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Seasonal Changes In Zoobenthos In The Northwestern Part Of The South Caspian

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Abstract

The article is devoted to seasonal changes in zoobenthos in the northwestern part of the South Caspian. During research in the northwestern part of the South Caspian, 60 species belonged to 10 taxonomic groups. Crustaceans prevail by the number of species, accounting for 45.0% of the total number of species. Worms occupy second place in benthos - 31.7%, followed by molluscs - 21.7%. The maximum number of species was recorded in the spring-summer season (from 52 to 60 species), and the minimum – in the autumn season (43 species). The average annual biomass was 101.27 g / m^2, with a population of 816 individuals / m^2. The maximum development of macrozoobenthos organisms was noted in summer (118.91 g / m^2), the minimum in autumn (77.12 g / m^2). Molluscs are the dominant group (67.7%) from the weight of the biomass of benthos in the environment of macrozoobenthic organisms in terms of biomass, crustaceans are in second place in terms of biomass (52.0%), and amphipods are in third place (5.0%). In terms of species and quantity, the fauna of the ooze-shell biotope is most abundant, where the total biomass of zoobenthos was 129.17 g / m^2, with with an abundance of 940 species / m^2. Among these animals on the biomass of benthos, decapods are in second place - 17.9%. The quantitative distribution of zoobenthos by depth is not the same. In the coastal zone (10-25m), the average biomass of benthos was 115.86 g / m^2, at a depth (25-50m) - 126.99 g / m^2, at a depth (50-100m) - 85.52 g / m^2 and at a depth (100-200) - 76.71 g / m^2. At all depths, the basis of zoobenthos is obtained from the biomasses of these animals.

Keywords: South Caspian, biotope, depth, zoobenthos, distribution, abundance, biomass.

Introduction. The Caspian Sea is one of the essential fishery reservoirs in the world. This largest saltwater lake in the world was isolated from the rest of the seas in the post-glacial time and preserved the richest Late Tertiary brackish-water fauna of marine origin, formed in isolated Tertiary, South Russian water bodies with multiple salinity changes.

The nature of the relief and the hydrological regime peculiarities of the Caspian Sea is 39.3% of the entire sea area, and the volume of water is 65.6% of the total sea. The maximum depth is 1025 m, the average depth is 345 m. [6]

Most of the South Caspian (62.2%) is occupied by depths of up to 100m. The depth of more than 900 m occupies only 1% of the sea area. [6]

In recent years, the rise in the level of the Caspian Sea and intensive oil production strongly affect its ecological state. Therefore, scientific research of the macrozoobenthos fauna in the new ecological conditions of the Caspian Sea is of great theoretical and practical importance since these organisms are not only food for commercial fish but also constitute an essential link in the historically formed food chain of the ecosystem of the Caspian Sea.

In this regard, the main goal of this study was to study seasonal changes in zoobenthos in the northwestern part of the South Caspian under new environmental conditions.

Literature data analysis and problems formulation

Information on the species and quantitative changes in zoobenthos in the coastal waters of the South Caspian Sea is available in the works of A.D. Aliev [1], V.M. Hasanov [3], A.G. Kasymov [4,6], G.S. Mirzoev [7,12,13].

According to the data of A.D. Aliyev [1], the species composition and distribution of zoobenthos in the South Caspian are indicated. During the study, the author indicated 85 species of these animals living in the western part of the South Caspian, where molluscs accounted for 39.9%, and crustaceans - 61.9% of the total fauna. The average benthos biomass reached 288.2 g / m^2.

V.M. Hasanov [3] indicated 68 species of zoobenthos for the western part of the South Caspian. Of these, 12 species are crustaceans, 15 species are molluscs. The average biomass of benthos was 124 g / m^2, almost two times less than in 1962.

As a result of the studies carried out by A.G. Kasimov [4] in 1976-1977, 50 species of these animals were noted in the western part of the South Caspian. Crustaceans prevailed in terms of the number of species - 68% of the entire fauna.

The works of G.S. Mirzoev [7,12,13] are devoted to the species composition and quantitative distribution of zoobenthos in the deep-water zones of the Azerbaijan sector of the Caspian Sea. The author indicated that 118 species inhabiting the deep-water zones of the Azerbaijan sector of the South Caspian belong to 10 systematic groups. Among them, 57 species were first explicitly discovered for deep-water zones. The maximum number of species was noted at depths of 200-300 m (118 species), and the minimum - at depths of 900-1000 m (6 species).

A.G. Tarasov [11] considered the history of the study of the fauna of the marine parts of the Caspian, citing a list with 138 species and subspecies of data and five species of planktonic macroinvertebrates found outside the sublittoral zones of the sea.

The fishing industry of the Caspian Sea is developing under the influence of sea-level fluctuations and negative impacts on the nature of the quantitative development and distribution of benthic animals. In

this regard, it is essential to study in detail the seasonal fluctuations in the abundance and biomass of individual groups of zoobenthos species to analyze the conditions prevailing in a particular region of the Caspian. Based on such studies, it is necessary to assess the priorities of changes in the ecological situation and the productivity of food organisms of the Caspian, especially in areas where intensive oil production is carried out, concentrated on established food pastures for fish and migration routes.

In the western part of the South Caspian, oil pollution harms the production of food organisms; therefore, there is poor development of these animals and low catches of benthophagous fish. In this regard, primary attention was paid to a comprehensive study of the species and quantitative diversity and the distribution of zoobenthos by depths and biotopes in the most polluted sections.

The purpose and objectives of the study are to study the seasonal changes in the species and quantitative diversity of zoobenthos in the northwestern part of the South Caspian in the context of the complex impact of economic and anthropogenic factors.

Primarystudy objectives:

- To reveal seasonal fluctuations in species and quantitative composition
  diversity of zoobenthos;
- To study the quantitative diversity of zoobenthos;
- To consider the quantitative distribution by depth;
- To Consider the quantitative distribution by biotopes.

Materials and methods

Studies of seasonal changes in zoobenthos in the northwestern part of the South Caspian were carried out seasonally in 2014-2015. The material for this communication was our bottom grab collections from 2 sections and 16 biological stations. The works were covered with depths of up to 200 m and all the main types of soil. Samples were taken with a “Van-Win” grab with a capture area of 0.1 m. Three samples were taken at each station. A total of 144 species of zoobenthos samples were collected and selected.

The samples taken were fixed in a 4% formalin solution, and the selection of organisms was carried out in laboratory conditions. After external examination, the selected organisms, using filter paper, were weighed on an electronic balance with an accuracy of 1 mm.

The collection and processing of benthic samples were carried out according to the generally accepted method [5, 10]. To analyze zoobenthos’ species and quantitative diversity, we used the mathematical methods developed by Shannon-Wiener [14], Sorensen [15] and others.

When studying seasonal changes in zoobenthos in the northwestern part of the South Caspian, the main abiotic factors (water temperature, salinity, oxygen, pH, transparency, current, etc.) were also

considered. To determine the species diversity, we used the Keys to the Fauna of the Black and Azov Seas, Keys to Fish and Invertebrates of the Caspian Sea and Atlas of Invertebrates of the Caspian Sea. [2]

Discussion of research results

In the results of the study carried out by us from 2009 to 2010, 60 species of zoobenthos species belonging to 10 taxonomic groups were found in the northwestern part (on the Kurinskaya Kosasection) (Table 1). In the benthos, crustaceans prevail in terms of species, which account for 45.0% of the total number of species. Worms occupy second place in benthos - 31.7%, followed by molluscs - 21.7%. The rest of the groups are represented by 1-2 species. (Table 1)

The number of zoobenthos species in the northwestern part (in the section of the Kurinskaya Kosa) is unstable and varies by season. In 2010, 60 species of zoobenthos were recorded on the section of the Kurinskaya Kosa, 52 species of which were recorded in spring, 60 species - in summer, and 43 species - in autumn. The crustaceans played the leading rolein enriching the species composition of zoobenthos during all the year seasons, which accounted for 44.2% in spring, 45.0% in summer and 48.8% in autumn of the total number of species (Table 1).

The species of N.diversicolor, H.invalida, Ps.deserticola, M. lineatus, C. rhomboides, A. ovata, M. amblyops, N. robustoides, N. maeoticus, C. nobile, P.elegaus, Rh.harrisi tridentatus were prevailing in the zoobenthos composition in all year seasons.

This year, the average annual zoobenthos biomass was 101.27 g / m^2, and the number was 816 species / m^2. Among macrozoobenthic organisms in terms of biomass, the dominant groups are molluscs - (67.7%) of the total biomass of benthos, barnacles are in second place in biomass - (5.2%), and amphipods (5.0%) are in the third one. The minimum biomass values were noted in the oligochaete (0.1%) (Table 2)

Table 1. Species composition and seasonal distribution of zoobenthos on section of the Kurinskaya Kosa in the South Caspian in 2010.

Taxons	Seasons		
	Spring	Summer	Autumn
Polychaeta			
Nereis diversicolor Müller, 1776	+	+	+
N.Succinea(Leucart, 1847)	+	+	+
Hypania invalida(Grube, 1866)	+	+	+
Hypaniolakowalewskü (Grimm in Annikova, 1927)	+	+	+

Fabricia Sabella Caspica Zenkewitch, 1922	+	+	_
Manayunki caspica (Annikova, 1929)	+	+	_
Ficopamatus enigmatika (Fauvel, 1923)	+	+	_
Parhypanis brevispinis (Grube, 1860)	+	+	_
Oligochaeta			
Psammocyctides deserticola Grimm, 1877	+	+	+
TubifextubifexMüller, 1774	+	+	_
T. acapillatusFinogenova, 1972	_	+	_
Stylodrilus parvus (Hrabe et Cernocvitov, 1927	+	+	+
S. cernosvitovi Hrabe, 1950	+	+	+
Isochaetides michaelseni (Lastockin, 1937)	+	+	+
Potamothrix grimmi (Hrabe, 1950)	_	+	_
P. cekanovskayae Finogenova, 1972	+	+	_
P. Caspicus Lastockin, 1937	+	+	+
Marionina abberans Finogenova, 1973	_	+	_
Aktedrilis svetlovi Finogenova, 1972	_	+	_
Mollusca			
Mytilaster lineatus (Gmelin, 1791)	+	+	+
Cerastoderma rhomboids Lamarck, 1812	+	+	+
C. isthmicum (Issel, 1869)	+	+	+
Abra ovata (Philippi, 1836)	+	+	+
Didacna profundicola (Logvinenko et Starobagatov, 1967	+	+	+
D. baeri (Grimm, 1877)	+	+	+
D. longipes (Grimm, 1877)	+	+	+
D. puramidata Grimm, 1877	+	+	_
D. trigonoides practrigonoides Nalwkin et Anisimov, 1915	+	+	+
Dreissena caspia Eichwald, 1855	+	+	+
D. compressa Logvinenko et Starobogatov, 1966	+	+	+
D. elata (Andursov, 1897)	+	+	_
D. rostriformis pontocaspica Andrusov,	+	+	+

1897			
Cirripedia			
Balanus improvises Darwin, 1854	+	+	+
B.eburneus Gould, 1897	+	+	+
Mysidacea			
Mysis Caspia Sars, 1927	+	+	+
M. amblyops Sars, 1907	+	+	+
Paramysis kessleri Sars, 1895	+	+	_
Cumacea			
Schizorhynchus eudorelloides Sars, 1894	+	+	+
Pterocuma rostrata (Sars, 1894)	+	+	+
Sterocuma diastyloides Sars, 1897	+	+	+
S. graciloides Sars, 1894	_	+	_
S. gracilis Sars, 1894	_	+	_
Amphipoda			
Psudalibrotus caspius (Grimm) Sars, 1896	_	+	_
Gammaracanthus loricatus Caspius (Sabine 1824)	+	+	+
Dikerogammarus haemobaphes (Eichwald, 1841)	+	+	_
Niphargoides grimmi sars, 1896	+	+	+
N. robustoides (Grimm, 1894)	+	+	+
N. maeoticus (Sowinsky, 1894)	+	+	+
N.carausui(DerzhavinetPjatokova, 1962	+	+	_
Pondorites podoceroides (Grimm, 1880)	+	+	_
Gmelininopsis aurita sars, 1896	+	+	+
Echinogammarus ischnus (Stebbing, 1899)	+	+	+
Monoporeia affinis (Lenodstrom, 1855)	+	+	+
Corophium chelicorne Sars, 1895	+	+	+
C. nobile Sars, 1895	+	+	+
Isopoda	+	+	+
Saduri entomon caspica Sars, 1898	+	+	+
Decapoda			
Palaomon elegans Rathke, 1884	+	+	+

P. adspersus Rathke, 1884	+	+	+
Rhithropanopeus harrisi tridentatus Maitland, 1898	+	+	+
Insecta			
Chironomus albidus Constantinov, 1956	+	+	+
Total:	**52**	**60**	**43**

The maximum development of macrozoobenthic organisms was noted in the summer season, where their biomass was 118.91 g / m2, with with an abundance of 979 species/m^2. The summer biomass of benthic organisms was dominated by molluscs (64.2%), followed by amphipods (6.0%) and barnacles (5.7%). The minimum of the zoobenthos development was noted in autumn (77.12 g / m^2) with the abundance (669 species / m^2), where, in comparison tothe summer season, the benthos biomass constantly decreases in autumn, which is mainly associated with the end of the development cycle of certain species of benthos. (Table 2)

Table 2. Seasonal changes in zoobenthos in the section Kurinskaya Kosa of the South Caspian in 2010

Groups	Seasons			
	Spring	**Summer**	**Autumn**	**Average**
Polychaeta	$\frac{133}{0,28}$	$\frac{148}{0,34}$	$\frac{124}{0,16}$	$\frac{135}{0,26}$
Oligoshaeta	$\frac{121}{0,14}$	$\frac{130}{0,16}$	$\frac{116}{0,10}$	$\frac{123}{0,14}$
Mollusca	$\frac{138}{74,96}$	$\frac{173}{76,38}$	$\frac{118}{54,32}$	$\frac{143}{68,55}$
Cirripedia	$\frac{82}{5,02}$	$\frac{92}{6,78}$	$\frac{69}{3,95}$	$\frac{81}{5,25}$
Mysidacea	$\frac{29}{0,92}$	$\frac{47}{1,02}$	$\frac{26}{0,44}$	$\frac{34}{0,79}$
Cumacea	$\frac{43}{0,45}$	$\frac{51}{0,95}$	$\frac{29}{0,31}$	$\frac{41}{0,57}$
Amphipoda	$\frac{193}{5,12}$	$\frac{250}{7,15}$	$\frac{51}{2,98}$	$\frac{198}{508}$
Isopoda	$\frac{13}{2,13}$	$\frac{18}{2,32}$	$\frac{8}{1,97}$	$\frac{13}{2,14}$

Decapoda	$\frac{27}{16,34}$	$\frac{25}{2,67}$	$\frac{10}{1,95}$	$\frac{18}{2,35}$
Insecta	$\frac{19}{2,43}$	$\frac{25}{2,67}$	$\frac{10}{1,95}$	$\frac{18}{2,35}$
Total:	$\frac{798}{107,79}$	$\frac{979}{118,91}$	$\frac{669}{77,12}$	$\frac{816}{101,27}$

It is also worth noting that, according to several scientists [1, 3, 4], the nature of the soil plays a vital role in the zoobenthos distribution. During the study of zoobenthos in the western part of the South Caspian, we noted four biotopes: silty, silt-sandy, shell-silty and sandy.

In 2010, when studying the zoobenthos distribution in the northwestern part of the South Caspian by biotopes, it was found that the distribution of zoobenthos biomass in individual groups was not the same. Table 3 shows that the richest in species composition and quantitative development is the mud-shell soil, where 60 species belonging to 10 taxonomic groups were found. Crustaceans, which account for 45% of the total species number, prevail among the noted soils in terms of species composition. Worms occupy second place - 31.7%, followed by molluscs - 21.7% (Table 3). The dominant species in this biotope are N. diversicolor, H. invalida, H. kowalewskii, Ps. deserticola, T. tubifex, M.lineatus, C. rhomboides, A. ovata, D.longiper, B. improvisus, M. caspia, Sch. eudorelloides, N. robustoides, N. maeoticus, P. elegans and Rh. harrisii tridentatus.

Table 3. Species composition and distribution of zoobenthos by depth and biotopes in the Kurinskaya Kosa section of the South Caspian in 2010

Taxons	Depth, m				Biotopes			
	10 - 25	25 - 50	50 - 100	100 - 200	Silty	Silt-sandy	shell-silty	Sandy
1	2	3	4	5	6	7	8	9
Polychaeta								
Nereis diversicolor Müller, 1776	+	+	+	+	+	+	+	+
N.Succinea(Leucart, 1847)	+	+	+	+	+	+	+	+
Hypania invalida(Grube, 1866)	+	+	+	+	+	+	+	+
Hypaniola kowalewskü (Grimm in Annikova, 1927)	+	+	+	+	+	+	+	+
Fabricia Sabella caspica Zenkewitch, 1922	+	+	-	-	-	-	+	-

Manayunki caspica	+	+	-	-	+	-	+	-
Ficopamatus enigmatika (Fauvel, 1923)	+	+	-	-	-	-	+	-
Parhypanis brevispinis (Grube, 1860)	+	+	-	-	-	-	+	-
Oligochaeta								
Psammoryctides deserticola Grimm, 1877	+	+	+	+	+	+	+	+
Tubifex tubifex Müller, 1774	+	+	+	+	+	+	+	+
T. acapilatusFinogenova, 1972	-	+	-	-	-	-	+	+
Stylodrilus parvus	+	+	+	+	+	+	+	+
S. cernosvitovi Hrabe, 1950	+	+	+	+	+	+	+	+
Isochaerides michaelseni (Lastockin, 1937)	+	+	+	+	+	+	+	-
Potamothrix grimmi (Hrabe, 1950)	-	+	+	-	-	+	+	-
P. cekanovskayae Finogenova, 1972	+	+	-	-	+	+	+	+
P. Caspicus Lastockin, 1937	+	+	+	-	+	+	+	-
Marionina abberans Finogenova, 1973	-	+	+	-	-	+	+	+
Aktedrilis svetlovi Finogenova, 1972	-	+	+	-	-	+	+	+
Mollusca								
Mytilaster lineatus (Gmelin, 1791)	+	+	+	+	+	+	+	+
Cerastoderma rhomboids Lamarck, 1812	+	+	+	-	+	+	+	+
C. isthmicum (Issel, 1869)	+	+	+	-	+	+	+	+
Abra ovata (Philippi, 1836)	+	+	+	+	+	+	+	+
Didacna profundicola (Logvinenko et Starobagatov, 1967	+	+	+	+	+	+	+	+
D. baeri (Grimm, 1877)	+	+	+	-	+	+	+	+
D. longipes (Grimm, 1877)	+	+	+	-	+	+	+	+
D. puramidata Grimm, 1877	+	+	+	-	+	+	+	+
D. trigonoides practrigonoides Nalwkin et Anisimov, 1915	+	+	+	+	+	+	+	+
Dreissena caspia Eichwald, 1855	+	+	+	-	+	+	+	-
D. compressa Logvinenko et Starobogatov, 1966	+	+	+	+	+	+	+	-
D. elata (Andursov, 1897)	+	+	+	-	+	+	+	-
D. rostriformis pontocaspica Andrusov, 1897	+	+	+	-	+	+	+	-
Cirripedia								

Balanus improvises Darwin, 1854	+	+	+	+	+	+	+	+
B.eburneus Gould, 1897	+	+	+	+	+	+	+	+
Mysidacea								
Mysis Caspia Sars, 1927	+	+	+	+	+	+	+	+
M. amblyops Sars, 1907	+	+	+	+	+	+	+	+
Paramysis kessleri Sars, 1895	+	+	+	-	+	+	+	-
Cumacea								
Schizorhynchus eudorelloides Sars, 1894	+	+	+	+	+	+	+	+
Pterocuma rostrata (Sars, 1894)	+	+	+	+	+	+	+	+
Stenocuma diastyloides Sars, 1897	+	+	+	+	+	+	+	+
S. graciloides Sars, 1894	+	+	+	-	+	+	+	-
S. gracilis Sars, 1894	+	+	+	-	-	+	+	-
Amphipoda								
Psudalibrotus caspius (Grimm) Sars, 1896	+	+	+	-	+	+	+	+
Gammaracanthus loricatus Caspius (Sabine 1824)	+	+	+	+	+	+	+	+
Dikerogammarus haemobaphes (Eichwald, 1841)	+	+	-	-	+	+	+	+
Niphargoides grimmi Sars, 1896	+	+	+	+	+	+	+	+
N. robustoides (Grimm, 1894)	+	+	+	-	+	+	+	+
N. maeoticus (Sowinsky, 1894)	+	+	+	-	+	+	+	+
N.carausui (DerzhavinetPjatokova, 1962	+	-	-	+	+	+	+	+
Pondorites podoceroides (Grimm, 1880)	+	+	+	-	+	+	+	+
Gmelininopsis aurita Sars, 1896	+	+	+	+	+	+	+	+
Echinogammarus ischnus (Stebbing, 1899)	+	+	+	+	+	+	+	+
Monoporeia affinis (Lenodstrom, 1855)	+	+	+	+	+	+	+	+
Corophium chelicorne Sars, 1895	+	+	+	+	+	+	+	+
C. nobile Sars, 1895	+	+	+	+	+	+	+	+
Isopoda								
Saduri entomon caspica Sars, 1898	+	+	+	+	+	+	+	+
Decapoda								
Palaomon elegans Rathke, 1884	+	+	-	-	+	+	+	+
P. adspersus Rathke, 1884	+	+	-	-	+	+	+	+
Rhithropanopeus harrisi tridentatus	+	+	+	+	+	+	+	+

Maitland, 1898								
Insecta								
Chironomus albidus Constantinov, 1956	+	+	+	+	+	+	+	+
Итого:	56	60	50	31	52	55	60	45

Table 4. Distribution of zoobenthos by biotopes in the section Kurinskaya Kosa of the South Caspian in 2010 ($\frac{\text{spc}}{2}$m²)

Groups	**Сезоны**			
	Silty	**Silt-sandy**	**Shell-silty**	**Sandy**
Polychaeta	$\frac{145}{0,21}$	$\frac{158}{0,33}$	$\frac{174}{0,39}$	$\frac{56}{0,11}$
Oligoshaeta	$\frac{131}{0,12}$	$\frac{136}{0,17}$	$\frac{147}{0,20}$	$\frac{78}{0,07}$
Mollusca	$\frac{145}{66,19}$	$\frac{166}{86,82}$	$\frac{200}{88,25}$	$\frac{61}{32,94}$
Cirripedia	$\frac{83}{4,96}$	$\frac{97}{6,03}$	$\frac{107}{7,79}$	$\frac{37}{2,22}$
Mysidacea	$\frac{28}{0,65}$	$\frac{32}{1,14}$	$\frac{50}{1,24}$	$\frac{26}{0,13}$
Cumacea	$\frac{37}{0,45}$	$\frac{51}{0,58}$	$\frac{59}{1,08}$	$\frac{17}{0,17}$
Amphipoda	$\frac{190}{4,13}$	$\frac{206}{6,27}$	$\frac{107}{1,62}$	$\frac{289}{8,30}$
Isopoda	$\frac{10}{2,23}$	$\frac{14}{2,39}$	$\frac{20}{2,58}$	$\frac{8}{1,36}$
Decapoda	$\frac{22}{13,03}$	$\frac{32}{18,43}$	$\frac{49}{23,24}$	$\frac{17}{9,86}$
Insecta	$\frac{12}{2,07}$	$\frac{22}{2,58}$	$\frac{27}{2,78}$	$\frac{11}{1,97}$
Total:	$\frac{810}{94,04}$	$\frac{914}{124,74}$	$\frac{940}{129,17}$	$\frac{600}{57,13}$

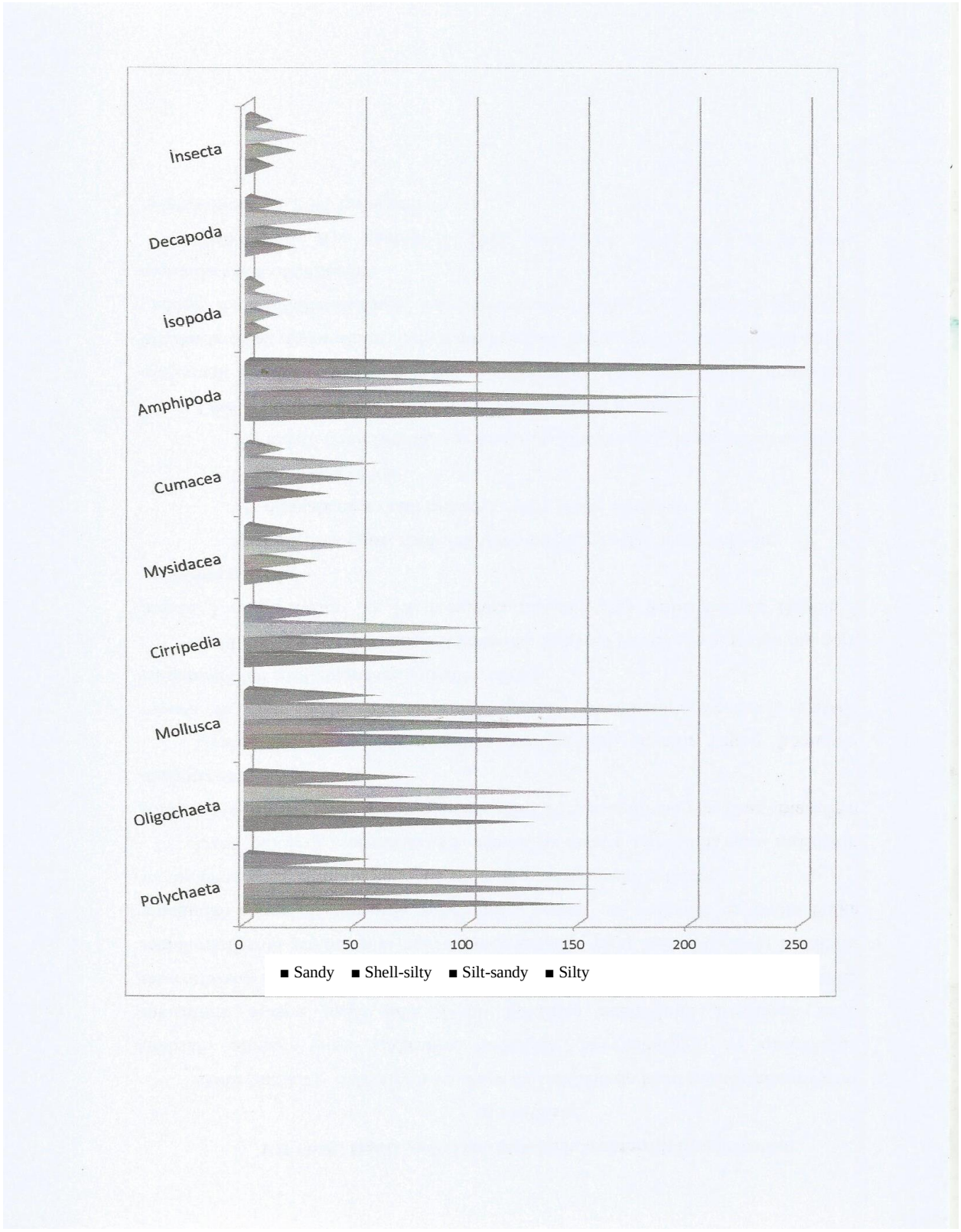

Fig. 1. Distribution of zoobenthos by biotopes in the section of the Kurinskaya Kosa in the South Caspian in 2010

In this biotope, the total zoobenthos biomass was 129.172 g / m^2, with an abundance of 940 species/m^2. Among these animals in terms of biomass, molluscs dominate - 68.3% of the total biomass

of benthos, in second place in biomass of decapods (17.9%), in third place - barnacles (6.0%) (Table 4, Fig. 1).

The silty-sandy biotope occupies second place in terms of zoobenthos' species and quantitative composition. In this biotope, 55 species belonging to 10 groups were found. Crustaceans, which account for 49.1% of the total number of species, prevail among these groups in terms of species. Worms occupy second place - 25.4%, then molluscs - 23.6%, the rest of the groups are represented by 1-5 species. The dominant species of this biotope are H. invalida, H. kowalewskii, Ps. deserticola, I. michaelseni, C. rhomboides, D. profundicola, D. baeri, D.longiper, M. caspia, Sch. eudorelloides, S. diastyloides, P. elegans, Rh. harrisii tridentatus, N. maeoticus, | D. haemobaphes, N. grimmi.

In 2010, 52 species of zoobenthos belonging to 10 systematic groups were found in the muddy biotope. Crustaceans - 50.0%, and molluscs - 25.0%, prevail among the groups noted by the number of species. In this biotope, the total biomass of zoobenthos was 94.04 g / m^2, with an abundance of 810 species / m^2. Among these animals in terms of biomass, the dominant position was occupied by molluscs - 70.4% of the total biomass. The second place is occupied by decapods - 13.8%. The dominant species in this zone are cerastoderm (12.26 g / m2), abra (7.95 g / m2) and crab (5.20 g / m2).

Compared with other biotopes, the minimum abundance and biomass of zoobenthos was noted in the sandy biotope. In this biotope, only 45 species have been found to belong to 10 taxonomic groups. According to the study, according to the number of species, the dominant groups of amphipods account for 28.9% of the total number of species, followed by molluscs - 20.0%, then oligochaetes - 17.8% (Table 2). In this biotope, the total benthos biomass is 57.13 g / m^2, with an abundance of 600 species / m^2. The zoobenthos biomass basis was molluscs - 32, 94 g / m^2 and decapods - 9.86 g / m^2. Molluscs play a central role in the formation of benthos biomass. Their biomass was 57.6% of the total biomass of benthos. (Table 4).

One of the factors determining the distribution of this fauna in water bodies is depth. Hydrostatic pressure, thermal and gas regimes, currents, soil composition and the amount of food change with depth. To analyze zoobenthos distribution by depth, we conditionally identified four zones.

It should be noted that these depths differ from each other both in species composition and in the quantitative development of zoobenthos.

In the first coastal zone (10-25 m) on the Kurinskaya Kosa section of the South Caspian, only 56 species belonging to 10 groups were found (Table 3). The total number of zoobenthos in this zone was 890 species/m^2, and the biomass was 115.86 species/m^2. Amphipods predominated in number, accounting for 23.8% of the total, and in terms of molluscs biomass - 69.1%. Decapods were in second place in terms of biomass - 15.2%. Weak development of oligochaetes, polychaetes, and mysids was observed (Table 5, Fig. 2).

Table 5. Depth distribution of zoobenthos along the section Kurinskaya Kosa of the South Caspian in 2010.

Groups	Seasons			
	10- 25	**25 - 50**	**50 - 100**	**100 - 200**
Polychaeta	152 / 0,30	167 / 0,38	143 / 0,19	78 / 0,16
Oligoshaeta	142 / 0,17	150 / 0,20	137 / 0,12	63 / 0,07
Mollusca	153 / 80,07	188 / 81,48	133 / 59,42	98 / 53,23
Cirripedia	89 / 5,53	98 / 7,28	76 / 4,46	61 / 3,73
Mysidacea	32 / 1,06	48 / 1,16	30 / 0,57	26 / 0,37
Cumacea	46 / 0,53	56 / 1,03	35 / 0,39	27 / 0,33
Amphipoda	212 / 5,56	268 / 7,59	170 / 3,76	142 / 3,42
Isopoda	13 / 2,34	19 / 2,53	11 / 2,18	9 / 1,51
Decapoda	30 / 17,68	47 / 22,49	23 / 12,29	20 / 12,10
Insecta	21 / 2,62	26 / 2,85	14 / 2,14	11 / 1,79
Total:	890 / 115,86	1067 / 126,99	772 / 85,52	535 / 76,71

In the first zone, N. diversicolor (0.11 g / m^2), M. lineatus (12.81 g / m^2), C. rhomboides (17.87 g / m^2), A. ovata, (10 , 99 g / m^2), D. rosterformis pontocaspica (10.75 g / m^2) have widespread distribution and development.

In the second zone (25-50 m), 60 zoobenthos species belonging to 10 groups were found. The total biomass of zoobenthos was 126.99 g / m^2, of which molluscs - 64.2%, decapods - 17.7%, amphipods - 5.9% and barnacles - 5.7%. Compared to the depths of 0.25 m, the average biomass of zoobenthos increased from 115.86 to 126.99 g / m^2. The biomass was dominated by molluscs and decapods associated with the predominance of soft silty soils. In this zone of the sea, the dominant species are C. rhomboides (21.45 g / m^2), A. ovata, (11.52 g / m^2), D. longiper (7.90 g / m^2), Rh. harrisii tridentatus (15.04 g / m^2).

In the third zone (50-100 m), 50 species of zoobenthos were found. The total biomass of benthos is 85.52 g / m^2, with an abundance of 772 species/m^2. The share of molluscs is 69.5%, decapods - 14.4% and barnacles - 5.2%. In terms of numbers, the dominant position was occupied by amphipods - 22.0% of the total number of zoobenthos. The second place is occupied by polychaetes - 18.5% (Table 5. Fig. 2). In the formation of zoobenthos biomass, molluscs (59.42 g / m^2) and decapods (12.29 g / m^2) play a significant role.

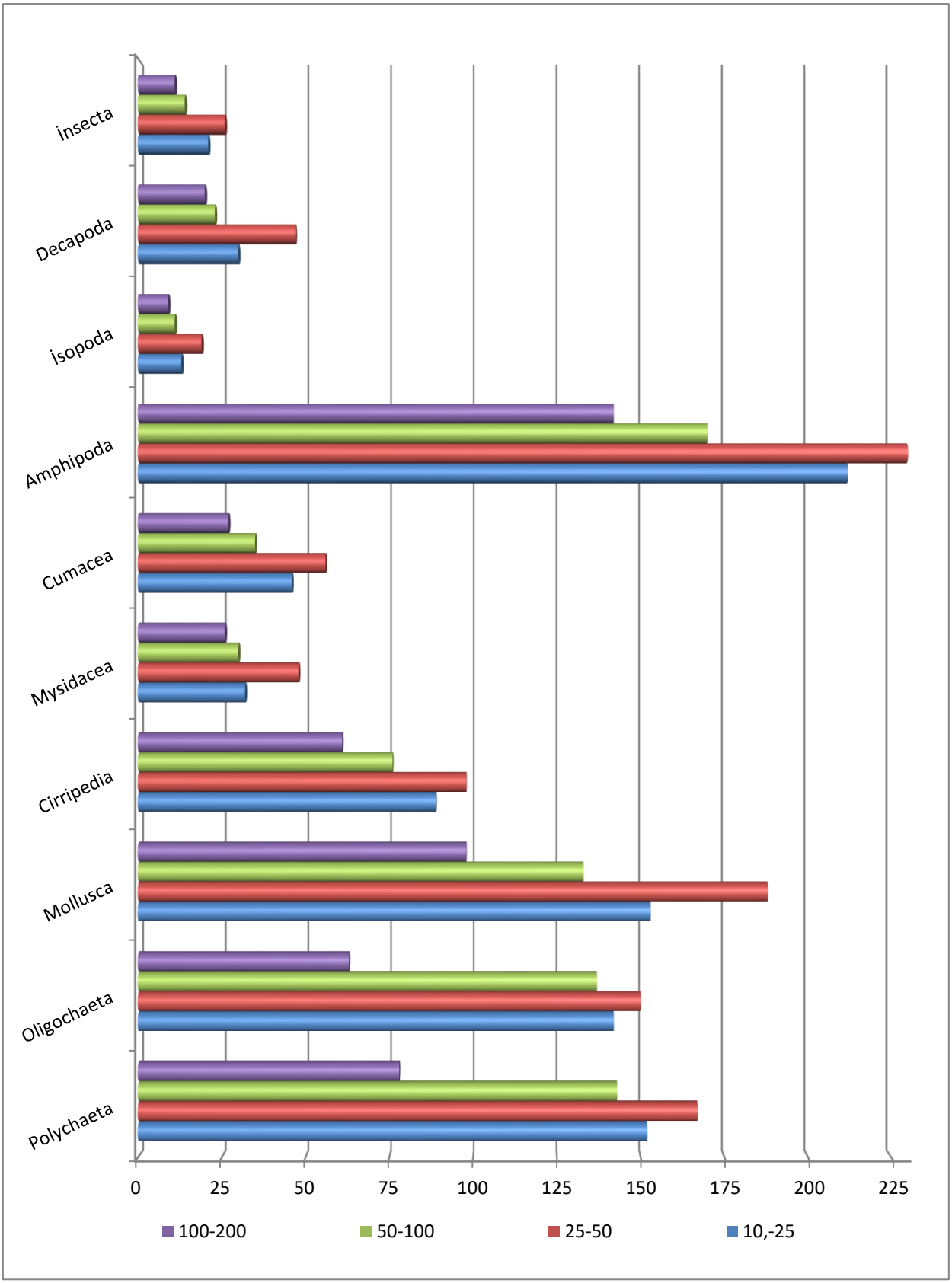

Fig. 2. Distribution of zoobenthos by depth in the section of the Kurinskaya Kosa of the South Caspian in 2010.

In the fourth zone (100-200 m), only 31 species belonging to 10 groups were recorded. Crustaceans prevailed in terms of species composition, accounting for 51.6%, followed by worms - 29.0%. In this zone, the total biomass of zoobenthos varied from 0.16 to 53.23 g / m2, with an abundance of 9 - 142 species/m^2. The primary biomass of zoobenthos was molluscs (69.4%), followed by decapods (15.8%) and barnacles (4.9%) (Table 4). In this zone of the sea, the dominant species are M.lineatus (21.88 g / m^2), A. ovata, (12.95 g / m^2), D. profundicola (10.14 g / m^2), Rh. harrisii tridentatus (8.15 g / m^2).

Based on the above, the following conclusions can be drawn:

1. In the northwestern part (on the section of the Kurinskaya Kosa) of the South Caspian, a total of 60 species belonging to 10 taxonomic groups have been found. Among them, crustaceans (45.0%) dominate by the number of species, worms (31.7%) and molluscs (21.7%) are in second place.
2. Average annual biomass of zoobenthos in the Kurinskaya Kosa.
3. Kosa in the northwestern part of the South Caspian Sea was 101.27 g / m^2, with an abundance of 816 specimens / m^2. Among macrozoobenthic organisms in terms of biomass, the dominant groups are molluscs - (67.7%) of the total biomass of benthos, in second place in terms of biomass are barnacles (52.0%), and in third - amphipods (5.0%). The minimum biomass was recorded in the oligochaete (0.1%).
4. The species and quantitative distribution of zoobenthos in biotopes are not the same. The maximum development of zoobenthos was observed in the shell-silty biotope. In this biotope, the total biomass of zoobenthos was 129.17 g / m^2, with an abundance of 816 species/m^2. Among these animals in terms of biomass, molluscs dominate - 68.3% of the total biomass of benthos, in second place in biomass of decapods - 17.9%, in third place - barnacles - 6.0%. It is because the oozy-shell biotope is a suitable substrate for both adhering organisms and burrowing forms. And also, this biotope with nutrients, detritus, microorganisms and algae. In all biotopes in terms of biomass, molluscs are dominant, accounting for 57.6 - 70.4% of the total biomass of benthos. The minimum biomass of molluscs was recorded in the sandy biotope and was only 32.94 g / m^2.
5. The quantitative distribution of zoobenthos also differs in depth. In the coastal zone (10-25m), the average biomass of benthos was 115.86 g / m^2, at a depth (25-50m) - 126.99 g / m^2, at a depth (50-100m) - 85.52 g / m^2 and at a depth of 100-200 - 76.71 g / m^2. Thus, the most productive zone of the Caspian Sea is a depth of 25-50m. At all depths, the basis of zoobenthos in terms of biomass was mollusks, which account for 69.1 to 69.5% of the total biomass of these animals.

References

1. Aliev A.D., Pyatakova G.M. (1968) “Species composition and distribution of zoobenthos in the Middle and South Caspian” // Moscow: Nauka, 1968, 80-100.
2. Atlas of invertebrates of the Caspian Sea. - M., Food Industry, 1968, 414.
3. Gasanov V.M. (1972) “Seasonal changes in the abundance and biomass of zoobenthos on the western coast of the South Caspian” // Biol. Resources of the Caspian Sea. Astrakhan, 60-64.
4. Kasymov A.G. (1987)“Animal world of the Caspian Sea” // Baku, Elm, 156
5. Kasymov A.G. (2000) “Monitoring methods in the Caspian Sea” // Baku: GAPP-Polygraph, 35-40.
6. Kasymov A.G., Askerov F.S. (2001) “Biodiversity. Oil and biological resources of the Caspian Sea” // Baku: “Print Studio”, 375.
7. Mirzoev G.S. (2011) “Species composition and quantitative distribution of macrozoobenthos in coastal waters of the Azerbaijan sector of the South Caspian” // Tr. Institute of Zoology of the National Academy of Sciences of Azerbaijan. vol. XXIX, 203-209.
8. Keys to the fauna of the Black and Azov seas. Vol.2. Crustaceans. Kiev, 1969,536.
9. Keys to fish and invertebrates of the Caspian Sea. Vol. 1. Pisces. And shellfish. M .: Tovarstvo scientific publications KMK, 2013. - 543.
10. Romanov N.N. (1983) “Methodical instructions for the study of the benthos of the seas of the USSR” // M .: VNIRO, 13
11. Gasanov A.G. (1996) “Bottom fauna of the deep-water basins of the Caspian” // Zool. Magazine. 1996. Vol. 75. issue 12, 1763-1775
12. Mirzoev G.S., Alekperov I.Kh. Zoobentos distribution on biotope in the shelf Zone of the Azerbaijan sector of the South Caspian. Jourmal of Entomology and Zoology Studies. JEZS.2017: 5(2): 953 – 959
13. Mirzoev G.S., Alekperov I.Kh. Zoobentos distribution patterns in the deepüatür horizon of Azerbaijan sector of the Caspian Sea. İnternational Journal of Zoology stadies, Volume 2, İssue 1, Jan – Feb, Tompson, 2017.
14. Shannon C., Weaner W. The mathematical theery of communication || Urbana Univ. Plinove press, 1963, 117p
15. Sorensen T.A method of establishing groupe of equal amplitude in plant

socioligy || Kgl. Danneke Vidensk. Selks., 1948, № 4, p.1-34