Data Regarding Qualitative and Quantitative Composition of Benthic Populations from Musura Bay-Danube Delta, Romania

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Abstract: The present paper refers to some data regarding zoobenthic communities from one of northern lagoon of the Danube delta, known as Musura bay (ROSCI0065, coded as coastal lagoon *1150). Faunal composition is influenced by the mixture of waters from the Danube and the marine coastal zone. According to monitored areas, there are dominant freshwater or marine invertebrates forming populations that live in the sediments. The aim of this paper is to offer a view of the endopsammic and endopelagic benthic communities from Musura bay, during two years of observations (2013 and 2014) and analyze the seasonal dynamics of invertebrates' populations. Based on quantitative samples collected from infralittoral zone, the paper presents the qualitative structure and a quantitative analyze (abundance, constancy—F%, dominance—D% and $W_D\%$) of invertebrate populations from all taxa (belonging to Foraminifera, Nematoda, Gasteropoda, Oligochaeta, Polychaeta, Ostracoda, Copepoda, Cumacea, Amphipoda and Chironomidae etc.) found in the researched zones, in connection with variation of local ecological conditions. Some considerations regarding the role of invertebrates' populations as food resources for lagoon fishes are done.

Key words: Black sea, Danube delta, Musura bay, zoobenthos.

1. Introduction

The Danube Delta is one of the most amazing ecobiome of the European continent, being a mosaic of aquatic and terrestrial ecosystems intertwined with wetlands, which develops a huge variety of flora and fauna. In the last years, a series of studies were developed in the coastal area of the Romanian coast of the Black sea and the Danube Delta in order to monitor the biodiversity of the coastal ecosystems, mainly as a Natura 2000 protected areas network.

The Danube delta is formed by the Danube river before it flows in the Black sea, as the second largest river in Europe. The Danube delta biosphere reserve has an area of 5,800 km², 79% of it lies in Romania, occupying 3,510 km² area [1] and lies between three main branches— Sfântu Gheorghe, Sulina and Chilia.

The terrestrial and aquatic biodiversity is very high. According to the literature, fauna is very rich, including several thousand species of terrestrial and aquatic invertebrates. Among vertebrates, fish and birds are the most representative species of this ecobiome.

In Danube delta biosphere, reserve waters are cited 133 fish species, 54 of them are freshwaters, 66 are marine species and 13 are eurihaline, which encountered in aquatic ecosystems with very varied salinity. The diversity of avifauna includes over 325 species of aquatic and terrestrial birds, of which more than half nest in summer as summer guests. During autumn, winter and spring, 159 more species traverse the Danube delta, as passage birds, which feed on the reserve territory. There is also a rich fauna of reptiles and mammals that inhabit either terrestrial or wetlands and lentic or lotic water bodies slowly [1-3].

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Regarding flora and vegetation, more than 1,642 species of plants were recorded along the decades, dominants the aquatic species. It is considered that the Danube delta includes the greatest area of reed beds in the world, including floating islands of reed, which called “plaur”.

The coastal lagoons (*1150) from the Danube delta are Musura bay, Zătonul Mic, Zătonul mare and the lagoon complex Razelm-Sinoe.

Musura bay—located between Chilia (at north) and Sulina (at south) branches is a relatively recent geomorphologic formation with a less of a century age. Musura bay is situated at north of Sulina channel up to a branch, called Stambulul Vechi (Staro Stambul) which belongs to the secondary delta of Chilia branch, at Ukraine border (Fig. 1). In the last 20 years processes of accumulation, it formed a little island which could close the gulf in the next decades in front of Musura bay [4].

2. Materials and Methods

The study was conducted during different seasons of 2013 and 2014 with occasion of a research project

which aimed to monitor the current state of coastal and marine habitats.

In this paper, it was analyzed the situation of Musura bay benthic populations based on samples collected in spring, summer and autumn of 2013 and the spring of 2014.

Sampling were done from four sites, which were fixed taking into account the influence of the Danube (Sulina and Chilia) and the Black sea (Fig. 1). They were called conventional depending on their position as (Fig. 2):

- Site 1— island lighthouse (with predominantly sandy bottom);
- Site 2—Musura center (black smelly mud bottom);
- Site 3—drain chilia branch (muddy bottom);
- Site 4—Musura continental (bottom with sand and silt).

Quantitative samples were collected from infralittoral zone on mobile substratum with a Van Veen bodengreiffer (with an evaluate surface of 256 cm²) from depths between 220-225 cm in site 1, 125-130-140 cm in site 2, 80-100-135 cm in site 3 and 150-165 cm in site 4.

Fig. 1 Map of Romanian Danube delta with the main branches and Musura bay [5].

Fig. 2 Musura bay—The scheme of the monitoring track and the sampling sites.

A number of other physical and chemical parameters (temperature, pH, transparency, turbidity, salinity and conductivity) were recorded using a CTD. During the study, the wind recorded different speeds (spring of 2013—22 m/sec, in 2014—5 m/sec and autumn 2013—2-3 m/sec), but in the summer of 2013, it was very strong, exceeding 30 m/sec. The water and air temperatures recorded normal values for respective seasons, without registering extremes. For water 14.17 °C-20.83 °C and for air 16.57 °C-22.53 °C.

The samples were processed after classical methods [6-9]. Statistics analyze was done.

3. Results and Discussions

In order to know the composition of benthic communities from the Musura bay, a qualitative and quantitative evaluation has been done, and some ecological indexes like density, frequency and rank were calculated [10].

In all quantitative samples, they were identified individuals belonging to: Foraminifera, Nematoda, Polychaeta, Oligochaeta, Hirudinea, Gasteropoda, Ostracoda, Copepoda, Cumacea, Amphipoda, Chironomidae (larvae) and other Diptera larvae. The proportion and their presence vary considerably from one season to another. The species which are living in sediments such as nematodes and oligochaetes have the greatest proportions throughout the studied period (Figs. 3-7).

Fig. 3 Qualitative composition of invertebrates population—spring, 2013.

Fig. 4 Qualitative composition of invertebrates population—summer, 2013.

Fig. 5 Qualitative composition of invertebrates population—autumn, 2013.

Representatives of these groups can harness the best the food resources founded in the muddy substrate. Analyzing the frequency (Fig. 8) of the major taxonomic groups' populations collected from the Musura bay, it is noted that Nematoda and Oligochaeta are present in 100% of samples, as a constant group of biocoenosis.

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Fig. 6 Qualitative composition of invertebrates population—spring, 2014.

Fig. 7 Qualitative composition of invertebrates population for all studied seasons.

Fig. 8 Frequency variation of invertebrates populations in studied sites.

Ostracoda recorded value of 40% as accessories species. The other groups are considered as accidental with values under 25%. Even some of them were found in certain sites or seasons, their presence and their abundances are very hard to take into account to characterize the whole ecosystem (Fig. 9).

Fig. 9 Variation of the mean annual abundance.

Analyzing the mean annual abundances variation of benthic populations in all sites and in dependence of sediment type composition and granulometry (Fig. 9), the greatest values were recorded still by Nematoda, Oligochaeta and Ostracoda. This reveals a typical mixture of freshwater species with marine or mesomixohaline one, depending on the distance of the Danube freshwaters inflow or by the sea.

Ecological significance indices $W_D\%$ (Table 1) shows as characteristics species for the entire biocoenosis nematodes and oligochaetes, who occupy the first two rank positions. Representatives of Ostracoda, Polychaeta and Chironomidae—larvae, could be considered as accessorized species, with bigger values of dominance only in some season or in some sites.

These benthic invertebrates inhabitants from lagoons are an important food resource for fish that live in these mixed waters. The sturgeons *Acipenser gueldenstaedtii*, *Acipenser stellatus*, the shads *Alosa immaculata* and *Alosa tanaica* which have anadromous reproduction migrations are encountered in this zone, mainly in the spring. As adults, the sturgeons live at different depths of sea (20-40 m) and the shads in pelagic zone. During the breeding and in juvenile stages, they prefer the mouth of the Danube river and the lagoon area. They can find here favorable feeding zones both on rocky substrata and on sandy and muddy ones. At pelagic level, they find meroplanktonic individuals or diverse insects larvae [2, 11].

Table 1 Ecological significance indices $W_D\%$ and the Ranke of main invertebrates recorded groups.

Taxonomic group/taxon	D%	A%	$W_D\%$	Rk
Foraminifera	6.66	1.53	0.102	9
Nematoda	100	45.95	45.95	1
Oligochaeta	100	21.95	21.95	2
Polychaeta: <i>Alitta succinea</i>	20	7.19	1.438	4
Gasteropoda: <i>Theodoxus danubialis</i>	13.33	5.43	0.724	7
Copepoda	20	6.66	0.132	8
Ostracoda	40	10.21	4.084	3
Cumacea	6.66	0.74	0.094	10
Chironomidae—larvae	20	5	1	5
Diptera—larvae varia	20	4	0.8	6

Maintaining the balance of living conditions in these lagoon habitats is essential for both primary producers and consumers of various degrees. The mentioned fish species and others are protected of different conventions and international documents, such as Bern convention, habitats directive, CITES, IUCN red list and NATURA 2000 Network etc..

4. Conclusions

The benthic populations from studied sites are various included 12 invertebrates groups' inhabiting middlittoral and infralittoral waters. It is a mixture of freshwater species with marine species incoming from the sea. Even the qualitative composition is large, there are fluctuations from a season to another, and from sites influenced by the sea comparing to those situated in the proximity of the continent. These communities are selected by dominance of sand or mud in a way more evident than the other environmental conditions (waves, temperature and turbidity) typical for the lagoon waters. They have an important role as food resources especially for benthophagous fishes.

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