RESEARCHES CONCERNING THE WATER QUALITY OF FISH FARM CÂRJA 1

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Abstract

To obtain big fish productions, one of the most important factors is the quality of water.

The aquatic environment is under permanent changes due to continuous interaction between biotic and abiotic parameters. The purpose of this paper is to analyze the water quality of an aquatic ecosystem anthropogenic (farm Cârja 1) in spring 2011, through biological indicators of the planktonic communities correlated with physical – chemical parameters. The determination of water trophicity was based on the functional guilds of phytoplankton communities established by Reynold (2002) Bilous et.al. (2012) by Van Dam et. al, 1994. Also, it was calculated the Saprobic Index on the basis of the qualitative and quantitative identification of the species. The Physical – chemical indexes analyzed were: temperature, pH, DO (Dissolved Oxygen), BOD (Biochemical Oxygen Demand) and nutrients. The global assessment was made according to the requirements of Order 161/2006. The research conducted on phytoplankton communities led to the establishment of taxonomic structure consisting of 29 species. They belong to five taxonomic groups: Chlorophyceae (42.28%), Bacillarophyceae (17.24%), Euglenophyceae (17.24%), Cyanophyceaea (13.8%), Pyrrophyceae (3.45%). After analyzing the biological and physical - chemical indicators, the water farm belongs to Class III - IV water quality which corresponds to meso – eutrophic level.

Key words: phytoplankton, biological and physical - chemical indicators

INTRODUCTION

The phytoplankton is probably the most important component of the aquatic biocenosis because its structure also determines other biotic components (zooplankton, macrophytes, and macroinvertebrates).

Also, the phytoplankton taxonomic structure of the water surface is very important because it's a component that reflects the status of the aquatic ecosystem to eutrophication, acidification, salinity, pollutants.

So, there are predictable relationships between the quantitative and qualitative structure of phytoplankton and the physical - chemical parameters of the aquatic ecosystem.

The evaluation of the water quality through algal communities has a long history. Along time, there have been developed different indices of phytoplankton communities through which has been attempted to assess the quality of the water surface (biotics and diversity indexes are the most widely used). The purpose of this paper is to determine the quality of the aquatic ecosystem Cârja 1 through algal species composition, saprobity index correlated with water chemistry.

For this purpose, it was made a classification according to the trophic status, temperature and acidification.

MATERIALS AND METHODS

2.1. The description of the study area

Carja 1 farm is located in Vaslui County, near the Murgeni village. (Figure 1)

The profile of the company's activity is producing popular material and fish consumption.

The farm supply is from the River Prut, by pumping and / or gravity. For inlet and outlet of the water, is used the same channel.

The farm has a total area of S = 647 ha.

The samples were taken from pond fish consumption growth (also called Great Pond, whose surface is S = 297 ha).

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The sampling physical - chemical and phytoplankton was carried out in spring (May) 2011.

The samples were collected from six stations arranged so as to capture the heterogeneity living conditions (5 stations located inside the pond and the 6th station represented by the supply - evacuation channel (Figure 1).

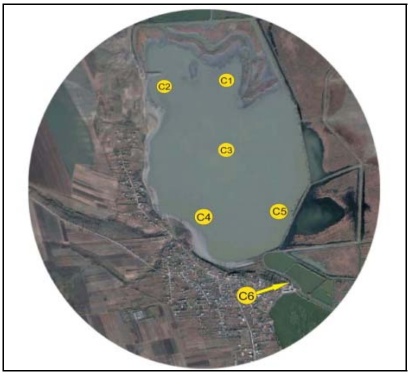

Fig. 1 Area study

2.2 Materials and methods

The phytoplankton samples were collected from the water surface in 500 ml bottles and immediately fixed with Lugol solution in ratio 1/100. The samples were taken to the laboratory for the quality assessment.

The chemical parameters analyzed in the laboratory were: ammonium, nitrates, nitrites, inorganic nitrogen, organic nitrogen, total nitrogen, phosphate, total phosphorus biochemical oxygen.

The pH, temperature and dissolved oxygen content were measured instantly on the field using *Digital electrochemistry with HQD meters and intellical electrods.*

The phytoplankton samples were evaluated qualitatively and quantitatively.

The taxonomic determination of the phytoplankton samples was done to species level, using the specialty literature (key determination, atlases, etc.). [2], [3], [4], [5], [7], [8], [9], [10], [11].

Each species was classified according to trophic status, temperature and acidification by O. Bilous, et. al, (2012) and Reynold C.S, et. al., (2002).

The saprobic index for each species was calculated according to the methodology Pantle - Buck (1955) using the following formula:

$$S = \sum_{i=1}^{n}(si * hi) / \sum_{i=1}^{n} hi$$

where: S – Index of saprobity of algal community; s_i – species-specific saprobity index; hi – species abundance.

RESULTS AND DISCUSSIONS

The mean values of the physical - chemical parameters registered in the sampling stations are shown in Table 1.

Regarding the qualitative structure of phytoplankton, we mention that has been identified a total of 29 species belonging to five taxonomic groups, as follows: Chlorophyceae (48.28%), Bacillarophyceae (17.24%), Euglenophyceae (17.24 %), Cyanophyceaea (13.8%), Pyrrophyceae (3.45%). (Figure 2).

In table 2 is given the taxonomic distribution on stations, the species classification in trophic guilds according to feeding mode [12], [13], a classification that follows th sensitivity pH [6] and saprobic index.

Table 1 Mean physical – chemicals variables at the sampling stations on Carja 1

Physical – chemicals parameters	Means values ±SD (min – max)	Quality classes
Dissolved oxygen mg/l	9,171±0,030 9,150÷ 9,193	I
CBO_5 mg/l	7,595±0,181 7.724 ÷ 7.467	III - IV
pH	8,684±0,051 8.648÷8.72	I
$N (NH_4)$	0.179±0.0493 (0.240 ÷ 0.11)	I
$N(NO_2)$	0.012±0.0036 (0.009÷0.018)	I – II
$N(NO_3)$	2.415±1.143 (1.145÷4.553)	I – II
N total	9.032±6.7 (2.835÷21.947)	II – III
P total	0.3±0.08 (0.203÷0.441)	I – II

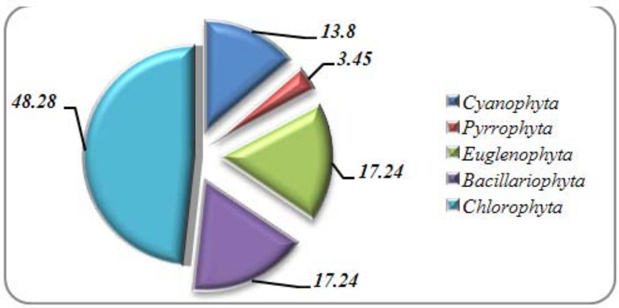

Fig. 2 *The taxonomic distribution of the phytoplankton*

Table 2 Taxonomic structure and trophic status of the phytoplankton community

Class	*Specie*	*Stations*						*Trophic state*	*Acidity (pH)*	*Saprobic index*
		1	2	3	4	5	6			
Cyanophyta	*Anabena flos aque*	-	+	-	-	-	-	e	-	β (2,0)
	Anabena circinalis	+	-	-	-	-	-	e	-	o - β (1,5)
	Oscilatoria sp.	-	-	-	-	-	+		-	-
	Merismopedia punctata	+	-	+	-	++	-	m	-	β (2,0)
Pyrrophyta	*Peridinium sp.*	+	-	-	-	-	-	m	-	o (1,0)
Euglenophyta	*Euglena acus*	+	-	-	-	-	-		ind	β - α (2,5)
	Euglena oxiurius	+++	-	-	++	-	-		ind	o - β (1,5)
	Euglena viridis	-	+	++	-	-	-		ind	p - α (4,0)
	Phacus pleuronectes	+	++	+	+	-	+		ind	β - α (2,5)
	Tranchellomonas armata	-	-	-	-	-	+	m	-	β (2,0)
Bacillariophyta	*Amphora ovalis*	-	+	+	++	++	-	e	alk	α (3,0)
	Navicula cryptocephala	+	++	+	-	-	-	e		α (3,0)
	Pinularia viridis	-	++	-	-	-	-			β (2,0)
	Synedra acus	-	++	+	-	+	-	me		β (2,0)
	Nitzschia linearis	+	-	-	-	-	-	me	alk	-

	Crucigenia tetrapedia	+++	-	++	-	+	-		ind	β (2,0)
	Crucigenia rectangularis	+	-	-	-	-	-			β - α (2,5)
	Lagerheimia longiseta	+	-	-	-	-	-		-	α (3,0)
	Monoraphidium contortum	+	-	-	-	-	-	e	-	-
	Pediastrum boryanum	-	-	+	-	++	-			β (2,0)
	Pediastrum duplex	-	-	-	-	-	+			β (2,0)
	Pediastrum tetras	-	-	+	-	-	-			β (2,0)
Chlorophyta	*Scenedesmus acuminatus*	+++	+++	-	++	++	+			β (2,0)
	Scenedesmus quadricauda	+++	+	+	++	+	+++			β (2,0)
	Scenedesmus spinosus	+	-	-	-	-	-			-
	Scenedesmus bijuga	-	-	-	-	+	-			β (2,0)
	Scenedesmus opoliensis	-	-	-	-	+	-			β (2,0)
	Tetrastrum staurogeniaeforme	-	-	-	+	-	+		-	β (2,0)
	Coelastrum microporum	-	-	+	-	+	+		ind	β (2,0)
Saprobity index		1.98	2.33	2.56	2.12	2.16	2.01			2,165

Trophic state (Van Dam et. Al. 1994): m – mesotrophic; me - meso-eutrophic; e – eutrophic;
Acidity (pH) (Hustedt 1957): ind – indifferent; alk – alkaline

Following the evolution of the monitored physical - chemical parameters, it can be observed an increase in the concentration of nitrogen (total nitrogen concentration inherent) and biochemical oxygen demand

These indicate an organic pollution of the water and a classification under Order 161 Class III – IV of quality, waters which correspond to mezasaprobe areas with medium to high contamination.

The saprobity index reflects the organic pollution as shown in Figure 3.

In the aquatic ecosystem which was studied, from the total of 25 identified species as being indicators of the water quality, the β-mezosaprobic species are predominant (14) and β-and α mezosaprobic and o -β-mezosaprobic are found in number of 3 and, respectively, 2.

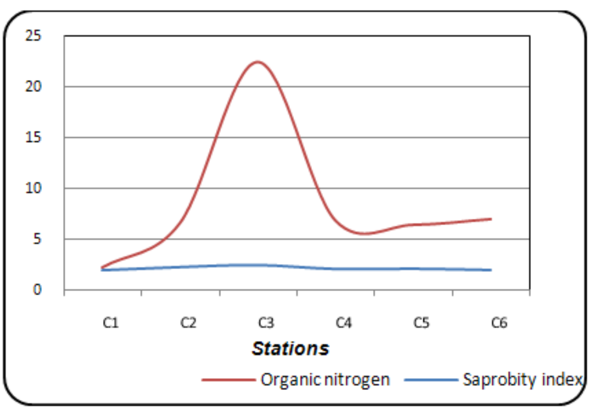

Fig. 3 Saprobic index and organic nitrogen variation on stations

Also, following the frequency of phytoplankton species according to their trophic status in the various stations of the farm, it can be observed that the most abundant species are the meso - eutrophic and eutrophic species.

The phytoplankton species with preferences for environments with high organic load, which give the aquatic ecosystem a meso-eutrophic character, are represented by *Amphora ovalis*, *Navicula cryptocephala*, *Monoraphidium contortum*, *Anabena flos aque*, *Synedra acus*, *Nitzschia linearis*.

The quality of the water in the studied aquatic ecosystem is given by both the interaction of biotope with biocenoses characteristics, but it is also influenced by the quantity and the nature of inorganic and organic substances of the Prut River.

CONCLUSIONS

The aquatic ecosystem which was studied, represents the growth pond of the asian cyprinid and carp. So, the phytoplankton, the quantity and its quality, play a special role because the species which are grown, have the nutritional spectrum represented by the phytoplankton or other trophic links whose food source is Phytoplankton.

After the completion of the study we can conclude that:

the phytoplankton community structure consists of 29 species belonging to five taxahnomic groups, the Chlorophyceae family was dominant (48.28%);

the water quality evaluated through the physical - chemical parameters, according to Order 161/2006 in class III- IV, classes corresponding to mezosaprobic water areas with medium to high contamination.

the trophic status of the existing species also reflects the meso - eutrophic character of the studied aquatic ecosystem;

although waters have a strong eutrophic character, no algal blooms were recorded and no mortality or low concentrations of oxygen. This is explained by the trophic spectrum of the existing fish fauna (silver carp, bighead carp, grass carp and carp).

As a general conclusion, we can say that the waters of the studied aquatic ecosystems have a high trophic level, being in the class of mesotrophic - eutrophic waters, with a high organic pollution.

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