THE MONITORING OF PHYTOPLANKTON EVOLUTION BY BIOLOGICAL YEAR WITHIN ARINIS-MARAMURES FISHERY COMPLEX

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Abstract

The research took place on the period 2005-2008, being a part of CEEX project, number 45/2005, module I Biotech. The purpose of the study was the monitoring of phytoplankton evolution in the nine fish ponds, having in total a surface of 90 hectares, being an indicator of the water biologic qualitative level. The phytoplankton having algae in its composition, a base for the consumers development, we observed the composition of Chlorophyceae, Cyanophyceae and Diatoms species. We established the taxonomic composition for each month of the study, evaluating the species number, as well as the percent from total value. Specially, we examined Cyanophyceae, Crysophyceae, Bacillariophyceae, Chlorophyceae, Conjugatophyceae, Euglenophyceae, Cryptophyceae species. Within the Chlorophyceae we identified: volvocals, protococaceae, Desmids; within the Cyanophyceae, the genera: Spirulina, Coelosphaerium, Oscillatoria sp., Dactylococcopsis, Merismopedia, Microcystis. The identified Diatoms, especially in springtime, are included in the genera: Melosira, Cyclotella, Amphora, Navicula sp., Achnanthes, Asterionella, Cymbella, Cocconeis, Fragillaria, Synedra. The phytoplankton taxonomic composition shows a good qualitative water, proper for carp culture.

Key words: phytoplankton, taxonomic composition, *Chlorophyceae, Cyanophyceae, Diatoms*

INTRODUCTION

The phytoplankton is composed exclusively by algas (producing organisms, on which are developing the consumers), and that are growing up in the illuminated area of the fish-pond. The phytoplankton includes species of *Chlorophyceae* (green algas), *Cyanophyceae* (blue-green algas) and *Diatoms* (silicate algas). Those algas were analyzed in March, April, May, June, July, August, September 2008.

MATERIAL AND METHODS

There were monitored 9 fish-ponds in total surface of 90 Hectares, from Arinis fishery complex, Maramures county, on the period 2005-2008.

In this paper we present some results from the year 2008. Because we wanted that the samples were representative, from each fish-pond there was collected a mixted medium sample consisting in 5 samples gathered from different areas (one sample for each shore and one from the centre).

For the Diatoms identification we made fixed samples. A small quantity of gathered sample is washed with distilled water, decanting two or three times, for the formalin removal, then are put droplets on the calcination spangles, on a asbestos strainer.

There are incinerated for 25-30 hours, then are put the colophonium fragments, for the melting. The colophomium spangles are fixed on microscope slides, avoiding the forming of air bubbles.

In this manner we eluded the organic substance and there are remaining visible only the skeleton ornamentations. The frustule ornamentations, the knurls and dots number on the linear unit of 10 μm are the base of Diatoms classification systems.

The Diatoms species identification from those microscopic samples realized with a Niklon Eclipse E400 optic microscope, 100x

objective, using usual determinations (Hindák F., 1978; Krammer K., Lange-Bertalot H., 1986, 1988, 1991; Zelinka M.M., Proskina-Lavrenko A.I., Sesukova V.S., 1951).

For the establishing of Diatoms species relative abundance, we made average counts of 800 individuals/sample (1 ml), the obtained values being expressed either as number/species/sample, or as percent.

For the construction of Diatoms normal distribution curves, we used Preston method (1948), applied for the first time by Patrick, Holn and Wallace (1954). The allocation of individuals' number on intervals (1, 2, , ..., n) was made so that each interval should be 2 times bigger then the previous one (1-2, 2-4, 4-8, ..., n-2n).

The flowery similarity degree between the algas communities, adequate to the five collecting points from the nine fish-ponds, was analyzed using Sörensen index, which is based on the species presence or absence in the biocenoses. The numeric value of the index is between 0 and 1, and when the value is more closer to 1, the similarity is more pronounced.

RESULTS AND DISCUSSIONS

In the following tables we present: the phytoplankton taxonomic composition (number of species), as well as the percent of each species from the total number of identified species in each monitored fish-pond, depending on the analyzed month.

We observed differences from one species to another, either as number, or as a percent, between months and fish-ponds (tables 1-14).

Table 1
The phytoplankton taxonomic composition (number of species)

Species	March 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	11	8	10	10	8	9	8	8	10
Crysophyceae	3	1	2	1	1	2	2	2	1
Bacillariophyceae	35	25	25	20	29	25	25	30	30
Chlorophyceae	12	13	14	10	8	8	13	8	15
Conjugatophyceae	8	8	8	3	5	4	7	5	5
Euglenophyceae	-	-	-	-	-	-	-	-	-
Cryptophyceae	-	-	-	-	-	-	-	-	-
Total specii/ lună	69	65	59	44	41	48	55	53	61

F-p=Fish-pond

Table 2
The phytoplankton taxonomic composition (%)

Species	March 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	15,94	12,30	15,38	22,73	19,51	18,75	14,54	15,09	16,39
Crysophyceae	4,35	1,54	3,40	2,27	2,43	4,16	3,63	3,77	1,63
Bacillariophyceae	50,72	38,46	42,37	45,45	70,73	52,08	45,45	56,60	49,18
Chlorophyceae	17,39	20,00	23,73	22,73	19,51	16,66	23,63	15,09	24,59
Conjugatophyceae	11,59	12,30	13,56	6,82	12,19	8,33	12,72	9,43	8,19
Euglenophyceae	-	-	-	-	-	-	-	-	-
Cryptophyceae	-	-	-	-	-	-	-	-	-

F-p=Fish-pond

Table 3
The phytoplankton taxonomic composition (number of species)

Species	April 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	9	10	10	11	10	10	9	10	11
Crysophyceae	3	3	1	3	3	3	3	2	2
Bacillariophyceae	25	30	31	29	25	25	30	30	30
Chlorophyceae	12	15	20	20	15	20	25	25	20
Conjugatophyceae	3	3	3	3	2	2	1	1	2
Euglenophyceae	-	-	-	-	-	-	-	-	-
Cryptophyceae	2	1	1	1	2	1	2	2	2
Total specii/lună	54	62	66	67	57	61	70	69	67

F-p=Fish-pond

Table 4
The phytoplankton taxonomic composition (%)

Species	April 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	16,66	16,12	15,15	16,41	17,54	16,39	12,85	14,49	16,41
Crysophyceae	5,55	4,83	1,51	4,47	5,26	4,91	4,28	2,89	2,98
Bacillariophyceae	46,29	48,38	46,96	43,28	43,85	40,98	42,85	43,47	44,77
Chlorophyceae	22,22	24,19	30,30	29,85	26,31	32,78	35,71	36,23	29,85
Conjugatophyceae	5,55	48,38	4,54	4,47	3,50	3,27	1,42	1,44	2,98
Euglenophyceae	-	-	-	-	-	-	-	-	-
Cryptophyceae	3,70	1,61	1,51	1,49	3,50	1,63	2,85	2,89	2,98

F-p=Fish-pond

Table 5
The phytoplankton taxonomic composition (number of species)

ŁSpecies	May 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	9	10	10	10	9	10	8	10	9
Crysophyceae	8	5	3	5	3	3	2	5	5
Bacillariophyceae	15	10	10	15	15	15	15	19	15
Chlorophyceae	25	25	30	30	28	25	25	21	20
Conjugatophyceae	2	3	4	2	1	2	2	2	1
Euglenophyceae	3	7	5	5	3	2	3	3	3
Cryptophyceae	5	7	3	3	2	1	2	3	5
Total specii /lună	67	67	65	70	61	58	58	63	58

F-p=Fish-pond

Table 6
The phytoplankton taxonomic composition (%)

Species	May 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	13,43	14,92	15,38	14,28	14,75	17,24	13,79	15,87	15,51
Crysophyceae	11,94	7,46	4,61	7,14	4,91	5,17	3,44	7,93	8,62
Bacillariophyceae	22,38	14,92	15,37	21,42	24,59	25,86	25,86	30,15	25,86
Chlorophyceae	37,31	37,31	46,15	42,85	45,90	43,10	43,10	33,33	34,48
Conjugatophyceae	2,98	4,47	6,15	2,85	1,63	3,44	3,44	3,17	1,72
Euglenophyceae	4,47	10,44	7,69	7,14	4,91	3,44	5,17	4,76	5,17
Cryptophyceae	7,46	10,44	4,61	4,28	3,27	1,72	3,44	4,76	8,62

F-p=Fish-pond

Table 7
The phytoplankton taxonomic composition (number of species)

Species	June 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	10	10	9	10	8	7	8	9	10
Crysophyceae	8	5	4	5	3	5	4	6	6
Bacillariophyceae	12	10	12	14	15	15	20	15	15
Chlorophyceae	30	30	30	32	35	32	29	30	29
Conjugatophyceae	5	5	4	3	5	5	3	4	5
Euglenophyceae	5	6	5	5	6	6	5	3	5
Cryptophyceae	5	5	4	5	5	4	4	3	5
Total specii/lună	75	71	68	74	77	74	73	70	75

F-p=Fish-pond

Table 8
The phytoplankton taxonomic composition (%)

Species	June 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	13,33	14,08	13,23	13,51	10,38	9,45	10,95	12,85	13,33
Crysophyceae	10,66	7,04	5,88	6,75	3,89	6,75	5,47	8,57	8,00
Bacillariophyceae	16,00	14,08	17,64	18,91	19,48	20,27	27,39	21,42	20,00
Chlorophyceae	40,00	42,25	44,11	43,24	45,45	43,24	39,72	42,85	38,66
Conjugatophyceae	6,66	7,04	5,88	4,054	6,49	6,75	4,10	5,71	6,66
Euglenophyceae	6,66	8,45	7,35	6,75	7,79	8,10	6,84	4,28	6,66
Cryptophyceae	6,66	7,04	5,88	6,75	6,49	5,40	5,47	4,28	6,66

F-p=Fish-pond

Table 9
The phytoplankton taxonomic composition (number of species)

Species	July 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	10	10	8	10	9	8	9	10	10
Crysophyceae	6	5	5	5	3	5	6	5	5
Bacillariophyceae	10	12	11	15	15	15	20	15	15
Chlorophyceae	30	30	29	33	34	31	28	30	30
Conjugatophyceae	5	5	4	3	5	5	2	4	5
Euglenophyceae	4	5	5	5	6	5	5	3	5
Cryptophyceae	5	5	4	5	5	4	4	3	5
Total specii/lună	70	72	65	76	77	73	74	70	75

F-p=Fish-pond

Table 10
The phytoplankton taxonomic composition (%)

Species	July 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	14,28	13,88	12,30	13,15	11,68	10,95	12,16	14,28	13,33
Crysophyceae	8,57	6,94	7,69	6,57	3,89	6,84	8,10	7,14	6,66
Bacillariophyceae	14,28	16,66	16,92	22,38	19,48	20,54	27,02	21,42	20,00
Chlorophyceae	42,85	41,66	44,61	43,42	44,14	42,46	37,83	42,85	40,00
Conjugatophyceae	7,14	6,94	6,15	3,94	6,49	6,84	2,70	5,71	6,66
Euglenophyceae	5,71	6,94	7,69	6,57	7,79	6,84	6,75	4,28	6,66
Cryptophyceae	7,14	6,94	6,15	6,57	6,49	5,47	5,40	4,28	6,66

F-p=Fish-pond

Table 11
The phytoplankton taxonomic composition (number of species)

Species	August 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	10	10	9	10	9	8	9	10	9
Crysophyceae	9	5	6	5	4	5	5	5	5
Bacillariophyceae	11	12	12	15	15	15	15	15	15
Chlorophyceae	30	32	30	31	35	31	32	31	28
Conjugatophyceae	5	5	5	4	5	4	3	4	5
Euglenophyceae	5	5	5	5	6	6	5	3	5
Cryptophyceae	5	5	4	5	5	4	4	3	5
Total specii/lună	75	72	71	75	79	73	72	71	72

F-p=Fish-pond

Table 12
The phytoplankton taxonomic composition (%)

Species	August 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	13,33	13,88	12,67	13,33	11,39	10,95	12,50	14,08	12,50
Crysophyceae	12,00	6,94	8,45	6,66	5,06	6,84	6,94	7,04	6,94
Bacillariophyceae	14,66	16,66	16,90	20,00	18,98	20,54	20,83	21,12	20,83
Chlorophyceae	40,00	44,44	42,25	41,33	44,30	42,46	44,44	43,66	38,88
Conjugatophyceae	6,66	6,94	7,04	5,33	6,32	5,47	4,16	5,63	6,94
Euglenophyceae	6,66	6,94	7,04	6,66	7,59	8,21	6,94	4,22	6,94
Cryptophyceae	6,66	6,94	5,63	6,66	6,32	5,47	5,55	4,22	6,94

F-p=Fish-pond

Table 13
The phytoplankton taxonomic composition (number of species)

Species	September 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	10	10	10	10	9	8	8	10	10
Crysophyceae	6	5	4	4	4	5	5	6	5
Bacillariophyceae	10	10	11	14	15	15	20	15	15
Chlorophyceae	30	32	31	33	35	30	30	30	31
Conjugatophyceae	5	5	5	4	5	5	3	4	5
Euglenophyceae	4	5	5	5	6	6	5	4	5
Cryptophyceae	5	5	4	5	5	5	4	3	5
Total specii/lună	70	72	70	71	77	74	75	72	76

F-p=Fish-pond

Table 14
The phytoplankton taxonomic composition (%)

Species	September 2008								
	F-p 1	F-p 2	F-p 3	F-p 4	F-p 5	F-p 6	F-p 7	F-p 8	F-p 9
Cyanophyceae	14,28	13,88	14,28	14,08	11,68	10,81	10,66	13,88	13,15
Crysophyceae	8,57	6,94	5,71	5,63	5,19	6,75	6,66	8,33	6,57
Bacillariophyceae	14,28	13,88	15,71	19,71	19,48	20,27	26,66	20,83	19,73
Chlorophyceae	42,85	44,44	44,28	46,47	45,45	40,54	40,00	41,66	40,78
Conjugatophyceae	7,14	6,94	7,14	5,63	6,49	6,75	4,00	5,55	6,57
Euglenophyceae	5,71	6,94	7,14	7,04	7,79	8,10	6,66	5,55	6,57
Cryptophyceae	7,14	6,94	5,71	7,04	6,49	6,75	5,33	4,16	6,57

F-p=Fish-pond

From the identified *Chlorophyceae* we present: the ***volvocals*** *Chlamydomonas*, *Eudorina*, *Volvox*, *Pandorina*; the ***protococaceae*** *Scenedesmus sp.*, *Coelastrum*, *Pediastrum sp.*, *Tetraedron sp.*, *Actinastrum*; the ***desmids*** *Cosmarium*, *Euastrum*, *Staurastrum*, *Micrasterias*, *Closterium*, *Spirogyra*. Most frequent there were identified Cyanophyceae from the species of the genera: *Spirulina*, *Coelosphaerium*, *Oscillatoria sp.*, *Dactylococcopsis*, M*erismopedia*, *Microcystis*.

The diatoms were observed most frequent in spring colder months, being better represented by the species from the genera: *Melosira*, *Cyclotella*, *Amphora*, *Navicula sp.*, *Achnanthes*, *Asterionella*, *Cymbella*, *Cocconeis*, *Fragillaria*, *Synedra*.

CONCLUSIONS

1. The phytoplankton evolution in the observed fish-ponds follows an evolution curve, characterized by: the presence in a big number of *Bacillariophyceae* species in springtime and in a small number of *Chlorophyceae* and *Cyanophyceae* species, following their regression in the warm season, when the phytoplankton is formed by *Chrolophyceae,* succeded by *Cyanophyceae,* percent maintained in the same order in the next season.

2. *Euglenophyceae* and *Crysophyceae* species are absent in springtime in the studied fish-ponds; their appearance taking place begining with April month, in the case of *Crysophyceae* and May in the case of *Euglenophyceae*; on the hole summery period and in the first autumn month their number being constant.

3. Refering to the phytoplanktonic species number, the smallest number is recorded in springtime (41-69), following an ascendant curve in the next months (79 species).

4. There is a large palette of phytoplanktonic species, specific to some changes of the medial water parameters, as: *Cosmarium, Scenedesmus, Microcystis, Asterionella.*

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