RESEARCH ON THE PRODUCTION AND PRODUCTIVITY OF ZOOPLANKTON IN A FRESHWATER AQUATIC POOL

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Abstract

The complex hydrobiological investigations undertaken in Lake Ezăreni Iasi in summer 2012 were conducted qualitative and quantitative determinations of zooplancton. Qualitative analysis of zooplankton samples was to determine the main taxon groups of zooplancteri (rotifers, copepods, cladocere) and to produce the conspect of faunal taxonomic groups. Quantitative analysis was performed for structural characterization of planktonic zoocenoza (density, abundance, biomass) by the gravimetric method, which consists in determining the wet weight of each species of zooplancters. They made lots of 100 individuals of the same species and have weighed the analytical balance. Was obtained as an average weight of each body of the species analyzed. With your average weight of each species could calculate the total biomass of zooplankton in water volume (liter). The results indicate that the composition of zooplankton was identified three taxonomic groups (Cladocere, Copepods, Rotifers), largest numerical density occurring in the upstream area of the lake area with 6104 ex./m3, followed by the center of Lake with 5454 ex./ m^3 and finally in downstream area with a total of 3122 ex/ m^3. Regarding the biomass highest values were registered at the cladocers in the central area of the basin investigated (920.82 g/m^3), then at copepods in the upstream area (223 ex./m^3.), and the lowest value was recorded at rotifers in all three sectors of the basin investigated.

Key words: aquatic, zooplankton, biomass, density

INTRODUCTION

Zooplankton are an important link in the food chains of aquatic ecosystems, being the most valuable food source for planctonofag fish species, but and carnivore species in the early ontogenetic stages. It also zooplankton ensures in the ecosystems the transfer of substances and energy from primary breeding to higher-order consumers [1, 3].

Zooplancters are small organisms from several microns to several centimeters. There are several groups by size: nanoplankton - includes small protozoa passing through small planktonic; microplankton - includes infusion, rotifera, smallcrustaceans; mezoplanctons - includes most rotifera, cladocera and copepods; macroplankton - consists of marine's zooplankters sized between 1 cm and 100 cm [1, 2]. In water basins, zooplankton is uneven distributors, primarily related to aggregation phenomena and active migration ofzooplankters due to the influence of biotic and abiotic factors.

Cladocers, copepods and rotifers form swarms, flocks or clouds of plankton, moving in search of food and favorable physicochemical conditions in the aquatic environment [1, 3]. Secondary production efficiency depends on the quality of the food ingested by consumers, being higher in phytophagous species than in carnivores. On zooplankton, assimilation efficiency varies between 50% and 90%, being higher in herbivorous species. Assimilation efficiency depends on the nature of the food: it is lower in those that feed on diatoms and higher in those who consume mostly cloroficee. In the water, uneven spread of zooplankton is subject to dynamic phenomena such as horizontal and vertical currents or waves, which in some areas collect large amounts of planktonic organisms [7, 8].

Horizontal spread of zooplankton is influenced by various factors such as: the quantity and quality of food, presence of planktonofag's fish, physical parameters of water [10, 11]. In the water, vertical

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distribution of zooplankton has a nictemeral character; thus, during the day, the surface layer is polluted with a few zooplankters, registering young forms, while at depths greater than 5 m adult individuals are mostly from phytophagous species and their predators. During the night is carried upward migration and populate the layer of water [4, 5]. Quality seasonal variations of zooplankton recorded shows that systematic groups during the year have unequal development: winter, spring and summer growing rotifers and in autumn growing cladocers and copepods, eliminating rotifers from zooplankton composition [1, 2].

MATERIAL AND METHOD

A first step in determining of the zooplankton from the investigated lake was the consist in the collection of samples. Choice collection stations was made so as to include the most significant ecological areas from investigated ecosystems [1, 2]. From the water basin investigated were collected samples from the upstream (supply), the area downstream (evacuation) and the central area. In the supply and evacuation areas, samples were collected from the surface horizon (0 meters), and in the central area, of the surface at different depth horizons (5-10-15 m) [4, 5]. Results obtained by taking successive samples gave a relative situation of zooplankters' number from investigated water basin, because the zooplankton was constantly traveling and moving. For this reason different methods were used to estimate their distribution: simultaneous collection of samples from several points of collection, quantitative evidence collection series along a straight, approximately equidistant divided into parts of 3 m [3, 6]

Collection tools used were: planktonic net of different construction and sizes made from silk mesh with diameter of 40-50 μ, reversible double planktonic net to capture zooplankton organisms at different depths. Collected water samples were filtered through planktonic net fitted with a cylindrical glass collector [1, 8]. Concentrate on zooplankton was introduced in plastic bottles of 100 - 150 ml. To eliminate loss of organisms net was rinsed by introducing in water until near the metal ring, was shaken vigorously and new focus to add the previously collected

Sample was preserved with formalin 4%. Volume of filtered water from basin depends on food, in this case being 10 l. Samples were prepared for microscopic analysis. The first operation that took place was the concentration, by slow sedimentation: samples were left motionless on the flat about 3 weeks, during which all biological material settled, then using a vacuum pump to siphon the supernatant, and sediment that includes biological material was placed in vials to be analyzed microscopically [2, 3].

Qualitative analysis of zooplankton from samples was to determine the major taxonomic groups of zooplankters (protozoa, rotifers, copepods, cladocers) and to produce epitome faunal taxonomic groups and trophic level (secondary consumers or predators, herbivores or primary consumers). Quantitative analysis was performed for structural characterization of planktonic zoocenoza (density, abundance, biomass) by the gravimetric method, which consists in determining the wet weight of zooplankters depending on the species. They made lots of 100 individuals of the same species and have weighed the analytical balance. Was obtained as an average weight of each body of the species analyzed. With your average weight of each species could calculate the total biomass of zooplankton in water volume (liter) [7, 9]. Results of analyzes of samples were transferred into special lists that were included quantitative and qualitative data resulting from microscopic analyzes. These data were used to calculate the parameters and ecological indices such as density an abundance. With their help we could characterize the structure of the planktonic of ecosystem investigated [10, 11, 12].

Numerical density is the number of individuals per unit volume. We counted the individuals belonging to each species, was summed number of individuals in each taxonomic group, which resulted the total number of individuals in the sample. The result is expressed in numbers of individuals

per m^3 taking into account the amount of water which was initially filtered. Numerical abundance is the ratio between taxonomic groups (or between species) in terms of numbers, where they reported the percentage number of individuals of a taxonomic group by the total number of individuals in a sample [1, 6, 7].

Zooplankton biomass was calculated wet substance, based on specific average weight (μg), number of individuals of each species was multiplied by the average appropriate individual and by summing the biomass of taxonomic groups obtained the total biomass of all species from sample. The result was expressed in mg per unit of volume (mg/m^3). Abundance of biomass is the of biomass of a species (group systematically relative to biomass of other species in the sample [2, 3].

RESULTS AND DISCUSSIONS

Following investigations undertaken have achieved a series of results presented in tables 1, 2, 3 and figures 1, 2.

Table 1 Numerical density and biomass of zooplankton in the upstream area of aquatic basin investigated

Taxonomic group/species	Numerical density no. ex./ m^3	Numerical abundance %	Zooplankton biomass g/ m^3	Abundance biomass %
Copepoda	**3207**	**52,53**	**223,0**	**23,07**
Cyclops strenus	645	10,57	129	13,34
Cyclops vernalis	596	9,76	6,43	0,67
Eucyclops serrulatus	310	5,07	12,4	1,28
Macrocyclops albidus	412	6,74	41,2	4,27
Macrocyclops gracilis	595	9,75	4,76	0,49
Diaptoma sp.	649	10,64	29,2	3,02
Cladocera	**1902**	**31,16**	**742,2**	**76,80**
Bosmina longirostris	157	2,57	5,49	0,56
Chydorus sphaericus	201	3,29	2,01	0,22
Daphnia galeata	186	3,04	18,6	1,95
Daphnia longispina	191	3,12	19,1	1,97
Daphnia magna	217	3,55	308,1	31,88
Daphnia sp.	309	5,06	20,0	2,08
Daphnia pulex	410	6,71	266,5	27,57
Moina sp.	187	3,06	14,0	1,44
Sida crystalina	201	3,29	88,4	9,13
Rotatoria	**995**	**16,31**	**1,16**	**0,13**
Brachionus angularis	97	1,58	0,41	0,05
Brachionus calyciflorus	117	1,92	0,46	0,04
Brachionus urceolaris	112	1,84	0,11	0,02
Filinia sp.	264	4,32	0,06	0,006
Keratela cohlearis	209	3,43	0,04	0,004
Keratela sp.	196	3,22	0,08	0,008
Total	**6104**	**100**	**966,36**	**100**

The data in table 1 and figure 1 concerning the numerical density of zooplankton in the upstream area of Lake Ezăreni indicates that the highest density recorded a number of copepods, followed by cldocers and then rotifers. On zooplankton biomass in this area of the lake we see that the highest values were recorded by cladocers followed by copepods and rotifers. Regarding the abundance of biomass, it was still higher in cldocers, followed by copepods, while rotifers showed the lowest value.

In the downstream water basin investigated (table 2, figure 2) was to determined the total number of 3122 individuals/m^3, which were dominant the copepods, followed by cladocers, rotifers showing in this sector of the basin a small density. Higher values of biomass in this sector observed at cladocers followed by copepods, the lowest values registred at rotifers.

Table 2 Numerical density and biomass of zooplankton in the downstream area of aquatic basin investigated

Taxonomic group/species	Numerical density no. ex./m^3	Numerical abundance %	Zooplankton biomass g/m^3	Abundance biomass %
Copepoda	**1590**	**50,93**	**129,66**	**21,11**
Cyclops strenus	567	18,16	113,4	18,54
Cyclops vernalis	432	13,83	4,66	0,76
Eucyclops serrulatus	215	6,88	8,60	1,40
Macrocyclops gracilis	376	12,04	3,00	0,49
Cladocera	**1140**	**36,51**	**481,47**	**78,79**
Bosmina longirostris	98	3,14	3,43	0,56
Daphnia galeata	76	2,43	7,60	1,24
Daphnia longispina	107	3,42	10,70	1,75
Daphnia magna	118	3,78	167,56	27,42
Daphnia sp.	265	8,49	17,22	2,82
Daphnia pulex	312	9,99	202,8	33,18
Sida crystalina	164	5,25	72,16	11,80
Rotatoria	**392**	**12,56**	**0,10**	**0,072**
Brachionus calyciflorus	52	1,67	0,020	0,003
Brachionus urceolaris	87	2,78	0,026	0,004
Filinia sp.	118	3,78	0,029	0,005
Keratela cohlearis	135	4,32	0,027	0,006
Total	**3122**	**100**	**611,23**	**100**

The number density of all individuals in the center of the water basin investigated (Table 3) was of 5454 individuals/m^3, cladocers and copepods registering very similar values compared with rotifers were less numerous. The highest biomass in this sector was recorded at cladocers and the lowest in rotifers.

Table 3 Numerical density and biomass of zooplankton in the central area of aquatic basin investigated

Taxonomic group/species	Numerical density no. ex./m^3	Numerical abundance %	Zooplankton biomass g/m^3	Abundance biomass %
Copepoda	**2145**	**39,33**	**169,75**	**15,54**
Cyclops strenus	714	13,09	142,80	13,08
Cyclops vernalis	601	11,01	6,49	0,59
Eucyclops serrulatus	432	7,92	17,28	1,58
Macrocyclops gracilis	398	0,73	3,18	0,29
Cladocera	**2132**	**39,09**	**920,82**	**84,39**
Bosmina longirostris	256	4,69	8,96	0,82
Daphnia galeata	216	3,96	21,60	1,98
Daphnia longispina	258	4,73	25,80	2,36
Daphnia magna	287	5,26	407,54	37,35
Daphnia sp.	367	6,73	23,85	2,18
Daphnia pulex	495	9,07	321,75	29,49
Sida crystalina	253	4,64	111,32	10,20
Rotatoria	**1177**	**21,58**	**0,89**	**0,071**
Brachionus calyciflorus	123	2,25	0,049	0,004
Brachionus diversicornis	212	3,88	0,63	0,05
Brachionus urceolaris	289	5,30	0,086	0,007
Filinia sp.	307	5,62	0,076	0,006
Keratela cohlearis	246	4,49	0,049	0,004
Total	**5454**	**100**	**1091**	**100**

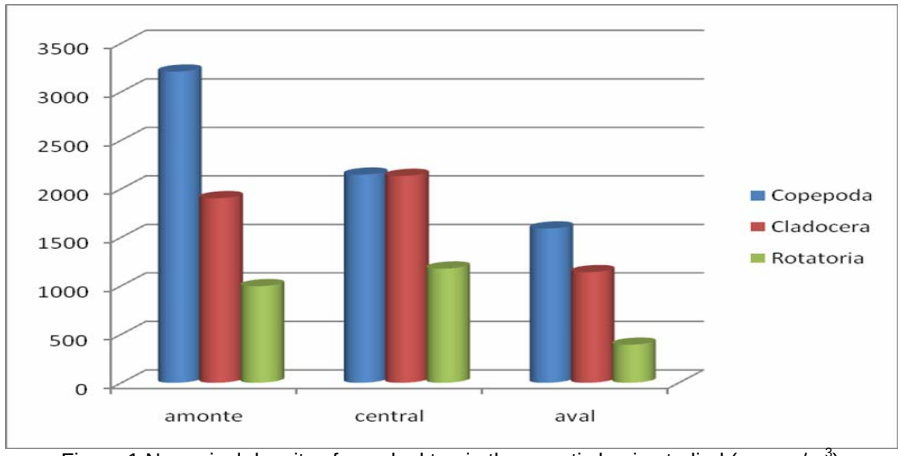

Figure 1 Numerical density of zooplankton in the aquatic basin studied (no. ex./m^3)

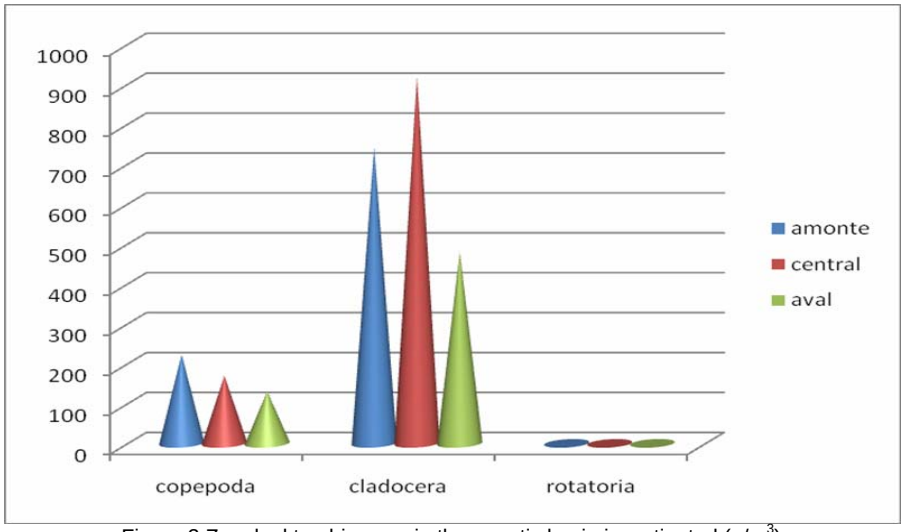

Figure 2 Zooplankton biomass in the aquatic basin investigated (g/m^3)

CONCLUSIONS

As a result of research conducted in the summer of 2012 in the Lake Ezăreni in Iasi County, concerning the determination of zooplankton productivity in the three sectors of the lake (upstream, central and downstream) have obtained a series of results which have emerged as a number of conclusions.

Total density of zooplankton individuals in all three sectors of the lake Ezăren was 14,680 ex./ m^3 and the total biomass recorded a value of 2668.59 g/ m^3.

The highest of numerical density of zooplancters occurred in the upstream of the lake (6104 ex/ m^3), then in the central area (5454 ex./ m^3) and the lowest density was recorded in the downstream (3122 ex./ m^3).

Regarding the weight of taxonomic groups the most abundant were copepods (6942 ex./m^3), followed by cladocers (5174 ex./m^3), while rotifers were less abundant (2564 ex./ m^3).

The highest value of zooplankton's biomass was recorded in the central area of the lake (1091 g/ m^3), then in the upstream (966.36 g/ m^3) and lowest in the downstream (611.23 g / m^3).

Concerning the taxonomic groups, the largest amount of biomass was recorded by

cladocers (2,114.49 g/ m^3), then copepods (522.41 g/ m^3) and the smallest amount in rotifers (2.15 g/ m^3).

Research conducted in Lake Ezăreni from Iasi county in the summer of 2012 allow us to state that zooplankton productivity is high, thus constituting an important source of food for many types of hydrobionts of this lake.

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