STUDY OF ENVIROMENTAL INDICATORS OF THE NARTA LAGOON (ALBANIA)

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Abstract. This study was designed to provide data for mollusc species living in the Lagoon of Narta, their distribution by habitat type within the lagoon and to assess the state of its mollusc populations. The fauna of the lagoon is a very important part of the lagoon ecosystems. In these ecosystems cockle are the main ingredients of zoobenthos biomass. They are very important elements of the food chains playing a major role in the functioning of these ecosystems. The study of the fauna of the Lagoon Narta presents interest not only in the context of the lagoon research in our country, but also due to the fact that this lagoon is one of the most important lagoons of the Albanian coast, with a great value of biodiversity, the recognition of which should be much more profound and complex. According to the study conducted in the Lagoon of Narta, we found 24 mollusc species, 15 of them belonging to gastropods and 9 to bivalve. The statistical estimates of the population characteristic for the lagoon fauna (density, constant, frequency) show that the distribution of the cockle within Narta Lagoon depends on the communication with the sea, the presence of fresh water, the water level and scale of euthrophism.

Keywords: indicator, lagoon environment, mollusc, ecosystem, biodiversity, Albania.

Rezumat. Studiul indicatorilor de mediu din Laguna Narta (Albania). Acest studiu a fost proiectat să furnizeze date despre speciile de moluşte care trăiesc în Laguna Narta, distribuţia lor în funcţie de tipul de habitat şi să evalueze starea populaţiilor de moluşte. Fauna lagunei este parte importantă a ecosistemelor lagunare. În aceste ecosisteme, moluştele constituie principalii reprezentanţi ai biomasei zoobentosului. Acestea sunt elemente importante în lanţul trofic şi joacă un rol major în funcţionarea acestor ecosisteme. Studiul faunei Laguna Narta prezintă interes nu numai din punct de vedere al cercetării din ţara noastră, dar şi datorită faptului că această lagună este una dintre cele mai importante de pe coasta albaneză în ceea ce priveşte biodiversitatea, a cărei cunoaştere ar trebui să fie mult mai profundă şi complexă. Conform studiului realizat în cadrul Lagunei Narta, au fost identificate 24 specii de moluşte, dintre care 15 aparţin gastropodelor şi 9 bivalvelor. Prin estimările statistice ale populaţiilor caracteristice faunei de tip lagună (densitate, constanţă, frecvenţă) s-a demonstrat dependenţa distribuţiei moluştelor în cadrul lagunei de comunicare cu marea, de prezenţa apei dulci, de nivelul apei, precum şi de starea de eutrofizare a apelor.

Cuvinte cheie: indicator, mediul lagunei, moluşte, ecosistem, biodiversitate, Albania.

INTRODUCTION

Narta lagoon and its surrounding areas is part of Vlora. Its space extends from the mouth of the bay to Vjosa Triportit functioning as a single ecological unit. Part of the lagoon is represented by the wetlands that lie on its edges. Intervention in this area damaged all the ecosystems and the extermination of certain traditional populations made them being replaced by a new human ecosystem (agar-industrial etc.). Narta Lagoon has an area of 6,500 ha. It is the second most important in the country mainly due to water birds, being a very important IBA. 20,000 birds live here during winter, belonging to more than 40 species. Here we mention a pelican species, *Pelecanus crispus*, which is met regularly, as well as the flamingo, *Phoenicopterus ruber*. Around the lagoon, there develops a rich flora and fauna typical for the Mediterranean wetland. The southern part of the lagoon was subject to some regional projects, not only due to its geographical position, but also to its value as a bog of international importance. Narta Lagoon is protected by international conventions. The importance of this lagoon is the result of the biodiversity potential and of the reports established between different constituent elements of its biodiversity. There is a great diversity and a large number of bird species that may be rarely encountered in natural environments. Based on the studied data, in the lagoon environment, there are about 2.2% of the representatives of *Roses* sp., 1.4% of chivalry and 1.2% of swallow-tailed gull. At the same time, in Narta Lagoon of, there grow 192 species of birds from 320 species in the U.S. total, half of which being water birds. In Narta Lagoon, there currently grow about 45-50 thousand bird that winter here, 18 thousand of them being ducks etc. There also are registered 364 tern pairs (MANKOLLI, 2006, 2007; VERMEIJ, 1993; Nature, 1997; Natura 2000, 2007).

MATERIAL AND METHODS

The observations were carried out in the lagoon in April-May and September-October 2008 and 2009 (Fig. 1). The establishment of the sampling stations was based on certain criteria, such as the distance between the communication channels of the lagoon with the sea, distance from the water flow channels in the lagoon, type of substratum, distance from the islands, the presence of phytobenthos, organic pollution and decrease of water level during summer. On the basis of these criteria, there were defined seven sampling stations in the lagoon, which appear in the scheme below. The quantitative data were subjected to some simple statistical calculations used in ecology. For the species with high density, there are calculated the values of density and frequency for each station. The estimation of the degree of divergence between the maximum and average values of these species characteristics and the frequency values can be established by taking into account the cockle populations for each station, and therefore the situation across the lagoon malacofauna. In addition to frequency values within each station, there were also calculated the

frequency values for each type. This type level provides a more complete picture of the species distribution throughout the lagoon and helps in assessing the overall situation in the lagoon malacofauna (SIGWART & SUTTON, 2007; STEINER & DREYER, 2003).
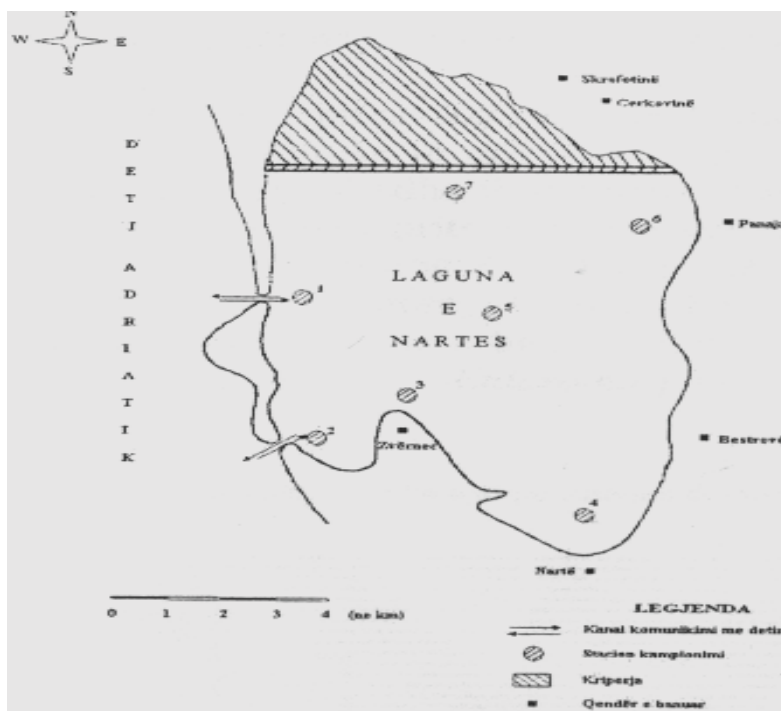

Figure1. Map of Narta Lagoon (Nature 1997).
Figura 1. Harta Lagunei Narta (Nature 1997).

RESULTS AND DISCUSSIONS

Of the seven stations, in the Narta Lagoon there were registered 24 mollusc species. Tables 1 and 2 renders the names of the species, their systematic position, and the station where they were collected from (presence of type is indicated by + in the appropriate column of the station).

Table 1. The indicator fauna within Narta Lagoon - Gastropod class.
Tabel 1. Fauna indicatoare din Laguna Narta - clasa Gastropoda.

The names of species	Rends	Family	Stations						
			1	2	3	4	5	6	7
Tricolia pullus (LINNAEUS 1758)	Archaeogastropoda	Phasianellidae		+					
Hydrobia sp.	Mesogastropoda	Hydrobiidae	+	+	+	+	+	+	+
Alvania lineata RISSO 1826	Mesogastopoda	Rissoidae		+					
Alvania sp.	Mesogastropoda	Rissoidae						+	
Turboella parva (DA COSTA 1779)	Mesogastropoda	Rissoidae	+					+	
Rissoa ventricosa DESMAREST 1841	Mesogastropoda	Rissoidae	+	+					
Turbonilla sp.	Entomotaeniata	Pyramidellidae	+						
Rissoa sp.	Mesogastropoda	Rissoidae	+	+	+	+	+	+	
Pirenella conica (BLAINVILLE 1826)	Mesogastropoda	Potamididae	+	+	+	+	+	+	+
Bittium reticulatum (DA COSTA 1779)	Mesogastropoda	Cerithiidae	+	+		+			
Cerithium vulgatum (BRUGUIERE 1792)	Mesogastropoda	Cerithiidae	+	+					
Cerithium rupestre RISSO 1826	Mesogastropoda	Cerithiidae	+	+					
Cyclope neritea (LINNAEUS 1758)	Neogastropoda	Nassariidae	+	+	+	+	+	+	+
Haminea sp.	Bullomorpha	Atyidae	+			+			
Bulla striata BRUGUIERE 1792	Bullomorpha	Bullidae	+						

Sources: Investigated area 2008-2009
Sursa: Zona analizată 2008-2009

As one may notice from the aforementioned tables, the largest number of mollusc species was registered at station 1 and 2, respectively 21 and 16 species. These stations are close to the channels of communication with the sea, so the physical and chemical characteristics of water in these parts of the lagoon are almost similar to those of the sea. Consequently, the diversity of the molluscs living within the lagoon, which are of marine origin, is expected to be high.

Table 2. The indicator fauna within Narta Lagoon - Bivalve class.
Tabel 2. Fauna indicatoare din Laguna Narta - clasa Bivalvia.

The names of species	Rends	Family	Stations						
			1	2	3	4	5	6	7
Mytilus galloprovincialis LINNAEUS 1758	Mytiloida	Mytilidae	+	+					
Mytilaster sp.	Mytiloida	Mytilidae	+	+					
Anomia ephippium LINNAEUS 1758	Pterioida	Anomiidae	+	+					
Cerastoderma glaucum (POIRET 1789)	Veneroida	Cardiidae	+	+	+	+	+	+	+
Macoma cumana (O.G.COSTA 1892)	Veneroida	Tellinidae	+						
Scrobicularia cottardi (PAYRAUDEAU 1826)	Veneroida	Scrobiculariidae	+	+	+	+	+	+	+
Scrobicularia plana (DA COSTA 1778)	Veneroida	Scrobiculariidae	+	+					
Dosinia lupinus (LINNAEUS 1758)	Veneroida	Veneridae	+						
Tapes decussates (LINNAEUS 1758)	Veneroida	Veneridae	+						

Sources: Investigated area 2008-2009
Sursa: Zona analizată 2008-2009

The analysis of the sediments emphasized the fact that the substratum of these stations is dominated by sand fractions of sludge land. This substrate is covered by a layer of considerable thickness of marine plants, such as *Ruppia cirrhosa* and by green algae – *Cladophora* and *Enteromorpha*. A small number of species was identified at the stations 3, 5, 7; the last mentioned station is the poorest in species. This situation is mainly induced by the fact that a considerable area of these stations registers a very low water level during the summer season or they may even get dry. That causes a stressing situation for the fauna of the lagoon, because as it is known, the water level in such environments and the associated temperature, highly influence the content of salt and oxygen. The substratum of these stations is dominated by clay fractions. These stations are characterized by low-density phytobenthos and the prominence of *Enteromorpha* algae, the development of which is the indicator of eutrophication of the ecosystem. The species with high ecological valence of the aforementioned factors, such as *Cerastoderma glaucum*, *Hydrobia* sp., *Pirenella conica* have found proper conditions in this environment characterized by great fluctuations. Abiotic factors dominate the lagoon fauna, being represented by high density and frequency. The density and frequency of the species was calculated for each station. Table 3 renders the maximum and average values for each station (BEESLEY et al., 1998; MEDINA & COLLINS, 2003; PASSAMANECK et al., 2004; ROSENBERG, 1992; RUNNEGAR & POJETA, 1985).

Table 3. The indexes obtained at the stations from the lagoon.
Tabel 3. Indicii obţinuţi la staţiile din cadrul lagunei.

Types	Maximum density (ind./m^2)	Average density (ind./m^2)	Station	Maximum frequency (%)	Average frequency (%)	Stations
Cerastoderma glaucum	7,280	5,516	5	87.1	72.6	3
Scrobicularia. cottardi	1,800	1,457	5	25.3	20.6	2
Hydrobia sp.	1,148	602	4	52.2	32.8	7
Pirenella conica	1,081	556	2	41.5	26.6	2
Cyclope neritea	688	518	5	12.8	6.5	4

Sources: Statistical method
Sursa: Metoda statistică

Of the 24 species found in the lagoon, six of them (25%) are constant species – four gastropods and two bivalve. Ten species (42%) are associated – six gastropods and four bivalves. Eight are casual species – five gastropods and three bivalves. It can be noticed that five of the six constant species are exactly those that are characterized by higher values of density, while *Rissoa* species registers lower density and very low frequency (TAYLOR, 1996).

CONCLUSIONS

The study conducted in Narta Lagoon emphasized the presence of twenty-four mollusc species, 15 of them belonging to gastropods and nine to bivalves. The statistical estimates of the characteristics of the lagoon populations (density, index, frequency) showed that their distribution depends on the distance to the sea, presence of fresh water, water level, and level of eutrophication. The highest number of species is found in the western part of the lagoon (station 1 and 2), where the channels fully communicate with the sea. This situation is induced by the fact that the properties of the water in this part of the lagoon are quite similar to those of the seawater, which is favorable for the lagoon cockle, whose origin is marine. The lowest number of species was registered at station 7, in the northern part of the lagoon, which is far from the sea. During summer drought periods, water level decreases a lot and, consequently, temperature increases, as well as salt concentration. At the same time, there occurs a decrease of the dissolved oxygen content. At stations characterized by fresh flowing water (station 4 and 6), the number of species is lower and their density registers great fluctuations. The lagoon fauna is conditioned by the eutrophication rate, which is illustrated by the development of *Enteromorpha* algae. In these areas, only a small number of species has adapted – *Hydrobia* sp., *Cerastoderma glaucum* reaching very high values of density, constancy, and frequency. Other species displaying higher

values of the indexex, density and frequency are *Cerastoderma glaucum, Scrobicularia cottardi, Hydrobia* sp., *Pirenella conica*, and *Cyclope neritea*. Because of their high ecological valences, these species have adapted to the unstable conditions of their habitat. In the areas with sand-sludge land substratum, covered with vegetation, *Cladophora* algae and especially *Ruppia cirrhosa*, the fauna is much richer in variety and density than in the areas with clay substratum and poor vegetation. This fact deserves a more elaborated study in order to establish whether Narta Lagoon has a fauna that is directly dependent on the type of substratum or it is a casual association mainly induced by the characteristics of the environment. There were 46 species, 3% of which have already disappeared, 21% are in a good state, and the rest 76% is considered stable.

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