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The caddisfly faunas (Insecta, Trichoptera) of Protected Natural Areas in southern Far East Russia

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Abstract

The caddisfly fauna of 10 Protected Natural Areas (PNAs) in the southern part of the Russian Far East (9 on the continental part of Primorye Territory, and 1 on Kunashir Island, South Kuriles) were investigated and analyzed based on our own and literature data. The total caddisfly species list of studied PNAs includes 310 species of 90 genera, belonging to 26 families. The Sikhote-Alin Nature Reserve is habitat for 97 species, Udege Legend − 56, Khankaysky − 119, Ussuriisky − 93, Lazovsky − 68, Tiger Call − 42, Kedrovaya Pad − 93, Leopard Land − 80, Far Eastern Marine − 59, and Kurilsky − 87. One hundred fifty-two species are added to lists of caddisflies in studied PNAs including, 5 in Sikhote-Alin, 40 in Udege Legend, 15 in Khankaysky, 11 in Ussuriisky, 8 in Lazovsky, 18 in Tiger Call, 2 in Kedrovaya Pad, 27 in Leopard Land, and 17 in Far Eastern Marine. Among 28 endemic and rare species, some are recommended for inclusion in the Russian Red Lists. A comparison of Trichoptera faunas showed the highest similarity between mountain, forested, well-investigated PNAs: Sikhote-Alin, Kedrovaya Pad, and Ussuriisky. The most distinctive caddisfly fauna is in the insular, southeasternmost Kurile Nature Reserve (63.2% specificity relative to other studied PNAs), and in the unforested lowland Khankaysky Nature Reserve (34.7% specificity). Comparisons of the species lists of closely located areas without accounting for longitudinal distribution of organisms and landscape peculiarities largely helps to identify faunal-landscape complexes, rather than biogeographic differences among faunas. All caddisfly species discovered in the PNAs are considered inhabitants of clean waters and their Tolerance Values are estimated from 0 to 4 (on a scale of 0 to 10) as a starting point.

Keywords: Nature Reserves, National Parks, endemics, species composition, faunistic comparison, caddis-flies, biodiversity

Introduction

Protected Natural Areas (PNAs) are "refuges" for preservation of biotas and ecosystems that maintain stable environments in a variety of regions. Such relatively untouched areas have become “natural islands of biota,” retaining environmental conditions despite expanding anthropogenic impacts, including fragmentation of landscapes, expansions of farmland, urban sprawl, and development of new pipelines and ecologically hazardous industries. PNAs have often become the last havens for many animal and plant species threatened with total disappearance. In protected areas (nature reserves, national parks, natural sanctuaries, etc.) sustainable natural complexes generally remain, with all their variety of ecological structure, relatively undisturbed habitats retaining their original state.

Due to the threat of disappearance of original ecosystems and biodiversity, the countries represented in the 10th Conference of the Parties (COP 10) of the Convention on Biological Biodiversity, meeting in Nagoya, Japan, in 2010, assumed the obligation to increase the number and extent of protected natural areas by 2020. These countries decided also to protect not less than 17% of their terrestrial habitat and 10% of marine habitats in their national jurisdiction. At the Conference, a number of the important decisions regulating the organization and conduct of research, educational and other activities in the PNAs was accepted (Report of the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity 2010).

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Thus, according to the adopted Convention, the international priorities are the broad creation of protected natural areas, intensified biodiversity research within them, and using them to educate the public about natural ecosystems, the value of biodiversity, and threats against these (Vshivkova 2015b).

By 2014, the extent of PNAs in Russia grew to 12% of the total area of the country, there were 247 federal PNAs (102 nature reserves, 46 national parks, 71 federal wildlife areas, 28 federal nature sanctuaries) and more than 12,000 PNAs of regional value. In the Russian Far East, there were about 600 PNAs with a total of 89,066,989 hectares; 41 of these PNAs were federal (25 national nature reserves, 11 federal wildlife areas, 5 national parks) and 546 of regional value (86 wildlife areas and more than 460 PNAs of other categories such as natural parks, wildlife reserves, protected landscapes, nature sanctuaries). Such PNAs give scientists unique possibilities for conducting inventories of biotas in natural conditions. One especially interesting and important group for taxonomic, faunistic and ecological research is the aquatic insect order Trichoptera. Because of their diversity and abundance, these insects are crucial for the ecological integrity of freshwater ecosystems. They are also generally very sensitive to pollution. The bioindicator complex "EPT" (Ephemeroptera + Plecoptera + Trichoptera) is commonly sampled for biological estimation of water quality. In this regard, the study of caddisfly faunas in natural areas and the investigation of their ecological traits in natural conditions provide important basic knowledge for freshwater monitoring. Research on the structure and longitudinal distribution of bottom communities gives valuable data for development of freshwater bioassessment systems.

In this article the results of inventories of the Trichoptera faunas of 10 PNAs located in the southern Russian Far East (RFE) are presented.

Study areas

The study areas cover continental and insular parts of the southern RFE (Fig. 1). The 10 PNAs that we inventoried reflect different climates and natural landscape conditions of the region: 3 national parks, 4 biosphere nature reserves, and 3 state nature reserves. Furthermore, all studied PNAs belong to 2 types of the IUCN (International Union for Protection of Nature) Protected Area Categories: Category Ia (Strict Nature Reserves) − Category Ia areas were established to protect biodiversity and also occasionally geological/geomorphic features, where human visitation, use, and impacts are strictly controlled and limited to ensure protection of their conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring; and Category II (National Parks) − Category II protected areas are large natural or near-natural areas established to protect large-scale ecological processes, along with the complement of species and ecosystems that are characteristic of the area; they also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational, and visitor opportunities. The IUCN Category Ia PNAs were Sikhote-Alin, Khankaysky, Kedrovaya Pad, and Far East Marine Biosphere Nature Reserves; and Ussuriisky, Lazovsky, and Kurilsky National Nature Reserves. The IUCN Category II PNAs were Udege Legend, Tiger Call, and Leopard Land National Parks.

The Far Eastern Marine Biosphere Nature Reserve occupies the southernmost continental coast of South Primorye (Khasan District) and some islands located in the Peter the Great Gulf of the Japan Sea; the Kurilsky National Nature Reserve is situated on the southeasternmost point of the island territory of South RFE (Kunashir, Oskolki, and Dyomina Islands) (Fig. 1). Other PNAs are located on continental (coastal or inland) parts of Primorye. The main characteristics of these PNAs are given below and in Table 1.

Materials and methods

Information about caddisflies of the studied PNAs is based on literature and our own data. Species recorded for the first time for the studied PNAs are marked in Table 2 by an asterisk. Voucher specimens of most adults are dry on pins or preserved in ethyl alcohol (75–80%) from standard entomological collections; some specimens of adults and immature stages are preserved in 96% EtOH for DNA analyses. Information about previous expeditions and collectors can be found in references cited, detailed information about newly recorded species (dates, collectors and exact localities) will be published later in separate articles. Adults were collected by sweeping with aerial nets, use of different types of light-traps, and rearing. Male and female genitalia were cleared in a 10% solution of KOH for detailed examination.

TABLE 1. Some physical-geographic characteristics of 10 Protected Natural Areas in southern Far East Russia, numbered as in Fig. 1.

№	Protected Natural Areas	Date of creation	Number of Sectors	Location	Altitude (m a.s.l.)	Total Area (hectares[2])	Main Landscape
1	Sikhote-Alin State Nature Biosphere Reserve	10.ii.1935	2	45° 15′ 05″ N 136° 10′ 48″ E	mostly 600–650 max 1,598	401,600 including 2,900 sea water area	mountainous, 97% forested
2	Udege Legend National Park	09.vi.2008	2	45° 49′ 09″ N 135° 24′ 42″ E	average 1,330	88,600	mountainous, 99% forested
3	Khankaysky State Nature Biosphere Reserve	28.xii.1990	5	45° 00′ 00″ N 132° 09′ 00″ E	64–147	39,289 including 5,690 water area	more than 90% plains and lowlands
4	Ussuriisky Nature Reserve	07.viii.1934	1	43° 40′ 49″ N 132° 32′ 44″ E	mostly 300−400 max 700	40,432	hilly, 99% forested
5	Lazovsky State Nature Reserve	10.ii.1935	1	43° 14′ 00″ N 133° 24′ 00″ E	mostly 500–700 max 1,671	120,998	mountainous, 96% forested
6	Zov Tigra (Tiger Call) National Park	02.vi.2007	1	43° 35′ 00″ N 134° 16′ 00″ E	155−1,854	83,343	mountainous, 96% forested
7	Kedrovaya Pad State Nature Biosphere Reserve	1916 (1925)	1	43° 06′ 18″ N 131° 30′ 45″ E	400−700 max 700	17,897	mountainous, 75% forested, 25% meadows and bushes
8	Leopard Land National Park	05.iv.2012	1	43° 10' 50" N 131° 29' 18" E	mostly 400–700 max: 996 (Vysotnaya Mt.)	279,913.65	mountains 60%, wetlands 7%, forest-steppe 12%, thin-forest 21%
9	Far Eastern Marine State Nature Biosphere Reserve	24.iii.1978	4	42° 33′ 59″ N 131° 12′ 00″ E	island: max 193 (Bolshoy Pelis Island) continental: max 200	64,316.3 including 63,000 sea water area	sea water area 98%; land territory partially forested
10	Kurilsky State Nature Reserve	10.ii.1984	3	44° 05′ 00″ N 145° 59′ 00″ E	max 1,819 (Tyatya Mt)	65,365	70% forested

The newly recorded specimens mentioned in this study are deposited in the Laboratory of Freshwater Hydrobiology of the Institute of Biology and Soil Sciences, Far Eastern Branch of the Russian Academy of Sciences (FEB RAS).

Specifity of the fauna (S) for each PNA is calculated as a percentage of exclusive species (N*ex*) found in a particular PNA to the total number of species of this PNA (N*t*):

S = N*ex* * 100/N*t*)

"Exclusive species" are defined here as the species which were found in only one of the 10 studied PNAs (such species may have been found in other, unstudied areas). We used the metric of "number of exclusive species" to estimate faunistic specifity (exclusiveness) among the studied PNAs only.

Similarity of faunas was estimated using the Sorensen-Dice coefficient (Legendre & Legendre 1998) and the software program PAST was used for dendrogram construction (Hammer *et al*. 2001).

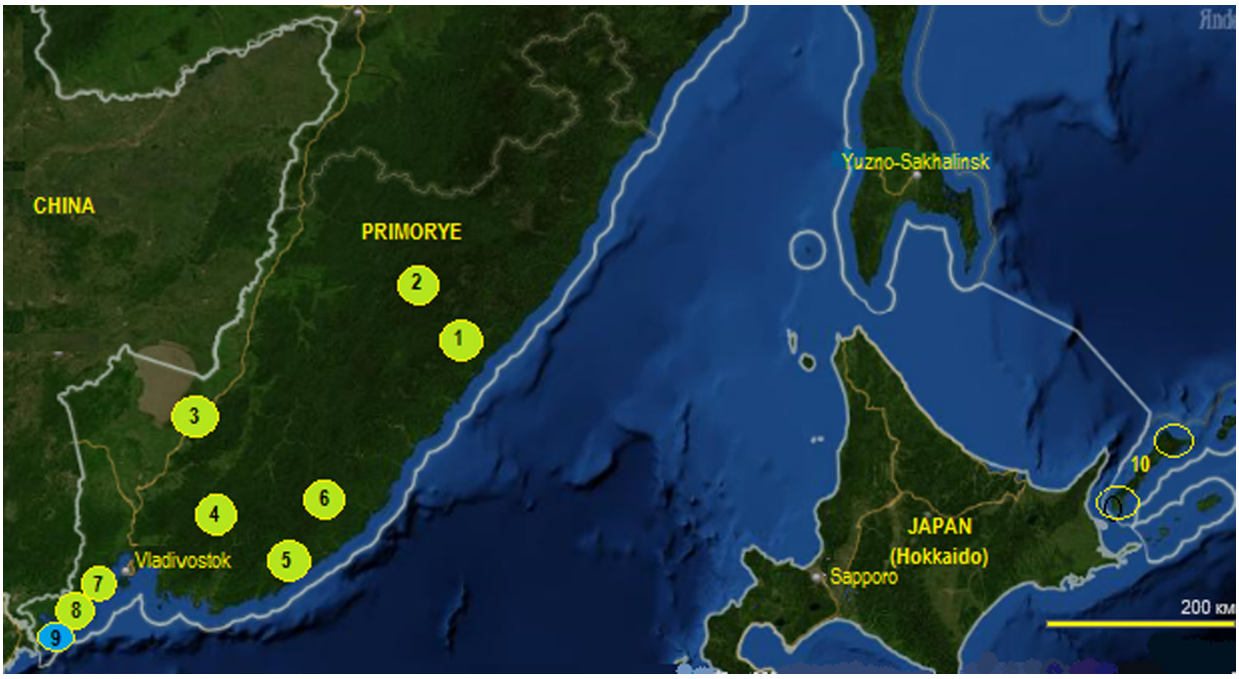

FIGURE 1. Map showing the location of the studied Russian Far East Protected Natural Areas.

Results

Characteristics of the studied PNAs and the degree of faunistic knowledge on Trichoptera

Continental PNAs

1. Sikhote-Alin Biosphere Nature Reserve (IUCN Category Ia)

This PNA is located on the eastern and western slopes of Middle Sikhote-Alin Ridge and includes the Japanese seashore. Mountain ranges lie in the altitude range from 500 to 800 m above sea level. The highest elevation is on Glukhomanka Mountain (1593 m). The main rivers are Serebryanka, Taezhnaya, and Dzhigitovka, flowing into the Sea of Japan, and the river Kolumbe, belonging to the river Ussuri basin. Woodland covers 99% of the area. Altitude zones are well-defined: the narrow line of shore side vegetation formed by littoral plants and shrubs, including the ramanas roses, is replaced by the higher oak forests – Siberian-pine, broad-leaved, and fir-spruce forests, birch stands, elfin Siberian pine thickets, and mountain-tundra vegetation. The Siberian pine/broad-leaved forests are the most peculiar, with many layers and a lot of species. Many local species are rare, with narrow distribution ranges, including endemics of the southern Far East fauna. The Sikhote-Alin Zapovednik is the world's largest Amur tiger reserve.

The Trichoptera fauna was well-investigated by the senior author (Potikha 1989, 1991, 1997, 2001; Potikha & Arefina 2003; Potikha & Vshivkova 2013). Her collections were also partially used by other authors (Arefina 2001; Ivanov & Levanidova 1996). Seven species are reported as exclusive and not found in the other 9 studied PNAs. Five species are new records for the Sikhote-Alin BNR (Table 2).

2. Udege Legend National Park (IUCN Category II)

This National Park is located in the Krasnoarmeisky District of Primorye Territory in the foothills of the western macroslope of the Sikhote-Alin ridge. The proximity of the ocean (100 km from the coast of the Sea of Japan), in combination with continental conditions results in a continental climate with monsoonal peculiarities that makes the fauna of the National Park distinctive. Considerable elevational differences (from 200 meters above sea level in the valley of the Bolshaya Ussurka River to 1300 meters at the highest tops)

cause high biodiversity and existence of many rare species needing protection). In this rather small territory, both boreal and oriental taxa are found. The southern limits of many typical representatives of the Ussuriisky taiga occur in this PNA. Three villages (Dalnyi Kut, Dersu, and Ostrovnoye) are located in close proximity to borders of the PNA. The PNA was named after the indigenous Udege tribe who lived in this area before the arrival of Russian settlers. Today a few hundred Udege remain and among them are a few Udege families that live in a village at the entrance of the park. The Park is covered with old-growth mixed forests. Common tree species include Korean pine, oak, and maples. A few impressive trees are around 2000 years old. The PNA was created especially for preservation of a valley complex of the rivers flowing from the western macroslope of the Sikhote-Alin Ridge.

The Trichoptera fauna has been insufficiently investigated. However, occasional information was published after Martynov's expedition in 1927 (Martynov 1934, 1935; Nagayashi & Ito 1993; Vshivkova 1995; Vshivkova & Tanida 1995; Vshivkova, Arefina 1996; Arefina, Vshivkova & Morse 2002; Arefina 2003) reporting a total of 16 species. The results of an expedition in 2008–2009 and later short expeditions of the Laboratory of Freshwater Hydrobiology of IBSS (FEB RAS) around this area brought 40 new records (71.4%) to the species list that are published here for the first time. Ten species noted in this PNA (exclusive species) have not been found in the other 9 (Table 2).

TABLE 2. Species list of caddisflies of Protected Natural Areas (PNAs) of southern Far East Russia and their conservation values (see explanation in text). BNR = Biosphere Natural Reserve; NP = National Park; NR = Natural Reserve; R0 = endemics; R1 = rare species limited in distribution to Far East Russia; R2 = rare species in Far East Russia, distributed also outside of Far East Russia; + = present; green shading − "exclusive species", which is recorded only for one of 10 studied PNAs; * = first record for the PNA.

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
1	**Family Apataniidae**											
1	*Allomyia coronae* Levanidova & Arefina 1995										+	*R0*
2	*A. delicatula* Levanidova & Arefina 1995										+	*R1*
3	*A. sichotalinensis* (Martynov 1935)		+		+							*R1*
	Allomyia sp.					+	+*					
4	*Apatania aberrans* (Martynov 1933)										+	*R2*
5	*A. complexa* (Martynov 1935)	+			+	+	+	+	+*			
6	*A. crymophila* McLachlan 1880	+	+*		+*			+				
7	*A. insularis* Levanidova 1979										+	*R1*
8	*A. maritima* Ivanov & Levanidova 1993							+	+			*R1*
9	*A. parvula* (Martynov 1935)										+	
10	*A. sinensis* (Martynov 1914)				+	+				+		
11	*A. zonella* (Zetterstedt 1840)	+			+	+	+*	+	+			
12	*Apatania* sp. 2							+				
	Apatania sp. (larvae)									+		
13	*Proradema furcatella* Mey 1993					+						*R0*
2	**Family Arctopsychidae**											
14	*Arctopsyche amurensis* Martynov 1934		+									
15	*A. palpata* Martynov 1934	+		+*	+	+	+	+	+	+		

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
16	*Parapsyche shikotsuensis* (Iwata 1927)										+	*R2*
3	**Family Brachycentridae**											
17	*Brachycentrus americanus* (Banks 1899)	+				+	+				+	
18	*B. japonicus (*Iwata 1927)	+	+*			+	+		+			
19	*Dolichocentrus tenuis* Martynov 1935			+								*R0*
20	*Micrasema* (*gelidum*) *kurilicum* Botosaneanu 1988										+	*R1*
21	*M. hanasense* Tsuda 1942										+	*R2*
22	*M.* (*gelidum*) *primoricum* Botosaneanu 1990	+			+	+	+*	+				
4	**Family Calamoceratidae**											
23	*Anisocentropus pallidus* (Martynov 1935)			+								*R2*
24	*Ganonema extensum* Martynov 1935		+	+								*R2*
5	**Family Dipseudopsidae**											
25	*Hyalopsyche sachalinica* Martynov 1910			+								*R2*
6	**Family Ecnomidae**											
26	*Ecnomus tenellus* (Rambur 1842)	+		+	+*					+	+	
27	*E. tsudai* Kumanski 1992		+						+*			
28	*E. yamashironis* Tsuda 1942		+	+								
7	**Family Glossosomatidae**											
29	*Agapetus inaequispinosus* Schmid 1970	+									+	
30	*A. jakutorum* Martynov 1934				+			+		+		
31	*Agapetus* sp. n. "levanidovae"	+		+*	+	+			+*	+*		
32	*A. sibiricus* Martynov 1918		+*	+								
33	*Electragapetus martynovi* Vshivkova & Arefina 1996	+	+									*R1*
34	*E. praeteritus* (Martynov 1934)	+			+	+	+*	+	+	+		
35	*Glossosoma schmidi* Levanidova 1979	+	+*		+	+	+*	+	+	+*	+	
36	*G. altaicum* (Martynov 1914)	+	+*		+	+	+*	+	+		+	
37	*G. angaricum* (Levanidova 1967)	+	+*		+		+*	+	+	+		
38	*G. dulkejti* (Martynov 1934)										+	*R2*
39	*G. intermedium* (Klapálek 1892)	+	+*		+	+	+	+	+	+		
40	*G. nylanderi* McLachlan 1879		+*				+					
41	*G. ussuricum* (Martynov 1934)	+	+*		+	+	+	+	+	+	+	
42	*Padunia adelungi* Martynov 1910							+				*R2*

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
43	*P. bikinensis* Martynov 1934		+*		+							*R2*
44	*P. forcipata* Martynov 1934		+*									*R2*
45	*P. lepnevae* Martynov 1929		+*									*R2*
8	**Family Goeridae**											
46	*Archithremma ulachensis* Martynov 1935	+					+					*R2*
47	*Goera curvispina* Martynov 1935				+							
48	*G. horni Navás* 1926				+*	+*			+			
49	*G. japonica* Banks 1906										+	*R2*
50	*G. kawamotonis* Kobayashi 1987			+								*R2*
51	*G. parvula* Martynov 1935	+		+	+			+				
52	*G. squamifera* Martynov 1909	+			+	+		+				
53	*G. tungusensis* Martynov 1909	+	+*	+	+			+		+		
	Goera sp.						+*		+			
9	**Family Hydrobiosidae**											
54	*Apsilochorema sutshanum* Martynov 1934	+		+*	+	+	+*	+	+*		+	
10	**Family Hydropsychidae**											
55	*Amphipsyche proluta* McLachlan 1872			+								
56	*Cheumatopsyche albofasciata* (McLachlan 1872)							+				*R2*
57	*Ch. chinensis* (Martynov 1930)			+								*R2*
58	*Ch. brevilineata* (Iwata 1927)			+	+	+			+*			
59	*Ch. infascia* Martynov 1934	+	+*	+	+	+		+	+		+	
60	*Hydropsyche albicephala* Tanida 1986										+	*R2*
61	*H. kozhantschikovi* Martvnov 1924		+*	+	+*			+	+			
62	*H. lianchiensis* (Li & Tian 1990)			+	+							
63	*H. newae* Kolenati 1858		+*		+	+						
64	*H. orientalis* Martynov I934	+	+*		+	+	+	+	+		+	
65	*H. valvata* Martynov 1927		+*	+	+							
66	*Macrostemum radiatum* (McLachlan 1872)			+	+			+				
67	*Potamyia chinensis* (Ulmer 1915)			+				+	+			
68	*P. czekanovskii* (Martynov 1910)	+		+				+				
11	**Family Hydroptilidae**											
69	*Agraylea multipunctata* Curtis 1834			+								

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
70	*Hydroptila asymmetrica* Kumanski 1990					+						*R2*
71	*H. botosaneanui* Kumanski 1990					+			+*			*R2*
72	*H. chinensis* Xue & Yang 1990			+	+							
73	*H. dorsoprocessuata* Botosaneanu 1993		+*	+								*R2*
74	*H. itoi* Kobayashi 1977			+								*R2*
75	*H. ornithocephala* Yang & Xue 1992			+								*R2*
76	*H. phenianica* Botosaneanu 1970			+					+			*R2*
77	*H. spinosa* Arefina & Armitage 2003	+										*R2*
78	*H.* aff. *tineoides* Dalman 1819				+							*R0*
79	*H. thuna* Olah 1989		+*	+								
80	*Hydroptila* sp. n.			+								
	Hydroptila sp.									+		
81	*Ithytrichia lamellaris* Eaton 1873			+*								*R2*
82	*Orthotrichia costalis* (Curtis 1834)		+	+								
83	*O. tragetti* Mosely 1930	+		+				+	+*	+		
84	*Oxyethira distinctella* McLachlan 1880			+*								*R2*
85	*O. ecornuta* Morton 1893	+		+				+	+*	+		
86	*O. josifovi* Kumanski 1990			+		+			+	+		
87	*Oxyethira* sp. n.			+								*R0*
88	*Stactobia makartschenkoi* Botosaneanu & Levanidova 1988										+	*R0*
89	*S. sujangsanica* Kumanski 1990								+			*R2*
90	*Stactobiella biramosa* Martynov 1929				+							
91	*S. nikulinae* Arefina 2004			+								*R1*
92	*S. tshistjakovi* (Arefina & Morse 2002)								+			*R1*
12	**Family Lepidostomatidae**											
93	*Lepidostoma albardanum* (Ulmer 1906)	+	+*	+	+	+		+	+	+	+	
94	*L. complicatum* (Kobayashi 1968)										+	*R2*
95	*L. coreanum* (Kumanski & Weaver 1992)									+		*R2*
96	*L. crassicorne* (Ulmer 1907)										+	*R2*
97	*L. elongatum* (Martynov 1935)	+	+*	+*	+	±	+	+	+	+		
98	*L. hirtum* (Fabricius 1775)		+*									
99	*L. hiurai* (Tani 1971)										+	
100	*L. naraense* (Tani 1971)										+	*R2*
101	*L. salomatini* (Ito & Vshivkova 1994)									+		*R0*

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
102	*L. satoi* (Kobayashi 1968)										+	*R2*
103	*L. sinuatum* (Martynov 1935)	+			+	+		+		+		
104	*L. stellatum* (Ito 1984)										+	
13	**Family Leptoceridae**											
105	*Adicella longiramosa* Yang & Morse 2000									+		*R2*
106	*Ceraclea albimacula* (Rambur 1842)			+							+	
107	*C. annulicornis* (Stephens 1836)			+					+			
108	*C. bifurcata* Morse, Yang & Levanidova 1997			+								*R0*
109	*C. coreana* Kumanski 1991		+	+*								
110	*C. ensifera* (Martynov 1935)			+								
111	*C. excisa* (Morton 1904)	+		+					+			
112	*C. gigantea* Kumanski 1991			+	+							*R2*
113	*C. globosa* Yang & Morse 1988			+								
114	*C. indistincta* (Forsslund 1935)			+								*R2*
115	*C. lobulata* (Martynov 1935)		+*	+	+	*?*		+	+			
116	*C. nigronervosa* (Retzius 1783)			+								
117	*C. riparia* (Albarda 1874)			+								
118	*C. shuotsuensis* (Tsuda 1942)				+	*?*			+			
119	*C. sibirica* (Ulmer 1906)	+								+		
120	*C. superba* (Tsuda 1942)			+								*R2*
121	*C. trilobulata* Morse, Yang & Levanidova 1997			+								*R1*
122	*C. variabilis* (Martynov 1935)		+*									
123	*Ceraclea* aff. *fulva* (Rambur 1842)			+								
124	*Ceraclea* sp. n. (Spassovka River mouth)			+								
125	*Ceraclea* sp. 1 (Barabashevka River)								+			
126	*Leptocerus* aff. *bitaenianus* Yang & Morse 2000			+*								*R2*
127	*L. biwae* (Tsuda 1942)			+								*R2*
128	*L. valvatus* (Martynov 1935)			+						+*		
129	*Mystacides absimilis* Yang & Morse 1997			+								*R2*
130	*M. azurea* (Linnaeus 1761)										+	
131	*M. bifida* Martynov 1924	+		+								

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
132	*M. dentata* Martynov 1924			+	+*					+*		
133	*M. pacifica* Mey 1991										+	*R2*
134	*M. sibirica* Martynov 1935	+		+				+		+*		
135	*Oecetis antennata* (Martynov 1935)			+								
136	*O. brachyura* Yang & Morse 1997			+*							+	*R2*
137	*O. bullata* Yang & Morse 1997			+								*R2*
138	*O. furva amurensis* Martynov 1935			+								
139	*O. lacustris* (Pictet 1834)	+		+						+		
140	*O. minuta* Martynov 1935			+				+				
141	*O. morii* Tsuda 1942			+							+	*R2*
142	*O. nigropunctata* Ulmer 1908	+		+	+			+		+	+	
143	*O. notata* (Rambur 1842)		+*									
144	*O. ochracea* (Curtis 1825)			+								
145	*O. paxilla* Yang & Morse 2000			+								*R2*
146	*O. testacea kumanski* Yang & Morse 2000			+		+			+			
147	*O. tripunctata* (Fabricius 1793)			+								*R2*
148	*Oecetis* sp. SN (Vshivkova 1999)				+							
149	*Oecetis* sp. (IBSS000000622 1M)									+		
150	*Parasetodes aquilonius* Yang & Morse 1997			+								
151	*P. respersellus* (Rambur 1842)			+				+				
152	*Setodes amurensis* Martynov 1935			+				+				
153	*S. argentatus* Matsumura 1906							+	+*	+*		
154	*S. obscurus* Schmid & Levanidova 1986		+									*R2*
155	*Setodes sp.* (Dmitrievka Village)			+								
156	*Triaenodes qinglingensis* Yang & Morse 2000									+		*R2*
157	*T. pellectus* Ulmer 1908			+							+	
158	*T. rufescens* Martynov 1935			+								
159	*T. unanimis* McLachlan 1877	+		+						+	+	
160	*T.* aff. *conspersus* Rambur 1842			+				+				
161	*T. jakutanus* Martynov 1910								+			
162	*T. levanidovae* (Morse & Vshivkova 1997)	+	+*							+		
163	*Trichosetodes japonicus* Tsuda 1942			+								*R2*

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
14	**Family Limnephilidae**											
164	*Anabolia semenovi* (Martynov 1935)				+	+*			+	+*		
165	*A. servata* (McLachlan 1880)								+			
166	*Anabolia* sp. n. (female)									+		*R0*
167	*Asynarchus amurensis* (Ulmer 1905)	+		+	+	+		+	+*			
168	*A. iteratus* McLachlan 1880		+									
169	*A. sachalinensis* Martynov 1914										+	
170	*Brachypsyche rara* (Martynov 1914)	+			+	+*	+			+		
171	*B. sibirica* (Martynov 1924)	+				+						
172	*Brachypsyche* sp.1	+										
173	*Chilostigma sieboldi* McLachlan 1876	+										
174	*Chilostigmodes forcipatus* Martynov 1914	+										
175	*Dicosmoecus jozankeanus* (Matsumura 1931)	+	+		+		+	+	+*		+	
176	*Ecclisocosmoecus spinosus* Schmid 1964										+	*R2*
177	*Ecclisomyia kamtshatica* (Martynov 1914)	+			+	+	+	+	+			
178	*Grammotaulius signatipennis* McLachlan 1876			+								
179	*Halesus sachalinensis* Martynov 1914		+								+	
180	*Hydatophylax festivus* (Navas 1920)										+	*R2*
181	*H. grammicus* (McLachlan 1880)	+	+	+	+	+	+*	+				
182	*H. magnus* (Martynov 1914)			+	+		+*	+	+*			
183	*H. minor* Nozaki 2004										+	*R2*
184	*H. nigrovittatus* (McLachlan 1872)	+			+		+*	+		+*		
185	*H. soldatovi* (Martynov 1914)	+			+		+	+	+			
186	*H. variabilis* (Martynov 1910)	+			+	+					+	
187	*Lenarchus fuscostramineus* Schmtid 1952										+	*R2*
188	*L. productus* (Morton 1896)	+	+				+					
189	*Limnephilus abstrusus* McLachlan 1872			+*	+*							
190	*L. alienus* Martynov 1914	+							+*		+	
191	*L. correptus* McLachlan 1880	+		+				+	+			
192	*L. fenestratus* (Zetterstedt 1840)	+*										
193	*L. fuscovittatus* Matsumura 1904	+*		+*					+*		+	

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
194	*L. kedrovayaensis* Nimmo 1995							+	+*			*R1*
195	*L. nipponicus* Schmid 1964										+	*R2*
196	*L. orientalis* Martynov 1935										+	*R2*
197	*L. ornatulus* Schmid 1965										+	*R2*
198	*L. picturatus* MacLachlan 1875	+		+								
199	*L. primoryensis* Nimmo 1995			+								*R2*
200	*L. quadratus* Martynov 1914	+		+	+			+	+*		+	
201	*L. rhombicus* (Linnaeus 1758)										+	
202	*L. sericeus* (Say 1824)	+		+	+	+		+	+*			
203	*L. sparsus* Curtis 1834										+	
204	*L. stigma* Curtis 1834	+		+							+	
205	*L.* aff. *subcentralis* Brauer 1857	+*										
206	*L. tiunovae* Arefina & Levanidova 1996	+	+*					+				*R1*
207	*Nemotaulius admorsus* (McLachlan 1866)	+		+	+	+	+	+	+*		+	
208	*N. miyakei* (Nakahara 1914)										+	*R2*
209	*N. mutatus* (McLachlan 1872)	+		+	+			+	+*			
210	*Nothopsyche nigripes* Martynov 1914			+		+				+		*R2*
211	*Nothopsyche* sp.										+	
212	*Philarctus rhomboidalis* Martynov 1924	+		+					+*			
213	*Pseudostenophylax adlimitans* (Martynov 1914)			+	+	+				+		*R2*
214	*P. amurensis* (McLachlan 1880)	+			+	+	+*	+		+		*R2*
215	*P. riedeli* Botosaneanu 1970					+						*R2*
216	*Thermophylax tyoployensis* Nimmo 1995									+*		*R1*
15	**Family Molannidae**											
217	*Molanna moesta* Banks 1906	+		+	+	+*		+		+	+	
218	*Molannodes itoae* Fuller & Wiggins 1987										+	*R2*
219	*M. tinctus* (Zetterstedt 1840)	+		+	+	+*		+		+		
16	**Family Odontoceridae**											
220	*Psilotreta falcula* Botosaneanu 1970					+		+	+	+		*R2*
17	**Family Philopotamidae**											
221	*Dolophilodes affinis* Levanidova & Arefina 1996	+				+		+				*R2*
222	*D. japonica* (Banks 1906)										+	*R2*

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
223	*D. iroensis* (Kobayashi 1980)										+	*R2*
224	*D. mroczkowskii* Botosaneanu 1970	+				+		+				
225	*D. nomugiensis* (Kobayashi 1980)										+	*R2*
226	*D. orientalis* Martynov 1934					+		+				
227	*Kisaura aurascens* (Martynov 1934)	+	+*		+	+		+	+	+*		
228	*K. borealis* (Kuhara 1999)										+	*R2*
229	*K.dichotoma* Kuhara & Arefina 2004										+	*R2*
230	*K. hattorii* (Kuhara 1999)										+	*R2*
231	*Wormaldia niiensis* Kobayashi 1985	+	+*			+						*R2*
232	*Wormaldia* sp.										+	
	Philopotamidae gen. sp. (larva "F")									+		
18	**Family Phryganeidae**											
233	*Agrypnia acristata* Wiggins 1998										+	*R2*
234	*A. czerskyi* (Martynov 1924)	+		+				+	+	+*		
235	*A. picta* Kolenati 1848	+		+	+			+	+			
236	*A. sahlbergi* (McLachlan 1880)			+								
237	*A. sordida* (McLachlan 1871)										+	*R2*
238	*Eubasilissa regina* (McLachlan 1871)										+	*R2*
239	*Hagenella apicalis* (Matsumura 1904)										+	*R2*
240	*H. sibirica* (Martynov 1909)	+			+				+*			
241	*Phryganea japonica* McLachlan 1866										+	*R2*
242	*Ph. sinensis* McLachlan 1862			+						+*		*R2*
243	*Oligotricha hybridoides* Wiggins & Kuwayama 1971										+	*R2*
244	*O. lapponica* (Hagen 1864)	+		+	+			+				
245	*Semblis atrata* (Gmelin 1789)	+	+	+	+	+*		+		+		
246	*S. melaleuca* McLachlan 1871										+	*R2*
247	*S. phalaenoides* (Linnaeus 1758)	+	+	+	+	+	+*	+	+	+		
19	**Family Phryganopsychidae**											
248	*Phryganopsyche latipennis* (Banks 1906)	+		+	+	+	+	+	+*			
20	**Family Polycentropodidae**											
249	*Cyrnus fennicus* Klingstedti 1937								+*	+		
250	*C. nipponicus* Tsuda 1942			+					+	+		
251	*Neureclipsis bimaculata* (Linnaeus 1758)			+	+			+?				
252	*Neureclipsis mandjurica* (Martynov 1907)			+	+							

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
253	*Nyctiophylax angarensis* Martynov 1910		+*									
254	*N. digitatus* Martynov 1934		+*									*R1*
255	*N. hjangsanchonus* Botosaneanu 1970					+						*R2*
256	*Plectrocnemia levanidovae* Vshivkova, Arefina & Morse 2003										+	*R1*
257	*P. martynovae* Vshivkova, Arefina & Morse 2003					+			+			*R1*
258	*P. wui* (Ulmer 1932)			+*	+	+			+			
259	*Plectrocnemia* sp. n.			+								*R0*
260	*Polyplectropus nocturnus* Arefina 1996									+		*R1*
261	*Polycentropus* sp.								+			
262	*Pseudoneureclipsis proxima* Martynov 1934							+				*R1*
21	**Family Psychomyiidae**											
263	*Lype daurica* Ivanov & Levanidova 1996				+							*R0*
264	*L. excisa* Mey 1991										+	*R2*
265	*Metalype uncatissima* (Botosaneanu 1970)	+	+*		+	+		+	+			
266	*Paduniella uralensis* Martynov 1914	+		+	+							
267	*Psychomyia flavida* Hagen 1861			+	+			+	+			
268	*P. forcipata* Martynov 1934				+			+	+			
269	*P. minima* (Martynov 1910)		+*				+			+*		
270	*Psychomyia* sp. 1								+			
271	*Psychomyiidae* gen. sp. 2				+							
22	**Family Ptilocolepidae**											
272	*Palaeagapetus finisorientis* Botosaneanu & Levanidova 1987							+		+		*R1*
273	*Palaeagapetus flexus* Ito 1991										+	*R2*
23	**Family Rhyacophilidae**											
274	*Rhyacophila angulata* Martynov 1910	+	+*		+*	+		+				
275	*Rh. arefini* Lukyanchenko 1993										+	*R2*
276	*Rh. brevicephala* Iwata 1927										+	*R2*
277	*Rh. cedrensis* Schmid 1993							+				*R0*
278	*Rh. coreana* Tsuda 1940	+	+*		+			+	+*			
279	*Rh. depressa* Martynov 1910	+			+	+*		+*		+*		
280	*Rh. hokkaidensis* Iwata 1927										+	

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TABLE 2. (Continued)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
281	*Rh. imitabilis* Arefina 1993				+							*R1*
282	*Rh. impar* Martynov 1914	+	+*	+	+	+		+	+			
283	*Rh. implicata* Arefina 1993							+		+		*R0*
284	*Rh. kardakoffi* Navás 1926	+			+*	+	+*	+*	+			
285	*Rh. lata* Martynov 1918	+	+*	+*	+	+	+	+	+	+*	+	
286	*Rh. lepnevae* Levanidova 1977	+			+*	+*	+*	+	+			
287	*Rh. manuleata* Martynov 1934				+*			+	+			
288	*Rh.* aff. *manuleata* Martynov 1934	+*									+	*R2*
289	*Rh. maritima* Levanidova 1977							+				*R0*
290	*Rh. mirabilis* Levanidova & Schmid 1977										+	*R2*
291	*Rh. mjohjangsanica* Botosaneanu 1970							+				*R2*
292	*Rh. monstrosa* Levanidova & Schmid 1977	+					+*					*R1*
293	*Rh. mroczkowskii* Botosaneanu 1970							+				*R2*
294	*Rh. narvae* Navás 1926	+			+	+	+*	+	+	+*		
295	*Rh. nipponica* Navás 1933										+	*R2*
296	*Rh. retracta* Martynov 1914	+	+*		+	+	+	+	+		+	
297	*Rh. riedeliana* Botosaneanu 1970							+	+*			*R2*
298	*Rh. singularis* Botosaneanu 1970					+		+				*R2*
299	*Rh. sutchanica* Schmid & Levanidova 1986	+				+						*R0*
300	*Rh. transquilla* Tsuda 1940										+	*R2*
301	*Rh. vicina* Botosaneanu 1970							+				*R2*
302	*Rhyacophila* sp. N	+*										
303	*Rhyacophila* sp. U						+					
304	*Rhyacophila* sp. Z							+				
24	**Family Sericostomatidae**											
305	*Gumaga orientalis* (Martynov 1935)				+*							*R2*
25	**Family Stenopsychidae**											
306	*Stenopsyche bergeri* Martynov 1926		+*		+							
307	*S. marmorata* Navás 1920	+		+*	+	+	+	+	+		+	
26	**Family Thremmatidae**											
308	*Neophylax japonicus* Schmid 1964										+	*R2*
309	*N. relictus* (Martynov 1935)	+						+				*R2*
310	*N. ussuriensis* (Martynov 1914)	+			+	+	+	+	+	+*	+	

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TABLE 2. (Ending)

Number of species	Species	Sikhote-Alin BNR	Udege Legend NP	Khankaysky BNR	Ussuriisky NR	Lazovsky NR	Tiger Call (Zov Tigra) NP	Kedrovaya Pad BNR	Leopard Land NP	Far Eastern Marine BNR	Kurilsky NR	Conservation Importance
	Total number of species	**97**	**56**	**119**	**93**	**68**	**42**	**93**	**80**	**59**	**87**	
	Number of exclusive species	**7**	**10**	**41**	**8**	**4**	**1**	**10**	**8**	**8**	**55**	
	Faunistical Specifity (% of exclusive species)	**7.2**	**17.8**	**34.7**	**8.6**	**5.9**	**2.4**	**10.7**	**10.0**	**13.6**	**63.2**	
	Number of new records	**5**	**40**	**15**	**11**	**8**	**18**	**2**	**27**	**17**	**0**	

3. Khankaysky Biosphere Nature Reserve (IUCN Category Ia)

This PNA is located in southern Russian Far East in the central part of the West-Primorian plain (extended in the meridian direction from the lower part of the Bikin River to the mouth of Razdolnaya) on Prikhankaysky and Prisungachinsky lowlands. In the northeast the plain proceeds into the People's Republic of China, and in the southwest is limited to northern spurs of the Borisovsky basalt plateau. Its length from southwest to northeast (to the lower reach of the Bikin River) is about 470 km, and its width about 150 km. The plain is adjoined by a number of intermountain depressions. The PNA represents a complicated combination of ancient lake-alluvial and flood-diluvial plains divided by low buttes ("ostantzy"). On the southern (Luzanova Hill) and western coasts there are small hills 6−50 m high. The maximum height in the southern part (Luzanova Hill) is 102 m, in the northern part [Orlinaya (Eagle) Hill] it is 146 m. Plains and lowlands occupy more than 90% of this Nature Reserve. The main hydrographic net consists of Khanka Lake, inundated and deltoid lakes, "plavni" (downstream parts of rivers covered with reed and trees), and tributaries (all inflow except outflowing Sungacha River). Khanka Lake is one of the largest freshwater lakes of Asia (Great Asian Lakes), with an area of 4070 km² (average water level), a length of 95 km, and an average depth of 1−3 m (maximum depth of 10.6 m). Twenty-four rivers flow into the lake, in particular the Ilistaya, Melgunovka, and Komissarovka Rivers; the Sungacha River flows from Khanka Lake into the Ussuri River (in the drainage of the Amur River). Almost ¾ of the surface of Khanka Lake is in the Russian Federation, a little more than ¼ belongs to the People's Republic of China. On the Khanka Lowland there is a considerable number of lakes. Some of them are lagoons located at mouths of tributaries. The largest of them include Trostnikovoye (Reed) Lake (area of 22.8 km²), Protoka (Channel) (5.37 km²), and Krylovo (1.35 km²) Lakes. Closely located settlements include the towns of Spassk-Dalny, Kamen-Rybolov, and Lesozavodsk.

This PNA was created to preserve and study natural processes and phenomena and the communities of plants and animals of the unique Khanka Lowland.

Khanka Lake was the first wetland protected in Far East Russia, having not only national, but also international value (the object under the Ramsar Convention). In 1986, the Chinese created the protected natural territory of "Sinkay-Hou" and in 1994 gave it the status of a national wildlife reserve. In 1996, Russia and China signed an agreement establishing the Lake Khanka International Nature Reserve. On 29 June 2005, under auspices of the UNESCO "Man and Biosphere" program, the "Khankaysky" PNA was included in a network of world biosphere wildlife reserves.

Caddisflies of the lake have been studied rather well (Martynov 1910, 1914, 1925, 1935; Ito *et al*. 1993; Nimmo 1995; Vshivkova 1995; Arefina 1997, 2003, 2004, 2005; Yang & Morse 1997; Morse, Tanida & Vshivkova 2001; Arefina, Vshivkova & Morse 2002; Arefina 2003, 2004, 2005; Vshivkova *et al*., 2015). Here we add 15 species as new records for the Khankaysky BNR (12.6%). Forty-one species are considered as exclusive and not known from the 9 other PNAs (Table 2).

4. Ussuriisky Nature Reserve (IUCN Category Ia)

The Ussuriisk Nature Reserve is located in Ussuriisky and Shkotovsky Districts (40.9 and 59.1% of those districts, respectively). This PNA is on the southern spurs of Przhevalsky Ridge, on the headwaters of the Komarovka River. The western tributaries of the Artyomovka River originate in the eastern part of Ussuriisky NR. The purpose of the PNA is for protection and study of the mountain and forest ecosystems of the western macroslope of the Sikhote-Alin Ridge, typical for the southern Sikhote-Alin Ridge and relating to the Manchurian complex, with a high level of endemism. The main richness of the Ussuriisk Nature Reserve is the rather large massif with virgin liana-coniferous and broad-leaved woods which have almost disappeared in the Russian Far East and adjacent countries. The low-mountain relief consists of the southern spurs of Sikhote-Alin (Przhevalsky Ridge). The height of the mountains does not exceed 300−400 m above sea-level. Mixed valley deciduous woods prevail, sometimes with coniferous species. The territory of the reserve is a part of the moderate Amuro-Ussuriysky climatic region, with the well expressed monsoonal climate of East Asia. The main rivers of this PNA are the Komarovka and Artyomovka Rivers with a combined length of about 100 km. The closest settlements are the villages of Kaymanovka and Kamenushka.

The caddisfly fauna has been studied rather well (Martynov 1934, 1935; Vshivkova 1986, 1987, 1988, 1991, 1995b, 1995c; Mey 1991; Ito *et al*. 1992, 1993; Nagayashi & Ito 1993; Tanida 1993; Vshivkova *et al*. 1995; Arefina, Ivanov & Levanidova 1996; Vshivkova & Makarchenko 1999; Vshivkova & Ito 2000; Arefina, Vshivkova & Morse 2002; Arefina 2003). We add here 11 more species to the caddisfly species list (Vshivkova 1995b). Eight species are exclusive, not recorded for the other 9 studied PNAs (Table 2).

5. Lazovsky Nature Reserve (IUCN Category Ia)

This PNA is located in the southeast part of Primorsky Territory, on the eastern slopes of the Sikhote-Alin Ridge beside the Sea of Japan. The territory belongs to the South-Primorian mountain-valley province of the Sikhote-Alin area, a zone of broad-leaved and mixed woods. The PNA is situated between the main river basins of the Kiyevka and Chernaya (Black) Rivers. The Zapovedny Ridge divides the Reserve into two parts, a northern continental and a southern coastal part. The average height of mountains is 500−700 m, with separate tops reaching 1200−1400 m above sea level. Slopes of the mountains vary (on average 20−25°) and their crests are narrow, but flat. The considerable spaces between mountains are occupied by scattered rocks. The height of spurs decreases in the east towards the sea, reaching up to 100 m. A rugged relief and steep slopes are characteristic for most of the Reserve, so that most of the PNA is remote and difficult to access. The PNA is located in the moderate coastal climatic area of the Far East and has typically a monsoonal character which is shown in the change of directions of air streams in the summer and winter. The rugged relief and the influence of the sea create peculiar changes of climatic conditions in both the horizontal and vertical directions. In the Reserve, two climatic microzones are obviously allocated: coastal and continental. The density of the river network (1.1 km/km^2) considerably exceeds the average for Primorye (0.73 km/km^2) and average across Russia (0.22 km/km^2). All rivers and streams are mainly rainfed, characteristic for monsoonal climates and typically mountain character: narrow valleys, stony courses, shaded slopes (to 5 and more on 1 km), and rapid current. Only Kiyevka River and, to a lesser extent, Chernaya (Black) River in the lower elevations gain a quieter character, with broad valleys, and old channels. There are also small shoreline lakes which rarely exceed 3 km^2.

Caddisflies of this PNA have been insufficiently studied (Ito *et al*. 1993; Mey 1993; Vshivkova 1995, 1999, 2015a; Ivanov & Levanidova 1996; Arefina, Vshivkova & Morse 2002, 2003). We add here 8 new species records for the Reserve; 4 species are exclusive. Among them, *Proradema furcatella* Mey 1993 is an endemic species of Lazovsky NR and has not been found in any other localities (Table 2).

6. Zov Tigra (Tiger Call) National Park (IUCN Category II)

This PNA is located in the heart of the Ussuriisk taiga, in a remote place, at the junction of the Lazovsky, Chuguyevsky, and Olginsky Districts. The Park covers part of the Sikhote-Alin Ridge, the Oblachnaya Mountain system, and the headwaters of the Milogradovka, Ussuri, and Kiyevka Rivers. Within the national park, 56 mountain tops exceed 1000 meters and the Oblachnaya Mountain (1,854 m) is the highest mountain of Primorye. The lowest point within the park (155 m) is in the valley of the Milogradovka River at the Park's

southern border. The lower parts of slopes up to 800 m are covered with the cedar and broad-leaved woods with some dark-coniferous species. Up to 1000 m the belt of fir and cedar woods passes into a belt of the fir trees. Slopes of many tops are treeless and often covered with stone taluses. The Park is covered with a dense network of different streams and rivers characterized by a flood regime during summer. Streams and rivers proceed through V-shaped valleys with steep slopes. A flood plain is formed only in rare places. In the absence of precipitation, streams often become dry. The density of the river network is 0.3−0.4 km/km^2. The climate is monsoonal with continental peculiarities. There is a conspicuous climatic difference between northern (average annual temperature +0.4°C) and southern parts of the Park where the climate is much more mild (average annual temperature +2.3°C).

Trichoptera of this Park have been poorly studied (Martynov 1935; Levanidova 1982; Tanida 1993; Vshivkova & Tanida 1995; Vshivkova & Ito 2000).

7. Kedrovaya Pad Biosphere Nature Reserve (IUCN Category Ia)

This PNA is located in the Khasansky District of Primorye, between the western coast of Amur Bay and spurs of the East Manchurian mountains—Sukhorechensky and Gakkelevsky ridges separating the Kedrovaya River basin from the Barabashevka and Narva Rivers and proceeding near reserve borders. The main part of the East Manchurian system is in North Korea and in northeast China, resulting in a similar biota in these countries. The highest tops of the Sukhorechensky ridge located in the south of the reserve are Uglovaya (700 m) and Krestovaya (600 m) Mountains. The highest point of Gakkelevsky Ridge is the Chalban Mountain (600 m), located beside the middle part of the Kedrovaya River. Climate is monsoonal, with average annual air temperature about +4°C. The main vegetation is coniferous and broad-leaved woods, with 25% covered with meadows and bushes. This Reserve is unique in that it is possible to see at the same time 5 species of birches and 8 species of maple; some plants are endemics and found only in these places. Sixty-four species of plants are included in the Red List.

The Trichoptera fauna of Kedrovaya Pad Nature Reserve has been investigated very well. The first records of caddis from this BNR resulted from faunistic and ecological research by staff of the Laboratory of Freshwater Hydrobiology beginning in 1972 and conducted regularly and continually since then (Martynov 1934, 1935; Levanidova 1977, 1979, 1980, 1982, 1986, 1989; Levanidova *et al*. 1977; Botosaneanu & Levanidova 1987, 1988; Botosaneanu 1989; Ito 1992; Vshivkova *et al*. 1992; Vshivkova *et al*. 1993; Ito *et al*. 1993; Ivanov & Levanidova 1993; Nagayashi & Ito 1993; Tanida 1993; Arefina, Ivanov & Levanidova 1996; Ito & Vshivkova 1999; Arefina 2001). In recent studies, we add only 2 species to the list of Kedrovaya Pad BNR because the fauna has been studied so well (Table 2).

8. Leopard Land National Park (IUCN Category II)

"Leopard Land" National Park partially covers Khasansky, Ussuriisky, and Nadezhdinsky Districts. It includes the "Leopardovy" Wildlife Area and Kedrovaya Pad Nature Reserve. The territory stretches from the coast of Amursky Bay of the Sea of Japan to the Russian-Chinese border in the meridional direction, and from the southern borders of the "Poltavsky" Wildlife Area to a point of the Russian Federation border at the Tumannaya River. The distance from north to south is about 150 km. The Park is in the East Manchurian mountain system. The majority of the Park occupies the flat Borisovsky Plateau. In the center of the Plateau is the Borisovsky basalt dome (741 m) where all large rivers of the Park originate (Granitnaya, Ivashkina, Lesnaya, Kochkovataya, Krestovaya, Kamenistaya, Krounovka, Neprokhodimaya, Borisovka, Nezhinka, Kabanja, Amba, and Povorotnaya Rivers); the surface of the plateau is almost flat, boggy. Climate of the Park is monsoonal, with an average annual air temperature of +4.0^{0}C. The main reason for the creation of the Park is to protect and restore the population of a unique spotted cat, the Far East Leopard (about 50 individuals in Russia). The Amur Tiger is another big cat included in the Red List that lives here. The territory of this NP is an essential part of the Amur ecoregion, with the mixed woods of Manchuria (modern Priamurye and Primorye territories). Besides the Caucasus, the region is the only part of Russia which was not affected by the last glaciers, thereby providing refuge for a rich variety of flora and fauna. Thanks to this historical providence, ancient relic plants and representatives of a tropical fauna still live here.

The caddisfly fauna has been insufficiently investigated (except the fauna of Kedrovaya Pad NR which we analyzed separately and do not include in the Leopard Land NP list) (Ito 1992; Vshivkova *et al*. 1992;

Tanida 1993; Vshivkova 1995; Ito *et al*. 1993; Makarchenko *et al*. 1998; Arefina 2001, 2003, 2004; Arefina, Vshivkova & Morse 2002; Tiunova *et al.* 2003; Vshivkova *et al*. 2015). New information recently was obtained during CRDF-FEBRAS expeditions in 2012−2014 which will be published in a separate paper.

Continental-Island PNA

9. Far Eastern Marine Biosphere Nature Reserve (IUCN Category Ia)

The Far East Marine Biosphere Nature Reserve of FEB RAS is the only reserve in Russia covered mainly by sea water (98%). The Reserve includes 4 island clusters (Eastern, Southern, Western, and Northern): The first 3 are administratively part of the Khasansky region of Primorye, the fourth (Popov's island) is located near the edge of Amursky Bay opposite from Vladivostok. The water area is about 10% of the area of Peter the Great Bay (the northern part of the Sea of Japan). The islands and coastal continental shore includes 1316.3 hectares of land. Around the sea borders of the reserve, the sea protected zone is 4.8 km wide; a 500-meter coastal protected area has been established along the coast. The reserve is characterized by a monsoonal climate. The islands assigned to the reserve include Bolshoi Pelvis, Maly Pelis, Medvedev, De-Livron, Gildebrandt, Stenin, Durnovo, Furugelm, Vera, Falshivy, and the southern part of Popov Island (Likander's cape). The Reserve includes almost all landscapes of South Primorye: coniferous and broad-leaved woods, bogs, and steppes; rocks, warm sandy bays, cold depths of the Sea of Japan, streams, rivers, lakes, and mixohaline lagoons. In a few places it is possible to find a unique variety of the geological structures and soils concentrated in the small territory of reserved islands and coasts. The freshwater net is not well developed in the islands and is represented by rare small streams and springs; there are some small lakes in Bolshoy Pelis and Stenin Islands and some wetlands in the southern continental part. There are many lagoon (bar) lakes, some of which are partially connected with the sea. The coastal area has more streams, however they are mainly short.

Trichoptera of this PNA have not been investigated sufficiently. Since the first expedition around the southern part of the Reserve organized by the Institute of Marine Biology FEB RAS in 1997 (Vshivkova 1998), there have been no records of caddisflies from its islands. Results of that expedition and collection from the PNA coastal part brought some data on caddisflies (Ito, Vshivkova 1993, 1994, 1995,1999; Vshivkova 1998; Morse & Vshivkova 1998; Arefina *et al.* 2002, 2003; Ito & Vshivkova 1999; Vshivkova *et al.* 2004a,b; Vshivkova *et al*. 2015). New information was obtained during CRDF-FEBRAS expeditions in 2012−2014 and preliminary results will be reported in a separate paper.

Island PNA

10. Kurilsky Nature Reserve (IUCN Category Ia)

This Reserve was created to preserve and study the natural processes and phenomena of the typical ecological systems of the southern Kuril Islands. Natural complexes of the Reserve are unique. There are 3 island clusters of this PNA, the Northern Kunashir Cluster, the Southern Kunashir Cluster, and the Malaya Kuril Gryada. The Northern Kunashir Cluster (area of 49,899 hectares) is located in the northern part of Kunashir. The northwest part of the site is located in the foothills and mountains of the Dokuchayev Ridge, including the active Ruruy Volcano (1485 m). The southeast part of the site is occupied by the Tyatya Volcano (1819 m), with its coastal terrace towering to 30−50 m above sea level. The Southern Kunashir Cluster (area of 15,366 hectares) is located in the southeastern part of Kunashir. It differs from the Northern site in its more moderate relief with smaller height differences. The central part of the site is occupied by the caldera of Golovnin Volcano (541 m). At the bottom of this volcano are two mineralized lakes, Goryachye (Hot) Lake and Kipyasheye (Boiling) Lake. The Malaya Kuril Gryada (area of 100 hectares) is located on the islands Oskolki and Dyomina. It is characterized by considerable denudations which are a geomorphological continuation of the Nemuro Peninsula (Hokkaido Island, Japan). More than 70% of the Reserve is covered with woods. The small rivers and streams of the PNA flow into the Sea of Okhotsk and the Pacific Ocean. The majority of them can be considered mountain type streams. The longest river of the Reserve, Tyatina River, originates in Tyati's foothills. Climate of the Kuril ridge is damp, monsoonal. In the summer and fall powerful tropical cyclones

and typhoons occur, with plentiful rains and gales.

The Trichoptera fauna has been investigated since the times when the territory was under Japanese administration. Then, numerous Russian and international expeditions worked in the region and acquired many new data concerning the entomofauna of the South Kuriles, including caddisflies (Tsuda 1939, 1942; Konakov 1956; Schmid 1965; Kuwayama 1967; Levanidova & Schmid 1977; Levanidova 1979, 1980, 1982; Ito *et al*. 1992, 1993; Vshivkova *et al*. 1994; Vshivkova 1999; Arefina, Ivanov & Levanidova 1996; Arefina 1997, 2001; Arefina *et al*. 1999; Arefina, Vshivkova & Morse 2003; Minakawa *et al.* 2004).

List of caddisflies of the studied NPT

The total number of Trichoptera species recorded in the studied PNAs as result of our research is 310, belonging to 90 genera of 26 families. In comparison with fauna of the Far East region of Russia including 449 species (from 103 genera and 26 families), according to Vshivkova *et al.* 2015, it makes 69%.

The species biodiversity of caddis flies in studied reserves is presented as follows: Sikhote-Alin Nature Reserve is inhabited by 97 species, Udege Legend − 56, Khankaysky − 119, Ussuriisky − 93, Lazovsky − 68, Tiger Call − 42, Kedrovaya Pad − 93, Leopard Land − 80, Far Eastern Marine − 59, and Kurilsky − 87. To the lists of the studied PNAs, we added a total of 152 species (to Sikhote-Alin − 5, Udege Legend − 40, Khankaysky − 15, Ussuriisky − 11, Lazovsky − 8, Tiger Call − 18, Kedrovaya Pad − 2, Leopard Land − 27, Far Eastern Marine − 17, and Kurilsky − 0) (Table 2).

New species and records

Some new species and new records are found for the studied PNAs: *Agapetus* sp. n. ("*levanidovae*") (Vshivkova, 2015c), *Anabolia* sp. n., *Hydroptila* sp. n., *Oxyethira* sp. n., *Ceraclea* sp. n., and *Plectrocnemia* sp. n. are considered as new to science, since we could not identify them using available literature. They will be described in separate papers.

Species new for the Primorye Territory include *Adicella longiramosa* Yang & Morse 2000. This species was recorded earlier for the Khabarovsk Region (Arefina & Morse 2001, as *Adicella* sp.; Arefina 2005). Now we know it from streams of the continental shore of the Far Eastern Marine Biosphere Nature Reserve and Vinogradnaya River (Gladkaya River Basin) (results of CDRF-FEBRAS expeditions, 2010−2012).

One species is a new record for the continental part of the Russian Far East, *Rhyacophila* aff. *manuleata*). Recently it was recorded for the Sikhote-Alin Biosphere Nature Reserve (Potikha & Vshivkova, 2013) as *Rh. kawamurae*. In Russia the *Rh. kawamurae* is known from only Kunashir and Iturup (South Kuriles) (Vshivkova *et al*. 1994). The resolution of the status of this species needs special study.

A species new for the Russian Far East is *Thermophylax tyoployensis* Nimmo 1995. Previously it was found in Tyoploye Lake, Evreyskaya Autonomous Oblast (Nimmo, 1995); now we add a second locality for this species: Russian Island, near Vladivostok.

Two species *Nothopsyche* sp. and *Wormaldia* sp. have been recorded from Kunashir (South Kuriles) (Arefina *et al*. 1999; Minakawa N. *et al*. 2004), but still need species-level identification.

Endemics and rare species

Twenty-eight species are considered endemics and rare species (Table 3). Nine of them have been reported from very limited areas: Lazovsky NR: *Prorademа furcatella* Mey 1993; Kedrovaya Pad NR: *Limnephilus kedrovayaensis* Nimmo 1995, *Rhyacophila cedrensis* Schmid 1993, *Rhyacophila maritima* Levanidova 1977; Khasan District: G*oerodes salomatini* Ito & Vshivkova 1994, *Anabolia* sp. n., *Palaeagapetus finisorientis* Botosaneanu & Levanidova 1987, *Rhyacophila implicata* Arefina 1993; Khanka Lake basin*: Ceraclea bifurcata* Morse, Yang & Levanidova 1997. Ten species are found only in Primorye. South Primorye endemics include *Apatania maritima* Ivanov & Levanidova 1993, *Dolichocentrus tenuis* Martynov 1935, *Plectrocnemia martynovae* Vshivkova, Arefina & Morse 2003, *Polyplectropus nocturnus* Arefina 1996, and *Lype daurica* Ivanov & Levanidova 1996. Primorye endemics include *Allomyia sichotalinensis* (Martynov

1935), *Electragapetus martynovi* Vshivkova & Arefina 1996, *Limnephilus tiunovae* Arefina & Levanidova 1996, *Pseudoneureclipsis proxima* Martynov 1934, and *Rhyacophila sutchanica* Schmid & Levanidova 1986.

TABLE 3. Endemic and rare species of Trichoptera in southern Far East Russia.

Family Apataniidae
Allomyia coronae Levanidova & Arefina 1995 − South Kurile (Iturup, Shikotan, Kunashir) endemic
Allomyia sichotalinensis (Martynov 1935) − Primorye endemic
Apatania maritima Ivanov & Levanidova 1993 − South Primorye endemic
Proradema furcatella Mey 1993 − Lazovsky District (South Primorye) endemic
Family Brachycentridae
Dolichocentrus tenuis Martynov 1935 − South Primorye endemic
Family Glossosomatidae
Electragapetus martynovi Vshivkova & Arefina 1996 − Primorye endemic
Family Hydroptilidae
Stactobia makartschenkoi Botosaneanu & Levanidova 1988 − Kunashir (South Kuriles) endemic
Stactobiella nikulinae Arefina 2004 − South Russian Far East endemic
Stactobiella tshistjakovi (Arefina & Morse 2002) − South Russian Far East endemic
Family Lepidostomatidae
Goerodes salomatini (Ito & Vshivkova 1994) − Khasan District (South Primorye) endemic
Family Leptoceridae
Ceraclea bifurcata Morse, Yang & Levanidova 1997 − Khanka Lake basin (South Primorye) endemic
Ceraclea trilobulata Morse, Yang & Levanidova 1997 − South Russian Far East endemic
Family Limnephilidae
Anabolia sp.n. (female) − Khasan District (South Primorye) endemic, probably a new species
Limnephilus kedrovayaensis Nimmo 1995 − Kedrovaya Pad NR (South Primorye) endemic
Limnephilus tiunovae Arefina & Levanidova 1996 − Primorye endemic
Thermophylax tyoployensis Nimmo 1995 − South of Russian Far East endemic (reported from 2 sites: Tyoploye Lake, Evreyskaya AO (Nimmo 1995); Russian Island, Vladivostok vicinity, first record for RFE)
Family Polycentropodidae
Nyctiophylax digitatus Martynov 1934 − endemic of South Russian Far East
Plectrocnemia levanidovae Vshivkova, Arefina & Morse 2003 − endemic of south Sakhalin-Kuriles region
Plectrocnemia martinovae Vshivkova *et al*. 2003 − South Primorye endemic
Polyplectropus nocturnus Arefina 1996 − South Primorye endemic
Pseudoneureclipsis proxima Martynov 1934 − Primorye endemic
Family Psychomyiidae
Lype daurica Ivanov & Levanidova 1996 − South Primorye endemic
Family Ptilocolepidae
Palaeagapetus finisorientis Botosaneanu & Levanidova 1987 − Khasan District (South Primorye)
Family Rhyacophilidae
Rhyacophila cedrensis Schmid 1993 − Kedrovaya Pad NR (Khasan District, South Primorye) endemic
Rhyacophila imitabilis Arefina 1993 − South Russian Far East endemic
Rhyacophila implicata Arefina 1993 − Khasan District (South Primorye) endemic
Rhyacophila maritima Levanidova 1977 − Kedrovaya Pad NR (Khasan District, South Primorye) endemic
Rhyacophila monstrosa Levanidova & Schmid 1977 − South Russian Far East endemic
Rhyacophila sutchanica Schmid & Levanidova 1986 − Primorye endemic

One species is considered a Kunashir Island endemic (*Stactobia makartschenkoi* Botosaneanu & Levanidova 1988), one is a South Kurile endemic (*Allomyia coronae* Levanidova & Arefina 1995), and one species is an endemic of the South Kurile-Sakhalin region (*Plectrocnemia levanidovae* Vshivkova, Arefina & Morse 2003). There are 6 species that are endemic to southern Far East Russia: *Stactobiella nikulinae* Arefina 2004, *Stactobiella tshistjakovi* (Arefina & Morse 2002), *Ceraclea trilobulata* Morse, Yang & Levanidova 1997, *Thermophylax tyoployensis* Nimmo 1995, *Rhyacophila imitabilis* Arefina 1993, and *Rhyacophila monstrosa* Levanidova & Schmid 1977.

All studied Trichoptera were grouped into three categories, important for nature conservation (Fig. 2): R0 − endemics, with a *dot distribution* (e.g., species, known from the only localities, or from few localities situated in the same water basin); R1 − rare species, narrow distribution limited by the southern Far East Russia, known from localities in different water basins; R2 − rare species, in Russia limited by the southern Far East Russia, but noted from the adjacent countries.

Species of these three categories can be recommended to nature conservation managements for organizing protection of the habitats and corresponding water basins where the species inhabit, or even for consideration of these places as potential PNA.

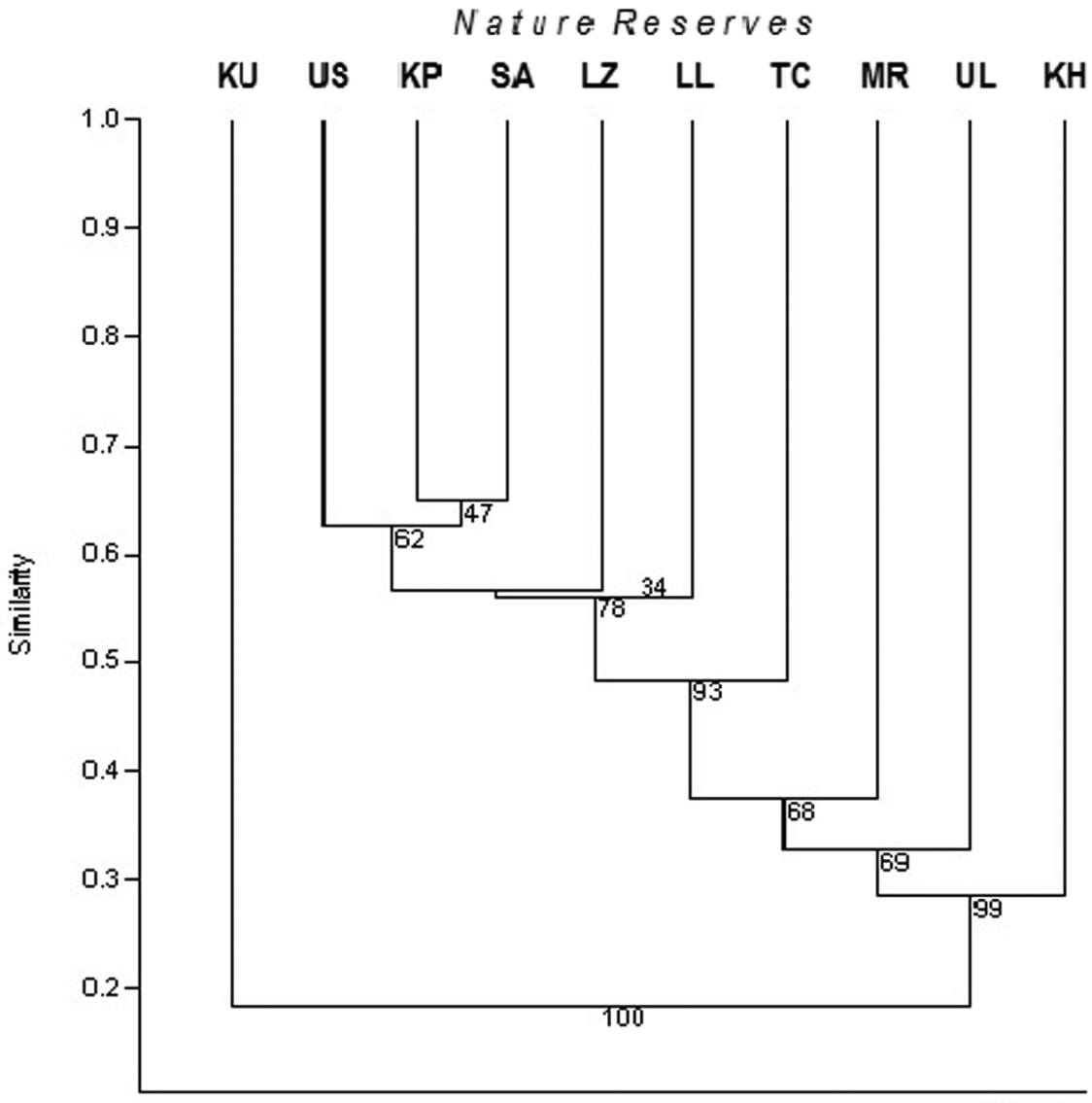

FIGURE 2. Dendrogram of faunistic similarity of 10 Protected Natural Areas of southern Far East Russia (KU − Kurilsky, US − Ussuriisky, KP − Kedrovaya Pad, SA − Sikhote-Alin, LZ − Lazovsky, LL − Leopard Land, TC − Tiger Call, MR − Far Eastern Marine, UL − Udege Legend, KH − Khankaysky).

Faunistical Specificity and Similarity of the Studied PNA Trichoptera Fauna

Faunistical Specifity of each PNA is estimated as a ratio of exclusive species to total number of species in each PNA (Table 2). It was revealed, that the most distinctive caddisfly fauna is in the insular, southeasternmost Kurile Nature Reserve (63.2% specificity in comparison to studied PNAs), and in the unforested lowland Khankaysky Biosphere Nature Reserve (34.7% specificity), Udege Legend NP (17.8%), Far Eastern Marine BNR (13.6%), Kedrovaya Pad BNR (10.7%), and Leopard Call NP (10%). Other PNAs are characterized by lower numbers of exclusive species (S <10%).

For comparison of the Trichoptera faunas of the studied PNAs, we used a Sorensen-Dice coefficient (Legendre & Legendre 1998), and a dendrogram of similarity was constructed with the program PAST (Hammer *et al*. 2001). The results of the faunal comparison are shown in Fig. 2. Results of the analysis showed high similarity between well-studied continental PNAs characterized by high mountain relief and forest landscapes: Sikhote-Alin and Kedrovaya Pad BNRs (bootstrap value 47). Close to them is the Ussuriisky BNR (bootstrap value 62). Among other well-studied PNAs, the Khankaysky BNR is far from other continental PNAs despite its close geographical position to them (bootstrap value 99). The reason for such a strong distinction probably results more from the remarkable differences of physiographic and landscape characteristics than from biogeographic proximity: prevalence of low relief and lentic habitats with limnophilic species in Khankaysky BNR versus high relief and lotic habitats with reophilic species in Sikhote-Alin, Kedrovaya Pad, and Ussuriisky BNRs. Conversely, the fauna of Kurilsky NR is extremely different of other forested continental PNAs (bootstrap value 100), despite similar relief and water body types (numerous mountain and foothill waterways located in forested areas). The main reason for such faunistic differences is biogeographic: Kurilsky NR is located in a rather different biogeographical zone, and isolation mechanisms characteristic for island biotas have been effective here.

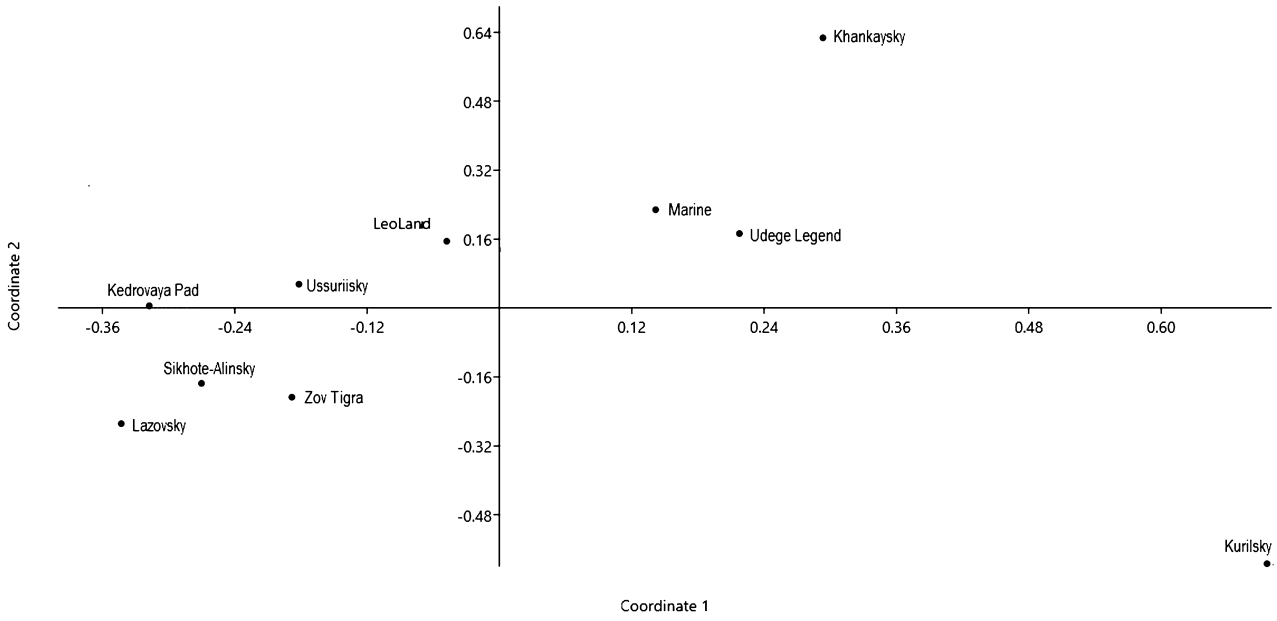

FIGURE 3. Ordination of faunistic similarity of 10 Protected Natural Areas of southern Far East Russia.

To reveal biogeographical differences in freshwaters faunas of closely located geographical areas it is necessary to compare not the general species composition lists, but lists of species collected in similar types of water ecosystems (lentic to lentic, lotic to lotic, etc.). When comparing faunas of river ecosystems, it is necessary to compare rithral complexes to rithral, potamal to potamal, considering the phenomena of longitudinal and zonal distribution of benthic organisms. In doing this, real biogeographical differences won't be shaded by local distinctions of relief and landscapes. A comparison of the species lists among closely located areas without considering landscape characteristics and the longitudinal distribution of organisms largely helps to identify faunal-landscape complexes, rather than biogeographic differences between faunas (Vshivkova & Kholin 1996).

Tolerance Value

The Family Tolerance Values of Far East Russian caddisfly families (preliminary results in Vshivkova 2013) as well as lower level taxa (generic and species) is in process of studying. To estimate tolerance amplitudes of regional Trichoptera representatives at generic and species levels, it will be necessary to study them in natural undisturbed conditions, and protected areas are the best settings for such investigations. All caddisfly species discovered in the PNAs are considered inhabitants of clean waters and their Tolerance Value is estimated from 0 to 4 as a starting point. Future analytic study of the species ecology in different conditions will help to create a regional list of genera and species with Tolerance Values using the methods explained by Lenat (1993).

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