

Northwest Atlantic



Fisheries Organization

Serial No. N694

NAFO SCR Doc. 83/VI/40

SCIENTIFIC COUNCIL MEETING - JUNE 1983

The 1982 Fishery for *Illex illecebrosus* in SA 4 and  
Biological Characteristics of the Stock

by

T. W. Rowell and F. Budden

Invertebrates and Marine Plants Division, Fisheries Research Branch  
Department of Fisheries and Oceans, P. O. Box 550, Halifax, N.S., Canada B3J 2S7

Introduction

The SA4 fishery for *Illex illecebrosus* has been summarized by Amaratunga and Roberge (1981) for the period 1977-80 and by Amaratunga *et al.* (1982) for 1981. This paper describes the 1982 fishery as well as the biological characteristics of *Illex* as derived from both the international observer program and research survey data.

Materials and Methods

The FLASH information system provided statistical information on the international offshore fishery, including for each participating country, area fished, squid by-catch, directed squid catch, and directed effort days. Information on the Canadian offshore fishery and the inshore fishery were obtained from quota management reports and sales slip data summaries respectively.

Biological data from the international offshore fishery were obtained from random samples by international observers. Research cruises also provided biological and hydrographic data for the offshore areas. Morphometric measurements were taken on each sample of 100 squid as described by Amaratunga and Durward (1979). These data were used to describe size and weight composition, growth, and the progression of maturity stages throughout the on-shelf residency sampling period.

International Offshore Fishery

Although six countries (USSR, Cuba, Poland, Japan, Italy, and Portugal) reported catches of *Illex* in 1982, only two, Poland and Japan, participated actively in the directed international offshore fishery.

The distribution of fishing effort in the years 1980-82, based on the locations from which international observer samples were taken, are presented in Fig. 1. In 1982, the fishery operated largely between 60°W and 63°W along the small mesh gear line, with most of the effort between 62°W and 63°W. This differed from 1981 when the bulk of the fishery occurred east of 62°W and from 1980 when effort was widely and more evenly distributed along the shelf edge (from roughly 59°W to 65°W).

A total of 505.3 tons were landed in the 1982 international offshore fishery; all from SA4 (Table 1, Fig. 2). This amounts to only 3.7% of the previous years catch of 13,521 tons. The directed squid fishery accounted for only 210.9 tons (42%) of the total, the remaining 294.5 tons being taken as by-catch in the silver hake fishery. Squid were first reported as by-catch during week 21 (3rd week of May), with catches remaining low until the 3rd week of July (week 30) when Poland and Japan commenced directed fisheries (Table 2, Fig. 3). The greatest part of the catch in the directed fishery was taken in weeks 30 to 33, with highest catches in week 30 by Poland and in weeks 31 to 33 by Japan. Catches then declined, with Japan responsible for most of the directed catch in the period up to week 40 (ending Oct 1) when the fishery ended.

Catches in the non-directed fishery also increased in week 30, peaked in week 31 as a result of high by-catches by the USSR and Cuba, then dropped in week 32 and leveled out between weeks 33 and 38. Small by-catches were reported by Japan in weeks 39 and 40. The USSR, Japan, and Cuba accounted for all of the non-directed catch.

Total effort (days of directed fishing) was 88 days as compared to 711 in 1981. The level of this drop is even greater when compared to the average effort for the years 1978-80 of 2488 days.

CPUE was extremely low throughout the entire period of the 1982 fishery, averaging 2.4 tons per day as compared to 10.6 tons per day in 1980 and 13.5 tons per day in 1981.

The weekly mean weight of squid, weighted by sex ratio, have been used to determine numbers of squid landed in each week of the fishery and the catch rate for directed effort days (Table 3, Fig. 4). Numbers of squid landed per day in 1982 were much lower than in the years 1977-81. During the first four and best weeks of the 1982 fishery, weeks 30 to 34, numbers landed per day ranged from  $1.88 \times 10^4$  to  $5.10 \times 10^4$ , whereas in 1981 numbers landed per day for the first four weeks of the fishery ranged from  $9.56 \times 10^4$  to  $14.45 \times 10^4$ .

#### Canadian Domestic Fishery

Landings of 19 tons were reported in the Canadian offshore fishery by one jigging vessel operating in SA4 during August (Table 4).

Catch by month and by gear type in the 1982 inshore fishery of SA4 are presented in Table 4. A total of 1130 tons was taken, with the highest catches in July and August. This is a level similar to landings in recent years, with the exception of 1981 when inshore landings were depressed.

#### Biological Characteristics

Mean mantle lengths obtained by averaging the first three weeks of data from the international observer program indicate that first arrivals to the Scotian Shelf were roughly comparable in size to those of 1981, although smaller than those of 1980 (Table 5).

Data on mean weight of squid in each week from international observer and research surveys are presented for the years 1977-82 in Table 6. Again, early arrivals in weeks 22 to 24 of 1982 have mean weights roughly comparable to those of 1981 and considerably below those of 1980. Mean weights increased until week 32, then declined until week 35, and subsequently increased again as the season progressed. Length frequency data from the observer program (Fig. 5) indicate that the decline in mean weight of *Illex* after week 32 was the result of increasing numbers of smaller squid entering the shelf area. This suggests a protracted spawning period in 1982 with early and late cohorts being produced. A similar pattern, with mid-season leveling and decline of mean weights is evident for weeks 28 to 32 in the 1980 data (Table 6).

The growth pattern for male and female *Illex* in 1982 as determined from research survey and observer sample data is presented in Fig. 6. In this figure, unsexed size frequencies are also presented for juvenile *Illex* caught in the February-May period between the Gulf Stream and the Shelf-edge during Canadian-Soviet surveys. Cumulative percentage of squid at each maturity stage and mantle length is also presented in figure 6. In males, maturity stages 1 and 2 predominated, with only a few stage 3 specimens appearing after week 35. Female maturity stages 1, 2, and 3 were found, along with one fully mature stage 5. In general, female maturity stages 1 and 2 predominated until week 36, after which small numbers of stage 3 animals were regularly observed. No stage 4 females were found. In contrast to the general pattern described above for progression of female maturities in 1982, a number of stage 3 specimens were captured in weeks 22-23 with mantle lengths of 140-170 mm. If the 50% levels for maturity stages 2 and 3 for males are projected to the growth curve these levels are found at roughly week 36 and 44, indicating considerably slower maturation than observed in 1981 (Amaratunga *et al.*, 1982). Similarly, female maturities in 1982 also lagged well behind those of 1981.

Combined international observer and research survey data for 1982 gave the following length-weight relationships for male and female squid.

$$\begin{array}{ll} \text{Male} & \log \text{ weight (g)} = 4.7591 + 3.0201 \log \text{ length (mm)} \\ \text{Female} & - \log \text{ weight (g)} = 4.6580 + 2.9705 \log \text{ length (mm)} \end{array}$$

These relationships changed little when examined separately for the early and late cohorts. The 1982 length-weight relationship was similar to those observed in the period 1977-79 (Amaratunga, 1981) with males weighing more than females of the same length. The reverse had been observed in 1981, with females weighing more than males (Amaratunga *et al.*, 1982).

#### Acknowledgements

The authors wish to express their gratitude to Mr. T. Amaratunga for his contributions to the collection of the data on which this paper is based.

# References

- AMARATUNGA, T. 1981. Preliminary update of *Illex illecebrosus* morphometrics in Subarea 4 for 1980. NAFO SCR Doc. 81/VI/84, Ser. No. N377.
- AMARATUNGA, T., and R. D. DURWARD. 1978. Standardization of data collection for the short-finned squid *Illex illecebrosus*. ICNAF Sel. Papers, No. 5, 37-41 p.
- AMARATUNGA, T., and M. ROBERGE. 1981. Summary of 1980 *Illex illecebrosus* fishery in SA4 in relation to 1977-1979 data. NAFO SCR Doc. 81/VI/35, Ser. No. N317.
- AMARATUNGA, T., J. YOUNG, and F. BUDDEN. 1982. Update for 1981 of the squid *Illex illecebrosus* fishery in Subarea 4. NAFO SCR Doc. 82/VI/29, Ser. No. N517.

TABLE 1. WEEKLY INTERNATIONAL CATCH STATISTICS FOR SQUID (ILLEX ILLECEBROSUS) IN SUBAREA 4 AS REPORTED TO FLASH FOR 1982.

WEEK ENDING	SQUID CATCH (t)			DIRECTED EFFORT (DAYS)	DIRECTED C/E (t/DAY)
	DIRECTED	NON-DIRECTED	TOTAL		
May 21 (21)		1.8	1.8		
May 28 (22)		8.0	8.0		
June 4 (23)		5.0	5.0		
June 11 (24)		1.5	1.5		
June 18 (25)		0.3	0.3		
June 25 (26)		11.8	11.8		
July 2 (27)		0.2	0.2		
July 9 (28)		3.5	3.5		
July 16 (29)		0	0		
July 23 (30)	48.7	14.4	63.1	21	2.32
July 30 (31)	43.3	136.2	179.4	9	4.81
Aug. 6 (32)	23.2	31.2	54.4	9	2.58
Aug. 13 (33)	44.3	8.7	53.0	13	3.41
Aug. 20 (34)	19.5	9.8	29.3	8	2.44
Aug. 27 (35)	1.3	13.1	14.4	4	0.33
Sept. 3 (36)	6.8	9.7	16.5	7	0.97
Sept. 10 (37)	0	26.6	26.6	2	0
Sept. 17 (38)	10.3	9.9	20.2	6	1.72
Sept. 24 (39)	12.8	2.0	14.8	7	1.83
Oct. 1 (40)	0.7	0.8	1.5	2	0.35
Total	210.9	294.5	505.3	88	2.40

Table 2. Catch (t) of Illex, directed effort (days) and CPUE (directed) of countries participating in the 1982 international fishery in SA4.

Week	USSR			CUBA			POLAND			JAPAN			ITALY			PORTUGAL			TOTAL								
	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE	By- catch	Dir. Days	CPUE						
21	0.4		1.4																1.8								
22	4.7		3.3																8.0								
23	4.4		0.6																5.0								
24	1.5																		1.5								
25	0.1		0.2																0.3								
26	5.6		6.2																11.8								
27			0.2																0.2								
28	3.4		0.1																3.5								
29																											
30	8.2		3.3																14.4	48.7	21	2.32					
31	61.1		59.6																136.2	43.3	9	4.81					
32	20.4		10.8																31.2	23.2	9	2.58					
33	6.4																		8.7	44.3	13	3.41					
34																			9.8	19.5	8	2.44					
35																			13.1	1.3	4	0.33					
36																			9.7	5.8	7	0.97					
37																			0.1	1	0.10						
38			0.6																26.6	0	2	0					
39																			9.9	10.3	6	1.72					
40																			0.5	12.8	7	1.83					
																			0.8	0.7	2	0.35					
Total	116.2	-	-	-	86.8	0.9	2	0.45	39.3	39	1.01	91.5	169.2	43	3.93	-	1.4	1	1.40	-	0.1	1	0.10	294.5	210.9	88	2.40

Table 3. Estimated number of Illex removed in the International Directed Fishery in 1982.

WEEK	DIRECTED CATCH	EFFORT	MEAN WGT (g)	NO. SQUID X 10 <sup>5</sup> LANDED PER WEEK	NO. SQUID X 10 <sup>4</sup> LANDED PER DAY	LN SQUID (SQUID X 10 <sup>3</sup> /dy)
July 23 (30)	48.7	21	94.4	5.16	2.46	3.2014
July 30 (31)	43.3	9	-*	4.59	5.10	3.9312
Aug. 6 (32)	23.2	9	132.8	1.75	1.94	2.9658
Aug. 13 (33)	44.3	13	-*	3.34	2.57	3.2449
Aug. 20 (34)	19.5	8	130.0	1.50	1.88	2.9312
Aug. 27 (35)	1.3	4	109.9	0.12	0.30	1.0843
Sept. 3 (36)	6.8	7	117.5	0.58	0.83	2.1123
Sept. 10 (37)	0	2	127.2	0	0	-
Sept. 17 (38)	10.3	6	157.2	0.66	1.09	2.3906
Sept. 24 (39)	12.8	7	-*	0.81	1.16	2.4538
Oct. 1 (40)	0.7	2	-*	0.04	0.22	0.8004

\*Where mean weights not available, previous week's mean used to calculate number of squid landed per week.

Table 4. Catch of Illex in the 1982 Canadian fishery in SA4.

Gear		Month	Catch (t)
Offshore			
	automatic jigger	August	19
Inshore <sup>a</sup>			
a) <u>By Month</u>		June	4
		July	368
		August	664
		September	42
		October	21
		November	31
			<u>1130</u>
b) <u>By Gear Type</u>			
	Trap		883
	Set Gill Net		7
	Handline		287
	Longline		2
	Unspecified		1
			<u>1130</u>

<sup>a</sup>Based on sales slips A and B.

Table 5. Mean squid length at arrival on Shelf.

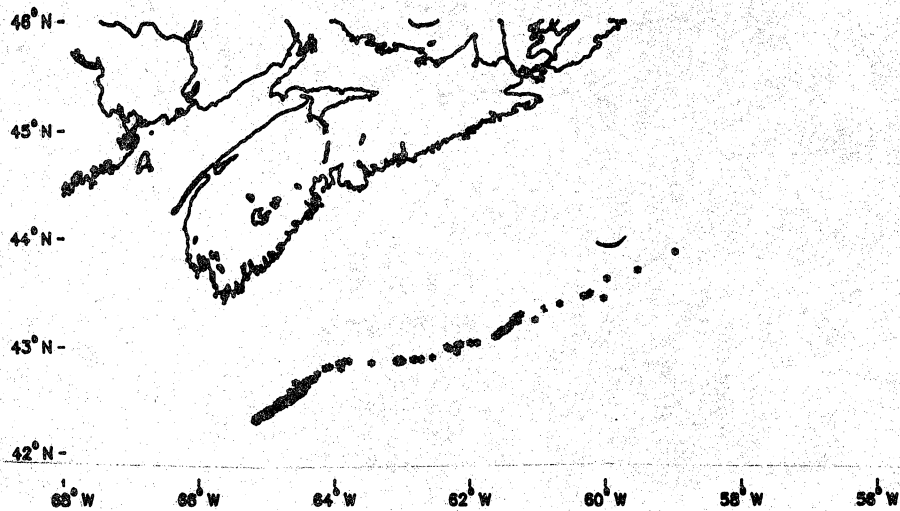
Year	Mantle Length (mm)	
	Male	Female
1978	145.29 (17-19)	148.86 (17-19)
1979	134.16 (19-21)	140.25 (19-21)
1980	155.56 (20-22)	164.40 (20-22)
1981	140.55 (20-22)	149.68 (20-22)
1982	145.81 (22-24)	151.53 (22-24)

\*Numbers in brackets refer to consecutive week within year.  
Means are obtained by averaging first three weeks of data from the observer program.

Table 6. Mean weight (g) of *Illex* from international observer samples and research surveys. Survey means are presented in parenthesis.

Week	Year					
	1977	1978	1979	1980	1981	1982
16	37					
17						
18	56					
19						67.5
20	70				(31.1)	
21				150.0 (97.9)	76.2	
22	101			90.1	54.8 (51.0)	57.9
23				97.8	(59.9)	58.6
24	123			103.9 (96.3)	(63.3)	80.7
25				11.2 (86.5)	120.1	74.5
26	165			85.9 (70.9)	112.6	68.0
27		137.9	137.1	136.5 (103.3)	150.5	
28	189	134.8	134.0	141.5	172.8	
29		138.4	138.1	92.5	192.8	94.4
30	197	189.6	149.9	104.3	174.5	112.5
31		159.9	159.8	130.3	-	
32	213	171.1	169.7	101.7	203.5	132.8
33		179.8	179.5	205.7	206.2	
34	240	189.8	189.4	215.3	209.8	130.0
35		199.3	199.3	138.4	231.4	109.9
36	251	209.4	209.2	196.5	248.8	117.5
37		219.3	219.1	183.6	237.2	127.2
38	265	229.2	228.9	303.3	234.8	157.2
39		239.1	238.8	217.1	-	
40	278	248.8	248.7	233.5	-	
41		258.7	258.6	249.2	-	
42	289	268.7	268.5	225.7	-	
43		309.0	308.2	264.2	-	
44	305	312.3	311.5	292.1	-	
45		314.5	313.8	240.0	-	
46	286	277.5	275.5	243.4	-	
47		292.2	291.8	285.1	-	

### 1980 OBSERVER SAMPLES



### 1981 OBSERVER SAMPLES



### 1982 OBSERVER SAMPLES

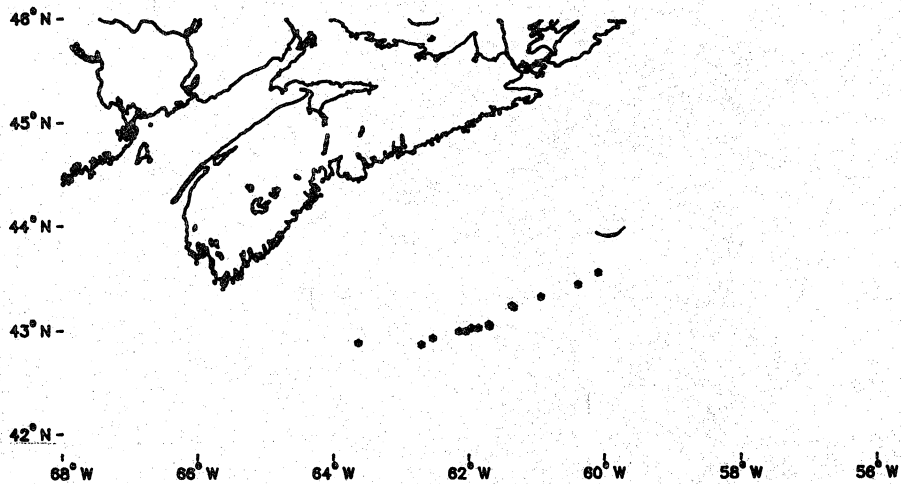


Figure 1. Locations sampled by international observers during the 1980 to 1982 squid fisheries in SA 4.



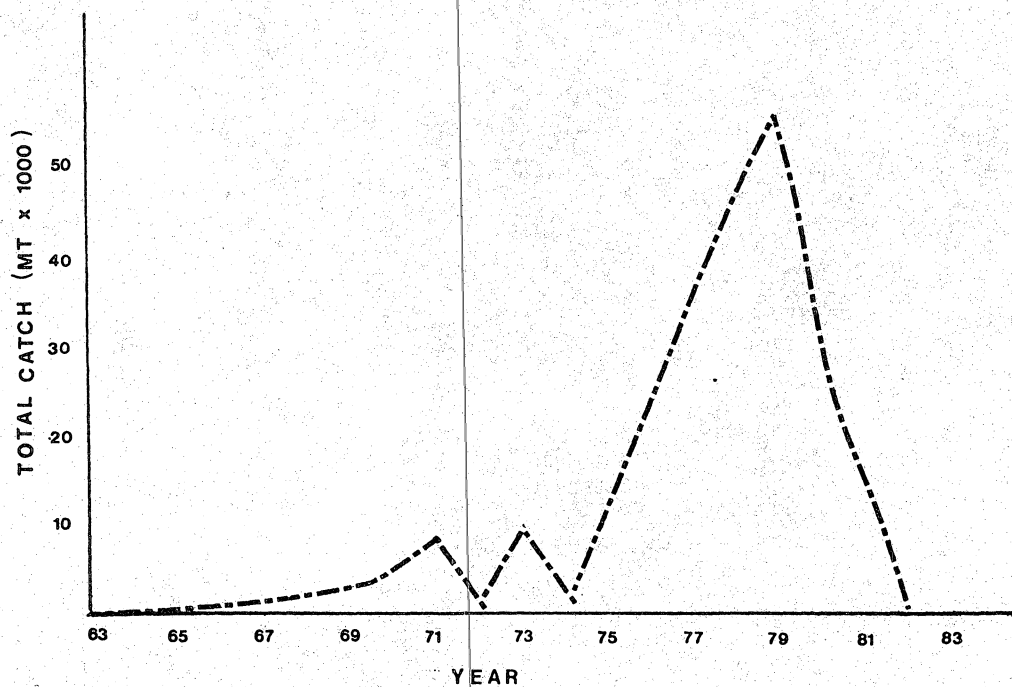


Figure 2. Annual catches of *Illex illecebrosus* by the international fishery in SA 4.

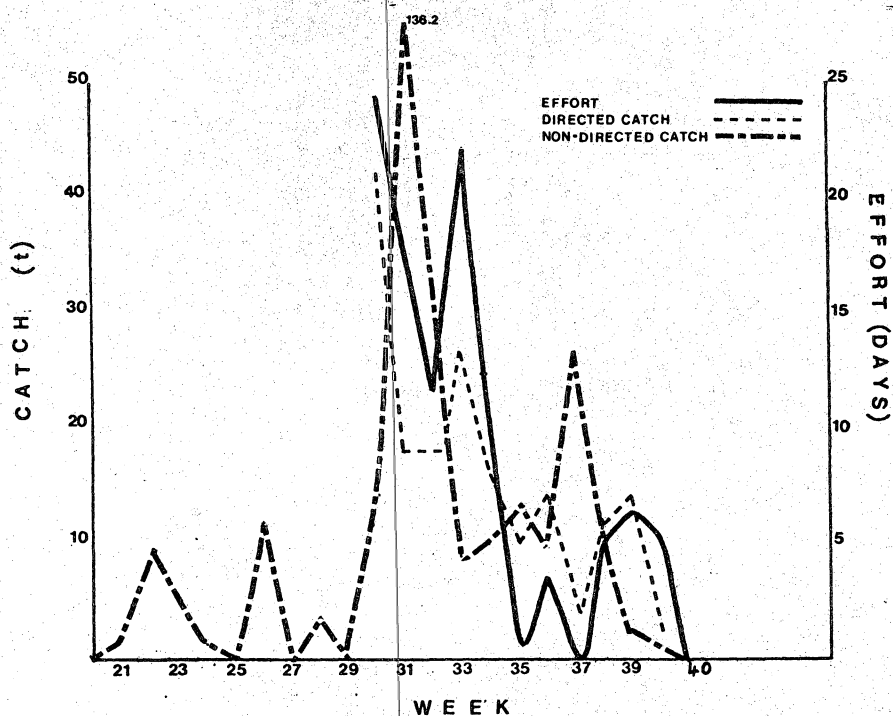


Figure 3. Directed and non-directed squid catches and effort as reported to FLASH for 1982 for Subarea 4.

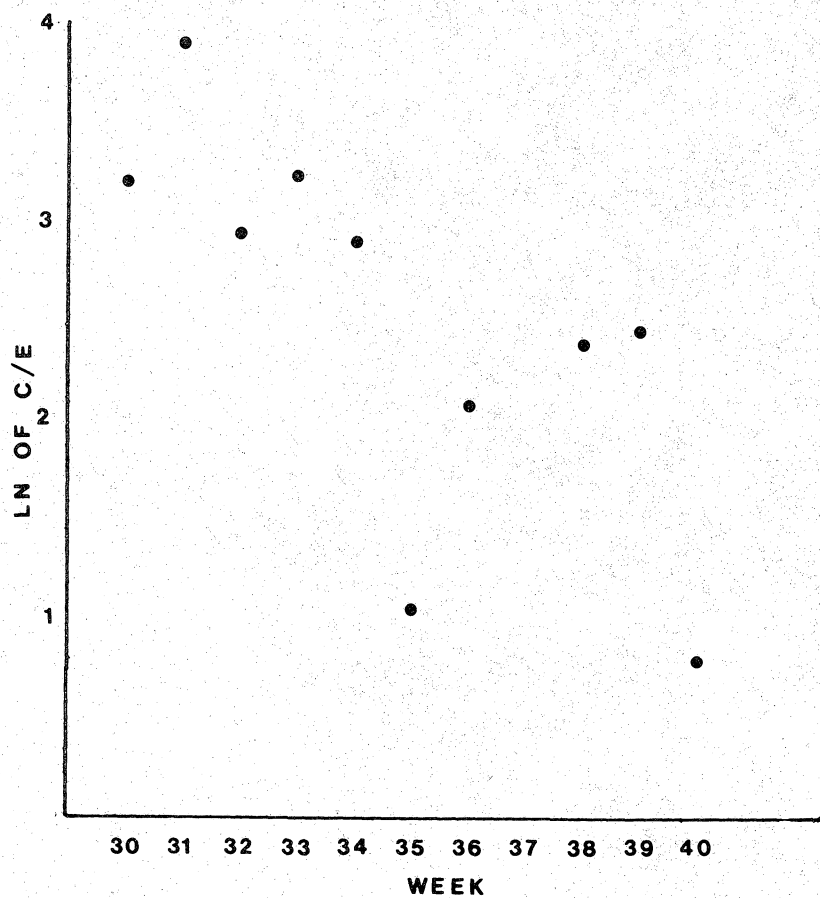


Figure 4. Natural log of CPUE by week in numbers of animals  $\times 10^3$  landed per directed fishing day during 1982.

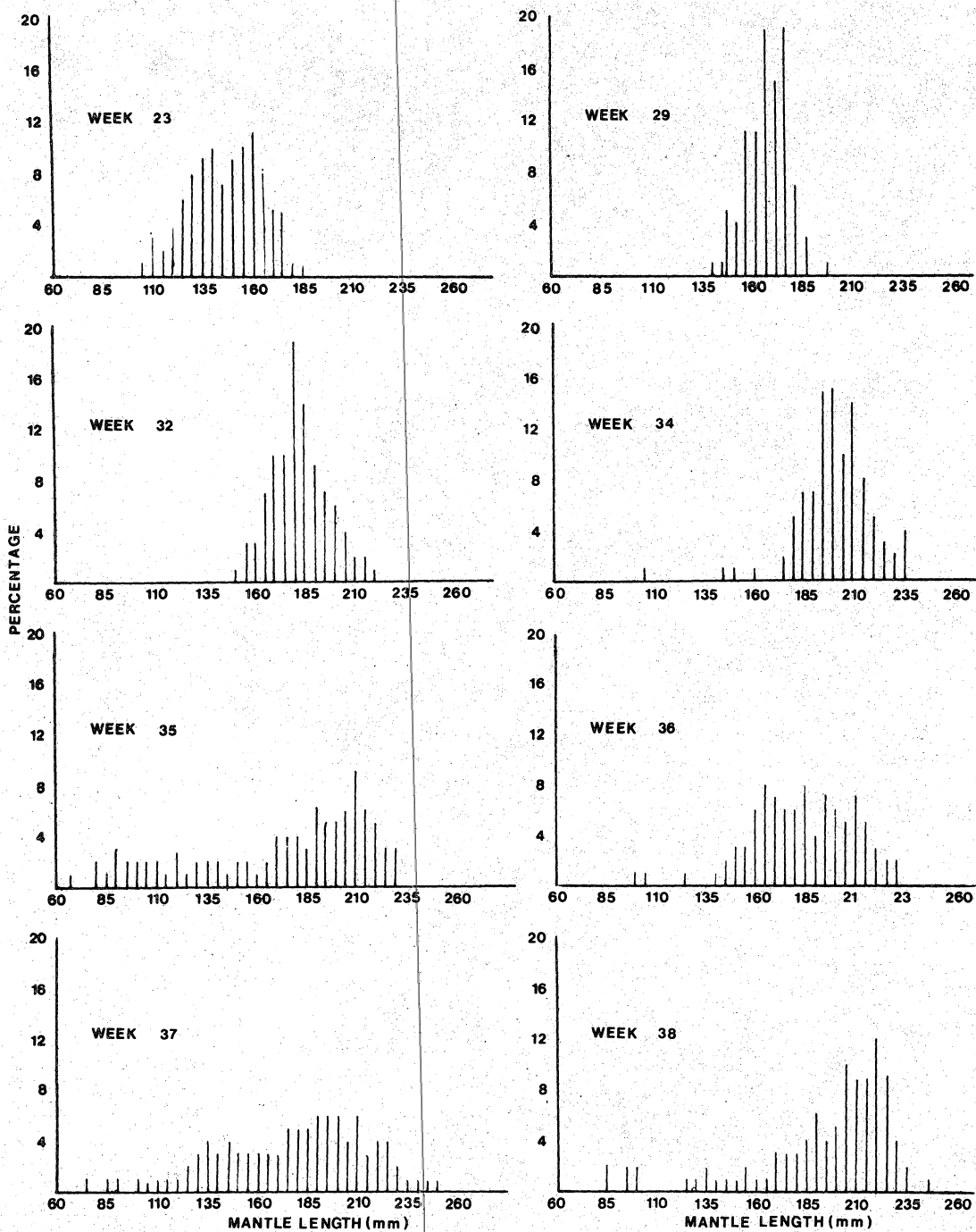


Figure 5. Percent length frequency distribution of Illex from observer samples.

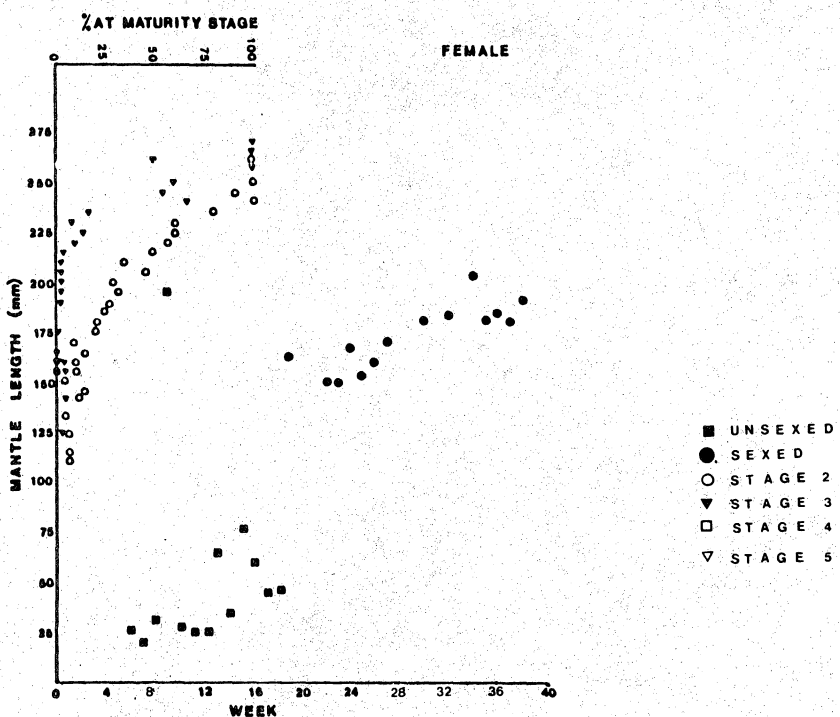
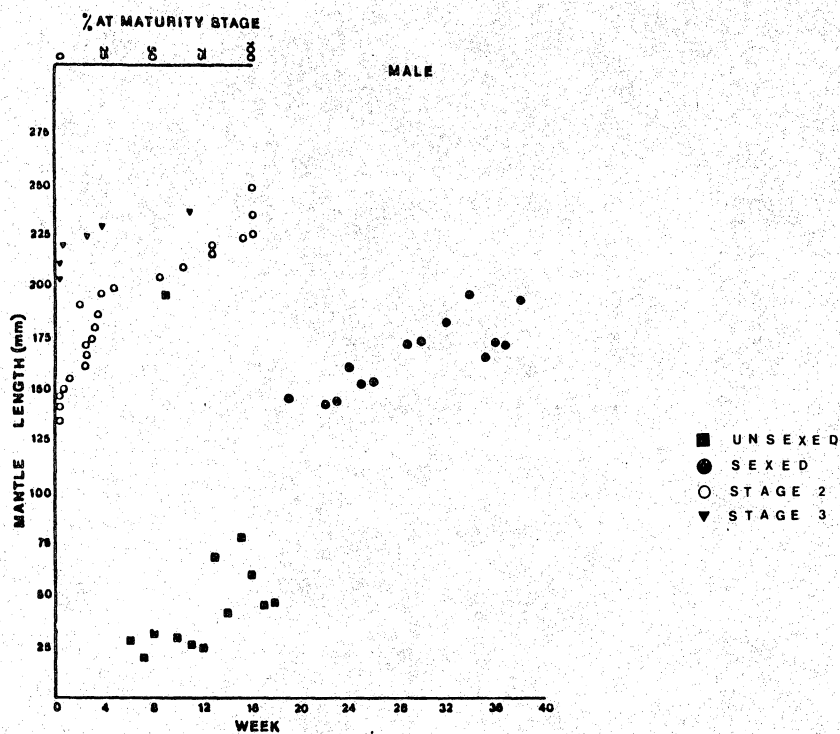


Figure 6. Growth (mean lengths by week) and percent having reached maturity stages for male and female Illex in 1982.