

**PHYTOPLANKTON AND ZOOPLANKTON IDENTIFICATION
AND THEIR PRODUCTIVITY IN PELOIDOGENESIS
PROCESS FROM THE THERAPEUTICALLY SALINE LAKES
-Lacu Sarat BRAILA AND Bazna, SIBIU- ROMANIA**

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ABSTRACT. From all the mineral lakes in Romania, the biggest therapeutic importance goes indisputably to the lakes with salted water because on the substrate of these lakes there are formed grand deposits of therapeutic mood.

The Salted Lake Braila is situated on the east side of the Romanian Lowlands; According to the chemical analysis the water of the lake is very concentrated reaching a mineralization of 111,05 g/l in 2004. A few species can resist in a such hiperhalin environment; they belong to some kinds of green-blue algae, green algae, diatoms. The zooplankton reflects an even more rigorous selection, being composed by species of protozoa, rotifers and crustacean . The crustaceans can be recognized with the naked eye; their biggest representative the phyllopod *Artemia salina* and represents the main cater of organic material, from their bodies resulting the black mood with well known therapeutic properties.

The Bazna, Sibiu spa disposes as treatment factors, many salted iodinated , brominates sources and a deposit of mineralized mood. In the four collection reservoirs of the sources it is produced a goo with slic character, and with a large amount of organic substance.

At Bazna- Sibiu , in those four collection reservoirs of the sources, the reduced mineralization grade allows the existence of a rich and various cenosis which consist of algae, protozoa, rotifers, copepods, phyllopod, ciliates, nematodes.

In Bazna Sibiu, the local conditions of biotope (bacterial load) and the incredible reproduction rate led to the mass extension of the rotifers, reaching a

monospecified zooplankton, represented in exclusivity by de *Brachionus urceolaris*.

KEY WORDS. phytoplankton, zooplankton, productivity, peloids, mineralisation, therapeutic.

INTRODUCTION

From all the mineral lakes in Romania, the biggest therapeutic importance goes indisputably to the lakes with salted water because on the substrate of these lakes there are formed grand deposits of therapeutic mood.

The quality of the mood depends on the physical and chemical properties of the water, the intensity of the biological life and the quantity of the organic substance which deposits itself on the bottom of the lakes.

In the lakes with a salt concentration under 100 g/l – such as the reservoirs from the Bazna Sibiu spa, which have a mineralization less than 40 g/l - develops a very rich biological life during the warm season so that organic mood reserves with peloides characters is formed on the bottom of the lake.

While the salt composition of the lakes grows, reaching more than 100 g/l, as it happens for example in the Salted Lake, Braila, where the mineralization reaches values of 111,05 g/l, the biological life reduces itself, and as a consequence the infusion of organic substance is lower, in compare with the inorganic elements which deposits itself. In those hypersaline lakes, there are formed mood with salted peloid characters.

MATERIAL AND METHODS

Biological samples have been taken from the Salted Lake, Braila, and from the reservoirs with salted water from Bazna, Sibiu during the summer season, when there is a high developing of the plankton, from more points considered as most representative.

There have been extracted qualitative samples for the total plankton and quantitative samples for the phytoplankton and zooplankton.

There have also been taken samples for the determination of the physical and chemical properties of the water – dissolved oxygen, the biochemical consume of oxygen, the saturation grade in the oxygen, temperature, pH, and transparency- but microbiological samples also, for the determination of the level of the bacteriological pollution of the water, evaluating the total number of aerobe bacteria at 37 Celsius degrees, the probable number of the coliform bacteria, the probable number of fecal coliform bacteria and probable number of fecal streptococ.

The biological material of the flora and fauna was conserved with formaldehyde 4%, microscopic examined and identified.

The abundance of the plankton per volume unit (A) was calculated using the next formula:

$$A = \left(\sum S_i \cdot n / S_e \cdot V \right) \cdot 1000$$

n= number of phytoplankton cells from the counting chamber;

S_i=sediment obtained from filtering ;

S_e= sediment examined at the microscope ;

V= filtered volume.

The algae biomass was calculated using the formula:

$$M = (S_i \cdot n / 100) \cdot V_{\text{cell}}$$

S_i =sediment obtained from filtering ;

n= number of phytoplankton cells from the counting chamber;

V_{cell}= cell volume (μ³).

The parameters of the cells volume were determined using the micrometer and the cells volume was calculated by the similarity method of the geometrical figures with the cellular bodies, using approximate models recommended for the simple geometrical figures (Chapman, Friedrich, Beim, 1992).

RESULTS AND DISCUSSION

The Salted Lake, Braila, is situated in the north-eastern part of the Baragan Plain and has a surface of 70 ha, 1 km long, 900 m width and the depth reaching just 1 m; it presents a therapeutic importance which is given by its main natural therapeutic factors: water with a high mineralization, the mood deposit on the substrate and the climate with an accentuate character of steppe, specific to the region in where it is situated (Morariu T, Morariu E, Savu, 1968).

According to the results of the chemical analysis the water of the lake is very concentrated reaching a mineralization of 111,05 g/l in July 2004. A few species can resist in a such salted medium, the high salinity representing a limitative factor which does not only limit the number of species but also excludes the full groups of organisms.

In these conditions, the predominant groups in the plankton are the single cell vegetal ones or those that form small colonies, with the missing of the pluricellular algae, moss and ferns.

The phytoplankton has microscopically dimensions (between 50-60μ and 1 mm), so that it contacts the water by a large surface and may utilize in the best way the sun light. Life in pulverized condition allows the optimum spreading of many vegetal organisms in water (Antonescu, 1967).

The microscopically single cell algae represents the main producers of primary organic substance from the Salted Lake, Braila, because it forms in the presence of light organic substances using as primary materials different sources of inorganic carbon, water and mineral salts.

Most common forms in the phytoplankton are the species of green-blue algae (Cyanophyceae), for instance: *Oscillatoria*, *Aphanizomenon* that appear under the form of beads or as filaments, of green algae (Chlorophyceae) such as *Rhizoclonium* and silicon algae (Diatomeae) in which most frequent are *Navicula* and *Nitzschia*. There have also been identified flagellates like *Euglena* and *Peridinium*.

The zooplankton of the Salted lake Braila reflects an even more rigorous selection of the species, in essence being composed of protozoa (flagellates), rotifers (worms), copepods and phyllopod (crustacean). There have been frequently observed the *Brachionus* (rotifer with a shell), *Artemia salina* (crustacean without a shell) and *Arctodiaptomus* (copepods with long antennas, with the size of their bodies).

Most organisms of the zooplankton have extremely small dimensions: rotifers and protozoa have microscopically dimensions, but the crustacean can be seen with naked eye, there largest representative being the *Artemia salina*, which measures a few millimeters- 1 centimeter. It represents the main producer of organic material, from their body resulting the black mood with recognized therapeutic properties (Papadopol, 1983).

The Bazna, Sibiu spa is one of the oldest spas from Romania;. it disposes as treatment factors, of many salted sources and deposits of mineralized mood.

The chemical composition of the collected salted water from the four reservoirs is smooth enough, with a salt content that has been modified in time.

The study of the population of these reservoirs with a geographical, climacterically situation which are not so different, indicates the fact that they are formed by cosmopolitan species (*Synedra ulna*, *Navicula peregrina*, etc.). In 1983 it was recorded the algal bloom with *Croococus turgidus* (Trica, 1983) and in 2003 with *Cladophora* sp.

Qualitative speaking the phytoplankton is made of organisms that belong to the group of algae: Cyanophyta, Flagellata, Bacillariophyta, and Clorophyta.

The zooplankton is made of the group of organisms: Protozoa, Rotifers, Copepods, Caldocerans, Phyllopod, Ciliates and Nematods.

During the study the zooplankton was represented by a few species but with a large number of individuals. Interesting to mention is the domination of the zooplankton from the regeneration reservoir by the *Brachionus urceolaris* observed in May and July 2003, its abundance having so high values that the water gained a brownish colour .

Brachionus urceolaris (O.F.M., 1773) is complet planktonic representative of the rotifers although most of the rotifers are fixed on a substrate or associated with the littoral zone; these species may form the major component of the zooplankton, as we have observed at Bazna, Sibiu in 2003. The rotifers are very important in the aquatic systems because of the incredible reproduction rate that they have, the density of the population reaching 1000 individuals/ l . Because of their efficient feeding and assimilation they have an important part in the energy flux and the circuit of the nutrients. The rotifers also contribute at the microbial circuit from the life environment like we have observed in the regeneration reservoir where the great abundance of the *Brachionus urceolaris* eas correlated with the results of the water microbiological analysis which have reflected a microbiological pollution (Gilbert, 2004).

CONCLUSIONS

The Salted Lake Braila presents because of its hypersaline concentration from the water a plankton reduced at a minimum number of species with a large number of individuals: a few species of algae, protozoa and with a high density the phyllopod *Artemia salina*, which sometimes gives the reddish colour of water.

In the Salted Lake Braila the phytoplankton is well represented, constituting enough food for the zooplankton with whom, after death, contributes at the forming of the black therapeutic mood.

At Bazna, Sibiu in the four collection reservoirs of the sources, the reduced mineralization grade of the water allows the existence of a rich and various plankton composed by algae, protozoa, rotifers, copepods, cladocerans, phyllopod, ciliates and nematods.

In the regeneration reservoir from Bazna spa Sibiu, the local conditions of life environment and the incredible reproduction rate, led to the elimination of the other species, reaching a zooplankton represented in exclusivity by the *Branchionus urceolaris*.

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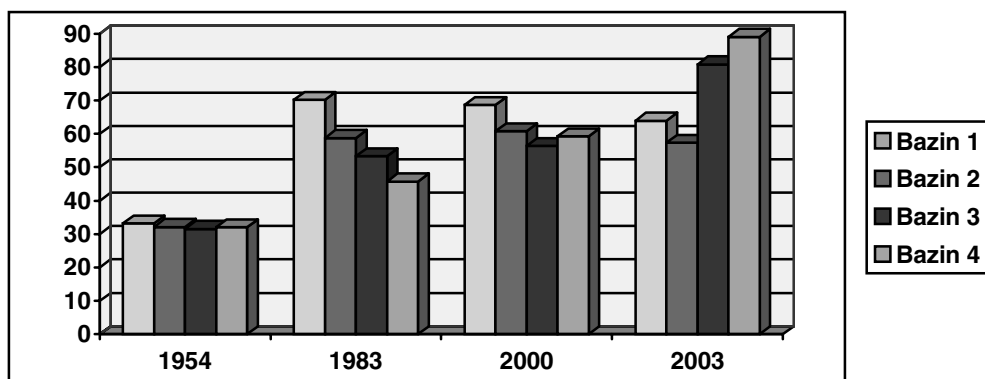


Figure 1. Mineralisation water variation in time from saline lakes **Bazna, Sibia spa**

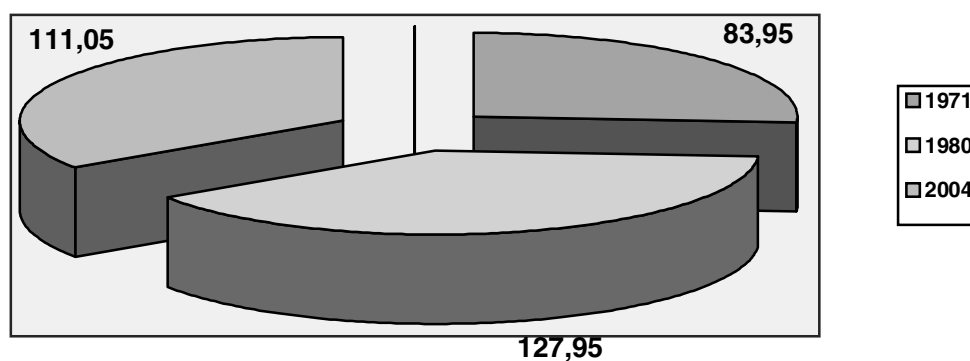


Figure 2. Mineralisation water variation in time from **Lacu Sarat I Braila**

TABLE 1 . BIOLOGICAL AND MICROBIOLOGICAL PARAMETRES OF
Lacu Sarat I - Braila
2004

Place of sampling	CENTRU	HAN TURIST	LA SOSEA	PONTON
Date of sampling	8.06.2004	8.06.2004	8.06.2004	8.06.2004
Secchi depth	25 cm	30 cm	20 cm	25 cm
Water temperature	25 °C	25 °C	28 °C	26 °C
pH	8,5	8,5	8,5	8,5
Dissolved oxygen	Nedoz. prin metoda Winckler	0,862 mg/l	0,165mg/l	0,330mg/l
Oxygen saturation	-	10,18%	2,12%	4,13%
CBO ₅	Nedoz.	Nedoz.	Nedoz.	Nedoz.
Phytoplankton - group	- density	10750 ex/l	8000 ex/l	9025 ex/l
	-biomass	2,35 g/l	1,85 g/l	2,05 g/l
	- group dominant	diatoms	diatoms	diatoms
Zooplankton - group dominant	-density	188 ex/l	60 ex/l	85 ex/l
	- biomass	13,5 g/l	5,1 g/l	5,06 g/l
	- group dominant	rotifers	copepods	phyllopod
Probable number of coliform bacteria	0/100ml	0/100ml	4/100ml	0/100ml
Probable number of faecal coliform bacteria	0/100ml	0/100ml	4/100ml	0/100ml
Probable number of faecal streptococ	0/100ml	0/100ml	0/100ml	0/100ml

TABLE 2. BIOLOGICAL AND MICROBIOLOGICAL PARAMETRES OF SALINE LAKES FROM
Bazna - jud. Sibiu
2003

Place of sampling	TANK 1	TANK 2	TANK 3	TANK 4
Date of sampling	30.05.2003	30.05.2003	30.05.2003	30.05.2003
Secchi depth	1 m	1,15 m	1,60 m	40 cm
Water temperature	28 °C	26 °C	26 °C	28 °C
pH	7,5	7,0	7,5	8,0
Dissolved oxygen	2,6 mg/l	7,25 mg/l	7,39mg/l	6,16mg/l
Oxygen saturation	33,55%	90,74%	92,5%	79,5%
CBO ₅	1,1mg/l	4,93mg/l	6.03mg/l	3,97mg/l
Phytoplankton - group dominant	- density	65 ex/l	8 ex/l	9 ex/l
	-biomass	0,002 g/l	0,0007 g/l	0.0008 g/l
	- group dominant	diatoms	diatoms	diatoms
Zooplankton - group dominant	-density	58 ex/l	59 ex/l	66 ex/l
	- biomass	0,434 g/l	0,302 g/l	0,556 g/l
	- group dominant	copepods	phyllopod	phyllopod
Probable number of coliform bacteria	280 / 1	50 / 1	45 / 1	20 / 1
Probable number of faecal coliform bacteria	220 / 1	50 / 1	45 / 1	20 / 1
Probable number of faecal streptococ	0 / 1	0 / 1	0 / 1	20 / 1

TABLE 3. COMPARATIVE ANALYSIS OF THE BIOLOGICAL COMMUNITIES FROM
Lacu Sarat I BRAILA - Bazinul 1 Bazna- SIBIU
2003 - 2004

GROUPS OF ORGANISMS	PLACE OF	SAMPLING
	Lacu Sarat I BRAILA	Bazin 1 BAZNA, jud.SIBIU
PHYTOPLANKTON		
Cyanophyta		
Oscillatoria sp.	+	+
Anabaena planctonica		+
Flagellata		
Euglena sp.	-	+
Bacillariophyta		
Navicula sp.	+	+
Nitzschia sp.	++	+
Pinnularia interrupta	-	+
Gomphonema angustatum	-	+
Cymbella sp.	-	+
Asterionella sp.	-	+
Pleurosigma salinarum	-	+
Clorophyta		
Rhizoclonium.sp.	+	-
Cladophora sp.	-	+
Spyrogira sp.	-	+
Enteromorpha clathrata		+
ZOOPLANKTON		
Protozoa		
Holophria sp.	+	-
Uronema marina	+	-
Rotifera		
Brachionus urceolaris	++	+
Copepoda		
Arctodiaptomus salinus	+	-
Branchiopoda		
Artemia salina	++	+
Diptera		
Culicidae(larve)	+	-

Legend : - = missing species ; + = present species; ++ = medium abundance ; +++ = very abundant species.