BADANIA FIZJOGRAFICZNE
R. II – SERIA C – ZOOLOGIA (C52) str. 007–012

# PRELIMINARY DATA ON CRUSTACEAN ZOOPLANKT ON COMMUNITIES IN EPHEMERAL WATER BODIES OF THE BIEDRUSKO MILITARY AREA (W POLAND)

KAROLINA KOPERSKA, KRYSTYNA SZYBIAK

Department of General Zoology, Adam Mickiewicz University,
Umultowska 89, 61-614 Poznań, Poland

**Abstract:** Two puddles on a tank Road in Biedrusko military range were sampled monthly for the structure and dynamics of planctonic crustacean communities. The pools differed in their hydroperiod – one was relatively permanent, with notable fluctuations in the water level, whereas the second was ephemeral, drying out at least four times a year. Composition of crustacean zooplankton assemblages during particular samplings was fairly similar – in both puddles five species were found, including two cladocerans and three copepods. Only one species occurred exclusively in the more permanent pool. The dominance structure during each sampling was also very similar. Fluctuations in numbers of Cladocera and Copepoda were clearly higher in the ephemeral pool, where sudden peaks of zooplankton abundance were observed. In the more permanent puddle clear trends in changes of crustacean assemblages could be observed. Cladocerans were typical of summer and their abundance slowly decreased towards winter. Numbers of Copepoda was highest in winter and lowest in summer, reaching moderate values during the autumn and spring months.

**Keywords:** Crustacea, Cladocera, Copepoda, zooplankton, puddle, temporary water, hydroperiod

## INTRODUCTION

Temporary water bodies in the temperate European zone belong to the group of extremely interesting, yet poorly studied freshwater ecosystems. Among them, ephemeral pools like puddles on the dirt roads are even less recognized. The ecosystems of such marginal habitats are important most of all because of their extreme environmental conditions resulting in the unique composition of their invertebrate communities. Only the most specialized and hardy species are able to survive and effectively reproduce under conditions of unpredictable changes in temperature, oxygen concentration, pH and other environmental factors. Most of all however, species inhabiting ephemeral pools have to develop mechanisms ensuring survival of the population during dry periods and fast recolonisation after successive flooding events. Such highly specialized species often occur only under those unique conditions, the best example being the crustaceans from the paraphyletic group of large branchiopods. Since such marginal ecosystems rapidly disappear from the agricultural landscape in most of the European countries, their characteristic species are severely threatened

by the loss of suitable habitats. This situation is best documented in the case of the above-mentioned large branchiopods, shrinking their once wide distribution to the limited areas where temporary pools and puddles are still abundant. In the conditions of central Europe such last posts of biodiversity in temporary pools are often connected with military areas where large, muddy puddles are still well preserved, due to the activities of military vehicles. Data on the composition and functioning of such ecosystems are however very scarce and are limited most of all to the spectacular group of large branchiopods. The only data on the zooplankton communities of puddles in military areas come from the study of Maier et al. (1997) conducted on the tank range near Ulm in southern Germany.

The aim of the present study was to assess the composition and fluctuations in the abundance of zooplankton crustacean communities in two puddles differing in their hydroperiod length.

## MATERIAL AND METHODS

Both pools are located on the tank road within the confines of the Biedrusko military range (W Poland, 52°30'20'' N; 16°55'50'' E). The ecosystems of the puddles studied are typical of well preserved temporary pools, as both are inhabited by two species of endangered large branchiopod crustaceans: *Branchipus schaefferi* Fischer 1834 (Anostraca) and *Triops cancriformis* (Bosc., 1801) (Notostraca). Puddle no. 247 is very ephemeral, drying 4 – 5 times a year under conditions of average precipitation. On the contrary, pool no. 201 is semi-permanent, totally drying out only in years of severe drought, but characterized by high fluctuations of the water level. Both puddles are devoid of higher vegetation and the water is usually very cloudy due to the vehicle driving activities.

Samples for zooplankton analysis were collected once a month, starting from 3rd April 2009, ending on 8th March 2010. Each time ten liters of water were collected and thickened using a planktonic net with a mesh of 45 μm to a volume of ca. 100 ml. The samples were preserved by adding 4% of formaldehyde and examined under light microscope for presence and numbering of planktonic crustaceans. Species determination was performed following the keys of Flößner (1972), Amoros (1984) and Rybak and Błędzki (2005). Detailed determination of the particular species abundance was performed only for samples collected in April, July, October and January, for the other samples only the general abundance of Cladocera and Copepoda was estimated.

In total 20 such samples were analysed, twelve from the more permanent pool no. 201 and eight from the ephemeral puddle no. 247. The second pool was not sampled in May and August since it remained dry in that period and in January and February, when the water was frozen solid.

## RESULTS AND DISCUSSION

During the study period six species of crustacean zooplankton were found, including two species of Cladocera (*Daphnia pulex* Leydig 1860 and *Moina brachiata* (Jurine 1820)) and four taxa of Copepoda (*Cyclops furcifer* Claus 1857, *Cyclops vicinus* Ulianine 1875, *Eucyclops serrulatus* (Fischer 1851) and *Acanthocyclops* sp.). Almost all the species occurred in both puddles with one exception for *E. serrulatus*, found only in pool no. 201 (Tab. 1).

Table 1. Species composition in the temporary pools studied

| Date set | Cladocera | | Copepoda | |
|---|---|---|---|---|
| | Pool 201 | Pool 247 | Pool 201 | Pool 247 |
| March | 2 x Cladocera | 4 x Cladocera | 9 x *Cyclops furcifer*<br>1 x *Acanthocyclops* sp. | 4 x *Cyclops vicinus*<br>3 x *Cyclops furcifer*<br>1 x *Acanthocyclops* sp.<br>2 x copepodit *Cyclops* |
| July | 2 x *Moina brachiata*<br>8 x *Daphnia pulex* group | 6 x *Moina brachiata*<br>4 x *Daphnia pulex* group | 7 x *Cyclops vicinus*<br>1 x *Cyclops furcifer*<br>2 x copepodit *Cyclops* | 6 x *Cyclops vicinus*<br>1 x *Cyclops furcifer*<br>3 x copepodit *Cyclops* |
| October | 1 x *Moina brachiata*<br>9 x *Daphnia pulex* group | 10 x *Daphnia pulex* group | 9 x *Cyclops vicinus*<br>1 x *Eucyclops serrulatus* | 10 x *Cyclops vicinus* |
| January | 10 x *Daphnia pulex* group | frozen | 10 x copepodit *Cyclopoida* | frozen |

Samples collected in spring (March–June) were very scarce in Cladocera with abundance of this group not exceeding 1.3 specimens per liter (Fig. 1). In July a sudden increase in numbering of cladocerans occurred, with 140 specimens/l in pool no. 201 and 239 spec./l in puddle no. 247. The highest abundance of Cladocera in the more stable water body was recorded in September (150 spec./l) while in the ephemeral one the representatives of this order were most abundant in November (398 spec./l). In general, numbers of cladoceran were more stable in pool no. 201, where it remained on the same level through the summer months and slowly decreased in autumn. In the ephemeral pool no. 247 sudden changes in abundances were recorded in the respective periods. In both puddles numbers of cladocerans decreased in winter and only a relatively small peak of abundance was recorded in pool no. 201 in January and February.

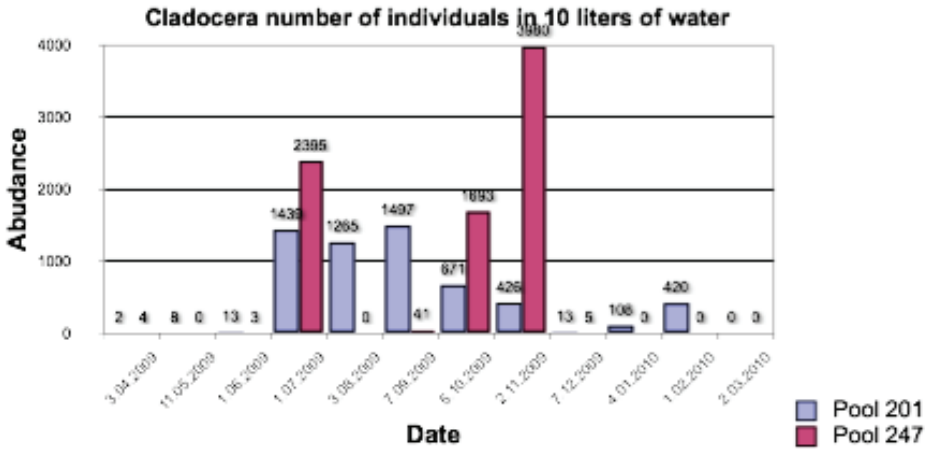


Fig. 1. Abundance of Cladocera

Among the two cladoceran species recorded during the study the more frequent one was *D. pulex*, found in all the samples determined to the species level (Tab. 1). *M. brachiata* was found only in the summer samples (July and October). In almost all cases *D. pulex* was also the more abundant species.

The pattern of changes in abundance of Copepoda in the pools studied was different than in the case of Cladocera (Fig. 2). The lowest abundances in both water bodies were recorded in late summer and early autumn, while the highest values were recorded in the remaining seasons. In pool no. 201 the numbering

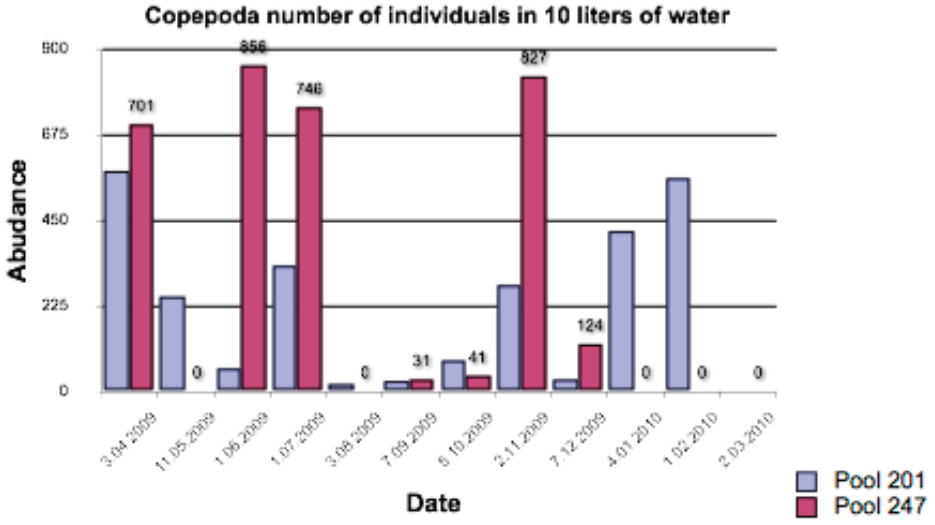


Fig. 2. Abundance of Copepoda

of Copepoda was the highest in winter and spring (maximum of 58 spec./l in March) slowly decreasing to 2 spec./l in August. In the ephemeral pool no. 247 the abundance changed more rapidly, with highest values in summer, late autumn and spring (maximum 86 spec./l in June) and the lowest in autumn (3 spec./l in September).

In the spring samples, the copepod assemblage was dominated by C. furcifer and *Acanthocyclops sp*. in both puddles. The presence of C. furcifer was also still observed in summer, the species was however accompanied by *C. vicinus* dominating the assemblage. The last mentioned species also dominated in autumn. In the winter samples from the more permanent puddle which did not freeze completely, only undetermined copepodits of the Cyclopoida family were found. *Eucyclops serrulatus* was observed only once, in October, in the more permanent pool.

Both the low number of taxa and high fluctuations in the density and assemblage structure observed during the present study are typical features of invertebrate communities of ephemeral bodies of water (Williams 2006). The crustacean taxa recorded during the present study could be divided into two groups. The first one includes ubiquitous species known from a wide range of habitats. Among the species found in the puddles sampled, *D. pulex*, *E. serrulatus* and *C. vicinus* occur in big lakes as well as in ponds and small astatic water bodies. On the other hand, the second group includes narrow range specialists, characteristic oftemporary waters. One of them is *M. brachiata*, which is believed to be relatively rare in Poland. In ephemeral pools in Hungary it is one of the most common species (Forró 1997) and it was also reported from the puddles in a military area in Southern Germany (Maier et al. 1997). Another specialist recorded during the present study dominating the crustacean assemblages of both puddles in Spring is *C. furcifer*. The species is typical of astatic and ephemeral bodies of water. It can survive a long period of desiccation in the form of resistant eggs as well as diapausing adults. The same as in the case of *M. branchiata*, the species was recorded in puddles on tank roads in Germany (Maier et al. 1997).

## ACKNOWLEDGMENTS

The research was partially financed by the Polish Ministry of Science and Higher Education grant no. NN 304 3400 33.

## LITERATURE

Amoros C. 1984: Introduction pratique à la systematique des organismes des eaux continentales Françaises. Crustaces cladocers. *Bull. Mens. Soc. Linn. Lyon*, 53:1–63

Flößner D. 1972: Krebstiere, Crustacea. Kiemen – und Blattfüsser, Branchiopoda, Fischläuse, Branchiura. Gustav Fischer Verlag, Berlin.
Forró L. 1997: Mating behaviour in *Moina brachiata* (Jurine, 1820) (Crustacea, Anomopoda). Hydrobiol., 360(1–3): 153–159.
Maier G., Hössler J., Tessenow U. 1998: Succession of physical and chemical conditions and of crustacean communities in some small, man made water bodies. International Review of Hydrobiology, 83(5–6): 405–418.
Rybak J.I., Błędzki L.A. 2005: Widłonogi, Copepoda: Cyclopoida, Klucz do oznaczania. Biblioteka Monitoringu Środowiska, Inspekcja Ochrony Środowiska, Warszawa, 127 pp.
Williams D.D. 2006: The Biology of Temporary Waters. Oxford Univ. Press.

## WSTĘPNE DANE DOTYCZĄCE ZGRUPOWAŃ SKORUPIAKÓW PLANKTONOWYCH, OKRESOWYCH ZBIORNIKÓW WODNYCH NA CZOŁGOWISKACH POLIGONU W BIEDRUSKU

### Streszczenie

Badaniom poddane zostały dwa okresowe zbiorniki wodne na czołgowiskach poligonu w Biedrusku. Próby do badań pobierano w comiesięcznych odstępach, od 3 kwietnia 2009 r. do 2 marca 2010 r. Oba zbiorniki różniły się pod względem długości trwania hydroperiodu (fazy mokrej). Jeden zbiornik był stosunkowo stały, ze znacznymi wahaniami poziomu wody, z kolei drugi wysychał, co najmniej cztery razy w roku.

Skład gatunkowy w obu badanych zbiornikach był bardzo podobny. Stwierdzono występowanie dwóch gatunków *Cladocera*, należących do dwóch rodzin, trzech gatunków *Copepoda* oraz należący do widłonogów *Acantocyclops* sp. Jeden gatunek – *Eucyclops serrulatus* pojawił się tylko raz w bardziej stałym zbiorniku. Wahania w liczebności *Cladocera* i *Copepoda* były znacznie wyższe w mniej stałym zbiorniku. Znaczny wzrost liczebności podgromady *Cladocera* zaobserwować można było w okresie letnim, a ich spadek odnotowywany w okresie zimowym. Wzrost liczebności podgromady *Copepoda* następował w okresie zimowym, a spadek był latem, uzyskując umiarkowane wartości w okresie jesienno-wiosennym.