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Report on R/V *Cryos* Squid Surveys May 3-19 and November 22-December 15, 1975

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Distribution and biological characteristics of Squid Loligo pealei and Illex illecebrosus are studied from data collected during squid surveys carried out in May and November-December 1975 on Nova-Scotia, Georges bank and adjacent areas.

As in previous years, stress is laid on population structures, with regard to size distributions, sexual maturity, and their variations with environment, the final aim being a better accuracy in the determination of age groups.

Methods.

Squid were sampled by trawl, during daylight hours, at standard 30 minute haul stations, with towing speed 3.5-4 knots.

Two gears had to be used in the spring cruise : a 35/42 high opening semipelagic trawl was used on Nova-Scotia and Northern Georges bank ; it was torn and replaced by a 31.20/17.70 Lofoten type trawl ; the latter was chosen for the fall survey.

In May, 56 stations were realized at standard depths (ca. 90 m, 110 m, 150 m, 180 m, 300 m, 600 m), along transects selected more or less randomly in the vicinity of Nova-Scotian banks (Banquereau, South Sable Island, Western-Emerald, La Have, Baccaro, Brown), near Lydonia, Hydrographer, Veatch and Oceanographer canyons, to the South of Cape Cod and on the Southeast Peak of Georges bank.

Some of the Nova-Scotian transects were replicated in November, but the stations occupied on Georges bank during the fall survey were randomly selected by staff of N.M.F.S., Woods Hole, using the procedure of international groundfish surveys. Special attention was given to deeper strata where squid were expected to be more abundant as they migrated (fig. 3).

Aboard, the catch, or a representative subsample, was measured to the half-centimeter below, each sex apart. Maturity stages, as defined by MERCER (1973) were recorded.

The analysis of complex length frequency distributions was realized by the graphical method improved by CASSIE (1954) ; most often, centimeter classes were used.

Results and discussion.

I - Loligo pealei.

A. May.

The total catch of only 175 kg for the whole survey indicates the scarcity of this species on the outer edges of the shelf. A few individuals, of large size generally, were encountered on Southern Nova-Scotia and Northeastern Georges bank, and the abundance of squid tended to increase from the Northeast to the Southwest of this bank. We think that the largest part of the population had already reached the inshore waters, as we could judge by the presence in Newport (R.I.) harbor itself of many squid aggregated under the vessels lights. The highest catches were realized along the 3 southern transects, around 40° N and 69° W to 71° W, in waters 150-250 m deep, where bottom temperatures were higher than 10° C (Strata 11 and 12).

The dorsal mantle lengths of squid ranged 5-33 cm in males 5-24 cm in females, and the analysis led to the distinction of 3 components :

1) Juvenile squid ranging 5 to 12-13 cm have modal length of 10.2 cm in males, 10.0 in females ; this group represents 44 % of the total number of males, 57 % of the females.

They are very scarse in the Northern part of the surveyed area and in waters deeper than 100 fms, but particularly abundant at the 60-100 fms level ; we could observe also that males of the group were rather few at the 30-60 fms level (7 % of total number of males) when compared with the relative importance of females (35 %).

Although some members of the group have already reached advanced stages of maturity if not full maturity, most of these young still are in immature or early maturing position.

2) The second strong size class of the population, 44 % of the males, 42 % of the females, is composed of squid ranging 10-18 cm, with modal lengths at 15.4 cm for males, 13.2 for females.

They are present mainly in the upper strata of the shelf (30-60 fms) and probably still dominant in inshore waters. Most of them, males and females as well, have reached sexual maturity or one of the last stages of maturation, and a majority of females, either mature or maturing, have mated. We can suppose that they will spawn within one or two months.

3) As usual, the large squid are relatively few and most of them are males. Their lengths are too scattered for permitting the calculation of a significative mean, and they probably are a mixture oflarge spring spawners and survivors of last year. Most have probably spawned and died, either in inshore or even in deep waters. All are fully mature, females mated, and egg-clusters were collected in 100 m deep waters on stratum 11. Let us underline at this stage two interesting points of the reproductive behavior of the species : the possibility of spawning in deep as well as in coastal waters, and above all the fact that squid mate during their migration to the shelf,rather a long time before spawning, and even not fully mature females are involved.

As defined above by their mean lengths, these components are very similar to those cited by SUMMERS (1971).

B. November-December.

A very different situation was observed during the fall survey. At least on the 39 stations realized on Georges bank and its vicinity, Loligo was the most abundant species of all "groundfish" with nearly 2 metric tons caught. Highest quantities were fished on Strata 14, 7, and particularly 3, in waters warmer than 11-12° C. Once more, we could notice the increase of abundance from Northeastern to Southwestern Georges bank, together with the dominance of bigger squid in the North, but this time, the evolution accounts for the reverse migration, from shelf to slope, which takes place at the end of autumn.

The squid sampled had Dorsal Mantle lengths 4-27 cm in males, 4-23 cm in females, and 3 components were extracted :

1) The young squid 4-14 cm form the strongest class of the population with about 80 % of the total number. They are present on the whole surveyed area. Males in fact seem more numerous and, since we fished mainly on the outer shelf, we may think that they lead the migration. Males have modal length 11.3 cm, females 10.9 cm. As a general remark, we add that all groups of small squid may have exagerated mean lengths since they are most affected by trawl selection and many individuals are lost.

2) The second size-group (11 to 17-20 cm) was rather badly represented and hard to dissociate from the previous. We think that a majority of its members had already left toward deeper or southern stations : it appears better on Southern Georges bank and Strata 3 and 4.

a1

Modal lengths of males are 14.6 to 15.5 cm, females being about 13.5 cm, and the percentages relative to the total numbers of males or females are 11 % and 27 % respectively.

As far as we could notice, most males were immature or at the first stage, while all females were immature.

3) Squid longer than 18 cm form the third group and represent 3 % of the population. Here again, they may be a mixture of generations and the mean lengths, 22.5 cm in males, 19.3 cm in females, may be not significative.

The males were at intermediate stages of maturation, I or II, and very few mature animals were caught.

By reference to SUMMERS's growth sheme, we can consider that group 1) consists of Young-of-the-year, hatched in summer, while groups 2) and 3) are the grown-up of groups 1) and 2) of the population sampled in May.

II - Illex illecebrosus.

A. May.

At the time of our spring cruise, Illex were virtually absent from Northern Nova-Scotia and began to appear to the South of La Have bank ; on Southern Georges bank, they were well represented and began to reach the shallower strata. The highest catch however was made on Baccaro bank just at the end of the cruise, as we were sailing back to the North, and this indicates that the inshore migration was developing.

At first sight, the size structure of Illex is simple, but we could notice regional variations of the mean lengths.

The main part of the population is composed of males 11-22 cm, females 10-23 cm, of which mean lengths are 15.1 cm and 15.7 cm respectively, when all the samples are added. In fact the mean length of males is 14.3 cm on Nova-Scotia, 15.4 cm on Georges bank, and 15.6 cm to the South of 40°30 N, the corresponding means for females being 14.6 cm, 15.8 cm and 16.4 cm. This latter value is rather high because of the presence of a greater number of females in the 19-22 classes only in the South. Large females 23-28 cm were also caught but in very little number.

Most Illex in this season are immature ; some males longer than 13 cm are at stage I, a few 15-18 cm are at stage II, some 14-22 cm (17 cm) and even a 12.5 cm specimen are mature. As usual, females are immature, but the large females 20-28 cm (21 cm) met in the South were maturing : these are probably slow grown members of the winter spawning group.

B. November-December.

Together with Loligo, Illex was one of the most abundant species present on the area in fall. The total catch was about 850 kg, the best hauls being realized near Corsair Canyon in the North, near Hudson Canyon to the South, in rather cold waters (10° -10.5° C).

Compared with our previous observations in early fall, the size distributions showed a very unusual pattern, and 3 components were isolated :

1) 60 % of the catch in number consists in juvenile squid 6-7 to 14-15 cm in mantle length ; modal length of males is 11.5 cm, 12.0 cm for females, if not biased by selectivity. They were present principally in the Northern part of the surveyed region, including Nova-Scotia (where their mean length is about 10.0 cm), and were the nearly exclusive inhabitants of strata 17 and 18.

2) 32 % of the total number are male squid 13-21 cm, modal length 16.5 cm, and females 14-23 cm, modal size 17.2 cm. They are widely dominant on Nova-Scotia and Southern Georges bank, but tend to be less important on strata 3 and 4, and are found principally at the 60-100 fms level.

In some stations occupied in shallow waters of the central area (Strata 10 to 15), mean lengths were found to be lower than in general : for example, males 13.7 cm and females 14.0 cm on strata 10 and 13, and this shift may be due to a mixture with the previous group.

While all females are immature, most males larger than 15 cm are at stage I, at stage II above 18 cm, and many 17-21 cm are mature.

3) The last 8 % of the population consist in the large squid which are the most commonly cited component. Ranges and mean lengths are 21 - 23.7 - 25 cm in males, 22 - 25.9 - 30 cm in females. IF we refer to the classical growth scheme of the species, they were the main component of the population observed in May, and are equivalent to the animals leaving Newfoundland in November. In this season, we found them everywhere, but in rather little quantities, if we except the deepest strata and more particularly stratum 4 to the South where they are dominant. As indicated also by their aggregation near the canyons, natural channels to the slope, most members of the group have left the shelf where smaller squid of the two other groups stand dominant.

The situation described here is quite different of what was observed in September-October of previous years, because of the appearance of large numbers of small squid, and the decrease of the bigger animals we used to meet. The second group described above was observed with equivalent size in 1974, but them was only in the South (PAULMIER and MESNIL, 1975), and it seems similar to the group of little squid appearing on Newfoundland banks in November of some years (SQUIRES,1957).

Although cited from U.S. Groundfish Surveys in late fall or early spring (TIBBETTS, 1975) the group of juvenile squid is new to us. Its existence, its dominance even, call for an original growth scheme.

In this report, only a description is given of the situations observed in both seasons, and particular attention is given to the identification of size groups. Little explanation is written of their interrelation, ages or progeny. The multiplicity of the groups demands a better precision in the establishment of growth schemes. This particular problem will be the more precise subject of a second paper (MESNIL, ICNAF Res.Doc. 76/VI/65).

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	Males				Females**		
cm class	Imm.	Stage I	Stage II	Mature	Imm.	maturing	Mature
5	2				4		
6	6				6		
7	6			2	9		
8	10	2	2		18	1	
9	26	4	5	5	37	8	2
10	15	6	9	11	45	24	16
11	6	8	8	16	26	17	20
12	7	6	5	21	18	43	25
13	2	9	9	19	12	23	26
14	2	12	13	20	4	13	32
15		9	8	24	1	11	28
16		5	5	18	2	4	13
17	1	4	9	24	1		9
18		2	6	25		2	3
19			4	18			
20				21		1	6
21			2	25			3
22			1	12			1
23				13			1
24				9			1
25				5			
26				8			
27				2			
28				2			
29				2			
30							
31							
32							
33				1			

* Only examined individuals are considered.

** Most maturing or Mature females have mated.

Fig. 1 - Maturity stages of Loligo pealei* - May 1975

cm class	Males			Females		
	Nova Scotia	N of 40°30'N	S of 40°30'N	Nova Scotia	N of 40°30'N	S of 40°30'N
5			1			
6						
7			1			1
8			2			
9			1			3
10	2	1	3	1		2
11	4	1	5	3	1	7
12	32	6	28	28	2	20
13	136	15	57	132	17	61
14	231	42	95	219	40	83
15	96	70	197	99	46	153
16	11	45	213	45	42	196
17	6	11	64	19	35	128
18	1	3	15	1	7	93
19	2		8	4	2	43
20			3		1	22
21	1			4	1	8
22	1			2		
23					1	1
24						
25				1		
26				2		
27						
28						1
NT	523	194	693	560	195	822

Fig. 2 - Length distributions of Illex illecebrosus (expanded to the whole cruise catch) - May 1975.

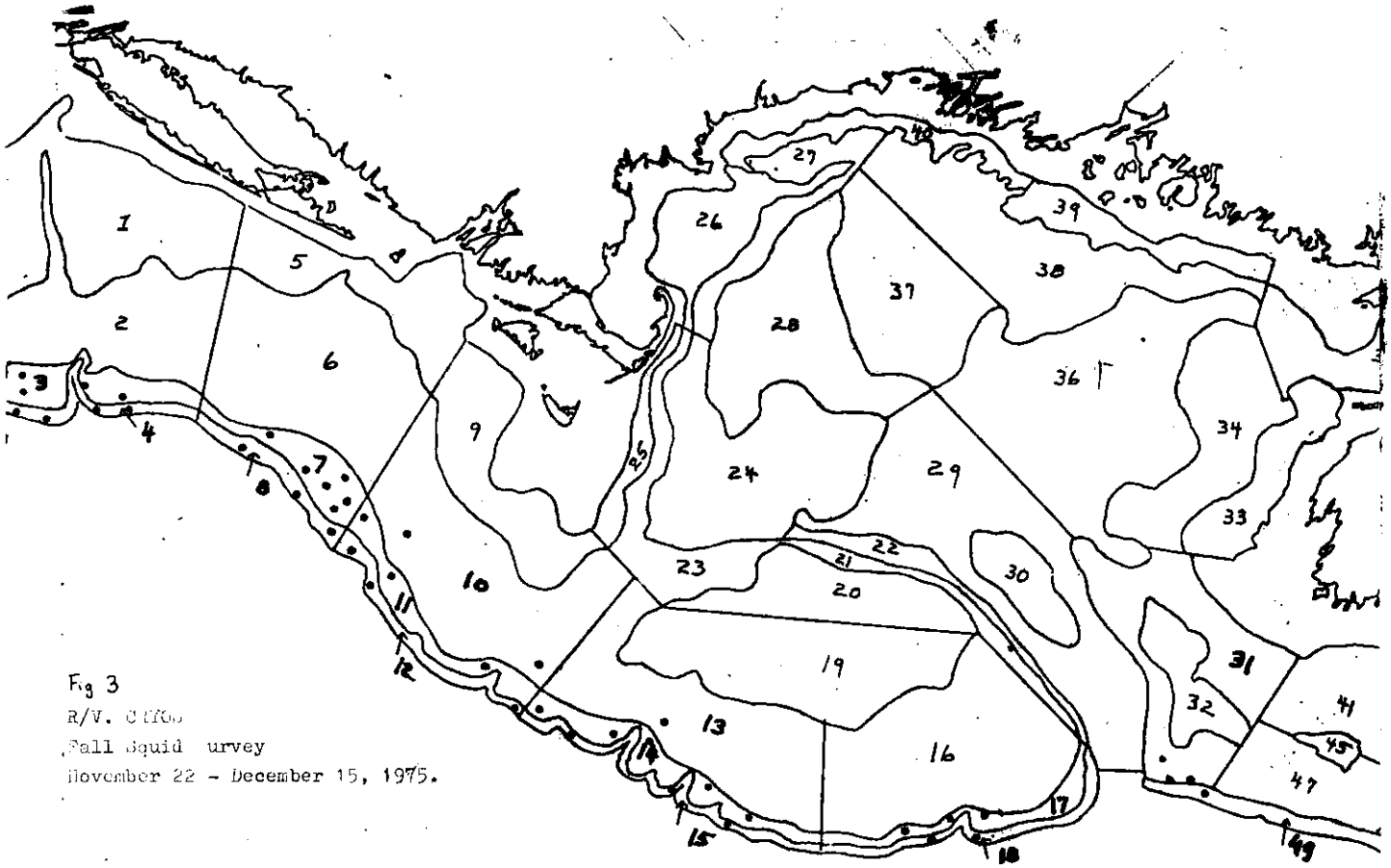

Fig 3
R/V. Cliffco
Fall Squid Survey
November 22 - December 15, 1975.

Stratum number		Nova-Scotia		17	18	14	15	10 & 13	11	12	7	8	3	4	Total
Area (Sq. Miles)		4258	459	360	172	656	230	5896	622	176	514	230	566	188	
Depth Range (m.)		90-180	185-315	110-180	225-480	110-180	200-390	55-110	110-180	210-360	110-180	200-315	110-180	225-370	
Number of hauls		4	4	3	2	5	3	3	3	2	6	3	4	4	46
Bottom Temp.		7°	9.3	10.0	9.5	12.3	10.4	13.0	11.5	10.1	12.3	9.5	13.0	10.0	
Range		10°	9.4	10.3	11.4	14.0	11.4	14.3	13.2	12.2	13.2	10.6	13.4	11.4	
Loligo pealei	W			2	1	369	95	217	97	41	313	25	638	170	1 968 kg
	N	2		10	5	7632	1842	4294	2030	834	4704	341	9475	3662	34 830
Illex illecebrosus	W	35	20	215	17	52	9	6	78	73	23	18	32	254	832 kg
	N	433	110	6807	37	822	48	78	988	818	270	95	446	1350	12 220

Fig. 4 - **Fall Squid Survey - Catch per stratum, weight and number**

cm class	Males	Females
4	17	16
5	127	154
6	339	333
7	580	390
8	1178	1019
9	1654	1430
10	2383	2178
11	3045	2771
12	2630	2341
13	2150	1887
14	1372	929
15	798	416
16	355	228
17	211	117
18	152	102
19	114	74
20	97	114
21	152	16
22	101	13
23	74	11
24	42	
25	44	
26	25	
27	29	
Tot.	17381	14539

Fig. 5 - Length distribution of the whole catch of Loligo pealei November-December 1975

cm class	Males	Females
6	1	
7	4	3
8	6	6
9	125	18
10	1037	649
11	1506	1436
12	825	837
13	400	483
14	321	387
15	368	354
16	379	363
17	336	304
18	242	227
19	173	212
20	56	116
21	52	75
22	89	38
23	165	36
24	140	69
25	19	111
26		116
27		49
28		33
29		10
30		3
Tot.	6244	5935

Fig. 6 - Length distributions of the whole catch of Illex illecebrosus - November-December 1975

cm class	Imm.	Stage I	Stage II	Mature
6	1			
7	4			
8	6			
9	30			
10	123			
11	155			
12	138			
13	142			
14	164	1		
15	206	13	1	
16	148	50	1	
17	63	60	2	2
18	18	32	23	13
19	14	22	29	30
20	2	6	13	16
21		1	2	28
22		1	1	57
23			2	100
24				80
25				13

Fig. 7 - Maturity stages of examined males Illex illecebrosus

November-December 1975