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Catch, Effort and Biological Characteristics of Shrimp (*Pandalus borealis*)  
in the French Fishery off West Greenland, 1982

by

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The French fishery for shrimp off West Greenland was conducted, as in 1981, by two stern trawlers (OTB 2 - class 6) which have completed one trip, from the end of June to mid September, on the offshore grounds in NAFO Division 1B. The total catch was close to 660 m. tons against a total of 556 m. tons in 1981. The fishing logbook of one of these trawlers (the *Finlande III*) was provided by the Captain and also eight samples of shrimp collected and frozen on board of this vessel on a weekly basis.

Informations on the location of the fishery, on the catches (effort, c.p.u.e.) and on the biological characteristics of shrimp (length distribution, age groups, composition by sex, maturity stages) are presented in this paper.

OBSERVATIONS ON CATCHES AND FISHING EFFORT

During the trip of *Finlande III* in the Davis Strait, from June 28 to August 28, about 347 m. tons of shrimp were caught. The corresponding trawling time was of 1 200 hours.

1. Location of the fishery.

The fishing grounds were located on the northern part of the Store Hellefiske bank, from 67°07 N to 68°00 N, on the right side of the midline between Greenland and Canada. The depth of trawling ranged from 200 m to 360 m with most of the tows occurring between 250 and 300 m. Minor differences were observed in the location of the fishery, compare to previous year.

In June (Fig. 1a), the fishery was limited to the vicinity of the midline around the mean position 67°30 N and 58°00 W by depth ranging from

238 to 298 m (units KM1 and KM2).

In July (Fig. 2a) the Finlande III first moved in a southeastern direction by depth of 225 to 280 m (units KL3 to KL7) and then on the north-western part of Store Hellefiske on depth of 250 to 360 m most of fishing occurred in units KR1 and KS1.

In August (Fig. 3a) the Finlande III remained in the same area, most of the tows being made in units KP2 and KR1 and 3.

A total of 21 units were fished as in 1981, representing a total area of about 3 000 km<sup>2</sup>.

## 2. Catch and c.p.u.e.

The monthly distributions of the c.p.u.e. (kg/hour) including all tows, and without adjustment to the fishing period, are reported in Fig 1b 2b and 3b. The best yields were obtained in units KM2 for June (297 kg/hour), KN1 for July (303 kg/hour) and also for August with 434 kg/hour.

The catch and c.p.u.e. per month are presented in the following table :

Fishing period	June 28-30	July 1-31	August 1-28	Total
No. of tows.....	17	173	134	324
Catch (m. tons).....	11.8	157.1	177.7	346.6
Fishing effort (hours)	50	614	549	1 213
c.p.u.e. (Kg/hour)1982	235	256	324	288
c.p.u.e. (kg/hour)1981*	291	350	330	346

\* from DUPOUY et al. 1981a

From June to August, the catch rate has increased (235 kg/hour to 324 kg/hour) but these figures are lower than those of 1981. So the total c.p.u.e. for 1982 decreased from 17 % compare to previous year, however it remains at a level higher than in 1980 (254 kg/hour).

## 3. Discards and by catches

The smallest shrimps caught were sorted by automatic machine. A total close to 6 m. tons were discarded, i.e. 2% of total catch. The additional sorting by hand on soft and damaged shrimps is not available for 1982 but in 1980 it was estimated at 2.4 % (DERIBLE and al. 1980).

By catches were constituted mostly of redfishes (1.5 % of the shrimps catch) Greenland halibut (< 1 %) and few specimens of cod. Moreover, two Greenland sharks were also caught, representing about 5 m. tons.

## OBSERVATIONS ON SAMPLES

### 1. Methods

Shrimp were collected randomly in the total catch before sorting. In each sample, the sexual components were separated by reference to the first pair of pleopods in three categories : males, transitionals and females. The presence of head roe (ripening female gonad) was noted for transitionals and females. Moreover, attention was given to the evolution of reproduction (ovigerous females).

In addition, all the individuals in the samples were separated by reference to the three stages of sternal spines described by Mc CRARY (1971) : sternal spines very sharp (spines I) reduced (spines II) remnant or lost (stage III). These informations can be usefull for age group determination as noted by Mc CRARY.

Characteristics of the eight samples collected from April 15th to June 10th 1982 are presented in table I, in relation to date, location and depth of the tows and the timing of trawling. Because of the small number of individuals per sample, biological data were analysed on a fifteen days basis and presented in Fig. 4 to 7, where sexual and maturity stages are on the left side of the figures instead the sternal spines characteristics par sex are on the right side.

### 2. Size distributions and modal groups

The size of shrimps caught by the 40 mm stretched mesh trawl was measured from the hiatus of the eye to the middle of the edge of the carapace. All the individuals were ranging from 12 to 30 mm with the bulk between 20 and 29 mm (Fig. 8). The mean lenght and weight were, before sorting, 25.3 mm and 9,5 g against 24.1 mm and 8.0 g respectively, in summer 1981 (DUPOUY et al., 1981 a).

Males represent 29 % of the catch. Their size range from 15 to 25 mm. They are composed of two modal groups (see Fig. 8). The first mode (15 to 19.5 mm) is characteristised by the presence of individuals with sternal spines I, instead the second mode (19.5 to 25 mm) presents some individuals with sternal spines II indicating that evolution towards transitionals can intervene also in this mode, at a small scale (less than 3 % of individuals).

Transitionals are distributed from 23 to 28 mm. They constitute a single mode and they represent 23 % of the shrimp in the total of samples. Transitionals are composed of a mixture of individuals with spines I and II, respectively 23 % and 77 % (see Fig. 4 to 7).

Females with spines II represent 6 % of the total number of shrimp and 12 % of the females. Their sizes range from 24 to 29 mm. They pertain to the same modal group as transitionals.

The remaining of the catch (about 42 %) is composed of females without spines (i.e. spines III on the right of figures 4 to 7). Their sizes range from 24 to 30 mm and the structure of distribution is bimodal, the first

mode overlapping the mode of transitionals and females with spines, and the second is composed of few specimens ranging from 28 to 30 mm (see Fig. 8).

### 3. Age and recrutement

The age of West Greenland shrimp was analysed by HORSTED and SMIDT (1965). The smallest individuals appearing in our samples in July-August with size around 12 mm are issued from the hatching of spring 1981. The second mode of juvenile ranging from 15 to 20 mm represents age group II. The mode of individuals from 19.5 to 24.5 mm corresponds to age groupe III and is consti-tued mainly of maturing males. The mode composed of transitionals and females with spines (22.5 to 28 mm) corresponds to the age groupe IV. The first mode of females without spines is an accumulation of age groups V and V<sup>+</sup> because most of the females maturing each year cannot increase their sizes. The last mode of large females (28 to 30 mm) corresponds to the females that have not spawn a given year and have an extra-year of growth.

The evolution of the relative strength of each year class from 1978 to 1982 in the samples collected on Finlande III is expressed in Fig. 9 by weighting the size distribution of shrimp by the mean number of shrimp caught per hour (i.e. - C.p.u.e./individual mean weight of shrimp in the samples).

Although large variations are observed in the abundance<sup>of</sup> individuals < 25 mm, it is important to note the relative stability of the number of individuals > 25 mm for the differents years; this pattern results of the accu-mulation of different year classes in the largest modes (transitionals, first spawning females, old females). Most of fishing is based on transitionals and females (HORSTED, 1978) but also on males from 20 to 25 mm (DERIBLE et al. 1980). If we consider the selectivity ogive for trawl with mesh close to 40 mm (THOMASSEN et al. 1975 ; SAKHNO et al. 1980) the new recruitment is composed of individuals of age group III (partially recruited ) and age groupe IV (totally recruited).

So, the diminution of c.p.u.e. in 1982 resulted of a lower importance of age group III compare to the exceptional level of this group in 1981, while the abundance of age group IV and IV<sup>+</sup> are close to the previous year one (Fig.9). However the high abundance of age group II in 1981 is in contrast with the low abundance of age group III in 1982. Because ogive selection affects mainly the individuals of age groupe III, a possible lower growth rate in 1982 (due to the long winter duration) could affect importantly the number of individuals of age group III caught in 1982.

### 4. Evolution of maturation.

The percentages of individuals with ripening ovaries (head roe) among transitionals and females are presented in the following table :

Date of sampling :	July 5 ::	July 15 :	July 29 :	August 12 :	Total
:	+ July 14 :	+ July 28 :	+ August 11 :	August 26 :	:
Transitionals...	68	100	98	90	83
Females without spines.....	73	84	80	44	70
Females without spines.....	33	48	53	57	48

The comparison of these results to the situation observed last year for the same period (DUPOUY et al. 1981a) indicates a lower percentage of head roe. This percentage is quite normal (83 % against 92 % in 1981) but is abnormally low for the females (97 % of head roe in previous year against only 51 % in 1982).

This decrease affects particularly the females without spines, all samples indicating a low percentage of head roe among them, instead for the females with spines most samples indicates high percentage of head roe.

Normally on the offshore grounds off West Greenland most of females mature each year (DUPOUY et al. 1981 a and 1981 b). But in the coldest fjords or in the coldest years, a large part of females don't mature (HORSTED and SMIDT, 1965). The hard winter of 1982 probably resulted in a longer period of incubation that delayed hatching and then resulted in a lower proportion of maturing females. So, it appears that an important part of females should not have spawned in the autumn of 1982. If this is confirmed, the percentage of large females (29 to 30 mm) will be increased in 1983 due to the extra-year of growth resulting of their non-maturation of 1982. On another hand, one can expects a low recruitment to the fishery in 1986 for males and in 1987 for transitionals.

#### CONCLUSIONS

1 - As in previous years, most of the fishery was located on the Northwestern part of Store Hellefiske bank, in NAFO Division 1B. The mean French c.p.u.e. indicates a decrease of 17 % compare to 1981 but remains higher than the 1980 c.p.u.e. This decline results mostly of the lower abundance of males (age group III) in the catch, but not necessarily in the stock (if their growth was affected by the long winter of 1982).

2 - An abnormally low percentage of maturing females was observed probably due to coldest conditions in spring of 1982. This could affect the recruitment to the fishery in 1986 and 1987. However, because most of the commercial catches are based on an accumulation of females between 25 and 30 mm (age groups IV and IV+) the expected decline would not be too important, because the maturation and reproduction was high in the previous years.

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Sample No	Date	Average position		Depth range	Time of trawling (GMT - 3 h)	No of shrimp examined	Composition per sex in percentage		
		Lat.	N Long. W				Males	transitionals	Females
1	July 5	67°47'	58°10'	268 - 290'	15:10 - 19:10	100	46,0	14	40
2	July 8	67°28'	57°44'	238 - 250'	9:00 - 11:20	103	15,5	24,3	60,2
3	July 15	67°46'	58°09'	278 - 280'	12:55 - 15:40	107	30,9	19,6	49,5
4	July 22	67°55'	57°55'	284 - 320'	10:20 - 14:20	135	40,0	25,2	34,8
5	July 29	67°54'	57°46'	294 - 306'	03:40 - 07:50	96	12,5	15,6	71,9
6	August 5	66°55'	57°43'	296 - 310'	14:05 - 18:35	301	19,0	39,5	41,5
7	August 12	67°41'	57°32'	243 - 258'	04:10 - 07:55	126	29,3	19,1	51,6
8	August 19	67°45'	57°21'	245 - 260'	09:00 - 12:10	143	50,3	4,9	44,8
						1111	29	23	48

Table 1 - Characteristics of samples collected on board Finlande III off West Greenland in 1982.

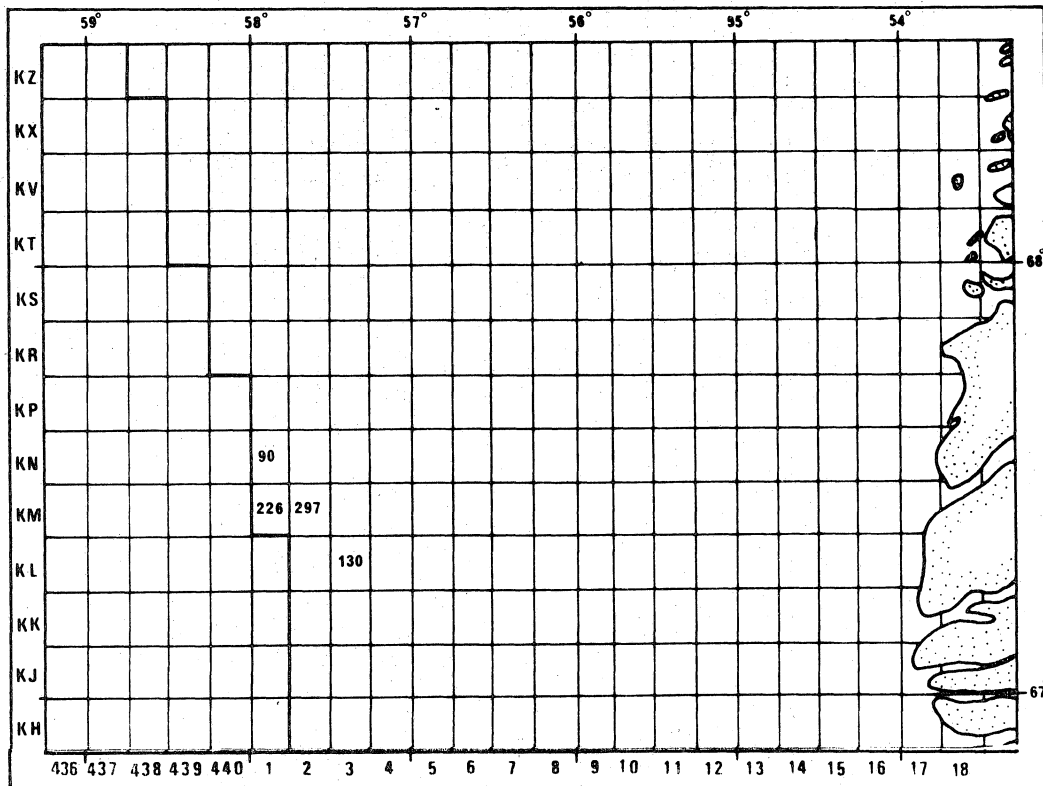
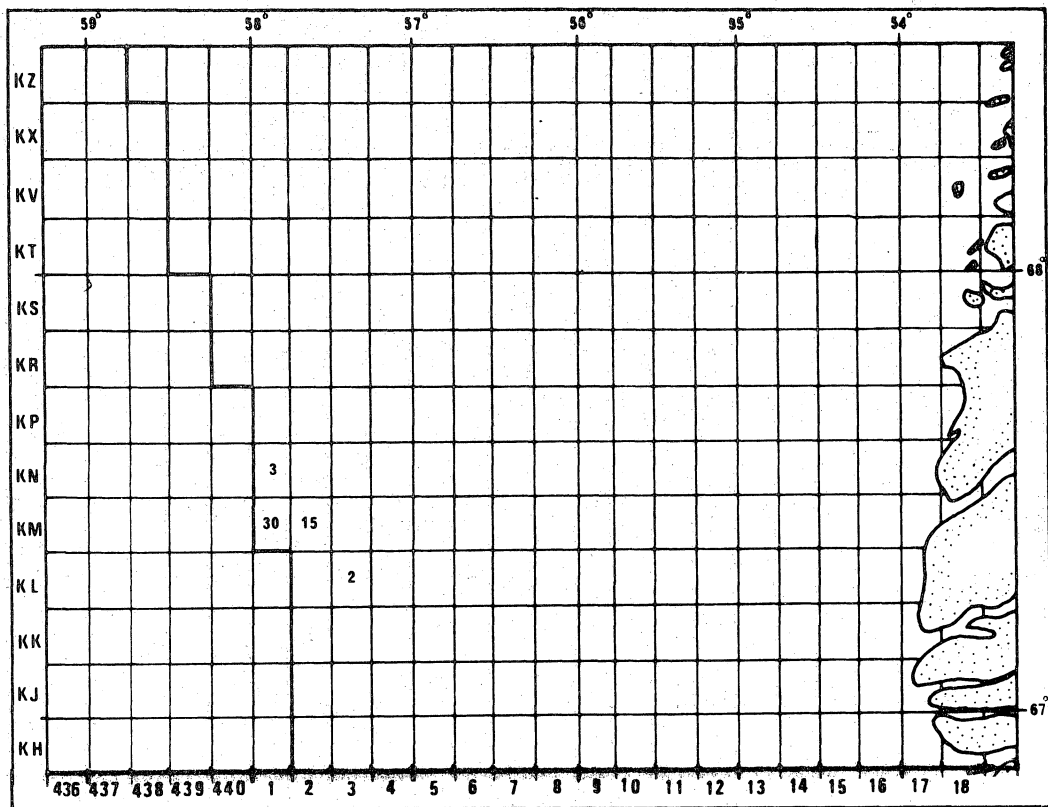


Fig. 1. Distribution of fishing effort (hours) (upper diagram), and of CPUE (kg/hour) (lower diagram) of Finlande III at West Greenland in June 1982.



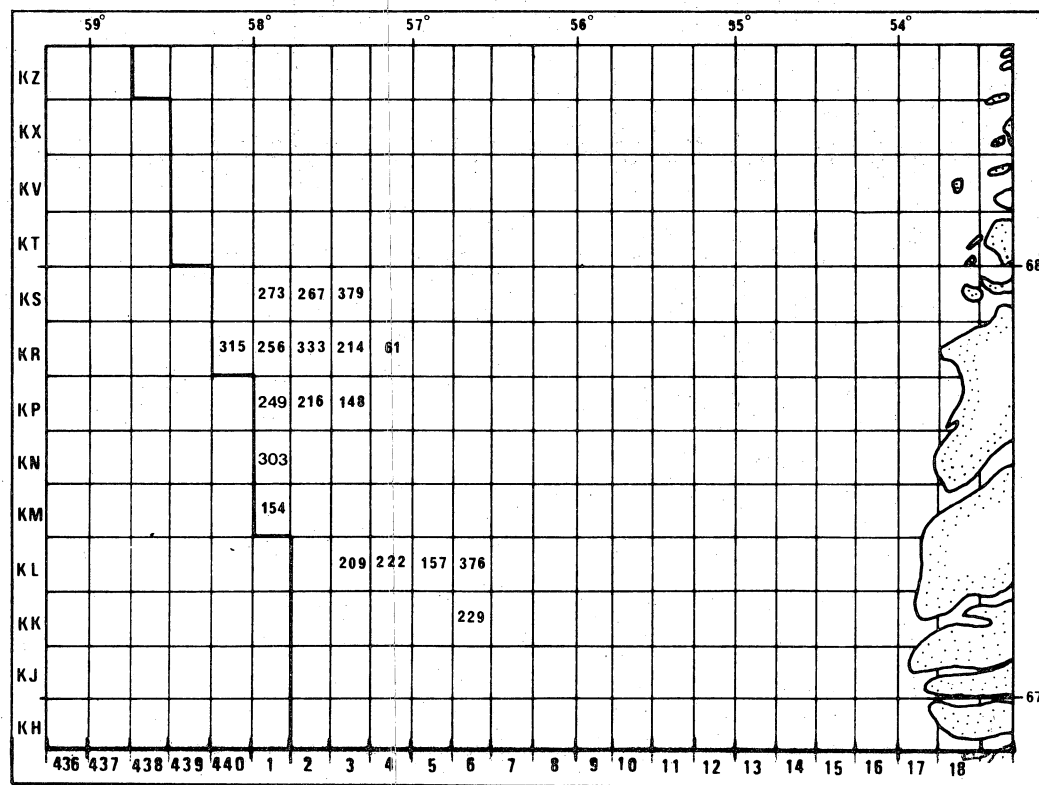
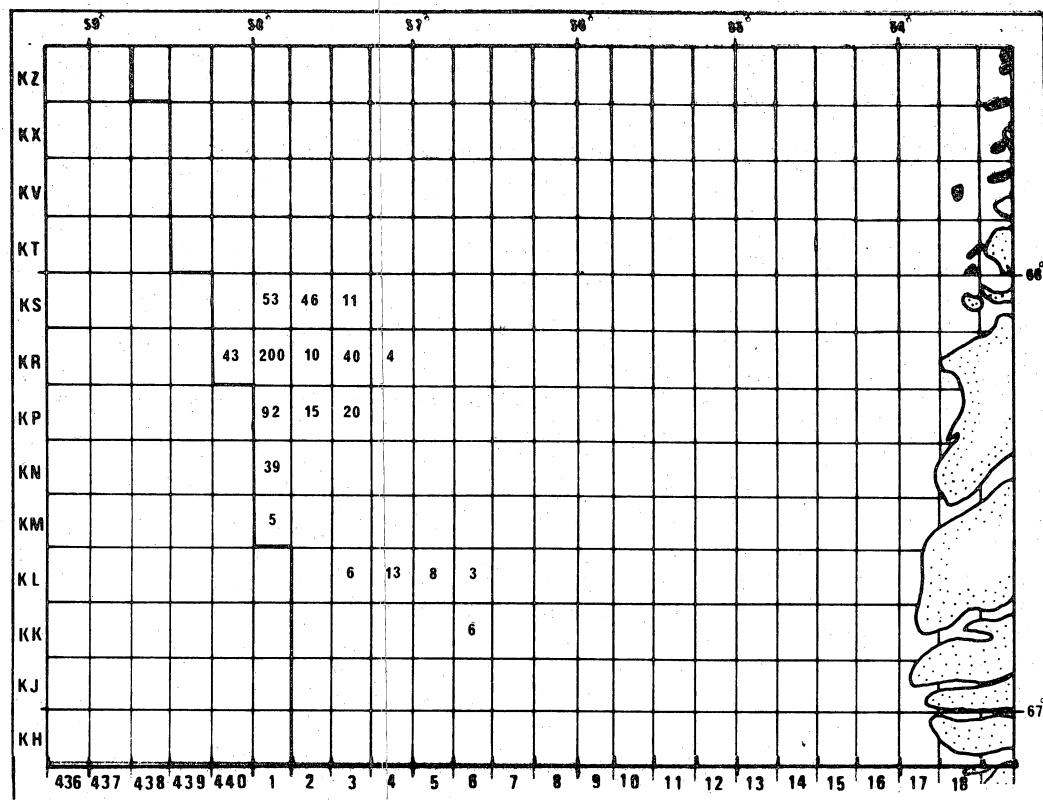


Fig. 2. Distribution of fishing effort (hours) (upper diagram), and of CPUE (kg/hour) (lower diagram) of Finlande III at West Greenland in July 1982.

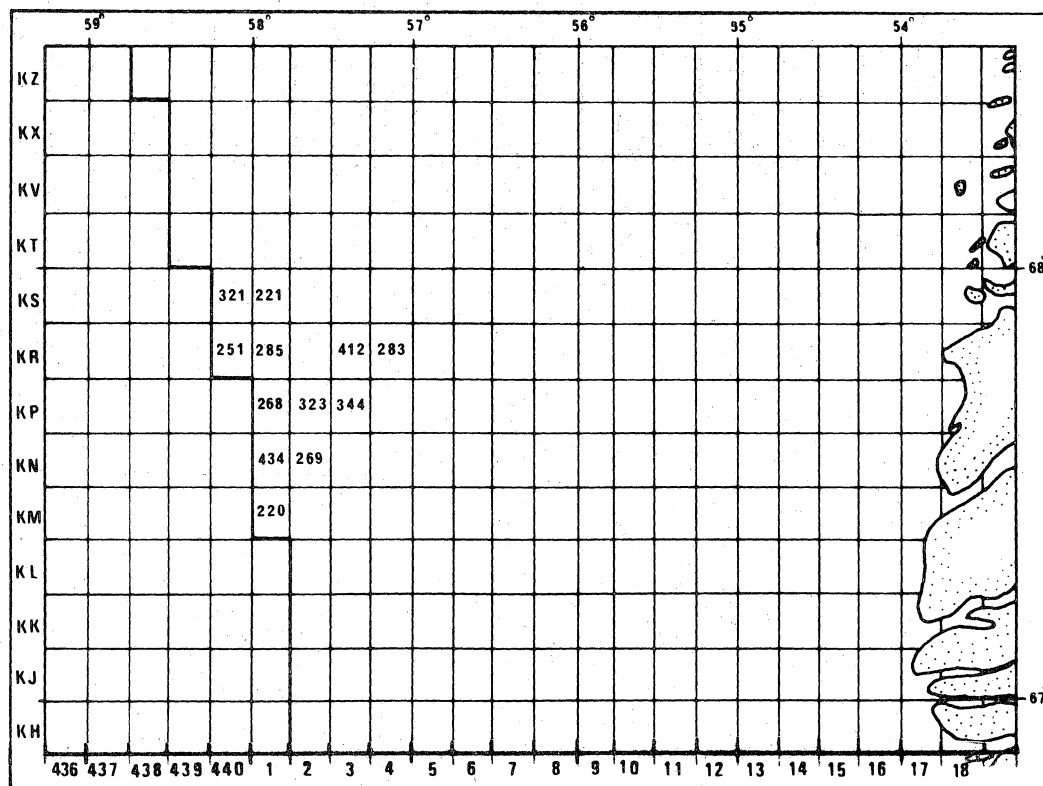
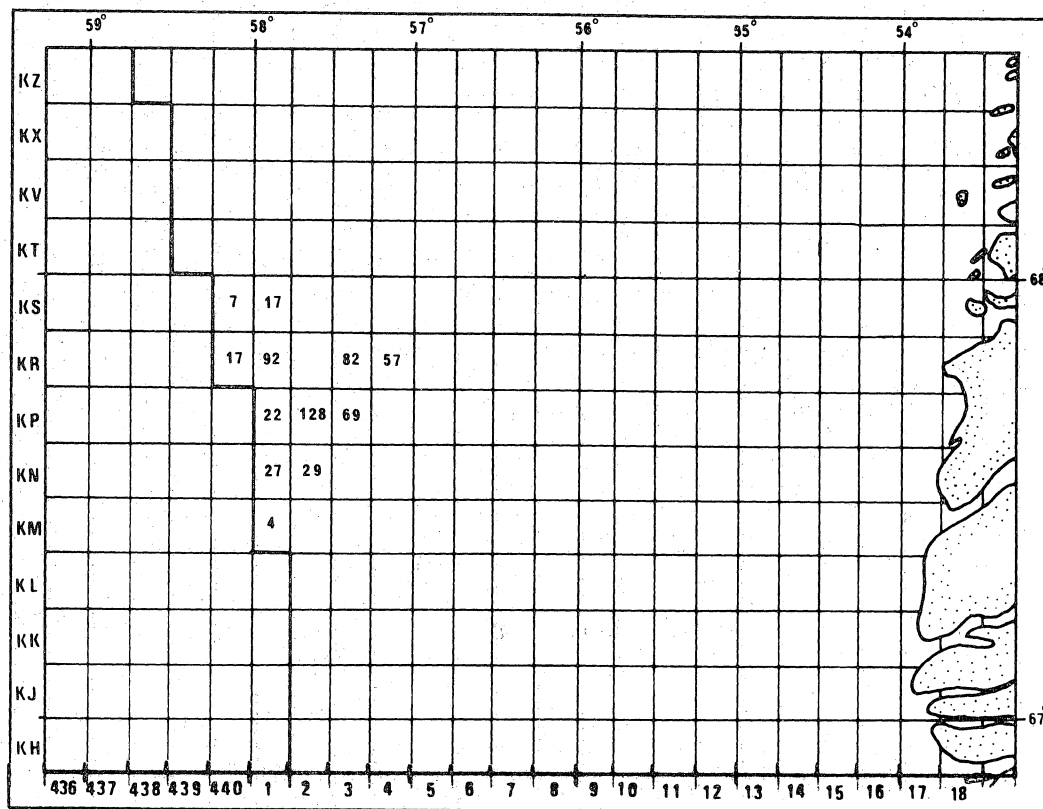


Fig. 3. Distribution of fishing effort (hours) (upper diagram), and of CPUE (kg/hour) (lower diagram) of Finlande III at West Greenland in August 1982.

5 + 14 July 1982

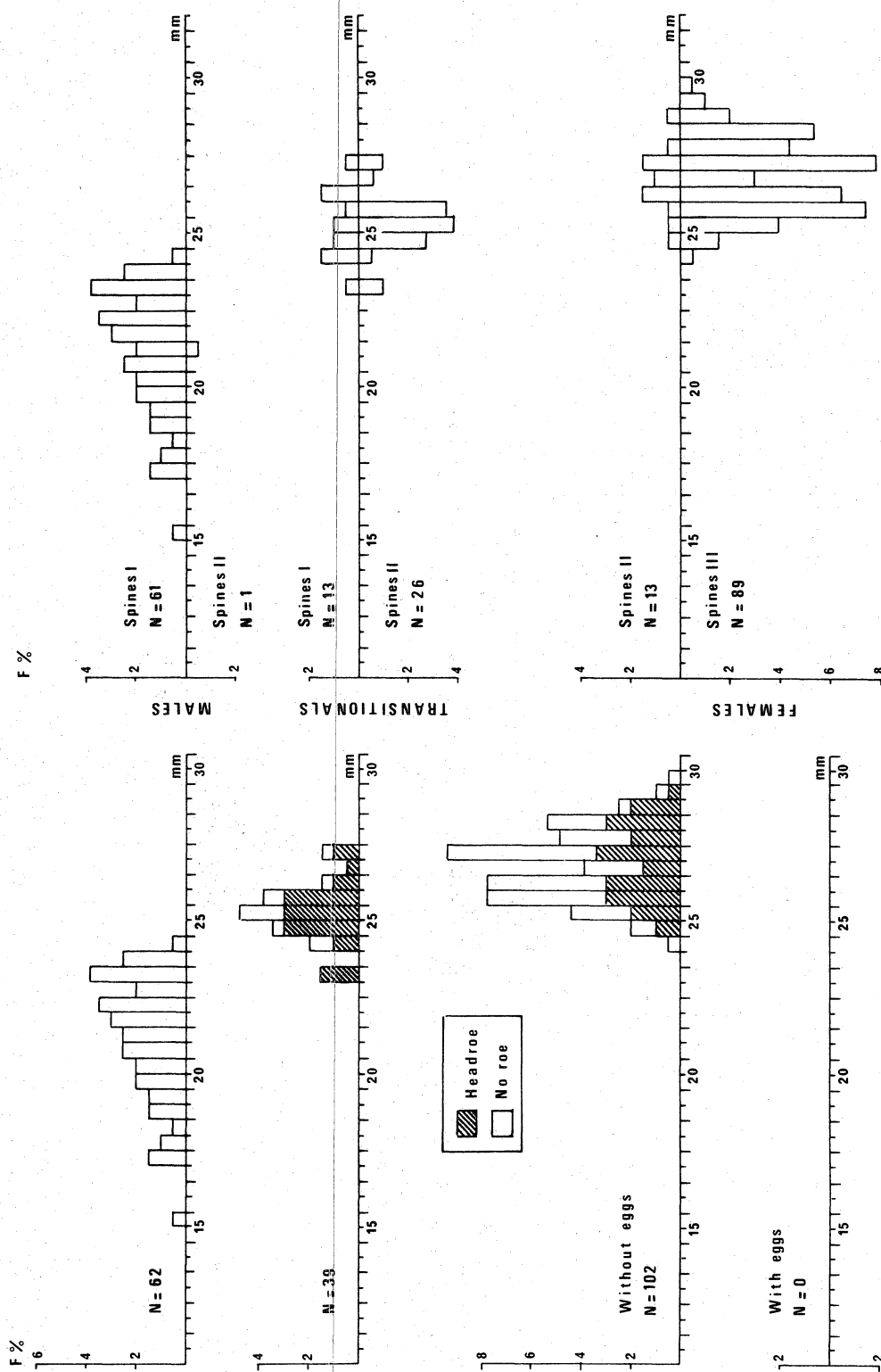


Fig. 4. Size distribution of sexual components in the samples of July 5 to 14, 1982 related to maturity (left side) or to the spines characteristics (right side).

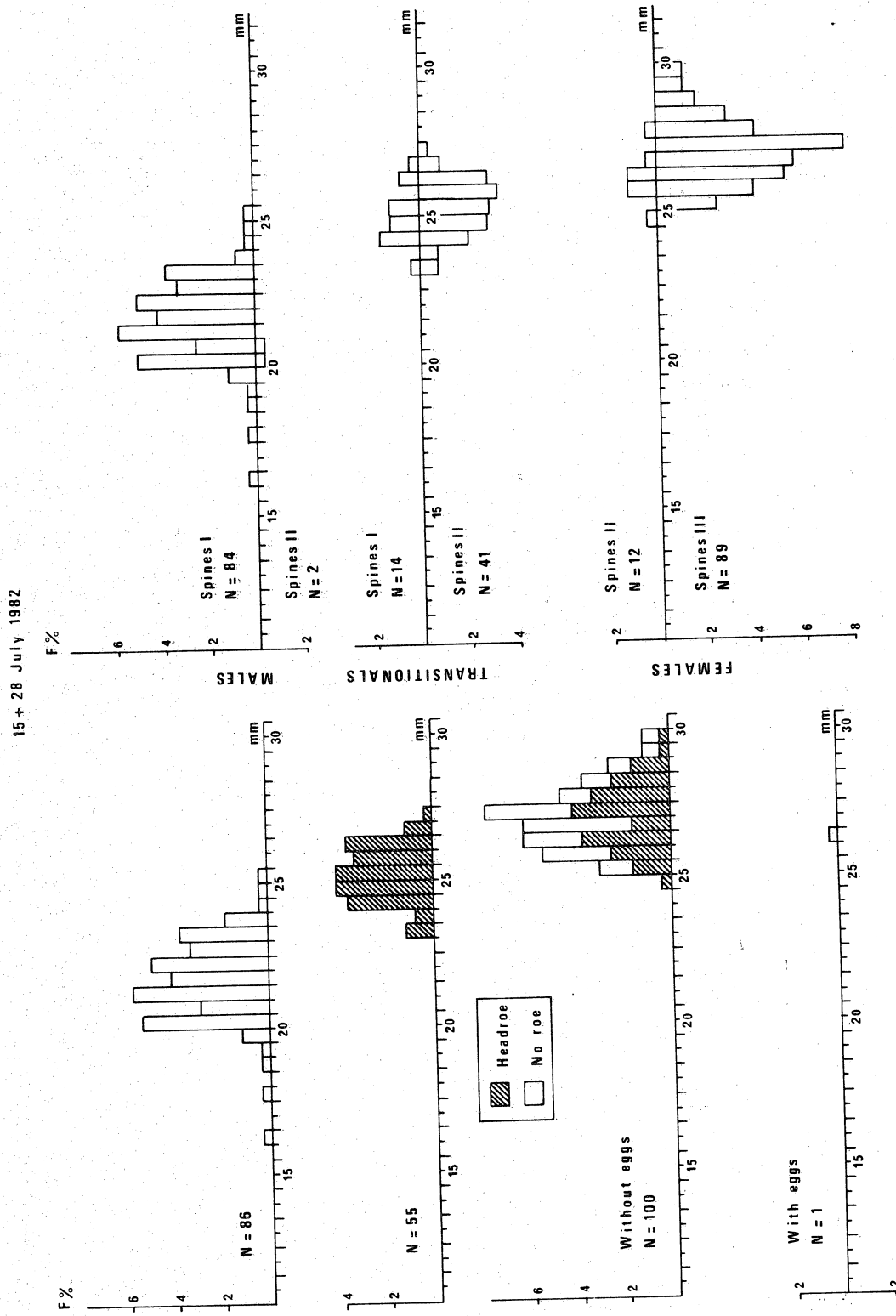


Fig. 5. Size distribution of sexual components in the samples of July 15 to 28, 1982.

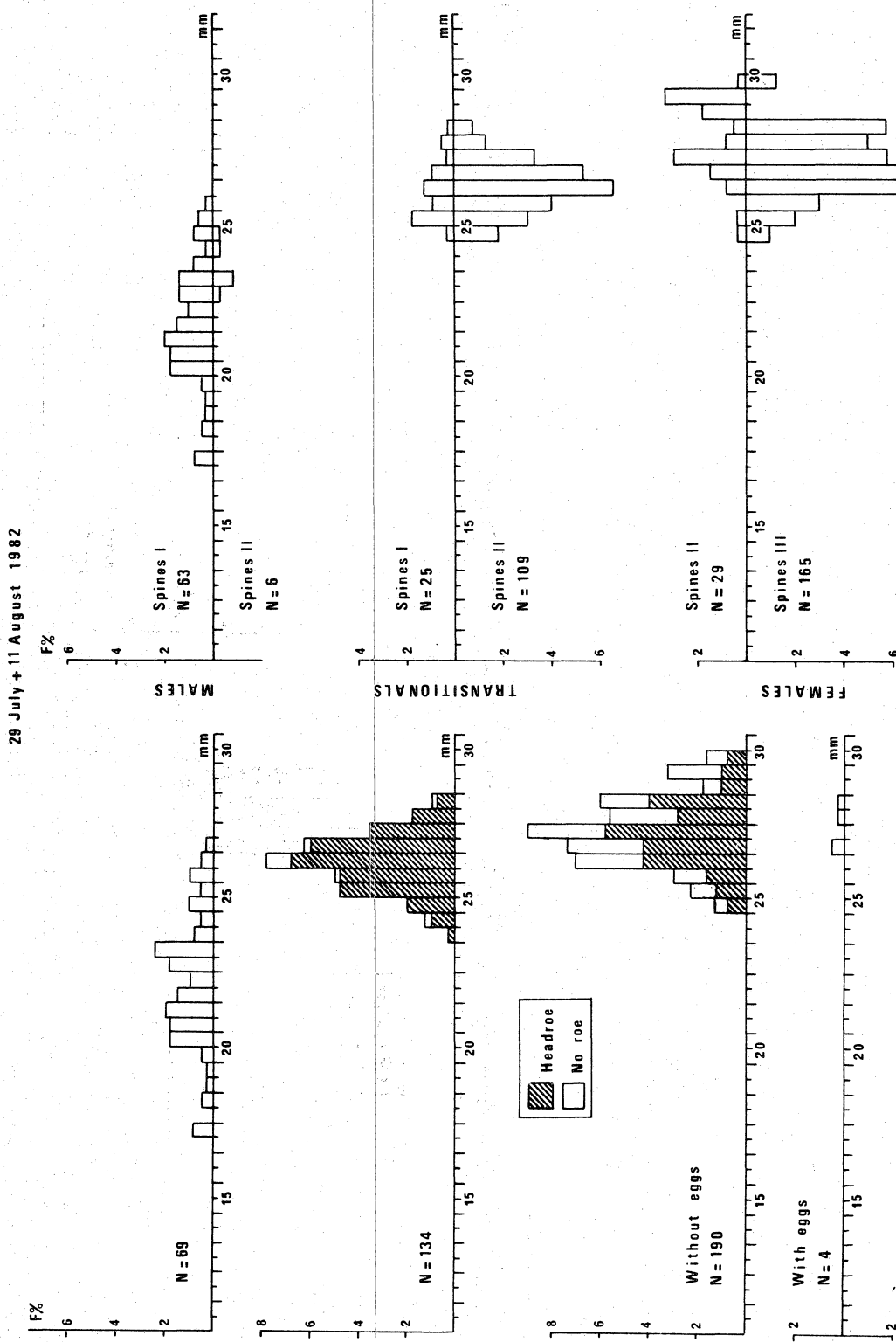


Fig. 6. Size distribution of sexual components in the samples of July 29 to August 11, 1982.

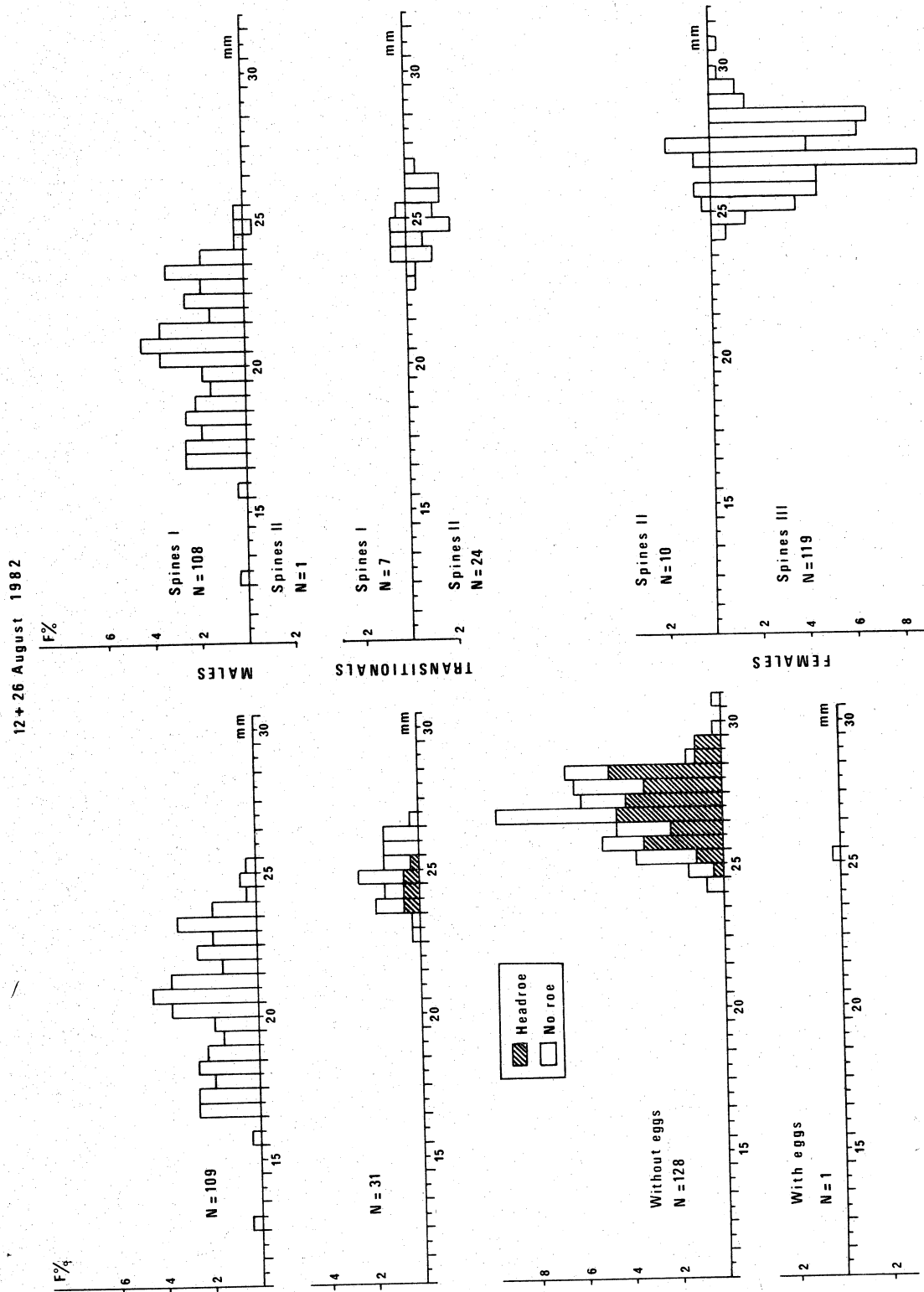


Fig. 7. Size distribution of sexual components in the samples of August 12 to 26, 1982.

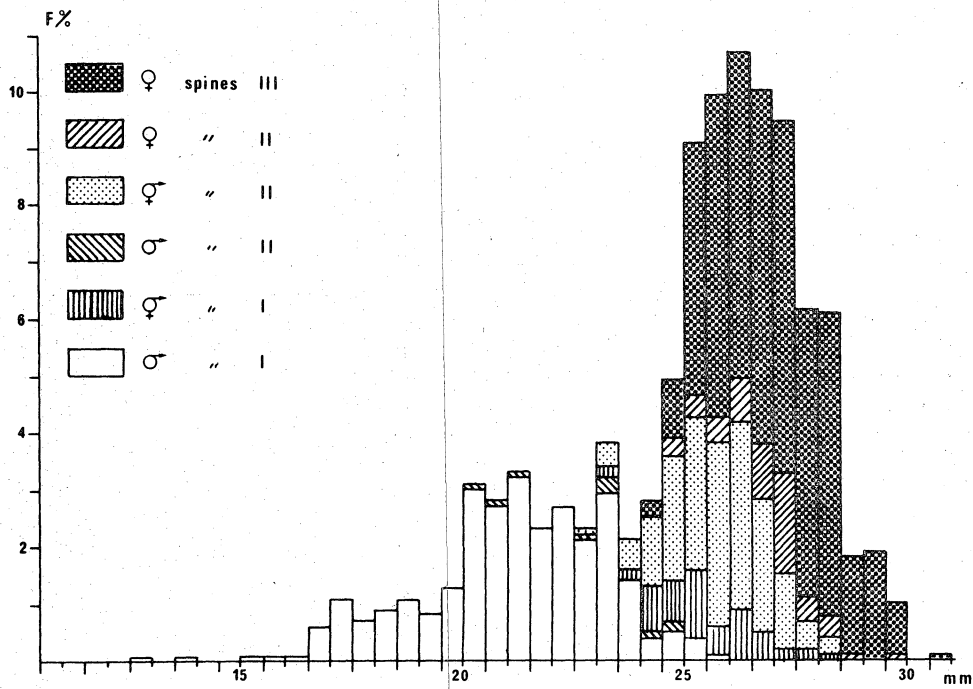
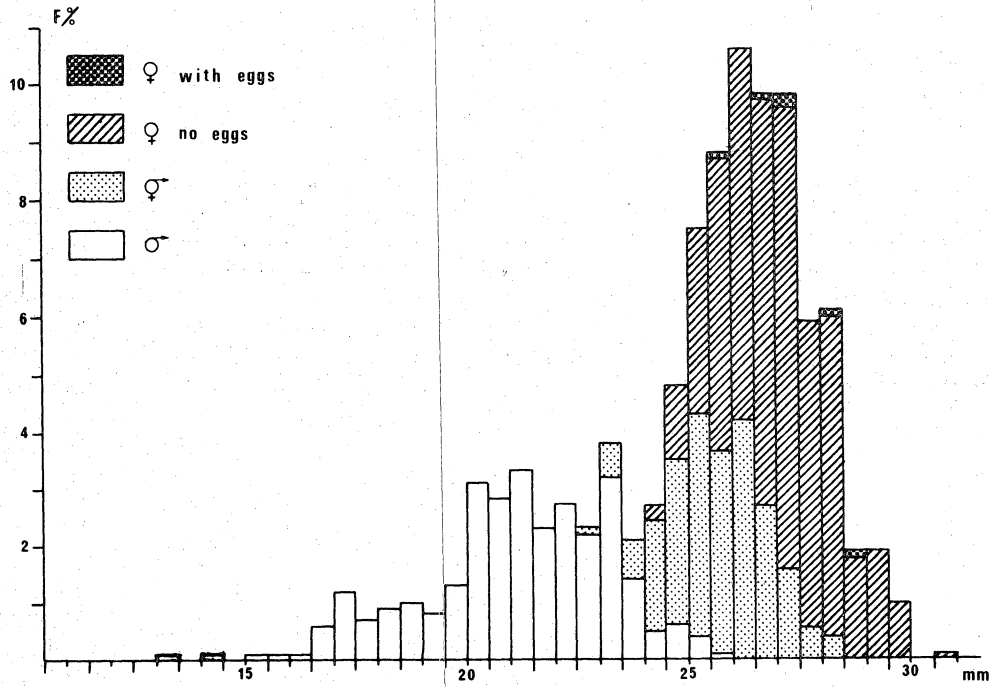


Fig. 8 - Total size distribution of shrimp related to the sexual components (top figure) and to the characteristics of spines in the summer of 1982

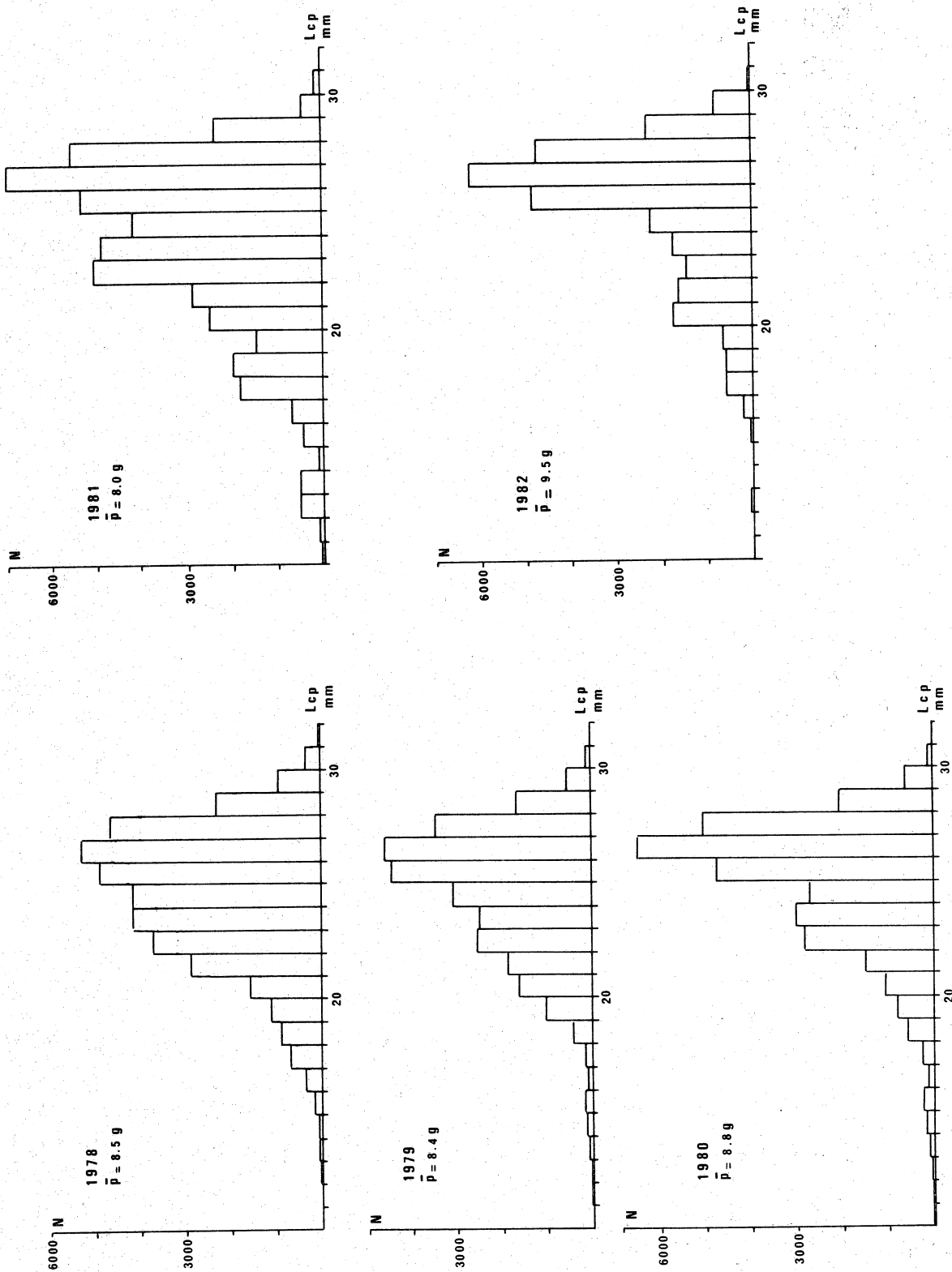


Fig. 9 - Weighted size distribution (in number of shrimps caught per hour) obtained by Finlande III off West Greenland from 1978 to 1982.