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Catch, Effort and Biological Characteristics of Squid (*Illex illecebrosus*) in the French Fishery in Subareas 3 and 4, 1979

by

J. P. Minet and H. Dupouy
Institut Scientifique et Technique des Peches Maritimes
St. Pierre et Miquelon

I - Introduction.

In 1979, the French fishery on squid (Illex illecebrosus) was conducted by small inshore boats around St.Pierre and Miquelon Islands (Subdiv. 3 Ps) and by large freezer trawlers off the Nova Scotia Shelf (Div. 4 W), on the edge of St.Pierre bank (Subdiv. 3 Ps) and on the tail of the Grand Bank (Div. 3 O). A program was set up in the St.Pierre Laboratory to study the squid stock around the French islands. A survey was carried out by the R/V Cryos in the autumn of 1979 (DUPOUY and POULARD, 1980) to estimate the biomass of this species and bring new biological data. Furthermore, an effort was made to collect a maximum of data on the commercial fishing operations : fishing areas and periods, catches and efforts, by-catches, biological sampling to know the composition of catches (length distributions by sex and maturity stages) and other relevant information such as length-weight relationships and stages of gut repletion.

II - The inshore fishery.

1. Catch and effort.

The inshore fishery took place around the French islands of St.Pierre and Miquelon, inside the 12 miles limits in Subdiv. 3 Ps. The fishery was conducted by 50 dories : 45 based in St.Pierre and 5 based in Miquelon. The fishing season started on 27 June, as soon as the squid concentrations began to appear in the inshore waters. The provisional figures give a total catch of 1,845 metric tons, 1,736 t from the St.Pierre fishing grounds and 109 t from the Miquelon fishing grounds (Table 1). The best concentrations were located around the St.Pierre island, as shown by the catch rates obtained (38.58 t/dory versus 21.80 t/dory off Miquelon).

However, those catch rates have to be considered with caution since the squid landings were limited from 23 July to 2,000 pounds per fisherman (i.e. 4,000 pounds per dory in most cases) by the St.Pierre fish plant due to freezing capacity. Also, on 26 September, this fish plant did not accept squid landings anymore because of market problems. So, the inshore fishermen were obliged to stop activity on squid in spite of its still great abundance in coastal waters.

2. Hydrographic observations.

Observations on water temperatures (surface and bottom) were made in 1979 at a standard station off St.Pierre and related to those observed in 1969 (Fig.1). It seems interesting to note that, when the inshore concentrations of squid appear at the end of June and disappear at the beginning of November, the water temperatures are close to 7 or 8° C. This level, that seems to be the minimum value necessary to the squid for its inshore migration, was also the value above which 90 p.cent of the catches of squid were made by the R/V Cryos on St.Pierre bank (DUPOUY and POULARD, 1980).

3. Biological characteristics of catches.

Six samples of squid, from catches landed in St.Pierre from 4 July to 14 September, were examined after determination of sex and maturity stages according to MERCER (1973) for males and AMARATUNGA and DURWARD (1978) for females (Fig.2).

For both sexes, this figure shows the growth of the species during the fishing season. The mean mantle length vary as follows :

Date	Males		Females	
	$\overline{ML}$ (cm)	s.d.	$\overline{ML}$ (cm)	s.d.
July 4	19.49	1.18	20.04	1.59
July 24	20.04	0.87	20.07	1.05
August 2	20.66	1.29	21.51	1.64
August 16	21.58	1.33	22.86	1.86
August 28	22.07	1.17	23.54	1.84
Sept. 14	22.33	1.08	25.05	1.60

In those inshore catches, more females than males are progressively taken at stages 2 and 3. This observation must be related to the sex-ratio : there are more males than females in the catches untill the beginning of August and after the mid-august, the number of females progressively increases as the males progressively leave the inshore waters.

III - The offshore fishery.

1. Catch and effort.

The offshore fishery was conducted by 4 French (M) freezer trawlers : Commandant Gué, Zélande, Joseph Roty and Capitaine Pleven. The fishery took place in three places :

a) Off the Scotian shelf in Div. 4 W, inside the Canadian fishing zone, from 22 August to 25 September, at depth ranging from 150 to 250 meters,

b) On the slope of the Grand Bank, in Div. 3 O, outside the Canadian fishing zone, from 16 to 29 September,

c) On the Southwestern edge of St.Pierre bank (Subdiv. 3 Ps), mainly from 30 September to 27 October, at depth ranging from 150 to 200 meters.

The provisional figures give a total catch of 2,736 metric tons : 1,926 t in Div. 4 W, 353 t in Div. 3 O and 457 t in Subdiv. 3 Ps (Table 2). In this table, catch and effort data are indicated for each NAFO division, according to the fishing periods. Resulting figures indicate CPUE of 22.40 t/day in 4 W, 8.83 t/day in 3 O and 13.06 t/day in 3 Ps and a total CPUE of 16.99 t/day for all areas combined. However, the values of catch rates obtained in Div. 4 W must be taken with caution since, the catches being limited by the freezing capacities on board the trawlers, they are not representative of the real abundance of the stock.

2. Diurnal variability of squid.

From data on catch rates obtained by one trawler when fishing in Subdiv. 3 Ps and Div. 4 W, the diurnal variability of squid was studied (Fig.3). It appears that, in 3 Ps, from 18 to 21 August 1979, the highest CPUE were obtained during daylight with a maximum between 12:00 and 16:00. This observation is similar to data given for the Scotian shelf at the end of July 1978 (FROERMAN, 1979).

On the contrary, in Div. 4 W, during all the fishing period (22 August to 25 September) the largest catch rates were observed during the morning (04:00 to 12:00) and the evening (16:00 to 20:00), with a drop between noon and 4 p.m.

In both cases, the catch rates obtained during the night were the lowest.

3. Estimate of by-catches.

From data on by-catches provided by one of the four trawlers, it is possible to estimate the overall by-catches :

Division	Percent of the catches			
	Squid	Silver hake	Pollock	Other
3 Ps	90	0	8	2
4 W	98	1	0	1
TOTAL	98	1	0	1

The "other" by-catches are composed, in order of importance, of cod, monkfish, halibut and haddock. Since 94 p.cent of the squid catches by this vessel were made in Div. 4 W, the total results, for both areas combined, give the same figure.

4. Biological characteristics of catches.

A total of 10 samples of squid were collected from the offshore fishery either directly on the non-sorted catches on board the trawlers (6 samples) or when landing in St.Pierre (4 samples). According to the period of fishing, these commercial samples were combined to provide data on :

- length distributions by sex and maturity stages in Divisions 4 W, 3 O and 3 Ps,
- length-weight relationships for males and females in Subareas 3 and 4,
- gut fullness by sex and periods in Divisions 4 W, 3 O and 3 Ps.

a) Length frequency distributions.

In Division 4 W (Fig. 4-A), length distributions are given by sex and maturity stages (except for two samples measured on board) from 31 August to 19 September 1979. Here again, the growth of the species can be seen in those 20 days but the sex-ratio do not changed in this interval of time with the number of males almost double of the number of females.

In Divisions 3 Ps and 3 O (Fig. 4-B), from 21 August to 19 September, the same observations can be made : slight increase in size for both sexes in this one month interval, but a sex-ratio almost equal to 1 in both areas.

b) Length-weight relationships.

From the samples collected in Subareas 3 and 4, the length-weight relationships were calculated for each sex (Fig.5). A number of 196 males were measured (mm) and weighted (g) and the resulting equation is :

$$W = 0.0684 \cdot L^{2.630}$$

(where L is the mantle length).

The same data obtained from 298 females give the equation :

$$W = 0.0171 \cdot L^{3.046}$$

In order to determine if the observations made on thawed samples (case of samples provided by the offshore fishery) were correct and comparable with those made on fresh samples (case of samples made on the inshore fishery), the relationships between fresh and thawed length and weight were established after examination of 168 specimens.

The results (Fig.6) indicate that no significant bias (1 to 2 p.cent) is introduced when using thawed material to study length and weight data.

c) Gut repletion.

The stages of gut fullness of squid are given in Table 3, for each sample collected on the offshore fishery in the three divisions. It is difficult to distinguish a trend in the feeding rate of squid inside this one month interval. However, it is clear that most of the guts examined are either empty or half-full, very few being full or distended. It is also obvious that there are no great differences between sexes.

References

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DUPOUY (H.) and POULARD (J.C.), 1980.- Biomass estimate and biological characteristics of the squid, Illex illecebrosus, on St.Pierre and Burgeo banks (NAFO Subdiv. 3 Ps) in the autumn of 1979.- NAFO SCR Doc. 80/II/11, Serial No. N043.

FROERMAN (Y.M.), 1979.- Biomass estimates of the short-finned squid, Illex illecebrosus, in ICNAF Division 4 W, 1978.- ICNAF Res.Doc. 79/II/28, Serial No. 5354.

MERCER (M.C.), 1973.- Sexual maturity and sex ratio of the ommastrophid squid, Illex illecebrosus (LESUEUR), at Newfoundland (Subarea 3).- ICNAF Res.Doc. 73/71, Serial No. 3023.

Table 1. Provisional catch (metric tons) and CPUE data from the French (St. Pierre) inshore fishery in 1979 by month and fishing area.

Month	Squid catches (t)		
	off St.Pierre	off Miquelon	TOTAL
June	32	0	32 (a)
July	280	3	283 (b)
August	854	64	918
September	570	42	612 (c)
TOTAL	1736	109	1845
CPUE (t/dory)	38.58	21.80	36.90

(a) - Squid fishing season started on 27 June 1979.
(b) - Squid landings limited from 23 July 1979.
(c) - Squid landings stopped on 26 September 1979.

Table 2. Provisional catch (metric tons) and effort (days fished) from the French (M) offshore fishery in 1979, by division and fishing period.

Date	4 W		3 O		3 Ps		TOTAL	
	C (t)	E (d)	C (t)	E (d)	C (t)	E (d)	C (t)	E (d)
Aug.19-25	63	4	0	0	21	4	84	8
Aug.26-Sept.1	366	23	0	0	0	0	366	23
Sept.2-8	690	28	0	0	0	0	690	28
Sept.9-15	611	24	0	0	0	0	611	24
Sept.16-22	168	6	353	40	0	0	549	47
Sept.23-29	28	1			0	0		
Sept.30-Oct.27	0	0	0	0	436	31	436	31
TOTAL	1926	86	353	40	457	35	2736	161
CPUE (t/d)	22.40		8.83		13.06		16.99	

Table 3. Gut fullness of squid in commercial samples according to sex, period and division. (St.0 : empty - St.1 : half-full - St.2 : full - St.3 : distended).

Date	Trawler Name	Division	Number examined	St.0	St.1	St.2	St.3
31-08-79	Cmdt Gué	4 W	♂ 57	92.9	7.1	-	-
			♀ 42	80.9	16.6	-	2.4
2-09-79	Zélande	4 W	♂ 61	27.8	55.7	13.1	3.3
			♀ 38	36.8	44.7	13.2	5.3
8-09-79	Zélande	4 W	♂ 62	35.5	56.4	8.1	-
			♀ 34	26.5	61.8	5.8	5.8
9-09-79	Joseph Roty	4 W	♂ 50	72.0	24.0	22.0	2.0
			♀ 49	75.5	14.3	8.2	2.0
10-09-79	Capt.Pleven	4 W	♂ 33	18.2	72.7	9.1	-
			♀ 17	41.2	53.0	5.8	-
19-09-79	Cmdt Gué	4 W	♂ 72	91.6	8.3	-	-
			♀ 29	72.4	20.6	6.8	-
19-09-79	Joseph Roty	3 O	♂ 21	23.8	47.6	28.6	-
			♀ 29	34.5	58.6	6.9	-
20-09-79	Capt.Pleven	3 O	♂ 74	72.9	13.5	13.5	-
			♀ 56	55.4	17.9	16.1	10.7
21-09-79	Joseph Roty	3 O	♂ 16	31.2	68.8	-	-
			♀ 37	43.2	54.1	-	2.7
21-08-79	Cmdt Gué	3 Ps	♂ 49	93.8	6.1	-	-
			♀ 48	95.8	2.1	2.1	-
28-09-79	Joseph Roty	3 Ps	♂ 62	17.7	50.0	19.4	12.9
			♀ 38	15.7	57.9	18.4	7.9

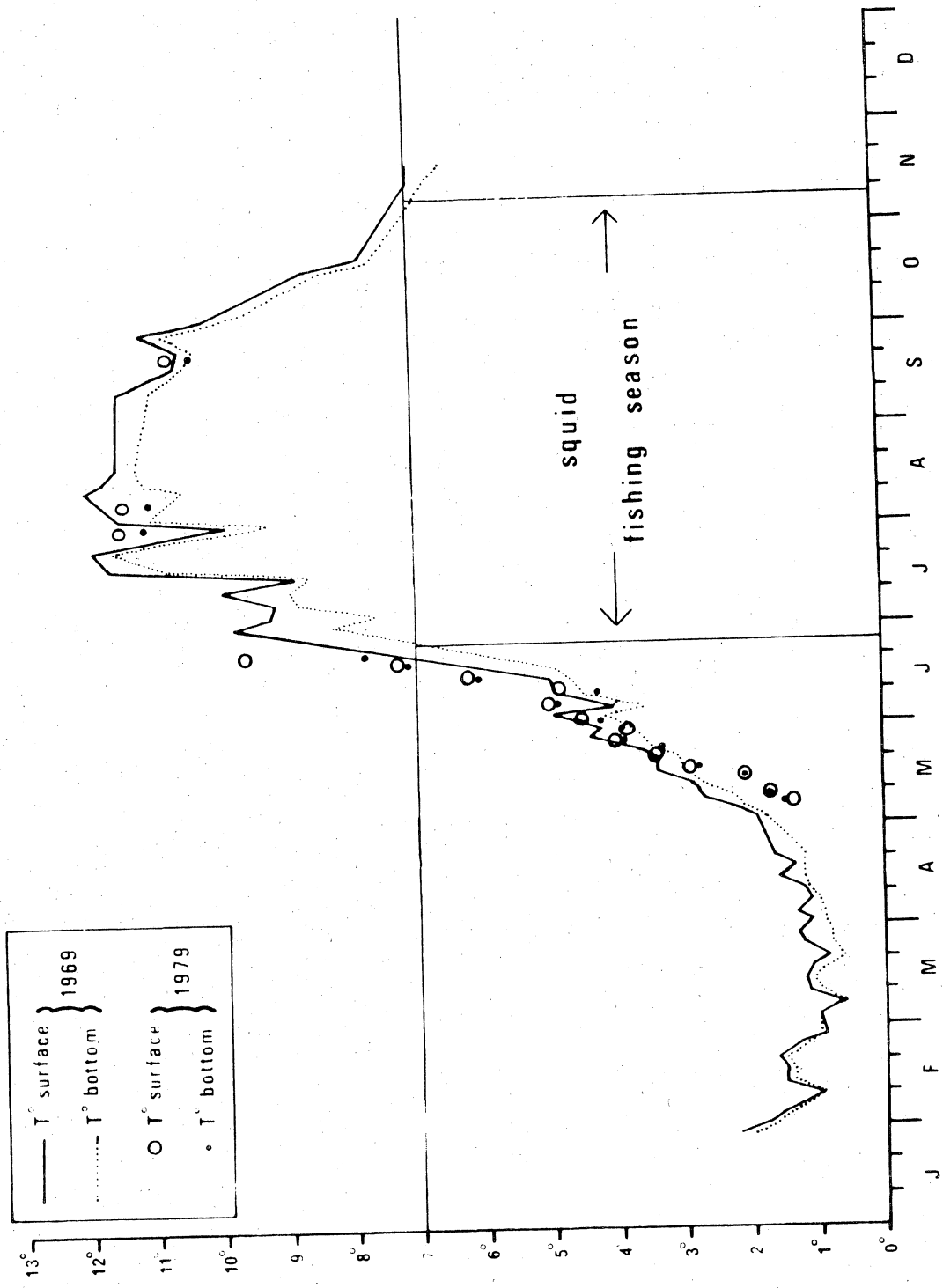

Fig.1. Annual variation of water temperatures off St-Pierre in relation to the inshore migration of squid.

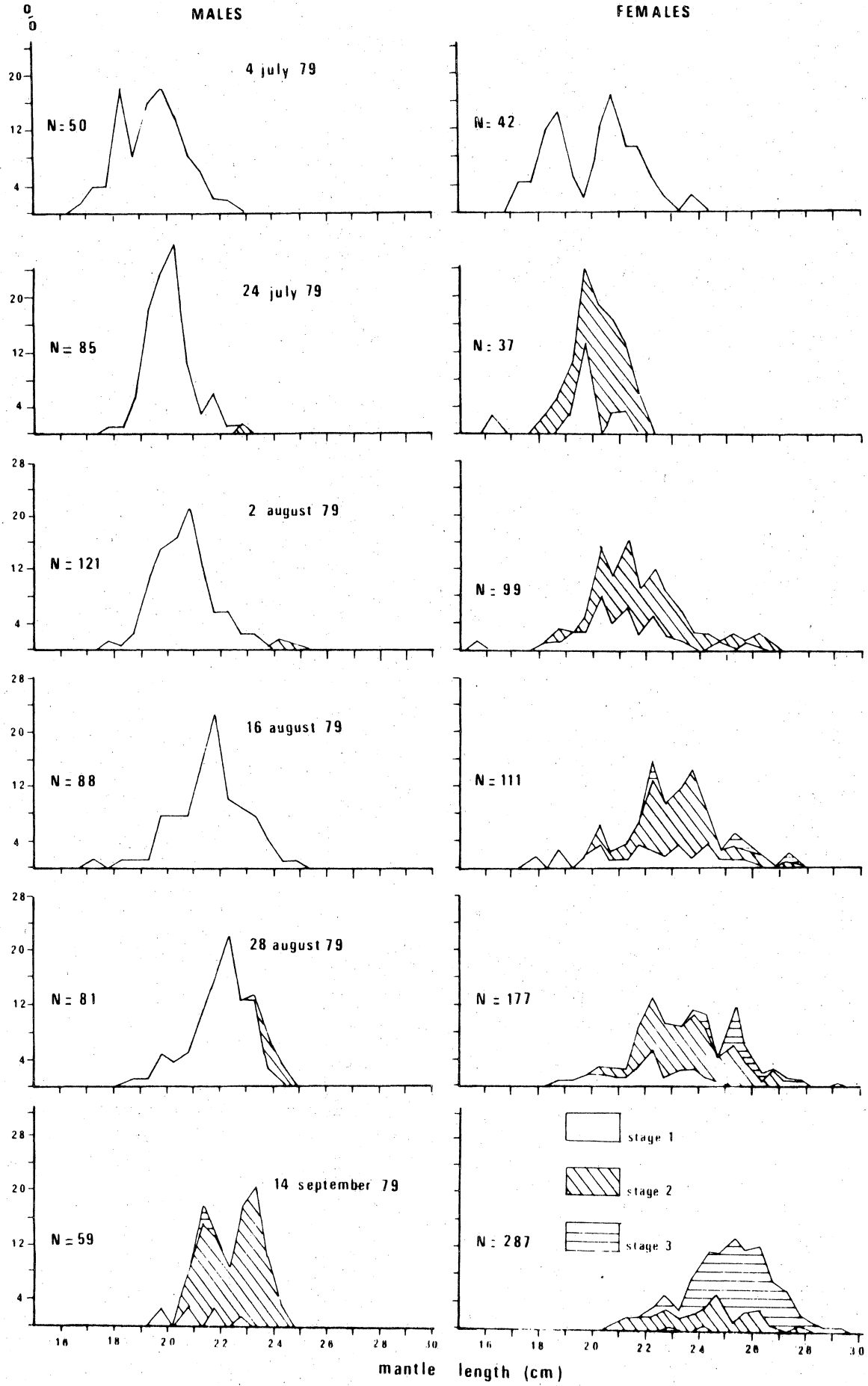

Fig.2. Length distribution of squid in the French (SP) inshore fishery (Subdiv. 3Ps) according to sex, maturity stages and period of fishing.

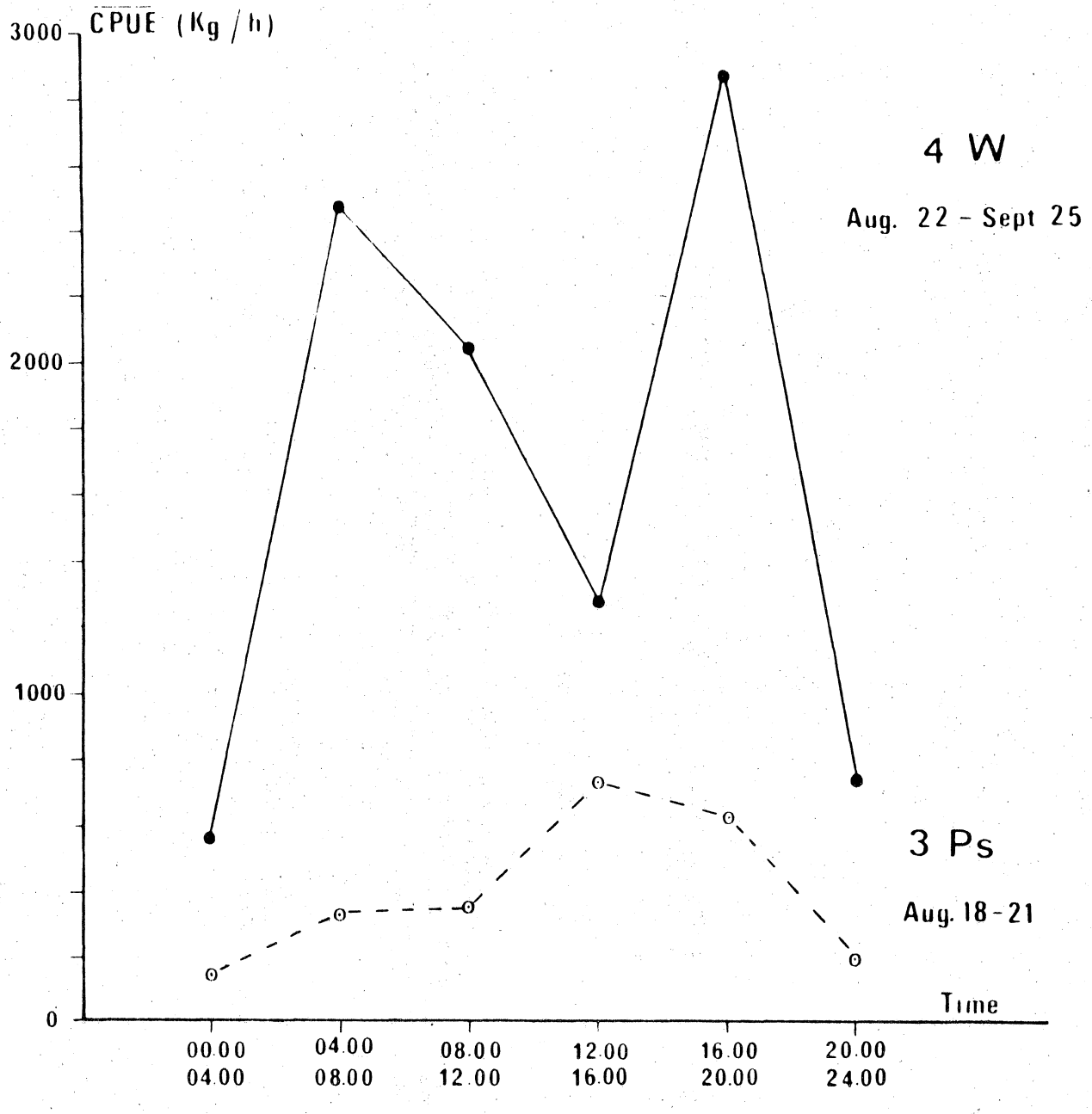

Fig.3. Diurnal variability of squid within the near-bottom layer in two fishing zones at different periods, based on data from one trawler.

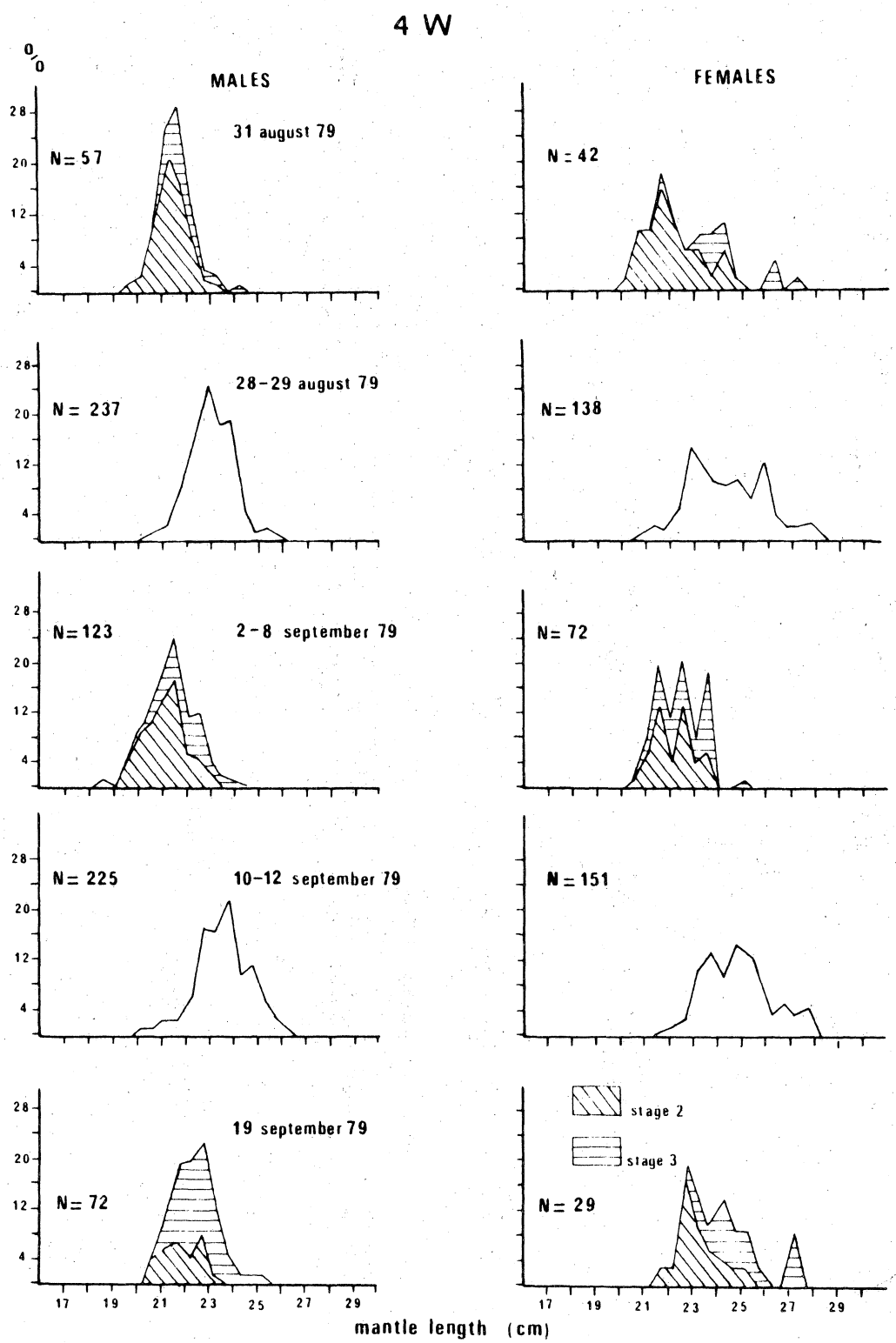

Fig. 4-A. Length distribution of squid in the French (M) offshore fishery (Div. 4 W) according to sex, maturity stages and period of fishing.

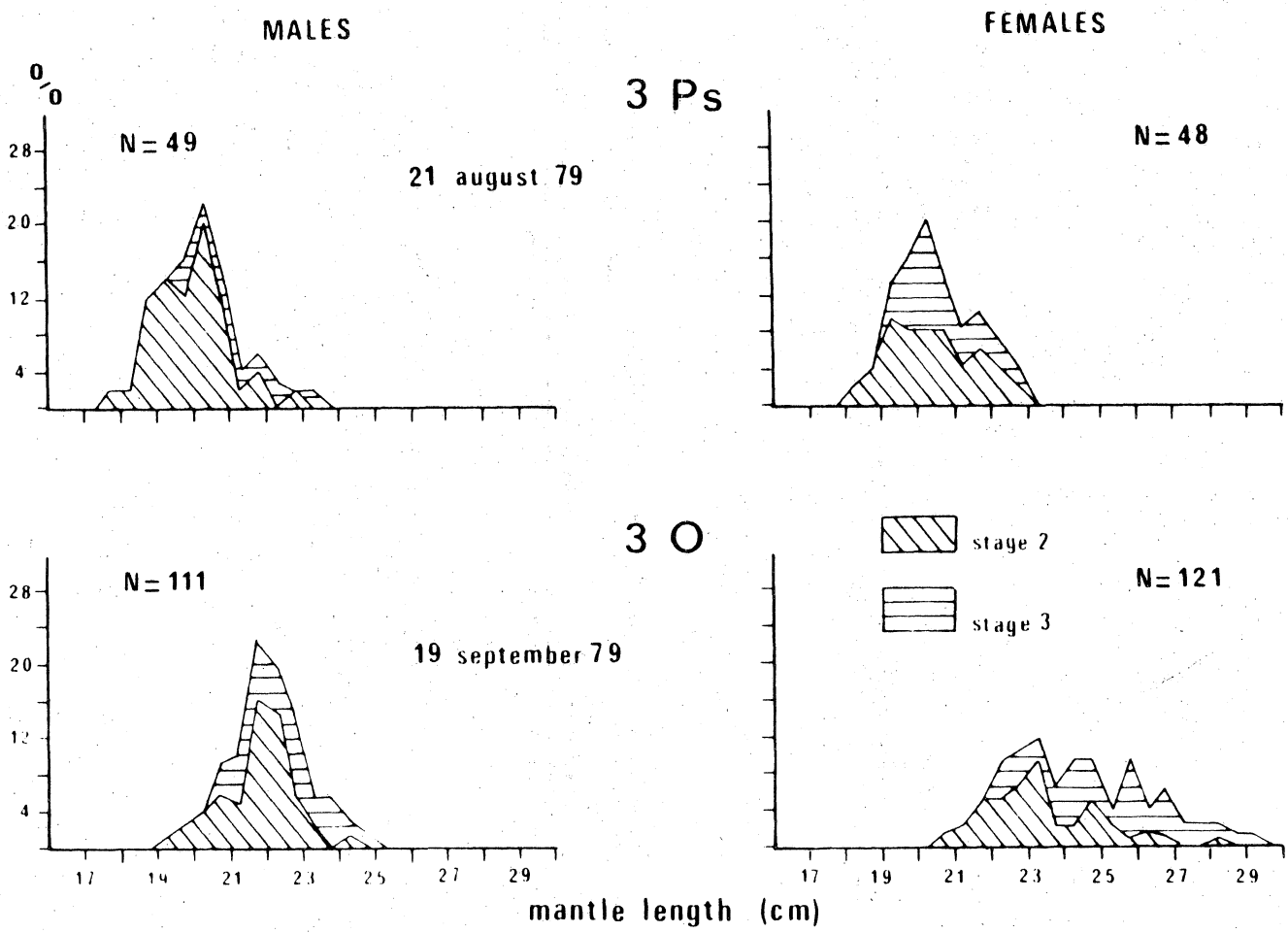

Fig.4-B. Length distribution of squid in the French (M) offshore fishery (Div. 3 O Ps) according to sex and maturity stages.

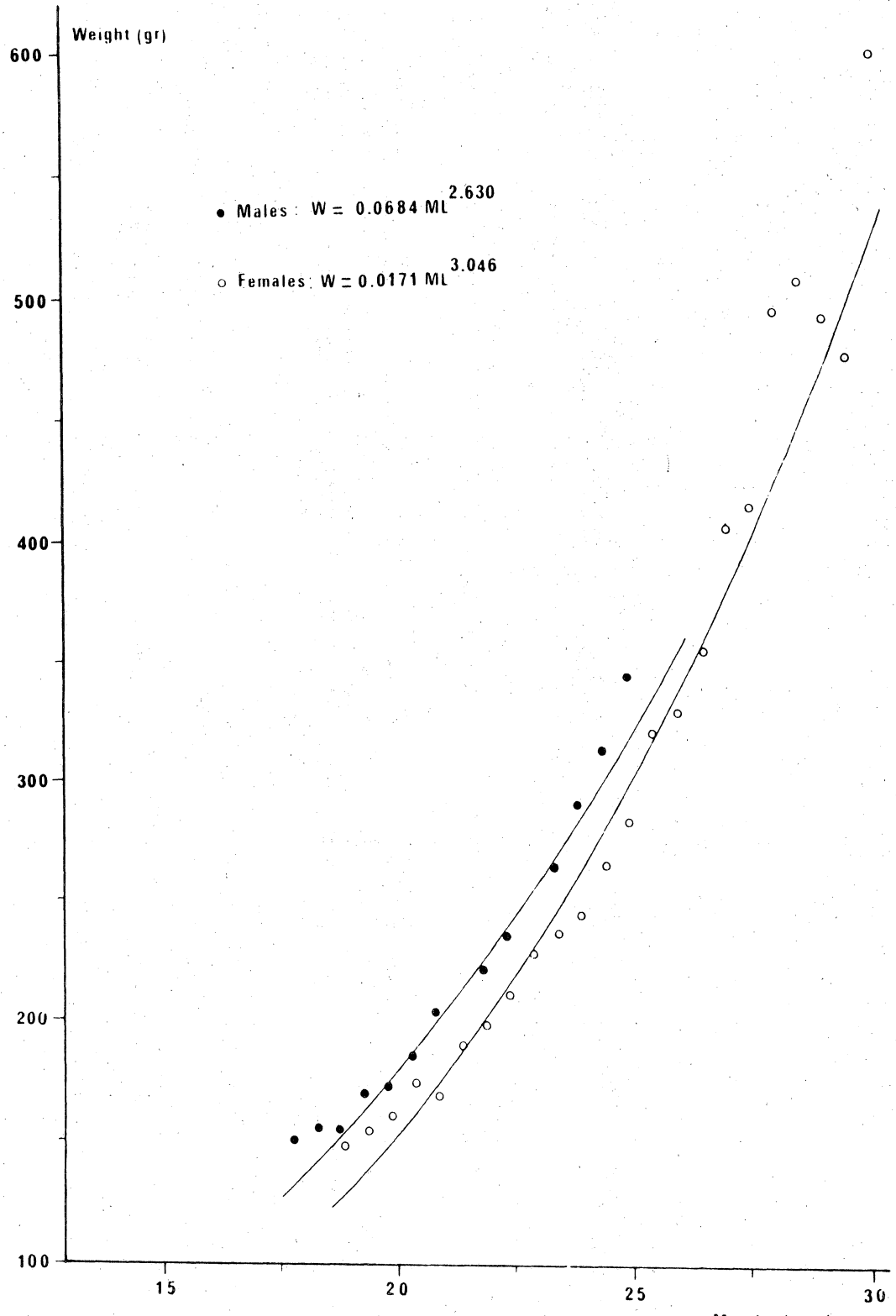

Fig.5. Length-weight relationships for squid (males and females) in Subareas 3 and 4.

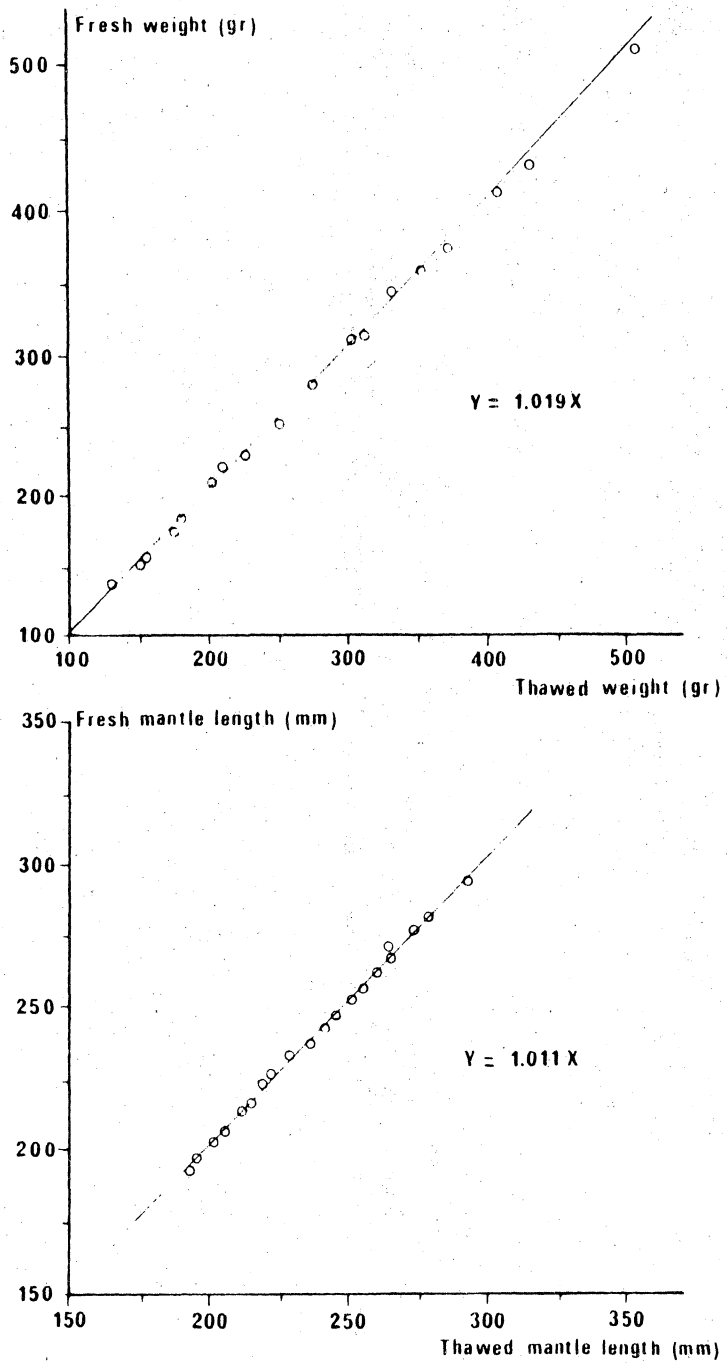

Fig. 6. Relationships between fresh and thawed length and weight of squid in Subareas 3 and 4.