HORIZONTAL DISTRIBUTION AND DENSITY VARIATION OF EUDIAPTOMUS GRACILIS (COPEPODA, DIAPTORIDAE) IN THE BICAZ RESERVOIR

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Abstract. The copepod Eudiaptomus gracilis (Sars, 1863), identified for the first time in the 19th year of the Bicaz Reservoir existence, had so far an increasing in density. In order to study the present horizontal distribution and density of this species, we have taken quantitative and qualitative zooplankton samples, from November 2006 to October 2007. In the fifth decade of this oligo-mesotrophic reservoir existence, Eudiaptomus gracilis is a wide spread and dominant species in the planktonic crustacean populations from this ecosystem.

Keywords: Eudiaptomus gracilis, Bicaz Reservoir, horizontal distribution, density.

Rezumat. Distribuția orizontală și variația densității speciei Eudiaptomus gracilis (Copepoda, Diaptomidae) în lacul Bicaz. Copepodul Eudiaptomus gracilis (Sars, 1863), identificat pentru prima dată la 19 ani după formarea lacului Bicaz, a avut până în prezent o densitate ascendentă. Pentru a studia distribuția orizontală și densitatea acestei specii la momentul actual s-au efectuat prelevări calitative și cantitative de zooplancton în perioada noiembrie 2006 – octombrie 2007. După cinci decenii de existență a acestui lac de acumulare, Eudiaptomus gracilis este o specie larg răspândită și dominantă în cadrul comunităților de crustacee planctonice din acest ecosistem.

Cuvinte cheie: Eudiaptomus gracilis, lacul de acumulare Bicaz, distribuție orizontală, densitate.

Introduction

The Bicaz Reservoir (Eastern Carpathians, Romania) was created in 1960 by damming the Bistrița River at Izvoru Munteleului. After five decades, Miron et al. (2010) noted the preservation of the oligotrophic state of water associated with a present trend towards mesotrophy in this reservoir.

The development of the zooplanktonic communities in the Bicaz Reservoir during the first decades of the lake existence was studied by Miron (1963), Miron & Grasu (1964a, 1964b), Corneanu (1972), Rujinschi & Rujinschi (1983) and Mustată et al. (1999a, 1999b). These published works show that in the reservoir, were identified 48 zooplanktonic species in 1968, 46 in 1974 and 51 in 1978 (Rujinschi & Rujinschi, 1983).

The copepod Eudiaptomus gracilis has been identified only beginning with 1979 (Rujinschi & Rujinschi, 1983), becoming a constant component of the zooplanktonic communities.

Eudiaptomus gracilis is a filter-feeding calanoid copepod, feeding on algae, protozoans and detritus particles (Monakov, 2003). This paper analyses the present horizontal distribution and density variations of Eudiaptomus gracilis in the Bicaz Reservoir.

Material and Methods

The Bicaz Reservoir develops great level variations inducing high fluctuations of maximum depth (55.2 – 90.2 m), length (20.3 – 33.3 km), surface (16 – 31.25 km²) and volume (339.5 – 1200 x 10⁶ m³) (Miron, 1973, 1983). This temperate reservoir has dimictic characteristics with summer direct stratification. Bicaz Reservoir receives water
from two main tributaries, Bistrița and Bistricioara rivers and from other seven small permanent streams, on both right and left sides. In the lower part of the reservoir, four fish floating farms are developed, using the trout aquaculture biotechnologies.

Nine sampling sites were established (Fig. 1), five of them located in some tributary outlets (S4, S6, S7, S8, S9) and four situated in the pelagic zone of the Bicaz Reservoir (S1, S2, S3, S5). The samples were taken monthly, during the day time, between November 2006 and October 2007.

**Figure 1.** Sampling sites on the Bicaz Reservoir: S1 – Dam, S2 – Floating farms Potoci, S3 – Ruginești, S4 – Buhănița, S5 – Hangu Plane, S6 – Hangu, S7 – End of the lake, S8 - Izvorul Alb, S9 – Secu.

Quantitative and qualitative zooplanktonic samples were collected using a Van Dorn drum 5 liters capacity and a plankton net 100μm mesh size. Samples were preserved in the 96% ethanol and analyzed using an Optika stereomicroscope and compound microscope. *Eudiaptomus gracilis* was taxonomically identified, according to Damian – Georgescu (1966) and Dussart & Defaye (2000). The counting was made using a Ward counting wheel. The density has been expressed in number of individuals/cubical meter (ind./c.m).

The sampling protocols were developed at the Potoci ACVAPUR Laboratory, belonging to the “Alexandru Ioan Cuza” University of Iași. Field observations and sampling were made using the research boat and other equipment of this laboratory.

**Results and Discussion**

Analyzing the samples collected from the Bicaz Reservoir during this 12 month period, we obtained the data presented in table 1 and figure 1.
Table 1. *Eudiaptomus gracilis* densities (ind./c.m.).

<table>
<thead>
<tr>
<th>Sites Date</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
<th>S5</th>
<th>S6</th>
<th>S7</th>
<th>S8</th>
<th>S9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov.</td>
<td>1686</td>
<td>3333</td>
<td>1967</td>
<td>8500</td>
<td>4360</td>
<td>8200</td>
<td>47400</td>
<td>9000</td>
<td>9600</td>
</tr>
<tr>
<td>Dec.</td>
<td>1800</td>
<td>3233</td>
<td>667</td>
<td>4000</td>
<td>6550</td>
<td>20600</td>
<td>0</td>
<td>1400</td>
<td>13600</td>
</tr>
<tr>
<td>Jan.</td>
<td>1286</td>
<td>1567</td>
<td>3750</td>
<td>4500</td>
<td>3500</td>
<td>1500</td>
<td>0</td>
<td>3000</td>
<td>2000</td>
</tr>
<tr>
<td>Mar.</td>
<td>316</td>
<td>305</td>
<td>138</td>
<td>42</td>
<td>372</td>
<td>57</td>
<td>229</td>
<td>85</td>
<td>212</td>
</tr>
<tr>
<td>Apr.</td>
<td>102</td>
<td>823</td>
<td>131</td>
<td>85</td>
<td>133</td>
<td>127</td>
<td>134</td>
<td>45</td>
<td>29</td>
</tr>
<tr>
<td>May</td>
<td>348</td>
<td>301</td>
<td>184</td>
<td>234</td>
<td>212</td>
<td>0</td>
<td>64</td>
<td>212</td>
<td>616</td>
</tr>
<tr>
<td>Jun.</td>
<td>426</td>
<td>146</td>
<td>566</td>
<td>637</td>
<td>372</td>
<td>1592</td>
<td>106</td>
<td>212</td>
<td>637</td>
</tr>
<tr>
<td>Jul</td>
<td>1963</td>
<td>3487</td>
<td>1587</td>
<td>507</td>
<td>1380</td>
<td>318</td>
<td>38</td>
<td>531</td>
<td>596</td>
</tr>
<tr>
<td>Aug.</td>
<td>1367</td>
<td>909</td>
<td>675</td>
<td>637</td>
<td>728</td>
<td>70</td>
<td>0</td>
<td>318</td>
<td>64</td>
</tr>
<tr>
<td>Sep.</td>
<td>1154</td>
<td>3079</td>
<td>2389</td>
<td>1964</td>
<td>1558</td>
<td>1805</td>
<td>0</td>
<td>425</td>
<td>210</td>
</tr>
<tr>
<td>Oct.</td>
<td>354</td>
<td>643</td>
<td>700</td>
<td>2707</td>
<td>994</td>
<td>2813</td>
<td>2335</td>
<td>318</td>
<td>424</td>
</tr>
</tbody>
</table>

Figure 2. Horizontal distribution and density variation of *Eudiaptomus gracilis* in the Bicaz Reservoir.

*Eudiaptomus gracilis* was present in almost 95% of samples, on the entire surface of the Bicaz Reservoir, in the pelagic zones and also in the tributary outlet areas.

The greatest densities were observed during the cold months (November – February) with a maximum value in November in the S7 sampling site where the main tributary of the Bicaz Reservoir (the Bistrița River) flow in, bringing great quantities of particulate and dissolved organic matter. The *Eudiaptomus gracilis* high densities may be
correlated also with the maximal density of the zooplankton communities, observed by Erhan (2009). This result corresponds to the transition from fall turnover to winter inverse thermal stratification. Between March and June, period corresponding to the spring turnover during monothermy stage until the summer direct thermal stratification, the density of *Eudiaptomus gracilis* is low with a uniform distribution in the lake. During the direct summer thermal stratification, the density values of the *Eudiaptomus gracilis* are between the lower spring and higher fall-winter values.

**Conclusions**

Even if it was identified later than other component of the zooplanktonic communities, *Eudiaptomus gracilis* became a dominant species in the Bicaz Reservoir. During this study period (November 2006 – October 2007), this species was constantly recorded throughout the year in all sampling sites as being the most abundant species. Its maximum density corresponds to the transition from fall turnover to winter inverse thermal stratification. The minimum density is correlated with the spring turnover in the monothermy stage.

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**References**


