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Biomass Estimates of Young *Illex illecebrosus* (LeSueur, 1821) from a Survey in Subareas 3 and 4 in March-April 1979

by

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Abstract

As a result of the joint Soviet-Canadian research programme on board the RTM BELOGORSK the abundance of young short-finned squid has been estimated at 78×10^9 - 86×10^9 sp. beyond the shelf waters of Subareas 3 and 4 in the period from March to April 1979. The possibility of short-finned squid biomass estimate within 6-8 months in advance the fishing season peak was revealed. Biomass size was calculated taking into account the young squid mortality rates expressed conventionally as 25% (8.2-9.0 mill.t); 50% (5.5-6.0 mill.t) and 75% (2.7-3.0 mill.t).

It is recommended that the special meeting on squids be adjourned from February till May-June. It will permit to determine the true magnitude of short-finned squid allowable catch from the young abundance survey data directly before the beginning of fishing season.

Introduction

The recent estimates by a number of countries concerned show that the short-finned squid biomass size in Subareas 3 and 4 of the Northwest Atlantic ranges from about 100 to 400 thous.t (R.Dufour, 1979; Yu.M.Froerman, 1979; G.V.Hurley and P.Beck, 1979; M.Lipinski, 1979; A.Mari et al., 1979; T.Nagai and S.Kawahara, 1979; D.E.Waldron, 1979).

This paper is aimed at revealing the possibility of the short-finned squid biomass estimate well in advance by means of direct account of young abundance during the winter-spring period based on the materials of the Soviet-Canadian cruise aboard the Soviet RV BELOGORSK in 1979.

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Materials and Methods

The material for the present paper was collected from 10 March to 13 April, 1979.

The trawl abundance survey was conducted in the area between the Nova Scotian shelf and Gulf Stream (fig. 1, table 1).

The quantitative tows at the stations were made by 400-mesh Engle Trawls (EMT; fig. 2) at the horizonts of 50, 100, 200, 300, and 500 m. The tow duration was 15 min. at a mean speed of 1.8 knots.

The EMT catchability during the light and dark hours of the 24-hour period varied considerably. Thus, the coefficients for 50 tows using two periods of a day 04.00-12.00 a.m. and 12.00-20.00 p.m. were introduced (table 2).

The EMT catchability within 20.00 p.m. and 04.00 a.m. was assumed conventionally as 100 per cent. The calculations were made by the data of the stations where even one shortfinned squid was taken (excepting EMT-5-300 m and EMT-15 - 300 m). The calculations were based on the diurnal (31) and semi-diurnal (32) station data.

The number of squids was determined at each station in the depth range of 50-500 m throughout 0.003 sq. mile (tow area) by

means of vertical interpolation. The squid abundance between each two horizons was estimated applying the formula deduced by the graphic method during the data analyses, on the analogy with the deduction of the formula for trapezium area calculation:

$$E_Y = \frac{Y_1 - Y_2}{2} \quad n$$

where Y_1 is the number of squids at the first horizon

Y_2 is the number of squids at the second horizon

n is the number of strata between the horizons where a stratum is equal to the vertical opening of a trawl (11m).

The calculation of the data obtained by the traditional method of horizontal interpolation gave us the picture of the young short-finned squid quantitative distribution and permitted to estimate the abundance and biomass throughout 81 936 sq. miles.

Results

In the area under investigations the short-finned squid was found at 27 stations out of 39 (table 3).

Short periods of time within which the abundance survey was conducted, and even spacing of stations give the opportunity to estimate the short-finned squid abundance. The results cannot be overestimated because trawl catchability coefficient (unknown for the short-finned squid) ia assumed conventionally as 1. Abundance surveys do not cover the area between 64°-58°W and 39°-41°N where abundance should be in our opinion as high as in the positions of stations 33 and 39 (fig. 1, table 5).

As a result of horizontal interpolation the minimum abundance of the short-finned squid is estimated at 46.596×10^9 - 86.047×10^9 in the area between the Nova Scotian shelf and Gulf stream in the period from March to April 1979 (fig. 3, table 6). The mean size of the short-finned squid at that period is 46 mm, its mean weight being 2.0 g.

Discussion

The short-finned biomass estimate using the method of young abundance account outside the shelf area has in our opinion the following advantages over the traditional method of bottom trawl surveys earlier used (Grosslein M.D., 1969):

1. The possibility of fishing biomass estimate within 6-8 months in advance.

2. The elimination of a lot of causes (bad ground, lobster trap zones, zones prohibited for the bottom trawl operations, etc.) which prevent thorough account of squids on the shelf. Due to this the higher accuracy of estimate is achieved.

3. The conduction of surveys during the winter period in the area between the continental slope and the Gulf stream from Cape Hatteras to Labrador excludes the underestimation of any significant aggregations of short-finned squid in the other distribution area (short-finned squid abundance was not found to be inconsiderable on the shelf from December to February).

4. The high speed of operations (after the improvement and detailed consummation of the method).

One of the main drawbacks of the squid stock estimation method by means of young abundance account is lack of any data on mortality at this life history stage.

Thus, we present three biomass size estimates at the moment when short-finned squid reach the optimum sizes available for fishery (July-September) taking into account the young mortality in April, June as 25% (8.2×10^6 - 9.0×10^6 t), 50% (5.5×10^6 - 6.0×10^6 t) and 75% (2.7×10^6 - 3.0×10^6 t).

Conclusion

According to the data on young abundance surveys Illex biomass and abundance in NAFO areas 3 and 4 was considerably higher in 1979 than in recent years. There are no data on the

directed fishery and research quantitative activities on Illex on the Northwest shelf from July to September 1979 (data of only two fishing vessels) Therefore, we cannot compare the data on young and adult short-finned squid abundance.

However, the following conclusions could be made by this time:

1. Minimum biomass of shortfinned squid totals 2.7 - 3 mill. t in 1979 in NAFO Subareas 3 and 4.

2. Even if the year 1979 is anomalous for the short-finned squid abundance, it is evident that biomass estimates of this species were underestimated extremely for past years according to the data on fishery and trawl surveys on the shelf.

3. The organization of standard abundance surveys in the period from December to May in the NAFO Subareas between the shelf and Gulf stream permits to estimate the species biomass within 6-8 months before the fishing season peak.

4. The NAFO special session on squids is recommended to be adjourned till May-June. This permits to determine the true magnitude of allowable catch of this species for the given year directly before the beginning of the fishing season.

References

1. DUFOUR R., 1979. Update of the distribution, biomass estimates and length frequency of Illex illecebrosus from Canadian research cruises, 1970-78 ICNAF Res.Doc., 79/11/14, Ser. No. 5339.

2. FROERMAN Yu;M., 1979. Biomass estimates of Illex illecebrosus (Le Sueur, 1821) for ICNAF Div. 4W. ICNAF Res.Doc. 79/11/28, Ser. No 5354.

3. GROSSLEIN M.D., 1969. Groundfish survey program of BCF Woods Hole.Comm.Fish.Rev., 31: 22-35.

4. HARLEY G.V. and P. BECK, 1979. Assessment of the short-finned squid (Illex illecebrosus) in ICNAF Subarea 3 for 1978. ICNAF Res.Doc. 79/11/25, Ser. No. 5351.

5. LIPINSKY M., 1979. Assessment of Illex illecebrosus (Le Sueur, 1821) stocks in ICNAF Div. 4W determined by area-density method. ICNAF Res.Doc. 79/11/37, Ser. No. 5363.

6. MARI A., VALDES E., DOMINQUEZ R., 1979. Abundance estimates and fishing mortality rates of squid (Illex illecebrosus) in Subareas 3 and 4. ICNAF Res.Doc. 79/11/8, Ser. No 5333.

7. NAGAI T. and KAWAHARA S., 1979. Estimation of the Illex biomass on the edge along the Scotian shelf. ICNAF Res.Doc. 79/11/8, Ser. No 5346.

Table 1 Data by coordinates and dates of abundance survey station sets

Station No	Data	Coordinates	
		N latitude	W longitude
1	2	3	4
1	10.03.79	40°04'0	65°38'0
3	13.03.79	39°31'5	65°01'0
5	16.03.79	39°52'0	63°47'0
7	17.03.79	40°36'2	64°33'2
9	18.03.79	41°16'3	64°25'2
11	19.03.79	42°00'3	65°10'8
12	19.03.79	42°23'8	64°42'0
13	19.03.79	41°43'0	64°01'8
14	20.03.79	41°00'8	63°21'0
15	21.03.79	40°22'7	62°35'0
16	21.03.79	40°52'6	61°32'2
20	22.03.79	42°16'0	63°04'0
21	23.03.79	42°53'0	62°10'7
22	24.03.79	42°13'8	61°29'2
23	24.03.79	41°37'5	60°45'5
24	28.03.79	40°56'0	60'04'0
25	28.03.79	40°17'0	59°15'0
26	29.03.79	40°11'0	59°12'0
27	29.03.79	40°00'0	59°03'0
28	29.03.79	39°52'5	58°54'0
29	30.03.79	39°41'0	58°33'0
30	31.03.79	39°01'5	56°10'0
31/1	31.03.79	39°44'0	56°59'0
32	02.04.79	40°34'0	57°41°0
33	03.04.79	41°06'5	58°38'5
34	03.04.79	41°50'5	59°23'0
35	04.04.79	42°26'5	58°25'8

Table 1 (continued)

1	2	3	4
37	05.04.79	41°44'0	57°38'0
39	05.04.79	41°00'0	56°47'5
41	06.04.79	40°17'0	55°58'3
42	06.04.79	39°32'7	55°06'0
43	07.04.79	38°50'0	54°16'0
44	07.04.79	38°04'0	53°30'0
45	08.04.79	39°26'0	53°12'0
46	09.04,79	40°13'0	54°07'0
47	09.04.79	40°58'0	55°00'0
48	10.04.79	41°39'0	55°46'0
49	10.04.79	42°00'5	56°10'0
50	11.04.79	42°22'0	56°40'0
51	11.04.79	43°38'2	56°32'0
52	12.04.79	43°08'0	55°55'5
53	12.04.79	42°13'0	54°52'5
54	13.04.79	41°30'5	54°04'0

Table 2 Temporal rates of trawl catching efficiency for short-finned squid in the period from March to April 1979

Hours	Depth (m): 50	100	200	300	500
04.00 - 12.00	9.4	5.7	7.6	9.0	3.8
12.00 - 20.00	6.5	8.8	4.2	2.5	4.1

Table 3 Number of short-finned squid specimens (Illex illecebrosus, Le Sueur, 1821) on abundance survey station in the period from March, 10 to April,13, 1979

Depth (m) / Station No.	50	100	200	300	500
1	79	-	-	-	-
3	0	0	0	1	1
5	0	14	39	179	14
7	122	5	21	28	0
9	0	0	0	0	0
11	9	13	1	1	2
12	0	0	0	0	0
13	0	0	2	0	0
14	1	0	0	0	0
15	28	82	103	243	53
16	0	28	7	7	3
20	0	2	0	0	0
21	0	0	0	0	0
22	0	0	0	0	0
23	0	0	0	0	0
24	0	0	0	0	0
25	184	254	63	49	67
26	-	129	3	-	-
27	-	2	-	-	-
28	-	46	-	-	-
29	3	1	2	14	1
30	6	0	0	0	0
31	130	326	44	27	109
32	188	106	2	36	47
33	38	27	64	17	16
34	66	10	22	18	24
35	0	0	0	0	0

Table 3 (continued)

Station	50	100	200	300	500
37	10	62	0	0	0
39	0	103	54	75	64
41	2	46	0	8	2
42	72	184	73	71	64
43	20	6	18	10	8
44	0	0	0	0	0
45	0	0	0	0	0
46	1	0	0	0	0
47	54	193	145	35	50
48	1	0	0	0	2
49	3	3	1	0	1
50	0	0	0	0	0
51	0	0	0	0	0
52	0	0	0	0	0
53	0	0	0	0	1
54	0	0	0	0	0

Table 4 Number of short-finned squids in the catches of EMT with the temporal rates introduced

Depth (m)	50		100		200		300		500	
	*12.00-20.00	04.00-12.00	*12.00-20.00	04.00-12.00	*12.00-20.00	04.00-12.00	*12.00-20.00	04.00-12.00	*12.00-20.00	04.00-12.00
Station No.	2	3	4	5	6	7	8	9	10	11
3								9		4
5	0		123		164		X			
7	793		44		88		70		0	
14	7		0		0		0		0	
15								X		201
16	0		246		29					
26				753		23				
27				11						
28				262						
29	20		9		8		35		4	
30		56		0		0		0		0
32					8		90		193	
33		357		154		486		153		61
34	429		88							
37		94		353		0		0		0
39	0		906		227					
41		19		262		0		72		8
43		188		34		137	25		33	
46		9		0		0		0		0
48		9		0		0		0		0
49	20		26		4					

* Temporal period

X For haulings on station N 5 (300 m) and N 15 (300 m) the temporal rate was not introduced.

Table 5 Number of short-finned squid individuals within the depth range of 50-500 m and throughout 0.003 square mile according to the results of vertical interpolation of the given trawl abundance station*

Depth range (m) / Station No	50 100	100 200	200 300	300 500	Summed number of squids in the depth range of 50-500 m
1	2	3	4	5	6
3	0	0	41	155	196
5	280	1 304	1 559	1 754	4 897
7	1 904	600	718	255	3 477
11	50	64	9	27	150
13	0	9	9	0	18
14	16	0	0	0	16
15	250	841	1 573	4 036	6 700
16	560	1 250	164	91	2 065
20	5	9	0	0	14
25	997	1 441	509	1 054	4 001
29	66	77	195	491	829
30	114	0	0	0	114
31	1 037	1 682	323	1 236	4 278
32	669	518	445	2 936	4 568
33	1 163	2 909	2 904	2 582	9 558
34	1 176	500	182	382	2 240
37	1 017	1 604	0	0	2 621
39	2 061	5 150	1 373	1 264	9 848
41	639	1 191	327	1 027	3 184
42	582	1 168	655	1 227	3 632
43	505	777	736	627	2 645
46	21	0	0	0	21

Table 5 (continued)

1	2	3	4	5	6
47	562	1 536	818	773	3 689
48	21	0	0	18	39
49	98	136	18	9	261
53	0	0	0	9	9

* The data were used of those stations where five horizontal haulings by EMT were made.

Table 6 Results of the horizontal interpolation of young short-finned squid abundance according to the data on abundance survey by RTM BELOGORSK during March-April 1979

Stratum No.	Number of Squids throughout 0.0003 square mile in the depth range of 50 - 500 m (sp.)	Stratum Square Mile	Number of squids per Stratum (sp.)
1	0 - 500	22104	$0 - 3.684 \times 10^9$
2	500 - 2000	24120	$4.02 \times 10^9 - 16.080 \times 10^9$
3	2000 - 4000	18144	$12.096 \times 10^9 - 24.192 \times 10^9$
4	4000 - 6000	9432	$12.576 \times 10^9 - 18.864 \times 10^9$
5	6000 - 8000	5688	$11.376 \times 10^9 - 15.168 \times 10^9$
6	8000 - 9876	2448	$6.528 \times 10^9 - 8.059 \times 10^9$
1 - 6		81936	$46.596 \times 10^9 - 86.047 \times 10^9$

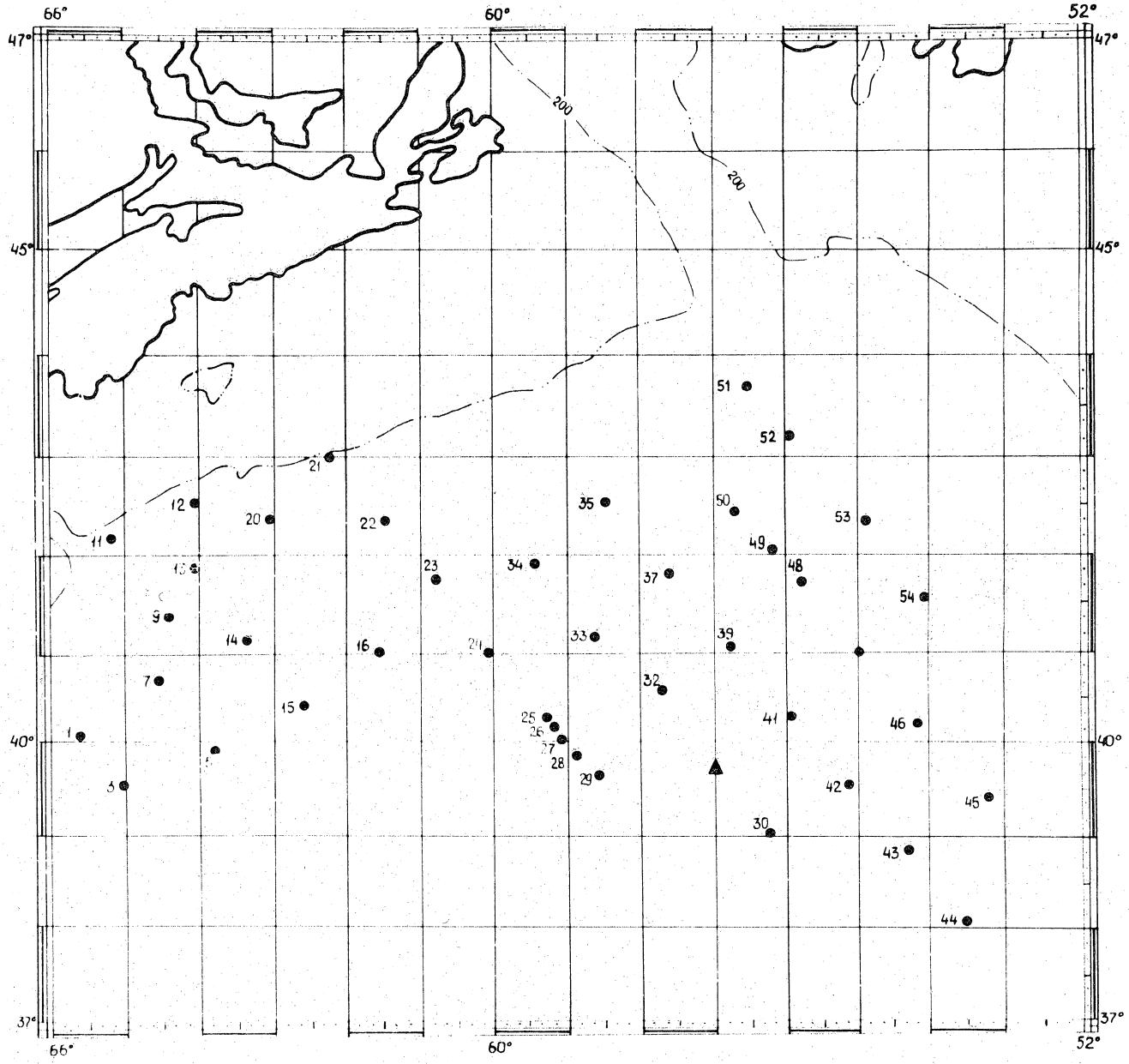

Fig. 1. Abundance survey station grid (▲ station N 31 is the diurnal station)

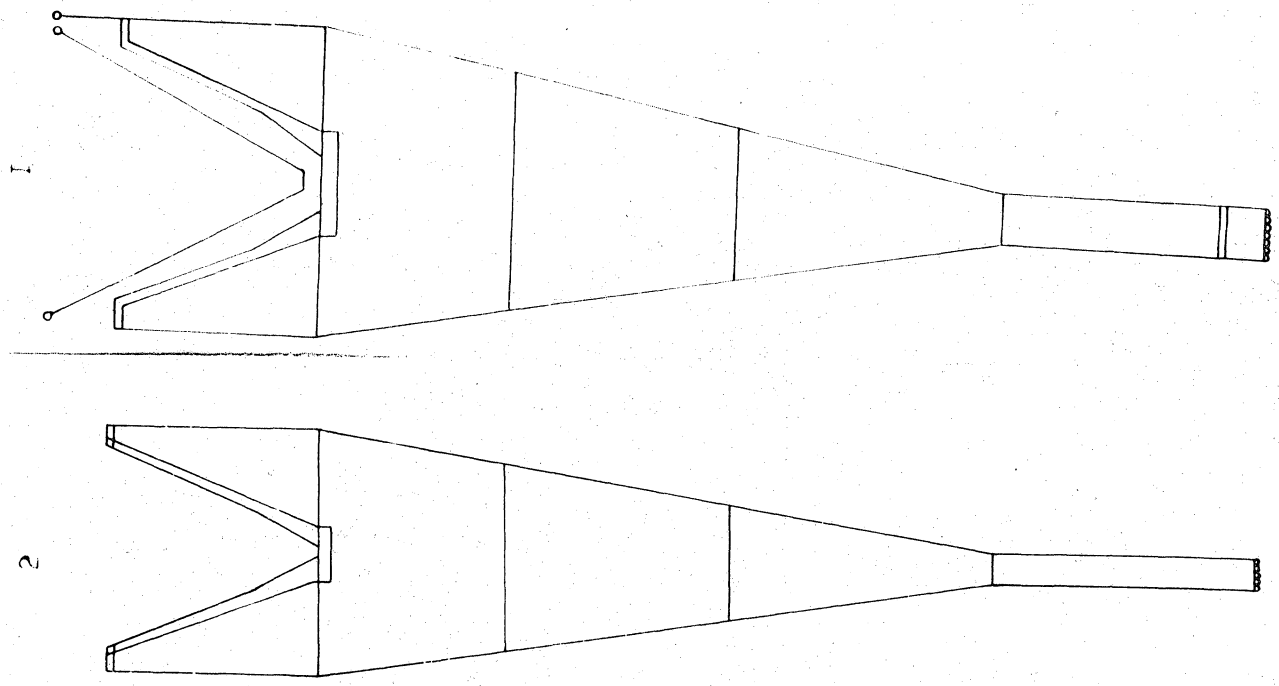

Fig. 2. 400-mesh "Engel Trawl" (EMT)

1 - view from above

2 - side-view

Length of head and foot ropes	- 17.8 m
Length of brail lines	- 16.8 m
Vertical opening	- ≈ 11.0 M
Horizontal opening	- ≈ 12.0 m
Size of mesh in the frame of last part of the trawl bag	- 60 mm
Size of mesh of the chafer in the last part of the trawl bag	- 5 mm
Diameter of the polystyrolene floats	- 20 cm
Area of wing-like trawl doors without gallow	- 2 sq. m
Weight of trawl doors	- 150 kg

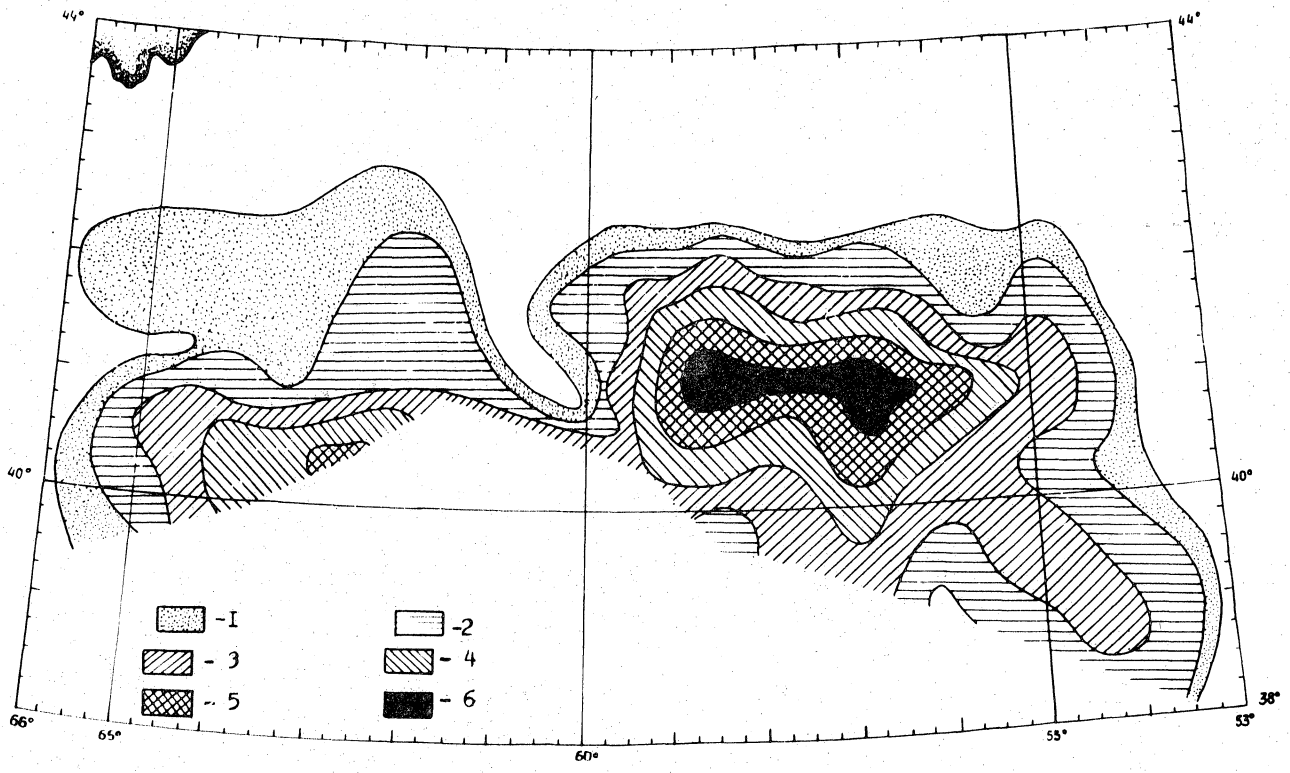

Fig. 3. Distribution of young short-finned squids (Illex illecebrosus, Le Sueur, 1821) in the depth range of 50-500 m throughout the area of abundance survey during March-April 1979

1 - 6 - stratum number (see table 6).