

Rotifer distribution in relation to temperature and oxygen content

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Abstract

Lunzer Obersee, a small lake located at an altitude of 1100 m above sea level, was investigated from July 1985 to October 1987. The rotifer community consists of 7 dominant species, 7 subdominant species and 34 species which occasionally occurred in the plankton. The dominant species show rather different demands in relation to temperature and oxygen content; e.g.: *Filinia hofmanni* was found at a wide range of oxygen concentrations ($0.6\text{--}13.3\text{ mg O}_2\text{ l}^{-1}$) and low temperatures ($4\text{--}6\text{ }^{\circ}\text{C}$), living in the upper water layers (1–7 m) during spring and in the deeper, anoxic zone in summer. In contrast, *Asplanchna priodonta* was found at rather high oxygen contents ($>9\text{ mg O}_2\text{ l}^{-1}$), and showed a wide range of temperature tolerance ($4\text{--}15\text{ }^{\circ}\text{C}$).

On the basis of field data the temperature and oxygen requirements of several species are described and discussed.

Introduction

Temperature and oxygen content are key factors in restricting rotifer occurrence. Physiological and population parameters are influenced by temperature, and the population development of rotifers is limited by the combined effect of oxygen concentration and temperature (Herzig, 1987). The present study is based on field data and describes and discusses the requirements of different rotifer species in relation to these important physical parameters.

The lake

Lunzer Obersee is a small lake situated at an altitude of 1100 m above sea level. The area of the lake is 0.144 km^2 , 44% of the surface being

covered by quaking bogs. There are five basins. In the main basin the maximum depth is 15.5 m; the mean depth of the lake is about two meters.

Methods

From July 1985 to October 1987 samples were taken at the main basin from the surface to a depth of 14 m at one meter intervals using a 10 l Schindler sampler. Samples were concentrated by filtering through a 0.034 mm mesh size net. Using the Winkler method oxygen content and temperature were measured simultaneously at each sampling date. Except during the time of ice-cover, samples were taken biweekly. In winter the sampling interval was extended to about one month.

Temperature and oxygen content

After ice thaw, usually at the end of April or beginning of May, a rapid temperature increase occurs in the topmost water layers and inhibits complete mixing. The spring turnover reaches a water depth of only about 7 m and the chemocline becomes established in 9-10 m (Fig. 1).

In general the temperature of the lower stratum (10-14 m) never rose above 5 °C. The temperature of the middle stratum (5-10 m) always remained below 10 °C.

Rapid cooling in October and November resulted in a uniform temperature profile (4-5 °C). The intensity of the autumnal turnover primarily depends on the duration of the homothermous period and the wind intensity during this period.

Planktonic rotifers

The rotifer community consists of 7 dominant species, 7 subdominant species and 34 species which occasionally occurred in the plankton but were usually confined to the littoral or benthic zone.

Only *Keratella cochlearis* is a perennial and forms two maxima. The more significant one occurs in summer (July/August); the second one is in winter (January/March). All the other

species are monocyclic. The seasonal occurrence and abundance of the different species is shown in Table 1.

Occurrence and abundance of different species in relation to temperature and oxygen content.

The analysis of the relationship between these two parameters and the occurrence of each species was restricted to samples containing more than 5 ind. l^{-1} (*Synchaeta pectinata*, *Asplanchna priodonta* and *Filinia hofmanni*) and 10 ind. l^{-1} (*Polyarthra dolichoptera*, *Ascomorpha ecaudis* and *Keratella hiemalis*), respectively. Because of the high densities of *Keratella cochlearis*, only samples containing more than 100 ind. l^{-1} were used for analysis.

F. hofmanni and *K. hiemalis* were most abundant at low temperatures (<7.5 °C) under a wide range of oxygen concentrations. Both species inhabited the upper layers (0-7 m) during spring and migrated to the deeper, deoxygenated zone in summer. *P. dolichoptera* and *S. pectinata* preferred waters with a high oxygen content but developed at a wide range of temperatures (> 8.7 mg $O_2 l^{-1}$, 5.5-16.0 °C for *P. dolichoptera*; > 9.1 mg $O_2 l^{-1}$, 5.1-12.7 °C for *S. pectinata*). Both species were restricted to the upper water layers (0-6 m). As the preceding two species, *A. priodonta* showed a wide range of temperatures being tolerated (6.8-15.4 °C) and – apart from a few samples – high numbers were found at oxygen contents

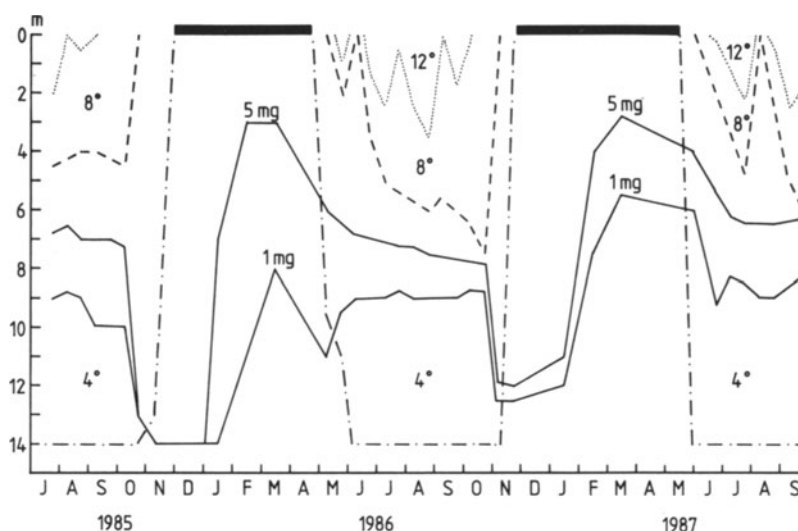


Fig. 1. Temperature and oxygen content in Lunzer Obersee during the years 1985-1987. The isopleths of 5 and 1 mg $O_2 l^{-1}$ and the isotherms of 4, 8 and 12 °C are shown. Black bars indicate ice-cover.