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

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#### Introduction

The French fishery off East-Greenland was conducted during the spring of 1982 by two stern trawlers (O T B 2 - class 6). The total landings (414 m.t. of shrimp) were fished from April 14th to June 13th. The fishing logbook of one trawler (the Finlande III) was provided by the captain and nine samples of shrimp, collected on a weekly basis, were frozen for further analysis, in the Saint-Pierre Laboratory.

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

## Observations on catches and fishing effort

During the trip of Finland III at East-Greenland, 265 m. tons of shrimp were caught from April 13th to June 14th, against 241 m. tons from April 21 th to June 16th in 1981.

## 1. Location of the fishery

The fishery was located in C.I.E.M. area XIV, on the Dohrn bank, on the western side of the mid-line between Greenland and Iceland.

In April, the fishing area was restricted alont the 30°W meridian, from 65°30 to 66°30 N, on depth 300-400 m. Most of tows were located in the north (Danish units 112 Ka and Kb) and in the south (units 112 Jr and Jt) of the Dohrn bank where best c.p.u.e. were obtained (Fig. 1a and 1b). In May, the fishery was limited to the south of 66°15 N, on the southern tip of the Dohrn bank, mainly in depth from 380 to 420 m. Most of tows occured in the vicinity of units 112 Jr and Jt (Fig. 2a and 2b).

In June, the fishery moved northwards (Fig. 3a and 3b) between  $66^{\circ}00$  and  $66^{\circ}45$  N on depths from 300 to 350 m. Most of effort was made in the northern part (unit 112 Kf) in the vicinity of the pack.

It is noted that during this spring, the ice cover was more important than previously, impeding to fish west of 30°10 and north of 66°30 during April and May, while in 1981 the fishing area was more spread out. A total of only 20 units (representing an area of 2 800 km2) was fished in 1982 against 39 units (5 500 km2) in 1981 (30°25 W and 66°50 N).

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

The mean c.p.u.e. per month obtained per Finlande III with a Kalud trawl are presented in the following table :

Fishing period	April 13-30	! ! May ! 1-31	! ! June ! 1-14	! ! Total !
No. of tows Catch (tons) Fishing Effort (hours).	104 72 331	! ! 168 ! 149 ! 563	! 76 ! 44 ! 238	348 265 1 132
c.p.u.e. (Kg/h) 1982	216	264	185	234
c.p.u.e; (Kg/h) 1981*	<b>43</b> 3		! ! 144 !	257

\* figures from DUPOUY and al., 1981a.

The total c.p.u.e., 234 kg/h indicates a decrase of 9% compared with the 1981 c.p.u.e. (257 kg/h). It is important to note that this decline results of the catch rate obtained in April 1982, While in May and June 1982 catch rates were similar or higher than in 1981. It is likely that the important ice cover observed in April 1982 was in part responsable of such diminution.

### 3. Discards and by-catches

Because the large size of the shrimp, no discard by automatic sorting was noted. Just a low percentage (not available) of soft-shelled and broken shrimp was discarded by hand. 74 % of the catch, in weight, was sorted in

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extra-large individuals (50 to 70 shrimp per kg), 22 % in large (70 to 90 per Kg) and the remaining 4 % in medium (90 to 120 per kg) and small (120 to 150 per kg).

By catches were constitued mostly of redfishes (5 070 kg) and capelins (1 000 to 2 000 kg). Few specimens of cod were also caught.

#### 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, hatching of eggs, presence of egg-setae on pleopods of females without eggs).

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 wery 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 nine 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 per 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 20 to 36 mm with the bulk between 25 and 32 mm (fig. 8). The mean lenght and weight were, before sorting, 28.3 mm and 15.7 g against 28.9 mm and 16.1 g respectively, in spring 1981 (DUPOUY et <u>al</u>., 1981 a).

Males represent 17 % of the catch. Their size range from 20 to 28 mm. They are composed of at least two modal group (see fig.4 and 7). The first mode (20 to 25 mm) is characteristized by the presence of individuals with sternal spines I, instead the second mode (24 to 28 mm) is a mixture of individuals with sternal spines I and II indicating that evolution towards transitionals is taking place in spring, mainly in April. Transitionals are distributed from 25 to 31 mm (see fig. 4 and 7). They are characterized by the presence of sternal spines II. The few number of females with spines II (one individual un April and 3 in June, i.e. a total less than 1 %) is probably related to the fact that transitionals change into females stage II juste a short time before oviposition, as observed by Mc CRARY (1971). These females spines II (29 to 31 mm) pertain to the same modal group as transitionals and larger males. This group extends from 25 to 31 mm with a mean close to 27.5 mm.

The remaining of the catch (about 75 %) is composed of females without spines (spines III) which represents at least three modal groups (fig.9) the first one, more abundant ranged from 25 to 31 mm, the second from 29 to 33 mm and the last one from 32 to 36 mm.

Because the lack of data on youngest stages ( $\leq 20 \text{ mm}$ ) and the complexity of female growth, it is difficult to determine age for these shrimps.

# 3 - Evolution of sexual components in the samples

Males were encountered mostly in the samples of April and June, and were absent in three samples on a total of four in May. Looking at table I, we can obseve that the percentage of males is important north of  $66^{\circ}00$  N (15 to 46 % of individuals) instead south of  $66^{\circ}00$  N males are very scarce (0 to 3 %). This is in good agreement with the logbook of captain indicating an increase of large individuals in the south of Dorhn bank.

As for males, no transitionals were collected in May, south of 65°50, although they were present in April and June (9 to 17%) north of 66°00 N.

All these samples were collected in the same range of depth (300 to 400 m), so this factor cannot explain such differences. Another explanation should be seen in the time of trawling when samples were taken, because the influence of vertical migration of non ovigerous shrimps during night. However if we compare the percentage of sexual components for samples collected in the same period of time, the differences are still observed (for example, in the range from 5:00 to 10:00 o'clock the sample 3, 5; 6 and 7 in table I).

So, all these informations bring us to the conclusion that the south of Dohrn bank is an area of concentration for ovigerous females instead in the north of 66th parallel all the sexual components (except immatures) are present. This pattern of distribution can results of presence of higher temperature more favourable for incubation of ergs on the southern tip of Dohrn bank (influence of Irminger current) while the middle of the plateau was under influence of colder water of east Greenland current (ICNAF NORWESTLANT atlas, 1963).

# 4 - Period and duration of hatching

If we take in account only the shrimp involved into the 1981-1982 breeding season (i.e. q ovigerous, q with eggs partially hatched and q with egg-setae) we can observe in the following table the evolution of the reproduction in spring 1982 :

! date !	!April !	15!April :	22!April !	29!May 6 !	!May 13 !	!May 20	)!May 27 !	!June 3	!June 10 !
! with eggs not hatched	100	! 100	! 100	! 100 !	1 100	! 95	! 80 !	! 20	! 0 !
o with eggs partally hatched	! ! !	! 0 !	! 0 !	! 0 !	! ! !	! ! 5 !	! 20 !	47 !	! 7 ! 7
o with eggs totally hatched	! ! 0 !	! !! 33 !	! ! 93 !						

As indicated, the hatching period started in mid-May and finished about mid-June. This is in good agreement with the observations made in the previous year DUPOUY and al., 1981a).

## 5 - Proportion of maturing transitionals and females

All the transitionals examined were head roe. Few females with spines were present in our samples (one individual in April, three in June). All these individuals had ripening gonade.

Among the females without spines the percentage of those non participating in the spawning of 1981 (i.e. females non ovigerous or non egg-setae) was 5 % in April, 0 % in May, and 5 % in June). All these females developped head roe in spring of 1982.

The remaining females without spines was composed of 35 % of head roe in April, 46 to 50 % in May and only 10 % in June. So, if the spawning period begin in July, as observed in 1980 (MINET et al., 1980) it appears that almost 60 % of shrimp that are ovigerous a given year don't spawn the next year (see fig.9). Consequently, these non-spawning females can continue their growths and attain larger sizes as for the shrimp stock off Baffin island (DUPOUY et al. 1981b).

## 6 - Length-weight relations

Individuals, collected at East Greenland by trawler Finlande III in 1981 and 1982, were also examined at the laboratory for drawing up lenght-weight

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relationship. Individuals were weighted to the nearest decigram, for each 0.5 mm interval of length. Moreover ovigerous females were weighted separatly.

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The mean value of weight for each class interval was then used to calculate the parameters of length-weight equation, by least-square method and this resulted :

- for individuals without eggs :  $W = 7.88 \times 10^{-4} L^{2.924}$ (with r of 0.996)
- for ovigerous females :  $W = 17.73 \times 10^{-4} L^{2.718}$ (with r of 0.969)

where W represents the total body weight (in grams) and L the caphalothorax lenght (in mm).

Although light differences in the value of calculated parameters, the representation of data (fig.10) are very similar to those presented by MINET et <u>al</u> (1978) and DUPOUY et <u>al</u> (1981b) for the Davis strait shrimp stocks.

## Conclusion and discusion

1 - Because the importance of ice-cover, shrimp trawling in spring of 1982 was restrited to a small part of Dohrn bank along the meridian 30 ° West, representing about half of the previous year fishing area.

2 - The mean CPUE of trawler Finlande III espressed in kg per hour indicated a decline of 9 % compared to the same period of 1981. Due to a slight decrease in the mean size and weight of shrimp in 1982, the abundance index expressed in number of individuals caught per hour of trawling is close to the 1981 index (14 838 against, 15 963 individuals). This diminution of 7.6 % in number results in a lower proportion of individuals larger than 29 mm; however the shrimp ranging from 20 to 29 mm were more abundant than in the spring of 1981 (fig.8).

3 - The period of incubation of eggs extends from mid-summer to mid-spring most of hatching taking place in May. Ovigerous females were present on the whole fishing area but with an increasing proportion on the southern part of Dohrn bank. This pattern of distribution is probably related to a migration behaviour of egg-bearing females in area with warmer temperatures more suitable for incubation.

4 - An important part of females (till 60 %) were not maturing in spring. It is likely that they do not participed to the spawning of summer 1982. So, they can have an extra year of growth between two consecutive spawnings this can explain the existence of larger shrimps than in West Greenland where most of the females mature each year. (HORSTED, 1978). 5 - The absence of immatures on the fishing grounds (no individuals <20 mm were caught in 1982 as in previous years) indicated that a current<sup>ca</sup>rry the larvae outside the fishing grounds. Considering hydro sections made in March-April of 1963 by R/V THALASSA in that area (ICNAF NORWESTLANT atlas, 1968) it appears that a branch of Irminger current enters in the channel separating Icelandic plateau from Strede-Dohrn bank. This branch can carry to the north the larvae hatched on the fishing grounds.

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# Acknowledgements

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	65	06:20-09:40 65	340-370 06:20-09:40 65	30°00° 340-370 06:20-09:40 65	66°13° 30°00° 340-370 06:20-09:40 65	April 29 66°13° 30°00° 340-370 06:20-09:40 65
	54	14:10-17:40 54	380-385 14:10-17:40 54	30°02° 380-385 14:10-17:40 54	65°40° 30°02° 380–385 14:10–17:40 54	May 6 65°40° 30°02° 380-385 14:10-17:40 54
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	58	06:20-10:20 58	540-350 06:20-10:20 58	29°57° 340-350 06:20-10:20 58	65°50° 29°57° 340-350 06:20-10:20 58	May 20 65°50° 29°57° 540-350 06:20-10:20 58
	62	05:30-08:30	360-370 05:30-08:30 62	30°02° 360~370 05:30~08:30 62	65°49° 30°02° 360–370 05:30–08:30 62	May 27 65°49° 30°02° 360–370 05:30–08:30 62
	65	17:10-20:40 65	330-340 17:10-20:40 65	29°52° 330~340 17:10~20:40 65	66°21° 29°52° 330-340 17:10-20:40 65	June 3 66°21° 29°52° 330-340 17:10-20:40 65
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		17:30-21:00 65 06:20-09:40 65 14:10-17:40 54 05:30-10:00 54 06:20-10:20 55 05:30-08:30 62 17:10-20:40 65	355-375 17:30-21:00 6   340-370 06:20-09:40 6   380-385 14:10-17:40 54   360-400 05:30-10:00 54   360-370 05:30-08:30 62   360-370 05:30-08:30 62   370-340 17:10-20:40 62	30°00° 355-375 17:30-21:00 65   30°00° 340-570 06:20-09:40 65   30°02° 380-385 14:10-17:40 54   30°02° 380-385 14:10-17:40 54   30°02° 360-400 05:30-10:00 54   20°02° 340-350 05:30-10:00 56   20°02° 360-370 05:30-08:30 62   30°05° 350-340 17:10-20:40 63   30°05° 378-374 16:35-20:05 63	66°13°   30°06°   355-375   17:30-21:00   66     66°13°   30°00°   340-370   06:20-09:40   65     65°40°   30°02°   380-385   14:10-17:40   54     65°40°   30°02°   380-385   14:10-17:40   54     65°40°   30°02°   360-400   05:30-10:00   54     65°49°   30°02°   360-370   06:20-10:20   56     65°49°   30°02°   360-370   05:30-08:30   62     65°49°   30°02°   360-370   05:30-08:30   62     65°40°   30°05°   350-340   17:10-20:40   65     66°21°   29°52°   370-340   16:35-20:05   63	April 22   66018*   30006*   355-375   17:30-21:00   65     April 22   66013*   30006*   340-370   06:20-20:40   65     May   6   65°40*   30°00*   340-370   06:20-20:40   65     May   6   65°40*   30°02*   380-385   14:10-17:40   54     May   13   65°40*   30°02*   380-385   14:10-17:40   54     May   20   65°40*   30°02*   380-385   14:10-17:40   54     May   20   65°40*   30°02*   380-385   05:30-10:00   56     May   20   65°50*   29°57*   340-350   05:30-10:20   52     May   27   65°49*   30°02*   360-340   05:30-08:30   62     June   3   66°21*   29°52*   370-340   17:10-20:40   65     June   3   66°21*   30°52*   370-340   17:10-20:40   65

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

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Fig. 1 a - Distribution of the fishing effort (hours) of Finlande III at East Greenland in April 1982

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Fig. 1 b - Distribution of the CPUE (Kg/hour) of Finlande III at East Greenland in April 1982

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Fig. 2 a - Distribution of the fishing effort (hours) of Finlande III at East Greenland in May 1982

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Fig. 3 a - Distribution of the fishing (hours) of Finlande III at East Greenland in June 1982

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Fig. 3 b - Distribution of the CPUE (Kg/hour) of Finlande III at East Greenland in June 1982

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- Size distribution of sexual components during the first half of June 1982 Fig. 7







Fig. 9 - Total size distributions of females related to the presence of eggs (top of figure) and to the presence of head roe (bottom) in spring 1982



Fig. 10 - Length-weight relationships for East Greenland shrimp

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