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Stream ecosystems in mountain grassland (West Carpathians)*

9. *Oligochaeta*

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Abstract — The oligochaetes fauna of two mountain streams (Biała Woda and Kamionka) is discussed. 22 species belonging to 5 families were found in the streams. In the Biała Woda stream the characteristic communities of mountain streams were noted. The species of the genus *Nais* predominated while *Enchytraeidae* were also fairly numerous. Apart from species typical for mountain streams, those typical for lowland or slightly polluted waters were also encountered in the Kamionka stream, this suggesting the eutrophicating effect of pasturing.

Key words: stream ecosystems, influence of pastoral economy, the West Carpathians, oligochaetes communities.

1. Introduction

The aim of the work was to examine the composition of oligochaetes communities in mountain streams of the upper Grajcarek catchment basin, in areas of different intensity of pastoral economy. Moreover, the comparison of the composition and structure of *Oligochaeta* communities in the investigated streams with those in other mountain streams was made. It was an attempt to assess the effect of pasturing on these communities.

* The investigations were carried out within Project 10.2.

2. The area of investigation

From March 1977 to April 1978 three stations appointed in streams flowing across the sheep grazing area near the village of Jaworki were examined: the control station BW1 (the Biała Woda stream) with no grazing areas above it, lay below the outflow of the stream from the forest. Station BW2 in the Biała Woda stream lay about 1.5 km below station BW1. In this sector the stream flows across a valley with traditional pasturing. Station K2 was in the Kamionka stream, about 1.3 km below the spring. On the surrounding meadows intensive pasturing, including the application of mineral fertilizers, had been introduced.

3. Method

The samples were taken with a bottom scraper covered with a 0.3 mm mesh net. Each time two-three samples were taken at a station, the different habitats of the given stream sector being taken into consideration. The density of *Oligochaeta* was calculated per 2 dm^3 of the substratum. The domination index was calculated according to the K o w n a c k i formula (1971):

$$d = \frac{\bar{Q} \times 100}{\bar{Q}_t} \times f$$

$\bar{Q}$ — average number of specimens of the given species in the investigated run of samples,
$\bar{Q}_t$ — the total of average numbers of specimens of all species
f — frequency.

Frequency was calculated according to the formula $f = \frac{n}{N}$

N — number of samples in a run,
n — number of samples where the given species occurred.
The value of the domination index lies in the interval:

$$0 \leqslant d \leqslant 100$$

On the basis of the domination index 3 groups were identified in *Oligochaeta* communities:

dominants	— with a domination index 100—10
subdominants	— with a domination index 9.9—1
adominants	— with a domination index 0.9—0.

4. Results

4.1. The *Oligochaeta* communities

The occurrence of 22 *Oligochaeta* species was observed in the investigated streams: 18 species in the Biała Woda and 11 in the Kamionka. It was striking that only two species belonged to the family *Tubificidae*, usually represented by large numbers of species in lowland streams and rivers. As many as 11 species belonged to the *Naididae* family, with the predominating *Nais bretscheri* and *N. alpina*. Such a large percentage of *Naididae* is characteristic for the fauna of mountain streams (K a s p r z a k 1979). Of the 6 identified *Enchytraeidae* species, *Proppapus volki* was the only aquatic form, while the remainder were amphibiotic of soil species. From the families *Lumbriculidae* and *Lumbricidae*, single specimens only being found in the samples.

At all stations *Oligochaeta* constituted a very small part of the bottom fauna (K o w n a c k i 1982). The smallets number was found at station K2 (22 specimens/2 dm³ of the substratum). At station BW1 the number of specimens reached 39/2 dm³, and at station BW2 it rose to 108 specimens/2 dm³.

At station BW1 *Nais bretscheri* (Table I), a polyrheophilous species (F o m e n k o 1972), characteristic for a stony bottom (K a s p r z a k, S z c z ę s n y 1976, W a c h s 1967), predominated. The subdominants

Table I. Composition of Oligochaeta communities in the investigated streams (according to the domination index)

Species \ Stream / Station	Biała Woda st.1	Biała Woda st.2	Kamionka st.2
Nais bretscheri Michaelsen, 1899	29.4	7.4	
- pardalis Piguet, 1906	3.2	7.1	
- alpina Sperber, 1948	2.0	33.8	10.9
- communis Piguet, 1906	0.2	7.1	2.3
Enchytraeidae juv.	3.9	0.01	0.04
Cernosvitoviella sp. Nielsen et Christensen, 1959	0.5	0.02	0.02
Nais variabilis Piguet, 1906	0.05		7.2
Tubificidae juv.	0.01		6.9
Cernosvitoviella atrata (Bretscher, 1903)	0.03		0.02
Enchytraeus buchholzi Vejdovsky, 1879	0.003		0.02
Chaetogaster diastrophus (Gruithuisen, 1828)	0.03		
Henlea sp. Michaelsen, 1889	0.01		
Mesenchytraeus armatus Levinsen, 1884	0.003		
Cernosvitoviella carpatica (Bretscher, 1903)	0.003		
Marionina argentea (Michaelsen, 1889)	0.05	0.006	
Lumbriculus variegatus (Müller, 1773)	0.03	0.06	
Propappus volki Michaelsen, 1916		0.06	
Pristina idrensis Sperber, 1948		0.07	
Naididae juv.		0.03	
Stylodrilus heringianus Claparede, 1862		0.02	
Eiseniella tetraedra (Savigny, 1826)		0.003	
Lumbricidae juv.		0.003	
Nais elinguis Müller, 1773		0.002	0.003
Pristina rosea (Piguet, 1906)		0.003	0.7
- menoni (Aiyer, 1929)			3.0
Tubifex ignotus (Stolc, 1886)			0.04
- tubifex (Müller, 1773)			0.009
Pristina foreli Piguet, 1906			0.02

were: *Nais alpina*, a species typical for mountain streams (Sperber 1948, Giani 1976) juvenile *Enchytraeidae* forms, and *N. pardalis*, an α-mesorheophilous species (Fomenko 1972) encountered in different water courses, frequently with *N. bretscheri*. Also among adominants, species of the family *Enchytraeidae* predominated. The abundant occurrence of *Enchytraeidae* is characteristic for the spring zone and the upper course of streams (Dumnicka 1976, Kasprzak, Szczęsny 1976).

The pattern of domination changed slightly at station BW2. *Nais alpina* predominated while *N. bretscheri*, *N. pardalis*, and *N. communis*, which occurred in large numbers at the previous station, appeared here as subdominants. The last species prevailed in the upper course of the River Fulda, on a gravelly bottom (Wachs 1967). It has frequently been found in the spring zones of rivers (Kasprzak, Szczęsny 1976) also. As at station BW1, *Enchytraeidae* appeared among adominants while specimens of *Lumbriculidae*, other *Naididae* species (particularly of the genus *Pristina*) and a few *Lumbricidae* were observed.

In the Kamionka stream (station K2) *Nais alpina* with a low domination index, was found as the only dominant. The subdominants were more numerous. Among them, *Pristina menoni* is usually observed on a sandy-gravelly bottom (Kasprzak 1973, Learner et al. 1978) while *Tubificidae* are typical for lowland rivers. The other sub-dominants, *Nais communis* and *N. variabilis*, occur in mountain streams. Besides species of the family *Enchytraeidae*, *Tubificidae* (*Tubifex tubifex* and *T. ignotus*) and two species of the genus *Pristina* appeared among adominants.

4.2. Seasonal changes

The variation of density throughout the year was examined only in *Nais alpina*, *N. bretscheri*, and *N. pardalis* (fig. 1). The maximum numbers of these species were observed in May. Only at station BW1 maximum numbers of *Nais bretscheri* did not appear before the beginning of July. This delay may have been caused by lower temperatures at this station, since the average annual temperature of the water was by 1° lower than that at station BW2. In August, after heavy rains, the water level rose and the abundance of species distinctly decreased. A small increase in number was observed in November. The variation of density was more irregular only in *Nais pardalis*. At station BW2 this species increased in number already in October and for the second time in February. Also at station BW1 the highest density was noted in February.

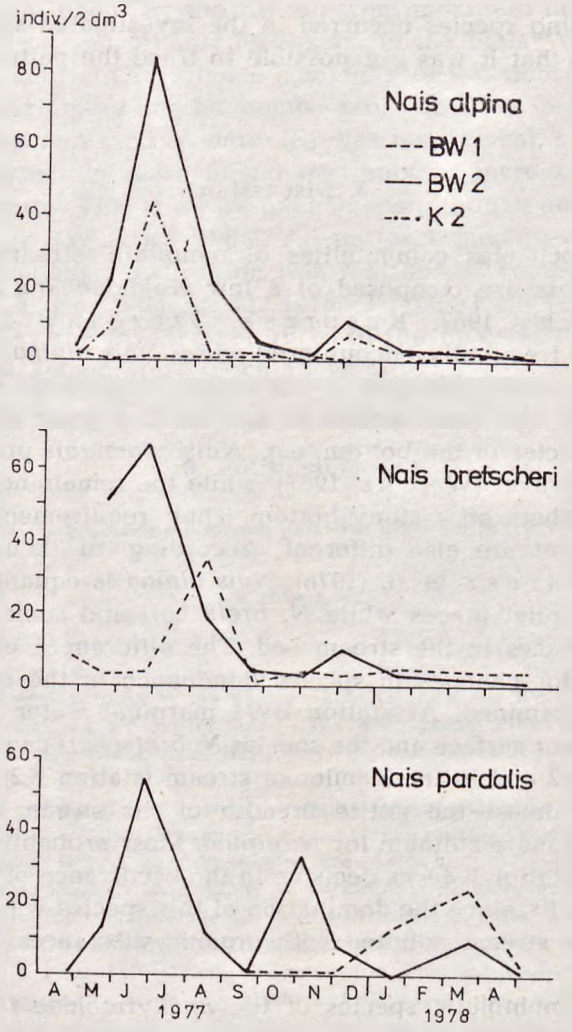

Fig. 1. Seasonal changes in the density of some *Oligochaeta* species in the investigated streams. BW1 — the Biała Woda stream, station 1; BW2 — the Biała Woda stream, station 2; K2 — the Kamionka stream, station 2

All the discussed species were sexually reproduced. Mature specimens of *Nais alpina* occurred in July and August. *Nais bretscheri* and *N. pardalis* matured very late in the investigated streams, specimens with developed genital organs being encountered in October and November, and of *N. pardalis* even in February. Among the collected specimens of this species about 80% had developed genital organs, while among *Nais alpina* and *N. bretscheri* mature specimens constituted a small percentage.

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