



Birds in the Ecosystem of the Forest Tundra of Western Siberia

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Received:  July 18, 2019

Published:  July 30, 2019

Abstract

The species composition and ecology of birds in the forest-tundra natural zone are analyzed. There is no own avifauna of the forest-tundra, with the existence of fauna of taiga and tundra natural zones. At present, it is being formed, the species diversity of nesting birds is increasing, species have appeared, whose density maxima are located in the forest tundra. But there is practically no effect of "overlying faunas" both on the whole space of Western Siberia and on the local territory of woodlands. Ecological adaptations of birds to the conditions of life in the forest-tundra have not been identified with such adaptations to the taiga and tundra.

Keywords: Birds; Fauna; Forest-Tundra; Abundance; Biotope

Introduction

The forest-tundra is an element of the landscape envelope of the Earth, a natural zone, transitional between the taiga and the tundra. The forest-tundra type of vegetation proper is northern light forest. These are detached trees or their small groups, separated from each other so far that any connection between them disappears [1]. But even with strong sparseness of trees in light forests, their root systems appear to be closed, due to the weakness of the soil [2]. The forest-tundra for a long period, from the end of the Tertiary - the beginning of the Quaternary periods [3], occupies vast territories of Northern Eurasia, which gives rise to the formation of its own fauna of the forest-tundra, including the fauna of birds. Analysis of the avifaunas of the north of Western Siberia in order to identify the ecological specifics of the forest-tundra bird complex and the peculiarities of the use of forest-tundra communities by birds is the objective of this article.

Conventionally, the strip of the West Siberian forest-tundra can be divided into the southern, middle and northern. In the southern forest-tundra, on the plakors of interfluvies, taiga cedar and spruce islands are found among tundra-like swamps, larch light forests and sections of shrub tundra. In the middle forest-tundra, spruce-

larch forests grow in floodplains, and on plakory there are islands of larch light forests. In the northern forest-tundra, the plaque is occupied by shrub tundra and sedge marshes, floodplains - islands of larch woodlands. In the forest-tundra there are many small lakes, mostly of thermokarst origin, interconnected by streams and small rivers with narrow valleys overgrown with yernik and tall willows. The largest river of the West Siberian Plain - The Ob River during the period of open water brings a significant amount of heat, which significantly softens the climate in spring and autumn. Heat flow, associated changes in permafrost phenomena and drainage conditions contribute to the penetration of continuous valley forests to the latitude of the Arctic Circle, and island forests to the 67th parallel somewhat to the north. Even more heat carries r. Yenisei, therefore, in the east of the region, the northern boundary of the forest-tundra comes for the 68th parallel. In this work, the species composition, nesting density and ecology of birds in the Lower Ob and Southern Yamal are considered, materials from counts and observations in the forest tundra, in the area of the town of Labytnangi (66°50' N, 66°30' E) are used; on South Yamal: on average for the river. Khadytayakh (67° 's. 67°30' E), and in the upper reaches of the river. Yaydayakhodayaha (67°30' N, 71° 30' E).

Results

Fauna of birds of the Priobskaya Forest-Tundra and Adjacent Zones

In the north of Western Siberia, from the Polar and Subpolar Urals to the valley of the r. Yenisei, from northern taiga to arctic tundra's, more than 250 species of birds were recorded, of which 210 species were proved to be nesting in 2000 [4]. 177 species nests within the left bank of the Ob River, from the northern taiga to shrub tundra. The nesting avifauna of the forest-tundra of our region numbers 134 species. For the border of taiga and the southern tip of the forest-tundra, nesting is established 158 species; 69 species of nesting were established for the border of shrub tundra and the northern tip of the forest-tundra. The distribution of 28 species extends beyond the territory under consideration both to the south (middle and southern taiga, steppes) and to the north (typical and arctic tundra's). The list of taiga birds that have mastered all or part

of the forest tundra and do not penetrate into the shrub tundra includes 72 species. Among them are dominated by birds, building nests in the trees and double nest. The whole forest tundra or its northern part was mastered by 17 tundra species. Compared with the northern taiga, the number of species of Anseriformes (from 18 to 20 species) and Charadriiformes (from 24 to 32 species) increased in the fauna of the forest-tundra, followed by a decrease in the tundra zone to 15 and 24 species, respectively. Within the richest order, Passeriformes, the species diversity decreases from 76 species of northern taiga to 53 species of forest-tundra and 23 species of shrub tundra (Table 1). The Jacquard community index [5] of the faunas of the northern taiga and forest-tundra is significantly higher than the forest-tundra and shrub tundra: 0.69 and 0.41, respectively, at 1.0 in the case of maximum generality, which coincides with the conclusion of NN Danilova [6] that the forest-tundra in the ornithogeographic relation belongs to the boreal subregion.

Table 1: Zonal structure of avifauna on the left bank of the Ob and South Yamal. The number of nesting species in the northern taiga (I), forest-tundra (II), bush tundra (III).

Detachment Family	I	II	III	Detachment Family	I	II	III
<i>Gaviiformes</i>	2	2	2	<i>Strigiformes</i>	6	3	2
<i>Podicipediformes</i>	1	1	0	<i>Caprimulgiformes</i>	1	0	0
<i>Anseriformes</i>	18	20	15	<i>Piciformes</i>	5	3	0
<i>Anserinae</i>	3	5	6	<i>Passeriformes</i>	76	53	23
<i>Anatinae</i>	6	6	3	<i>Hirundinidae</i>	3	1	1
<i>Aythinae</i>	6	6	4	<i>Alaudidae</i>	2	2	1
<i>Somaterini</i>	0	0	1	<i>Motacillidae</i>	7	8	6
<i>Merginae</i>	3	3	1	<i>Laniidae</i>	1	1	0
<i>Falconiformes</i>	14	12	5	<i>Sturnidae</i>	1	0	0
<i>Pandionidae</i>	1	1	0	<i>Corvidae</i>	6	6	1
<i>Accipitridae</i>	8	7	2	<i>Prunellidae</i>	2	2	0
<i>Falconidae</i>	5	4	2	<i>Bombycillidae</i>	1	1	0
<i>Galliformes</i>	4	3	2	<i>Silviidae</i>	13	7	4
<i>Gruiformes</i>	2	2	0	<i>Regulidae</i>	1	0	0
<i>Charadriiformes</i>	24	32	25	<i>Muscicapidae</i>	3	1	0
<i>Charadriidae</i>	3	5	6	<i>Turdidae</i>	13	9	3
<i>Haematopodidae</i>	1	0	0	<i>Aegithalidae</i>	1	0	0
<i>Scolopacidae</i>	14	18	14	<i>Paridae</i>	4	2	0
<i>Stercorariidae</i>	0	3	3	<i>Sittidae</i>	1	0	0
<i>Laridae</i>	6	6	2	<i>Passeridae</i>	2	2	1
<i>Columbiformes</i>	3	1	0	<i>Fringillidae</i>	10	6	1
<i>Cuculiformes</i>	2	2	0	<i>Embericidae</i>	6	5	5
Total					158	134	74

The forest-tundra does not have any endemic species or subspecies of birds, i.e. did not play any role in their shaping. In the Lower Priobye and in the Southern Yamal Peninsula, *Falco rusticolus* and *Tringa erythropus* can be included in the group of species that nest almost exclusively in the forest tundra. Falcon nesting requires solitary trees with old large nests or rocks. All

this is in the forest tundra of our region, but in other parts of the Subarctic gyrfalcon are a type of seacoasts and scrub tundra. It is characteristic that in the mountains of the Polar Urals, bordering the forest-tundra, gyrfalcons were not found [7]. Kulik prefers to nest in the floodplains of forest-tundra lakes with rich near-water vegetation and sedge marshes, but he also enters the northern

taiga. Mostly in the strip of the forest-tundra is the nesting area of *Limosa lapponica*, which occupies the elevated parts of the tundra. *Anser erythropus*, *Anthus gustavi* and *Emberiza pallasi* should be included in the group of inhabitants of the border strip: northern forest-tundra / southern tundra. They do not penetrate to the northern limits of the bush tundra and to the southern limits of the forest-tundra.

The interpenetration of taiga and tundra faunas into the forest tundra does not mean their mechanical mixing. Taiga species penetrate into the southern forest-tundra by floodplain forests and taiga islands of plakora, into the middle and northern forest-tundra only by floodplain forests, gradually losing part of the list. At the latitude of Labytnangi (middle forest tundra) compared with the latitude of the village. Men (southern forest-tundra) practically cease to meet: *Anser anser*, *Anas platyrhynchos*, *Pandion haliaetus*, Black Kite, Species: *Accipiter gentilis*, *Lyrurus tetrix* *Tetrastes bonasia*, *Vanellus vanellus*, *Haematopus ostralegus*, *Tringa ochropus*, *T. nebularia*, *Numenius arquata*, *Arenaria interpres*, Wood Pigeon, the Cuckoo is satisfied, *Dendrocopos major*, *Hirundo rustica* *Corvus frugilegus*, *Sturnus vulgaris*, *eater hypoleuea*, *Mnscicapa fluted*, *Emberiza*, *Parns* mountainous and *Parus major*, *Sitta europaea*, *hookbill curvirostra*, *Emberiza citrinella?* *E. rural*, *e halo*. The island floodplain forests of Shchuchya and Khadytyaha (northern forest-tundra) are limited to moving north. Podiceps, Pochard, Bucephala, Mergens albellus, M. merganser, Harrier, eagle, tailed, Falco, Capercaillie, Porzana porzana, Charadrius undecided, *Scolopax rnsticola* *Sterna swallow*, *Manitoba funereus*, *Dendrocopos minor*, *Anthus hodgsoni*, *Motacilla cinerea*, *Perisoreus infaustus*, *Bombicilla garrulus*, *Ficedula parva*, *Phoenicurus phoenicurus*, *Tarsiger cyanurus*, *Turdus atrogularis*, *T. philomelos*, *Pyrrhula pyrrhula*. The sparse forest valleys of the Yadayahodayaha and Baidarata rivers (the southern boundary of the shrub tundra) have limited distribution *Aythya fuligula*, *F. tinnunculus*, *Grus grus*, *Actitis hypoleucos*, *Xenus cinereus*, *Gallinago media*, *Numenius phaeopus*, *Larus canus*, *L. ridibundus*, *L. minutus*, *Cuculus canorus*, *Asio flammea*, *Surnia ulula*, *Picoides tridactylus*, *Alauda arvensis*, *Motacilla flava*, *Lanius excubitor*, *Pica pica*, *Corvus corax*, *Prunella montanella*, *Silvia curruca*, *Philloscopus borealis*, *Ph. trochiloides*, *Ph. inornatus*, *Saxicola torquata*, *Parus cinctus*, *Fringilla montifringilla*, *Pinicola enucleator*, *Carpodacus erythrinus*, *Loxia leucoptera*. The depletion of the fauna occurs at the expense of forest and near-water birds. There are no tundra species that penetrate into the forest-tundra by floodplain forests and floodplain reservoirs. The

enrichment of the forest-tundra fauna with tundra birds takes place on a plakor: in areas of tundra, tundra-like marshes and in the depressions of forest-tundra lakes. It *Anser albifrons*, *Aythya marilla*, *Clangula hyemalis*, *Lagopus mutus*, *Pluvialis apricaria*, *Eudromias morinellus*, *Charadrius hiaticula*, *Phalaropus lobatus*, *Calidris minuta*, *C. temminckii*, *C. alpina*, *Stercorarius pomarinus*, *St. parasiticus*, *St. longicaudus*, *Sterna paradisaea*, *Eremophila alpestris*, *Anthus cervinus*, *Calcarius lapponicus*, *Plectrophenax nivalis*. They all nest in the northern forest tundra; 12 species nests in the middle forest tundra; in the south 8-10 species, also penetrating into the northern taiga, into areas of tundra-like marshes. Of course, these are not complete listings.

The Bird Population of the Main Types of Forest-Tundra Habitats

V Sdobnikov [1] who published a special work on the distribution of birds and mammals by habitat types in the Bolshezemelskaya tundra and on the Yamal Peninsula, identified two main complexes of habitats for the northern forest-tundra: valley and watershed, or Compliance with the principle of zonality, floodplain (intrazonal) and upland (zonal). The valley complex is characterized by valley forests, willow groves, valley shrubs, dry meadows of the slopes and floodplain terraces, sedge marshes, wet meadows of floodplains and a number of smaller habitats. A group of "lake" habitats, open tundra, scrubland and watershed forests are distinguished in the complex between the river spaces. The author gave only lists of the dominant species of these habitats without specifying abundance; therefore, they are not further considered. WITH. Paschalny and M Golovatin [8] based on the "Vegetation Map of the Yamalo-Nenets Autonomous District" for the border of the northern forest-tundra / tundra identified the following types of habitats, indicating the density and dominant species: lichen subarctic tundra; moss subarctic and cotton grass moss tundra; ernik tundra; zakustareny valleys with larch woodland and mixed forests; larch woodlands; wild rosemary-lichen hummocky and shrub-lichen-moss flat-hilly marshes; tundra-like lowlands of coasts. For the territory located to the south, at the latitude of the Polar Circle, one can distinguish: mixed forests of the slopes of the native bank of the Ob and its tributaries; floodplain-sor areas of the Ob valley with stripes of near-willow willows; larch woodlands of plakor; lake-marsh with Yernik thickets of brook valleys connecting lakes; shrub tavern and hilly moderately wet tundra; wet yarn tundra of the brook valleys. Generalized information on dominants and the abundance of birds in such habitats are given in Table 2.

Table 2: The density of birds in the main types of habitats of the Southern Yamal and Lower Ob Ob.

Habitat type	Number of species	Density, os / km ²		Dominant species
		Min	Max	
South Yamal				
Mossy subarctic tundra	47	87	232	<i>A. cervinus</i> , <i>C. lapponicus</i> , <i>Ph. lobatus</i>
Lichen subarctic tundra	40	60	95	<i>A. cervinus</i> , <i>E. alpestris</i> <i>Ph. pugnax</i>
Yernikova tundra	46-48	93	363	<i>A. cervinus</i> , <i>C. lapponicus</i> , <i>T. glareola</i>

Old valleys with larch woodland	64-65	228	631	<i>A. flammea, E. pusilla Ph. trochilus</i>
Larch woodlands floodplain and plakora	44	73	395	<i>A. cervinus, A. pratensis T. glareola</i>
Hillocky and flat-milled swamps	31	94	216	<i>A. cervinus, M. flava, Ph. lobatus</i>
Tundra lowlands coasts	36	91	168	<i>L. svecica, C. lapponicus Ph. lobatus</i>
Lower Priobye				
Native Shore Mixed Forest	38	1114	1390	<i>Ph. trochilus E. pusilla, Ph. borealis</i>
The floodplain sor areas of the Ob valley with stripes of near-willow willows	42	Not considered	Not considered	<i>Ph. trochilus, E. pusilla, F. montifringilla</i>
Larch woodlands plakor	23	137	468	<i>A. cervinus, M. flava, E. pusilla</i>
Lacustrine with marsh thickets	29	93	334	<i>A. cervinus, M. flava, E. pusilla</i>
Shrubs hummocky and hilly moderately wet tundra	19	50	257	<i>A. cervinus, A. pratensis, Ph. trochilus</i>
Uncooked raw tundra of brook valleys.	22	620	830	<i>A. cervinus, A. pratensis, E. pusilla</i>

First of all, it should be noted that differences in the number of species registered in Southern Yamal and Lower Priobye are associated with different accounting methods. On routes with a non-fixed counting band (South Yamal), more species are always recorded than when counted in local areas of Priobye, where birds that were worried beyond its borders were not included in the count. Uncooked raw tundra of brook valleys. 22 620 830 *A. cervinus, A. pratensis, E. pusilla*. The more complex the structure of the vegetation of the landscape in the forest-tundra, the higher the abundance of birds nesting there. The maximum abundance is recorded in the multi-tiered forest of the southern slope of the native coast of the Ob River. With a density exceeding 1-1.5 pairs / ha in some years, *Ph. trochilus, Ph. borealis, E. pusilla, A. flammea, L. svecica, F. montifringilla, T. pilaris* were very numerous. In Southern Yamal, the slopes, floodplain terraces and floodplains of major river valleys occupied by larch woodland with chernikov undergrowth have a significantly lower bird density with *A. cervinus, A. pratensis, Tringa glareola* dominating. Northern birds: *Calidris minuta, C. temminckii u C. lapponicus* in such biotopes virtually none. They appear in the tundra of the plakor, with the universal dominance of the plantain and at relatively low density. The maximum density for the South Yamal forest-tundra was found in the smoked valleys with larch woodlands and mixed forests (Easter, Golovatin, 2004). This biotope can be considered as a "transitional intrazonal", from the mixed forest of the indigenous coast of the Lower Ob and its tributaries to the larch floodplain forests of the Southern Yamal: the total species composition of the dominants with a gradually decreasing nesting density. In the Priobskoy forest-tundra there is another "transitional zonal" biotope, from mixed forest shores to larch woodland and shrubby tundra plakora. These are the raw tundra of the valleys of small rivers with individual larches or without them. The area of such biotopes is relatively small compared with the adjacent drier tundra, with a high number of nesting birds of both open tundra (*A. cervinus, A. pratensis*) and mixed forest (*Ph. Trochilus, E. pusilla*). The result is a high-density spot, composed of a small number of passerine species.

Larch woodlands in our area are extended from the native coast of the Ob River and tributaries into the plakor, where light

forests turn into islands. At the same time, the species composition changes: the light forest fauna is enriched by *A. cervinus, A. pratensis, M. flava; F. montifringilla, T. pilaris, Ph. disappear. borealis, Parus cinctus, T. iliacus, Pica pica* and other forest species. The nesting density of *E. pusilla*, a member of the dominant group in both forest and light forest, is 5-10 times lower in the second biotope (in different years) than the first one. *Ph. trochilus*. As a result, the larch woodland of the plakor is somewhat richer in species than the tundra of plakor, poorer than the coastal forest; the abundance of light forest closer to the tundra landscapes. In some years, the group of woodland dominants included *Tr. glareola* (6-8%), which is characterized by woody vegetation. Probably, the average curlews and small spindles, equally scarce in both biotopes, do not find any particular differences between light forests and shrub tundra. *Pluvialis apricaria*, not avoiding light forests, is more common in areas of dry and moderately wet tundra. Lower Ob region occupy 30-40% of the territory. There are practically no large sections of the tundra of one type. The tops of the hills are occupied by dry tundra. She is the poorest in life. There are no obvious dominants, but practically only *Eudromias morinellus, Charadrius hiaticula, E. alpestris, O. oenanthe* are found here. The main part of the tundra is the tundra. medium moisture. *A. cervinus* dominates, common *Pl. apricaria*, and *Tr. glareola*. In the middle - end of the last century, *C. lapponicus* was among the dominants, which became rare in recent years. Since *A. cervinus* rarely nest with a density above 2-3 pairs / 10 ha, and the density of other birds is an order of magnitude lower, there is little abundance in the hummock and hilly tundra of the Lower Ob region (Table 2). In the northern forest-tundra, where *C. lapponicus* is among the dominants in addition to *A. cervinus*, and *Calidris* begins to nest, the abundance in the tundra doubles.

Humidity is an important factor determining the distribution of birds by habitat. With a relatively small amount of precipitation (less than 500 mm / year), tundra and forest-tundra belong to areas with excessive humidity, since due to lack of heat, moisture evaporates very slowly. In the forest tundra there are a lot of small lakes of predominantly thermokarst origin and small grass (sedge, cotton grass) and sphagnum bogs interconnected by streams, whose shores are overgrown with dwarf birch, wild rosemary. All

this forms a peculiar lake-marsh type of bird habitat. On the lakes, depending on their size and feeding, most aquatic and riparian forest-tundra species can be encountered. Preference is given to lakes with low shores covered with yernik and large areas of sediment-covered shallow water. *Anas acuta*, *A. crecca*, *Aythya marila*, *Clangula hyemalis*, *Phal-aropus lobatus* dominate. Grass-moss bogs are attractive for *Philomachus pugnax*, bogs partially flooded - for *Ph. lobatus* Together with *A. cervinus* and *M. flava*, these waders form the population of such sites. Coastal yreniki and yreniki of brook valleys inhabit shrub species with relatively low total density, among which *Acrocephalus schoenobaenus* dominates in some years, but more often *L. sveci-ca*, *Ph. trochilus*, *E. pusilla*. In Southern Yamal, over 8% of the territory is occupied by moss-lichen hummocks and lat-hilly marshes (Easter, Golovatin, 2004), where *M. flava*, *Ph. pugnax*. The tundra-like lowlands of the coasts of the Ob and Baidaratskaya lips are flooded with water in the days of surge winds and dried out during the distant winds. With a low number of birds nesting on elevated areas, wetland species dominate.

The Longline Structure of Avifauna of Forest Tundra

In the forest tundra, when moving from its southern border to the northern one, there is a transition from a 4-tier plant community of valley forests (tall cedars, spruces, larch trees, medium-growth birch, aspen, rowan, alder, bushes and undergrowth, shrubs and grasses) to 2-level floodplain (tall willow; shrub-grass-moss tier) and a 1-2-tier community of shrub tundra plakora (mosaic shrub tier, solid shrub-grass-moss-lichen tier). In this case, no bio topic changes occur only for birds nesting on the ground and collecting food in the first tier or in water bodies. The total number of such species on the southern border of the forest-tundra is 69, on the northern border - 60; their share in the fauna increases with advancing north from 51% to 64%. The tier of tall riparian willows *Salix* on the forest-tundra border takes in *T. pilaris* and *Corvus cornix*, to the south preferring to nest in the third or fourth tier. Woody vegetation of riparian forests, The light forests of plakora and floodplains of the South Kama rivers provide opportunities for nesting a relatively large group of species nesting in the hollows and half-hollows of *Mergellus albellus*, *Mergus serrator*, *M. merganser*, *Dendrocopus major*, *D. minor*, *Ficedula parva*, *P. cinctus*). The northern limit of the distribution of large single trees necessary for nest building limits the passage to the north of *Haliaeetus albicilla*; the disappearance of forest islands in the river valleys limits the *Aquila chrysaetos*. North the borderline of the inhabitants of the second - third tier (*Lanius excubitor*, *Bombicilla garrulus*, *Prunella montanella*, *Silvia curruca*, *Emontifringilla*, *Carpodacus erythrinus*, *Pinicola enucleator*, *Pyrrhula pyrrhula*, *Loxia leucoptera*), who build the nests on the trees in the nests on the trees, *Pyrrhula pyrrhula*, *Loxia leucoptera*) sparse forest. Only *C. erythrinus* and *L. leucoptera* feed the chicks with plant food, the rest in summer consume animal food collected on bushes and trees. In the shrub tundra there is no feed for crossbills, the advance of other species

into the tundra is apparently due to the loss of tree species from the plant communities. The ecological capacity of a solid 2-tier willow community is substantially less than a diluted 3-tier community.

Trophic Links of Birds of The Forest Tundra

There are few vegetation users among forest tundra birds. These are *Anserinae*, *Cygninae*, *Lagopus lagopus*. The number of these birds in the forest-tundra is minimal, their impact on vegetation is just as small. The main consumers of the seeds of conifers, *L. leucoptera*, are rare in the forest tundra, all cases of birds meeting belong to larch forests in the years with its high yield. There are few grass seed consumers in the forest tundra. At the nesting time, seeds, mainly cotton grass, are present in significant amounts in the feed of *A. flammea*; in spring and late summer, seeds feed not only on Fringillidae and Emberizidae, but seeds are found in the stomachs of *A. cervinus*, *A. pratensis*, *Pl. apricaria* [9]. The main consumers of vegetation in the forest tundra are small rodents: *Clethrionomys rutilus*, *Microtus oeconomus*, *M. agrestis*, *M. gregalis*, *M. middendorfi*, *Myopus schisticolor*, *Lemmus sibiricus*. The number of their forest tundra is usually quite high even in spring, and even more so by the middle - end of summer. *Asio flammea*, *Surnia ulula*, *Circus cyaneus*, *Buteo lagopus* are consumers of small rodents, but all of them are rare in the forest tundra, cases of nest detection are rare. In the Priobskaya forest-tundra, we did not observe such a high concentration of myophages, which was repeatedly recorded in the tundra zone. In the tundras of the Southern Yamal, in the year of a high number of rodents (1999), A Sokolov [10] counted 16 pairs of cold-skinny in a 100 km² area. It is possible that the low number of myophages in the forest tundra is explained by the presence of light forests with high shrub undergrowth and thick wrenches of relief depressions and stream valleys, where it is much harder to catch rodents than in the tundra, but not the lack of the latter.

Shallow fast-warmed lakes of the forest-tundra provide feed for waterfowl. Ducks prefer lakes with low coastal vegetation overgrown with shores with a high concentration of chironomid larvae in the benthos. There are significantly more birds on such lakes than on lakes without coastal vegetation, and even more so on deep lakes with steep peaty banks. The latter warms up slowly, benthic animals, due to the depth, are available only for diving ducks, only they are found on such lakes. It should be noted that the biomass of invertebrate benthos of forest-tundra lakes in the first half of summer is comparable to the biomass of terrestrial invertebrates. L Stepanov [11] for one of the lakes in our region (Lake Vozeyty), it gives biobiota biomass to 16. 7kg / ha, and N. Danilov (1974) for the tundra of the inpatient station Harp yields 5.6kg / ha of arthropods and 11.9kg / ha of earthworms, in total 17.5g / ha. By mid-summer, chironomids, which account for up to 40% of the mass of hydrobionts [11], leave the aquatic environment and disperse over land, but the number of ducks in water bodies does not decrease. Chicks and ducks appear that have flown in from the north. On small lakes, they are usually not; on

lakes with a diameter of several hundred meters dozens of ducks can shed, but their number is hardly limited to the amount of feed. In the shrub tundra, where the biomass of aquatic organisms is not higher, tens and hundreds of birds shed even on relatively small lakes. In addition to invertebrates, the lake inhabits the lake. for one of the lakes in our region (Lake Vozeyty), it gives biobiota biomass to 16.7kg / ha, and N Danilov [12] for the tundra of the inpatient station Harp yields 5.6kg / ha of arthropods and 11.9kg / ha of earthworms, in total 17.5g / ha. By mid-summer, chironomids, which account for up to 40% of the mass of hydrobionts [11], leave the aquatic environment and disperse over land, but the number of ducks in water bodies does not decrease. Chicks and ducks appear that have flown in from the north. On small lakes, they are usually not; on lakes with a diameter of several hundred meters dozens of ducks can shed, but their number is hardly limited to the amount of feed. In the shrub tundra, where the biomass of aquatic organisms is not higher, tens and hundreds of birds shed even on relatively small lakes. In addition to invertebrates, the lake inhabits the lake.

All sandpipers and practically all passerine tundra in the middle of summer feed on land and soil invertebrates. The biomass of earthworms [12] is present in the floodplains and on the plague of the present, possibly dominating in the feed, "probing" species: *Gallinago gallinago*, *G. stenura*, *G. media*, *Lymnocyrtus minimus*. *Phalaropus lobatus* peck from the surface of the water and aquatic plants: small beetles: stafilin and floaters, larvae of centipedes, caddisflies, larvae and imago chironomids and blood-sucking mosquitoes. A similar range of nutrition in *Tringa glareola*, *T. erythropus*, *Philomachus pugnax*. All of them to search for food in damp, partially wetlands of the forest-tundra. In the diet of the inhabitants of the drier tundra, *Pl. apricaria*, *Charadrius hiaticula*, *Limosa lapponica*, there are larvae and imago of dolphins, chironomids, caddisflies, flies, beetles, butterflies, spiders, i.e. all that can be collected from the surface and in the moss-lichen tier. Specialized nutrition can only be talked about in relation to *Gallinago*, other waders feed in accordance with bio topic preferences and body size. The favorite food for all species of sandpipers is the larvae of the long-legged mosquitoes, which are present in the stomachs of most of the birds caught in mid-summer [9].

From passerines, they feed on worms and bring them to Turdidae chicks - *T. pilaris*, *T. iliacus*, *T. atrogularis*, *T. philomelos*. Of course, worms are not the only species of food for thrushes, all fairly large terrestrial and soil invertebrates, including mollusks, are present in the food. *A. cervinus*, *A. pratensis*, *M. flava*, *L. svecica*, *C. lapponicus* collect arthropods, mainly adults, from the surface of moss-lichen layer, from grass and shrubs. Shrubs of brook and lake valleys, relief depressions, light forests in order to search for arthropods survey *Ph. trochilus*, *Ph. collybita*, *a. schoenobaenus*, *e. pusilla*, *E. schoeniclus*. The most common food in July is the larvae of sawflies, with spiders and diptera in second place. Noticeable differences in

the composition of feed in different species of passerines, despite the differences in the methods of their extraction, were not found [12,13]. According to calculations NN Danilova [12] in the second half of July (the period of maximum need of broods in feed) passerines per day consume from 1.5 to 3% of the feed available at the site without taking into account invertebrates that depart from reservoirs at that time, i.e. In the forest-tundra, insectivorous passerines in the nesting period had more than enough food and the impact of birds on arthropods was insignificant. But we [14], observing in the second half of summer, the migration of passerines from shrub tundra areas to coastal willows of streams and lakes, where the invertebrate biomass during this period is higher, they came to the conclusion that trophic relations of insectivorous birds can be tense in the post-nesting time of the flora.

The Seasonal Aspect of Bird Life in The Forest Tundra

The northern limit of distribution of light forests is not only the northern boundary of the forest-tundra, but also the boundary of penetration into the Subarctic of hibernating bird species. In the West Siberian forest-tundra it is *Falco rusticolus*, *Tetrao urogalus*, *L. lagopus*, *L. mutus*, *Nyctea scandiaca*), *D. major*, *D. minor*, *P. tri-dactylus*, *C. corax*, *P. pica*, *P. infaustus*, *P. cinctus*, *p. montanus*, *P. major*, *Pater*, *Sitta europaea*, *Passer domesticus*, *P. montanus*, *A. flammea*, *Pinicola enucleator*, *L. leucoptera*, *P. pyrrhula*, *bullfinch*. Part of the species is found only in the villages, part - occasionally, but all of them were registered in our region during the winter months. The spring migration begins with the arrival in the first half of April of the gray crow and the snow creek; in the second half of April, *Haliaeetus albicilla*, *Cygnus cignus*, *Larus heuglini* arrive. In May - early June, most of the birds arrive. Finish the migration of *Ph. borealis*, *A. schoenobaenus* at the end of the first - middle of the second decade of June. In the years from late spring, the arrival time of predominantly early migrants is shifted to a later time, the later ones respond to the situation less. The total duration of spring migration in the Lower Ob is 65 - 76 days. Sparrows and sandpipers pass 1-3 weeks from meeting the first individual of the season to the end of the passage of northern species or until the formation of the local population in the forest tundra. In the late spring, the passage of northern birds and the formation of the local population takes place in a shorter time. The egg-laying period of the main mass of birds of the forest-tundra: the second - the third decades of June, after the transition of average daily temperatures through 0°. The total duration of the laying season is more than 2 months; In ducks, waders and passerines, the season lasts from 20 to 40 days in different years and ends no later than mid-July. Fly starts from the second decade of August and lasts until the end of October. Insectivorous passerines and waders cease to occur in the forest tundra in the second half of September; waterfowl in the floodplain of the Ob River occur before the reservoirs freeze in early to mid-October. The *Plec-trophenax nivalis* fly-out, which is distinguished by the maximum, among the northern birds lasting for the spring-

summer-autumn season - 7 months, concludes. The minimum duration of the season - at *Ph. borealis* (2.5 months).

Conclusion

N. Danilov (1966) pointed out that in the ornithogeographic relation the forest-tundra belongs to the boreal subregion. In Western Siberia, within the present boundaries, it has existed for 6-8 thousand years, since the end of the boreal xerothermal maximum. There is no own avifauna of the forest-tundra, with the existence of fauna of taiga and tundra natural zones. The taiga fauna apparently formed during the tertiary period; its latitudinal borders fluctuated along with the taiga zone. The avifauna of tundra is formed by eurybionts from taiga, mountain species, aquatic species of steppes,

and the subarcts of New World with marked endemism (14 genera, 51 species; Danilov, 1966). Since endemism indicates the age of the fauna, the tundra has a significant, minimum Pleistocene age. In some periods of the Pleistocene, the forest-tundra in its present form, probably not a continuous transitional band between the taiga and the tundra. Therefore, the fauna of the forest-tundra was not formed. At present, it is being formed: the species diversity of nesting birds is increasing, species have appeared, whose density maxima are located in the forest tundra. But there is practically no effect of "overlying faunas" both in the space of Western Siberia and in the local territory of woodlands. No adaptation of birds to the conditions of life in the forest-tundra was found in the presence of such to the taiga and tundra (Figures 1-3).



Figure 1.



Figure 2.

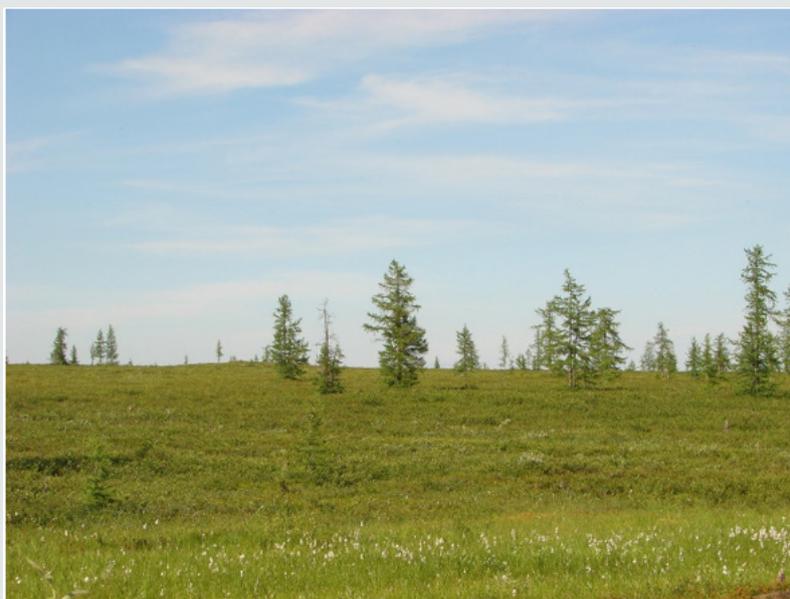


Figure 3.

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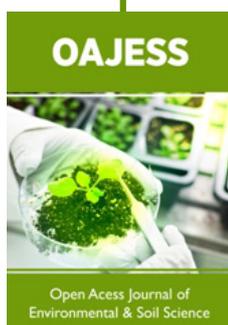
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DOI: [10.32474/OAJESS.2019.03.000162](https://doi.org/10.32474/OAJESS.2019.03.000162)



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