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Results of the Bratsk Reservoir Ecosystem Monitoring*

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Abstract: *Regime observations 017 the zoobenthos state in the Balagansk transect in 1971, 1972 and in the Odissa bay in 1987- 1993 of the Bratsk Reservoir were conducted.In 1991-1993 there is a change in the zoobenthos structure of the Bratsk Reservoir. In the depth zone of 0-5 m in the Balagansk transect in 1971-1972 the bottom community was considered as Gammaridae- Chironomodae, in 1991 as Gammaridae- Ephemeroptera in 1992-1993 as Chironomidae-Ephemeroptera-Gammaridae. As compared with 1968-1972 the importance of Gammaridae decreased and the role of Ephemeroptera increased in the zoobenthos structure in 1991-1993.*

Changes were noted in the species composition of the Ologochaeta fauna and increase of the role of Oligochaeta in the zoobenthos in 1991-1993 as compared with 1965-1972.

During all studies Chironomidae played a significant role in the zoobenthos. Since 1989 Paratanytarsus baialensis, *bailialian endemic, has occurred in the Chironomidae fauna.*

The comparison of zoobenthos has shown that aver-age number and biomass of bortom invertebrates by 3-6 times and species diversity by 2.25 are higher- in the Odissa bay than in the Balagansk transect.

Keywords: *Bratsk Reservoir, monitoring, zoobenthos*

1. Introduction

The Bratsk Reservoir is one of the largest reservoirs in the world (Avakyan *et al.*, 1987). After the construction of the dam on the river Anmgara in September 1961, its filling to a normal level continued till the end of 1967. The Bratsk Reservoir is the second and the largest reservoir in the cascade of the Angara Reservoirs and is subject to anthropogenic impact. On the shores of the Angara and the reservoir big industrial enterprises of the towns Irkutsk, Angarsk, Usolye-Sibirskoye and Svirsk are located, and their industrial wastes come into the Bratsk Reservoir through the Angara river.

The main peculiarity of the Bratsk Reservoir ecosystem is that its flora and fauna took form under the influence of the baikalian flora and fauna. The bottom fauna of the Bratsk Reservoir contains 30 baikalian endemics.

Studies into zoobenthos. as an element of the Bratsk Reservoir ecosystem, started from the period of its tilling. Long-term research permitted to determine peculiarities of zoobenthos formation. The process of formation of the Bratsk Reservoir as in other reservoirs, consisted of three

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stages in the zoobenthos development, characterised by different productivity, structure complexity and duration (Erbaeva *et al.*, 1982). At present, the Bratsk Reservoir is in the process of forming stable biocoenoses, the making of which, in the first place, depends on the work of the hydropower station, anthropogenic impact and temperature in the prebottom water layer.

According to O. M. Kozhova (1983), the methodological basis of ecological monitoring is observation in nature permitting to reveal spatial and temporal changes in populations and communities. Due to this, the Scientific Research Institute of Biology is carrying out regime observations on the state of the Bratsk Reservoir ecosystem, ill particular of zoobenthos.

The aim of the research is to evaluate the zoobenthos state, to trace changes in the structure of bottom communities affected by different factors.

Thanks to regime observations on the Bratsk Reservoir, much valuable information has been accumulated on zoobenthos, which permits to characterise development and state of zoobenthos, as an element of the Bratsk Reservoir ecosystem.

2. Materials and Methods

Regime observations were conducted from May till October 1971-1972. 1987, 1989, 1991-1993 in a shallow zone (0- 5 m), and in 1971-1972, 1991-1993 in deep-water zone (36-42 m) in the Balagansk transect, and 1991-1993 in a shallow zone (0-5 m) of the Odissa bay (Ecological monitoring..., 1994). Samples were collected every ten days on stationary stations in the central part and by the left shore in the Balagansk transect (open part of the reservoir) and in the central part by the right shore of the Odissa bay (closed part of the reservoir). All in all, 473 quantitative samples have been collected using a Petersen grab (S= 0. 025 m^2). Washing of samples was done using a mill sieve N 23.

3. Site description Bratsk Rreservoir

The Bratsk Reservoir occupies the middle part of the Angara River. The Bratsk hydropower station dam is located 605 km of Irkutsk, lower the Anrrara current. The main limnic indices of the Bratsk Reservoir are the following (Kozhova, 1973).

Tab. 1 The main limnic indices of the Bratsk Reservoir

Catchment area, km^2	167 000	Average depth, m	32.6
Volume, km^3	179	Maximum water transparency, m	10.5
Reservoir area, km^2	5 500	Average water transparency, m	3.5
Length, km	570	Maximum temperature of the superficial water layer, ℃	24.0
Maximum depth, m	100	Water-exchange intensity, per year	0.5

The flooded territory lies, primarily, in the taiga zone and, partly, in insular forest-steppe. The flooded zone in the reservoir was predominated by podsol soils, less chernozem, semi-swampy and swampy soils. For more than 20 years there has occurred transformation of flooded soils. At present, bottom sediments of the Bratsk Reservoir are represented by silts, clay, sands with detri-

tus.

The bottom sediments of the Balagansk transect and the Odrssa Bay are different. So, in the Balagansk transect, at a depth of 0-3 m, in the bottom sediments contain, primarily, clay with sand admixture, at a depth of 3-5 m silt with coarse detritus, at a depth of 34-42 m silts. In the Odissa Bay at a depth of 0-5 m there occur silt with great amount of coarse detritus and growths of macrophytes.

The Bratsk Reservoir belongs to poorly mineralized waterbodies with relatively insignificant fluctuations of the total sum of ions by seasons as contrasted to fat reservoirs of the European part of Russia, where these changes are well expressed (Primary..., 1983)

Development of the Bratsk Reservoir zoobenthos is affected by water-level fluctuations. Instability of the level regime both interannual and intaanual, is typical of the Bratsk Reservoir. Seasonal fluctuations of the water level are due to the hydropower station work, snow thawing and precipitation. Fall of the water level during "winter" period starts at the end of October beginning of November and reaches maximum value by April of the next year due to the work of the Hydropower station. Rise of the water level starts in April-May and attains its maximum in "summer" period by August-September during one year.

4. Results end Discussion

The bottom fauna of the Bratsk Reservoir contains 357 species and forms, of which 30 are baikalian endemics. In 1991-1993 in the Balagansk transect and Odissa Bay 130 taxons of invertebrates of different rank were found (Tab. 2). By species variety the first place is occupied by Chironomidae larvae – 74, then follow Oligochaete - 29, Mollusca - 9, Gammaridae - 2, Hirudinae - 3, Ephemeroptera - 3, other groups. The species composition of bottom invertebrates changes insignificantly during these years, generally owing to rare species. The bottom fauna of

Tab. 2 Number of bottom invertebrate species in the Bratsk Reservoir in 1991-1993

Taxon	The Balagansk transect			The Odissa Bay		
	1991	1992	1993	1991	1992	1993
Polychaeta	0	1	0	0	0	0
Oligochaeta	16	17	23	17	18	19
Hirudinae	2	0	1	2	2	2
Acari	+	+	+	0	+	+
Gammaridae	2	2	2	1	1	1
Odonata	0	0	0	0	1	0
Ephemeroptera	0	2	1	0	3	2
Trichoptera	1	1	1	0	0	0
Coleoptera	1	0	0	0	0	0
Chironomidae	31	36	29	50	45	41
Ceratopogonidae	+	+	+	+	+	+
Mollusca	3	3	3	5	6	4
Total	56	62	60	75	76	69

the Odissa Bay (total number of species in 1991-1993 - 105) was more diverse than in the Bala-

gansk transect (84 species) both on the whole and in separate years.

Of 55 recorded species and groups of the Chironomidae species in the shallow of the Balagansk transect in 1991-1993 dominant were *Proclacdius ferrugineus, Stempellina bausei, Tranytarsus gr. gregarius, Cladotanytarsus gr. mancus, Endochironomus albipennis, Glyptotendipes paripes, Polypedilum nubeculosum, P. bicerenatum* and *Paralauterborniella nigrochalteralis.*

In the shallow of the Odissa Bay in the same years of 67 recorded species and groups of the Chironomidae species mass species were *Proclacdius ferrugineus, Tranytarsus gr. gregarius,Paratanytarsus baicalensis (baikalian endemic), Cladotanytarsus gr. mancus, Chironomus plumosus, Parachironomus pararostrstus, Endochironomus albipennis, Glyptotendipes paripes, Polypedilum nubeculosum, P. bicerenatum* and *Leptochironomus tener.*

In the Balagansk transect of 25 species of Oligochaeta in 1991-1993 the 0-5 m depth zone was dominated by *Nais pardalis, N. simplex, N. variablis, Piquetiella blanci, Limnodrilus hoffmesteri,* and the profundal by *Isochaetides arenarius* (baikalian endemic). The greatest species variety of Oligochaeta is typical of the depth zone from 2 to 5 m.

In the Odissa Bay of 25 species of Oilgochaeta mass are *Limnodrilus hoffmesteri,Tubifex tubefex, Orchidonais serpentina, Dero obtusa, Nais pardalis, Isochaetides arenarius,*found earlier in the former Angara river-bed, (depths 34-42 m) was recorded in the Odissa bay shallow in 1992 (1320 specim·m^{-2}) and in 1994 (3 200 specim·m^{-2}).

Of 5 Mollusca species in the Balagansk transect mass species are *Valvata aliena*, occurring at a depth of 0.6-11.0 m and *Pisidium annicum*, living in the depth zone of 0.6-42.0 m. In the Odissa bay of 9 Mollusca species more frequent are *Pisidium amnium, Anodonta piscinalis,Gyraulus gredien* and *Radix ovata.*

In the Balagansk transect Gammaridae are represented by 2 species: *Gamelinoides fascintzrs* and *Micruropus wahlii* (baikalian endemics) - the first species is dominant and occurs only in the Odissa Bay.

These data testify that dominat species of Chironomidae, Oligochaeta and Mollusca in the Balagansk transect and Odissa bay are different. The differences can be accounted for by living conditions of bottom invertebrates - types of bottom sediments and water temperature. The water temperature in the Odissa bay in summer is by 2-4 ℃ higher than that in the Balagansk transect.

The fall of water level atfects negatively the zoobenthos development in the shallow zone (0-5 m) both in the open part of the Bratsk Reservoir and in its bay. It has been established that the water level fluctuations result in decrease of number-s and biomass of animals in the shallow zone, particularly in the depth zone of 0-1 m.

Average numbers and biomass of zoobenthos in the Balagansk transect, at a depth of 0-5 m in 1971-1993 ranged from 2 528 to 8 916 specim·m^{-2}, and biomass - from 2.31 to 5.49 g·m^{-2}.

In the Balayansl transect, if to judge by average data for the 0-5 m depth zone (Tab. 3), the zoobenthos biomass in 1971-1993 was dominates by Gammaridae (in the main, baikalian endemic (*Gmelinoides fasciatus*) and Chironomidae (Kozhova, Tomilov, 1973; Erbaeva *et al.*, 1980, 1982), in 1987 - by Chironomidae, in 1989 by Chironomidae, Mollusca and Ephemeroptera, in 1991 -

Ephemeroptera and Gammaridae, in 1992 - Ephemeroptera, Gammaridae and Chironomidae, in 1993 - Chironomidae and Ephemeroptera. Under considerable restructure of the community composition the total biomass changed insignificantly and was low -2.3-5.5 $g \cdot m^{-2}$ Of interest is the increasing role, especially beginning with 1989, of Ephemeroptera, in particular of Ephemera orientalis; their maximum biomass (2.25 $g \cdot m^{-2}$)) and numbers (712 $specim \cdot m^{-2}$) are recorded at a depth of 3-5 m. If to consider the zoobenthos numbers in the 0-5 m depth zone (average for the zone 3700-8900 $specim \cdot m^{-2}$), it is evident that in all years this zone was dominated by Chironomidae, and besides in 1971-1972 by Gammaridae, in 1991-1993 by Oligochaeta.

Tab. 3 Average numbers and biomass of zoobenthos in the Balagansk transect of the Bratsk Reservoir, depth 0-5 m

Groups	1971-1972	1987	1989	1991	1992	1993
			Numbers, specim · m^{-2}			
Oligocheta	534	746	169	1654	788	2764
Chironomidae	1999	7747	4277	1065	1268	2186
Gammaridae	1008	168	226	800	251	216
Mollusca	132	69	34	4	8	9
Ephemeroptera	0	100	632	363	155	151
Others	30	86	87	101	57	53
Total	3703	8916	5425	3987	2528	5379
			Biomass, g · m^{-2}			
Oligocheta	0.13	0.04	0.02	0.15	0.08	0.33
Chironomidae	1.04	1.73	2.17	0.34	0.63	0.93
Gammaridae	2.57	0.23	0.38	0.92	0.60	0.44
Mollusca	0.24	0.62	1.27	0.04	0.08	0.14
Ephemeroptera	0	0.09	1.58	1.04	0.76	0.80
Others	0.30	0.04	0.07	0.34	0.16	0.28
Total	4.28	2.75	5.49	2.83	2.31	2.89
Sample number	45	13	76	60	60	27

In the deepwater part (36-42 m) in the Balagansk transect absolutely dominant (by biomass and numbers) were Oligochaeta and zoobenthos biomass (16.0-31.9 $g \cdot m^{-2}$) and numbers (20200-34600 specim. m^{-2}) were significantly higher than in the coastal zone of 0-5 m (Tab. 4, 5).

In the Odissa Bay in 1991-1993 in the depth zone of 0-5 m zoobenthos biomass and numbers were considcrably higher than in the open ofrhe same depth rone (Tab. 6), particularly in samples with the big Mollusca *Anodonta piscinalis* (occurrence frequency 7-15 %). In 1991 numbers and biomass were dominated by Chironomidae, Oligochaeta and Gammaridae, in 1992 in numbers dominant were Chironomidae and Oligochaeta, and in biomass - Mollusca, in 1993 in numbers dominant were Oligochaeta and Chironomidae and in biomass - Mollusca.

Now we consider some additional characteristics of distribution of separate groups of bottom animals (Tab. 4, 5).

Comparison of numbers and biomass of Gammaridae in 1971-1972 and in 1987-1993 has shown that during 1998-1993 there was decrease of their numbers and biomass, except for the

depth zone of 0-1 and 1-3 m in 1991 and the depth zone of 35 m in 1991- 1993, when there was increase of Gammaridae numbers.

Tab. 4 Average number (specim · m^{-2}) of zoobenthos in the Balagansk transect of the Bratsk Reservoir

Groups	1971-1972	1987	1989	1991	1992	1993	1971-1972	1987	1989	1991	1992	1993
	Depth, 0-1 m						Depth, 1-3 m					
Oligocheta	36	140	129	331	382	1478	159	1235	192	1456	892	3491
Chironomidae	332	4955	402	154	623	718	2335	12445	4191	1116	1482	3715
Gammaridae	2338	310	337	986	233	126	486	30	357	974	248	353
Mollusca	1	20	3	0	0	3	21	170	85	9	9	20
Ephemeroptera	0	0	193	64	25	40	0	100	1074	703	236	270
Others	10	30	34	2	10	13	37	70	115	82	62	240
Total	2717	5455	1099	1519	1275	2380	3038	14050	5993	4244	2930	8070
	Depth, 3-5 m						Depth, 36-42					
Oligocheta	1407	900	192	3178	1070	3699	20256			31774	31989	34616
Chironomidae	3341	4320	6061	1940	1674	2024	183			372	281	104
Gammaridae	202	200	34	542	281	175	0			0	8	4
Mollusca	374	40	32	4	12	32	878			320	624	540
Ephemeroptera	0	0	432	321	182	167	0			2	12	0
Others	43	120	104	75	94	100	586			2	401	664
Total	5367	5580	6858	6060	3299	6199	21903			32648	33318	36028
Sample number	15	5	19	20	18	9	15	5	19	20	18	9

In 1971-1973 in the depth zone of 0-1 m in the Balagansk transect there predominated Gammaridae, their share constituted 86 % of the total numbers and 82 % of the total biomass of zoobenthos. In 1987-1993 in this zone there was a decrease in the numbers and biomass of Gammaridae and their role in zoobenrhos, except for 1991, when they dominated again, constituting 70 % of the total numbers and 89 % of the total biomass of zoobenthos. Decrease of the Gammaridae numbers and biomass occurred in the 1-3 m depth zone (except for 1991). In the depth zone of 3-5 m in 1987- 1989 there was observed a decrease in the Gammaridae numbers and biomass; in 1991 there was an increase in the Gammaridae numbers and biomass. Somewhat greater became the Gammaridae biomass in 1992, when Gammaridae constituted 22 % of the total zoobenthos biomass Analogous decrease of the Gammaridae numbers and biomass in 1991-1993 was observed in the Odissa bay (Tab. 6). Among Gammaridae dominant is one species – *Gmelinoides fasciatus*, the other – *Micruropus wahlii* occurs in the Balagansk transect rarely and has low numbers (Safronov, 1988).

The rule of Oligochaeta in the zoobenthos composition of the upper littoral of the Balagansk transect, in all depth zones and in the Odissa bay has lately (1993) increased, especially in the 1-3 m depth zone. In the profundal (36-42 m) of the Balagansk transect Oligochaeta in 1971- 1972 constituted 92 % of the total numbers and 90 % of the total biomass of zoobenthos. In 1991-1993 their share was 98 % of the total numbers and 90 % of the total biomass of zoobenthos, i.e. they also continued to dominate. In 1991-1993 the Oligochaeta biomass got reduced almost by two times as compared with 1971-1972, and their numbers as compared with 1971-1972 somewhat

incr-eased (Tab. 3, 4).

In 1991-1993 there was observed a change in the Oligochaeta composition. Occurring in 1968-1972 (Akinshina, Tomilov, 1976) *Vejdovskiella comata, Nais pseudobtusa, Isochaetides michaelseni, Iliodrilus templetonii, Tubifex ignotus, Peloscolex ferox, P. inflatus, P. velutinus, Lamprodrilus wagneri, Telescolex grubei, Lycodrilus parvus*, were found in 1991-1993 in the Balagansk transect of the Bratsk Reservoir. In 1991-1993 they were replaced by the following species: *Dero obtusa, Nais bretshei, N. simplex, Pignetiela blanci, Amphichaeta leydigi, Chaetogaster limmaei, Limnodrilus hoffmeisteri, L. helveticus*, of which *Nais simplex, Pignetiela blanci,* and *Limnodrilus hoffmeisteri* became dominant species in the Balagansk transect and Odissa bay.

Tab. 5 Average biomass ($g \cdot m^{-2}$) of zoobenthos in the Balagansk transect of the Bratsk Reservoir

Groups	1971-1972	1987	1989	1991	1992	1993	1971-1972	1987	1989	1991	1992	1993
	Depth, 0-1 m						Depth, 1-3 m					
Oligocheta	0.01	0.01	0.01	0.05	0.25	0.14	0.02	0.07	0.03	0.97	0.08	0.38
Chironomidae	0.65	0.95	0.18	0.05	0.37	0.23	1.39	2.78	2.00	0.21	0.48	1.60
Gammaridae	5.38	0.30	0.77	1.25	0.44	0.20	1.74	0.01	0.47	0.90	0.62	0.54
Mollusca	0.29	0.08	0.02	0	0	0.02	0.05	0.91	0.56	0.10	0.04	0.85
Ephemeroptera	0	0	0.74	0.03	0.03	0.26	0	0.32	2.01	1.00	0.77	0.83
Others	0.23	0.03	0.01	<0.01	0.03	0.02	0.49	0.06	0.08	0.16	0.18	0.19
Total	6.56	1.37	1.46	1.38	0.97	0.84	3.69	4.10	5.17	2.45	2.18	4.38
	Depth, 3-5 m						Depth, 36-42					
Oligocheta	0.35	0.04	0.02	0.30	0.10	0.48	31.92			16.00	14.31	16.65
Chironomidae	1.09	0.89	3.62	0.78	0.90	0.89	0.36			0.41	0.31	0.36
Gammaridae	0.61	0.53	0.04	0.68	0.75	0.56	0			0	0.02	0.02
Mollusca	0.38	0.10	3.55	0.01	0.16	0.04	2.92			1.31	1.38	1.18
Ephemeroptera	0	0	1.28	2.57	1.25	1.13	0			0.03	0.08	0
Others	0.19	0.50	0.12	0.12	0.24	0.09	0.08			<0.01	0.10	0.22
Total	2.63	2.13	8.65	3.96	3.40	3.20	35.29			17.81	16.20	18.43
Sample number	15	5	19	20	18	9	15	5	19	20	18	9

In 1971- 1972 *Isochaetides arenarius*, baikalian endemic, occurred in the profundal of the open part of the Balagansk espansion of the Bratsk Reservoir, but played a secondary role in zoobenthos. *Tubifex tubifex* was dominat at this time. In 1974-1976 *T. tubifex* earlier dominant was replaced by *I. arenarius*. In 1991- 1993 *I. arenarius* became a dominant species in the profundal of the river-bed part of the reservoir and besides this zone occupied partly the upper littoral (depth, 3-5 m) of the open part of the Balagansl; expansion of the Bratsk Reservoir (20 000 specim$\cdot m^{-2}$ and 17.29 $g \cdot m^{-2}$ in 1993) and of the Odissa bay (depth 0-1 m and 1-3 m, numbers 1 960-3 200 specim$\cdot m^{-2}$. biomass 2.03- 10. 14 $g \cdot m^{-2}$ in 1992- 1993).

The role of Chironomidae in zoobenthos in the years under study was rather high. In 1987-1993 there was an increase in the Chironomidae numbers and biomass as compared to 1971-1972, except for 1991, when in the 0-1 m depth zone their share constituted 9 % of the total numbers and 2 % of the total biomass in zoobenthos. In the 1-3 m depth zone in 1987-1989 Cironomidae constituted 77 %-91 % of the total numbers and biomass of zoobenthos. The chironomidae numbers and

biomass in the depth zone of 1-3 m in 1991 were lower than in 1971-1972 , in 1987- 1989 and in the following years. In the 3-5 m depth zone the Chironomidae numbers and biomass in 1987-1989 were higher than those in 1971-1972. In 1991- 1993 the numbers value is lower than in 1971- 1972, and the biomass value was close. At a depth of 36-42 In the share of Chironomidae in the zoobenthos composition in 1991-1993; remains practically at the same level as in 1971-1973 (0.8-1.1 of the total numbers and 1.9 %-2.3 % of the total biomass of zoobenthos).

Tab. 6 Average numbers (specim·m^{-2}) **and biomass** (g·m^{-2}) **of zoobenthos in the Odissa bay of the Bratsk Reservoir**

Groups	1991	1992	1993	1991	1992	1993	1991	1992	1993	1991	1992	1993
Number	Depth, 0-1 m			Depth, 1-3 m			Depth, 3-5 m			Depth, 0-5 m		
Oligocheta	751	3048	5015	3662	4668	6055	4772	4542	4591	3061	4086	5220
Chironomidae	5067	4558	3916	10953	11100	5255	10884	7353	1781	8968	7670	3650
Gammaridae	3655	712	147	2112	684	715	401	601	25	2056	665	295
Mollusca	86	105	101	30	95	86	24	113	83	46	104	90
Ephemeroptera	16	24	73	77	57	188	24	63	22	39	48	94
Others	26	89	105	94	128	81	30	138	71	50	118	86
Total	9602	8537	9357	16928	16733	12380	16165	12813	6575	14221	12692	9437
Biomass	Depth, 0-1 m			Depth, 1-3 m			Depth, 3-5 m			Depth, 0-5 m		
Oligocheta	0.65	1.64	3.70	1.42	1.75	4.86	3.27	2.05	4.59	1.78	1.81	4.38
Chironomidae	2.72	2.62	2.20	3.32	8.48	3.70	3.84	4.28	1.54	3.29	5.12	2.48
Gammaridae	6.87	2.05	1.15	3.39	1.72	2.51	0.96	2.38	0.02	3.74	2.05	1.22
Mollusca	0.85	36.87	0.15	0.09	2.64	116.23	0.78	15.52	0.14	0.57	18.34	38.84
Ephemeroptera	0.08	0.19	0.85	0.80	0.54	0.47	0.50	0.88	0.25	0.46	0.53	0.52
Others	0.06	1.12	2.23	0.13	0.25	0.54	0.01	0.33	0.35	0.06	0.06	1.14
Total	11.23	44.50	10.08	9.18	15.38	128.31	9.36	25.44	6.88	9.91	28.43	48.49
Sample number	20	17	9	20	16	10	19	17	9	59	50	28

Note: Total biomass is given with regard for the *Anodonta piscinalis* biomass.

In the Chironomidae composition since 1989 the baikalian endemic *Paratanytarsus baicalensis* started to appear in the upper littoral of the open part and in the Odissa bay (Erbaeva, 1994). At present it is one of the most mass species of Chironomidae.

The Mollusca numbers in the 0-1 m in 1987-1993 were somewhat higher than in 1971-1972, though their biomass ranged from 0.02 to 0.08 g·m^{-2}. In the 1-3 m depth zone in 1987-1989 the Mnllusca numbers increased by 3-6 times as compared to 1971-1972. In 1991-1993 the Mollusca numbers decreased and ranged from 0.03 % to 0.26 % of the total zoobenthos numbers. The Mollusca biomass in 1987- 1993 increased by sever-al times as compared to that in 1971-1972. In the zone depth of 3-5 m the Mollusca numbers in 1987-1993 decreased to 4 specim·m^{-2} in 1991, and biomass ranged from 0.01 to 3.55 g·m^{-2}. In the 36- 42 m depth zone the mollusca numbers and biomass in 1991-1993 were lower than in 1971-1972.

5. Conclusion

In 1991- 1993 in the Balagansk transect and in the Odissa Bav 130 taxons of invertebrates of various ranks were recorded. By the number of species and forms the first place belongs to Ciro-

nomidae larvae - 71, then follows Olirrochaeta - 29. Mollusca - 9, Gammaridae - 2, Hirudinae - 3, Epherneroptera -3 and other groups.

Despite the fact that the Chironomidae numbers and biomass in different years changed within broad limits, they always played a significant role in zoobenthos. In their composition since 1989 the baikalian endemic *Paratanytarsus baicalensis* started to appear in the upper littoral of the open part and in the Odissa Bay (Er-baeva, I994) At present it is one of the most mass species of Chironomidae ill a shallow zone.

The changes in the species composition of the Oligochaeta fauna and increase of the role of Oligochaeta in zoobenthos in 1991-1993 as compared with 1968-1972 can be accounted for by changes of ecological conditions. So, during those years bottom sediments were formed, silting happened, which affected favourably the quantitative development of Oligochaeta and resulted in some changes in their species composition.

Comparison of the Gammaridae numbers and biomass in 1971-1972 and in 1991-1993 has shown that in 1991-1993 there is a decrease in the Gammaridae numbers and biomass.

In 1991-1993 there occurred changes in the zoobenthos composition. As compared to 1973-1972 the role of Gammaridae decreased and the role of Ephemeroptera in the zoobenthos composition increased in 1991-1993. Maximum values of numbers (712 specim·m^{-2}) and biomass (2.25 g·m^{-2}) of Ephyemeroptera are recorded in the depth zone of 1-5 m.

In the 0-5 m depth zone in the Balagansk transect in 1971-1973 the bottom community is considered as Gammaridae-Chironomidae (Tomilov, Erbaeva, 1997), in 1971 as Gammaridae-Ephemeroptera, in 1992-1993 as Chironomidae-Ephemeroptera-Gammaridae

Comparison of zoobenthos has shown that average numbers and biomass of the bottom invertebrates by 3-6 times and species diversity by 1.25 times are higher in the Odissa bay than in the Balagansk transect. The differences can be accounted for, in the first place, by life conditions of bottom invertebrates. So, the water temperature in the Odissa bay in summer is by 2-4℃ higher than in the Balagansk transect In the Odissa bay there predominate silty bottom sediments and aquatic vegetation is intensively developing, in the Balagansk transect predominant are clay sediments and there is no practically aquatic vegetation In the Odissa bay (closed site) bottom sediments are less subject to wave effects than in the Balagansk transect (open site).

The data obtained on the composition, numbers and biomass in zoobenthos and presence of baikalian endemics in the Bratsk Reservoir testify to its ecosystem well-being.

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