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**MARENZELLERIA VIRIDIS (VERRILL, 1873) (POLYCHAETA: SPIONIDAE) – A
NEW COMPONENT OF SHALLOW WATER BENTHIC COMMUNITY
IN THE SOUTHERN BALTIC**

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The presence of a North American spionid polychaete, *Marenzelleria viridis* (Verrill, 1873) was revealed along Wolin Island shores (Pomeranian Bay) in 1988. The highest density (506 ind./m²), recorded in muddy sediments off the River Świna mouth, even exceeded that of *Nereis diversicolor*. *Marenzelleria viridis* was also abundant (more than 200 ind./m²) off Międzyzdroje and east of the River Dziwna mouth. The distribution of this mesohaline species points to its preference for finer sediments (muddy sand and mud). The worm has been reported from the North Sea estuaries since 1983. As there was no *M. viridis* in the Pomeranian Bay in 1984 in contrast to its quite wide distribution in 1988, it is suggested that the polychaete was introduced into Polish waters in 1985 or 1986. Its presence in the vicinity of large North Sea and Baltic harbours seems to indicate man mediated dispersal of the species in European waters.

INTRODUCTION

Marenzelleria viridis (Verrill, 1873), known previously as *Scolecoplepides viridis* (Verrill, 1873) (Maciolek, 1984), is a common estuarine polychaete inhabiting Atlantic coast of North America from Newfoundland (Canada) to Georgia (USA) Dörjes and Howard 1975 in Essink and Kleef 1988; George 1966). It is there most abundant in intertidal sands in those portions of estuaries which show reduced salinities (Dauer et al. 1981; George 1966). Found in the Ems Estuary in 1983 (Essink and Kleef 1988) and in the Tay Estuary in 1984 (Atkins et al. 1987), this polychaete became subsequently common on intertidal flats of the North Sea estuaries (Essink and Kleef 1988) (Fig. 1).

In the Baltic, the species was found first in the Darss-Zingst estuary (G.D.R.) in 1985 (Bick and Burckhardt 1989). Few specimens were recently found also in the

Fig. 1. Distribution of *Marenzelleria viridis* in the North Sea estuaries and in the Baltic. Numbers represent following estuaries: 1 – Tay; 2 – Forth; 3 – Humber; 4 – Ems; 5 – Weser; 6 – Elbe; 7 – Wismar Bay; 8 – Darss-Zingst; 9 – Greifswalder Bodden; 10 – Pomeranian Bay

Greifswalder Bodden (A. Bick pers. comm.) and in the Wismar Bay (R. Burckhardt pers. comm.) (Fig. 1).

In 1988, the presence of *Marenzelleria viridis* was revealed in Polish inshore waters (Fig. 1 and 2), by now the easternmost locality of the species.

This paper discusses distribution of *Marenzelleria viridis*, a spionid polychaete new in the Baltic Sea, along the Wolin Island (Pomeranian Bay) against the background of some of its ecological requirements.

MATERIALS AND METHODS

Four transects (SW-W, SW-E, LU and MZ) located between Świnoujście and Międzyzdroje and 5 transects (SK, KI, ST, DZ-W and DZ-E) between Święta Kępa and Dziwnów (western part of the Polish Baltic coast) (Fig. 2) were sampled on 6 and 9 September 1988 respectively. Sampling sites were located 0.5, 1 and 1.5 nautical miles offshore at each transect. The samples were taken with a Petersen grab and sieved through a 0.5 mm screen, the retained material being preserved in 10% formalin. The fauna was hand-sorted in the laboratory. Specimens were counted under a stereo-microscope; the bundance data are expressed as individuals/m².

Fig. 2. General location of sampling sites in the Pomeranian Bay

AREA OF STUDY

Inshore waters along the Uznam (Usedom) and Wolin Islands belong to the most freshened part of the Pomeranian Bay, showing the largest variations in many parameters of the physical-chemical regime. This is an effect of the mixing of fresh (entering from the Szczecin Lagoon) and brackish Baltic waters (Majewski 1972; Wiktorowie 1964). The Pomeranian Bay is shallow here (no more than 15 m deep) which enhances thorough mixing of the water column.

The bottom water salinity is 7–8 ‰, but in spring, especially off the river mouths, it decreases below 7 ‰ (Majewski 1972). Bottom sediments consist mostly of mud and sandy mud in the western part and sand in the eastern part of the investigated area. Muddy sediments occur off the river Świna mouth (Gruszka unpubl. data).

Fig. 3. Distribution of *Marenzelleria viridis* in the Pomeranian Bay in September 1988

RESULTS

George (1966) described the worm as *Scolecoplepides viridis* (Varrill). Macialek (1984) transferred the species to *Marenzelleria* giving a detailed description of the polychaete. Specimens found in the Tay Estuary (Scotland) and identified as *Marenzelleria viridis* were described by Atkins et al. (1987).

In the present study, specimens of a polychaete identified as *M. viridis* were found throughout the whole investigated area (Fig. 3) except for two sites with *Mytilus edulis* concentrations (SK, 0.5 mile and DZ-W, 1 mile) and one of the coarse sand sites (DZ-W, 1.5 mile). The highest density (506 ind./m²) was recorder off river Świna mouth (SW-W, 1 mile) in mud. The species was also abundant (>200 /m²) at sites on the LU transect (1 and 1.5 mile), at MZ, 1 mile; SK, 1.5 mile and DZ-E, 1 mile (Fig. 2 and 3).

Densities of *M. viridis* were found to increase about 1 mile off shore (Fig. 4) and decreased farther off.

At SW-W stations, the recorded densities of *M. viridis* exceeded even those of *Nereis diversicolor* (Fig. 5).

Fig. 4. Mean densities (standard error of the mean) of *Marenzelleria viridis* in relation to the distance off the Wolin Island shore in September 1988

Fig. 5. Densities of *Marenzelleria viridis* and *Nereis diversicolor* as percentage of total polychaete densities at transects where *M. viridis* per cent contribution is particularly high

DISCUSSION

The distribution of *Marenzelleria viridis* along the Wolin Island (Fig. 3) points to its preference for finer sediments (mud and muddy sand). In the eastern part of the investigated area where sands dominate, densities were lower and in coarse sand the worm was even absent.

M. viridis (referred to as *Scolecopides viridis*) from North American estuaries was reported to be most abundant in sands (Dauer et al. 1981; George 1966). *Marenzelleria* from the Tay Estuary intertidal flat turned out to prefer coarser sediments with low organic content, too (Atkins et al. 1987). However, the population from intertidal mud-sand at Lawrencetown, Nova Scotia, showed aggregation which could not be correlated neither with particle size of the substratum nor with its organic content (George 1966).

According to Remane (1971), the substratum tolerance and reduced competition enable many sand dwelling species to change to soft substrata on transition from sea to brackish water.

In the Pomeranian Bay, the highest concentration of the polychaete was found in mud off the River Świna mouth (Fig. 3), the concentrations consisting of younger specimens mostly. In the Ems Estuary top densities were found also in muddy sediments and, similarly, juveniles played a major role, adults being numerous in fine sandy sediments (Essink and Kleef 1988). On the other hand, studies on the vertical distribu-

tion of the *Marenzelleria* population by Atkins et al. (1987) showed that great numbers of adults could be found deeper than 20 cm in the sediment, i.e. beyond the reach of a grab sampler. The worms were observed to inhabit vertical, mucus-lined burrows up to 30 cm deep (Dauer et al. 1981; Essink and Kleef 1988; George 1966).

M. viridis can utilize particles both from the water column and the sediment surface, and it is classified along with some other spionids by Dauer et al. (1981) as an "interface feeding" microphagous (handling food particles in bulk) polychaete. Essink and Kleef (1988) observed sediment feeding behaviour also below the sediment surface.

Low densities at 0.5 mile sites in relation to 1 mile sites (Fig. 4) seem to indicate also the combined influence of pollution (caused by the rivers) and dynamic conditions (currents and wave action) on the pattern of distribution of the worm. Increase in density at 1 mile sites and decrease farther off (particularly clearly visible off the river mouths) seem to be an effect of lower influence of pollution and dynamic conditions while trophic conditions for "interface feeders" (suspended organic matter discharged by the rivers) still remain very good. Especially off the River Dziwna mouth, where the bottom is sandy, such an increase can hardly be related to the type of sediment.

Off the Świna mouth, densities of *M. viridis* were higher than those of *Nereis diversicolor* (Fig. 5), hitherto most common polychaete there (Gruszka unpubl. data). At SW-W, 1 mile site, for example, density of *M. diversicolor* dropped from 1106 ind./m² in 1984 to 437 ind./m² in 1988 while density of *M. viridis* increased from 0 to 506 ind./m². The decrease in *M. diversicolor* density may be the result of competitive interaction between these two polychaete species, as suggested by Essink and Kleef (1988).

However, correlation data from the Tay Estuary suggest that *Marenzelleria viridis* is separated from the rest of the community there by either or both its ecological requirements and its interspecific interactions. In the opinion of Atkins et al. (1987) it is the evidence of *M. viridis* having been introduced to the area.

The Ems (in 1983) and the Tay (in 1984) estuaries are considered by Essink and Kleef (1988) as being two independent sites of introduction of *M. viridis* to the North Sea. From there, water circulation could have dispersed the species towards other estuaries.

In the Baltic area, the species was first recorded from the Darss-Zingst estuary in 1985 (Bick and Burckhardt 1989).

As no *M. viridis* was found in the River Świna mouth area in September 1984 (Gruszka unpubl. data), in contrast to the polychaete's quite wide distribution in 1988, it is then inferred that the species was introduced into Polish waters in 1985 or 1986 at the latest. A polychaetous worm found in the northern part of the Szczecin Lagoon in June 1986 (J. Maślowski pers. comm.) turned out to be *M. viridis*. Had it been introduced later on (say, in 1987), the species would not have been able to succeed to colonize such a vast area of the Pomeranian Bay, as its entirely planktonic larval development takes 4 to approximately 8 weeks (Atkins et al. 1987; George 1966).

The presence of the polychaete in the vicinity of large North Sea and Baltic harbours seems to indicate man mediated dispersal of *M. viridis* in Europe. Transportation in the ballast is the most probable explanation (Atkins et al. 1987; Essink and Kleef 1988), all the more so as the larval development is planktonic and juveniles and adults are reported to be active nocturnal swimmers (Dauer et al. 1980).

By now it is not known how far offshore and eastwards in the Polish waters the polychaete has been dispersed. Organism capable of "interface feeding" should be widely distributed here because of their ability to utilize a wide variety of food resources (Dauer et al. 1981).

Salinity should not be a limiting factor for *Marenzelleria viridis* in the Baltic Proper. In the North American estuaries, the worm often experiences considerable changes in salinity (1–32 ‰) during a tidal cycle (George 1966), but subtidally it is abundant in regions of estuaries with lower salinities (Dauer et al. 1981), e.g. in the upper Delaware Bay, where *M. viridis* dominates, the salinity range is 5–15 ‰ (Kinner and Maurer 1978). In the North Sea estuaries, the polychaete was found between a. 4 and 23 ‰ (Atkins et al. 1987; Essink and Kleef 1988). Relatively low salinities (between 0.3 and 9 ‰) are recorded from the Darss-Zingst estuary where it has been numerous since 1987 (Bick and Buckhardt 1989).

Reproduction and cleavage are not possible below 5 ‰, but 3-setiger larvae are able to live at a salinity of 2.5 ‰ and adults can tolerate salinity of 0.5 ‰ for a long time (George 1966). Swimming activity of adults and post-metamorphic juveniles (Dauer et al. 1980) as well as extended planktonic phase seem to explain why *M. viridis* manages to maintain populations in areas below 5 ‰.

In the Pomeranian Bay, *M. viridis* encounters salinities of about 7 ‰ (cf. Majewski 1972), thus similar to those in other regions of the Baltic Proper.

In the Bay, it was found at greater depths (down to 12 m) than in the North Sea where only a few records from the subtidal of the Ems Estuary exist (Essink and Kleef 1988). Along the east coast of North America the worm is most common intertidally, but occurs down to 38 m (Dauer et al. 1981; George 1966; Kinner and Maurer 1978; Maciolek 1984).

Thus, it seems probable that *M. viridis* has not been only capable of colonizing the inshore areas but, like other eulittoral brackish water species having their sole or main centre of development in tidal areas (Remane 1971), will also penetrate to greater depths in the Baltic provided oxygen conditions are suitable.

CONCLUSIONS

It is obvious that *Marenzelleria viridis* has succeeded in establishing populations in Baltic waters as it did in NW European estuaries.

Its larval development is entirely planktonic, so one should expect to find *M. viridis* farther on along the Polish coast (following the net water current) and in the vicinity of Baltic harbours, as being carried with ship's ballast waters is the most probable explanation of the appearance and successful dispersal of the species in European waters.

Extensive areas of soft bottom in deeper zones of the Baltic Sea provide favourable conditions for the polychaete and are also expected to be colonized by the polychaete unless low oxygen concentrations prevent that.

ACKNOWLEDGEMENTS

I would like to thank Dr T. Radziejewska for criticisms and discussion of the manuscript. I also thank Ms. D. Anioł (Students Oceanographic Research Society) for help in the collection and counting of specimens and Ms. J. Gruszka for preparing the figures.

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