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Ugrupowania skąposzczetów (Oligochaeta)* rzeki Nidy i jej dopływów

Communities of oligochaetes *(Oligochaeta)* of the River Nida and its tributaries

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Abstract: The *Oligochaeta* fauna of the lowland River Nida was investigated and 57 species of this group were identified. Four types of communities of oligochaetes were determined, their occurrence depending on the degree of water pollution and the character of the river bottom. The composition and structure of communities in sandy, muddy-sandy, and muddy habitats were also determined for pure stations and for various levels of water pollution.

The present work forms part of the complex hydrobiological investigations carried out by the Laboratory of Water Biology of the Polish Academy of Sciences under the direction of Docent Kazimierz Pasternak, Ph.D. The investigations conducted so far were concerned with the character of the catchment area and the chemism of water of the River Nida (Pasternak 1973, 1977 b), the properties of its bottom sediments (Pasternak 1977 b), and the microbiological (Starzecka 1977) and faunistic (Srokosz 1977) characteristics of the river.

It is worth noting that up till now in Southern Poland comprehensive complex investigations have been carried out on mountain streams (Rybi Potok, Sucha Woda) and in submontane rivers (Raba, San). To characterize the rivers of Southern Poland, this type of investigations of a lowland river was still lacking.

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The River Nida was chosen because its course comprises some pure sectors, a polluted sector and a great zone of self-purification. The aim of the investigation was to observe changes in the communities of oligochaetes depending on the character of the river bottom and the degree of river pollution. Moreover, the construction of a dam reservoir in the neighbourhood of Chęciny is planned for the years to come, therefore a chemical and biological description of the river is necessary before the construction begins, in order to characterize changes which are bound to occur there.

The knowledge of oligochaetes in the running waters of Poland is not satisfactory. In numerous geographical regions no works were conducted on the occurrence and distribution of this group of animals in rivers and streams (Moszyńska 1962). In the Little Poland Upland only the fauna of the Prądnik-Białucha stream (Kasprzak 1976 b) was investigated. The knowledge of communities and ecology of species in the running waters of this country is also insufficient and concerns only the Kryniczanka stream (Szczęsny 1974), the submontane River Raba (Kasprzak, Szczęsny 1976), the lower course of the lowland River Wełna (Kasprzak 1976 a), the moderately polluted River Narew (Wiśniewski 1976), and also some streams of the Polish High Tatra Mts (Dumnicka 1976).

Oligochaeta were chosen for the investigation, as they are a very important component of the benthos in lowland rivers, particularly in the polluted ones (Hynes 1963). Nevertheless, in the investigation on the effect of wastes on the zoocenoses of rivers oligochaetes are frequently disregarded or considered as a whole without identifying lower taxons (Vivier 1971, Goodnight 1973, Cairns 1974). In a number of works Brinkhurst (1965 a, 1965 b, 1966) stressed the phenomenon of great numbers of oligochaetes occurring in polluted waters and of their importance in the purification of waters. Goodnight and Whitley (1960) and Makrušin (1974) stressed the value of oligochaetes as indicators in the determination of the pollution taking into consideration the composition and distribution of species as well as their numbers. However, these studies are incomplete and thus further detailed elaborations in this field seem very called for.

Characterization of the area of the investigation and of the stations

Besides the River Nida the investigation included its more important affluents as the Lubrzanka, Bobrza, Biała Nida, and Mierzawa (Table I). The upper course of the Nida is composed of the Rivers Belnianka and Czarna Nida.

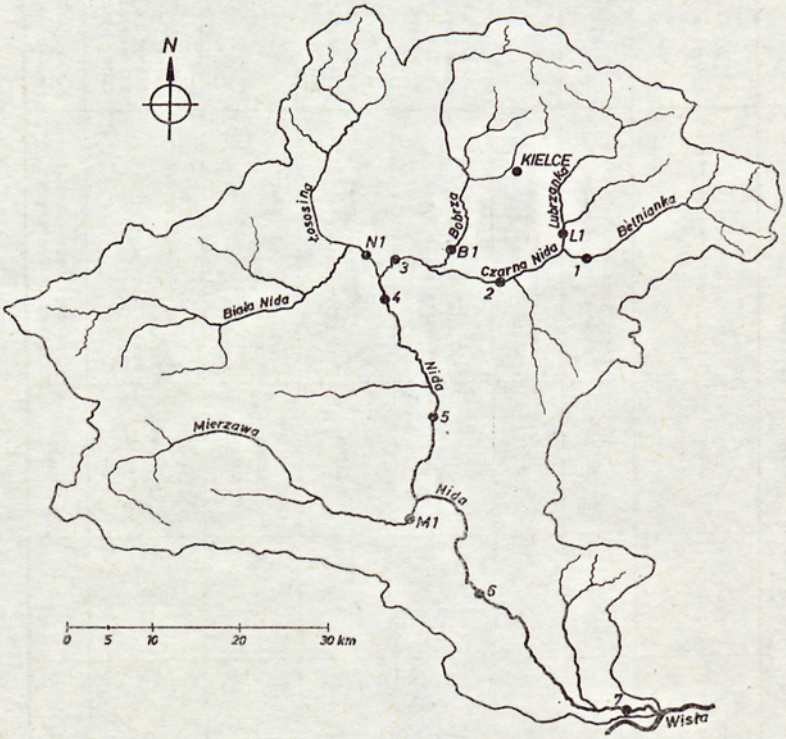
Tabela I. Charakterystyka badanych rzek

Table I. Characteristic of the invetigated rivers

Rzeka River	Wys. n.p.m. źródła Altitude of the spring m	Długość Length km	Powierzchnia zlewni Drainage area km^2	Spadek Gradient %	Dopływy Tributaries	Region geograficzny Region of the river course	Źródło zanieczyszczeń Origin of pollution
Belnianka	490	46	279	6.9	-	Pasmo Łysogórskie Range of the Łysogóry Mts	-
Lubrzanka	360	33	254	3.5	Warkocz	Góry Świętokrzyskie Świętokrzyskie Mts	-
Czarna Nida		62	1 123	4	Bobrza	Góry Świętokrzyskie Świętokrzyskie Mts	W dolnym biegu zanieczyszczona wodami Bobrzy In the lower course polluted by waters of the River Bobrza
Bobrza	420	48	378	4	Silnica	Góry Świętokrzyskie Świętokrzyskie Mts	Ścieki komunalne i przemysłowe z Kielc Industrial and municipal sewage from the town Kielce
Biała Nida	270	72	1 033	1.1	Lipnica Łososina	Zachodnia część Niecki Nidziańskiej West part of the Nida Syncline	-
Nida		107	3 862	1.8	Mierzawa Maskalis	Pd - wsch część Niecki Nidziańskiej South-East part of the Nida Syncline	Wody Czarnej Nidy, ścieki komunalne i przemysłowe z Pińczowa Waters of the River Czarna Nida industrial and municipal sewage from the town Pińczów
Mierzawa	280	65	562	1.4	Mozgawa	Płaskowyż Jędrzejowski Plateau of Jędrzejów	Ścieki z Sędziszowa Sewage from the town Sędziszów

The characteristics of the catchment basin and chemism of the Nida waters with the particular consideration of microelements was given by Pasternak (1973).

The chief stations were distributed on the Rivers Belnianka, Czarna Nida and Nida and given the numbers 1—7, beginning at Belnianka and ending at the outflow of the Nida (fig. 1). The stations on the tributaries



Ryc. 1. Mapa rzeki Nidy i jej dopływów z zaznaczonymi stanowiskami poboru prób
Fig. 1. Map of the River Nida and its tributaries with marked sampling stations
Miejscowości — Localities: 1 — Borków; 2 — Morawica; 3 — Tokarnia; 4 — Brzegi; 5 — Motkowice; 6 — Chroberz; 7 — Nowy Korczyn; L1 — Papiernia; B1 — Radkowice; N1 — Mosty; M1 — Michałów

were marked with two symbols: a letter indicating the name of the river and the number of the station on this river, eg.: L1 = Lubrzanka, station 1. A short description of the stations is given in Table II.

Method

In the investigated rivers samples were collected on 17 days: 19th June, 1973, 14th August 1973, 8th October 1973, 28th November 1973,

Tabela II. Krótka charakterystyka stanowisk

Table II. Short characteristic of the stations

Stanowisko Station	Rzeka River	Głębokość Depth cm	Prąd Current cm/s	Przepływ-Flow m^3/s najniższy lowest / najwyższy highest	Szerokość koryta Width of the river-bed m	Roślinność wyższa Higher plants	Charakter dna Character of the bottom	Źródło zanieczyszczeń Origin of pollution
1	Belnianka	5 - 60	40 - 60	0.48 / 5.83	3 - 5	pojedyncze kępy single tufts	piasek i żwir, miejscami muł sand and gravel, in places mud	-
2	Czarna Nida	40 -100	10 - 40	0.94 / 11.5	4 - 6	liczne kępy Elodea canadensis numerous tufts of Elodea canadensis	muł i piasek zamulony mud and muddy-sand	-
3	Czarna Nida	20 -100	10 - 60	2.57 / 17.0	15	brak - none	muł, w nurcie piasek mud, sand in the current	wody Bobrzy waters of the River Bobrza
4	Nida	10 - 60	10 - 60	5.6 / 37.5	30 - 40	brak - none	piasek, miejscami piasek zamulony - sand, in places muddy-sand	wody Czarnej Nidy waters of the River Czarna Nida
5	Nida	5 -100	20 - 60	6.15 /	30	pojedyncze kępy single tufts	piasek, miejscami piasek zamulony - sand, in places muddy-sand	mała gorzelnia we wsi Motkowice - small alcohol distillery in the village Motkowice
6	Nida	10 -120	10 - 60	6.87 / 56.4	20 - 40	nieliczne kępy not numerous tufts	muł i piasek zamulony mud and muddy-sand	-
7	Nida	20 -120	10 - 60	8.0 / 68.1	60	nieliczne kępy not numerous tufts	piasek i żwir, miejscami muł sand and gravel, in places mud	-
L1	Lubrzanka	10 - 50	5 - 20	0.26 / 3.04	3 - 5	nieliczne kępy not numerous tufts	piasek i piasek lekko zamulony sand and slighty muddy sand	-
N1	Biała Nida	10 -100	20 - 60	2.29 / 14.9	8 - 10	nieliczne kępy not numerous tufts	piasek miejscami pokryty detritusem - sand in places covered by detritus	-
B1	Bobrza	10 - 50	10 - 60	0.12 / 4.96	8 - 10	brak - none	muł, miejscami piasek mud, in places sand	ścieki komunalne i przemysłowe z Kielc - industrial and municipal sewage from the town Kielce
M1	Mierzawa	5 - 40	10 - 60	1.54 / 5.93	4 - 6	brak - none	piasek i piasek lekko zamulony sand and slighty muddy sand	-

5th February 1974, 11th March 1974, 17th April 1974, 27th May 1974, 2nd July 1974, 13th August 1974, 23rd September 1974, 14th November 1974, 13th January 1975, 19th February 1975, 8th April 1975, 20th May 1975, and 18th June 1975. Each time 3 samples were taken from habitats characteristic of a given station, 4 habitats being identified in the investigated rivers:

1. sandy or gravelly-sandy bottom, medium current (40—60 cm/sec.)
2. slimy sand, weak or no current (0—40 cm/sec.),
3. mud or detritus, very weak or no current (0—10 cm/sec.),
4. submersed higher plants, weak current (0—20 cm/sec.).

Not all types of the habitats were always found at every station: higher plants were investigated at 5 stations only, mud at 9 stations and sand at 10 (Table II).

The samples were collected with a bottom sampler of bolting cloth of 0.3 mm² mesh. The length of the net frame was 20 cm. The samples were taken from an area of 400 cm², fixed in 4% formalin and selected by means of a stereomicroscope. Semidurable preparations in lactophenol were made of the collected oligochaetes. All specimens of the family *Naididae* (excluding the genus Dero) were identified to species. In order to avoid overestimating the number of specimens, an individual with developed prostomium was regarded as a specimen, while forms without the developed prostomium, formed by the detachment of a zooid from a chain of individuals, were disregarded. Such a detachment often occurs under the influence of a strong impulse, for instance under the influence of the fixing medium. In the majority of species of the family Tubificidae it is only possible to identify mature specimens with genital organs developed. On the basis of juvenile forms one can only identify species of the genus *Aulodrilus, Psammoryctides barbatus, P. albicola, Tubifex ignotus,* and *Limnodrilus udekemianus*. Juvenile forms of the remaining species of the genus *Limnodrilus* were determined to genus only while immature specimens of other genera were quoted as *Tubificidae* juv.

The number of animals collected in a sample was calculated per 1 sq. m., then the average of all samples for the individual stations and the average of samples collected from a given habitat within a station were calculated.

In order to compare the fauna of oligochaetes from the separate stations, Jaccard's coefficient of similarity was calculated, using quantitative data for the individual species (mean numbers) and not qualitative ones (the presence or absence of a species).

$$PS = \frac{c}{a+b-c} \times 100$$

a — sum of mean numbers of species found at station A
b — sum of mean numbers of species found at station B

c — sum of smaller values of numbers of species common for these two stations.

In calculating the coefficient, juvenile forms of oligochaetes were also taken into consideration. This comparison was presented in a graph using dendrites. The distance between points denoting stations are the reciprocals of the magnitude of the similarity coefficient:

$$r = 100 - PS$$

Moreover, the domination index was calculated using the formula of K o w n a c k i (1971). The value of the domination index was found in the interval of 0—100. Three domination groups were determined in the *Oligochaeta* communities:

dominants, with the domination index of 100—10,
subdominants, with the domination index of 9.9—1,
adominants, with the domination index of 0.9—0.

This index was computed for the separate stations and determined habitats, taking into consideration juvenile forms, and then again for specimens identified to species.

Results

In the investigated material 57 species of 5 families of *Oligochaeta* were identified (Table III).

The family *Naididae* was most numerous and 30 species of 14 genera were identified there. Among them two: *Parnais frici* and *Pristina rosea* are new for Poland. Of the family *Tubificidae* 13 species of 7 genera were found. The *Enchytraeidae* family was represented by 8 genera with 11 species, 7 of which were aquatic or amphibiotic and 4 were land forms. Of the family *Lumbriculidae* only 2 species and of the *Lumbricidae* 1 species were found.

Only four species were found to occur at every station. They were: *Nais elinguis, Limnodrilus hoffmeisteri, Tubifex tubifex,* and *Marionina riparia. T. tubifex* and *L. hoffmeisteri* were frequently found to be eurytopic by many authors (K e n n e d y 1965, 1966, P a l m e r 1968) while *N.elinguis* and *M.riparia* sporadically occurred in strongly polluted waters. Probably single specimens were washed from higher purer sectors of the river or found their way to the main river bed from small temporary meadow streams.

10 species (this being 17% of the total of species found) were noted at one station only and in a small number of specimens. Among them *Fridericia perrieri, F. bulbosa, Henlea perpusilla,* and *H. nasuta* are land

Tabela III. Lista gatunków skąposzczotów rzeki Nidy i jej dopływów
(cyfry oznaczają średnią liczebność /m^2 w okresie badań)

Table III. List of oligochaetes species from the River Nida and its tributaries
(numbers refer to the average number/m^2 during the investigations)

Gatunek / Species \ Stanowisko / Station	N1	L1	1	2	B1	3	4	5	6	7	M1
Naididae											
Chaetogaster diastrophus			6	1			1				2
- diaphanus	1	1	3	4		22	32	259	3	4	
- limnaei			23	6							
Amphichaeta leydigii	2	14	1						163	43	76
Paranais frici										1	1
Specaria josinae	25	2	1	115				2	7	158	11
Uncinais uncinata	9	2		23						28	2
Ophidonais serpentina		2	4					24	3	4	1
Nais elinguis	1	1	176	1	41	8 649	3 889	19 259	41	39	17
- barbata	4	25	134	5		96	23	1 247	9	8	1
- bretscheri	10	11	397	86					154	285	1
- communis	1	6	476	21		1	1	53	9	28	6
- simplex	1	7	26					73		4	
- pardalis	3	62	99	21				4	21	93	2
- pseudobtusa	12	6	40	9			1	1	1	10	1
- behningi			1							9	2
- christinae			1							1	7
Slavina appendiculata	1	2	1	1				1			
Vejdovskyella intermedia	4	31	2	1			1		1	14	77
Ripistes parasita		1									
Stylaria lacustris	17	17	94	250				5	4	11	
Piguetiella blanci	1			31						2	
Dero digitata			1				9	1		5	
- obtusa		1	1								
Pristina longiseta			6	14							
- aequiseta									1		
- bilobata			3	2							1
- rosea	3	4	26	34						16	5
- foreli	5	23		200						28	
- menoni		5		1				1			
Tubificidae											
Tubifex tubifex	21	2	8	16	606	4 680	1 152	656	431	113	25
- ignotus	8	5	9	126				10	3	3	10
Limnodrilus hoffmeisteri	12	26	295	66	537	1 842	175	284	78	217	25
- udekemianus	11	17		11	11 746	12 275	676	194	49	42	11
- claparedeanus	1	2	1	5		2	6	2	1	60	1
- profundicola	1	2	6		5	3 066	1 546	60	112	15	2
Psammoryctides barbatus								1		1	
- albicola								16		2	1
Potamothrix hammoniensis				47						14	2
Ilyodrilus templetoni		1		8				1			
Aulodrilus limnobius	3			27					2	2	1
- pluriseta	10	1		166					7	71	35
Rhyacodrilus coccineus										1	
Enchytraeidae											
Propappus volki	2 616	1 575	3 687	41		35	1	2	195	967	313
Cernosvitoviella atrata		1								11	
- carpatica										2	
Henlea perpusilla	1										
- nasuta		1									
Fridericia perrieri								7			
- bulbosa						3					
Enchytraeus albidus										4	
- buchholzi			1	1							
Lumbricillus rivalis			6		3 199	436	6	7			
Marionina riparia	10	22	13	3	41	126	6	145	1	20	8
Lumbriculidae											
Lumbriculus variegatus		1		18			84			1	
Stylodrilus heringianus	1			1							1
Lumbricidae											
Eiseniella tetraedra					10						

forms, *Enchytraeus albidus* and *Eiseniella tetraedra* are amphibiotic forms while *Ripistes parasita, Pristina aequiseta, Rhyacodrilus coccineus,* and *Cernosvitoviella carpatica* are aquatic species, rarely found in our fauna.

Communities of *Oligochaeta* in the investigated rivers

The knowledge of oligochaetes communities in Polish rivers is scanty, the research on lowland rivers being particularly insufficient. Kasprzak alone (1976 a) characterized the oligochaetes communities in various habitats in the lower course of the River Wełna, while Wiśniewski (1976) described the *Oligochaeta* fauna of the moderately polluted River Narew, where he found the occurrence of a community in which the species *Limnodrilus hoffmeisteri* and *Tubifex tubifex* dominated in the whole investigated sector.

The species occurring only in a specific habitat or zone of pollution and showing a high domination index were regarded as the leading species of the *Oligochaeta* communities. This index was calculated for the individual stations on the basis of all samples, hence species of various biotopic requirements may concomitantly appear as subdominants (Table IV).

Station L1: the River Lubrzanka. At this station the number and community of *Oligochaeta* were very similar to station N1. *Propappus volki* and *Limnodrilus* sp. dominated while juvenile forms of *Tubificidae* and *Enchytraeidae* were subdominants. During the investigation the mean number was 3000 specimens per sq. m. 33 species of *Oligochaeta* were found, among them *Ripistes parasita* found in Poland for the first time.

Station 1, the River Belnianka. The *Oligochaeta* community was more differentiated here. The polyrheophilous species *Propappus volki* dominated while subdominants were juvenile forms of *Tubificidae,* a pelo- and limnophilous *Limnodrilus hoffmeisteri,* and 2 species of the genus *Nais,* living in the bottom: *N.communis* and polyrheophilous *N. bretscheri.* During the investigation the numbers amounted to about 7600 specimens per sq. m. on the average. *Nais barbata, N. elinguis,* and *Stylaria lacustris* were the most numerous adominants. Among 32 species found at this station some are rarely encountered in our rivers. They are *Nais behningi, N. christinae, Pristina bilobata,* and *Dero obtusa.*

Station 2, the River Czarna Nida. At this station only juvenile forms of *Tubificidae* and *Limnodrilus* sp. dominated, the subdominants being the phytophilous species *Stylaria lacustris* and *Pristina foreli,* rheophilous *Specaria josinae* and *Tubifex ignotus,* and limnophilous *Aulodrilus pluriseta.* The mean number was about 4000 specimens per sq. m. during the

Tabela IV. Ugrupowania skąposzczetów na poszczególnych stanowiskach w badanych rzekach (według wskaźnika dominacji)

Table IV. Oligochaetes communities at particular stations in the investigated rivers (according to the indices of dominance)

□ dominanci dominants 1.0 - 9.9 subdominanci subdominants + adominanci adominants

Gatunek Species / Stanowisko Station	N1	L1	1	2	B1	3	4	5	6	7	M1
Limnodrilus sp.	16.0	24.7	14.3	30.4	4.8	11.0	26.0	12.8	44.4	49.0	31.3
Tubificidae juv.	4.4	4.8	5.7	22.3	2.7	26.7	35.8	14.8	13.4	12.7	16.0
Limnodrilus udekemianus	+	+		+	56.0	18.4	1,2	+	+	+	+
Tubifex tubifex	+	+	+	+	1.3	4.1	1.3	1.0	2.4	+	+
Nais elinguis	+	+	+	+	+	4.8	5.3	34.3	+	+	+
Propappus volki	52.3	30.1	41.5	+		+	+	+	1.9	7.5	12.0
Limnodrilus hoffmeisteri	+	+	2.0	+	+	1.7	+	+	+	1.7	+
- profundicola	+	+	+		+	3.3	2.5	+	+	+	+
Lumbricillus rivalis			+		8.7	+	+	+			
Enchytraeidae juv.	+	1.2	+	+	+	2.7	+	+	+	+	+
Nais bretscheri	+	+	2.3	+					+	1.5	+
- communis		+	2.6	+		+	+	+	+	+	+
- barbata	+	+	+	+		+	+	1.8	+	+	+
Vejdovskyella intermedia	+	+	+	+			+		+	+	2.6
Stylaria lacustris	+	+	+	2.3				+	+	+	
Specaria josinae	+	+	+	1.1				+	+	+	+
Pristina foreli	+	+		2.2						+	
Tubifex ignotus	+	+	+	1,5				+	+	+	+
Aulodrilus pluriseta	+	+		2,1					+	+	+

investigation. The occurrence of 34 species was noted at this station, among them many phytophilous species *(Nais bretscheri, Chaetogaster diastrophus,* and *Piguetella blanci)* or those characteristic of slowly flowing waters *(Potamothrix hammoniensis).*

Station B1, the River Bobrza. The only dominant was *Limnodrilus udekemianus,* a species regarded as a limnophilous form. It attained a very high domination index of 56.0. As subdominants were noted the limnophilous species *Tubifex tubifex* and *Lumbricillus rivalis.* The share of juvenile forms of *Tubificidae* and *Limnodrilus* sp. was not great as compared with other stations. As compared with pure stations the numbers increased to about 19000 specimens per sq. m. during the investigation. At this station only 8 *Oligochaeta* species were found, half of them occurring very rarely. *Limnodrilus hoffmeisteri* was the only adominant occurring in greater numbers. Of the family *Naididae Nais elinguis* was found 3 times, the greatest numbers being noted in the winter season, not typical of this species.

Station 3, the River Nida. The domination of *Limnodrilus udekemianus* was less significant here, since it appeared as a second dominant after *Tubificidae juv.* Among several subdominants *Nais elinguis* seems particularly interesting, occurring in greater numbers in the investigated river only at moderately polluted stations, and *Limnodrilus profundicola,*

whose greater numbers were also found in this sector of the river only. Moreover, *Tubifex tubifex, Limnodrilus hoffmeisteri* and juvenile forms of *Enchytraeidae* also occurred as subdominants. At this station a marked increase in the number of Oligochaeta was observed, the average being 63 000 specimens per sq. m. for the period of the investigation. The number of identified species increased to 13, among them already 4 species of the family *Naididae. Propappus volki* also appeared though its number was very small.

Station 4, the River Nida. This station had a transitory character between the above-described station and the next. *Tubificidae* juv. and *Limnodrilus* sp. dominated, *L.udekemianus* only subdominated, while *Nais elinguis* and *L. profundicola* subdominated as at the preceding station. The number of *Oligochaeta* decreased to 36 000 specimens per sq. m. in the period of the investigation. It was noted that the number of species increased to 17, among them 8 being of the family *Naididae. Lumbriculus variegatus* also occurred there though its numbers were not great.

Station 5, the River Nida. *Nais elinguis* developed in masses here. It was the first dominant, accompanied by the phytorheophilous species *Nais barbata* and *Tubifex tubifex* as subdominants. Moreover, as it was at the preceding stations, *Tubificidae* juv. and Limnodrilus sp. dominated. The numbers of *Oligochaeta* were maintained at the same level as at station 4 (the average being 34 000 specimens per sq. m. during the investigation). The more numerous adominants were *Chaetogaster diaphanus, Limnodrilus hoffmeisteri* and *L.udekemianus.* The number of recorded species amounted to 26, among them 13 of the family *Naididae.*

At stations 3, 4 and 5 juvenile forms of *Tubificidae* always showed a higher domination index than *Limnodrilus* sp.

Station 6, the River Nida. Juvenile forms of the genus *Limnodrilus* and *Tubificidae* juv. dominated. *Propappus volki* appeared as subdominant. *Tubifex tubifex* which subdominated at all stations beginning from B1, here occurred for the last time more numerously. A distinct decrease in the number of *Oligochaeta* also occurred (to about 4000 specimens per sq. m. during the investigation). Among the more important adominants 4 species of the family *Naididae* were noted: *Nais bretscheri, N.pardalis, N.elinguis,* and *Amphichaeta leydigii,* and 3 species of the genus *Limnodrilus: L. profundicola, L. udekemianus,* and *L.hoffmeisteri.* At this station the occurrence of 23 *Oligochaeta* species was noted, 13 species representing the family *Naididae.*

Station 7, the River Nida. *Limnodrilus* sp. definitely dominated over the juvenile forms of *Tubificidae. Propappus volki* was still the subdominant. *Limnodrilus hoffmeisteri* and a rheophilous species *Nais bretscheri* also dominated. The numbers were again as great as at station 1 (the average of 8000 specimens per sq. m. for the period of the investigation).

At this station the *Oligochaeta* fauna was very rich, being represented by 39 species of 4 families. This is the greatest number species noted at one station in the investigated rivers. More than a half, as many as 21 species were of the family *Naididae*. *Rhyacodrilus coccineus* was found at this station only, while species characteristic of larger rivers were also observed: *Psammoryctides barbatus*, *P.albicola*, and *Potamothrix hammoniensis*.

Station N1, the River Biała Nida. The first dominant, of a very high domination index, was the polyrheophilous species *Propappus volki*, the second *Limnodrilus* sp. while as subdominants juvenile forms of Tubificidae occurred, among them immature specimens of the genera *Tubifex*, *Potamothrix*, *Ilyodrilus*, and *Rhyacodrilus* being classified. The mean number of oligochaetes amounted to about 3800 specimens per sq. m. during the investigation. 29 species of oligochaetes were found at this station, while the greatest number of 17 species of the family *Naididae* was noted. They occurred in very scarce numbers, a few individuals of each of these species being only encountered.

Station M1, the River Mierzawa. The first dominant was *Limnodrilus* sp., the second *Tubificidae* juv., and finally *Propappus volki* as the third. A rheophilous species *Vejdovskyella intermedia* subdominated. At this station the total of 30 oligochaetes species was found. The numbers were very small and amounted to the average of 1500 specimens per sq. m. during the investigation.

In the investigated rivers several *Oligochaeta* communities were found, their occurrence depending on the degree of water purity and on the character of river bottom in the given sector.

a. The community in which *Propappus volki* dominated, characteristic of pure waters with sandy bottom

This community was found at stations N1, L1 and 1. A sandy habitat covered the greater part of the bottom, in some places only slime was deposited or aquatic plants occurred, hence species of various habitat requirements appeared as subdominants. Station M1 was in character similar to the above-mentioned stations, but with a greater share of *Limnodrilus* and *Tubificidae* juv. in the community, owing to the greater percentage of organic matter in the sediments. It is also possible that a great content of Ca ions brought about a decrease in the numbers of *P. volki*, since this species had a negative correlation coefficient with the content of this element in the water (D u m n i c k a 1977). The similarity of stations was graphically presented by dendrites plotted on the basis of results obtained in computing Jaccard's coefficient. Pure stations are similar to each other, this being particularly evident on the example of

stations N1 nad L1. Station M1 is at the same time similar to station L1 and to slightly polluted stations 6 and 7, this suggesting its pollution. The community characterized by the strong domination of *Propappus volki* is typical of small and medium rivers of Central Europe with unpolluted water (Fomenko 1972, Kasprzak 1976 a).

b. Community in which phytophilous and pelophilous species dominate, characteristic of pure waters with muddy bottom partially overgrown by macrophytes

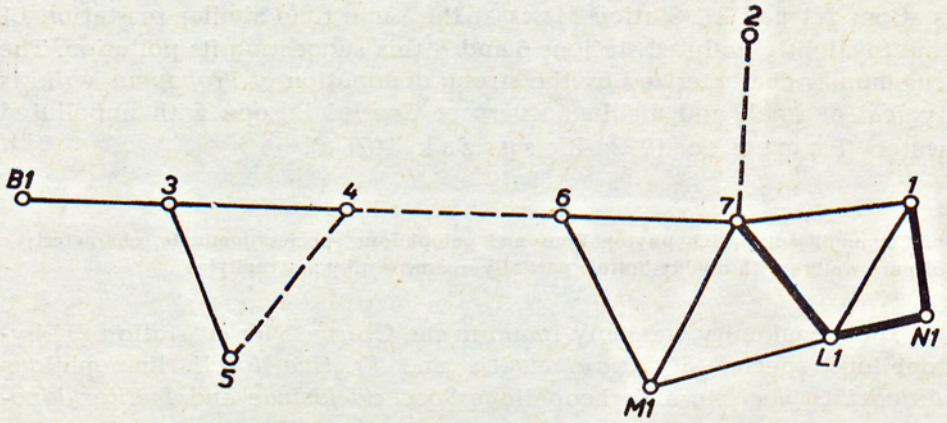
This community was only found in the Czarna Nida at station 2. Phytophilous species *Stylaria lacustris* and *Pristina foreli,* limnophilous *Aulodrilus pluriseta* and rheophilous *Specaria josinae* and *Tubifex ignotus* occurred in great numbers there. Its character differing from the other stations was presented by means of a dendrite. Station 2 shows a slight resemblance to station 7 only.

c. Community occurring in the strongly polluted river; with *Limnodrilus udekemianus* dominating, and *Lumbricillus rivalis* being a subdominant

This community has not been described yet. In strongly polluted waters a mass occurrence of *Limnodrilus hoffmeisteri* and *Tubifex tubifex* Kennedy 1965) or in general, *Limnodrilus* sp. (Hynes 1965) were usually noted. Probably the type of the bottom contributed to the formation of this community. The bottom of the River Bobrza is slimy-sandy and, as was experimentally shown (Wachs 1967), *Limnodrilus udekemianus* preferred substrata with particles of small diameter. *Lumbricillus rivalis is* a species characteristic of environments rich in organic matter (Nielsen, Christensen 1959).

d. Communities occurring in the zone of self-purification

These communities were continually changing, changes consisting in the diminishing share of *Limnodrilus udekemianus* and *Lumbricillus rivalis* in the community and in the occurrence of *Nais elinguis* and *Limnodrilus profundicola.* Then, these species recede and *Propappus volki* reappears, thus indicating an almost complete self-purification of the river. Numerous occurrence of *L. profundicola* in moderately polluted waters was found by Kennedy (1965), but this is not an indicatory species because owing to great difficulties in its identification the majority of authors do not mention it at all. The second species characteristic of moderately polluted waters is *Nais elinguis.* This species is a very good indicator occurring only in moderately polluted waters, independently of



Ryc. 2. Dendryt ugrupowań skąposzczetów badanych stanowisk
Fig. 2. Dendrite of oligochaetes communities of the investigated stations

the type of the bottom: *Nais elinguis* was the dominant species in the medium-montane Kryniczanka stream (Szczęsny 1974) and in the Prądnik-Białucha Jura stream, at a station below the inflow of sewage (Kasprzak 1976 b). Stations in the self-purification zone were similar to each other to a relatively low degree (fig. 2), since variation of communities occurred there. Station B1 had the greatest number of common characters with the following station 3, this in turn was similar to station 4. Station 5 was more similar to station 3 than to 4, owing to the secondary pollution of the river by the alcohol distillery at Motkowice. Station 4 and 6 resembled each other in a very small measure because in this sector of the river, chemical factors as well as communities of *Oligochaeta* distinctly changed; nevertheless they were taken into consideration in this run in order to investigate changes along the chief course of the Nida. Station 6 is similar to station 7 and the latter is also similar to the group of pure stations N1, L1 and 1 and, in a lesser degree, to M1 and 2. This "universal" character of station 7 is probably due to a great variability of habitats in this sector of the river. The similarity of the *Oligochaeta* fauna of station 7 to the fauna of pure stations also suggests an almost complete purification of the river.

Communities of *Oligochaeta* in the investigated habitats made with reference trade to pollution

The type of the bottom is a very important factor in the distribution of oligochaetes and other groups of bottom organisms (Popescu, Botea 1962, Fomenko 1964, Finogenova 1968, Lubianov,

Gajdas 1972). Several groups of organisms were identified depending on the habitat (Žadin 1974, Starmach 1959, Illies, Botosaneanu 1963) while a number of authors investigated the qualitative and quantitative distribution of the fauna in different habitats (Behning 1924, Berg 1948, Szczepański 1953, Kownacka 1971).

Another important ecological factor is the rate of the current. In the investigated rivers these two factors were closely correlated since at slow rate or no current, small particles of mud or detritus were deposited while at medium rate of the current the bottom was sandy or gravelly-sandy. Hence under natural conditions it was difficult to state which factor was more important for the bottom fauna. 4 habitats were determined in the Nida: sand, slimy sand, slime, and submersed vegetation; but the composition and structure of communities were investigated in the first three habitats only, because the number of samples from plants was too small.

a. Communities of *Oligochaeta* in the sandy bottom

The sandy bottom of stations N1 and L1 is a poor habitat where polyrheophilous species *Propappus volki* dominates (the value of the domination index being 79.1 and 92.0). (Table V). No subdominants were observed, the most numerous adominants being *Nais pseudobtusa* at station N1, a species noted in phytophilous communities (Lastočkin 1944). At station L1 the more numerous adominants were *Vejdovskyella intermedia, Nais pardalis, N. barbata* and *Pristina foreli.* According to Fomenko, the first two are α-mesorheophilous species occurring most frequently in the communities of slimy sand but also observed in pure sand. *Nais barbata* was encountered as well among psammorheophilous as pelorheophilous species (Žadin 1964). Also at station M1, in sand, one dominant, *Propappus volki* was noted, its domination index being 58.6. The subdominants were: the above-described species *Vejdovskyella intermedia* and *Aulodrilus pluriseta,* a pelorheophilous species (Žadin 1964). These subdominants suggest certain admixture of mud in the described habitat. At station 7 the *Oligochaeta* community of the sandy bottom is similar to those described above. *P. volki* dominates but the community is more differentiated having 5 subdominants: *Uncinais uncinata, Specaria josinae, Nais pardalis, N. bretscheri* and *Limnodrilus hoffmeisteri.* Besides *L. hoffmeisteri* these are species occurring in pure sand as well as in muddy sand (Žadin 1964, Fomenko 1972).

Tabela V. Ugrupowania skąposzczetów na dnie piaszczystym w badanych rzekach (według wskaźnika dominacji)

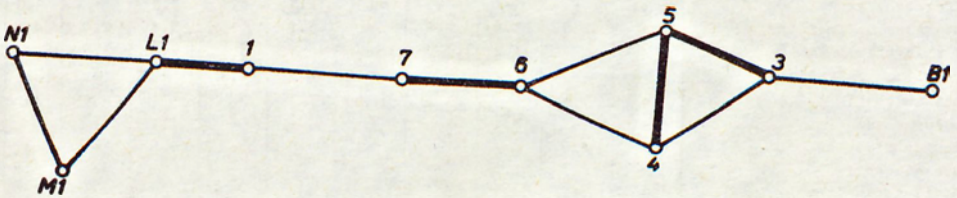
Table V. Oligochaetes communities in sandy bottom in the investigated rivers (according to the indices of dominance)

[ ] dominanci dominants 1,0 - 9,9 subdominanci subdominants + adominanci adominants

Gatunek Species / Stanowisko Station	N1	L1	1	B1	3	4	5	6	7	M1
Propappus volki	[79,1]	[92,0]	[85,6]		+	+	+	9.7	[46,5]	[58,6]
Limnodrilus udekemianus	+			[44,1]	[18,5]	4,5	1,8	2,1	+	+
Tubifex tubifex	+	+	+	1,3	1,1	[10,1]	1,4		+	+
Nais elinguis			+	+	[22,9]	4,1	[31,4]	1,2	+	+
Limnodrilus profundicola			+	+	2,4	[27,6]	+	1,0		+
- hoffmeisteri	+	+	1,1	+	2,1	+	+	[11,7]	5,2	+
Lumbricillus rivalis			+	[18,2]	+	+	+			
Nais bretscheri	+	+	2,6						7,6	+
- barbata		+	+		+	+	[14,6]		+	+
- pardalis	+	+	+					4.0	1,7	
Amphichaeta leydigii								2,5	+	+
Tubifex ignotus	+	+	+					1,1	+	+
Specaria josinae									1,7	+
Uncinais uncinata	+								1,9	
Vejdovskyella intermedia	+	+							+	3,2
Auledrilus pluriseta									+	1,5
Pristina rosea	+	+	+						+	
Nais pseudobtusa	+	+	+				+			+
Piguetiella blanci	+								+	
Chaetogaster diaphanus	+		+			+	+		+	
Auledrilus limnobius	+				+	+			+	
Nais communis	+		+			+	+	+	+	
Marionina riparia			+		+	+	+			+
Limnodrilus claparedeanus			+			+		+	+	
Nais simplex		+	+							
Pristina foreli		+							+	
Stylaria lacustris		+								
Slav. appendiculata		+								
Lumbriculus variegatus		+								
Nais behningi			+							+
Ophidonais serpentina			+						+	+
Psammoryctides barbatus							+		+	
Nais christinae									+	
Pristina bilobata										+
Potamothrix hammoniensis										+

The communities of *Oligochaeta* of the sandy bottom at polluted stations are quite different from those at pure stations and also differ from each other. As the self-purification and dilution of wastes occur, one community smoothly passes into another (fig. 3). At station B1 the first dominant was the limnophilous species *Limnodrilus udekemianus*, characteristic of poor and medium slimy sand (Fomenko 1972). Lastočkin (1944) quoted it as one of the less important species in the community *Limnodriletum unionetum*, together with other species of the genus *Limnodrilus*, *Tubifex tubifex* and *Amphichaeta leydigii*. The other dominant, *Lumbricillus rivalis* is known from wastes (Nielsen, Christensen 1959), but it is not included in the classification of animal

saprobia (Kolkwitz, Marson 1909), though a related salty-aquatic species *L. lineatus* is quoted for the polysaprobic zone. Here the dominant is *Tubifex tubifex*, a limnophilous species living in slimy bottom (Fomenko 1972, Žadin 1964) in waters of different degree of purity. No species dominating in this station is characteristic of sand, but owing to great amounts of organic matter contained in wastes and to the great content of NH_4, PO_4 and BOD_5 the species characteristic of this environment are eliminated while saprobiontic species develop in masses.



Ryc. 3. Dendryt ugrupowań skąposzczetów siedliska piaszczystego na badanych stanowiskach

Fig. 3. Dendrite of oligochaetes communities from the sandy biotope in the investigated stations

At station 3 the *Oligochaeta* community slightly changes. A new dominant species appears here: *Nais elinguis*, characteristic for α- and β--mesosaprobic zones (Kolkwitz, Marson 1909). The second dominant is *Limnodrilus udekemianus* while pelo- and limnophilous species *Tubifex tubifex*, *Limnodrilus profundicola*, and *L. hoffmeisteri* still subdominant.

At station 4 the community is composed of the same species but the structure of the domination changes: *Limnodrilus profundicola* is the first dominant, *Tubifex tubifex* is the second, while *L. udekemianus* and *Nais elinguis* are subdominants.

At station 5 *Nais elinguis* still dominates in the *Oligochaeta* community, the second dominant being a pelo- and psammorheophilous species *Nais barbata* (Žadin 1964). Thus, it is only at this station that a species characteristic of the described habitat begins to play a prominent part.

At station 6 the greatest variability of all *Oligochaeta* communities is noted, with a slight domination of *Limnodrilus hoffmeisteri* (the domination index of 11.7) while as subdominants species of different requirements with regard to the habitat are noted. *Limnodrilus udekemianus* and *L. profundicola* are pelo- and limnophilous species (Žadin 1964, Fomenko 1972) while *Amphichaeta leydigii*, *Tubifex ignotus* and *Nais pardalis* are characteristic of slimy sand. *Propappus volki* is the only psammophilous species.

Tabela VI. Ugrupowania skąposzczetów na dnie piaszczysto-mulistym w badanych rzekach (według wskaźnika dominacji)

Table VI. Oligochaetes communities in sandy-muddy bottom in the investigated rivers (according to the indices of dominance)

[ ] dominanci dominants 1,0 - 9,9 subdominanci subdominants + adominanci adominants

Gatunek Species / Stanowisko Station	N1	L1	1	2	B1	3	4	5	6	7	M1
Propappus volki	[84,8]	[11,6]	[17,8]	1,9		+		+	[43,7]	[32,4]	[10,9]
Limnodrilus udekemianus	+	+		+	[71,7]	[67,1]	1,6	7,8	2,0	+	+
Tubifex tubifex	+	+	+	+	1,5	[12,1]	8,5	9,9	+	1,1	2,6
Limnodrilus hoffmeisteri	+	2,9	5,6	3,9	+	3,0	+	9,4	2,0	4,5	3,7
Nais elinguis	+		4,2		+	+	[25,7]	[16,9]	1,5	+	+
Limnodrilus profundicola	+	+	+			4,8	[14,4]	+	+	+	+
Pristina foreli	+	1,6		[21,2]						+	
Nais communis	+	+	[17,4]	+				1,1	+	+	+
Marionina riparia	+	4,6	+	+	+	+	+	3,6	+	+	+
Nais bretscheri	+		1,6	+					+	5,6	
Aulodrilus pluriseta	+	+		5,1					+	1,7	3,4
Amphichaeta leydigii	+								3,2	+	5,4
Specaria josinae	+	+		1,6				+	+	+	+
Uncinais uncinata	+	+		1,1						+	+
Stylaria lacustris		+	+	1,2				+	+		
Aulodrilus limnobius	+			1,4					+		+
Tubifex ignotus	+	+		1,6				+	+	+	+
Lumbricillus rivalis					4,3	+	+				
Vejdovskyella intermedia	+		+	+					+	+	[10,8]
Nais pardalis	+	+	+	+				+	+	+	+
- barbata	+	+	+				+	+	+	+	
Limnodrilus claparedeanus	+			+		+		+		+	+
Pristina rosea	+	+		+						+	+
Nais pseudobtusa	+	+		+							
- simplex	+		+								
Chaetogaster diaphanus	+			+			+	+			
Slavina appendiculata	+			+							
Stylodr. heringianus	+										+
Aulodrilus limnobius	+								+		
Pristina menoni		+		+							
Dero obtusa		+									
Cernosvitoviella atrata		+									
Pristina longiseta				+							
Potamoth. hammoniensis				+							
Psammoryetides albicola								+			+
Chaetogaster diastrophus											+
Paranais frici											+

b. *Oligochaeta* community of the slimy-sandy bottom

These communities have a transitional character between the communities of the sandy and the slimy bottoms, but they show a greater similarity to the former (Table VI). At pure and almost pure stations the structure of the community is similar to that described from a sandy

habitat. The first dominant is *Propappus volki*, which in the River Oka appeared in great numbers in this habitat (Ž a d i n 1964). The subdominants are α-mesorheophilous species (F o m e n k o 1972) characteristic of this substratum *Vejdovskyella intermedia, Uncinais uncinata, Amphichaeta leydigii, Specaria josinae*, and *Nais communis*, limno-rheophilous *Tubifex ignotus*, and also limnophilous species living as well in the slimy--sandy as in slimy bottoms: *Aulodrilus pluriseta, A. limnobius, Limnodrilus hoffmeisteri*, and *Tubifex tubifex* (F o m e n k o 1972). At stations 1 and 7 the polyrheophilous species *Nais bretscheri* is still observed.

The slimy sand is an unstable habitat and the area of the river bottom covered by it varies with the variation of the water level. With a low water level the mud is being deposited and limnophilous species develop while with high water levels the slime is washed out and rheophilous species appear.

At polluted stations the *Oligochaeta* fauna of the sandy and slimy--sandy bottom is very similar, though the domination of *Lumbricillus rivalis* is less evident at station B1, and *Nais elinguis* does not appear as dominant till station 4. At station 3 this species appears as an adominant, which may be explained by deteriorated oxygenic conditions in the slimy-sandy habitat.

c. The *Oligochaeta* communities of the slimy bottom

The *Oligochaeta* communities of the slimy habitat are quite different (Table VII). In the communities the most important species are *Limnodrilus hoffmeisteri, L. udekemianus* and *Tubifex tubifex*, which dominate or subdominate at numerous stations independently of the degree of their pollution. *Nais elinguis* is an adominant at station 3, subdominant at station 4 and does not dominate before station 5, afterwards appearing again in small numbers. At station 2 the *Oligochaeta* community of the slimy habitat is not very similar to the communities of other stations. Here the dominants are: the limnophilous species *Aulodrilus pluriseta*, limno-rheophilous *Tubifex ignotus*, and α-mesorheophilous *Specaria josinae*. These species were subdominants in the slimy sand at this station. Besides typical pelo- and limnophilous forms (*Potamothrix hammoniensis* at station 2 and *Limnodrilus claparedeanus* at station 7) the α-mesorheophilous species have a relatively great share in the communities. *Propappus volki* dominates only at station N1 but no typical slime is found at this station, while at places with weak current coarse-grained detritus is deposited.

At the investigated stations no stagnant muds occurred, in which *Oligochaeta* community of stabile and slightly changeable domination

Tabela VII. Ugrupowania skąposzczetów na dnie mulistym w badanych rzekach (według wskaźnika dominacji)

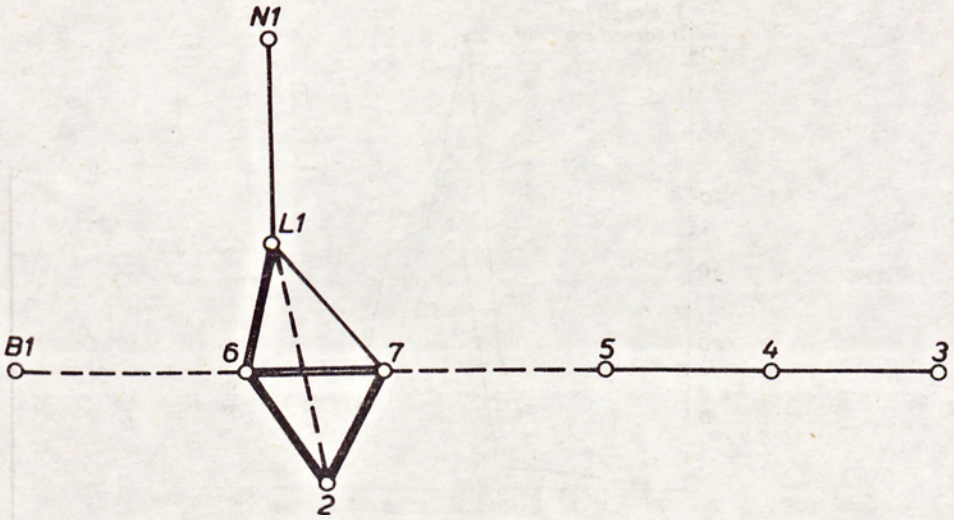
Table VII. Oligochaetes communities in muddy bottom in the investigated rivers (according to the indices of dominance)

□ dominanci dominants 1.0 - 9.9 subdominanci subdominants + adominanci adominants

Gatunek Species / Stanowisko Station	N1	L1	2	B1	3	4	5	6	7
Limnodrilus hoffmeisteri	[12.6]	[10.5]	2.0	1.3	4.4	9.1	1.6	3.5	[16.1]
- udekemianus	+	[17.4]	+	[64.7]	[54.8]	[45.0]	+	2.0	2.6
Tubifex tubifex	1.0		+	1.2	[10.7]	8.5	6.9	[24.4]	[13.5]
Limnodrilus profundicola		+		+	[12.3]	3.8	+	2.4	+
Propappus volki	[11.5]		1.4		+			+	+
Tubifex ignotus			[16.7]				+		
Specaria josinae		+	[11.1]					+	[14.7]
Aulodrilus pluriseta	+		[16.3]					+	6.8
Nais elinguis		+		+	+	8.5	[34.7]	+	+
- bretscheri	5.2	+						+	+
Henlea perpusilla	1.0								
Aulodrilus limnobius	1.1		+					+	
Pristina foreli		1.7							+
Marionina riparia		2.6		+	+	+	+	+	+
Potamothrix hammoniensis			4.4						
Nais pardalis		8.6							2.8
Lumbricillus rivalis				9.0	+		+		
Nais barbata		+				+	3.6	+	
Amphichaeta leydigii								2.6	2.1
Limnodrilus claparedeanus		+	+						1.3
Nais communis		+	+				+	+	+
Uncinais uncinata		+	+						+
Vejdov. intermedia		+							+
Chaetogaster diaphanus		+						+	+
Ophidonais serpentina							+	+	
Ilyodrilus templetoni			+						
Dero digitata							+		
Piguetiella blanci									+

structure used to live. The investigated muds may be classified as transit slimes (S z c z e p a ń s k i 1953) while their communities are characterized by fairly great variability of species and by great seasonal variation.

The similarity of the *Oligochaeta* communities of the slimy habitat is fairly great being independent of the degree of pollution of the River Nida (fig. 4), since the pelophilous species characteristic of this habitat are at the same time characteristic of polluted waters *(Tubifex tubifex, Limnodrilus hoffmeisteri, L. udekemianus)*. On the other hand, the density of *Oligochaeta* is several times greater in the mud of polluted stations as compared with pure ones: B1 — 21 000 specimens/m² (the average for the period of the investigation), station 3 — 189 000 specimens/m², station 4 — 70 000 specimens/m², and at pure stations: N1 — 1000 specimens/m² (the average for the period of the investigation), L1 — 4300 specimens/m², and station 2 — 7800 specimens/m².

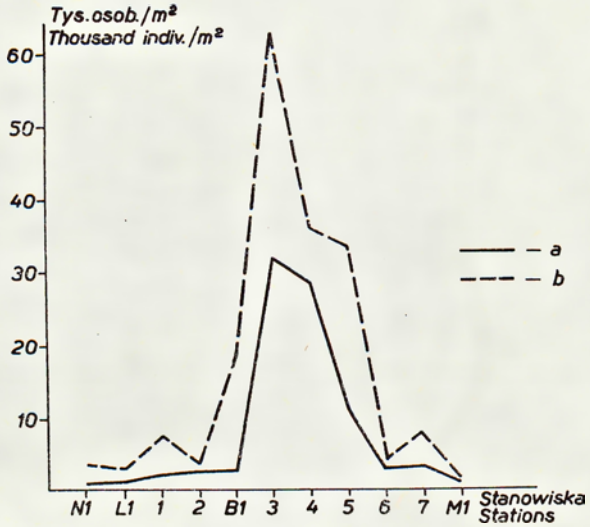


Ryc. 4. Dendryt ugrupowań skąposzczetów siedliska mulistego na badanych stanowiskach

Fig. 4. Dendrite od oligochaetes communities from the muddy biotope in the investigated stations

Recapitulation

On the basis of the *Oligochaeta* communities and their numbers at the stations, the degree of pollution of the investigated rivers may be determined. In the upper course of the River Nida (stations 1 and 2) and in its affluents Lubrzanka and Biała Nida, the occurring communities, not changed by the inflow of wastes, are characteristic of small lowland rivers (Fomenko 1972, Kasprzak 1976 a). The number of *Oligochaeta* is small (3—8 thousand of specimens per sq. m.) and the number of species found at one station amounts to about 30. The River Bobrza (station B1) is very strongly polluted, this being manifested by a decrease in the number of species (to 8) and by the mass development of sewage forms: *Limnodrilus udekemianus* and *Lumbricillus rivalis*. On the basis of chemical and biological data this sector may be classified as a polysaprobic zone (Kolkwitz, Marson 1909). The number of *Oligochaeta* increases as compared with pure stations but is much lower than the numbers noted at further stations (fig. 5) lying in the medium river course of the Nida. Stations 3, 4, and 5 may be classified in the α or β-mesosaprobic zone. In this zone the highest numbers of *Oligochaeta* were noted, owing to the mass development of *Limnodrilus profundicola* and *Nais elinguis* and also by the very numerous occurrence of juvenile forms of *Tubificidae*. The numbers of other groups of the bottom fauna *(Insecta, Mollusca)* are small (Srokosz 1977). In the lower course of



Ryc. 5. Zagęszczenie skąposzczetów na poszczególnych stanowiskach. a — formy młodociane; b — ogółem

Fig. 5. Density of oligochaetes at the particular stations. a — juvenile forms; b — total

the River Nida (stations 6 and 7) a distinct purification of the water occurs but the communities appearing there indicate that this process was not finished since the dominant forms are juvenile specimens of the *Tubificidae* family while *Propappus volki* (characteristic of pure waters) is only a subdominant.

At pure stations the *Oligochaeta* communities of the investigated habitats distinctly differ, so that the species occurring as dominants at one habitat are adominants at the other. A prominent part in the distribution of *Oligochaeta* is played by the character of the bottom: the size of particles, and the content of organic matter in the sediment. The role of these factors was emphasized by many authors, among others by Szczepański (1953), Wachs (1967), and Kasprzak, Szczęsny (1976).

At polluted stations the *Oligochaeta* communities are very similar for all habitats. A large content of organic matter as well as unfavourable oxygenic conditions inhibit the development of many species so that only sewage forms develop in masses (Kennedy 1965, Brinkhurst 1966). At the same time it was noted that species typical of mesosaprobic water appear earlier in the river sector with sandy bottom that in sectors with mud.

Independently of the degree of water pollution the communities of the muddy habitat are similar. Therefore they cannot be used in determining the degree of water purity of a lowland river, while for the medium-montane Kryniczanka stream the author suggests this habitat as reflecting most precisely the degree of water pollution (Szczęsny 1974).

STRESZCZENIE

Do badań wybrano Nidę jako typową rzekę nizinną, posiadającą w górnym biegu czyste odcinki, w środkowym biegu odcinek silnie zanieczyszczony, a następnie dużą strefę samooczyszczania. W makrofaunie tej rzeki duży udział miały skąposzczety i dlatego skoncentrowano się na szczegółowym opracowaniu tej właśnie grupy.

Celem pracy było określenie składu gatunkowego skąposzczetów, uchwycenie struktury ugrupowań na stanowiskach i w siedliskach i określenie zmian w ugrupowaniach wywołanych przez zanieczyszczenie.

W celu zrealizowania zamierzeń próby pobierano z 11 stanowisk w mniej więcej miesięcznych odstępach.

W badanym materiale znaleziono 57 gatunków skąposzczetów z pięciu rodzin. W tym z rodziny *Naididae* 30 gatunków, z *Tubificidae* — 13 gatunków, z *Enchytraeidae* — 11 gatunków, z *Lumbriculidae* — 2 gatunki, z *Lumbricidae* — 1 gatunek. Dwa znalezione gatunki stwierdzono po raz pierwszy na terenie Polski. Były to: *Paranais frici* i *Pristina rosea*.

Na podstawie wskaźnika dominacji wyróżniono w badanych rzekach 4 zasadnicze typy ugrupowań skąposzczetów, których występowanie zależne jest od charakteru dna i stopnia zanieczyszczenia wody. Pierwszy typ ugrupowania stwierdzono na stanowiskach czystych o dnie piaszczystym (stan. 1, L1, N1 i M1). Dominantem był psammoreofilny gatunek *Propappus volki*, a subdominantami gatunki charakterystyczne dla dna lekko zamulonego lub zarośniętego roślinnością wyższą. Drugi typ ugrupowania występował tylko na stan. 2. Dno rzeki było tu silnie zamulone i porośnięte makrofitami, dlatego najliczniej występowały gatunki fitofilne i pelofilne *(Stylaria lacustris, Pristina foreli, Aulodrilus pluriseta)*. Trzeci typ ugrupowania stwierdzono na stanowisku silnie zanieczyszczonym, o dnie piaszczysto-mulistym i mulistym. Dominował tu bardzo wyraźnie pelofilny gatunek *Limnodrilus udekemianus*, występujący wraz z wazonkowcem *Lumbricillus rivalis*. Ugrupowanie to występowało na stan. B1 i w mniej wyraźnej formie na stanowisku 3. Czwarty typ ugrupowania występował w strefie samooczyszczania się rzeki na dnie w przeważającej części piaszczysto-mulistym (stan. 4 i 5). Gatunkami charakterystycznymi dla tej strefy są: *Limnodrilus profundicola* i *Nais elinguis*.

Na wszystkich stanowiskach (poza B1) udział w ugrupowaniu *Limnodrilus* sp. i młodocianych form *Tubificidae* był duży, przy czym na stanowiskach czystych *Limnodrilus* sp. przeważał nad *Tubificidae* juv.

Współczynnik dominacji posłużył też do wyznaczenia ugrupowań poszczególnych siedlisk. Ugrupowania siedliska piaszczystego stanowisk czystych i zanieczyszczonych różnią się wyraźnie. Na stanowiskach czystych dominuje psammoreofilny *Propappus volki*, a w zanieczyszczonych odcinkach rzeki występują gatunki pelofilne *(Limnodrilus udekemianus, L. profundicola, Tubifex tubifex)* i inne, nietypowe dla tego siedliska *(Lumbricillus rivalis, Nais elinguis)*. W prawie czystym dolnym biegu rzeki znów powraca *Propappus volki*. Ugrupowania siedliska piaszczysto-mulistego są podobne do ugrupowań siedliska piaszczystego.

W siedlisku mulistym, zarówno na stanowiskach czystych jak i zanieczyszczonych, dominują w ugrupowaniach gatunki pelofilne, których liczebność jest kilkakrotnie wyższa w zanieczyszczonym odcinku rzeki.

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