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Distribution and Abundance of *Illex illecebrosus* (Le Sueur)
in Subareas 3 and 4. Results of an Exploratory Cruise

by

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INTRODUCTION

The migrant Cephalopod Onmastrephid *Illex illecebrosus* (Le Sueur), arrives to the Grand Bank of Newfoundland in late June or the beginning of July (SQUIRES 1957).

This species has long supported small inshore fisheries (MERCER 1973) but offshore fisheries have been expanding from some years ago, so that as given by MERCER (1974), in 1974 offshore landings of this species accounted for 93 per cent of the landings of the species in this two Subareas (3 and 4).

During the months of May and June of 1975 a cruise was carried out on board a spanish scouting vessel (commercial otter trawl type) in order to study the distribution, density and the possible yield of this resource for commercial purposes.

MATERIAL AND METHODS

For the survey a spanish commercial vessel (otter trawl type) was used, with an overall length of 37 m, a beam of 7.42 m and a depth of 3.90 m with a propulsive engine diessel type of 800 H.P. The vessel has 284 GRT.

The otters used were the rectangular traditional ones of an aproximate weight of 520 kilogrammes.

The gear used was a commercial bottom trawl, of the type normally used in the squid fisheries by the spanish vessels.

Its main features are as expressed below:

- Headline 70 meters
- Groundrope 90 "
- Quarter 12 "
- Wings(from headline) 31 "
- Wings(from groundrope)43 "
- Cod-end(polyamide) 9 "
- Cod-end mesh-size 36.5 mm

The area swept per mile was calculated to be approximately 0.01619 mile²

The position of the vessel during the fishing operations was checked each half an hour by LORAN system. Also surface temperature was registered in each tow. No data for bottom temperature were available.

Fishing operations started in the eastern slope of the Grand Bank, southwest to Cape Race (figure 1).

From this point the different tows were carried out following the border of the shelf southwards and always trying different depths.

Three main depths were selected, those close to 65-70 fathoms, 75-85 fth and 95-110 fth.

After the Grand Bank survey fishing operations were carried out in St Pierre Bank and Banquereau , where the biggest concentration of Illex was found.

When the gear was hauled, the total catch (in most of the cases) was estimated in tons and the gross composition of the catch by species registered. Only Illex catches were registered in kilograms and when possible cod catches as well.

When the catch was on deck, crew members proceeded to separate Illex from other species. After that, Illex was sorted in two commercial sizes (<15 cm >15 cm) and packed in rectangular aluminium trays to be frozen.

By-catch composition was analyzed by species and account of each one was estimated by means of the following empiric scale:

- A: Present, isolated specimens
- B: Present, specimens are representatives in the whole catch
- C: Some abundant, representing at less 1/4 from total catch
- D: Abundant, about 2/3 from total catch
- E: Very abundant, 1/2 or more from total catch.

Dorsal mantle length was registered in Illex measurements and the data were grouped in half centimeter classes. To obtain the length frequency distribution, a proportional number of trays of both sizes from the total catch were randomly taken to be measured.

To translate the length distribution from the sample to the total Illex catch, the following simple factor was used:

$$X = \frac{a \cdot y}{T_s}$$

where:

X: total number of Illex caught from a determined length class

a= number of individuals measured in that length class from the sample

y= total number of trays in the whole catch

T_s = number of trays measured.

RESULTS AND DISCUSSION

Results obtained are presented by Division as follows:

Division 3N

A total of nine tows were carried out in this area from a Latitude of 44° 32.5' N and a Longitude of 49° 0.6' W to a Latitude of 43° 02.2' N and a Longitude of 50° 51.2' W on 25-27 of May, following the border of the Bank in depths ranging from 54 to 106 fathoms and the average trawl distance being 4-16 miles as it is shown in table 1.

The usual surface temperatures ranged from 0.5° C to 4° C. Illex catch was reduced to only one specimen, which resulted to be a female with 170 mm of dorsal mantle length.

Table 2 shows the by-catch composition of each tow in this area, according to the empiric scale previously indicated. Cod catches in some cases appear in kilograms, and are estimated by the empirical index in some others.

The most frequent species in this area resulted to be: Raja sp, Pseudopleuronectes americanus (american plaice), Sebastes marinus (redfish) Glyptocephalus cynoglossus (witch) and Gadus morhua (cod), with certain dominance of Raja sp and american plaice. Other non-commercial species, were not taken into account specifically.

Division 30

In this area nine tows were carried out from Latitude 43° 21.2' N and Longitude 51° 19.7' W to Latitude 45° 04' N and Longitude 54° 24' W on 28-30 of May, in depths that ranged from 65 to 120 fathoms (Table 1)

Sea surface temperatures were ranging from 2° to 4° C. Time and miles towed are shown in table 1. Illex catches in this Division were null.

During the cruise rough bottoms represented a problem, and gear was strongly damaged in many cases.

In tables 2, 3, and 6, where total catch estimation is null it indicates that the gear was partially or totally broken, so that any estimation of the total catch could be done.

In this area although rough bottoms were found, eight of the nine tows gave a good estimation of the species existing in the area.

The most frequent species in the catches were the following: Gadus morhua (cod), Raja sp., Pseudopleuronectes americanus (american plaice), Sebastes marinus (redfish), Lophius americanus (goosefish) and others (table 3).

MERCER (1974) reports that the biggest catches were obtained in bottom temperatures from 8.8° C to 13.6° C in the research cruise carried out on May-June of 1974.

As it was said before it was impossible to register bottom temperatures, but surface ones, never reached the minimum bottom temperature (5° C) at which Illex was caught (MERCER 1974).

Division 3Ps

Two tows were carried out from Latitude 45° 06.5' N and Longitude 55° 18' W to Latitude 44° 55' N and Longitude 55° 52.5' W. The data concerning to this tows are presented in table 1.

Very rough bottoms for trawling produced serious damages on the gear, loosing almost a complet net in one case. Bottom temperatures in both tows was 3° C.

Illex catch was null again. Raja sp., Pseudopleuronectes americanus (american plaice), Gadus morhua (cod) and Glyptocephalus cynoglossus (witch) were the species caught.

Division 4Vs

Thirty one tows were carried out in this division. We distinguish two areas. Northward two tows were carried out with a null catch of Illex. Very rough bottom were found in this area.

A little more southwards there is an area of 20-25 miles adequate for trawling, oriented NNE - SSW. This area is into the LORAN- A - Rates 1H1-2490 and 1H1-2580 (see chart L 8008 from Canadian Hydrographic Service) and was the only area where Illex was caught in some quantity. Towing depths ranged from 76 to 84 fathoms, other data concerning to this tows are shown in table 1.

Length composition was studied as indicated previously. Figures 2 and 3 show the length distribution found in different samples measured (grouped in half centimeter classes). In table 4 the length frequency distribution estimated for the total catch from length frequency measured in the samples is shown.

From figures 2 and 3 it can be seen that length ranges are from 100 to 205 mm.

Distribution 1 (figure 2) has a length range from 120 to 190 mm, with a single mode in 160 mm. 231 specimens were measured in this sample.

Distribution 2 (figure 2) has a length range from 100 to 195 mm with the modal value in 150 mm.

Distribution 3 (figure 2) has a length range from 105 to 195 mm and appear as bimodal with modes in 130 and 150 mm.

Distributions 4, 5, 6 and 7 has a similar length range, with modes in 150 mm.

So, it is seen that length frequency distributions were unimodal except the third one, with modes being around 155 ± 0.5 mm.

The modal lengths seem to be in agreement with SQUIRES (1967), who finds a dorsal mantle length of 14 cm in May, when Illex arrives offshore at Newfoundland, with a monthly increase of 2 cm. Modal lengths observed in June for Illex were 15 and 16 cm, as it was seen before.

So our data are in between those given by this author. Only the third distribution presents a mode in 130 mm which does not agree with other surveys carried out before, it could be due to a systematic error

in the measurement, but the number of specimens measured and the absence of this mode in the other distribution presented, produce some doubts about it, so that we can not conclude on this point.

Due probably to the short period which samples of Illex could be taken, it was not observed any clear increase in modal values.

Table 5 shows the evolution of catch/hour fished, and also the sea surface temperature, it is not observed any relation between the two factors.

Table 6 gives the by-catch composition, in most of the cases total catch estimation was not available. The most frequent species were: Gadus morhua(cod), Raja sp, Pseudopleuronectes americanus (american plaice) Hippoglossus hippoglossoides (halibut) and some others (see table 6)

By-catch result to be lower when Illex was present in bigger account and when Illex catch was small by-catch was high. So it appear that Illex has a certain degree of agregation, forming compact groups without or with very few mixture of other species.

Division 4WX

Only three tows were carried out as it is shown in figure 1, being unsuccessfull in Illex catches. Damages in the gear were produced again due to rough bottoms.

The most frequent specie in the catches was Merluccius bilinearis(american hake).

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Table 1.- Data related to the different tows carried out

Tow	Longitude W	Latitude N	miles	depth	Time	surface Temperature
1	49° 06'	44° 32.5'	10	64-70	3h 10m	1° C
2	49° 03'	44° 21.5'	7.5	54-86	3h 5m	1°
3	49° 03.5'	44° 14.3'	4.5	98-92	3h 35m	1°
4	49° 20'	43° 44.7'	4	62-82	2h -	0.5°
5	49° 51'	43° 00'	4	62-70	2h -	2°
6	49° 57'	42° 56.5'	5.2	78-96	2h 45m	2.5°
7	50° 15.3'	42° 55.3'	11	68-70	3h 25m	2°
8	50° 33.5'	42° 55.5'	13	86-106	3h 35m	2°
9	50° 51.2'	43° 02.2'	16	80	4h -	4°
10	51° 19.7'	43° 21.2'	3	75	0h 45m	-
11	51° 37'	43° 26.1'	4	72	1h -	4°
12	51° 56.7'	43° 34.7'	4	92-102	1h 10m	4°
13	52° 10.7'	43° 44'	6.2	120-110	3h 10m	5°
14	52° 27.5'	43° 55.6'	7.2	103-94	2h 45m	5°
15	52° 43.4'	44° 12.5'	5.8	64-66	1h 30m	5°
16	52° 58.3'	44° 23.7'	6	80-92	2h -	5°
17	54° 06'	44° 49.7'	7	104-114	3h -	4°
18	54° 24'	45° 04'	5	84-98	2h 25m	2°
19	55° 18'	45° 06.5'	3	70-66	1h -	3°
20	55° 52.5'	44° 55'	13	92-82	4h 40m	3°
21	57° 19.7'	44° 44.7'	10	82-74	2h 25m	2.5°
22	57° 15.2'	44° 28.7'	5	92-78	1h 15m	3°
23	58° 40.7'	44° 01.5'	7	86-84	2h 15m	4.5°
24	" "	" "	15-18	88-80	4h 35m	4.5°
25	" "	" "	"	76-83	4h 20m	4.5°
26	" "	" "	"	80-84	4h 30m	6°
27	" "	" "	"	79-84	4h 30m	4°
28	" "	" "	"	80-82	4h 40m	4.5°
29	" "	" "	"	82	5h -	6°
30	" "	" "	"	84	4h 40m	4.5°
31	" "	" "	"	84-86	5h -	6°
32	" "	" "	"	84	6h 05m	6°
33	" "	" "	"	84	4h 50m	5°
34	" "	" "	"	84-86	4h 50m	5°
35	" "	" "	"	124-126	3h -	-
36	" "	" "	"	84-86	4h 30m	4.5°
37	" "	" "	"	82-86	4h 10m	5.5°
38	" "	" "	"	78-86	5h 15m	4°
39	" "	" "	"	82-84	5h -	4°
40	" "	" "	"	84	4h 25m	5°
41	" "	" "	"	84	3h 50m	1.5° - 3°
42	" "	" "	"	84	4h 05m	4°
43	" "	" "	"	82-84	5h -	4.5°
44	" "	" "	"	84-86	4h 20m	4°
45	" "	" "	"	84	5h 05m	4.5°
46	" "	" "	"	84	4h 45m	4°
47	" "	" "	"	84	5h -	5°
48	" "	" "	"	84	5h 15m	5°
49	" "	" "	"	84	4h 50m	4.5°
50	" "	" "	"	82	5h 45m	5°
51	" "	" "	"	82-84	4h 15m	6.5°
52	60° 28.2'	43° 26.6'	5.5	88-84	1h 45m	8.5°
53	61° 32.7'	43° 06.6'	9.2	82-86	3h 20m	11.5°
54	65° 28.5'	42° 09.5'	7	70-76	2h 35m	8°

Table 2.- By-catch composition. Total catch in tons is estimated and abundance of other species is according to an empiric scale cited in the text.

Division	3 H									
	Tow	1	2	3	4	5	6	7	8	9
Total catch (tons)	3	2	Null	1	Null	1	-	1	3-4	
Gadus morhua (kg)	800	400	A	500	0	480	60	300	0	
Raja sp	D	C	A	A		A				
Pseudopleuronectes americanus	D	C	A			A	A	A		
Ammodites sp	A									
Mallotus villosus	A						A			
Lycodes reticulatus	A	A	A	A						
Nezumia bairdi		B		A		A				
Reinhardtius hippoglossoides		A		A						
Sebastes marinus		A		A	A	A				
Glyptocephalus cynoglossus					A	A	A	A		
Anarhichas lupus									A	
Clupea harengus									A	
Other than fish (Echinoderm, Bivalves, Gasteropods...)									E	

Table 3.- By-catch composition in Divisions 30 and 3Ps

Division	3 0										3 Ps	
	Tow	10	11	12	13	14	15	16	17	18	19	20
Total catch (tons)	-	1	1-2	2	4	0.4	3	5	Null	Null	3	
Gadus morhua (kg)			500	150	400	A	450	A			100	
Raja sp.				B	B	E	C					D
Pseudopleuronectes americanus		C	B	A			C					D
Mallotus villosus	A											
Sebastes marinus				B	C			E				
Glyptocephalus cynoglossus												A
Anarhichas lupus				A								
Clupea harengus			A									
Anarhichas minor			A	A								
Paralichthys dentatus			A	A	B		A	A				
Urophycis sp			A	A	B			A				
Melanogrammus aeglefinus			A	A								
Scomber scombrus			A									
Lophius americanus				B	B	A	A					
Pollachius virens				A								
Merluccius bilinearis				A	A			A				
Argentina silus										A		
Other than fish (Echinoderm, Bivalves, Gasteropods...)	E	D										

Table 4.- Length frequencies distribution from samples(mes.) and estimated (est.) ,for Illex illecebrosus during the cruise.

Length (mm)	Tow													
	24 + 26		27 + 28		30 + 32		36 + 37		39		42		45	
	mes	est.	mes	est.	mes	est.	mes	est.	mes	est.	mes	est.	mes	est.
100			1	29										
105			2	58	1	14							1	89
110			5	131	8	92	1	24	1	41				
115			14	371	21	250			4	164			7	623
120	1	186	45	1179	32	376			12	492	5	520	11	979
125	3	558	38	997	62	748	6	168	9	369	10	1040	15	1335
130	2	372	51	1344	76	880	2	56	16	656	29	3016	32	2848
135	2	372	58	1584	42	500	5	144	38	1558	24	2496	33	2937
140	11	2046	88	2317	46	560	18	512	114	4674	43	4382	73	6424
145	9	1674	88	2313	62	735	33	928	118	4798	39	3876	65	5712
150	26	3852	130	3432	111	1187	111	3117	129	5209	60	5250	109	9263
155	27	3218	103	2377	87	678	114	2958	67	2227	56	3394	90	6404
160	71	6154	78	1454	102	367	129	2345	76	1156	69	2226	110	4826
165	27	2234	69	631	67	128	94	891	46	246	30	600	65	1478
170	33	2202	26	176	59	105	99	467	43	43	25	350	55	880
175	9	362	24	132	27	36	61	206	15	15	8	112	28	448
180	8	504	10	58	16	22	33	102	7	7	9	126	30	480
185	1	22	2	8	7	10	6	15	5	5	2	28	15	240
190	1	22	1	4	6	8	4	10	1	1	3	42	5	80
195			1	4	2	2	1	4	2	2	2	28	4	64
200													5	80
205					1	2							1	16
Total	231	23778	834	18599	835	6700	717	11947	703	21663	414	27486	754	45206

Table 5.- Evolution of catch per unit effort for Illex illecebrosus

Date	Catch (kg)	Hours fished	Catch/Hour (kg)
31/5	394	2h 15m	175.11
1/6	2797	13h 25m	178.60
2/6	2828	14h 10m	199.72
3/6	472	15h 45m	29.98
4/6	98	12h 40m	7.74
5/6	1539	13h 55m	110.64
6/6	1539	9h 25m	163.55
10/6	2169	7h 55m	274.21
11/6	3699	14h 25m	256.70
12/6	2997	15h -	199.80
13/6	1998	14h 50m	134.70

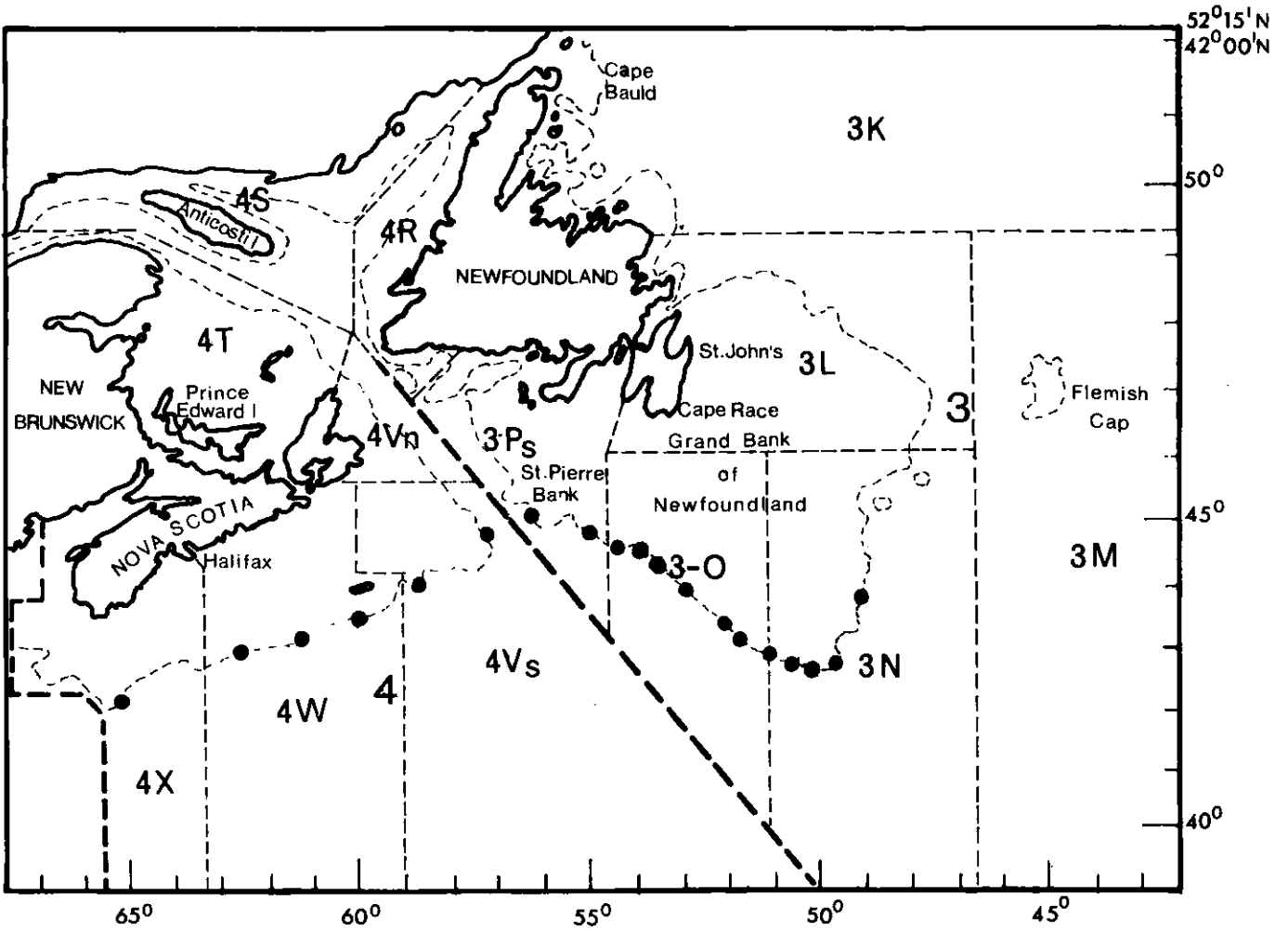


Fig. 1. Locations of the different tows carried out during the cruise.

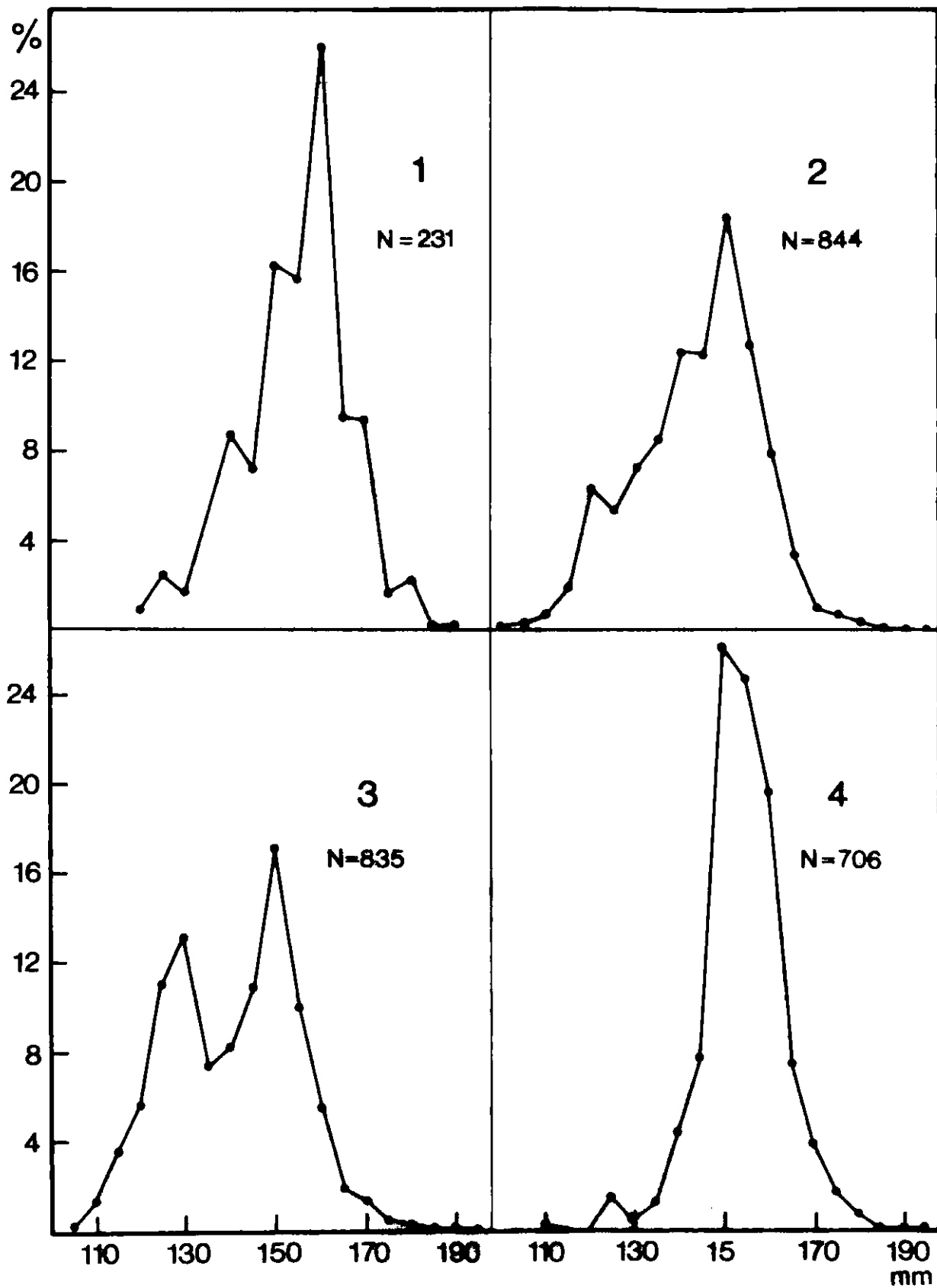


Fig. 2. Length frequencies distributions discussed in the text.

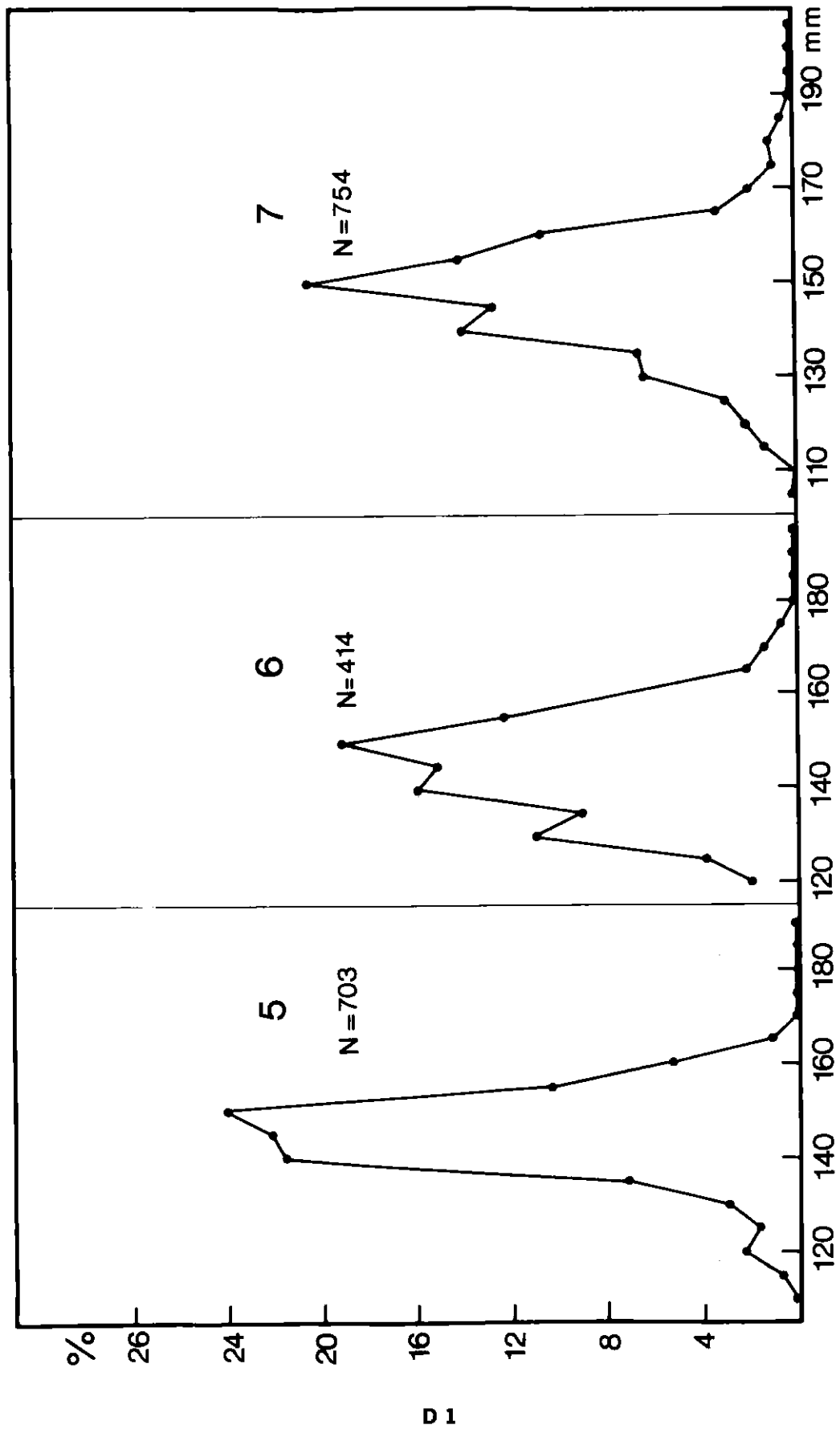


Fig. 3. Length frequencies distributions discussed in the text.

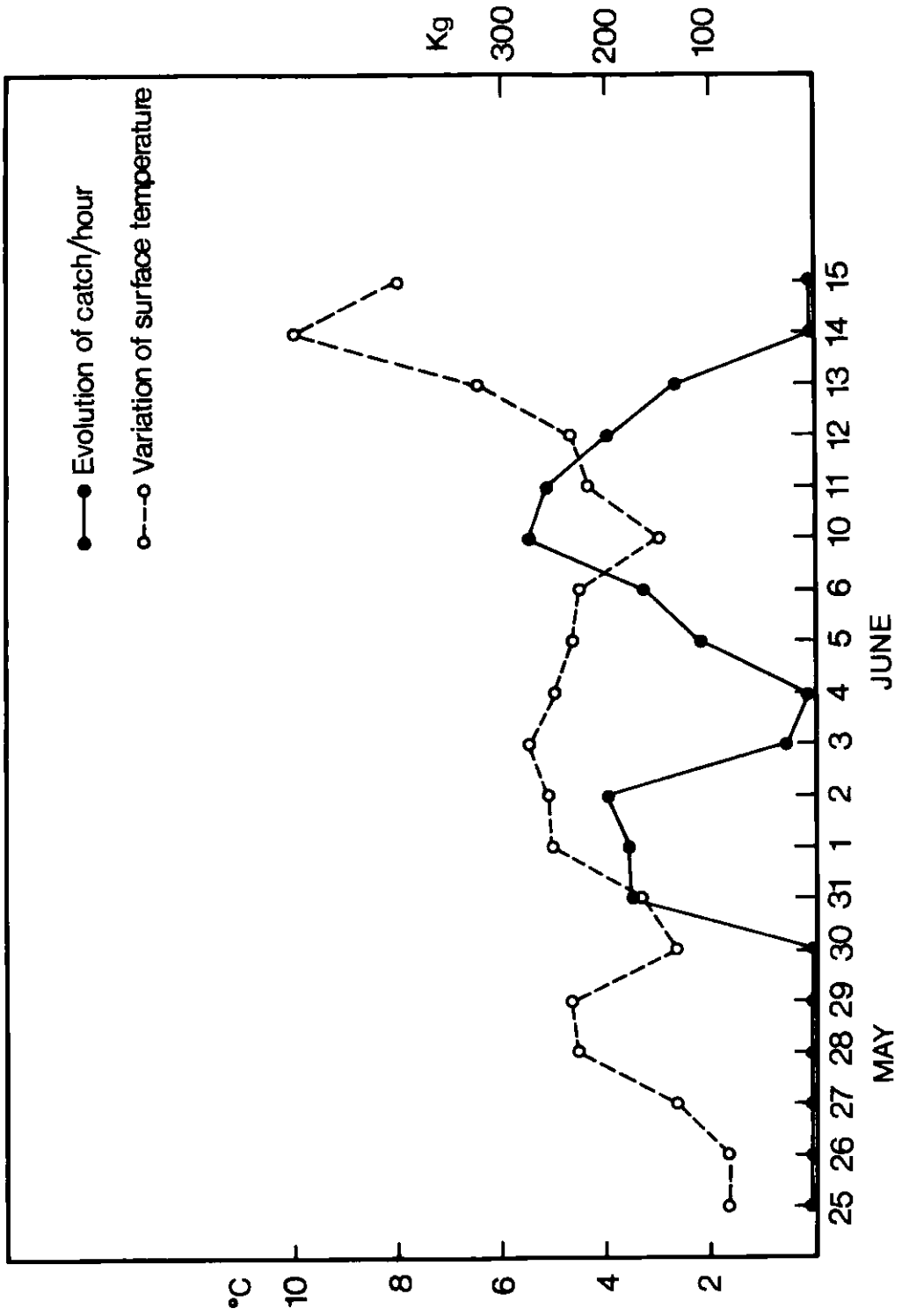


Fig. 4. Evolution of C.P.U.E. and variations of sea surface temperature.

