

RESEARCH ARTICLE

Ecological characteristics of mollusks in the Utlyukskij Liman

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Phylum Mollusca is represented in the Utlyukskij liman by 63 species, of which 43 belong to class Gastropoda and 20 species to class Bivalvia. Main groups of mollusks within the Utlyukskij Liman are irregularly distributed, and each part has a some slightly peculiarities. Data obtained show a weak correlation between the composition of mollusk communities and the type of the bottom. It was noted the presence of sufficiently stable "core" of malacofauna of entire estuary; while the composition of mollusk communities in certain areas reflects the specifics of the local hydrological conditions. Both quantitative and qualitative characters of mollusk communities are extremely inconstant in the the Utlyukskij Liman within the same area and even within the same sampling station. The structure and the proportion of mollusk groups is changing in a very short time.

Key words: Mollusca; fauna; distribution; ecology; Utlyukskij Liman; the Sea of Azov.

Introduction

By the characteristics of benthic productivity, the Sea of Azov is the richest among the seas of Mediterranean group. At the same time, communities with mollusk predominance give the maximum bioproduction.

One of them is the Utlyukskij liman. The long-term studies of V.P. Vorob'yev (Vorob'yev, 1949), F.D. Mordukhai-Boltovskoy (Mordukhai-Boltovskoj, 1960), L.A. Zenkevich (Zenkevich, 1963) and V.N. Dyatlov (Dyatlov, 1969) show that the benthos biomass in the Utlyukskij liman varied greatly throughout the year, from 300 to 500 g/m² and more.

Recently, the detailed studies of the biological characteristics of the mollusk communities in this water body have been intensified (Khaliman et al., 2006; Antonovskiy & Degtyarenko, 2009; Anistratenko et al., 2011; Khaliman et al., 2015; Anistratenko et al., 2017). The obtained data allow us to give an up-to-date assessment of the current state, as well as fluctuations of the quantitative and qualitative composition of the mollusk fauna in the Utlyukskij liman.

Material and methods

The main material for the study was quantitative and qualitative samples of mollusks collected at 16 stations in the Utlyukskij Liman. Mollusks were collected in spring, summer and autumn of each year from 2001 to 2007, except 2002 when the samples were carried out only in autumn. The samples were taken in coastal areas at the depth of 2.5 m by standard hydrobiological methods (Zhadin, 1960). During the period of 2008-2017, mollusks were collected by the methods of line transect. Totally, more than 150 samples were processed, in which about 6,000 specimens of mollusks were identified. The main part of the studied material is stored in the funds of the Institute of Zoology of the National Academy of Sciences of Ukraine. For species identification of mollusks, traditional methods of conchological analysis were used, taking into account the refinements of systematics of several groups (see (Anistratenko et al., 2011). Statistical processing and analysis of data was performed using Microsoft Excel 2007 and PRIMER 5 v.5.2.

Results and discussion

According to the recent reviews (Anistratenko et al., 2011; Khaliman et al., 2015; Anistratenko et al., 2017), the phylum Mollusca in the Utlyukskij Liman is represented by 63 species, of which 43 species belong to the Gastropoda class, and 20 species to the Bivalvia class. Characteristically, more than half of the Bivalvia families are represented here only by one species (Khaliman et al., 2006). Gastropoda prevailed by the number of species, though the number of families of Gastropoda and Bivalvia is almost equal (13 and 12 respectively). In some areas of the Utlyukskij liman the number of species of Gastropoda and Bivalvia is also almost equal.

Our data show that within the Utlyukskij Liman the mollusks are irregularly distributed. They are more evenly distributed along the seacoast, which is separated from the estuary by a narrow sandy spit named Biryuchy Island (Anistratenko et al., 2017).

For the convenient comparison of quantitative and qualitative composition of mollusks in benthic communities, we selected data on the most significant species from among those whose occurrence is not less than 0.03. We also nominally divided the water area of the estuary into four parts. From Tables 1 and 2, we can see that each part has some slight peculiarities of the mollusk fauna, and the main taxa of mollusks in all regions coincide (*Theodoxus astrachanicus*, *Rissoa*, *Hydrobia*, *Mytilaster lineatus*, *Cerastoderma glaucum*, *Abra ovata*).

Table 1. Species composition and occurrence of the mollusks in the Utlyukskij Liman (2006-2017)

№	Taxa	Parts of the Utlyukskij liman				occurrence (N=31)
		Biryuchy Island Spit	Fedotova Spit	Northern part	Western part	
1.	<i>Theodoxus astrachanicus</i> Starobogatov in Starobogatov, Filchakov, Antonova et Pirogov 1994	+	+	+	+	0.48
2.	<i>Bittium reticulatum</i> (Da Costa, 1778)			+	+	0.13
3.	<i>Rissoa</i> spp. Fremenville in Desmarest, 1813	+	+	+	+	0.42
4.	<i>Setia valvatoidea</i> Milaschewitsch 1909	+	+	+		0.16
5.	<i>Hydrobia</i> spp. Hartmann, 1821	+	+	+	+	0.42
6.	<i>Chrysallida incerta</i> (Milaschewitsch, 1916)			+		0.03
7.	<i>Mytilaster lineatus</i> (Gmelin in Linnaeus, 1791)	+	+	+	+	0.90
8.	<i>Mytilus galloprovincialis</i> Lamarck, 1819			+		0.06
9.	<i>Cerastoderma glaucum</i> (Poirer, 1789)	+	+	+	+	0.81
10.	<i>Abra ovata</i> (Philippi, 1836)	+	+	+	+	0.58
11.	<i>Mya arenaria</i> Linnaeus, 1758				+	0.03
	Total	7	7	10	8	-

Notes: N – number of processed samples

The high similarity index of the species composition (Table 2) for all the parts of the Utlyukskij liman confirms the presence of a specific and sufficiently stable “core” of the malacofauna in the entire estuary. Variations in the composition of mollusk communities in certain parts reflect local specificity of hydrological conditions. Thus, in the northern part, the average abundance of *M. lineatus* and *C. glaucum* is less than in other parts, but the maximum biomass of *C. glaucum* here is higher than in adjacent parts (Table 3). The range of abundance of *Th. astrachanicus* is the narrowest in the northern part of the estuary; settlements of this species are also characterized by low values of biomass.

Table 2. The similarity index of the mollusk fauna in the different parts of the Utlyukskij Liman

Site	Biryuchy Island Spit	Fedotova Spit	Northern part	Western part
Biryuchy Island Spit	7	1.00	0.70	0.67
Fedotova Spit	1.00	7	0.70	0.67
Northern part	0.82	0.82	10	0.64
Western part	0.80	0.80	0.78	8

Notes: diagonally, the number of taxa in the area; above the diagonal is the Jaccard index, below the diagonal is the Chekanovsky-Sorensen index

The area of Biryuchy Island and the coastal area of the Fedotova Spit do not differ in the composition of key mollusk species, the difference between them is only in the densities of some gastropods (*Rissoa* and *Hydrobia*) and bivalves (*Mytilaster* and *Cerastoderma*). Almost all quantitative indicators in the western part are lower than in the others, although the main species here are similar to those in other regions (Tables 1-3).

Table 3. Abundance (ind./m²) and biomass (g/m²) of mollusks in the Utlyukskij Liman (autumn 2015)

№	Taxa	Parts of the Utlyukskij Liman			
		Biryuchy Island Spit	Fedotova Spit	Northern part	Western part
1.	<i>Theodoxus astrachanicus</i>	<u>12100</u> 446.1	<u>4000-6100</u> 50.4-106.9	<u>100-3700</u> 1.3-42.2	<u>500-3900</u> 6.8-24.9
2.	<i>Rissoa</i> spp.	<u>1500-8300</u> 27.5-43.5	<u>600-900</u> 3.7-9.8	<u>400-3300</u> 1.7-20.3	<u>4800-8500</u> 23.6-74.0
3.	<i>Setia valvatoides</i>	<u>500</u> 0.1	<u>1200-9100</u> 0.4-3.1	<u>1800</u> 0.6	-
4.	<i>Hydrobia</i> spp.	<u>9100</u> 17.4	<u>3500-7400</u> 3.9-7.9	<u>200-8400</u> 0.2-9.6	<u>300-1000</u> 1.1-4.0
5.	<i>Mytilaster lineatus</i>	<u>23900-26600</u> 55.7-855.4	<u>8100-171700</u> 117.7-1347.1	<u>200-300</u> 0.5-22.5	<u>400-2600</u> 4.6-77.1
6.	<i>Cerastoderma glaucum</i>	<u>300-600</u> 9.3-345.5	<u>100-1200</u> 6.0-44.8	<u>200-700</u> 12.8-240.7	<u>200-900</u> 1.5-60.6

An important characteristic of benthic communities is an association of the certain species with a particular type of substrate. Our data are not extensive enough and, probably, therefore, show a very weak correlation between the species composition of the mollusk settlements and the type of the bottom. We may only note that by the set of species, sand and shelly substrate with silt differ somewhat from each other and from stony substrate, although they are all solid ones.

Our observations and literature data (Vorob'yev, 1949; Dyatlov, 1969; Anistratenko & Khaliman, 2006; Tkachenko & Demchenko, 2014) convince us that quantitative and qualitative characteristics of the mollusk communities in the Utlyukskij liman vary greatly in time and space.

This fact is also proved by our data from two neighboring stations in the northern part of the estuary. The material was collected here within the same biotopes and by the same methods with an interval of 10 days in June 2006 (Table 4). We noted that out of 6 registered species of mollusks, only one species was found again at the same station. At the same time, the abundance of *Mytilaster lineatus* at one station has changed almost 150 times, and biomass about 10 times.

Table 4. Abundance (ind./m²) and biomass (g/m²) of mollusks in the Utlyukskij liman in June 2006

№	Taxa	Station12		Station13	
		I decade	II decade	I decade	II decade
1.	<i>Theodoxus astrachanicus</i>	<u>267</u> 5.6	-	-	-
2.	<i>Bittium reticulatum</i>	-	<u>167</u> 3.9	-	<u>28</u> 0.4
3.	<i>Rissoa</i> spp.	<u>44</u> 0.1	-	-	-
4.	<i>Mytilaster lineatus</i>	<u>1511</u> 15.6	-	<u>4044</u> 22.7	<u>28</u> 2.2
5.	<i>Cerastoderma glaucum</i>	<u>22</u> 1.1	<u>28</u> 1.3	-	<u>278</u> 41.1
6.	<i>Abra ovata</i>	<u>733</u> 163.1	-	-	<u>28</u> 1.4

Noteworthy that *Abra ovata* is completely absent in the samples in 2015, although during the studies of Aleksandrov et al. (2011) – sampling in August 2011 –, this species was registered here with great abundance. The maximum occurrence was noted for *Hydrobia acuta* (83,3%) and *Cerastoderma glaucum* (50 %). On the contrary, in our samples in 2015, very few specimens of *C. glaucum* were found, more often juveniles, which did not form a high biomass.

Conclusions

Thus, we can state the extreme instability of the mollusk communities in the Utlyukskij liman within one area and even one station. It is clear that both the structure (insignificantly) and the ratio of mollusk groups (drastically) belonging to the certain benthic community are changing rapidly, especially in storm conditions. The relative shallowness of the estuary, the presence of bottom currents and the weak development of aquatic vegetation also do not contribute to the formation of stable benthic communities. In turn, such an even distribution of the productive benthos optimizes its accessibility to benthos-feeding organisms living in the estuary.

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