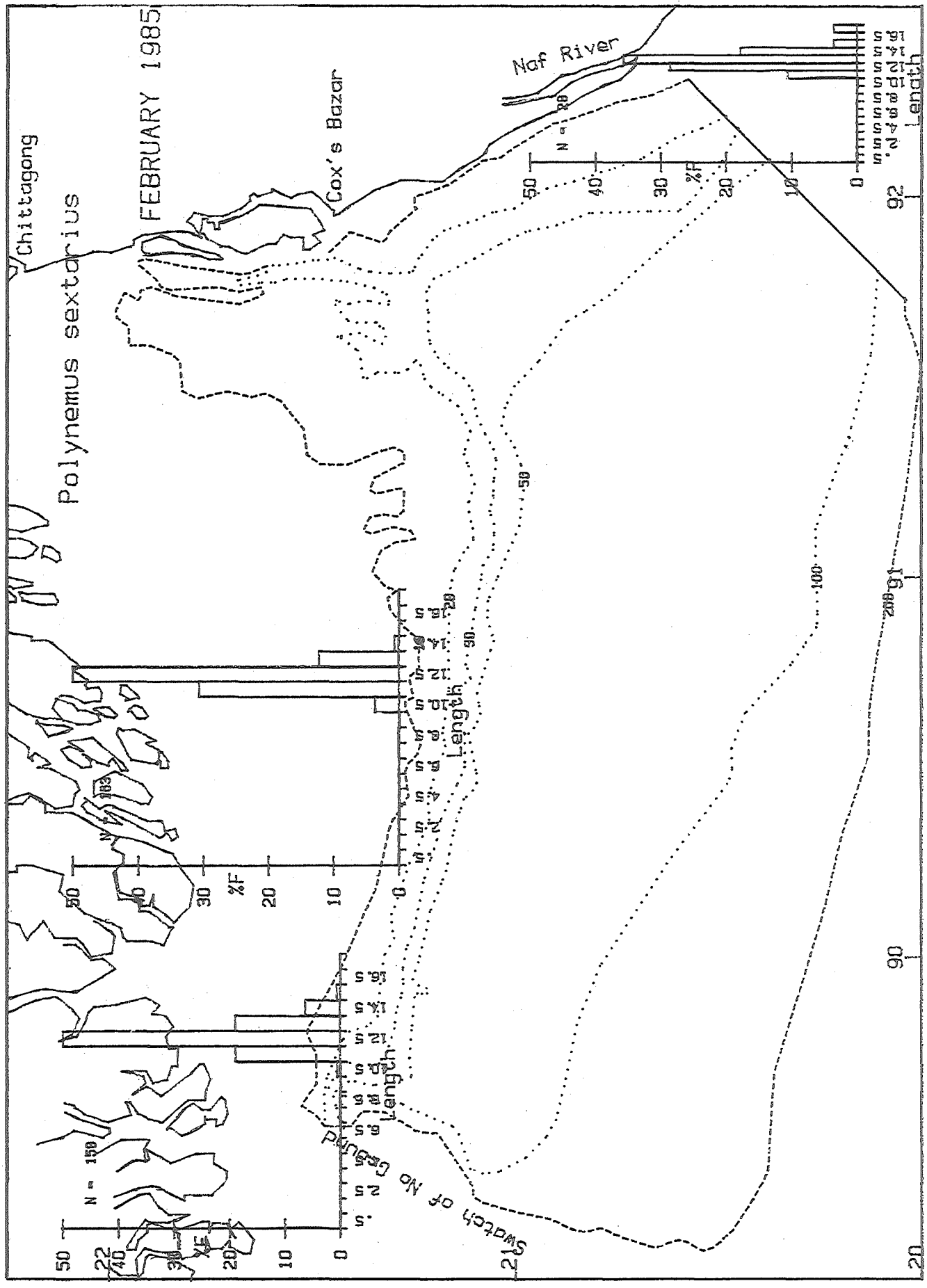

Chittagong
Polynemus sextarius
FEBRUARY 1985
Cox's Bazar
Naf River
Swatch of No Ground
Length
%F
N = 150
N = 183
N = 28
50
40
30
20
10
0
92
91
90
21
20
100
200

FIG. 30

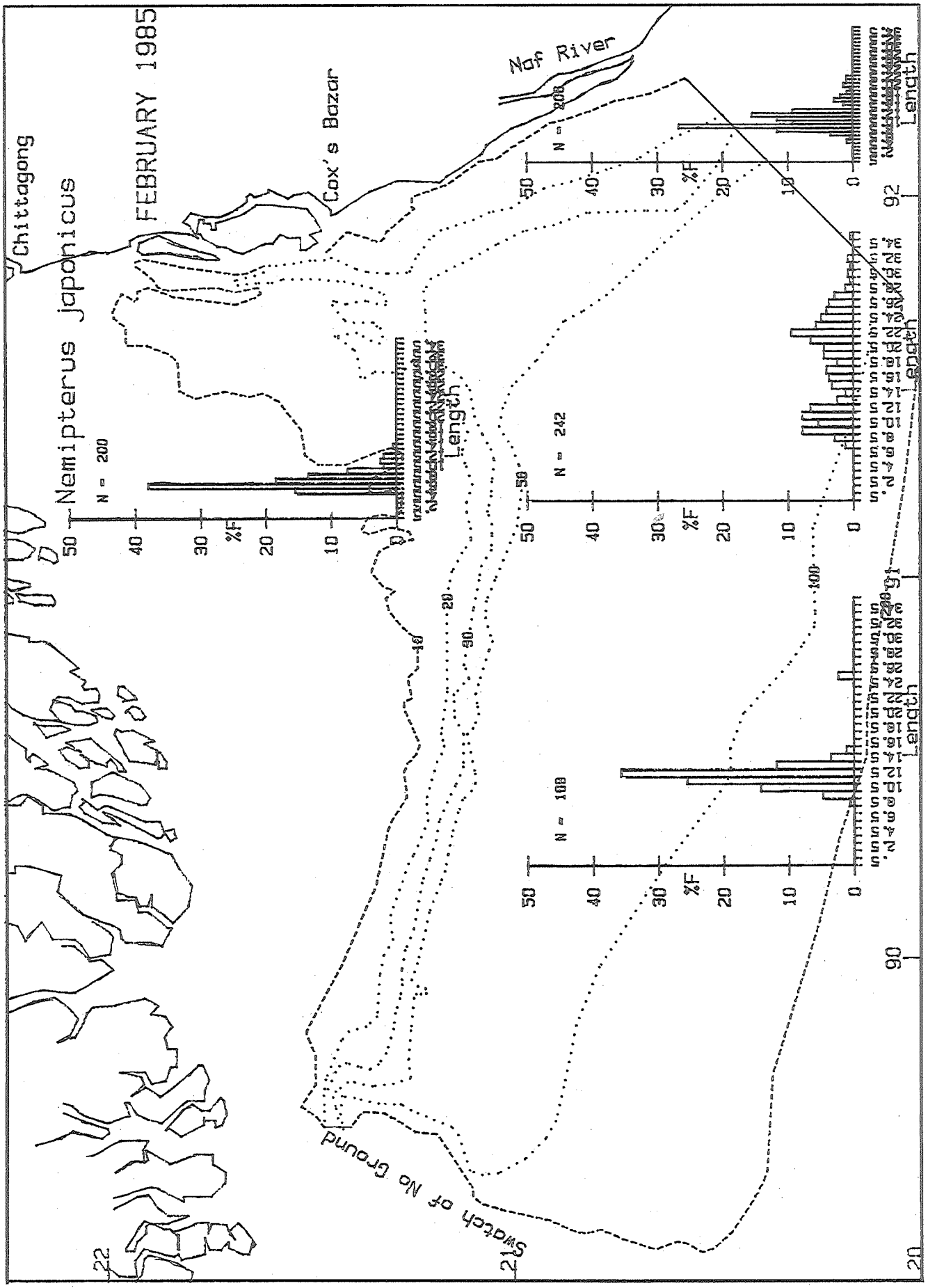

Nemipterus japonicus
FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
Swatch of No Ground
N = 200
N = 242
N = 108
N = 208
%F
Length
22
21
20
91
92

FIG. 31

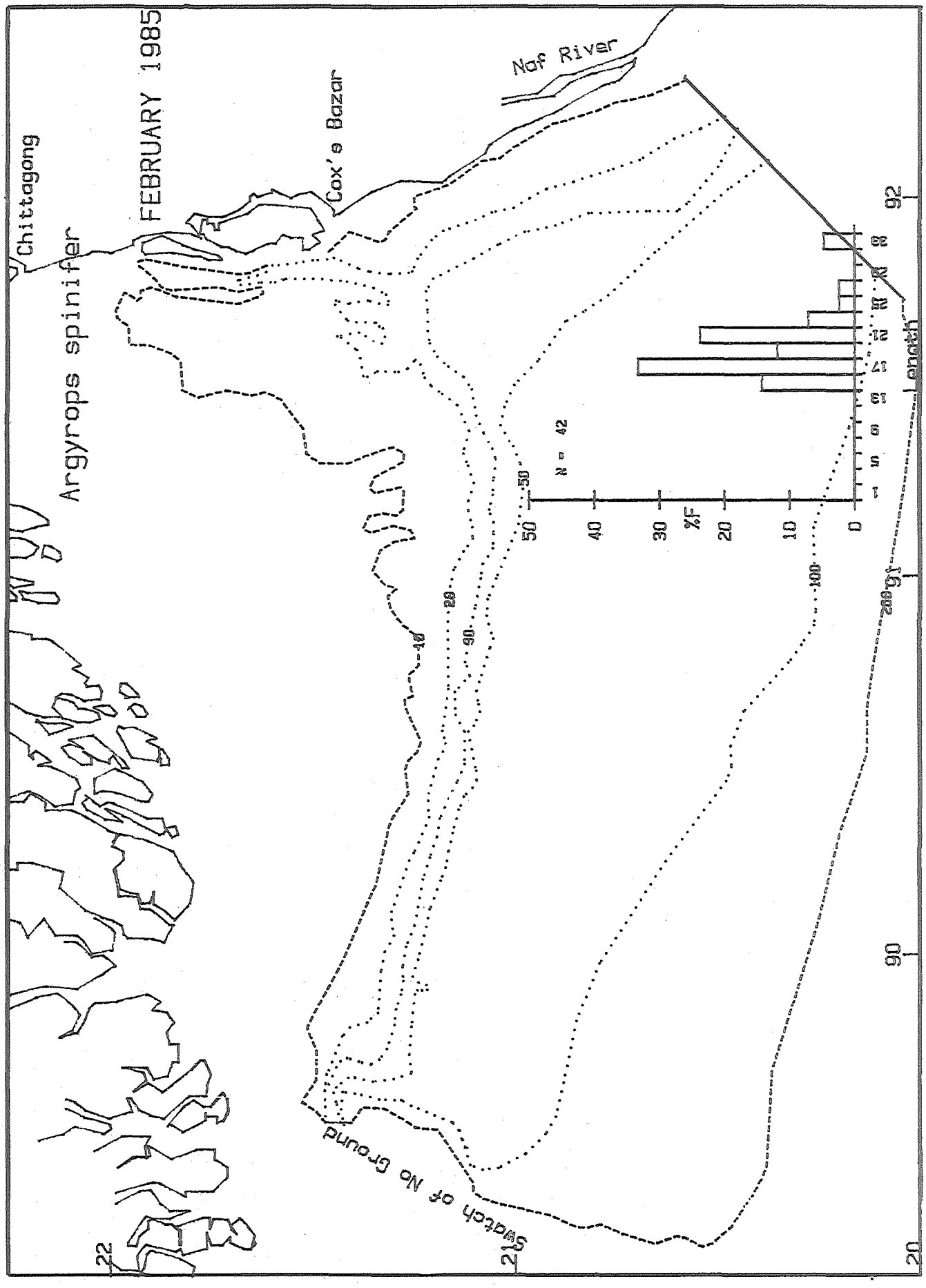

Argyrops spinifer
FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
Swatch of No Ground
N = 42
%F
Length
92
91
90
22
21
20

FIG. 32

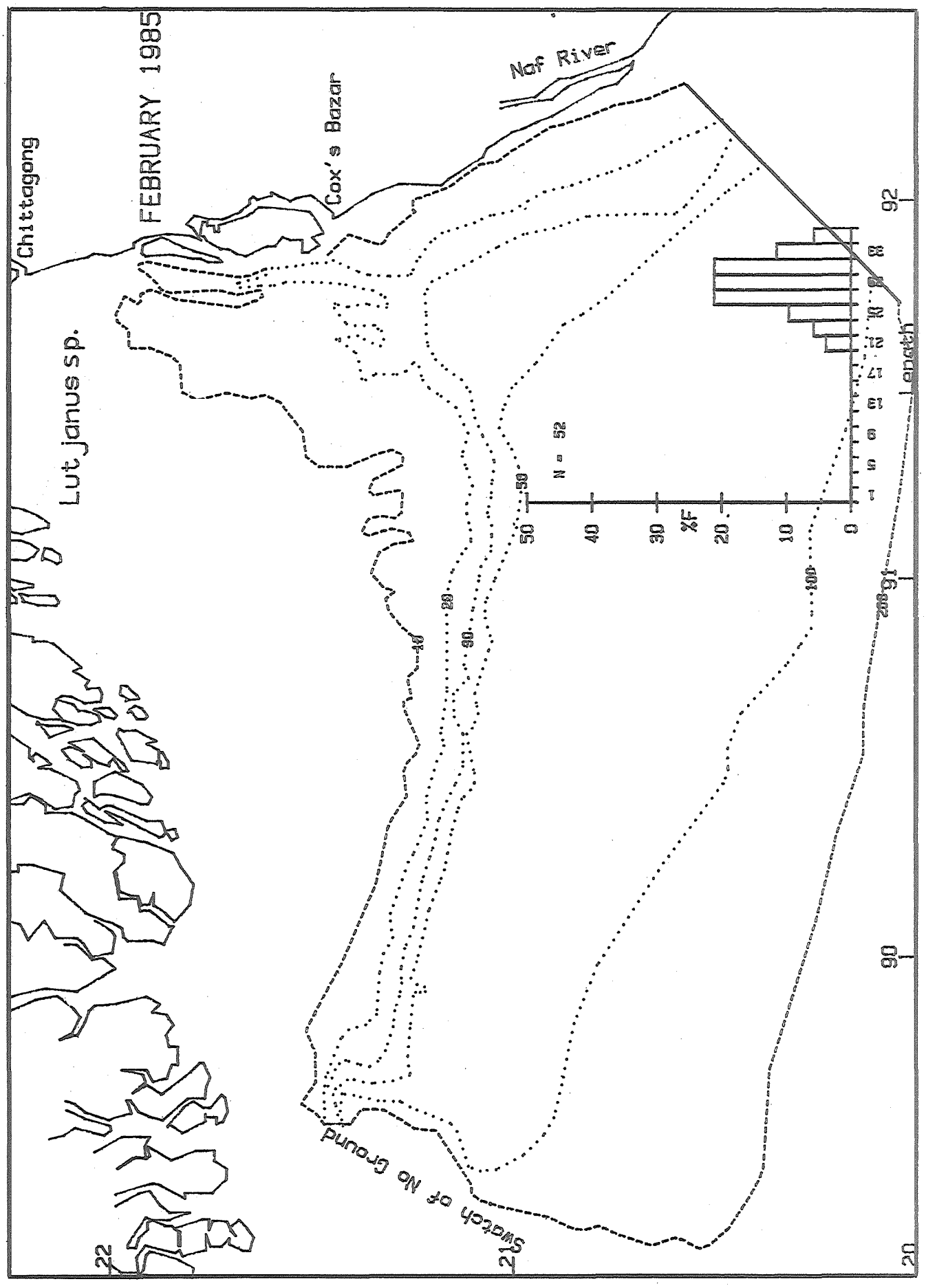

FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
Lutjanus sp.
Swatch of No Ground
N = 52
%F
Length
92
91
90
22
21
20
10
20
30
40
50
100
200

FIG. 33

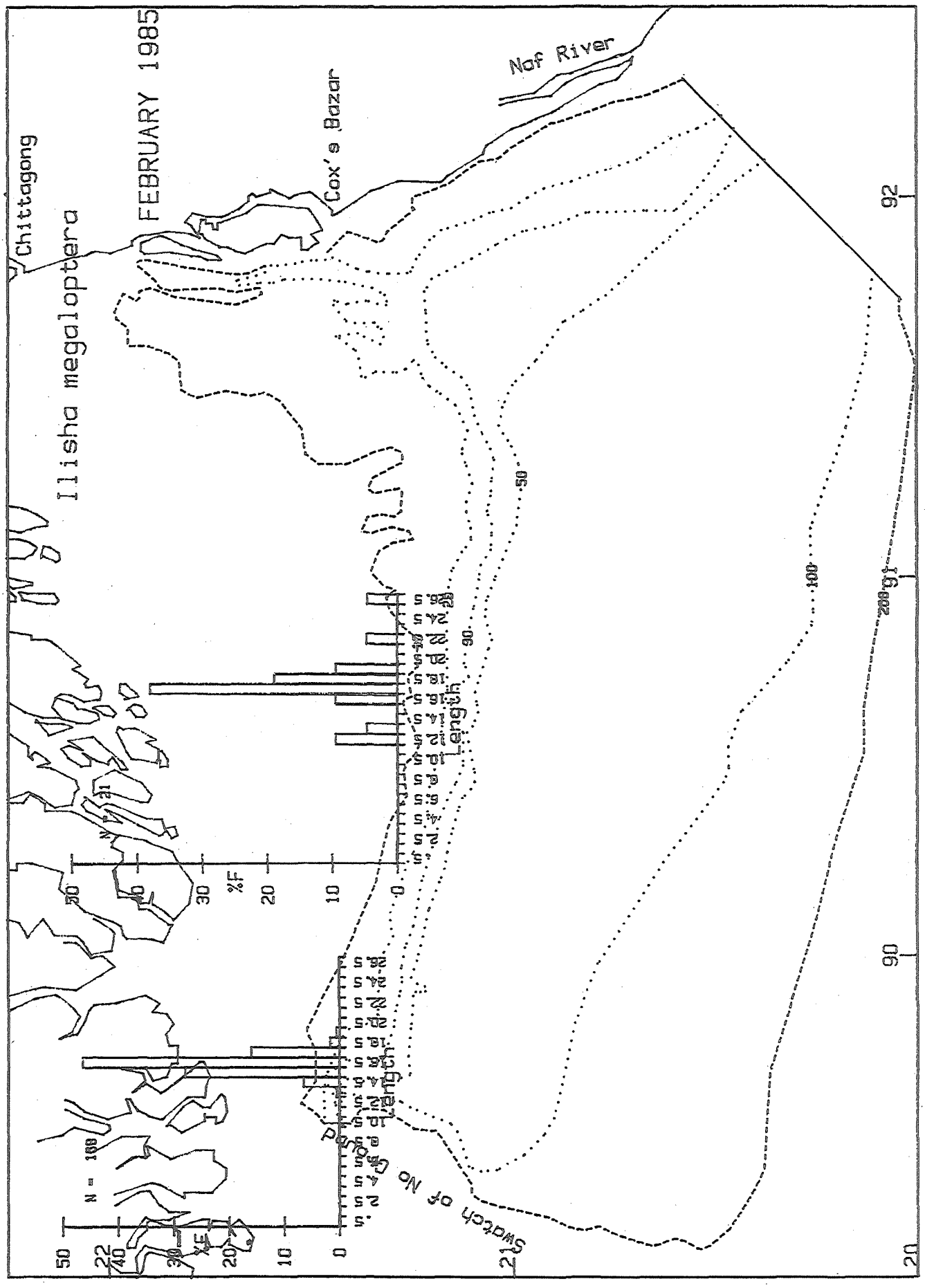

Chittagong
Ilisha megaloptera
FEBRUARY 1985
Cox's Bazar
Nof River
Swatch of No Ground
Length
%F
%X
N = 188
20
21
90
91
92
50
100
200

FIG. 34

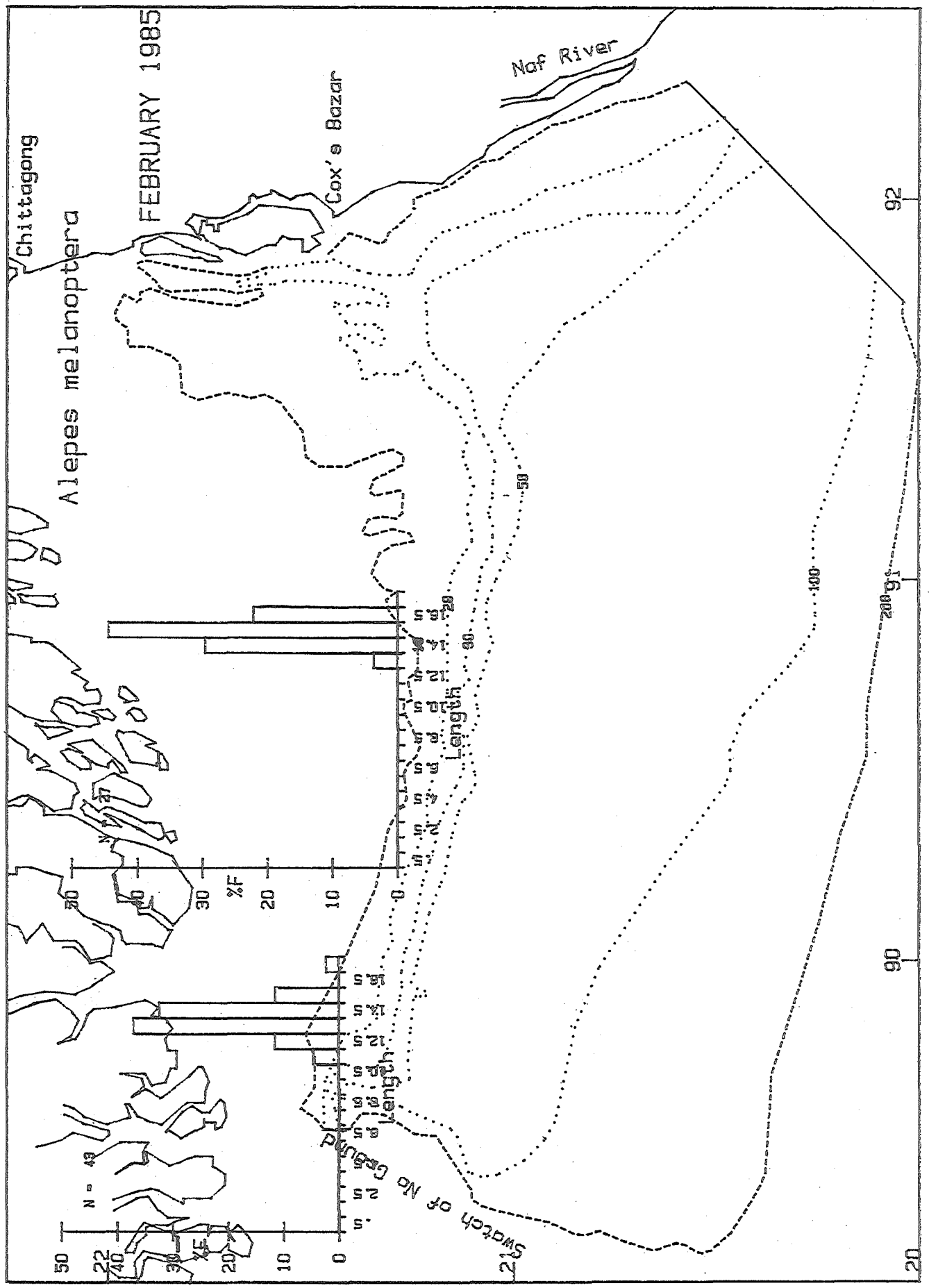

Chittagong
Alepes melanoptera
FEBRUARY 1985
Cox's Bazar
Naf River
Swatch of No Ground
Length
%F
%E
N = 49
N = 37
92
91
90
20
50
100
200
gt

FIG. 35

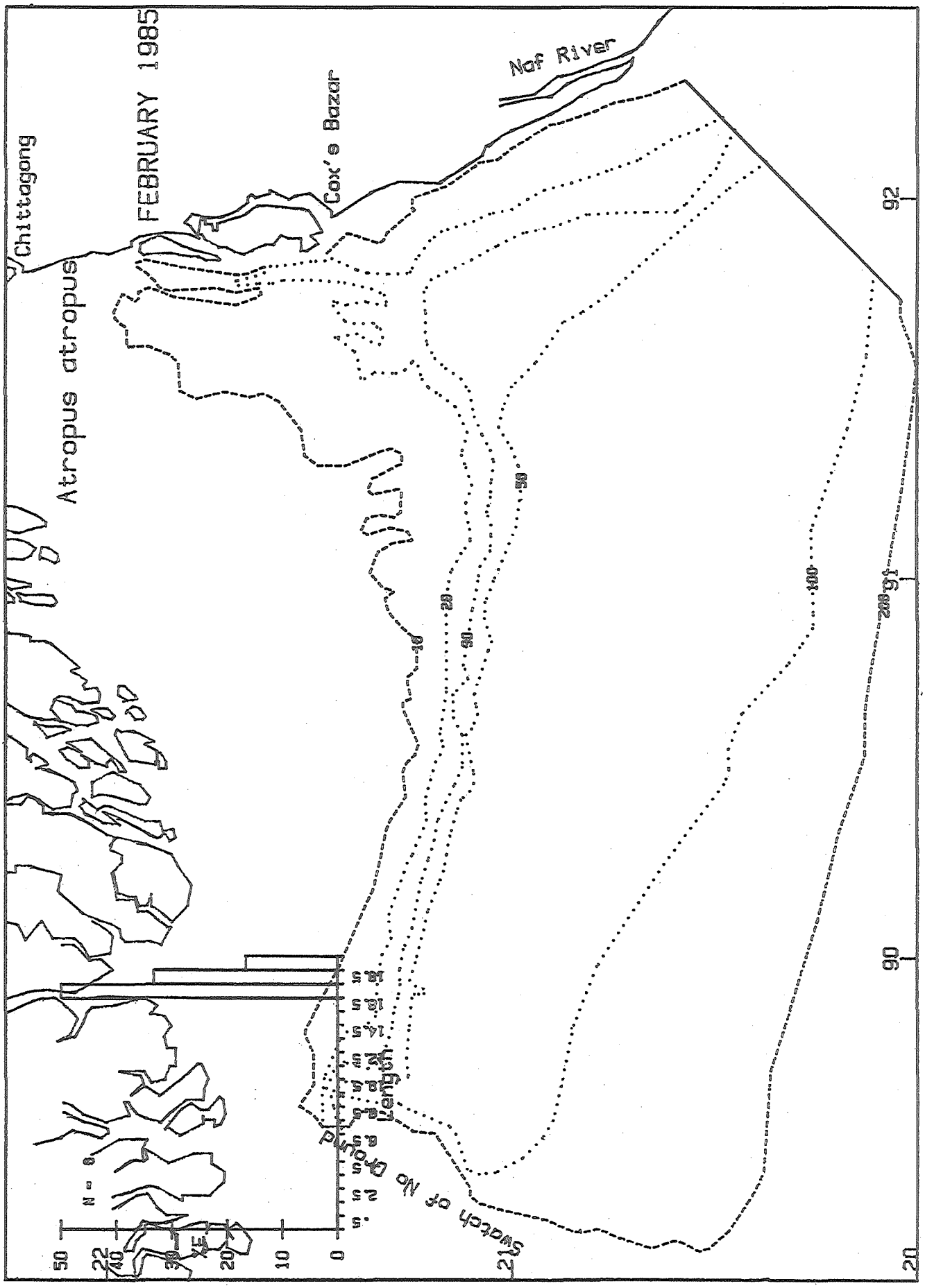

Atropus atropus
FEBRUARY 1985
Chittagong
Cox's Bazar
Naf River
Swatch of No Ground
Depth
Length
N = 0
92
91
90
89
21
20
10
28
50
55
100
200

FIG. 36

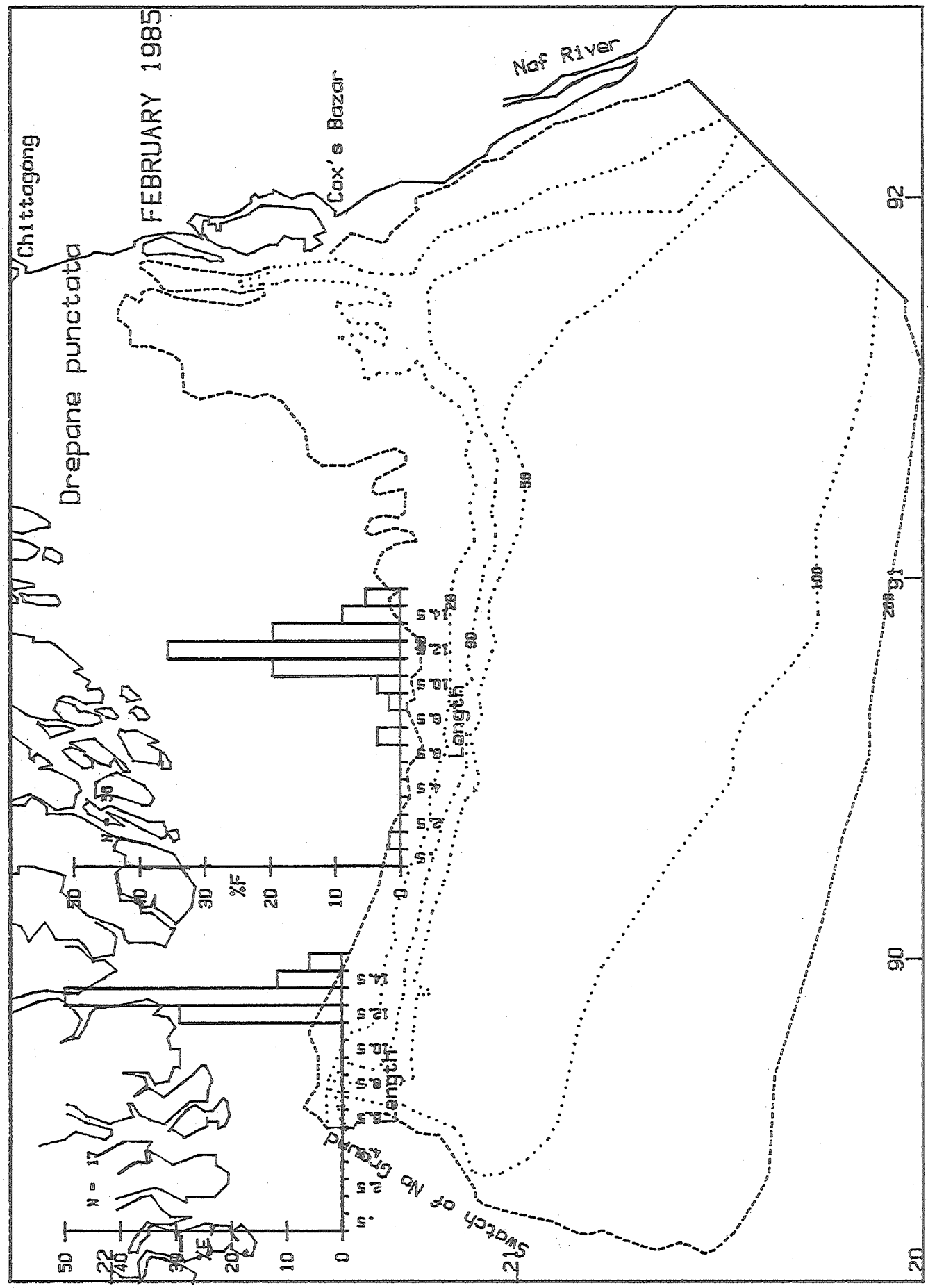

Chittagong
FEBRUARY 1985
Drepane punctata
Cox's Bazar
Naf River
Swatch of No Ground
Length
%F
%E
N = 17
20
21
90
91
92
50
100
200

FIG. 37

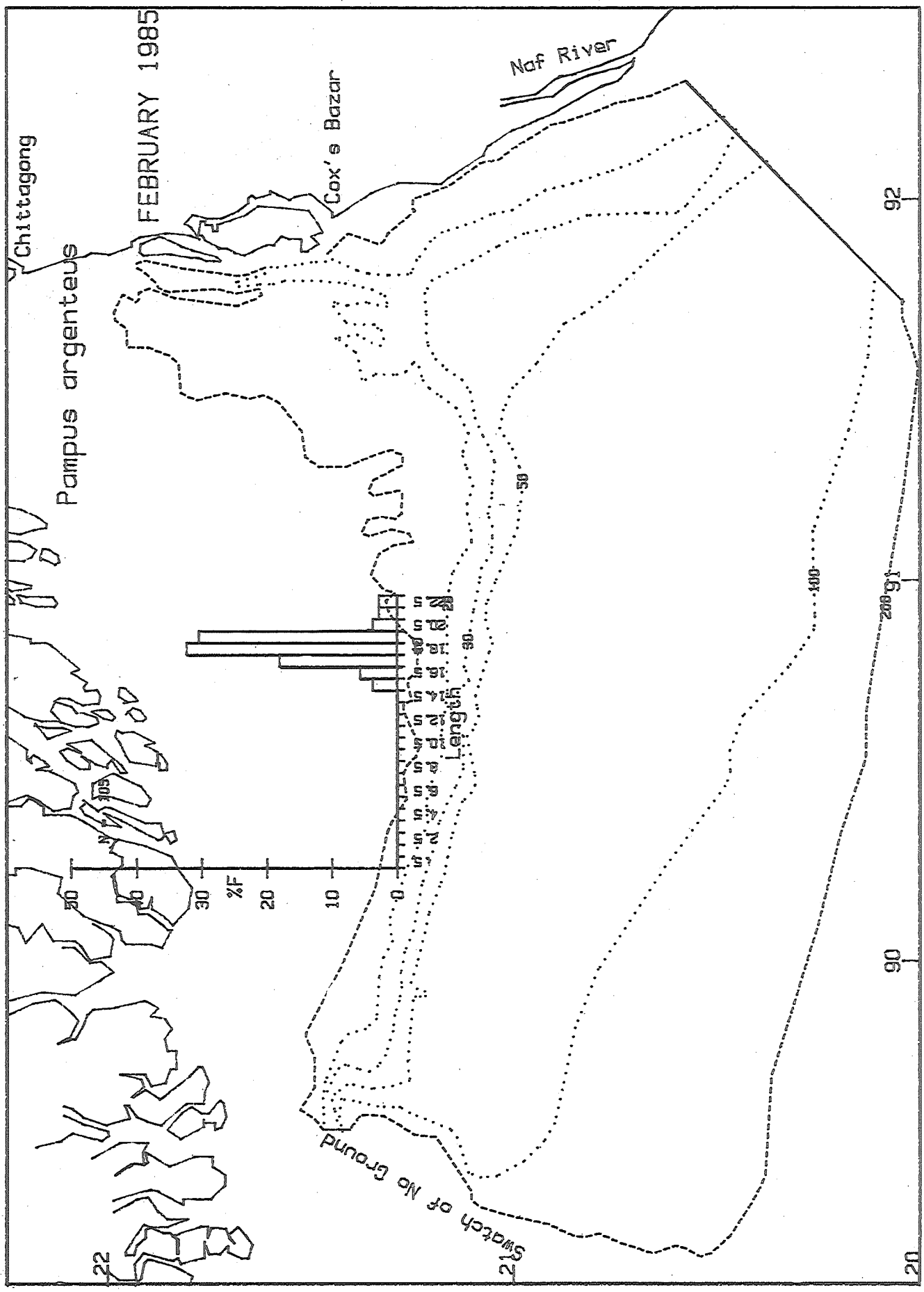

Chittagong
Pampus argenteus
FEBRUARY 1985
Cox's Bazar
Naf River
Swatch of No Ground
Length
%F
50
40
30
20
10
0
22
21
20
92
91
90
50
100
200

FIG. 38

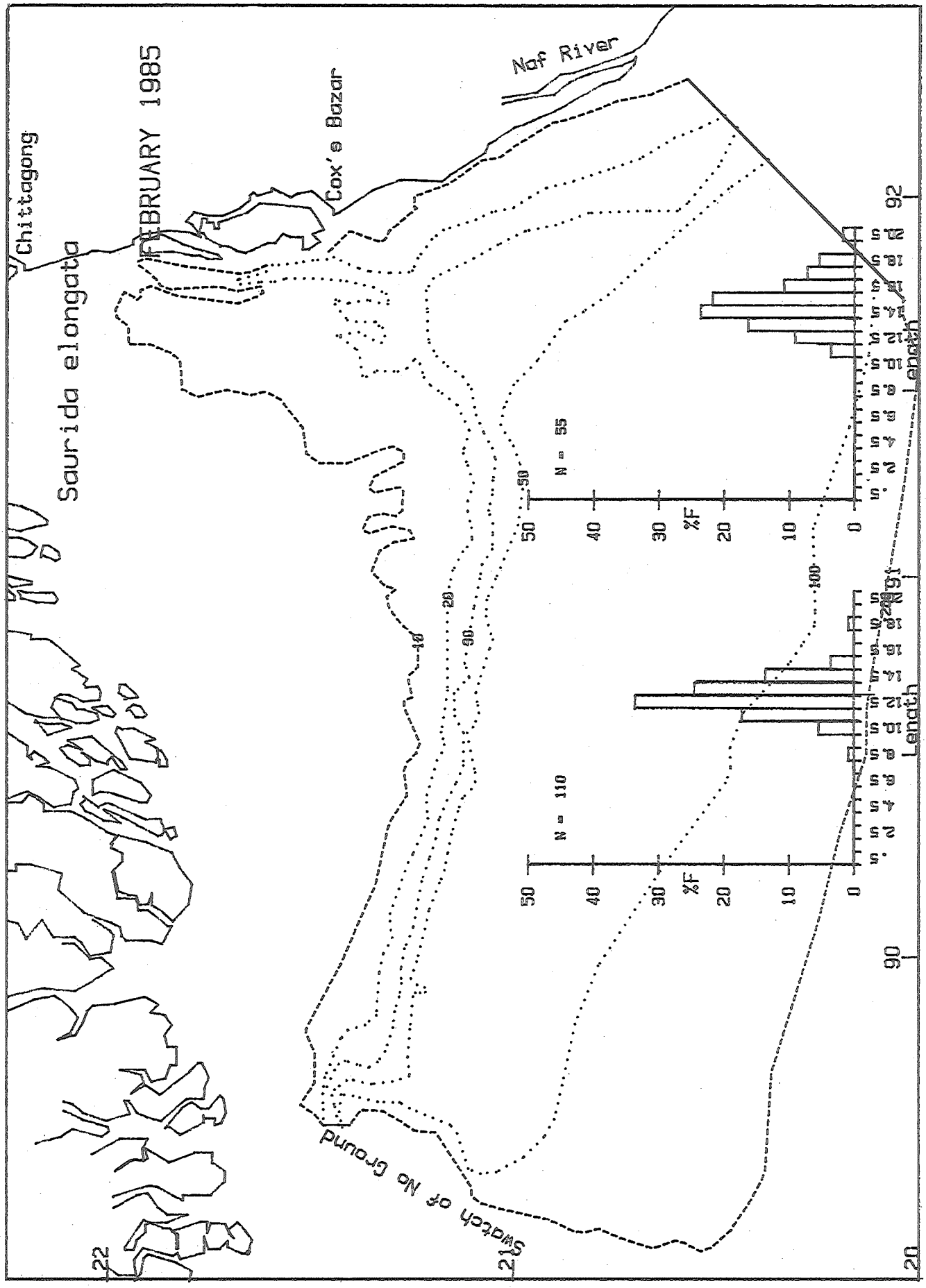

Chittagong
Saurida elongata
FEBRUARY 1985
Cox's Bazar
Naf River
Swatch of No Ground
22
21
20
90
92
10
20
60
100
N = 55
N = 110
%F
Length

FIG. 39

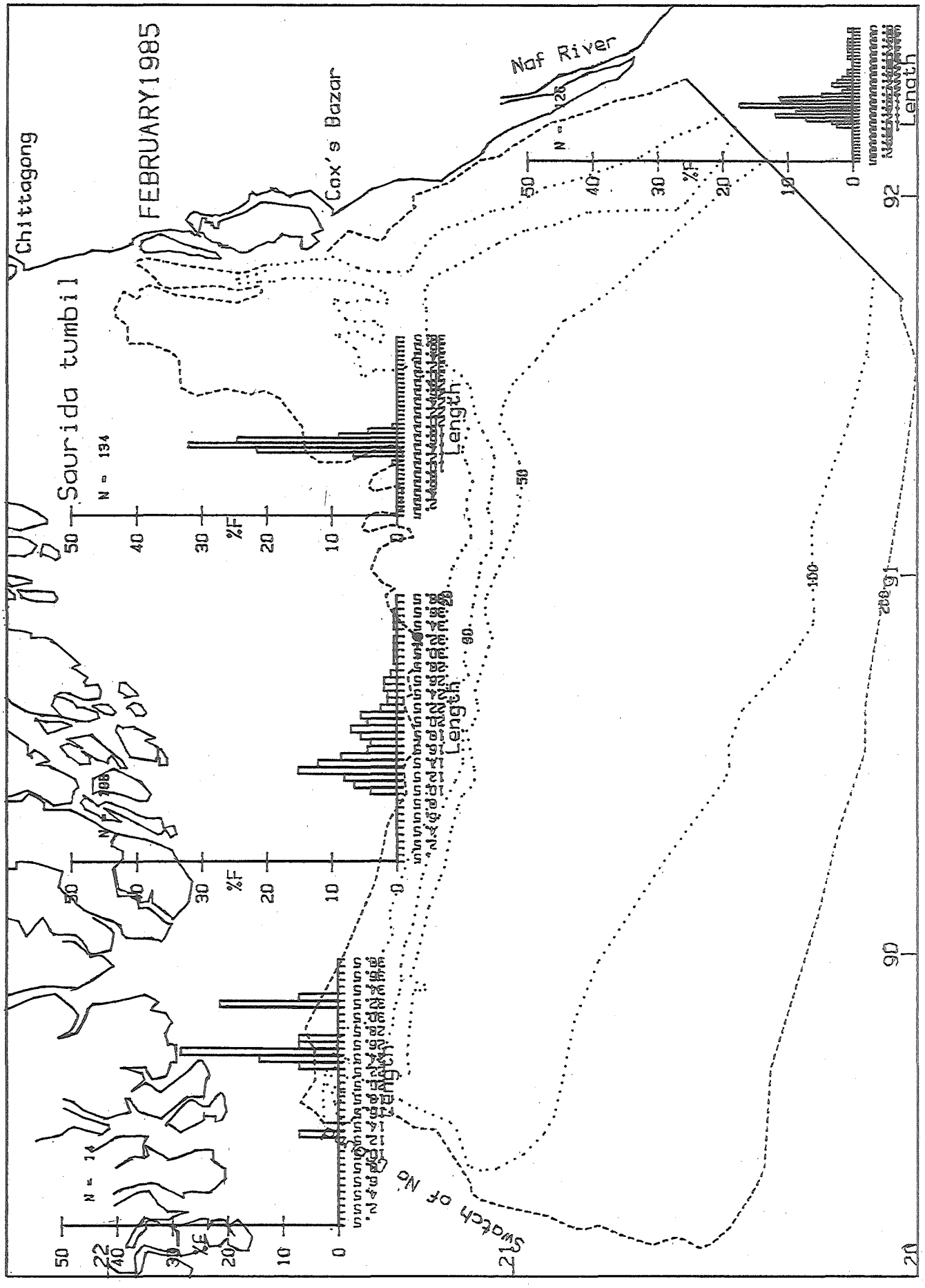

Chittagong
FEBRUARY 1985
Cox's Bazar
Naf River
Saurida tumbil
N = 134
%F
Length
Swatch of No
21
20
90
91
92
50
100
200

FIG. 40

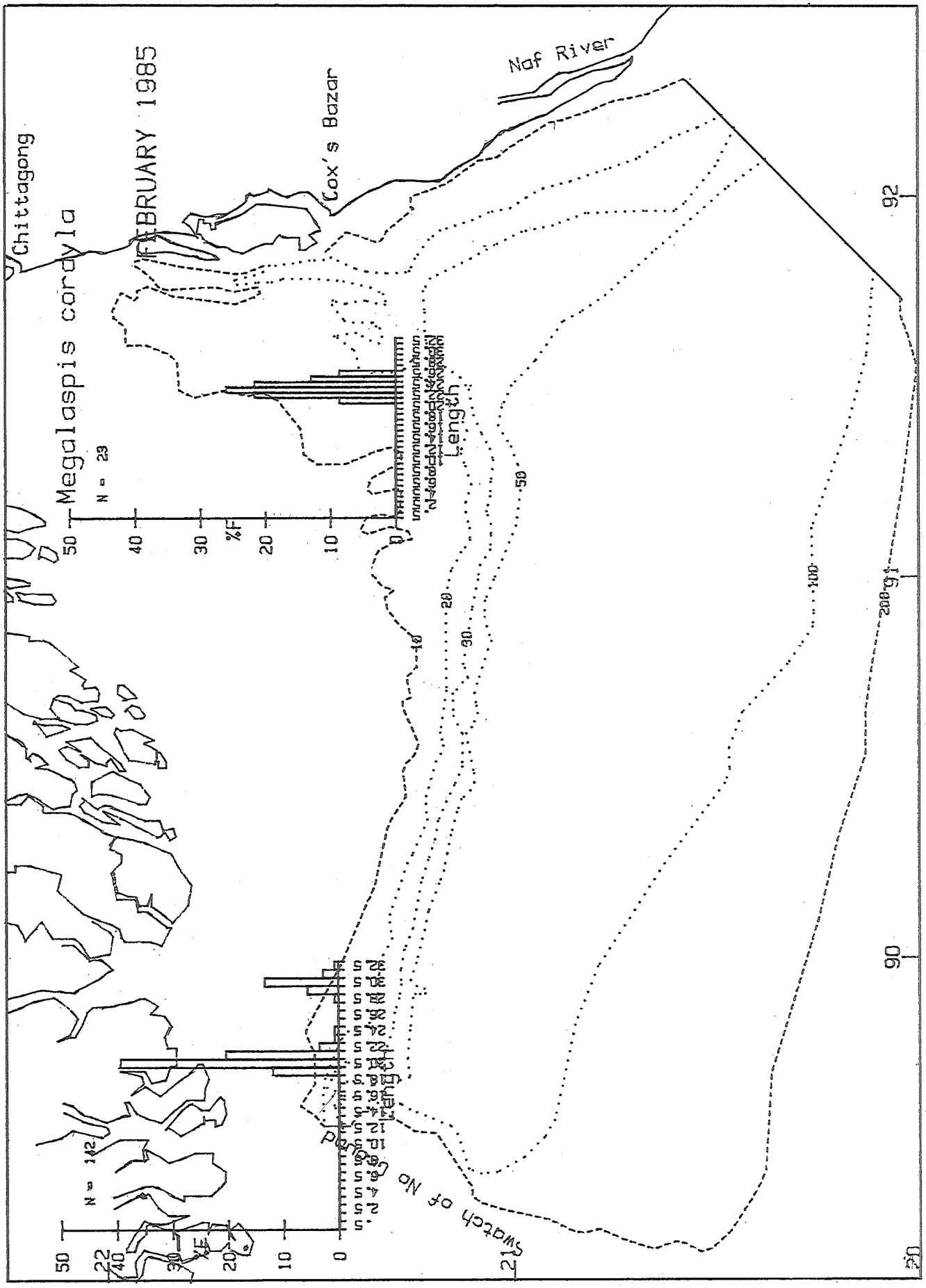

Chittagong
FEBRUARY 1985
Megalaspis cordyla
Cox's Bazar
Naf River
Length
N = 23
%F
Length
N = 142
%F
Swatch of No
92
91
90
21
20

FIG. 41

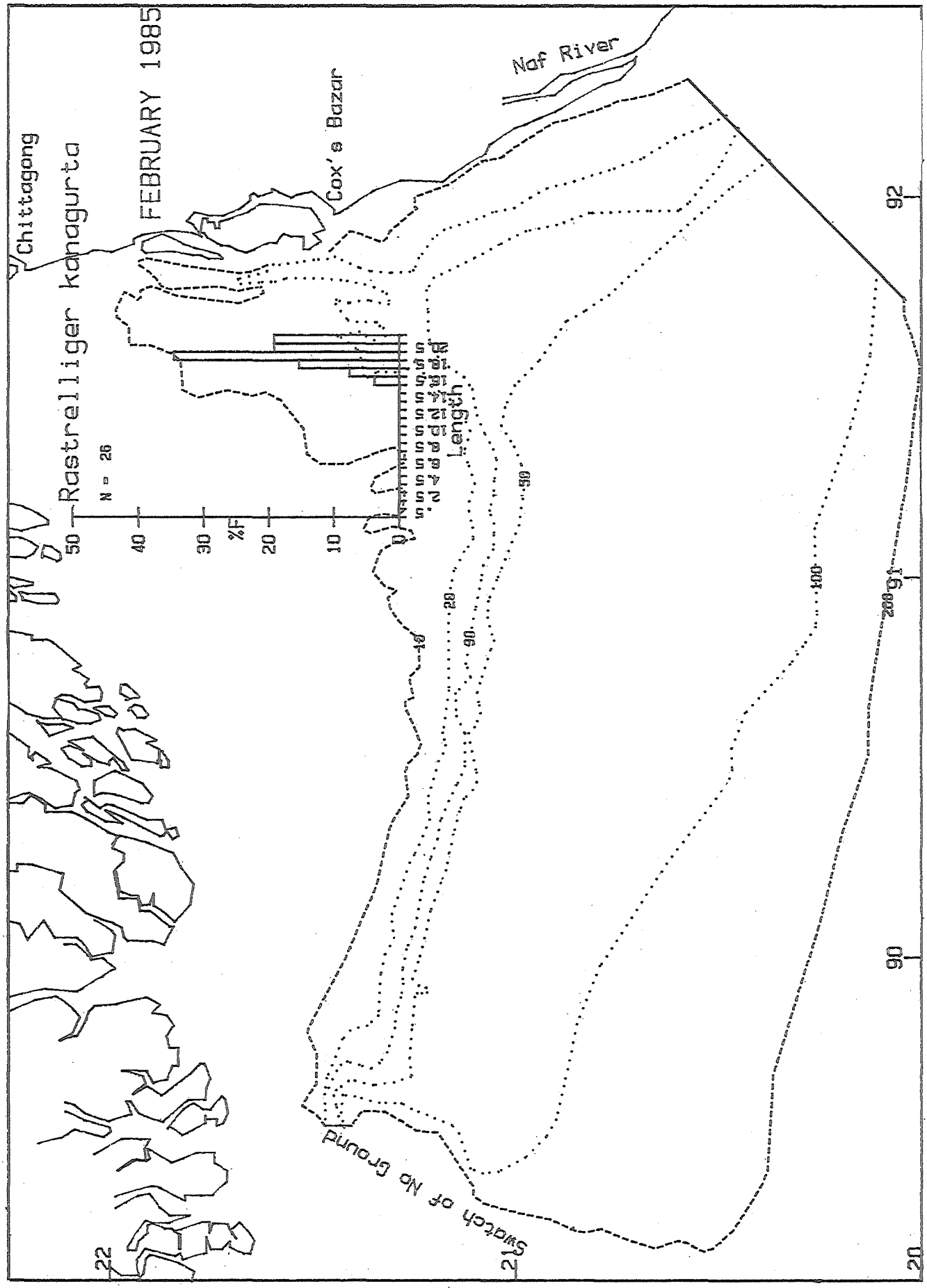

Chittagong
Rastrelliger kanagurta
FEBRUARY 1985
Cox's Bazar
Naf River
N = 26
%F
50
40
30
20
10
0
Length
10
20
90
100
200
Swatch of No Ground
22
21
92
91
90

FIG. 42

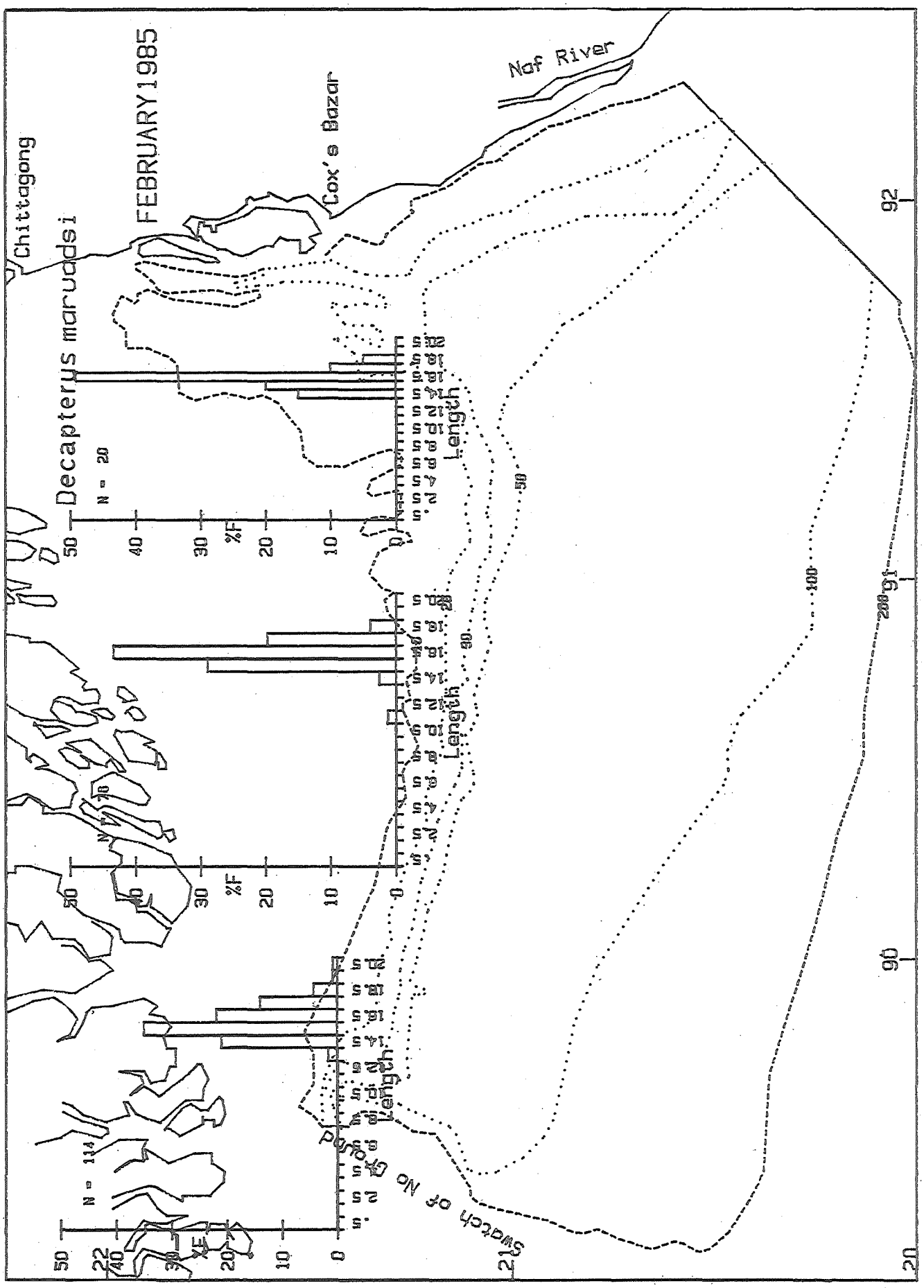

Chittagong
FEBRUARY 1985
Decapterus maruadsi
Cox's Bazar
Naf River
Length
%F
N = 20
N = 114
Swatch of No Ground
Pelagic
20
21
90
91
92
50
100
200

FIG. 43

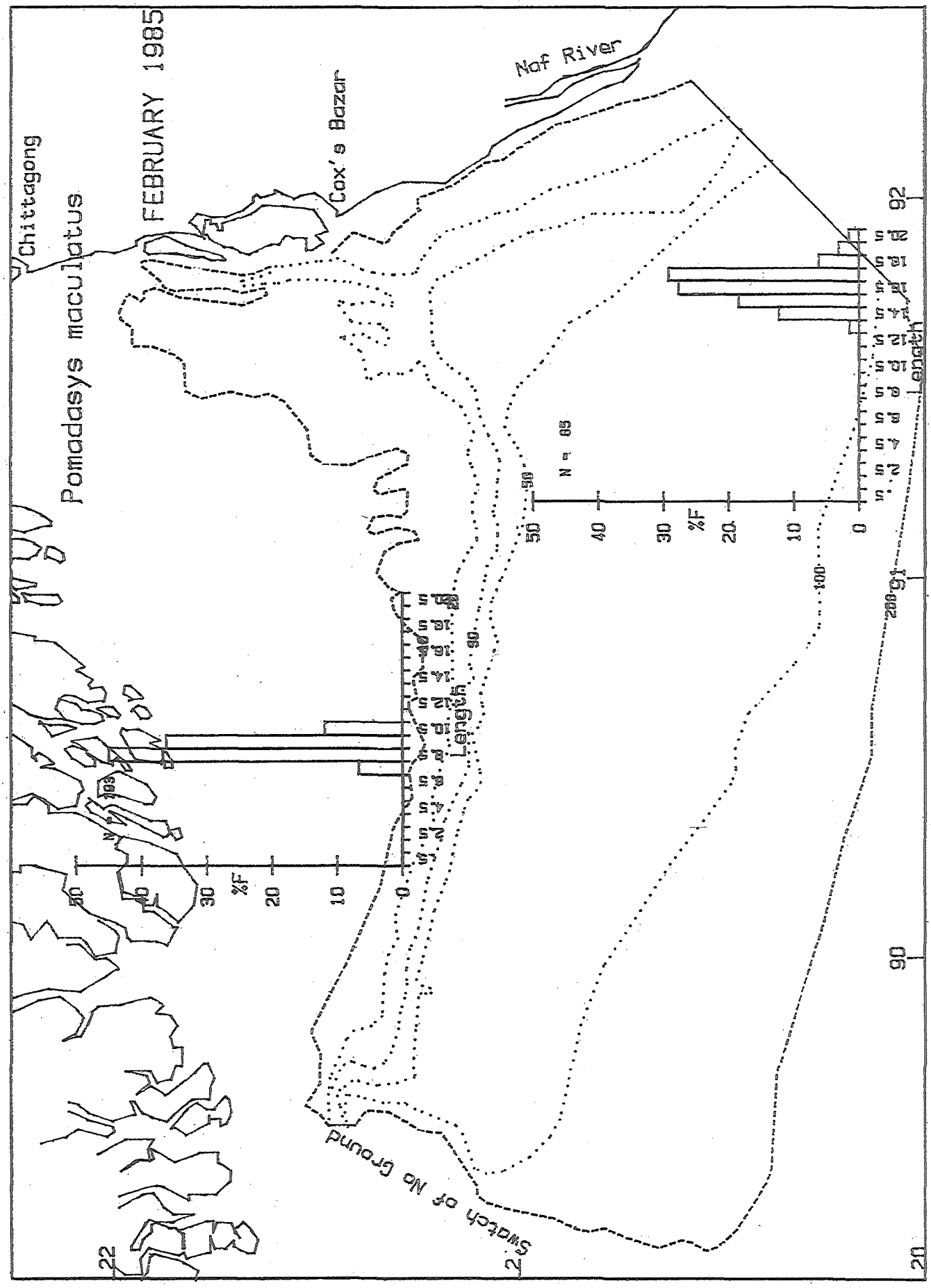

Chittagong
Pomadasys maculatus
FEBRUARY 1985
Cox's Bazar
Naf River
Length
%F
N = 103
N = 85
Length
%F
Swatch of No Ground
22
21
20
91
92
90
100
200

FIG. 44

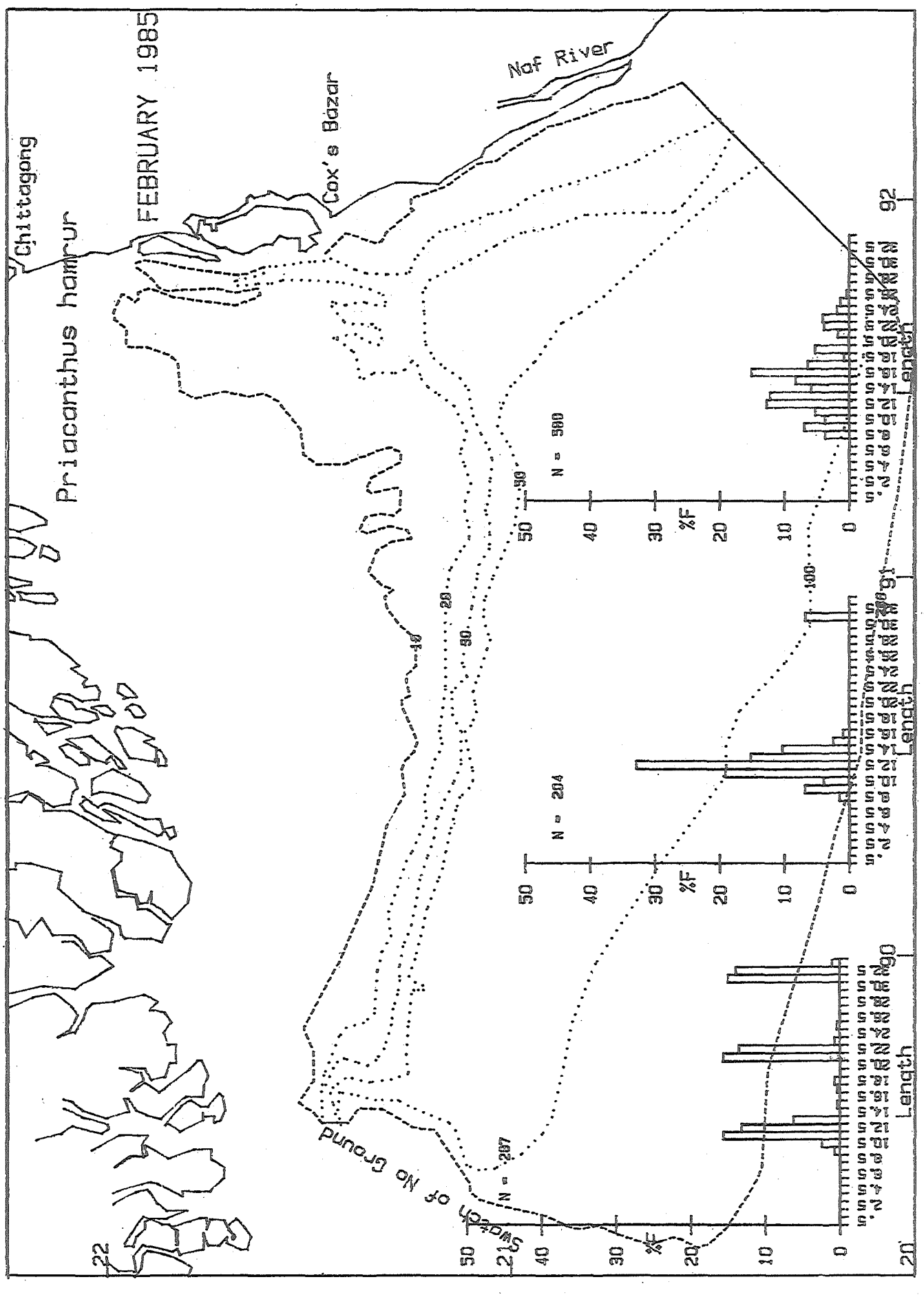

Chittagong
Priacanthus hamrur
FEBRUARY 1985
Cox's Bazar
Naf River
Swatch of No Ground
N = 207
N = 204
N = 500
%F
Length
20
21
22
92

FIG.45

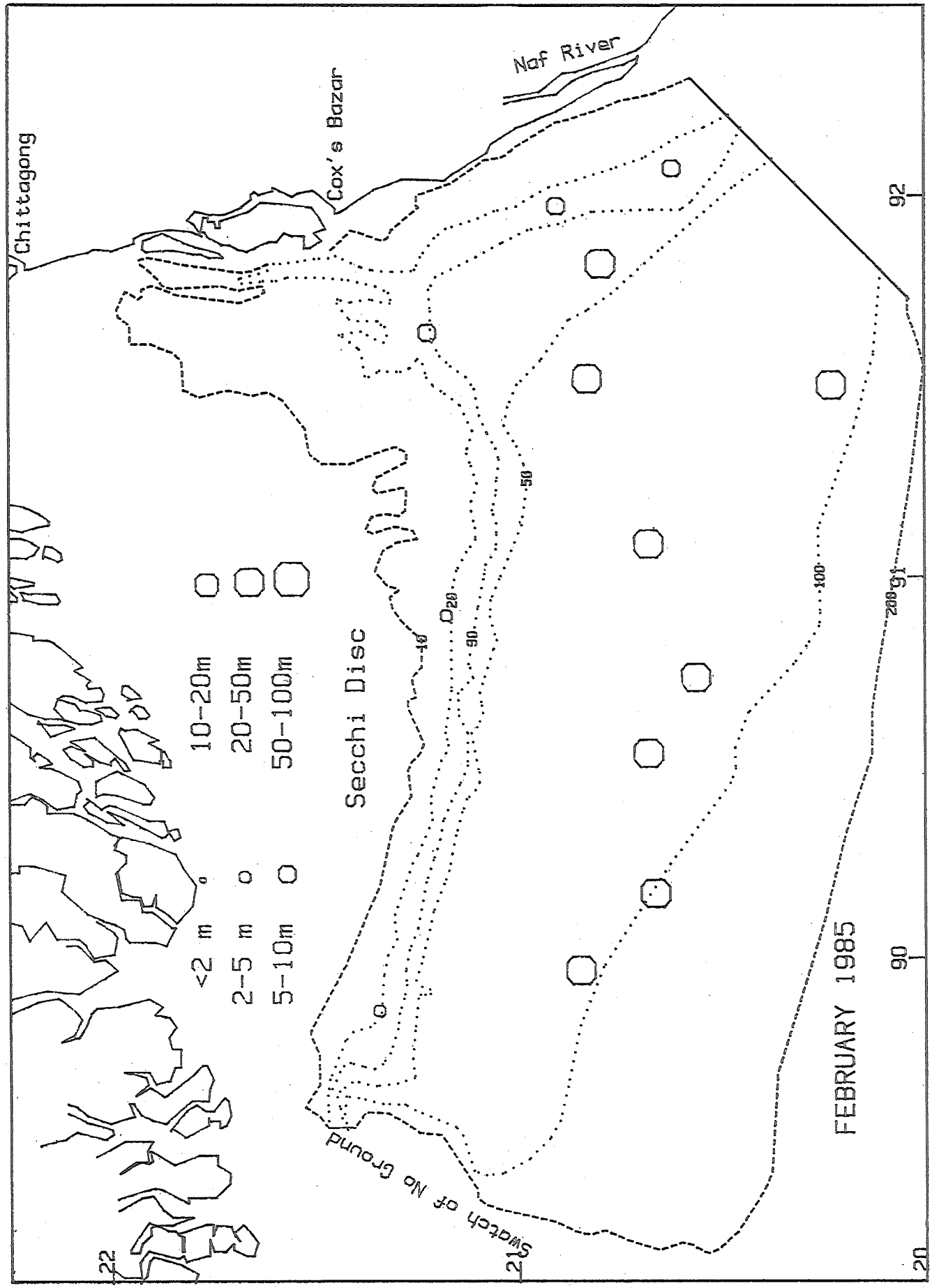

Chittagong
Cox's Bazar
Naf River
Secchi Disc
<2 m
2-5 m
5-10m
10-20m
20-50m
50-100m
Swatch of No Ground
FEBRUARY 1985
22
21
20
92
91
90

FIG. 46

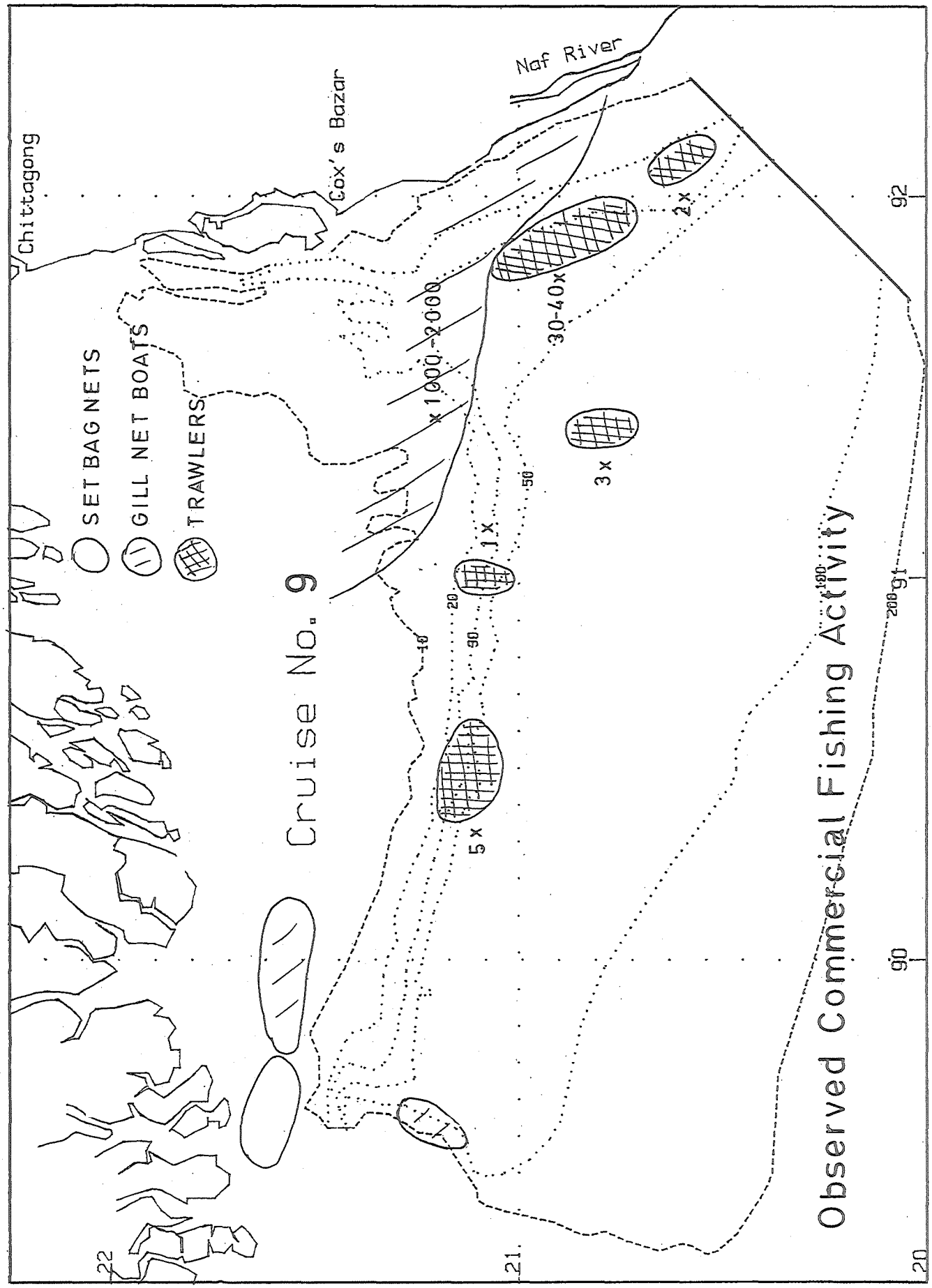
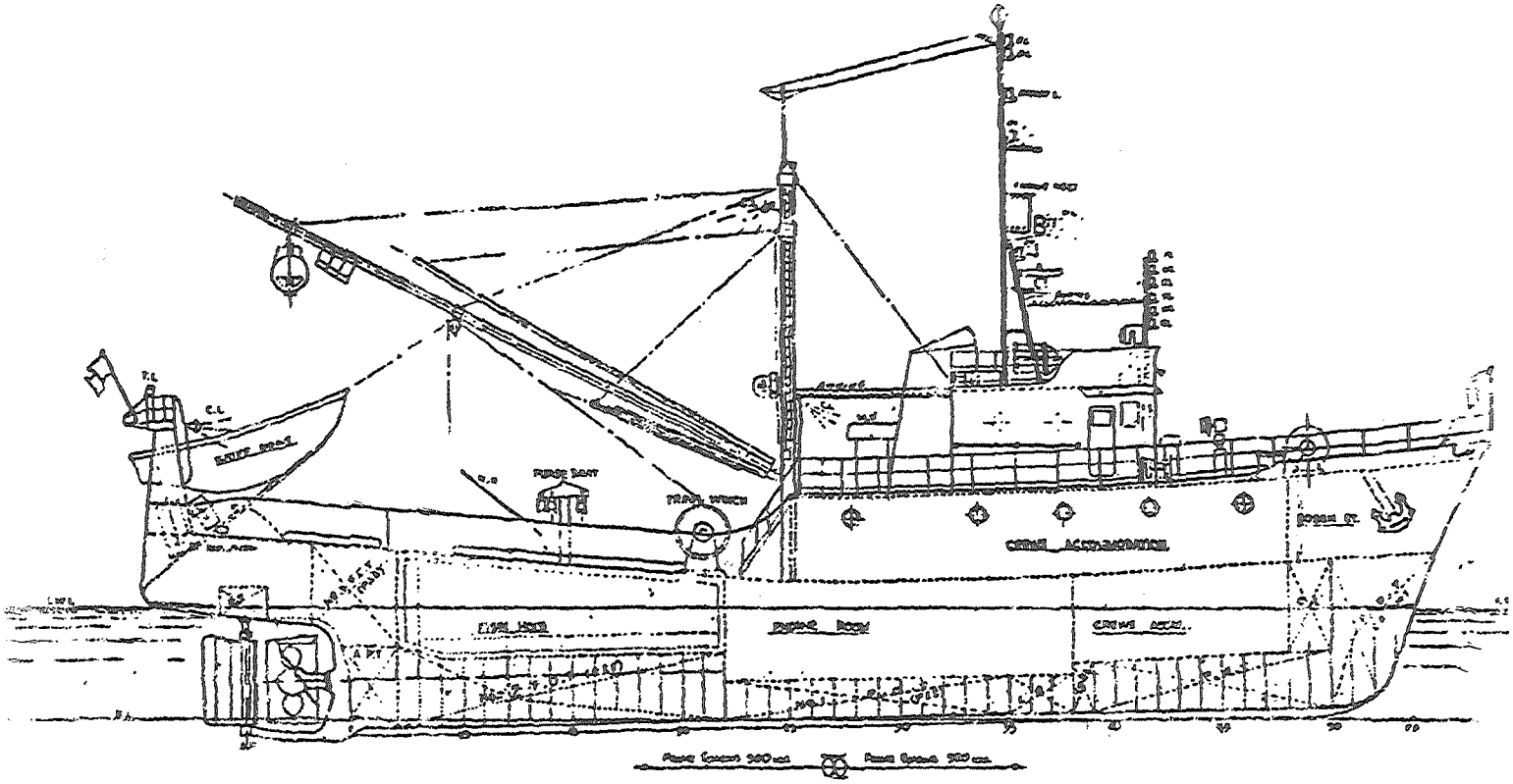

Chittagong
Cox's Bazar
Naf River
SET BAG NETS
GILL NET BOATS
TRAWLERS
Cruise No. 9
Observed Commercial Fishing Activity
1000-2000
30-40x
2x
3x
1x
5x
10
20
50
90
100
200
22
21
20
91
92

FIG. 47

APPENDIX A

RESEARCH VESSEL R/V "ANUSANDHANI"



Principal Dimension

Length Overall	32.40M
Length B.P.	28.00M
Breadth Mld	7.50M
Depth Mld	3.30M
Gross Tonnage	221.16 G.T.
Main Engine	900 PS
Max Trial SP	12.44km

Capacity

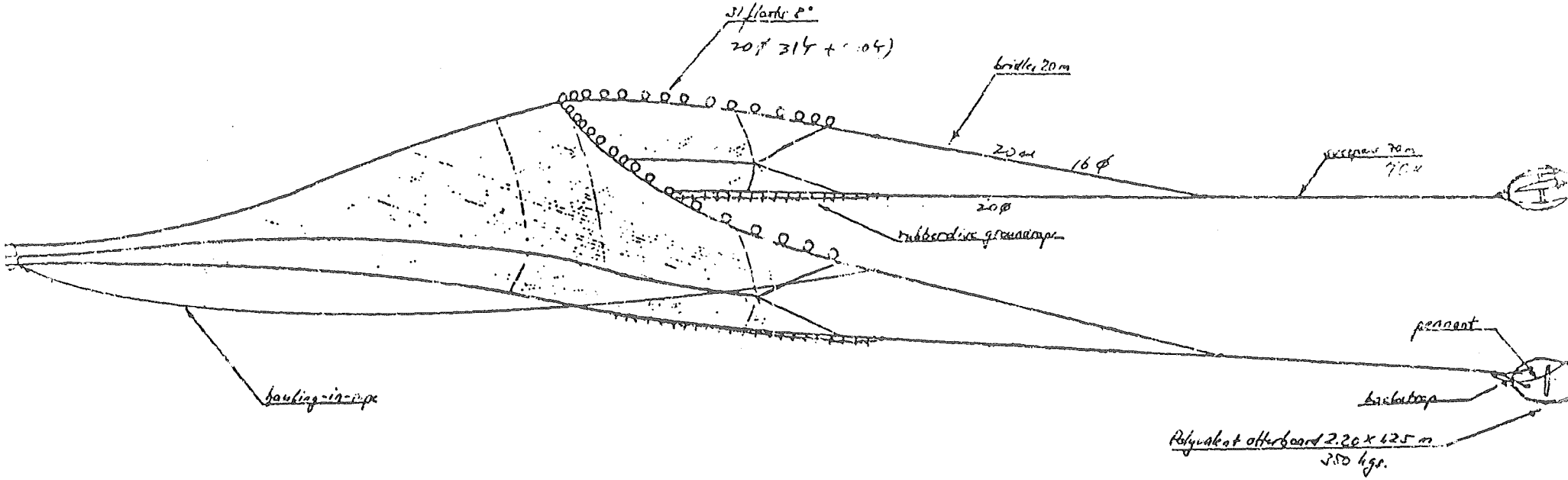
Fish Hold	73.67 M^2
Fuel Oil	88.22 M^2
Fresh water	34.53 M^2
Freezing Room	11.17 M^2

Complements

Officer	6P
Crew	12P
Scientists	4P
Total	22

APPENDIX B
ENGEL HIGH OPENING BOTTOM TRAWL

GENERAL ARRANGEMENT FOR ENGEL 486 MESH HIGH OPENING BOTTOM TRAWL



1. Headline 57.50 metres P. P. Combination wire rope 12mm dia with steel core

2. Footrope 66.30 mtrs. P. P. Combination wire rope 14mm dia with steel core

   RUBBER disc Groundrope 5×13, 10 mtrs.

APPENDIX C
SURVEY LOG SHEETS

MARINE FISHERIES RESEARCH, MANAGEMENT AND DEVELOPMENT PROJECT (BGD/80/025)

FISHING LOG

DAY	MONTH	YEAR

CRUISE NUMBER

STATION NUMBER

SURVEY POSITION NUMBER

VESSEL NAME

GEAR TYPE

COD END MESH SIZE

LOCAL TIME

LATITUDE AND LONGITUDE

TIME SHOT	TIME HAULED	DIRECTION	BOTTOM DEPTH (m)		FISHING DEPTH (m)		POSITION OF SHOOTING		POSITION OF HAULING		DISTANCE TRAVELLED N.M.
		°	S	H	S	H	° ' N	° ' E	° ' N	° ' E	

DECCA Readings Shooting			DECCA Readings Hauling		
R	G	P	R	G	P

SAMPLE BASKETS

TOTAL BASKETS

HAUL VALIDITY

FOR VALID HAUL ENTER 1
FOR NON-VALID HAUL ENTER 0

COMPOSITION OF TOTAL CATCH

SPECIES	CODE	NUMBER	WEIGHT (kg)

SPECIES	CODE	NUMBER	WEIGHT (kg)

REMARKS: (DETAILS OF GEAR DAMAGE ETC.)

SAMPLE TOTAL WT (kg)

SCIENTIST I/C .....

MARINE FISHERIES RESEARCH, MANAGEMENT AND DEVELOPMENT PROJECT (BGD/80/025)

LENGTH FREQUENCY SHEET

VESSEL NAME		CRUISE NUMBER		HAUL NUMBER		STATION NUMBER		DATE	DAY	MON	YEAR

		SPECIES		
CM	TICK	SPECIES CODE		TOTAL
0	0			
1	2			
2	4			
3	6			
4	8			
5	0			
6	2			
7	4			
8	6			
9	8			
0	0			
1	2			
2	4			
3	6			
4	8			
5	0			
6	2			
7	4			
8	6			
9	8			
0	0			
1	2			
2	4			
3	6			
4	8			
5	0			
6	2			
7	4			
8	6			
9	8			
0	0			
1	2			
2	4			
3	6			
4	8			
5	0			
6	2			
7	4			
8	6			
9	8			
0	0			

TOTAL CATCH OF THIS SPECIES		SAMPLE (IN SAME UNITS AS TOTAL CATCH)	

CM	TICK	SPECIES CODE		TOTAL

MARINE FISHERIES RESEARCH, MANAGEMENT AND DEVELOPMENT PROJECT (BGD/80/025)

BIOLOGICAL SAMPLING SHEET

sheet ..... of .....

SPECIES		VESSEL NAME		NUMBER OF SAMPLE		DATE SAMPLED	DAY	MONTH	YEAR

CRUISE NUMBER		STATION NUMBER		HAUL NUMBER	

FISH No.	LENGTH (mm)	WEIGHT (g)	SEX M. or F.	MATURITY	AGE			REMARKS
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

SCIENTIST I/C .....