THE ASSESSMENT OF AQUATIC ECOSYSTEM MALINA, THROUGH PHYTOPLANKTON'S SAPROBITY INDEX

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Abstract

This paper presents information about water quality classification for establishing the organic status in Malina fish farm, Galati county. The quality of water in the sample stations was evaluated on the basis of phytoplankton through saprobic index. The analysis of biological samples was achieved with the help of a stereomicroscope, using a rich special literature. The phytoplankton was present in all the samples from the sampling stations. The phytoplankton saprobic index calculated for each sampling station, has values between 1,98 and 2.11. From the quantitative point of view, the dominant species are β-mesosaprobe with values of numerical density and numerical abundance between 39520-ex 697528/l, respectively 91,78-98,82%. According to the upgrade of the 161/2006 these values indicate a good ecological status of the water that fits the second class of quality, the water being suitable for the growth and development of the Fisheries natural fund.

Key words: zooplankton, species, density, abundance, biomass

INTRODUCTION

Biological indicators of water pollution are saprobes; organisms have adapted to live in polluted waters. Thus, the level of water pollution can be determined by the presence and the quantity of saprobes.

In this respect, it was developed a sabrobes system by Kolkwitz and Marsson (1908, 1909) [6], Liebmann (1962) making a broad review of its [10], system that was used and developed by many other researchers.

This system is based on the observation that there are different degrees of water pollution with organic substances and also in the cleaned waters plant and animal species that inhabit these one are different. Their presence is conditioned by the quality and the quantity of food, by some physico-chemical properties of water, especially the amount of oxygen dissolved in water and the quantity produced by the decomposition of organic matter. The presence of certain species in very polluted areas is explained by their tolerance to these environmental conditions and the presence of others only in areas with clean water is explained by their sensitivity to contaminated environment. In saprobes system are used as indicators of water quality both species.

The saprobes' system divided the aquatic organisms into the following saprobic groups:
a) polisaprobes organisms present in the water with maximum pollution with organic matter, without oxygen available, with intense reducing chemical and biochemical processes;
b) mesosaprobes organisms present in the water with environmental pollution, the oxygen available for organisms subdivided them into:
-alfamesosaprobes - in waters with reduction process predominance and oxidation processes start;
-betamesosaprobes - in waters with oxidation processes prevalence;
c) oligosaprobes organisms present in waters less polluted or in the end of purification processes.

The saprobic level can represent an important indicator for the water quality.

MATERIAL AND METHOD

The first step in assessing water quality has been collecting biological and chemical samples.

Sample collection from cyprinids consumption growth basin (EC1 = 30ha) from Malina farm, Galati county, was made

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in seven sampling stations, denoted M1 to M7 (Figure 1). The stations were established beforehand using a navigation system GPS Garmin 72 type. EC1 basin is fed by pumping water from Siret River.

Figure 1 Sampling stations

The phytoplankton samples were collected from the water surfaces in bottles (500 ml) and immediately fixed with Lugol solution in a ratio of 1:100 (1 ml of solution for 100 ml of sample).

Analysis of biological samples was performed utilizing the stereomicroscope after using a rich literature. (Determinations key, atlases and other) [1], [2], [4], [5], [7], [8], [9], [12], [14].

Classification of surface water quality to determine ecological status was performed according to Order 161/2006 [13]. According to Order 161/2006, we have distinguished five quality classes, as follows:

- First class quality which maximum allowable references reflects the natural reference conditions or the background concentrations;
- Class II of quality in this case class limits correspond to the target values (benchmarks) and reflects the quality condition provided for aquatic ecosystems protection;
- Class III-IV-V of quality where limit values corresponding to these classes are 2-5 times higher than those of the benchmarks and reflects the weight of human influence.

Water quality was assessed using the saprobic system methodology using the Pantle-Buck method (1955) to determine the saprobic index, as described in the below formula [11].

Was made a classification of the degree of contamination of water by saprobic system. For each biological indicators used in these steps in the system, was assigned a numerical value (s) corresponding with degree saprobity.

These values are listed in the Order 161/2006.

$$S=\sum(s_i \times h_i) / \sum h_i$$

Where:

s = numerical value characteristic belonging to the saprobic area

h = absolute numerical abundance of individuals of a particular taxon

i = taxon

Table 1 shows the values of the saprobic index, for 5 quality classes or for the ecological status determined by the quality classes.

Table 1 Saprobic index values for the 5 quality classes, respectively ecological status determined by the quality classes (Norm 161/2006)

Saprobiotic index	contamination	Class	Ecological status	Trophic level
1,0 - <1,8	absent contamination	I	very good	Ultraoligotrof
1,8 - <2,3	moderate contamination	II	Hi	oligotrophic
2,3 - <2,7	Moderate to critical contamination	III	Moderate (Satisfactory)	mesotrophic
2,7 – 3,2	strong contamination	IV	(Satisfactory) Poor / Unsatisfactory	eutrophic
>3,2	Contamination strong to very strong	V	Bad	hypertrophic

In order to identify the habitat saprobic level, the concentration of chemical indicators for organic load was used as a reference, obtained through the level of dissolved oxygen, biochemical oxygen demand (BOD), nitrate nitrogen (N-NO2), nitrogen oxide (N-NO3).

In Table 2 are listed the chemical for the 5 quality classes.

Table 2 Chemical element and water quality standards (Norm 161/2006)

Nr	Quality indicator	UM	Quality classes				
			I	II	III	IV	V
1	Dissolved oxygen	mg O_2/l	9	7	5	4	4
2	CBO5	mg O_2/l	3	5	7	20	>20
3	Dissolved oxygen saturation	%	90-70	70-50	50-30	30-10	10
4	Nitrite (N-NO2)	mg N/l	0.01	0.03	0.06	0.3	>0.3
5	Nitrate (N-NO3)	mg N/l	1	3	5.6	11.2	>11.2

RESULTS AND DISCUSSIONS

TAXONOMIC

They were identified 28 species of algae from 5 taxonomic divisions in may 2010 in phytoplankton samples collected from stations in the basin regarding the growth of cyprinids for consumption of Malina fish farm, Galati county;

During the study period were recognized 4 species of Euglenophyceae, 4 species of Bacillariophyceae, 17 species of Chlorophyceae, 2 species of Zygnematophyceae and 1 species of Cryptophyceae (Table 3).

Table 3 Taxonomic list of Phytoplankton species, number of copies and numerical value (s) corresponding to the saprobity degree

Class	Species	M1	M2	M3	M4	M5	M6 supply	M7 evac	Level saprobity / numerical value
Euglenophyceae	*Euglena viridis*	12	4	15	24	0	1	0	p-α (4.0)
	Trachelomonas armata	0	0	2	0	0	0	1	β (2.0)
	Trachelomonas oblonga	14	55	29	132	21	11	9	β (2.0)
	Trachelomonas volvocina	18	43	10	27	1	0	1	β (2.0)
Bacillariophyceae	*Asterionella formosa*	0	1	0	0	0	0	1	o-β (1.5)
	Synedra acus	2	0	0	0	0	0	0	β (2.0)
	Gyrosigma acuminatum	6	2	0	0	0	0	1	β (2.0)
	Navicula cuspidata	2	0	0	0	0	0	0	β-α (2.5)
Chlorophyceae	*Actinastrum hantzschii*	0	87	1	125	54	0	2	β (2.0)
	Chlorella vulgaris	0	1	0	0	0	0	0	p (4.0)
	Monoraphidium contortum	0	5	0	0	0	0	0	-
	Lagerheimia genevensis	7	0	2	3	7	1	0	β (2.0)
	Crucigenia tetrapedia	5	1	1	0	0	1	1	β (2.0)
	Oocystis lacustris	0	1	2	0	0	0	0	o-β (1.5)
	Pediastrum boryanum	0	4	0	0	0	0	0	β (2.0)
	Pediastrum duplex	3	1	1	0	2	0	0	β (2.0)
	Pediastrum tetras	0	4	6	0	0	0	0	β (2.0)
	Scenedesmus acuminatus	37	54	40	0	10	0	4	β (2.0)
	Scenedesmus denticulatus	0	0	0	1	1	0	0	β (2.0)
	Scenedesmus opoliensis	0	2	5	0	0	0	2	β (2.0)
	Scenedesmus quadricauda	81	131	86	64	62	7	4	β (2.0)
	Scenedesmus spinosus	15	15	15	2	10	0	0	β (2.0)
	Tetraedron caudatum	2	4	2	0	0	0	0	β (2.0)
	Tetraedron trigonum	1	5	1	0	0	0	0	β (2.0)
	Ulothrix sp.	0	1	0	0	0	0	0	α (3.0)
Zygnematophyceae	*Spirogyra varians*	0	1	0	0	0	0	0	β-α (2.5)
	Staurastrum tetracerum	1	0	0	2	2	0	0	α (3.0)
Cryptophyceae	*Cryptomonas ovata*	0	0	1	0	0	0	0	α (3.0)

In terms of abundance [3], in the phytoplankton dominant are the Chlorophyceae with a share of 68.70%, followed by Euglenophyceae (29.78%), Bacillariophyceae (10.39%) and Zygnematophyceae or Cryptophyceae have to share less than 1% (0.42% and 0.07%).

SAPROBITY

In growth basin for the cyprinids consumer in Malina fish farm, from 28 species identified in May -2010, 27 species are indicators of water quality, most of which are β-mesosaprobic species (94.99%), p-polysaprobic (3.96%), o-β-mesosaprobic (0.35%) α-mesosaprobic (0.49%) and β-α mesosaprobic (0.21%).

Each identified species was assigned a numerical value corresponding to the saprobic zone, according to Norm 161/2006 (Table 3).

In terms of quantity, β-mezosaprobic species have value between 39520-697528 ex/ l regarding numerical density.

Both, the supply of basin, in basin and the evacuation of basin, the β-mezosaprobic species have the highest weight (95.24%, 91.78-98.82% and 96.15%) (Table 4).

Table 4 Numerical abundance on every level saprobity

Station	**Abundance**	**Saprobic category**				
		o-β (1.5)	**β (2.0)**	**β-α (2.5)**	**α (3.0)**	**p** (4.0)
M1	%	0	92.71	0.97	0.48	5.83
M2	%	0.48	97.84	0.24	0.24	1.20
M3	%	6.85	91.78	0	0.45	0.91
M4	%	6.32	93.16	0	0.52	0
M5	%	0	98.82	0	1.18	0
M6 supply	%	4.76	95.24	0	0	0
M7 evac.	%	0	96.15	0	0	3.85

The Phytoplankton saprobic index have values between 1.98 and 2.11 (Table 4), according to Norm 161/2006 which indicates that the water belong to the class II of quality, a good ecological status and an oligotrophic level (Table 5).

Table 5 Saprobity Index value on stations

Station	**Saprobity Index (S)**
M1	2.11
M2	2.02
M3	2.11
M4	2.10
M5	2.00
M6 supply	1.98
M7 evac.	2.07

CHEMISTRY

Chemical parameters of water plays an important role in determining the quality, its normal values leading to the presence of natural food in the water table, with a decisive contribution to the normal growth and development of fish material.

Growth Basin of cyprinids consumption (EC1) is characterized by values of dissolved oxygen: 8.22 in supply, 7.35 in pond, or 6.80 to evacuation (Table 5). The presence of dissolved oxygen in water hastens the oxidation and the decomposition of organic matter leading to a decreased toxicity on the aquatic organisms.

In subarea β-mesosaprobic, self-cleaning process is advanced; the mineralization of organic matter is almost over. Water has nitrates and nitrites. CBO5 is reduced, dissolved oxygen is in large quantity and does not fall below 50% of saturation (Table 6).

Table 6 Chemical parameters values of Malina fish farm

Parameter (U.M)	**M6 supply**	**M7 evac.**	**Averages in EC1**
Dissolved oxygen (mgO_2/l)	8.22	6.80	7.35
CBO5 (mg O2/l)	5.9	6.1	6.4
Saturation (%)	63.25	57.77	62.18
Nitrite (N-NO2)	0.037	0.056	0.043
Nitrate (N-NO3)	3.5	4.0	3.8

So, the EC1 fish bazin of Malina fish farm is characterized by chemical parameter values falling within acceptable limits for fish waters, indicating belonging to the second class quality.

CONCLUSIONS

Water quality ecosystem investigated is assigned to the β mezosaprobic subarea, prevailing the β-mezosaprobic species.

The characteristic biomarkers for this subarea are part of Euglenophyceae (Trachelomonas species), Bacillariophyceae (Gyrosigma species), Chlorophyceae (Actinastrum species, Lagerheimia, Crucigenia, tetrahedron, Scenedesmus, Pediastrum).

The Values of chemical parameters show that water belongs to class II of quality, according to Order 161/2006.

The Phytoplankton saprobic index falling the water of Malina fish farm in the second grade of quality, the water having a good ecological status and an oligotrophic level, being properly for the fisheries development.

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