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Preliminary studies on the occurrence of the larvae of deep water prawn (Pandalus borealis KRØYER) in southern Norway.

by



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#### INTRODUCTION

This paper is part of a project on prediction of possible impacts of warm water effluents from a planned plant to the environment in the Oslofjord. The plant is planned to use seawater for cooling. The sea water contains at times a great number of planctonic organisms. In a cooling system, the organisms are exposed to different kinds of stress which can result in their destruction. Prediction of impacts, however, depends upon adequate data on the distribution of the species of interest.

The catches of Pandalus borealis made an average of 19% of the total landings of fish and shellfish from the Oslofjord during the year of 1970 to 1976. Economically, the fishery for deep water prawn is the most important in the area.

RASMUSSEN (1953) gives a description of the biology of Pandalus borealis, with geographical variations, for the Norwegian waters. In the area of the Skagerrak-Oslofjord, the deep water prawn are spawning from October-November followed by hatching the eggs in March-April. From the hatching until the first bottom stage in

June/July, very little is known about the occurrence of the larvae. Except for the general knowledge that the larvae are pelagic (BERKELEY 1930, HJORT & RUUD 1938).

In order to obtain some idea of the occurrence, of the vertical distribution and of the development of the larvae of Pandalus borealis field studies were made over a prawn ground outside of Arendal. The sampling was done in March 1976 and 1977.

#### MATERIAL AND METHODS

The prawn ground, with a maximum depth of 180 meters, is located 6 n.m. SW of Arendal (Fig. 1).

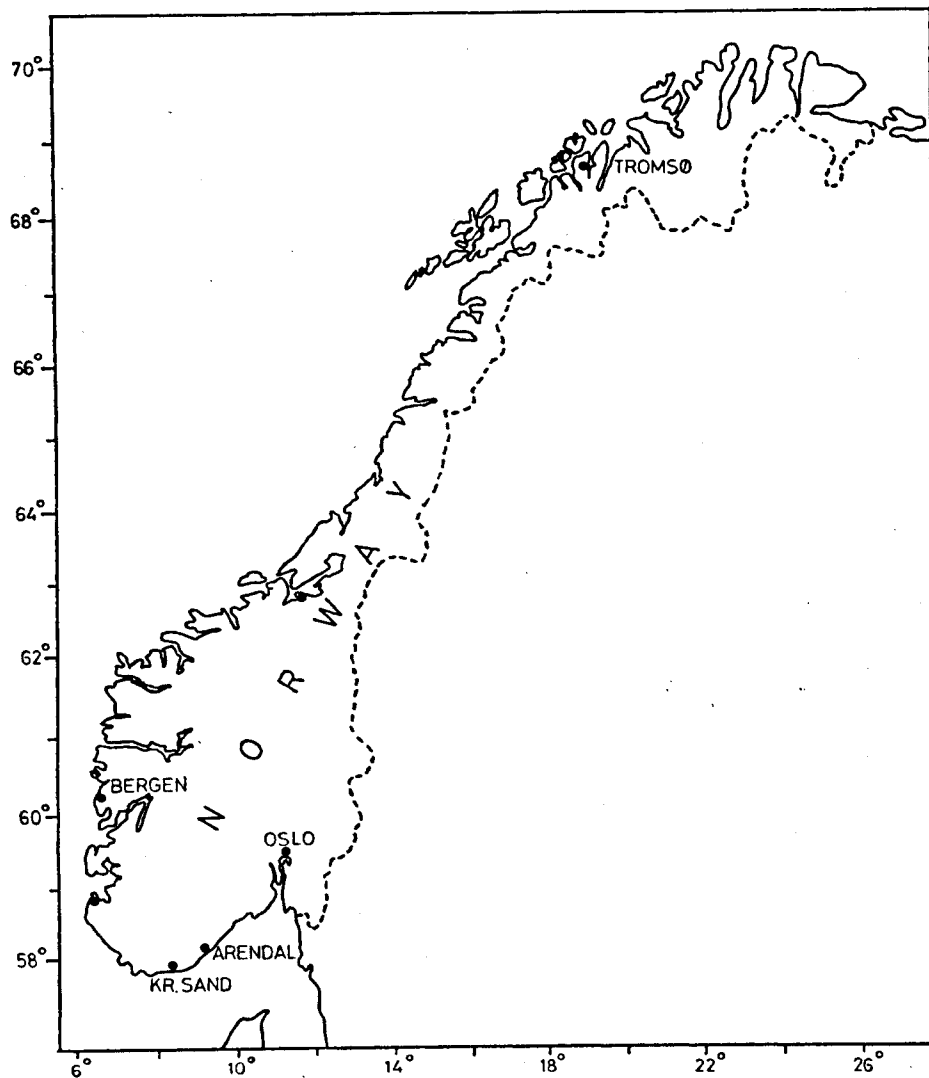


Fig. 1. A small scaled map showing the location of Arendal in southern Norway.

The surveys were carried out on March 22nd and 23rd, 1976 and on March 2nd - 4th and from March 28th to April 1st 1977. Sampling were done both in broad daylight and around midnight to look for possible diurnal changes in the occurrence. The sampling were made as replicate series in 1976 and as single series in 1977.

A 200 mm  $\emptyset$  Bongo plankton sampler (POSGAY, MARAK & HENNEMUTH 1968) with 180 mm long plastic collars, was used. Two samplers were used attached to the same wire with a fin-depressor (18 kg) at the end of the wire. Each Bongo was equipped with two flow meters and nets with a mesh size of 0.500 mm. Sampling was carried out as horizontal tows at about 3 knots, filter 20-40 m<sup>3</sup> water, in the following depths: 0,5,10,20,30,50,75,100,150 and 170 meters.

The plankton samples were immediately preserved in 2-4% neutral formaldehyde solution.

Larvae of decapods were sorted out from the samples. For identification of the larvae of Pandalus borealis, larvae hatched and developed in the laboratory and drawings from BERKELEY (1930) and WIENBERG (1975), were used. Occurrence of larvae are given as mean number per 100 m<sup>3</sup>, for the day and night samples respectively.

The temperature data (Fig. 2) are sampled as part of another project (un.publ.).

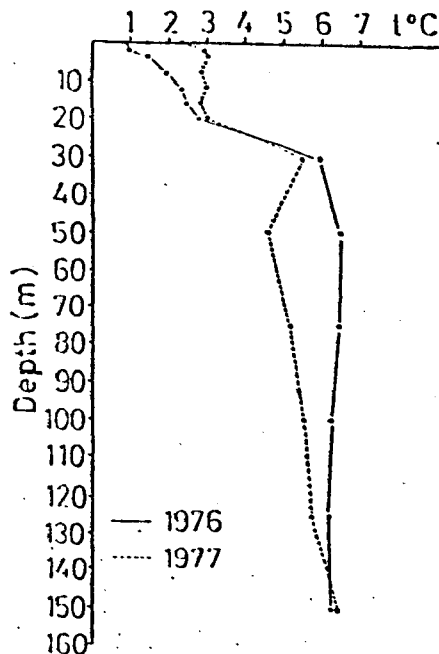


Fig. 2. Temperature, t°C, of the sea water, March 17th, 1976 and March 24th, 1977.

## RESULTS

Larvae of Pandalus borealis were found both in 1976 and 1977. The mean number per 100 m<sup>3</sup> of the larvae in the samples from the two years, are shown in Fig. 3 and Fig. 4. The maximum number in 1976 was 40 larvae/100 m<sup>3</sup> in the day and 209 larvae/100 m<sup>3</sup> at night, the corresponding numbers in 1977 were 86 larvae/100 m<sup>3</sup> and 239 larvae/100 m<sup>3</sup>. According to the figures, larvae were caught at all depths. Totally, the abundance were greater at night than during daytime.

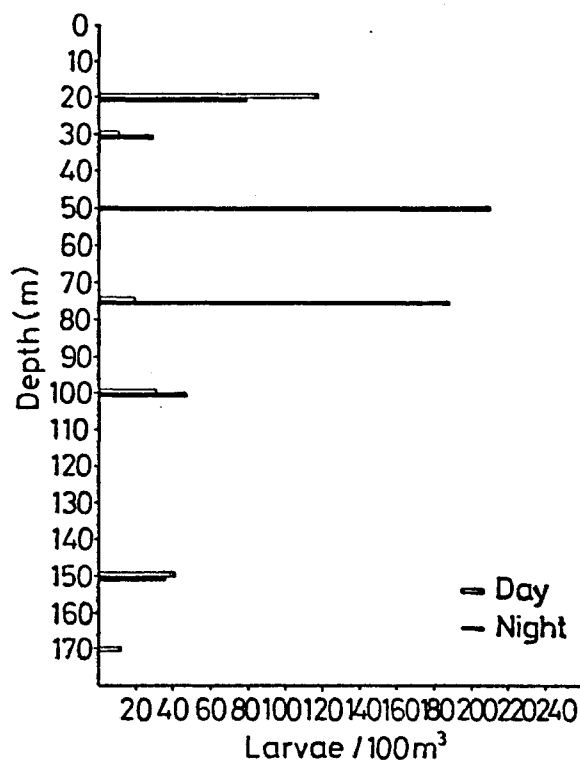


Fig. 3. The mean number of Pandalus borealis larvae per 100 m<sup>3</sup>, March 22nd - 23rd, 1976.

Four stages in the larval development were identified, stage I through IV. Tabel 1 gives the distribution of the stages at the different depths for days and nights. The catches of the larvae consisted mainly of the stages I, II and III. The occurrence of stage III appear to be more numerous in the 1976 samples than in the samples from 1977. Larval stage IV made a small part of the samples in both years.

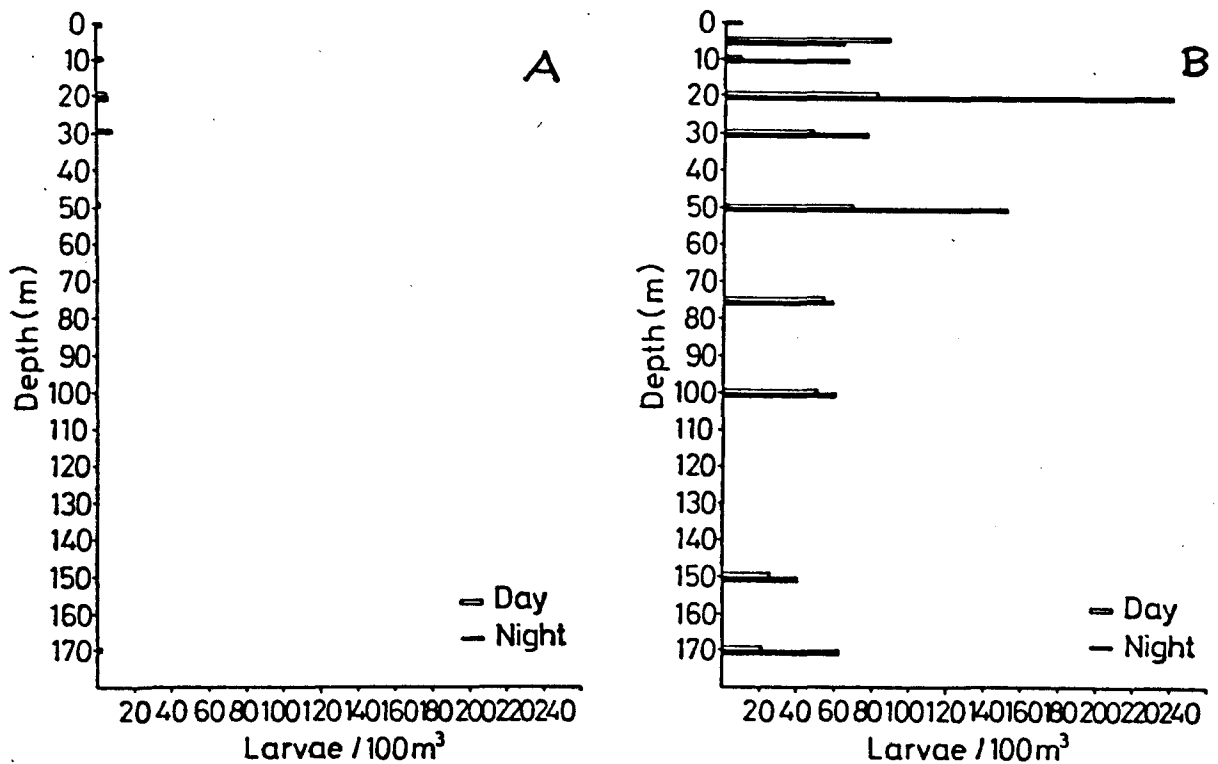


Fig. 4. The mean number of *Pandalus borealis* larvae per 100 m<sup>3</sup>  
A: March 2nd - 4th B: March 28th - April 1st, 1977.

#### DISCUSSION

The numbers of larvae recorded in 1976 were higher than in 1977. In both years the greatest number of larvae were obtained at night. Apart from the mid water, there seems to be no indication of diurnal variation in the abundance at the different depths. BERKELEY (1930), HJORT & RUUD (1938) have not presented their results per volume, making any comparison impossible.

BERKELEY (1930) found late in March mainly larvae in stages I and II, and she presumed that the same probably would be the case early in April. From her data she concluded that the larvae tended to disappear from the hatching area at about the third stage of development.

Tabel 1. The occurrence of larval stages of the deep water prawn (Pandalus borealis) at sampling depth at Ruaker, on March 22nd - 23rd, 1976 and on March 28th - April 1st, 1977. Mean numbers per 100 m<sup>3</sup> for the day and night (in brakets) samples. (-) not sampled.

Depth (m)	1976				1977			
	I	II	III	IV	I	II	III	IV
0	0 ( 0)	0 ( 0)	0 ( 0)	0 (0)	0 ( 4)	0 ( 4)	0 ( 0)	0 (0)
5	0 ( 0)	0 ( 0)	0 ( 0)	0 (0)	39 ( 32)	41 (22)	6 ( 6)	0 (0)
10	0 ( 0)	0 ( 0)	0 ( 0)	0 (0)	6 ( 40)	0 (15)	2 ( 8)	0 (0)
20	36 (27)	32 (30)	46 ( 21)	2 (0)	37 (157)	39 (69)	6 (10)	0 (2)
30	0 ( 3)	0 (15)	10 ( 10)	0 (0)	25 ( 50)	20 (32)	3 ( 1)	0 (0)
50	0 (48)	0 (54)	0 (104)	0 (3)	33 ( 89)	28 (52)	9 (16)	0 (0)
75	4 (62)	0 (52)	14 ( 68)	0 (5)	28 ( 30)	28 (24)	3 ( 3)	0 (0)
100	0 (14)	13 ( 7)	20 ( 25)	0 (0)	26 ( 33)	19 (26)	7 ( 5)	0 (0)
150	10 ( 6)	15 (13)	15 ( 18)	0 (0)	10 ( 18)	11 (15)	3 ( 6)	0 (0)
170	0 ( -)	2 ( -)	9 ( -)	0 (-)	8 ( 41)	8 (17)	5 ( 3)	0 (0)

Unfortunately, I have no exact data on the hatching time of Pandalus borealis from the prawn ground in these two years. Informations from fishermen, based on the number of egg bearing prawns, in the catches, indicates a 2-3 weeks earlier hatching in 1976 than in 1977. According to Fig. 2 the temperature in 1976 was higher in the middle and the deeper layer.

BØHLE (in press) found that the time required for developing from hatching to larval stage III and IV in the laboratory, are on an average 28 and 40 days respectively, at about 6°C. Data from experimental conditions do not necessarily give data exactly relevant to natural condition, but they should give an indication on the development through the stages.

From the results on the occurrence of different larval stages, stage III appeared to be relatively more numerous in 1976. This can be due to the higher temperature and thus to an earlier hatching time that year. It is not possible, however, to relate the observed distribution of the different stages to any depths, neither in the day nor at night.

Plankton sampling on March 2nd - 4th, 1977, gave very few larvae (0-6 larvae/100 m<sup>3</sup>) of the deep water prawn, all in stage I. This indicates the beginning of the hatching time.

The larvae have an increasing swimming speed with age, resulting in an increasing avoidance to the sampler. This, and the time of sampling related to the hatching time, are factors which probably affects the occurrence of the greater larvae in the samples and therefore the total number of larvae.

#### SUMMARY

Sampling for Pandalus borealis larvae were carried out in broad daylight and around midnight, in March 1976 and 1977. A 200 mm Ø Bongo sampler was towed in horizontal haul at 0,5,10,20,30,50, 75,100,150 and 170 meters.

Larvae were found in both years, with a greater abundance at night than during daytime. Four larval stages were identified, stage I through IV.

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