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OCCURRENCE AND LIFE CYCLE OF *MYSIS OCULATA* (CRUSTACEA) FROM SPITSBERGEN

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ABSTRACT

A shallow water mysid species was studied in the Hornsund fjord and in adjacent territories of Southwest Spitsbergen. The main part of the population occurs at 2-15 m depths among algae, in the range of temperature from 0.5 to 4°C and salinity from 10 to 35‰ in summer. Eggs are laid by *M. oculata* in September-October, incubation lasts till April-May, when 3.5 mm long juveniles are released. Life cycle duration is 2.5 years, with a single period of reproduction at the end of the 2-nd year of life.

1. INTRODUCTION

Mysis oculata is the most common mysid species in the coastal waters of the Svalbard archipelago. It makes up a large fraction of food of marine birds (Stott 1936, Løvenskjöld 1964, Lydersen et al. 1985, Ivashin et al. 1972) and seals (Popov 1982, Lowry et al. 1978).

Unlike the closely related *Mysis relicta*, (Holmquist 1959 a, Johnson 1966, Carpenter et al. 1974, Robertson et al. 1968), this species has not been subjected to special autecological studies in the Arctic. There exist only short faunistic notes on *M. oculata* from Arctic and Subarctic regions (Sivertsen 1935, Lagardere 1968, Just 1970). The aim of this study is to present a description of the life cycle and ecology of *Mysis oculata* in Spitsbergen.

The present work is a part of ecological studies of the Hornsund fjord conducted in 1977-1985 by Polish expeditions in an attempt to describe life histories of biologically important species from the investigated area.

2. MATERIAL AND METHODS

Mysis oculata specimens were collected from the Hornsund region (77°N, 15°E South Spitsbergen), mainly from its north-western part. A description of the physical environment in the investigated area has been given by Swerpel (1985), and Węśławski et al. (1988). Generally it is a subarctic fjord dominated by transformed Atlantic waters. Winter water temperatures fall to -1.88°C, while in summer the temperature maximum does not exceed 4°C at 10 m depth.

Mysids were collected with the use of a light dredge hauled from a boat and at low tide, by means of a hand net. Mesh sizes in the dredge and net were 1 mm and 0.5 mm respectively. Part of the analysed material came from stomachs of birds, seals and fish captured in the investigated area.

Samples were taken in 1984/1985, twice a month from different depths and localities. The collected specimens were preserved in 4% formaldehyde solution and analysed within 4 months from the date of capture. Length was measured from rostrum tip to the end of telson under a stereoscopic binocular with 0.1 mm accuracy. Wet weight was measured after having had dried the specimen externally on filter paper, dry weight — after drying for 2 days at 60°C.

All data on salinity and temperature of mysid habitats were collected with the use of reverse thermometers and the conductivity method, respectively.

Data on the callorific value and coefficients of *M. oculata*, which were presented by Wołowicz and Szaniawska (1986) were based on a part of the present material.

3. RESULTS

From over 300 dredgings carried out in the Hornsund 1984/1985, 35 contained 3045 specimens of *M. oculata*. The richest were the two hauls from August 1984, when 2000 specimens were caught from large shoals they formed.

From samples collected all over the fjord from the depth range 0-250 m, *Mysis oculata* was found only at coastal stations in the phytal zone (0 to 30 m depth). Depth preferences of mysids in Hornsund are shown in Fig. 1; the main size/age groups (juveniles, immatures and adults) were distributed separately, with the dominance of juveniles in shallow water and adults being the most common at 20 m depth. In the present material no mysids were found at depths below 100 m and only individual specimens were collected from depths below 30 m.

Salinity and temperature preferences from the observed population are shown in Fig. 2, for summer hydrological situation, when the most variable

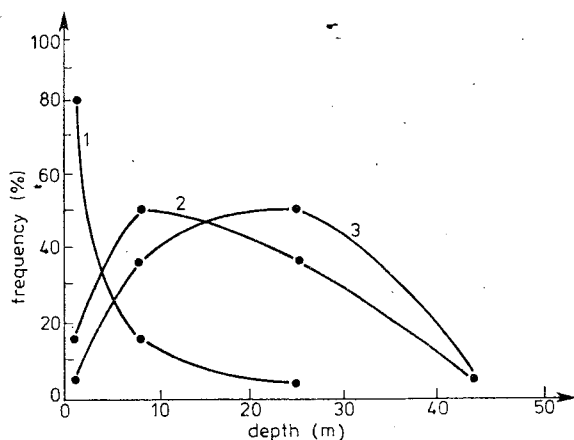


Fig. 1. Depth distribution of *Mysis oculata* population in Hornsund, Spitsbergen. 1 — juveniles, 2 — immatures, 3 — adults

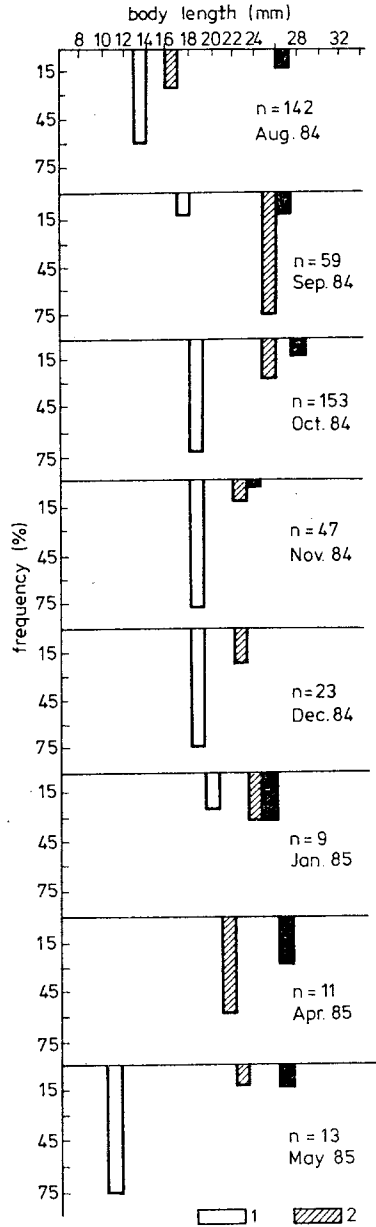


Fig. 3. *Mysis oculata* mean body length in the year cycle. Population from 2-10 m depth, Hornsund fjord, Spitsbergen. 1 - juveniles, 2 - immatures, 3 - adults

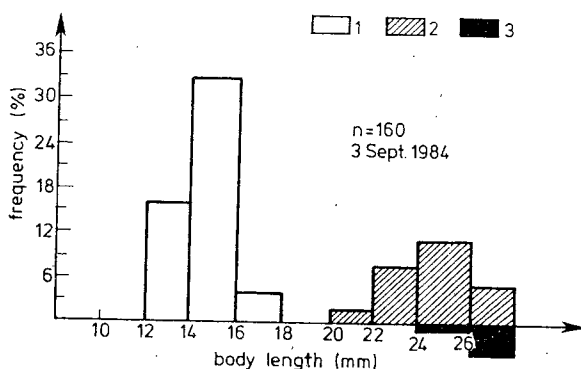


Fig. 4. Length frequency of *Mysis oculata* from Hornsund fjord, Spitsbergen. Population from 2-10 m depth. 1 — juveniles, 2 — immatures, 3 — adults

conditions are to be found. Most of the collected specimens were found within the 25-35‰ salinity and 1-4°C temperature ranges, although in several cases immature and juvenile individuals were collected from water of low salinity (up to 10‰).

The population characteristics in the course of the year are shown in Fig. 3. The data come from the materials collected from the one sampling point, where sampling was most complete (9 months). Since Fig. 3 is based on a small quantity of material (a-total of 470 specimens), only mean values of length are given. For comparison the results are given of frequency analysis of a sample taken in September 1984 from another locality (Fig. 4).

From all the *Mysis oculata* collected from various localities in Hornsund, the smallest specimens (4-5 mm length) have been found in early May. Those newly hatched juveniles reach 14 mm length in August (Fig. 3). They winter as a juvenile stadium of 10-20 mm length with almost no growth taking place

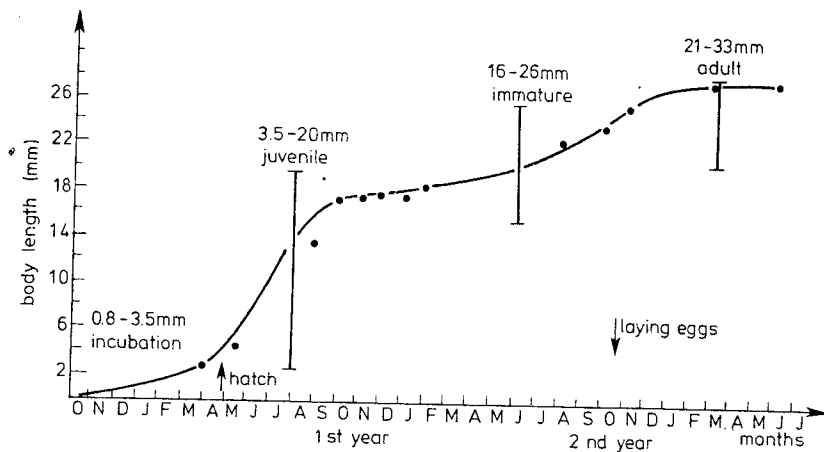


Fig. 5. Life cycle of *Mysis oculata* from Hornsund fjord, Spitsbergen (see also Table II)

during that season (Fig. 3). In April 1985 those juveniles turned into the immature stadium of 20-22 mm length. Individuals hatched in April 1985 were already 10 mm long (7-11 mm) in May. The life cycle, evaluated from the data shown in Fig. 3 and from individual observations from other years and localities in Hornsund is presented in Fig. 5. It can be summarised as follows: egg laying takes place between September and October, when eggs 0.88 mm in diameter are laid into a brood pouch. Incubation lasts till April-May, when juveniles of 3.5 mm length are released. During the first year of life *Mysis oculata* grows from a 3.5 mm juvenile into a 22 mm immature individual. In autumn of its second year of life *Mysis oculata* becomes adult and lays eggs. The dying out of adults takes place in the middle of their third year of life, when the length of the largest specimens ranges between 30 and 34 mm (Fig. 5). Only 10 egg bearing females were found in the collected material and their parameters are shown in Tab. I. The females were large (medium 27 mm) and carried not more than 39 eggs (21 in average). Eggs were large, 0.88 (0.80 – 0.96 mm) in diameter.

4. DISCUSSION

The depth distribution and environmental preferences of *Mysis oculata* in Hornsund fit into a typical range of these parameters for this species observed in Greenland, Northern Canada and Barents Sea (Sivertsen 1935, Just 1970, Jasnov 1948, Kusnetsov 1964).

Shoaling behaviour and depth separation of size groups are common among the majority of mysids in coastal North Atlantic waters (Mauchline 1971). Both of these factors create serious difficulties for the calculations of

Table II. Compared growth rates of two closely related *Mysis* species: *Mysis oculata* var. *relicta* (from temperate Stony Lake and from Arctic Char Lake – data from Lesenby, Langford, 1972) and *Mysis oculata* from Hornsund (the authors' materials)

Year	Month	Length (L) and percent part of final length (%)					
		Stony Lake		Char Lake		Hornsund	
		L	%	L	%	L	%
1st year	May	5.5	32	3.5	30	6	20
	September	12	70	6	52	16	53
	December	14	82	7.5	65	18	60
2nd year	May	15	88	8	70	20	66
	September	17	100	11	96	24	80
	December	—	—	11.5	100	27	90
3rd year	May	—	—	11.5	100	28	93
	September	—	—	—	—	30	100

density. Swarms of juvenile individuals with an approximate density of several thousand individuals per m^2 were frequently observed in Hornsund coastal waters, whereas in most places only single specimens were found.

Although calculated from a small number of specimens, the breeding parameters of *Mysis oculata* from Hornsund differ significantly from the data on *Mysis oculata*. var. *relicta* (*Mysis relicta*) given by Lasenby and Langford (1972). As compared to the population from Arctic lakes (Lasenby, Langford 1972), large females carrying relatively low number of large eggs are characteristic for the Hornsund population of *Mysis oculata*.

When the present data are compared with those for *Mysis oculata* populations from temperate and Arctic lakes (Lasenby, Langford 1972), a clear tendency is shown to increase life span and body length towards Arctic and marine environments (Tab. II).

At Fig. 6, constructed from the data presented in Tab. II, slow growth and growth stagnation in winter months are shown for Arctic populations. In a similar period of time, marine *Mysis* in Hornsund grow nearly three times as large as those in an Arctic freshwater population. Eggs large and yolky but relatively few, along with slow growth indicate the K-strategy, common among cold water invertebrate animals.

The size of adult females and egg diameter found for the Hornsund *Mysis oculata* population belong to the largest reported in literature for epipelagic mysid species (Mauchline 1973).

The reproductive effort (expressed as percent part of brood volume in body volume) calculated for most North Atlantic mysid species by Mauchline (1973) was about 10%. The 6-10.4% resulting from the present study falls within the range of other species' reproductive effort. This would support the supposition by Lasenby and Langford (1972), that *Mysis oculata* use the same amount of energy for their development, regardless the geographic

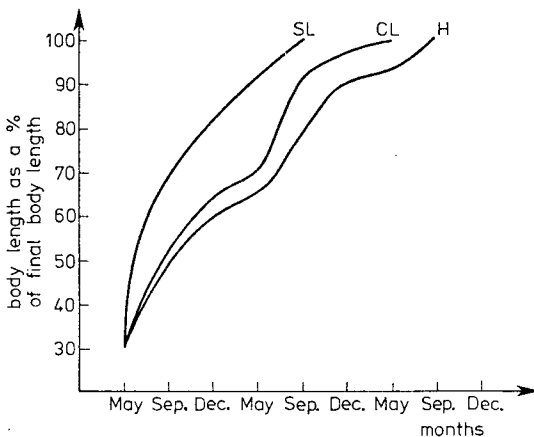


Fig. 6. Compared growth rates of mysids from Stony Lake (SL), Char Lake (CL) — data from Lasenby and Langford (1972) and from Hornsund fjord (H) (the author's data). Decreased growth rate in winter is visible for both Arctic populations (CL and H)

position. Life history with a cycle of 2.5 years was found for Arctic populations of *Mysis relicta* (Lasenby, Langford 1972) and *M. polaris* (Holmquist 1959b, Kulikov 1980) and it is considered to be typical for Arctic marine crustaceans.

Most of the known life histories of Arctic marine animals represent the K-reproductive strategy (sensu Pianka 1970), as do *Mysis oculata* with their long life span, slow growth and large yolky eggs. Such strategy is favourable in a stable and predictable environment. Hornsund, an Arctic fjord with low, nearly constant temperature throughout the year (Węśławski et al. 1988) is a good example of such environment.

5. SUMMARY

A littoral mysid species, *Mysis oculata* is common in coastal waters around Spitsbergen. It is an important factor in the food of fish, birds and seals in the studied region. The main part of the population inhabiting the Hornsund fjord occurs at the depth of 2-15 m among algae in the range of temperature from 0.5 to 4°C and salinity 10 to 35‰. Females lay their eggs in autumn, in September and October. Incubation lasts till April-May, when 3.5 mm long juveniles hatch. The length of *Mysis oculata* life cycle is about 2.5 years; with a single period of reproduction at the end of the second year of life. A characteristic feature of the reproduction of *Mysis oculata* in Hornsund is that relatively small numbers of eggs with a large diameter are laid, what indicates the K-reproductive strategy, characteristic for many polar populations.

6. STRESZCZENIE

Litoralny gatunek szczeponoga (*Mysis oculata*) występuje pospolicie w wodach przybrzeżnych Spitsbergenu. Jest ważnym składnikiem pokarmu ryb, ptaków i fok w badanym rejonie. Główna część populacji bytującej w fjordzie Hornsund występuje latem na głębokości 2-15 m wśród roślinności podwodnej w temperaturze 0,5-4°C i zasoleniu 10-35‰. Samice składają jaja jesienią, we wrześniu-październiku. Inkubacja trwa do kwietnia-maja, kiedy to wylęgają się młode o długości 3,5 mm. Cykl życiowy *M. oculata* wynosi w Hornsundzie 2,5 roku, z pojedynczym rozrodem pod koniec drugiego roku życia. Charakterystyczną cechą rozrodu *M. oculata* w Hornsundzie jest składanie stosunkowo niewielkiej liczby jaj o dużej średnicy, co świadczy o selekcji rozrodczej typu K, charakterystycznej dla wielu polarnych populacji.

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