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ЗООЛОГИЯ

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Фауна и сообщества донных беспозвоночных ручьёв и родников Айтуарской степи (Оренбургский государственный степной заповедник)

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Аннотация. В составе зообентоса ручьёв и родников Айтуарской степи выявлено 49 видов и форм. Наиболее разнообразно представлены хирономиды (11). Богаты видами подёнки (10), ручейники (7) и веснянки (5). Среди прочих беспозвоночных зарегистрированы нехирономидные двукрылые (8), моллюски (3), малощетинковые черви (1), бокоплавы (1), вислокрылки (1), клопы (1) и жуки (1). Специфику фауны определяет присутствие генетически сибирского вида *M. borealis*. Негативной чертой является отсутствие ручейников *Beraea*, *Crunoecia* и *Parachiona*. В ручьях выявлено пять типов зообентоценозов. Наиболее характерен зообентоценоз валунно-галечных грунтов. Его численность составляет 7.19 тыс. экз./м^2 при биомассе 17.75 г/м^2. Второй тип зообентоценозов приурочен к песчано-гравийно-галечным грунтам (20.28 тыс. экз./м^2 при биомассе 27.48 г/м^2). Зообентоценозы валунных грунтов с моховыми обрастаниями, песчаных грунтов и илов имеют меньшее распространение. В родниках установлено два типа зообентоценозов. На валунно-галечных грунтах формируется сообщество, численность и биомасса которого составляют 6.80 тыс. экз./м^2 и 10.88 г/м^2 соответственно. На песчаных грунтах с примесью грубого детрита складывается сообщество с умеренным уровнем развития (численность 3.80 тыс. экз./м^2 при биомассе 6.44 г/м^2).

***Ключевые слова*:** зообентос, ручьи и родники, Айтуарская степь

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ZOOLOGY

Original article

Fauna and benthic communities of invertebrates of the springs and streams within the Aituar steppe (Orenburg state nature reserve)

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Abstract. The benthic (invertebrate) community of streams and springs in the Aytuar steppe includes 49 taxon. Chironomids are the most diverse (11). Mayflies (10), caddisflies (7) and stoneflies (5) are rich in species. Among other invertebrates, non-chironomid dipterans (8), mollusks (3), oligochaetes (1), amphipods (1), alder flies (1), bugs (1) and beetles (1) were recorded. The specificity of the fauna is determined by the presence of the genetically Siberian species M. borealis. Its negative feature is the absence of such wide-spread European taxa as the caddisflies of the genera *Beraea*, *Crunoecia*, and *Parachiona*, as well as genetically Siberian elements, the mollusks *Parasphaerium rectidens* (Starobogatov et Streletzkaja, 1967), stoneflies *Arcynopteryx compacta* (McLachlan, 1872), and *Nemoura arctica* Esben-Petersen, 1910, may-flies *Cinygma lyriformis* (McDunnough, 1924) and *Ephemerella aurivillii* Bengtsson, 1908, caddisflies *Asynarchus lapponicus* Zetterstedt, 1840 and *Apa-*

tania stigmatella (Zetterstedt, 1840), common in the northern regions of the Urals and Cis-Urals. Were identified groups of invertebrates that are characteristic of both spring-fed water bodies and elements of the benthic fauna of warm-water streams. Five types of zoobenthocenoses were identified in streams. The zoobenthocenosis of cobbled (boulder-pebble) substra-tum is the most typical. Its abundance is 7.19 thousand ind./m2 with a biomass of 17.75 g/m2. The second type is the sand-gravel and pebble zoobenthocenoses (20.28 thousand ind./m2 with a biomass of 27.48 g/m2). Zoobentocenoses of boulder substratum with moss fouling, sandy substratum and silts are less widespread. Two types of zoobenthocenoses are found in springs. A community with the abundance and biomass of 6.8 thousand ind./m2 and 10.88 g/m2 respectively develops on boulder-pebble substratum, and on sandy substratum with coarse CPOM a community with a moderate level of development (number 3.80 thousand ind./m2 with a biomass of 6.44 g/m2) is observed.

Keywords: zoobenthos, streams, springs, Aituar steppe

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Introduction

The Orenburg National Nature Reserve was established on May 12, 1989 with the aim of preserving and restoring the steppe landscapes of the Southern Urals and adjacent territories [Chibilev, 1996]. Currently, the structure of the reserve includes five sections (Fig. 1).

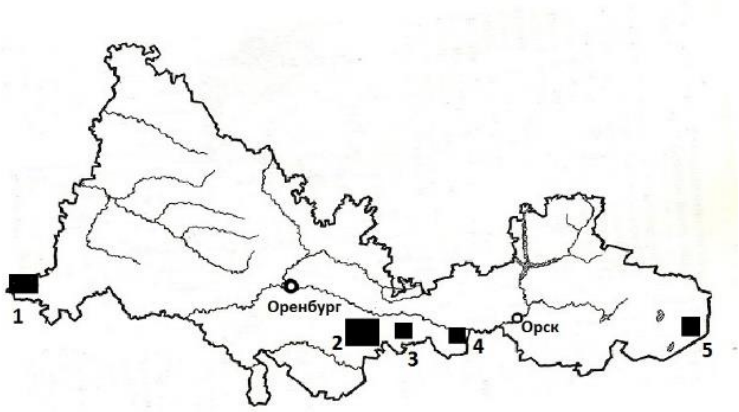

Fig. 1. Orenburg region. The black rectangles indicate the following areas of the Orenburg Reserve:
1 - Talovskaya steppe; 2 - Cis-Ural steppe; 3 - Burtinskaya steppe; 4 - Aytuarskaya steppe; 5 - Ashchisai steppe

The Aituarskaya steppe (Aituar steppe) is a parts of the Orenburg Reserve, its area is about 6300 ha [Chibilev, 1996]. It is located on the left bank of the Ural River, near the village of Aituarka in the Kuvandyk municipal district, on the border between Russia and Kazakhstan. There are several small rivers (streams or brooks) within this territory, the largest of them are Tashkak, Shinbutak and Aituarka.

Despite more than thirty years of history of the reserve, accompanied by an active study of the reference steppes, its streams and springs were beyond the attention of specialists. Meanwhile, water bodies are an integral component of steppe landscapes, and without studying them our understanding of the nature in this unique region will be incomplete.

Natural conditions

According to the scheme of physical-geographical zoning [Chibilev, 1987], the Aituar steppe belongs to the Guberlin lowland and hill region of the South Ural low-mountain steppe province of the Ural Mountains. This section of the reserve differs from its other territories in the most dissected and severe topography. In the distant past, from the end of the Triassic period through the Paleogene, this section laid within the vast peneplain, which developed on the site of the ancient Urals, subjected to erosion. Subsequently, due to the general elevation of the lands, watercourses eroded deep and narrow valleys, so, as a result, the so-called lowland and hill region was formed. Only a small plateau has survived to the present day – the remains ofthe ancient and heavily destroyed peneplain, rising two hundred meters above the Ural river [Chibilev, 1996].

The Aituar steppe is formed by elevated watershed areas with steppe vegetation, deeply incised ravines and ridges separating them from stony steppe, as well as small hills with rock outcrops. Against this background,

individual thickets of steppe shrubs stand out including birch and aspen groves, willows in marshy and low lands, and black alder brushes along streams [Chibilev, 1996].

Elevated areas and terrains with steep slopes are characterized by thin, discontinuous soils with frequent rock outcrops. Residual-calcareous low-humus black soils (chernozems), common for fescue-feather grass vegetation of the southern part of the steppe zone, are confined to watershed spaces and glacis of valleys. In some places, there are soils with chloride-sulfate salinization. Meadow-chernozem soils with an average content of humus and a heavy mechanical composition are developed along the bottoms of the ravines. Meadow-marsh soils are common mostly along the hollows [Chibilev, 1996].

The climate of the Aituar steppe is continental. The average long-term temperature of the warmest month, July, is +20 ... +21°C, the coldest, January, –15.6°C. An important feature of natural conditions is insufficient moisture (388 mm of precipitation per year) [Chibilev, 1996].

Characteristic elements of the Aituar steppe landscape are deep ravines with watercourses confined to their bottoms. These are small rivers or brooks, the length of which does not exceed 10 km. They are characterized by cobbled soils containing boulders and pebbles, sometimes with thick moss fouling, less often – sand and gravel-pebble soils, sandy and silty with varying proportions of coarse plant detritus. The water temperature in July, according to our observations, varied within 6.5-12.5°C. There are also numerous springs in this area.

Information on the chemical composition of the water of streams and springs of the Aituar steppe is not available in the literature.

Materials and methods

This report is based on the results of processing 12 quantitative zoobenthos samples taken by T.S. Krajneva in July 2017. The material was sampled on the territory of the Federal State Budgetary Institution “National Nature Reserve Orenburgsky” within the “Aituar Steppe” site (near the village of Aytuar (Fig. 2). The studies covered the tributaries of the Ural River - small rivers Aytuarka, Karagashta, Shinbutak and Tashkak, as well as three nameless springs.

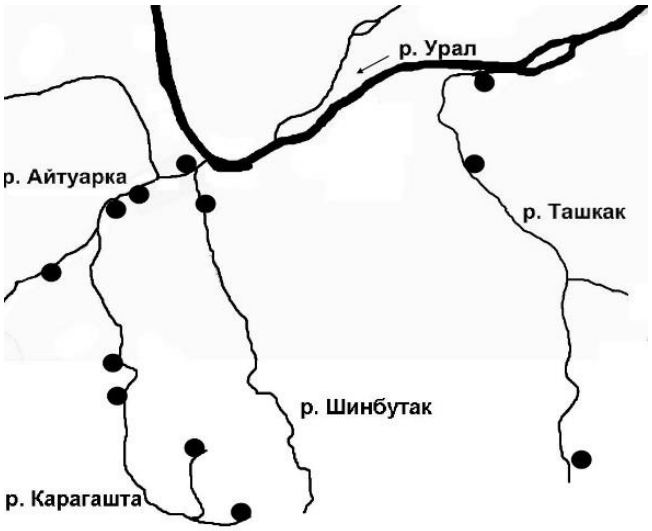

Fig. 2. Area of investigations. The circles indicate the places of hydrobiological sampling and adult amphibious insects

Quantitative samples of zoobenthos were taken by means of a surber sampler designed by V.V. Bogatov [1994] and a hydrobiological scraper. The material was processed according to the standard method [Methodika…, 1975].

To clarify the taxonomic affiliation of the larvae of amphibiotic insects living in the springs and streams, their imagoes were caught on stones and coastal vegetation, manually and with the help of an entomological net. The original materials are supplemented by collections made by S.L. Yesyunin in April and May 1997 and 2000. The total volume of the material contains 29 collections of imagoes.

Animal identification was carried out according to O.A. Chernova [1964], L.A. Zhiltsova [1964, 2003], O.L. Kachalova (1987), P. Ashe & P.S.Cranston [1990], D.R. Oliver, M.E. Dillon & P.S. Cranston [1990]. N.Yu. Kluge [1997], E.A. Makarchenko[1999], V.D. Ivanova et al. [2001], P.H. Langton & L.C.V. Pinder [2007], V.A. Teslenko and L.A. Zhiltsova [2009], P. Ashe & J.P. O'Connor [2009, 2012], Mayflies, stoneflies and caddisflies were identified by N.N. Pan’kov.

Taxonomic composition

In the zoobenthos of streams and springs of the Aytuar steppe, 49 species and forms of benthic animals were identified.

Diptera larvae are the most diverse, numbering 19 species and forms, of which the Chironomidae family is especially rich in species.

When identifying adult chironomids, 11 taxa were identified: *Thienemannimyia lentiginosa* (Fries, 1823) from the subfamily Tanypodinae, *Corynoneura lobata* Edwards, 1924, *Cricotopus bicinctus* (Meigen, 1818), *Cricotopus rufiventris* (Meigen, 1830), *Limnophyes minimus* (Meigen, 1818), *Limnophyes natalensis* (Kieffer, 1914), *Paraphaenocladius impensus* (Walker, 1856), *Rheocricotopus chalybeatus* (Edwards, 1929), *Tvetenia sp*. from Orthocladiinae, *Nilothauma brayi* (Goetghebuer, 1921) and *Paratendipes albimanus* (Meigen, 1818) from Chironominae.

In the non-chironomid Diptera larvae, the following were recorded: larvae of Simuliidae, Limoniidae (*Dicranota sp.*), Tipulidae, Tabanidae horseflies, Empididae, Ceratopogonidae, Dixidae, and Psychodidae moth flies.

The fauna of mayflies (Ephemeroptera) includes 10 species and forms belonging to 5 families: *Metretopus borealis* (Eaton, 1871) from Ametropodidae, *Baetis niger* (Linnaeus, 1761), *Baetis rhodani* (Pictet, 1845), and *Cloeon bifidum* Bengtsson, 1912 from Baetidae, *Ecdyonurus aurantiacus* (Burmeister, 1839), *Heptagenia coerulans* (Rostock, 1878) and *Heptagenia sulphurea* (Mueller, 1776) from Heptageniidae, *Ephemera lineata* (Eaton, 1870) and *Ephemera vulgata* (Linnaeus, 1758) from Ephemeridae and *Leptophlebia submarginata* (Stephens, 1835) from Leptophlebiidae.

Among the caddisflies (Trichoptera), 7 species from 5 families were recorded: *Rhyacophila nubila* (Zetterstedt, 1840) from Rhyacophilidae, *Plectrocnemia conspersa* (Curtis, 1834) and *Polycentropus flavomaculatus* (Pictet, 1834) from Polycentropodidae, *Brachycentrus subnubilus* (Curtis, 1834) from Brachycentridae, *Apatania crymophila* (McLachlan, 1880) from Apataniidae, *Limnephilus sp.* and *Potamophylax latipennis* (Curtis, 1834) from the Limnephilidae.

Plecoptera are represented by 5 species from two families: *Amphinemura borealis* (Morton, 1894), *Nemoura cinerea* (Retzius, 1783), *Nemoura flexuosa* Aubert, 1949 and *Protonemura intricata* (Ris, 1902) from Nemouridae, and *Leuctra hippopus* (Kempny, 1899) from Leuctridae.

Two Bivalvia were identified: *Euglesa supina* (Schmidt, 1850) and *Sphaerium rivicola* (Lamarck, 1818) from Sphaeriidae. Gastropoda are represented by *Galba truncatula* freshwater snails (O.F. Muller, 1774).

Among other invertebrates, we recorded *Nais elinguis* (O.F.Mueller, 1773) from Naididae, *Gammarus lacustris* (Sars, 1863), *Dikerogammarus haemobaphes* (Eichwald, 1841) from Gammaridae, *Sialis fuliginosa* (Pictet, 1836), *Aphelocheirus aestivalis* (Fabricius, 1803) from Aphelocheiridae, and *Elmis sp.* from Elmiidae.

In our collections, the discovery of *M. borealis* is of particular interest. Being mostly distributed in Eastern Siberia, those insects penetrate into Europe along its northern regions up to Scandinavia. The upper reaches of the Pechora river serve as the southern boundary of their continuous distribution in the Urals.

Apparently, like some other Siberian-Northern European species, *M. borealis* has an extensive disjunction within the low mountains of the Middle Urals, demonstrating an example of the boreal-alpine distribution in Europe, which is so characteristic for representatives of the Siberian faunal complex [Pan'kov, 2000].

The zoobenthos of springs and streams of the Aytuarskaya steppe contains species typical of spring-fed water bodies. These are larvae of *Dicranota sp.*, caddisflies of the *Apatania* genus, mayflies *B. rhodani*, and stoneflies *N. pictetii*. These invertebrates are among the most common representatives of the benthic fauna of springs and spring streams of the East European Plain [Ivanovsky, 2010; Chertoprud, 2011], including the Middle Volga region [Chuzhekova, 2015], as well as the Urals and Cis-Urals within the Perm Kama region [Pan'kov, Krasheninnikov, 2012].

Among the representatives of the benthic fauna of the springs and streams in the Aituar steppe, there are typical inhabitants of small cold-water rivers in Europe. These are *A. borealis*, *S. fuliginosa*, *R. nubila*, *P. conspersa*, and *P. latipennis*. The same species form the main background of the zoobenthos in the streams and rivers of the Perm Kama region [Pan'kov, 2000].

At the same time, the watercourses of the Aituar steppe, contain forms that are unusual for hydrological objects of this type. These include bivalve mollusks *S. rivicola*, mayflies *E. lineata*, bugs *A. aestivalis*, and caddisflies *B. subnubilus*, which are common for relatively large, temperate warm watercourses of plains and foothills. Perhaps this is due to the close vicinity of the Ural River, which provides a certain "demographic pressure" in the populations of these species, and the corresponding fund of migrants.

In comparison with most other regions of Europe, the specificity of the taxonomic composition of the benthic fauna in the springs and streams of the Aituar steppe is determined by the presence of the genetically Siberian species *M. borealis*, which is partly due to the borderline position of the Urals between Europe and Siberia, and partly due to its role as a unique faunistic corridor, which ensures penetration of relatively cold-loving representatives of the Siberian faunistic complex into low latitudes.

It should be noted, however, that in comparison with the northern Perm Kama region, the participation of genetically Siberian elements in the composition of the Aituar steppe hydrofauna is relatively small. Thus, neither

molluscs *Parasphaerium rectidens* (Starobogatov et Streletzkaja, 1967), nor stoneflies *Arcynopteryx compacta* (McLachlan, 1872) and *Nemoura arctica* Esben-Petersen, 1910, nor mayflies *Cinygma lyriformis* (McDunnough, 1924) and *Ephemerella aurivillii* Bengtsson, 1908, nor caddisflies *Asynarchus lapponicus* Zetterstedt, 1840 and *Apatania stigmatella* (Zetterstedt, 1840) found in similar water bodies in Perm region [Pankov and Krasheninnikov, 2012]. On the whole, this corresponds to the general zoogeographical rule— the gradual decrease of genetically Siberian elements in Europe as one moves to low latitudes [Pan'kov, 2000].

Among other negative features of the fauna of the springs and streams in the Aytuar steppe, common to the entire Urals and Cis-Urals, is the absence of such widespread European taxa as caddisflies genera *Beraea*, *Crunoecia* and *Parachiona*, which are characteristic for the central regions of European Russia [Ivanovsky, 2010;Chertoprud, 2011]. However, the last two taxa were not found in the spring streams of the Middle Volga basin either [Chuzhekova, 2015].

Apparently, this is explained by the faunogenetic processes that took place in the late Pleistocene and Holocene and consisted in filling a kind of "ecological vacuum" - a habitable, but uninhabited territory, recently abandoned by glaciers. Taxa, leaving European refuges, distributed and reached different borders, and not all of them were able to reach the Urals. As a result, we observe a trend towards depletion of the European fauna of amphibiotic insects in the direction from south to north and from west to east [Pan'kov, 2000].

It is noteworthy that 85% of the taxonomic diversity of the zoobenthos in the springs and streams of the Aituar steppe is provided by amphibiotic insects capable of flight in the adult stage. Similar figures are given by M.V. Chertoprud [2006] for springs near Moscow (91%), and N.N. Pan'kov and A.B. Krasheninnikov [2012] for Perm region along the Kama river (88%).

This once again confirms the proposition of the island theory of biogeography, according to which the terminal sections of the river network are similar to islands [Chertoprud, 2006]. These are small bodies of water, separated by more or less extensive areas of land. Although they are connected with each other within the same river system, the watercourses connecting them are not suitable for the habitation of specialized cold-water forms and therefore are effective obstacles to settling. Therefore, like any other insular fauna, the population of the terminal sections of the river network is characterized by the predominance of vagil forms capable of overcoming barriers (in this case, watershed spaces) and being carried by the wind over considerable distances.

Communities of zoobenthos

Based on biotopic features and differences in structural characteristics, the entire population of benthic animals in the streams of the Aituar steppe is divided into five types of zoobenthocenoses.

The most typical one for these watercourses is the zoobenthocenosis of boulder-pebble substratum, which covers most of the area of stream channels. This is a rather diverse and productive community: 22 taxa were identified in its composition, and the abundance is 7.19 thousand ind./m^2 with a biomass of 17.75 g/m^2 (Table 1).

Caddisflies *B. subnubilus*, *P. conspersa*, *P. latipennis*, *P. flavomaculatus*, and *R. nubila* and mayflies *B. rhodani* form the core of the community. They are accompanied by non-chironomid Diptera, mainly Limoniidae (*Dicranota sp.*) and chironomid larvae. Amphipods *G. lacustris* are also represented. Among other invertebrates, Oligochaeta (*N. elinguis*), *L. fusca*, and *A. aestivalis* are recorded, as well.

Table 1

Population structure, abundance (N, thousand ind./m^2) and biomass (B, g/m^2) of zoobenthocenoses in streams of the Aituar steppe

Species, groups	Substratum type									
	Boulder-pebble		Sand and gravel-pebble		Boulder-pebble with moss fouling		Sand		Silt	
	N	B	N	B	N	B	N	B	N	B
Trichoptera	0.24	5.50	0.24	12.88	0.04	3.36	0.20	1.84	0	0
Ephemeroptera	0.69	3.45	1.68	2.44	1.24	5.20	0	0	0.36	0.80
Diptera (except Chironomidae)	0.57	2.99	1.08	4.68	0.04	0.04	3.52	1.92	2.40	4.40
Chironomidae	4.71	2.93	15.16	3.16	3.12	0.80	1.36	0.60	1.68	1.04
Gammaridae	0.23	1.32	0	0	0.04	0.12	0	0	0.44	5.76
Oligochaeta	0.11	0.72	0.08	0.04	0.72	12.64	0	0	0	0
Plecoptera	0.55	0.51	1.72	2.24	0	0	1.52	1.00	0.28	0.16
Hemiptera	0.01	0.20	0	0	0	0	0	0	0	0
Megaloptera	0	0	0	0	0	0	0	0	0.04	1.04
Gastropoda	0	0	0.20	1.20	0	0	0	0	0	0
Bivalvia	0	0	0.08	0.84	0	0	0.08	0.44	0	0
Tolal	7.11	17.62	20.24	27.48	5.20	22.16	6.68	5.80	5.20	13.20

The second most common type of zoobenthocenosesis refers to sand-gravel and pebble substratum with varying degrees of siltation. It includes 12 taxa. This is the richest community in quantitative terms: its abundance reaches 20.28 thousand ind./m^2 with a biomass of 27.48 g/m^2.

The most significant contribution to the biomass of zoobenthocenosis (up to 47%) is made by caddisflies *R. nubila*. Along with them, the role of larvae of Limoniidae, Chironomidae, *E. vulgata*, *N. flexuosa* and *A. borealis* is relatively significant. Associated forms include *G. truncatula* and *S. rivicola*. Chironomid larvae constitute the basis of the population of benthic animals (75%). Along with them, mayflies and stoneflies significantly contribute in this indicator.

Among fairly common habitats of benthic fauna are boulder-pebble soils with moss fouling; a community that is relatively depauperate in terms of quality (only 7 taxa) were formed there, which, however, achieves impressive quantitative indicators (Table 1). More than half of the biomass (57%) is provided by oligochaetes. Mayflies *B. rhodani* and caddisflies *P. latipennis* make a significant contribution to the formation of zoobenthocenosis. They are accompanied by larvae of Dixidae, Chironomidae, as well as *G. lacustris*.

Sandy substratum are quite widely represented in the Tashkak stream. A qualitatively and quantitatively depauperated zoobenthocenosis is formed here, which is dominated by non-chironomid Diptera Limoniidae, Tabanidae, and Tipulidae and caddisflies *Limnephilus sp.* They are accompanied by *N. flexuosa*, chironomid larvae, and bivalves *E. supina*.

A relatively rare type of substratum is silt with an admixture of coarse plant CPOM. In particular, this kind of substratum is noted in the Shinbutak stream. A qualitatively scanty community is formed in this biotope, which is based on *G. lacustris* and Limoniidae, Tabanidae, and Tipulidae. *S. fuliginosa*, chironomid larvae, and *B. rhodani* play a significant part in the biomass composition. Stoneflies *A. borealis* were found there among other invertebrates, but they do not play a significant role in the community. The abundance and biomass of zoobenthocenosis are relatively moderate: 5.24 thousand ind./m2 and 13.24 g/m2, respectively.

In springs of the Aituar steppe, two types of benthic animal communities were identified. On boulder-pebble substratum with moss fouling, a quantitatively rich zoobenthocenosis is formed; that community is dominated by stoneflies *N. flexuosa* and *A. borealis*, mayflies *E. vulgata*, *B. niger* and *B. rhodani*. They are accompanied by larvae of Chironomidae and bivalves *Euglesa sp*. Along with them, larvae of Limoniidae, Tipulidae, *P. latipennis* and *A. crymophila*, and oligochaetes were recorded in the community, but their role in the composition of the zoobenthos structure is relatively insignificant. The abundance and biomass of benthic fauna amounted to 6800 ind./m^2 and 10.88 g/m^2, respectively (Table 2).

Table 2

Population structure, abundance (N, thousand ind./m^2) and biomass (B, g/m^2) of zoobenthocenoses in springs of the Aituar steppe

Species, groups	Substratum type			
	Boulder-pebble		Sand	
	N	B	N	B
Plecoptera	2.26	3.80	0.08	1.24
Ephemeroptera	0.22	3.28	0.04	0.32
Chironomidae	3.74	1.52	0.12	0.10
Bivalvia	0.08	1.10	0	0
Diptera (except Chironomidae)	0.50	0.74	3.56	4.88
Trichoptera	0.14	0.34	0	0
Oligochaeta	0.02	0.30	0	0
Total	6.96	11.08	3.80	6.54

A community with a moderate level of development gets formed on sandy substratum with an admixture of coarse plant CPOM; its abundance is 3800 ind./m^2 with a biomass of 6.44 g/m^2 (Table 2). The core of the community is formed by Psychodidae larvae; they account for over 90% of the population and 70% of the total biomass of benthic animals. Along with them, *N. flexuosa* and *P. intricata*, as well as *B. rhodani* and larvae of chironomids and Tipulidae play a significant role in the zoobenthos composition.

Thus, the abundance of zoobenthos in the streams and springs of the Aituar steppe was in the range of 3.80–20.28 thousand ind./m^2 with a biomass of 5.80–27.48 g/m^2.

Similar parameters of the development of benthic fauna in streams and springs are also given in the literature. For instance, for small streams of plains and foothills of the Perm Kama region, comparable in size and temperature conditions with streams of the Aituar steppe, N.N. Pan'kov [2000] gives the abundance and biomass values in the range of 1.39–84.1 thousand ind./m^2 and 1.28–33.513.9 thousand ind./m^2 and 8.7-19.9 g/m^2, respectively.

In springs of the Urals and Cis-Urals within the Perm region, the biomass of benthic animals varied within 8.5–32.9 g/m^2 [Pan'kov and Krasheninnikov, 2012]. T.A. Chuzhekova [2015] indicates that the biomass of zoo-

benthos in spring streams of the Middle Volga basin varied within a very wide range, but in most cases was in the range of 20–30 g/m^2 at a population of 0.8–40.0 thousand ind./m^2.

Conclusions

1. The zoobenthos composition of streams and springs of the Aituar steppe numbers 49 taxa of benthic animals. Chironomids are the most diverse (11). Mayflies (10), caddisflies (7) and stoneflies (5) are rich in species. Among other invertebrates, non-chironomid dipterans (8), mollusks (3), oligochaetes (1), amphipods (1), Alder flies (1), bugs (1) and beetles (1) were recorded.

2. The groups that are characteristic for spring-fed reservoirs, inhabitants of small cold-water rivers, and elements of the benthic fauna of relatively large warm-water streams are identified in the ecological structure of the population of streams and springs.

3. The specificity of the taxonomic composition of the benthic fauna in springs and streams of the Aituar steppe is determined by the presence of the genetically Siberian species *M. borealis*. A negative feature of the fauna is the absence of such widespread European taxa as caddisflies *Beraea*, *Crunoecia* and *Parachiona*, as well as genetically Siberian elements, the mollusks *Parasphaerium rectidens* (Starobogatov et Streletzkaja, 1967), stoneflies *Arcynopteryx compacta* (McLachlan, 1872), and *Nemoura arctica* Esben-Petersen, 1910, mayflies *Cinygma lyriformis* (McDunnough, 1924) and *Ephemerella aurivillii* Bengtsson, 1908, caddisflies *Asynarchus lapponicus* Zetterstedt, 1840 and *Apatania stigmatella* (Zetterstedt, 1840), common in the northern regions of the Urals and Cis-Urals.

4. Five types of zoobenthocenoses are identified in streams of the Aituar steppe. The most characteristic is the zoobenthocenosis of boulder-pebble substratum. Its abundance is 7.19 thousand ind./m^2 with a biomass of 17.75 g/m^2. The second most common type of zoobenthocenoses is confined to sand-gravel and pebble substratum (20.28 thousand ind./m^2 with a biomass of 27.48 g/m^2). Zoobentocenoses of boulder substratum with moss fouling, sandy substratum and silts are less common.

5. Two types of zoobenthocenoses are found in Aituar springs. The community with the abundance and biomass of 6800 ind./m^2 and 10.88 g/m^2 respectively develops on boulder-pebble substratum, and on sandy substratum with coarse CPOM the community with a moderate level of development (number 3.80 thousand ind./m^2 with a biomass of 6.44 g/m^2) is observed.

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