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Research Article

DISTRIBUTION AND ABUNDANCE OF *MARENZELLERIA NEGLECTA* (SIKORSKI AND BICK 2004) (POLYCHAETA, SPIONIDAE) IN THE KALININGRAD ZONE OF THE BALTIC SEA IN SEPTEMBER 2001 AND 2002

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Abstract

The results of investigations on the abundance and distribution of the polychaete *Marenzelleria neglecta* in the Kaliningrad zone of the Baltic Sea are presented. The research is based on data from benthic surveys conducted in September 2001 and 2002. The size structure was only analyzed in 2001. This alien species has become a common member of the benthos communities in suitable bottom types in Kaliningrad waters since 2001. The abundance and biomass of *M. neglecta* settlements fluctuated in 2001 from 4 to 354 ind.$\cdot$m^{-2} and 0.01 to 2.1 g$\cdot$m^{-2};

these ranges for 2002 were 10-14760 ind.$\cdot$m^{-2} and 0.01-17.3 g$\cdot$m^{-2}, respectively. The mass development of *M. neglecta* in 2002 was observed on sandy bottoms at depths less than 40 m in the community dominated by *Macoma balthica*. Juvenile specimens comprised 91% of the total abundance of worms, and the intermediate group – 9%; no adult specimens were noted. Thus, the current abundance and biomass data for these worms are the minimal estimated values for the 0-12 cm sediment layers only, and are not representative of the whole population. It is significant that the present values are mainly estimations of juveniles, *i.e.*, the segment that is recruited to the population.

INTRODUCTION

In less than a decade, the North American polychaete *Marenzelleria neglecta* (Sikorski and Bick 2004) has invaded macrozoobenthic communities in almost all the waters of the Baltic Sea. It was recorded for the first time on the German coast in 1985 (Bick and Burckhardt 1989), and in 1990 it was found in the coastal waters of Sweden and Finland (Persson 1990, Stigzelius *et al.* 1997).

M. neglecta was noted for the first time in Polish waters adjacent to Kaliningrad in 1985-1986 (Gruszka 1991, Maslowski 1992), and it reached Lithuanian waters in 1988-1989 (Olenin and Chubarova 1994). By 1990 it was noted near the port of Baltiysk in the Kaliningrad Region (Olenin pers. com.). Macrozoobenthic investigations in the Kaliningrad were not conducted regularly, and the species might have appeared there in 1987-1988. This species is currently widely distributed on the Sambia-Curonian plateau (Rudinskaya 2002).

The spatial distribution and preferred bottom types of *M. neglecta* have not yet been described in the Kaliningrad zone of the Baltic Sea. The aim of the present work was to study the abundance and distribution of *M. neglecta* in the Kaliningrad zone of the Baltic in September 2001 and 2002 and its size structure in 2001.

MATERIALS AND METHODS

The research area is located in the southeastern part of the Baltic Sea and encompasses the eastern part of the Gulf of Gdansk and the Sambia-Curonian plateau (Fig. 1).

The study material was collected at 46 stations on 1-5 September 2001 (Fig. 2) and at 52 stations on 9-14 September 2002 (Fig. 3) at depths from 9 to 111 m. Three replicate samples were taken at each station with a 0.1 m^2 van Veen grab. The maximum penetration depth into the sediments was 8-12 cm. All samples were rinsed through a 0.5 mm mesh sieve and preserved with 4% formalin neutralized with $NaHCO_3$. The samples were processed in a laboratory with a binocular microscope (magnification x8). The values of abundance and biomass (wet weight) were calculated as mean (M) ± standard error (SE) per square meter. The Statistica 6.0 software package was used to process the data with 1-way ANOVA. Density isolines were calculated with natural neighbors using the Surfer 8.0 software package. The bottom substrate type was defined visually during sample processing. General information on the distribution of bottom types in the investigated area (Emelyanov 2002) was taken into account.

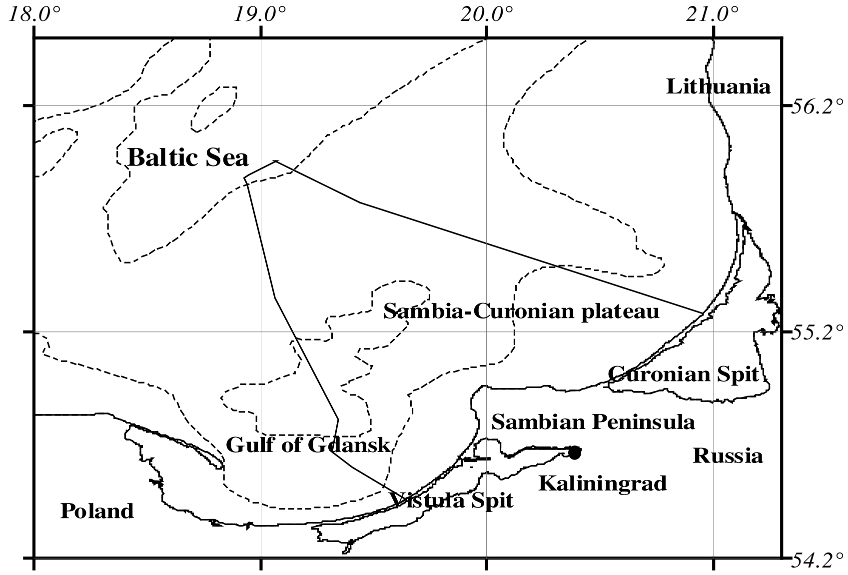

Fig. 1. Area of investigation.

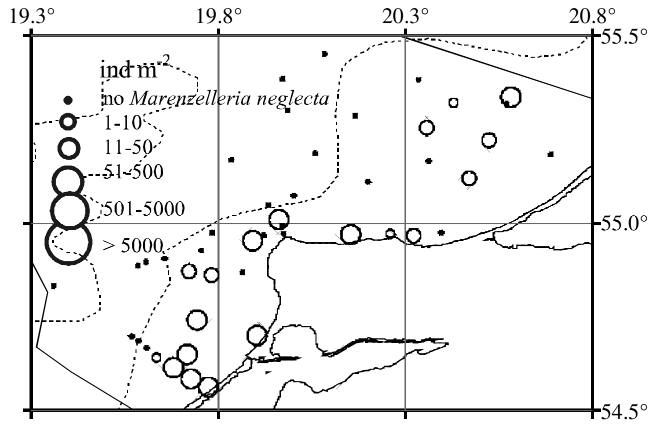

Fig. 2. Spatial distribution of *Marenzelleria neglecta* abundance (ind.$\cdot$m^{-2}) in the Kaliningrad zone of the Baltic Sea in September 2001.

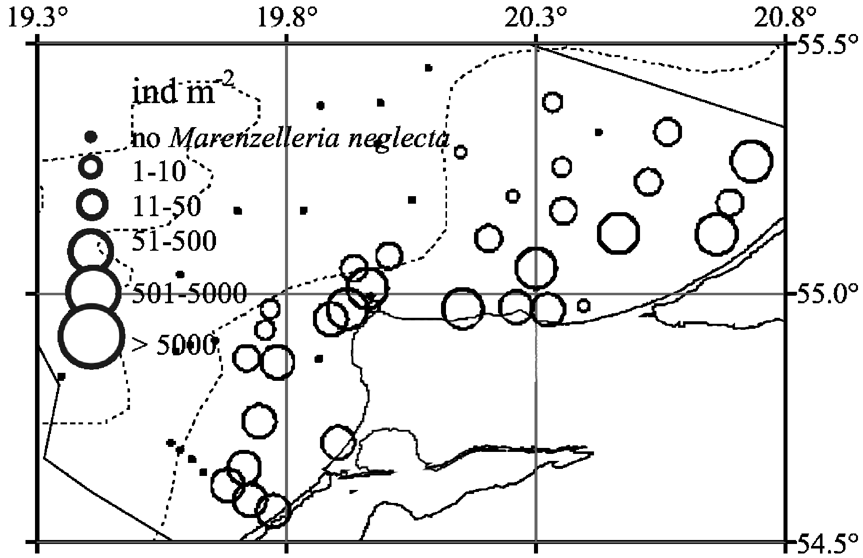

Fig. 3. Spatial distribution of *Marenzelleria neglecta* abundance (ind.$\cdot$m^{-2}) in the Kaliningrad zone of the Baltic Sea in September 2002.

The standard (see Atkins *et al.* 1987) maximum width between the fifth and tenth segments of all the *M. neglecta* specimens was only measured in 2001. Since many of the worms were fragmented during sample rinsing, the lengths and number of segments were restored using regression formulas by Zettler (1997). Specimens with fewer than 70 segments were classified as juvenile; those with 70 to 150 segments were classified as intermediate, and those with more than 150 segments were classified as adult (Zettler 1996). The abundance of *M. neglecta* settlements was classified after Zettler *et al.* (2002) as follows: high - above 5000 ind.$\cdot$m^{-2}; middle - 500-5000 ind.$\cdot$m^{-2}; low - less than 500 ind.$\cdot$m^{-2}.

In the week prior to the benthic surveys, in both 2001 and 2002 hydrological investigations of the same area were conducted. Salinity, temperature, and dissolved oxygen in the near-bottom water layer were determined at the same stations.

RESULTS

Marenzelleria neglecta was noted at 19 of 46 stations in 2001 and at 33 of 52 stations in 2002 at depths from 9 to 60 m (Table 1, 2). The species occurred within the following parameter ranges: water salinity - 6.5-8.5‰, temperature - 3.5-18.5°C; oxygen content above 3 mg/l.

Table 1

Bathymetric distribution of *Marenzelleria neglecta* on different bottom types in the Kaliningrad zone of the Baltic Sea in September 2001 (M ± SE).

Depth [m]	Bottom type					
	Number density, ind.·m^{-2} (P<0.001)			Biomass density, g·m^{-2} (P<0.001)		
	coarse sand	fine sand	coarse silt	coarse sand	fine sand	coarse silt
9-20	73±25	94±40	–	0.32±0.13	0.55±0.25	–
21-30	49±16	233±36	–	0.08±0.03	0.99±0.22	–
31-40	20±9	45±8	–	0.04±0.03	0.07±0.01	–
41-50	88±76	254±129	–	0.03±0.01	0.67±0.54	–
51-60	–	–	14±8	–	–	0.01±0.007

Table 2

Bathymetric distribution of *Marenzelleria neglecta* on different bottom types in the Kaliningrad zone of the Baltic Sea in September 2002 (M ± SE).

Depth [m]	Bottom type					
	Number density, ind.·m^{-2} (P<0.001)			Biomass density, g·m^{-2} (P<0.001)		
	coarse sand	fine sand	coarse silt	coarse sand	fine sand	coarse silt
9-20	1678±581	1700±207	–	2.48±0.8	2.43±0.44	–
21-30	4381±2645	6019±765	–	2.46±1.41	3.17±0.39	–
31-40	314±164	5440±511	–	0.18±0.09	7.28±1.09	–
41-50	24±15	184±86	484±212	0.01±0.003	0.09±0.04	0.19±0.06
51-60	10±1	67±27	338±95	0.01±0.001	0.03±0.01	0.2±0.05

The abundance of *M. neglecta* was low in 2001 (Fig. 2). The highest abundance of *M. neglecta* (> 200 ind.·m^{-2}) was found on the fine sand near Cape Taran at depths of 28-30 m and near the port of Baltiysk at a depth of 41 m.

The largest number of specimens and the highest biomass of *M. neglecta* were noted at depths of 21-30 and 41-50 m on fine sand (Table 1). The minimal values were noted at depths of 51-60 m on coarse silt. The correlations between abundance and biomass values and depth and bottom type were statistically significant (P < 0.001). The relative values varied from 0.3 to 6.1% of the total abundance of zoobenthic organisms and from 0.01 to 1.1 % of the total zoobenthic biomass.

This polychaete was recorded in benthos communities dominated by both *Macoma balthica* and *Mytilus edulis* (Gusev and Starikova 2003, Gusev and Urbanovich 2004, Gusev, 2004). In the *M. balthica* community, the worm abundance and biomass comprised 1.2% and 0.2% of the total abundance and biomass of macrozoobenthos. In the *M. edulis* community, these values were lower at 0.2% and 0.01%, accordingly.

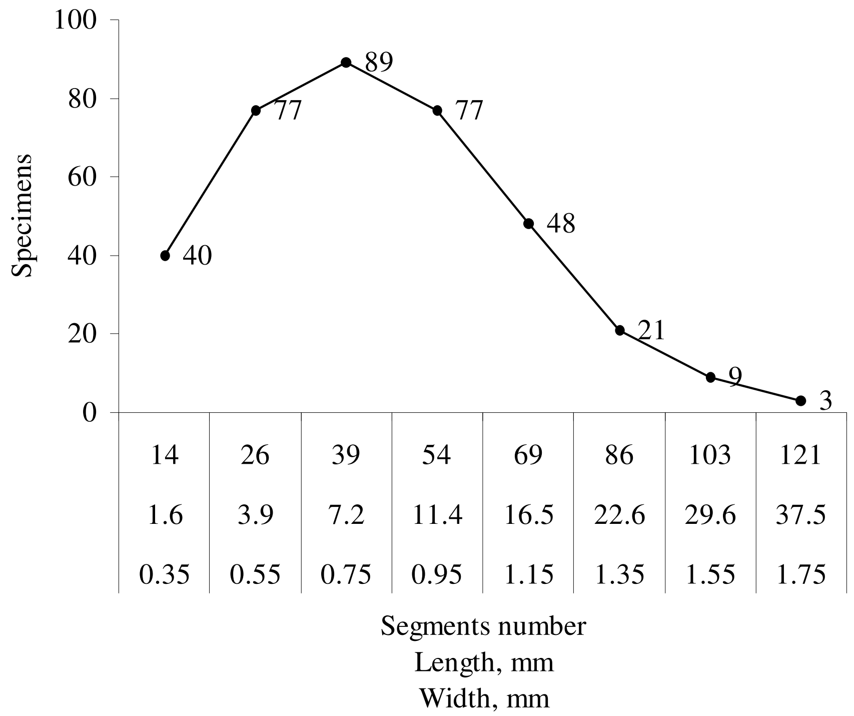

Fig. 4. Size structure of *Marenzelleria neglecta* in the Kaliningrad zone of the Baltic Sea in September 2001.

In 2001, the length of the studied worms varied from 1.2 to 39.6 mm, and the number of segments ranged from 12 to 126. The modal sizes and the number of segments were 7.2 mm and 39 mm (Fig. 4). Juvenile specimens comprised 91% of the total number of worms and the intermediate group – 9 %; adult specimens were not found.

In 2002, high abundance was noted at five small sections in the northern part of the Kaliningrad Region (Fig. 3) at depths from 17-39 m. Average abundance was observed at depths of up to 40 m and low abundance at depths of 41-60 m.

Correlations between abundance and biomass values and depth and bottom types were statistically significant (P <0.001) (Table 2). The abundance of *M. neglecta* was more than 50% of the total abundance of bottom fauna at depths of 21-30 on coarse sand and at depths of 21-40 m on fine sand. This fluctuated from 25 to 50% at depths of 9-20 m on coarse and fine sands. The species comprised less than 25% at depths of 41-60 m on all bottom types and at 31-40 m on coarse sand. Its relative biomass varied from 0.01 to 4.9 % of the total macrozoobenthos biomass.

M. neglecta dominated in the *M. balthica* community averaging up to 42% of the total abundance (authors' own data). The biomass of the species was 1.5% in this community, while in that of *M. edulis*, the abundance and biomass of these worms was lower at 3 and 0.1% of the total macrozoobenthos abundance and biomass values.

DISCUSSION

The number of stations at which *M. neglecta* was observed was higher in 2002 than in 2001. An overall increase in abundance and biomass was recorded except at depths of 41-50 m on coarse and fine sands. Abundance increased mostly in the coastal part of the investigated area at depths to 40 m. High and middle abundances (Zettler *et al*. 2002) were characteristic for this species here.

In the Baltic Sea, the maximal worm size was 120 mm and 250 segments, which corresponds to a life span of three years (Zettler 1997). This species has been recorded at depths to 65 m (Olenin and Chubarova 1994, Norkko *et al*. 1995, Zmudzinski *et al*. 1997). In the current study area, they were noted at depths to 60 m. In 2001, the abundance and biomass of *M. neglecta* fluctuated from 4 to 354 ind.$\cdot$m^{-2} and from 0.01 to 2.1 g$\cdot$m^{-2}. In 2002, these values were 10-14760 ind.$\cdot$m^{-2} and 0.01-17.3 g$\cdot$m^{-2}. According to the classification by Zettler *et al*. (2002), *M. neglecta* abundance in the Kaliningrad zone in September 2001 was low, but suddenly in 2002 high and middle level abundances were observed at depths of less than 40 m, while low abundance was recorded at depths of 41-60 m. These values are typical in the areas adjacent to Lithuania and Poland (Olenin and Chubarova 1994, Daunys *et al*. 2000, Warzocha *et al*. 2004). In the coastal waters of Lithuania *M. neglecta* abundance was about 1000 ind.$\cdot$m^{-2} at depths to 20 m, while in the deepest waters it was about 250 ind.$\cdot$m^{-2} (Olenin and Chubarova 1994, Daunys *et al*. 2000). In Polish coastal waters the highest abundances (2000-3000 ind.$\cdot$m^{-2}) were noted in the Gulf of Gdansk and the

Pomeranian Bay, whereas the lowest were noted in the central region of Polish coastal waters (Warzocha *et al*. 2004).

This species prefers the soft sediments of silt and sand. Of the total number of specimens in the study material, 91% were juveniles, 9% - intermediates, and no adults were noted. This corresponds with data in the literature that indicate that larger worms burrow deeper into the bottom than 10 cm. The most preferred bottom type for worms is sediment with an average particle size of 0.29 mm where they can penetrate to maximal depths of about 35 cm (Zettler *et al*. 1994). Up to 45% of the total worm abundance occurred at depths of 25 cm or less. On softer or harder bottom types, the maximal abundance and biomass shifted to depths of 5-20 cm. Immediately following sedimentation, juvenile worms inhabit the 0-10 cm bottom layer (Zettler *et al*. 1994, 1995).

Since the van Veen grab penetrated the bottom layer to 8-12 cm, the main part of the adult and intermediate worm populations were probably not sampled. Thus, the current data describe the quantitative distribution of the abundance and biomass of *M. neglecta* in the sediment layers up to 8-12 cm. This is confirmed by comparing samples taken with the van Veen grab and the box corer, which can penetrate 15-25 cm into bottom sediments with sample area of 0.0225 m^2. The average densities of *M. neglecta* were approximately 50% lower in the former samples than in the latter (Powilleit *et al*. 1995). Thus, the current abundance and biomass data for these worms are the minimal estimated values for the 0-12 cm sediment layers only, and are not representative of the whole population. It is significant that the present values are mainly estimations of juveniles, *i.e.*, the segment that is recruited to the population.

The current data indicate that by 2001 this alien species had become a common member of benthos communities with suitable bottom types. The mass development of *M. neglecta* in 2002 was observed on sandy bottoms at depths of less than 40 m in communities dominated by *Macoma balthica*.

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