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CHARACTERISTICS OF THE BRISTLEWORM (*PYGOSPIO ELEGANS* CLAPAREDE) (SPIONIDAE) AND ITS ROLE IN THE POLISH COASTAL ZONE OF THE BALTIC SEA

Zbigniew Piesik†, Krystian Obolewski, Jacek Wolikowski

Department of Waters Ecology, Pomeranian Academy,
ul. Arciszewskiego 22b, 76-200 Słupsk, Poland
e-mail: obolewsk@apsl.edu.pl

Abstract

Quantitative aspects of the spionid polychaete *Pygospio elegans* population in the Polish coastal zone of the Baltic Sea, in estuarine areas of Pomeranian river mouths were investigated. The frequency of occurrence (F) of *P. elegans* in the Polish coastal zone averaged 54% (permanent species) and ranged from 20 to 80%. The polychaete abundance along the Central Pomeranian coast peaked at 1 837 ind. m^{-2}, the mean abundance being 175.7 ind. m^{-2}. The density of the spionid worm in the Middle Pomerania was low and rarely exceeded 1 000 ind. m^{-2}. The mean wet weight biomass of *P. elegans* in different areas was low (max. 0.29 g_{ww} m^{-2}). The abundance of *P. elegans* in the river mouth areas (estuaries) was basically higher west of the mouth, in areas less exposed to polluted and freshened riverine water; water in those areas, however, carried lower bioseston loads, which affected trophic conditions.

Key words: coastal zone, Baltic Sea, *Pygospio elegans*

INTRODUCTION

Pygospio elegans is the most common polychaete in the shallow areas of the Baltic Sea, frequently dominating in the macrobenthos of sandy and sandy-muddy shores (Żmudziński 1982a). In the Baltic Sea, the polychaete occurs mainly within the depth range of 5-40 m, 80 m being the maximum depth range (Warzocha 1994). The species occurs also in the North Atlantic, off Norwegian, British, and Irish coasts and elsewhere (Avant 2002, Bolam and Fernandes 2002, Oug 2001). *P. elegans* has been reported by a number of authors (Kotwicki 1997, Masłowski 2001, Osowiecki 2000, Warzocha 1994, 1995, Wenne and Wiktor 1982) in the benthos of the southern Baltic, particularly in the Pomeranian Bay and the Gulf of Gdańsk. Characteristics of *P. elegans* population in the Baltic coastal zone, in river mouth areas, can be of interest not only in terms of ecology of this tube-dwelling polychaete, but also because the species regarded as an indicator in relation to eutrophication and pollution of the Baltic Sea (Rumohr et al. 1996, Żmudzinski 1976). Among other phenomena, filamentous algae that form mats on the bottom have been observed in the Baltic, the mats posing a threat to some macrobenthic organisms, including *P. elegans* (Norkko and Bonsdorff 1996).

The aim of the research was to describe the quantity of *P. elegans* population in the 3-nautical mile wide coastal zone of the Baltic Sea on the Polish central coast (from Kołobrzeg to Łeba). Due to a frequent occurrence of *P. elegans* on the shallow Baltic bottom and lower resistance to pollution, it was decided to define an influence of pollution and tributary freshwater of the coastal zone by the rivers on the *P. elegans* population. The quantitative data obtained should make it possible, in the future, to perform comparative analyses of *P. elegans* occurrence relative to effects of eutrophication, pollution, and invasion of alien species, e.g. filamentous brown algae such as Pilayella, Ectocarpus (Pliński and Florczyk 1993) and the polychaete *Marenzelleria viridis* (Gruszka 1991).

MATERIALS AND METHODS

The study was carried out from November 1997 until May 2003 in the Polish coastal zone of the Baltic, off the mouths of the rivers Parsęta (May 2003), Wieprza (November 1997), Słupia (May 2000), Łupawa (November 2001), and Łeba (November 1997) and off Władysławowo (October 1998). Due to high costs of ship charter, the research was carried out in different years and months what enabled to compare some information. In the research period of 1997-2003 the radical changes of a biotic environment were not affirmed in this coastal zone. This might have had an influence on the evolution of *Pygospio*. Despite the fact of the significant changes of density – the reduction of *Pygospio* in principle is noted down in the summer period – June, July, August (Mattila 1997) – the cooler months of the year (May, October, November) were chosen for the investigation, because the temperature of water did not exceed 10°C , and the density of *Pygospio* population was stable.

The samples were collected from 48 sites located on 11 transects laid perpendicularly to the shore (Fig. 1). The investigative profiles were located in the distance of 1 Nm to the East (E) and 1 Nm to the West (W) from the rivers mouths. 3 to 5 positions were in one profile.

Each site yielded 2 subsamples (i.e. contents of two 0.1 m^2 Van Veen grabs), where the material was gained from their sieves and then put into the common sample. The transects were situated 1 nautical mile east or west of the mouths of the rivers mentioned. The site coordinates were determined with GPS and the depth was determined with an echo-sounder mounted on board of a motor boat "Kontroler 25". The grab contents were washed through 0.5 mm mesh size sieve; the sieve residue being preserved in 4% formalin. The sediment type was recorded for each sample (Tab. 1). In the laboratory, the macrobenthos samples were sorted and *P. elegans* individuals picked out and enumerated. Their abundance was determined relative to 1 m^2 of the bottom. The wet weight biomass of *P. elegans* (g_{ww} m^{-2}) was determined by weighing the polychaetes on a laboratory Techniport I 5 scales to 10 mg. The individuals

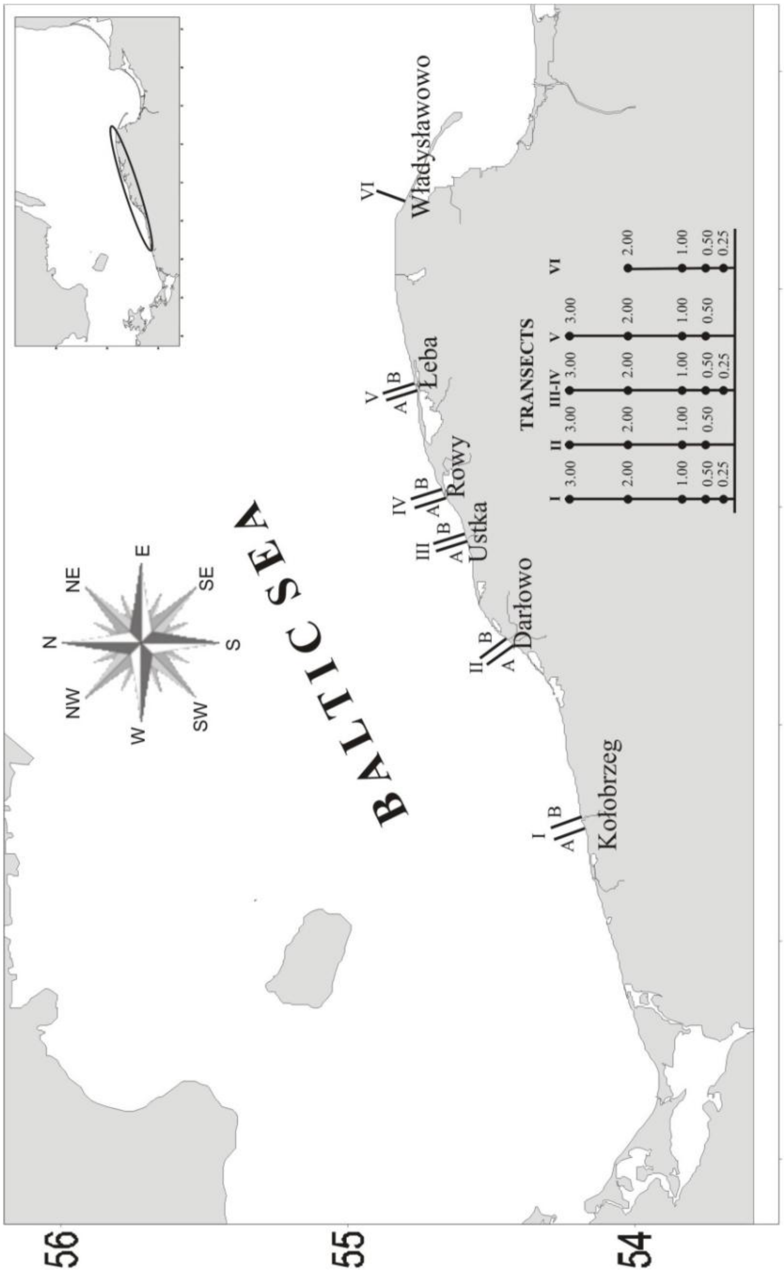

Fig. 1. Localisation of the sampling sites

Table 1

Depth (A) and sediments type (B) at sites sampled in the coastal zone of Middle Pomerania

Locality	Tran:	Nautical miles											
		0.25		0.5		1.0		1.5		2.0		3.0	
		A	B	A	B	A	B	A	B	A	B	A	B
Parsęta estuary Kołobrzeg – West	I W	10.4	fgs	12.1	fgs	12.5	ss	---	---	12.6	gs	13.2	gs
Kołobrzeg – East	I E	7.0	fgs	9.4	fgs	10.3	fgs	---	---	14.4	gs	15.6	gs
Wieprza estuary Darłówko – West	II W	---	---	9.0	fgs	13.5	mgs	---	---	14.7	mgs	19.3	fgs
Darłowo – East	II E	---	---	8.2	fgs	15.0	mgs	---	---	17.0	mgs	19.5	cgs
Słupia estuary Ustka – West	III W	6.5	fgs	11.0	fgs	14.6	gs	---	---	16.5	fgs	18.0	gs
Ustka – East	III E	---	---	6.7	g	12.5	gs	---	---	18.5	gs	20.0	gs
Łupawa estuary Rowy – West	IV W	2.3	fgs	5.7	fgs	16.5	ss	---	---	20.0	gs	22.4	gs
Rowy – East	IV E	2.1	fgs	6.4	fgs	12.7	fgs	---	---	22.4	gs	20.0	gs
Łeba estuary Łeba – West	V E	---	---	5.1	g	14.0	fgs	---	---	17.7	ss	18.2	fgs
Łeba – East	V W	---	---	3.0	fgs	11.2	fgs	---	---	15.0	fgs	---	---
Open coastal Władysławowo	VI	7.2	ss	10.8	g	11.5	ss	IW 12.0, I E 13.0	IW ss, I E ss	15.5	g	---	---

g – gravel, fgs – fine-grained sand, mgs – medium-grained sand, cgs – coarse-grained sand, ss – silty sand, gs – gravelly sand, s – stons to be weighed were released from their tubes and dried on blotting paper. To work out all the collected information of *Pygospio* were used the statistical values as: the mean (x),median (Me), standard deviation (SD), standard error (SE), coefficients variation (CV), coefficients corelation (r) and test Cochran&Cox (C). The frequency of occurrence (F) of *P. elegans* was determined from the formula:

$$F = \frac{n}{N} \cdot 100\%$$

where: n – number of sites inhabited by *P. elegans*, N – number of sites sampled.

The test of Cochran and Cox was used of nock (differences in meaning between two averages for small tests) to show prove significant arithmetic difference densities of the polychaete *Pygospio elegans* C > Cα points out on important arithmetic difference between examinated averages densities.

The test of Cochran and Cox: $C = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{E^2_{\bar{x}_1} + E^2_{\bar{x}_2}}}$ E = Error standard deviation

$$C_\alpha = \frac{E^2_{\bar{x}_1} \cdot t_{1\alpha} + E^2_{\bar{x}_2} \cdot t_{2\alpha}}{E^2_{\bar{x}_1} + E^2_{\bar{x}_2}}$$ α = 0.05 (from distribution t-Student)

RESULTS

Among the polychaetes found in the sediment samples collected in the area of study, relatively high abundances were attained by *Hediste diversicolor* Muller, *Pygospio elegans* Claparede and, sporadically, *Marenzelleria viridis* (Verrill), *Harmothoe sarsi* (Malmgren) supplementing the list in the colder seasons.

The most common seafloor type in the area of study was fine sand (about 44% of the bottom) and gravelly sand (27%), (Tab. 1). Less frequent was silty sand (12%), gravel (8%), and medium-grained sand (8%), coarse sand being encountered sporadically only (2%).

The mean abundance of *P. elegans* was at its highest in medium-grained sand (634.0 ind. m^{-2}; range: 0-1 400 ind. m^{-2}). The lowest mean abundance of the polychaete was recorded in silty sand (353.8 ind. m^{-2}; range: 0-1 710 ind. m^{-2}) and in gravelly sand (219.6 ind. m^{-2}; range: 0-1 837 ind. m^{-2}). The commonest bottom type, i.e. fine sand, supported lower abundances of *P. elegans* (mean of 40.3 ind. m^{-2}; range: 0-490 ind. m^{-2}), gravel being inhabited by *P. elegans* at a mean abundance of 14.8 ind. m^{-2} (0-30 ind. m^{-2}). The few sites with coarse sand-covered bottom lacked *P. elegans* altogether. The frequency of *P. elegans* peaked in gravel sand (77%) and in silty sand (67%). The most common sediment type in the area, i.e. silty sand revealed *P. elegans* frequency as low as 17%, which contributed to the overall low mean abundance, lower than that found in some other Baltic coast sections. The mean and maximum abundance of the polychaete studied increased with depth to show (r = 0.958 – the coefficient of correlation), (Fig. 2).

Frequency (F) of *P. elegans* on individual transects ranged from 20 to 80% (Tab. 2).

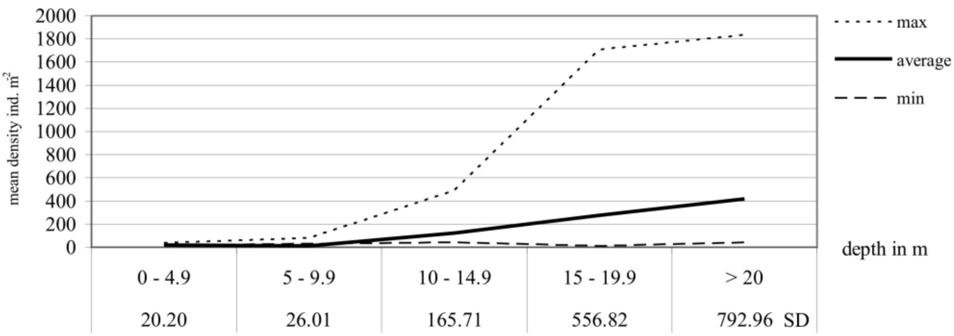

Fig. 2. Relationship between mean abundance and standard deviation (SD) of *P. elegans* and depth in the coastal zone of the southern Baltic under study (Middle Pomerania)

Table 2

Abundance (ind. m^{-2}), wet weight biomass (g_{ww} m^{-2}), standard deviation (SD) and frequency (F in %) of *Pygospio elegans* in the Polish coastal zone of the Baltic Sea (Middle Pomerania) W – transect West, E – transect East

		Density of *Pygospio elegans* in ind. m^{-2}										
		Parsęta Estuary (Kołobrzeg)		Wieprza Estuary (Darłowo)		Słupia Estuary (Ustka)		Łupawa Estuary (Rowy)		Łeba Estuary (Łeba)		Open coastal Władysła-wowo
		I W	I E	II W	II E	IIIW	III E	IV W	IVE	V W	V E	VI
month year		May 2003		November 1997		May 2000		November 2001		November 1997		October 1998
n		10		8		9		10		7		4
Distance [Nm]	0.25	0	0	–	–	0	–	0	15	–	–	30
	0.5	106	0	80	0	15	0	0	0	0	40	44
	1.0	80	0	0	1 136	180	320	0	0	0	490	303
	2.0	0	0	1 400	0	80	225	89	44	1 710	0	30
	3.0	0	26	0	0	10	65	1 837	59	20	–	-
x		37.2	5.2	370.0	284.0	57.0	152.5	385.2	23.6	432.5	176.6	101.5
SD		38.18		585.71		115.85		574.48		637.25		134.32
n_z		3		4		7		5		4		4
x_z		70.6		872.0		127.8		408.8		565.0		101.7
SD_z		33.32		570.30		108.19		714.49		687.25		116.33
CV_z		47.1		65.4		84.6		174.7		121.6		114.3

$\bar{x}$ wet mass	0.18	0.01	0.25	0.19	0.03	0.08	0.03	0.02	0.29	0.12	0.17
max. wet mass	0.70		0.95		0.17		0.12		1.16		0.80
F (%)	40	20	50	25	80	75	40	60	50	76	75

mean abundance (x), standard deviation (SD), number of sites with present species (n_z), excluding places omitted by this species (x_z), standard deviation at the species place of occurrence (SD_z), variability index at the species place of occurrence (CV_z)

Table 3

Comparison of *Pygospio elegans* density: range, mean abundance (x), excluding places omitted by this species (x_z), standard deviation (SD), coefficient of variability (CV) in coastal zone and open coastal zone in region with different level of pollution and urbanization
(W, E) – coastal zone west/east from mouth of a rivers
(SU) – open coastal zone in strongly urbanized region (town, harbour)
(NU) – open coastal zone in not urbanized region (Słowiński National Park), (Piesik 1998)

Type area	Transects West (W)	Transects East (E)	Władysławowo (SU)	Czołpino (NU)
Type coastal	estuary	estuary	open coastal	open coastal
Range abundance (ind. m^{-2})	0-1 837 n = 23	0-1 136 n = 21	30-303 n = 4	0-1 970 n = 5
Abundance min-max (ind. m^{-2})	10-1 837	15-1 136	30-303	240-1 970 n = 4
x – mean abundance (ind. m^{-2})	549.7 n = 23	242.0 n =21	101.7 n = 4	758.0 n = 5
x_z – excluding places omitted by this species (ind. m^{-2})	467.2 n = 12	235.4 n = 10	101.7 n = 4	947.5 n = 4
SD_z	720.49	347.33	134.32	678.35
CV (%)	64.8	67.8	75.7	71.59
x wet mass (g m^{-2})	0.15	0.08	0.17	0.61
Median (Me)	84.5	62.0	37.0	790.0
F (%)	52	47	100	80.0
Cochran and Cox test (C)	transects West – East $C > C_{\&(0.05)} = 9.849 > 2.076$			
			open coastal Władysławowo – Czołpino $C > C_{\&(0.05)} = 3.799 > 2.179$	
	estuary (West + East) – open coastal Władysławowo $C < C_{\&(0.05)} = 0.782 < 2.448$			
	estuary (West – East) – open coastal Czołpino $C > C_{\&(0.05)} = 6.230 > 2.272$			

In the coastal zone off Ustka (the Słupia estuary), *P. elegans* was an absolutely permanent species (F = 77%). On the open coast off Władysławowo (F = 75%) and off Łeba (the Łeba estuary), (F = 63%), the polychaete was a permanent species. Off Rowy (the Łupawa estuary), (F = 50%), off Kołobrzeg (the Parsęta estuary), (F = 30%), and off Darłowo (the Wieprza estuary), (F = 37%), *P. elegans* was an accessory species. Among the entire central Pomeranian coast, *P. elegans* can be regarded as a permanent species (F = 54%).

The density of *P. elegans* in the area of study varied greatly and ranged from 0 to 1 837 ind. m^{-2} (Tab. 2). This fact made difficult to use a method of mathematical statistic. Significant variation of density is confirmed by high value of standard deviation – SD and coefficient variation CV and the difference between an average density and median values. The average density of the species on individual profiles was not high. The highest density was noted down on the profile of V-W, Łeba West. The wide abundance variations contributed to the overall low mean abundance of 175.7 ind. m^{-2}. Among the transects sampled, the highest mean abundance of *P. elegans* (in excess of 400 ind. m^{-2}) was recorded on Transect V-W, i.e. Łeba West (Tab. 2). Transects IV-W (Rowy West) and III-W (Darłowo West) supported mean abundances exceeding 300 ind. m^{-2}. The mean abundance of *P. elegans* on most transects, except those off Ustka, was higher on transects located west of the river mouths (Tab. 2). The average density of *P. elegans* was from 1.3 to 16.3 times higher on the West profile in comparison with the East profile, which were under the huge influence of pollution and eutrophication of the river waters mass moved by the bottom steams toward East. The significance of arithmetical difference between the average density on the West profiles and more polluted East profiles was showed by Cochran and Cox test (Tab. 3). In the estuarine parts of the coastal zone, the highest abundance was recorded off the mouths of the Wieprza (327 ind. m^{-2}) and Łeba (304 ind. m^{-2}), the lowest abundance being characteristic for the area off the Parsęta mouth (21 ind. m^{-2}).

Similarly to the abundance, the wet weight biomass of *P. elegans* in the area of study varied greatly and ranged from 0 to 0.29 g_{ww} m^{-2} (mean biomass of 0.12 g_{ww} m^{-2}), (Tab. 2). The mean wet weight was higher than the mean wet weight biomass on the East transects by the factor of 1.3-18.

DISCUSSION

Tube-building polychaetes are frequent components of marine zoobenthos; they affect the bottom sediment structure and play a significant role in the trophic web (Reise 2002). Such polychaetes occasionally form dense concentrations with abundances reaching up to 200 000 m^{-2} and may be ecologically very important. They form a trophic resource for the fauna of various ecological groupings, including commercial fishes. Due to the low salinity of the southern Baltic, particularly in the coastal zone (7-8 PSU), tube-building polychaetes are represented by a few species only, *P. elegans* being the commonest species. The studies confirm the observations of other authors and show the fact of irregular and island bottom settlement by these

P. elegans which create dense conglomeration. Bolam and Fernandes (2002) and other authors attempted to explain the mechanism of patchy distribution of tube-building polychaetes. In the Polish coastal zone of the southern Baltic, studied in this work (central coast), abundances of *P. elegans* was found to vary within a wide range (0-1 837 ind. m^{-2}), the mass occurrence (more than 1 000 ind. m^{-2}) being recorded at as few as 4 sites (8%), within the depth range of 15-17 m. Most probably, the abundance of *P. elegans* in the area of study depended on the sediment type, the density of the bottom near-bottom water flow, and trophic conditions. *P. elegans* prefers sandy and sandy-silty bottoms and avoids gravel and pebbles. The species is absent also on sandy bottoms affected by strong flow that removes and transports the tubes although they are weighted by sand grains glued to their walls. Due to the wave action, the polychaete avoids settling in the shallowest part of the coastal zone, within the depth range of 0-2 m (Żmudziński 1982a); in sheltered areas, however, e.g. in the Puck Bay (Kotwicki 1997), down to 1 m depth, *P. elegans* may form concentrations of up to 3 597 ind. m^{-2} (2.67 g_{ww} m^{-2}).

The presence and development of *P. elegans* on the seafloor covered with grey sand or even mud may indicate that such bottom receiving sedimenting organic matter is not affected by strong water flow. Detritus-enriched sand is a habitat appropriate for detritivorous oligochaetes which, as it turned out, proved to be the basic food item of *P. elegans*, particularly larger individuals of the polychaete, in the area of study (Piesik and Obolewski 2007). As shown by Piesik and Obolewski (2007), the frequency of oligochaetes in the *P. elegans* food in the Polish coastal zone of the Baltic increased with the polychaete size from 30% in 7-mm long individuals to 100% in the largest ones (16 mm). The abundance of oligochaetes represented by *Tubifex costatus* (Claparede), *Peloscolex benedeni* (d`Udkem), *Phallodrilus monospermathecus* (Knollner), the Enchytraeidae, and *Stylodrilus* sp. in the area of study averaged from 0 to 744 ind. m^{-2} and peaked at 2 920 ind. m^{-2} at the frequency of 12-80% (mean F = 80%), (Piesik 1998). The abiotic (water dynamics, sediment type) and biotic (oligochaete biomass, predatory behaviours) factors discussed above are decisive for the development of the *P. elegans* population and account for the patchy distribution and frequency of the species in the area of study. The low average biomass of *P. elegans* (0.01-0.22 $g_{ww}m^{-2}$) on the individual profiles confirms that the polychaete plays less important role in the trophic system of the Middle Pomerania coastal zone than elsewhere along the coast. It should be added that the polychaete biomass was dominated by that of *Hediste diversicolor*. Detailed studies on food and feeding of *Platichthys flesus* and *Scophthalmus maximus* in the northern Baltic showed *P. elegans* to be present in as few as 1% of juvenile flounder up to 40 mm long, no *P. elegans* being found in the turbot guts (Aarnio et al. 1996). Detailed examination of food of the stickleback and large plaice failed to show that *P. elegans* was used as food by those fish (Krzykawski and Załachowski 1983). The factor forming the density of *Pygospio* is predatory of *Crangon crangon* (Mattila 1997) and probably *Garnela garnela* or *Potamoschistus*.

In the late 90's of the 20^{th} century, *Pygospio elegans* occurred in the Puck Bay at a frequency of 49% (Osowiecki 2000). In the Pomeranian Bay, Masłowski (2001) estimated the frequency of *P. elegans* at 75%, while the species occurred along the central coast at the frequency of 63%. According to Warzocha (1995), *P. elegans* frequency in the entire shallow coastal zone was 78%. In a long-term perspective, frequency of *P. elegans* in an area may fluctuate widely, which is related to pollution and eutrophication (Osowiecki 2000). The degree of pollution and eutrophication of the Polish central coast (Tab. 4), is much less severe, compared to the areas affected

Table 4

A checklist of pollutans load (t yr^{-1} or in *kg yr^{-1}) in the estuary areas of rivers (according to "Stan czystości rzek, jezior i Bałtyku")

Parameters	Pomeranian river				
	Parsęta	Wieprza	Słupia	Łupawa	Łeba
BOD_5 t yr^{-1}	2 083.0	1 910.1	2 150.0	843.9	1 570.0
COD Mn t yr^{-1}	11 753.0	3 704.0	2 830.0	1 107.4	2 789.0
Chlorides t yr^{-1}	27 460.0	5 666.0	6 590.0	2 199.0	5 311.0
Seston	16 443.0	10 214.0	8 923.0	3 741.0	8 057.0
Total dissolved matter	279 877.0	117 668.0	120 066.0	117 668.0	111 745.0
Nitrogen T-N	3 035.0	1 761.7	1 842.3	781.5	1 305.0
$N\text{-}NH_4$	305.2	159.3	276.0	37.7	99.9
$N\text{-}NO_2$	33.7	9.4	26.9	6.7	8.4
$N\text{-}NO_3$	1 748.4	740.8	671.3	358.8	500.6
T-P	231.4	99.2	124.3	40.6	79.0
$P\text{-}PO_4$	274.7	152.9	236.5	56.9	112.6
Chrome total (Cr)*	1 256.4	310.9	403.7	133.8	356.0
Zinc (Zn)*	9 150.0	4 720.0	5 127.0	1 739.0	4 466.5
Cadmium (Cd)*	385.5	535.7	592.1	323.1	1 634.0
Copper (Cu)*	2 288.7	729.5	780.0	300.3	1 012.4
Lead (Pb)*	2 432.7	4 583.5	5116.7	2 657.7	14 236.7

* in kg yr^{-1}

by the River Vistula (the Gulf of Gdańsk) and the Odra (Pomeranian Bay), (Rumohr et al. 1996, Żmudziński 1976). This fact presumably plays a role in creating better conditions for the pollution-sensitive *P. elegans* off Middle Pomerania, as evidenced by the higher mean and maximum biomass values:

Localisation	mean biomass	max. biomass	author
Pomeranian Bay	0.04 g_{ww} m^{-2}	0.53 g_{ww} m^{-2}	Masłowski 2001
Gulf of Gdansk	0.04 g_{ww} m^{-2}	0.14 g_{ww} m^{-2}	Wenne and Wiktor 1982
Central Pomeranian coast	0.12 g_{ww} m^{-2}	1.16 g_{ww} m^{-2}	this study

As shown by Witek (1995), the mean biomass of *P. elegans* in the polluted shallow area of the Gulf of Gdańsk (0.19 $g_{ww}m^{-2}$) is lower than that recorded along the open coast of the Hel Peninsula and off Władysławowo by the factor of 2.3 (mean biomass of 0.43 $g_{ww}m^{-2}$).

The authors using Cochran and Cox test showed the essential arithmetical differences of compared average density of *P. elegans* in the coastal waters which are under the influence of pollution eutrophication (the region of river mouths – board 5, urbanized coast) in relation to cleaner waters of the coastal zone of Słowiński National Park – natural coast (board 3). This data confirms the fact that *P. elegans* is a form being sensitive to pollution in not urbanized districts and living far-away from polluted and eutrophicated mouths of these rivers, reaching in these conditions a higher evolution. The evidence is its higher population.

In the Pomeranian Bay, Masłowski (2003) demonstrated that, of all the macrobenthic taxa, only *P. elegans* correlated directly with the primary production (up to 220 mg chlorophyll a m^{-3}) transported into the Pomeranian Bay from the eutrophic Szczecin Lagoon. In the area of this study, phytoplankton is transported to the sea off Rowy, from Lake Gardno (89.0 mg chlorophyll a m^{-3}) and off Łeba, from Lake Łebsko (65.0 mg m^{-3}).

The phytal material supply did not exert any pronounced effect on the abundance and biomass of *P. elegans*, compared to the remaining estuarine areas in this study. It can be presumed that, in addition to other factors, trophic conditions are important for the development and mass occurrence of *P. elegans*. By revealing *P. elegans* predation pressure on oligochaetes, Piesik and Obolewski (2007) demonstrated a new role of oligochaetes in the *P. elegans* food chain. Presumably, *P. elegans* bottom type preferences are expressed in the avoidance of more polluted and less oxygenated areas (Żmudziński and Ostrowski 1990) on the one hand and detritus-enriched sediment on the other, the latter colonised by detritivorous oligochaetes, which is why *P. elegans* seems to preferentially settle in sediments enriched with organic substances (detritus, faeces, and suspension-feeders' produced agglutinates). Unfortunately, no simple correlation between the abundances of *P.elegans* and oligochaetes could be derived for the area of this study (Middle Pomeranian coast). Quantitative data reported by various authors indicate that sites showing high abundances of *P. elegans* harboured low oligochaete densities and vice versa (Bolam and Fernandes 2002, 2003, Masłowski 2003). Kotwicki (1997) demonstrated that, off Kuźnica (Poland) in the Puck Bay where *P. elegans* attained abundances of up to 3 600 ind. m^{-2} (2.67 g_{ww} m^{-2}), oligochaetes occurred at abundances of as low as 283 ind. m^{-2} (0.20 g_{ww} m^{-2}), while other areas of the Bay, supporting low abundances and biomass of *P. elegans* (0-19 ind. m^{-2}; 0-0.01 g_{ww} m^{-2}) or lacking the polychaete altogether, oligochaetes occurred at high densities, usually higher than 2 000 ind. m^{-2}, with a maximum of 11 800 ind. m^{-2} (maximum biomass of 10.62 g_{ww} m^{-2}). The authors of the present paper are of the opinion that the role of *P. elegans* in coastal ecosystems should be investigated in details.

CONCLUSIONS

- In the 3-mile (Nm) Polish coastal zone of the Baltic Sea, in the Middle Pomerania the occurrence had an island character.
- The density of *P. elegans* in the area of study was considerably diversed and low, and only in 8% of observed positions the density exceeded 1 000 ind. m^{-2}.
- The wet mass achived not a large value (0-0.95 $g_{ww}m^{-2}$) and because of this fact *P. elegans* did not play more important role in forming an alimentary base for fauna (benthophages fishes as well) in the investigative coastal zone.
- In terms of abundance, *P. elegans* was a dominant or subdominant of the macrobenthos of the area, occasionally following the bivalves (*Mytilus, Cerastoderma*).
- The frequency of *P. elegans* off the Middle Pomeranian coast was 54% and ranged from 20 to 80%.
- The authors' research confirmed by Cochran and Cox test showed that *Pygospio elegant* achieved higher evolution in cleaner waters of coastal zone of natural coast in comparison to more polluted eutrophicated coasted waters of river mouth region and urbanized coast.
- This achieved data indicate that the abundance of *P. elegans* in the area of study increases with depth, range from 2.1 to 23 m.
- *P. elegans* seemed to find the best living conditions in medium-grained sand (mean abundance of 634.0 ind. m^{-2}) and silty sand (mean abundance of 353.8 ind. m^{-2}).This kind of bottom made up only 20% of sediments in the studied zone. In the most common sediment type, fine sand (44% of the bottom) the density of *P. elegans* was not high and this fact had unprofitable influence on abundance of *P. elegans* in this coastal zone.

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CHARAKTERYSTYKA WIELOSZCZETA (*PYGOSPIO ELEGANS* CLAPAREDE) (SPIONIDAE) I JEGO ROLA W POLSKIEJ STREFIE PRZYBRZEŻNEJ MORZA BAŁTYCKIEGO

Streszczenie

Badania dotyczyły ilościowych aspektów populacji Polychaeta – *Pygospio elegans* (Claparede) w polskiej strefie przybrzeżnej Morza Bałtyckiego oraz w obszarach przybrzeżnych ujść pomorskich rzek. Częstość występowania (F) *P. elegans* w polskiej strefie przybrzeżnej wyniosła 54% i wahała się od 20 do 80%. Zagęszczenie tego Polychaete wzdłuż wybrzeża środkowego osiągnęło maksymalnie 1837 osobn. m^{-2} (x = 175,7 osobn. m^{-2}) i w miejscach występowania rzadko przekraczało 1000 osobn. m^{-2}. Średnia biomasa mokra *P. elegans* w badanym obszarze była niska (maksimum 0,29 g_{mm} m^{-2}). Zagęszczenie *P. elegans* w strefie estuariowej (ujścia rzek) było zasadniczo wyższe na zachód od ujść, w obszarach mniej narażonych na zanieczyszczanie i wpływ wód rzecznych niosących znaczne ilości biosestonu odpowiedzialnego za wzrost warunków troficznych.