

## SINECOLOGICAL ANALYSIS OF PLANKTON IN BICAZ LAKE

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### Abstract

The aim of this work was to realize a sinecological analyses of a freshwater pool by analytical determination of environmental indicators (abundance, constancy, dominance) and synthetic organic indicators such as the index of ecological significance. Research has been organized in the summer of 2011, for a period of 45 days, respectively May and first half of June. For sinecological analyses the collection of plankton were made weekly, and the formalised samples were brought to the Hydrology Laboratory of Animal Husbandry Faculty, where were made the quantitative and qualitative determinations of planktonic species in the freshwater's lake investigated. In the summer of 2011, every week they have taken water samples to determine the structure and abundance of plankton in the Bicaz Lake. Water samples taken from the basin were fixed immediately with 3% formalin solution and then were transported to the laboratory for qualitative and quantitative determinations. Processing laboratory was to their sedimentation for 21 days and centrifuging at 1500 rpm/min., for 5 minutes. Numerical assessment and species identification was made in the laboratory with a microscope HC 1, using a counting camera. After quantitative determination of planktonic organisms which belong to different systematic groups, we reporting results to the initial volume of water and determined the total density of plankton. Based on the data obtained were calculate the analytical indicators: abundance, constancy and dominance and ecological indicators of the synthetic index of ecological significance. From the Bicaz Lake investigated in summer 2011 were collected a total of 10939 phytoplankton individuals, belonging to four systematic groups with 15 taxons and a number of 6289 zooplankton individuals, enrolled in four classes with 13 taxons. After determining the structure of phytoplankton observed that the most abundant were euglenofitele followed by cianofite and diatoms, while chlorophytes were less numerous. On zooplankton structure determinations showed that the highest abundance were rotifers followed by cladocere and the least abundant being copepoda.

**Key words:** analyze, plankton, abundance, dominance

### INTRODUCTION

Aim of this research was to do a sinecological analyze in a pool with fresh water by analytical determination of environmental indicators (abundance, constancy, dominance) and synthetic organic indicators such as the index of ecological significance.

Research has been organized in the summer of 2011, for a period of 45 days, respectively May and first half of June. The collections of plankton in the aim of sinecological analyze were made weekly, and the samples with formalin solution were brought to the

Laboratory of Hydrology from Faculty of Animal Sciences, and were made quantitative and qualitative determinations of planktonic species from the aquatic basin investigated.

### MATERIAL AND METHODS

Research has been done in the summer of 2011, with weekly collection of water samples for determining the structure and abundance of plankton in the Bicaz Lake. The samples collected were fixed immediately with 3% formalin solution and then were transported to the laboratory for qualitative and quantitative determinations. Processing laboratory was to their sedimentation time of 21 days and centrifugation at 1500 rpm for 5 minutes. Numerical assessment and species

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identification was made in the laboratory with a microscope HC1, on the counting room. After quantitative determination of planktonic organisms, which belong to different systematic groups and reporting results to the initial volume of water, we could determine the total density of plankton. Based on data obtained were calculated analytical indicators: abundance, constancy and dominance and from the ecological indicators the synthetic index of ecological significance

These indicators were calculated using the formula:

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These indicators were calculated using formulas:

$$C_A = \frac{npA}{N_p} \times 100$$

$$D_A = \frac{nA}{N} \times 100$$

$$W = \frac{C_A \cdot D_A}{100} \times 100$$

where:

$C_A$  = constancy A

$D_A$  = dominance of species A

$W_A$  = index of ecological significance of species A

q = index of affinity cenotic

$n_pA$  = number of samples in which the species has

$N_p$  = total number of samples

$n_A$  = number of individuals of species A

N = total number of individuals

a = number of samples in which the species

b = number of samples where the species is b

c = number of samples where both species are simultaneously

As for consistency, species distribution classes were under its classes. Thus:

$C_1$  = include accidental species corresponding to 0-25%

$C_2$  = accessories includes species corresponding to 25.1 to 50%

$C_3$  = constant includes species corresponding to 50.1 to 75%

$C_4$  = euconstant includes species corresponding to 75.1 to 100%

Regarding dominance, species distribution classes was under its classes. Thus:

$D_1$  = sub-recendence includes species (values less than 1.1%)

$D_2$  = recendence includes species (values between 1.1 - 2%)

$D_3$  = subdominant includes species (2.1 to 5% range from)

$D_4$  = include dominant species (range from 5.1 to 10%)

$D_5$  = dominant includes species (values greater than 10%)

Ecological significance on the index, according to the values obtained, species were employed in the following classes:

$W_1$  = values less than 0.1%

$W_2$  = values between 0.1 - 1%

$W_3$  = values ranging between 1.1 - 5%

$W_4$  = values ranging from 5.1 to 10%

$W_5$  = values greater than 10%

Class  $W_1$  = corresponds to accidental species

Classes  $W_2$  and  $W_3$  = classes correspond injured species

Classes  $W_4$  and  $W_5$  = corresponding classes of species characteristic

## RESULTS AND DISCUSSIONS

Following investigations into the lake Bicaz, were first identified in the sample collected the phytoplankton and zooplankton species, after which we determined abundance, dominance, constancy and ecological significance index. Research on the abundance, dominance, constancy and ecological significance of phytoplankton and zooplankton indexes from the aquatic basin studied are presented in Tables 1, 2, 3, 4 and Figures 1 and 2.

Table 1 Phytoplankton species distribution and abundance samples in Lake Bicaz

Species	The presence of species samples						Amount of evidence	*A.	
	May					June			
	1	2	3	4	5	1			2
<b>Cyanophyta</b>	<b>232</b>	<b>326</b>	<b>293</b>	<b>354</b>	<b>365</b>	<b>331</b>	<b>256</b>		<b>2157</b>
<i>Anabaena variabilis</i>	+	+	+	+	+	+	+	7	1141
<i>Oscillatoria princeps</i>	+	+	+	+	+	+	+	7	531
<i>Rivullaria sp.</i>	+	+	+	+	+	+	+	7	485
<b>Bacillariophyta (Diatomee)</b>	<b>389</b>	<b>483</b>	<b>594</b>	<b>645</b>	<b>655</b>	<b>671</b>	<b>515</b>		<b>3952</b>
<i>Cymbella lanceolata</i>	+	+	+	+	+	+	+	7	1045
<i>Diatoma vulgare</i>	+	+	+	+	+	+	+	7	1483
<i>Fragillaria crotonensis</i>	+	+	+	+	+	+	+	7	956
<i>Synedra ulna</i>	+	+	+	+	+	+	+	7	468
<b>Euglenophyta</b>	<b>424</b>	<b>436</b>	<b>525</b>	<b>585</b>	<b>468</b>	<b>480</b>	<b>415</b>		<b>3333</b>
<i>Euglena polimorpha</i>	+	+	+	+	+	+	+	7	985
<i>Euglena gracilis</i>	-	-	+	+	+	+	+	5	1065
<i>Trachelomonas planctonica</i>	+	+	+	+	+	+	+	7	741
<i>Trachelomonas granulosa</i>	+	+	+	+	+	+	+	6	535
<b>Chlorophyta</b>	<b>153</b>	<b>182</b>	<b>213</b>	<b>147</b>	<b>330</b>	<b>320</b>	<b>152</b>		<b>1497</b>
<i>Vovox aureus</i>	+	+	+	+	+	+	+	7	544
<i>Coelastrum microporum</i>	+	+	+	-	+	+	+	6	450
<i>Hydrodictyon reticulatum</i>	-	-	+	-	+	+	+	4	179
<i>Ulothrix zonata</i>	-	-	-	-	+	+	+	3	95
<i>Oedogonium sp.</i>	+	+	-	+	+	+	-	5	229
<b>TOTAL INDIVIDUALS</b>									<b>10939</b>

\*A. - abundance

The data in Table 1 on the distribution and abundance of phytoplankton species in samples from Lake Bicaz show that in all 7 samples collected from group of Cyanophyta the most abundant species was *Anabaena variabilis*, followed by *Oscillatoria princeps* and *Rivullaria sp.* From the group of Diatoms, the most abundant was *Diatoma*

*vulgare*, and the least abundant species *Synedra ulna*. From Euglena species the most abundance was presented by *Euglena gracilis*, and the smallest abundance *Trachelomonas planctonica*. Concerning the Euglena species, the most abundant species was *Volvox aureus*, and the least abundant species was *Ulothrix zonata*.

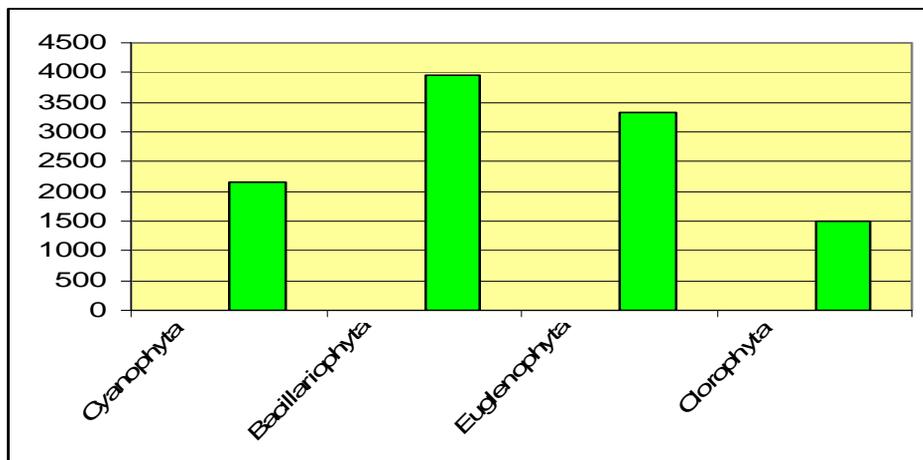


Figure 1. Phytoplankton species abundance of water bodies investigated

Table 2 Zooplankton species distribution and abundance samples in Lake Bicaz

Species	The presence of species samples						Amount of evidence	*A.	
	May			June					
	1	2	3	4	5	1			2
<b>Ciliophora</b>	<b>227</b>	<b>245</b>	<b>345</b>	<b>298</b>	<b>311</b>	<b>311</b>	<b>255</b>		<b>1192</b>
<i>Paramaecium aurelia</i>	+	+	+	+	+	+	+	7	997
<i>Tintinidium lacustris</i>	+	+	+	+	+	+	+	7	543
<i>Tintinidium fluviatilis</i>	+	-	+	+	+	+	+	6	452
<b>Cladocera</b>	<b>240</b>	<b>299</b>	<b>274</b>	<b>301</b>	<b>334</b>	<b>334</b>	<b>238</b>		<b>2020</b>
<i>Chydarus sphaericus</i>	+	+	-	-	-	-	-	2	144
<i>Daphnia cucullata</i>	+	+	+	+	+	+	+	7	695
<i>Daphnia longispina</i>	+	+	+	+	+	+	+	7	651
<i>Syda cristalina</i>	+	+	+	+	+	+	+	7	530
<b>Copepoda</b>	<b>77</b>	<b>101</b>	<b>127</b>	<b>132</b>	<b>152</b>	<b>146</b>	<b>58</b>		<b>793</b>
<i>Cyclops vicinus</i>	+	+	+	+	+	+	+	7	367
<i>Cyclops rubens</i>	+	+	-	-	+	+	-	4	132
<i>Eucyclops gracilis</i>		+	-	-	-	+	-	2	46
<i>Eucyclops serrulatus</i>	+	-	+	+	+	+	+	6	95
<i>Macrocyclus distinctus</i>	-	-	+	+	+	+	+	6	63
<i>Macrocyclus albidus</i>	+	+	-	-	+	+	-	6	32
<i>Paracyclops fimbriatus</i>	+	+	-	+	+	+	+	6	58
<b>Rotifera</b>	<b>225</b>	<b>320</b>	<b>358</b>	<b>340</b>	<b>402</b>	<b>351</b>	<b>288</b>		<b>2284</b>
<i>Brachionus calyciflorus</i>	+	+	+	+	+	+	+	7	867
<i>Keratella cochlearis</i>	+	+	+	+	+	+	+		694
<i>Keratella quadrata</i>	+	+	+	+	+	+	+	7	723
<b>TOTAL INDIVIDUALS</b>									<b>6289</b>

On the distribution and abundance of zooplankton samples, the data in Table 2 show that the group of ciliophora the most abundant species was recorded in *Paramaecium caudatum*, and lowest in *Tintinidium fluviatilis*. In the group of Cladocera the most abundant was *Cyclops*

*vicinus*, which was present in all 7 samples collected, unlike *Rubens Cyclops*, which was present in 4 samples and *Eucyclops gracilis* presented in only 2 samples. The other three species were present in 6 samples recorded a low abundance.

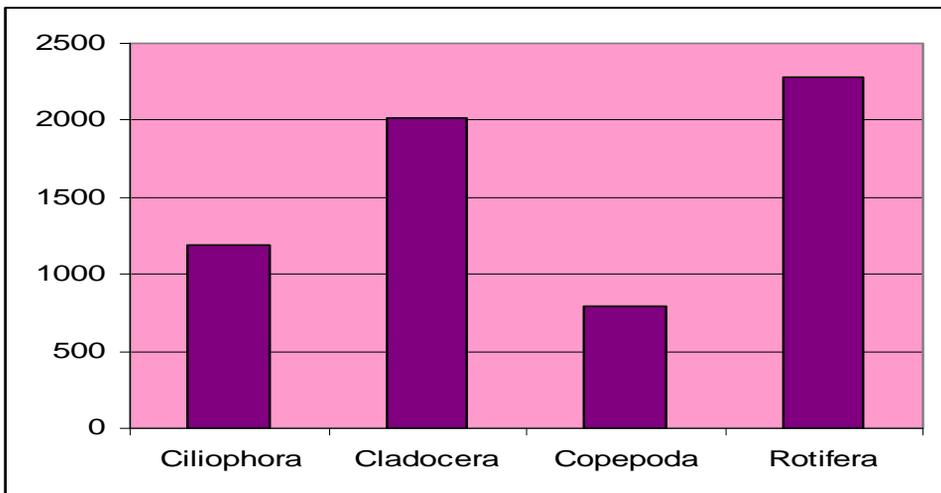


Figure 2. Zooplankton abundance in the water bodies investigated

Table 3 Constancy, dominance and ecological significance index of phytoplankton species in Lake Bicaz

Species	Abundanc (A) No. ind./dm <sup>3</sup>	Constancy (C)		Dominance (D)		Index of ecological significance (W)	
		%	Class	%	Class	%	Class
<b>Cyanophyta</b>	<b>2157</b>						
<i>Anabaena variabilis</i>	1141	100	C <sub>4</sub>	10.40	D <sub>5</sub>	10.40	W <sub>5</sub>
<i>Oscillatoria princeps</i>	531	100	C <sub>4</sub>	4.85	D <sub>3</sub>	4.85	W <sub>3</sub>
<i>Rivullaria sp.</i>	485	100	C <sub>4</sub>	4.43	D <sub>3</sub>	4.43	W <sub>3</sub>
<b>Bacillariophyta (Diatomee)</b>	<b>3932</b>						
<i>Cymbella lanceolata</i>	1045	100	C <sub>4</sub>	9.55	D <sub>4</sub>	9.55	W <sub>4</sub>
<i>Diatoma vulgare</i>	1483	100	C <sub>4</sub>	13.55	D <sub>5</sub>	13.55	W <sub>5</sub>
<i>Fragillaria crotonensis</i>	956	100	C <sub>4</sub>	8.73	D <sub>4</sub>	8.73	W <sub>4</sub>
<i>Synedra ulna</i>	468	100	C <sub>4</sub>	4.27	D <sub>3</sub>	4.27	W <sub>3</sub>
<b>Euglenophyta</b>	<b>3333</b>						
<i>Euglena polymorpha</i>	985	100	C <sub>4</sub>	9.00	D <sub>4</sub>	9.00	W <sub>4</sub>
<i>Euglena gracilis</i>	1065	71	C <sub>3</sub>	9.73	D <sub>4</sub>	7.05	W <sub>4</sub>
<i>Trachelomonas planctonica</i>	741	100	C <sub>4</sub>	6.77	D <sub>4</sub>	6.77	W <sub>4</sub>
<i>Trachelomonas granulosa</i>	535	85.7	C <sub>4</sub>	4.89	D <sub>3</sub>	4.19	W <sub>3</sub>
<b>Chlorophyta</b>	<b>1497</b>						
<i>Vovox aures</i>	544	100	C <sub>4</sub>	4.97	D <sub>3</sub>	4.97	W <sub>3</sub>
<i>Coelastrum microporum</i>	450	85.7	C <sub>4</sub>	4.11	D <sub>3</sub>	3.52	W <sub>3</sub>
<i>Hydrodichtion reticulatum</i>	179	57.1	C <sub>2</sub>	1.63	D <sub>2</sub>	0.93	W <sub>2</sub>
<i>Ulotrix zonata</i>	95	42.8	C <sub>2</sub>	0.86	D <sub>1</sub>	0.37	W <sub>2</sub>
<i>Oedogonium sp.</i>	229	71.4	C <sub>3</sub>	2.09	D <sub>3</sub>	1.49	W <sub>3</sub>

In terms of constancy, dominance and ecological significance index of the phytoplankton species from Lake Bicaz during the 7 collection, we find as shown in Table 3, that all three species have an euconstancy registered in class C<sub>4</sub>. Regarding the dominance can be seen that the species *Oscillatoria princeps* and *Rivullaria sp.* are subdominance, *Anabaena variabilis* is eudominance being present in a proportion exceeding 10%. Index ecological significance shows that *Oscillatoria princeps* and *Rivullaria sp.* are accessories species (accompanying), thus *Anabaena variabilis* is characteristic for this pool water.

From the diatoms group observed that that all species are euconstant, one (*Diatoma vulgare*) is eudominant and two species (*Cymbella lanceolata* and *Fragillaria*

*crotonensis*) are dominant. From Euglenofita group, the species *Euglena polymorpha*, *Trachelomonas planctonica* și *Trachelomonas granulose* are euconstant while *Euglena gracilis* is constant. Also note that only *Trachelomonas granulosa* is subdominant, the other species of euglenofita group being dominant. Ecological significance index tells us that all species of this systematic group are characteristic for aquatic basin investigated. According to the data in Table 3, the species *Vovox aures* and *Coelastrum microporum* from clorofite group are euconstant and subdominant. *Hydrodichtion reticulatum* and *Ulotrix zonata* are species accessories, subrecendence and recendence while *Oedogonium sp.* is constant and subdominant. In terms of ecological significance index, all species of this group are accessories.

Table 4 Constancy, dominance and ecological significance index of zooplankton species from Lake Bicaz

Species	Abundance (A) No. ind/dm <sup>3</sup>	Constancy (C)		Dominance (D)		Index of ecological significance (W)	
		%	Class	%	Class	%	Class
<b>Ciliophara</b>	<b>1192</b>						
<i>Paramecium aurelia</i>	997	100	C <sub>4</sub>	15.85	D <sub>5</sub>	15.85	W <sub>5</sub>
<i>Tintinidium lacustris</i>	543	100	C <sub>4</sub>	8.63	D <sub>4</sub>	8.63	W <sub>4</sub>
<i>Tintinidium fluviatilis</i>	452	85.7	C <sub>3</sub>	7.18	D <sub>5</sub>	6.15	W <sub>4</sub>
<b>Cladocera</b>	<b>2020</b>						
<i>Chydarus sphaericus</i>	144	28.7	C <sub>2</sub>	2.28	D <sub>3</sub>	0.65	W <sub>1</sub>
<i>Daphnia cucullata</i>	695	100	C <sub>4</sub>	11.95	D <sub>5</sub>	11.95	W <sub>5</sub>
<i>Daphnia longispina</i>	651	100	C <sub>4</sub>	10.35	D <sub>5</sub>	10.35	W <sub>5</sub>
<i>Syda cristalina</i>							
<b>Copepoda</b>	<b>793</b>						
<i>Cyclops vicinus</i>	367	100	C <sub>4</sub>	5.83	D <sub>4</sub>	5.83	W <sub>4</sub>
<i>Cyclops rubens</i>	132	57.14	C <sub>3</sub>	2.00	D <sub>3</sub>	1.14	W <sub>3</sub>
<i>Eucyclops gracilis</i>	46	28.5	C <sub>2</sub>	0.73	D <sub>1</sub>	0.20	W <sub>2</sub>
<i>Eucyclops serrulatus</i>	95	85.71	C <sub>4</sub>	1.51	D <sub>2</sub>	1.29	W <sub>3</sub>
<i>Macrocyclops distinctus</i>	63	85.71	C <sub>4</sub>	1.00	D <sub>1</sub>	0.85	W <sub>2</sub>
<i>Macrocyclops albidus</i>	32	85.71	C <sub>4</sub>	0.50	D <sub>1</sub>	0.42	W <sub>2</sub>
<i>Paracyclops fimbriatus</i>	58	85.71	C <sub>4</sub>	0.92	D <sub>1</sub>	0.78	W <sub>2</sub>
<b>Rotifera</b>	<b>2284</b>						
<i>Brachionus calyciflorus</i>	867	100	C <sub>4</sub>	13.78	D <sub>5</sub>	13.78	W <sub>5</sub>
<i>Keratella cochlearis</i>	694	100	C <sub>4</sub>	11.00	D <sub>5</sub>	11.00	W <sub>5</sub>
<i>Keratella quadrata</i>	723	100	C <sub>4</sub>	11.49	D <sub>5</sub>	11.49	W <sub>5</sub>

The data in Table 4 show that species from ciliophora group are constant, euconstant, dominant and eudominant. Index of ecological significance indicates that all species of this group are characteristic of biocenosis from aquatic basin studied. The species of copepoda group are accessories (*Eucyclops gracilis*), constants (*Cyclops rubens*) and euconstant (*Cyclops vicinus*, *Eucyclops serrulatus*, *Macrocyclops albidus*, *Macrocyclops albidus*), while all species are of rotifera group are euconstant.

In terms of dominance, species of ciliophora group are dominant and eudominant, cladocera are subdominant and eudominant, mostly copepoda are subcedent, one species (*Eucyclops serrulatus*) is recedent and the rest are subdominant and dominant, while all species of rotifera group are eudominant. Index of ecological significance shows that the species of ciliophora group are characteristic for the ecosystem of basin studied, the species of cladocera group are accessories and features for this aquatic ecosystem, the copepoda

group are mostly accessories and very few species characteristic of the basin studied, while all rotifera species studied are characteristic of studied biocenosis.

## CONCLUSIONS

From Lake Bicaz investigated in summer 2011 were collected a total of 10939 phytoplankton's individuals, belonging to four systematic groups with 15 taxons and a number of 6289 zooplankton individuals, enrolled in four classes with 13 taxons.

After determining the structure of phytoplankton was found that the most abundant were euglenophytes followed by cyanophyte and diatoms, while chlorophytes were less numerous. On zooplankton structure determinations showed that the highest abundance were rotifera followed by cladocera, the least abundant being copepoda.

In terms of analytical and synthetic indicators, from phytoplankton organisms have found that the most are euconstant, constant, eudominant, dominant, and few species are accessories, subdominant and

subrecendence. Biological significance index shows that the most species are characteristic of aquatic basin studied, very few species being accessories (accompanying).

Concerning zooplankton, researches results showed that most species are euconstant, constant, eudominant, dominant, a small number of species being accessories subdominant, subrecendence and recendence. Biological significance index indicates that most zooplankton species are characteristic of the basin studied, a relatively small number of species being accessories (accompanying).

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