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Scientific Report

Birds of High-mountain Daghestan, A report based on two decades bird survey

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Abstract

The paper is based on 19 years (1998-2017) of the avifauna monitoring in High-mountain Daghestan. Each of 11 bird communities of the study area is characterized by its whole set of birds, including the rarely occurred species since the latter promotes the formation of a unique pattern not only of an individual faunal community but also the entire avifauna of the region. It is assumed that a specific avifauna pattern of High-mountain Daghestan is determined not only by resident communities of typical mountain birds but also by nesting in the mountains adapted populations of migratory birds of the plains. The analysis of the collected material provides a picture of the species diversity and territorial distribution of birds and helps to understand the avifauna resource capacities of High-mountain Daghestan.

Keywords: Avifauna, bird community, ecology, High-mountain Daghestan, micropopulaton

Introduction

The High-mountain Province of Daghestan has the most difficult habitat conditions, substantially differing from Piedmont and Intra-mountain provinces by the sufficient level of moisture and contrasting orography intensified by intermountain trenches. It is occupied by quite complex bird communities that include representatives of not only High-mountain, Intra-mountain, and Piedmont Daghestan but also of the plains of the republic. However, the formation principle and composition of these communities still have to be revealed.

The purpose and objectives of the research were to describe specific features of bird ecology for each of the 11 bird communities forming the avifauna ecological structure of High-mountain Daghestan.

The paper summarizes the results of 19–year (1998–2017) ornithological counts carried out in 13 key sites, located within 6 administrative districts of High-mountain Daghestan. Material and methods are fully represented in Report 1. To characterize ecologically different species of birds, the author's classification was used (Vilkov 2010b), distinguishing the birds by their occurrence in preferred habitats that allowed the identification of 11 bird communities (Vilkov 2020, Fig. 2). The birds, found in the air above the upper boundary of the vegetation (birds of prey, airborne birds), were subdivided into bird communities of hoverers and airborne birds, while the air environment, being a feeding place of airborne birds and a location from where the hoverers view the surroundings in search of their victims, is conventionally treated as "habitat". In case of revealing other, not so significant, regularities, the bird communities were segregated into additional groups of birds depending on their ecological specificity.

Findings

Proceeding from the avifauna ecological structure of High-mountain Daghestan (Vilkov 2020, Fig. 2), the species richness of forest bird community ranks the first, uniting 45 species

with a total average abundance of 246 ind./km^2. The highest taxonomic density and ecological differentiation of the forest bird community are determined by the variety of habitats, high concentration of forage and diversity of shelters. In High-mountain Daghestan, being a bioclimatic province with harsh conditions, forest stands still can be found along river valleys, on mountain slopes of northern expositions and mainly in the north-western and central parts of the highlands, whereas the south-eastern part is dominated by mountain-meadow landscapes. The forests are mosaically fragmented, making such transitional habitats as solitary trees, shrubs and small tree-shrub groves critically important for forest birds. Due to their territorial discontinuity, these transitional formations play a role of short-term shelters by which part of the forest birds moves between distant forest areas. These mosaically scattered "forest" habitats, located between large forest formations, turn a sporadically forested area into a conventionally continuous woodland massif. Besides, the diffuse distribution of forest birds, as a specific adaptation, allows them to more effectively examine the entire forested territory and use different types of forage and suitable shelters.

According to the type of their daily movements and foraging the mountain forest birds can be conventionally subdivided into five groups. The first group consists of the species characterized by the extensive range, high speed of movements and the relative permanence of their daily routes (Böhme & Banin 2001). It includes the Green Leaf Warbler, Caucasian Chiffchaff, Coal Tit, Long-tailed Tit (9.3 ind./km^2), Great Tit (8.4 ind./km^2), Blue Tit (2.4 ind./km^2), Eurasian Treecreeper (5.1 ind./km^2) and some others, in which diet a significant role is played by insects and sporadically dispersed vegetation forage. The Green Leaf Warbler and Caucasian Chiffchaff (31 ind./km^2 and 16.2 ind./km^2) as well as the Coal Tit (23 ind./km^2) are absolute leaders in abundance. In the morning hours and under uniform settled weather these species, searching for food, move in the forest interior as gender pairs and family groups. During the daytime, differently oriented snow-covered slopes of mountains and groups of shrubs and trees between them are exposed to different intensity of light. The slopes located in the insect concentration areas are warmed up at a different time of the day. As a consequence, birds select their routes taking into account the hours when it is easier to get food in this or that part of the forest. In the afternoon, when the temperature reaches its peak, birds make up mixed flocks occupying the forest canopy with the highest concentration of insects. As a result, an observer being in the central part of a mountain forest in the interval between 13 and 15 hours, experiences a minimal presence of birds, since the bulk of them is concentrated at its upper boundary. Moreover, the birds, forming mixed flocks, dramatically shrink their feeding area, shifting to a strategy of detailed "combing" of the feeding site moving at high speed and with numerous repeats (probably due to the interspecific competition). This itinerary method of using the area allows birds to save their time and energy expenditures when exploring new feeding sites in the same area and increases their feeding efficiency. As an optimal foraging strategy is formed in the course of natural selection and aimed at increasing the consumption of net energy received during feeding (Cowie 1977), this method of exploration of the feeding area by this bird group can be attributed to the category of specific adaptations.

The second group unites birds which diet is predominated by easily accessible vegetative forage - fruits of the common sea buckthron *Hippophae rhamnoides* L., barberry *Berberis vulgaris* L., hawthorn *Crataegus pseudoheterophylla* Pojark, etc. It includes the Eurasian Jay (6.6 ind./km^2), Ring Ouzel (8.4 ind./km^2), Common Blackbird (11.5 ind./km^2) and Mistle Thrush (6.4 ind./km^2). Feeding of this bird group is characterized by a small range of movements, lack of permanent routes and more full consumption of revealed forage. In

the afternoon they concentrate in areas with high abundance of forage resources. When the fruits are eaten to such extent that they are found less frequently compared with other areas, the birds move to other sites (Böhme & Banin 2001). These two groups cannot be clearly separated since they have species with a transitional type of feeding. Depending on the environment the foraging strategy of such species (for example, Blue Tits) tends to the first or second group. Changes in the forage resources, depended on the productivity of trees and shrubs, which are the main suppliers of mass forage, have a crucial impact on the distribution of birds within their occupied area. In this regard, none of the above-mentioned species is a narrow foraging specialist that makes them more plastic and resistant to the high forage dynamics in mountains.

The third group includes birds that less intensively but quite widely move within extensive forest stands, making prolonged stopovers in particular forest areas with the highest concentration of forage. They are the Green Woodpecker (3 ind./km^2), Greater Spotted Woodpecker (2.2 ind./km^2), Black Woodpecker (1 ind./km^2), Tree Pipit (4.2 ind./km^2), Common Chaffinch (9.5 ind./km^2), Common Bullfinch (4.8 ind./km^2), etc. These birds rarely fly between large forest stands. If the ultimate goal of their flight is located at a considerable distance from their main habitat they travel (en route or by making short stopovers) through mosaically scattered forest groves, groups of shrubs and solitary trees.

The fourth group consists of species rarely leaving forest stands. It includes the Red-breasted Flycatcher (3.4 ind./km^2), Eurasian Wren (8.7 ind./km^2), Dunnock (4.9 ind./km^2), Common Redstart (5.7 ind./km^2), and Eurasian Robin (4.3 ind./km^2). Sizes of their occupied areas are insignificant compared with the three above-mentioned bird groups, since these species select them basing on an optimal set of conditions and preferred resources (including nesting habitats). The specific features of their ecology are determined by a strong territorial fidelity and aggression towards other individuals of the same species, trying to penetrate to their territory.

The fifth group is composed of diurnal birds of prey and owls. It includes the Northern Goshawk (1.3 ind./km^2), Eurasian Sparrowhawk (1.4 ind./km^2), Long-legged Buzzard (1.6 ind./km^2), Common Buzzard (1.5 ind./km^2), European Honey Buzzard (0.5 ind./km^2), Saker Falcon (1.7 ind./km^2), Eurasian Scops Owl (0.7 ind./km^2), Tengmalm's Owl (1.2 ind./km^2), Long-eared Owl (1.3 ind./km^2), and Eurasian Eagle Owl (0.4 ind./km^2). A distinctive feature of this group is an increase in the size of their feeding area in case of decreasing forage resources or their availability (Galushin & Golodushko 1963). They are also characterized by a pronounced fidelity to their nesting area and, in particular, to forests where the same species (pairs) nest for many years. In fact, during long-term counts of 2006-2010 in Tlyarosh Village (Charodinsky District), a pair of Common Buzzards was regularly observed within the same coniferous-deciduous forest. A similar territorial fidelity is observed for Northern Goshawks, Eurasian Sparrowhawks and owls. This feature of feathered raptors is traced not only in the forests of High-mountain Daghestan, but also in its Intra-mountain Province (Vilkov 2010; 2013a), being explained by the lack of their suitable habitats and, on the other hand, relative statics of habitats of their prey. As for the present status of the Caucasian Chiffchaff, as one of the three neoendemic Caucasian taxa, its abundance in the High-mountain Daghestan ranges from 5 to 54.2 ind./km^2, with the total average number equalling to 16.8 ind./km^2. Its range extends from Piedmont to High-mountain Daghestan (not found in lowlands), where it mosaically inhabits peripheral forest areas, forest edges with shrub thickets and small groves surrounded by meadows with high concentration of insects. This, in a birch grove located at an altitude of 1850–1950 m, 5–7 km southward of Urukh-Sota Village (Charodinsky

District), the species abundance reached 54.2 ind./km^2. The bulk of the Caucasian Chiffchaff population is also concentrated in High-mountain Daghestan. The species status is currently favorable, but there are certain threats associated with the reduction of forest areas, climate mesophilization and expansion of anthropogenic landscapes.

The second place in the species diversity is occupied by a bird community of subalpine meadows, composed of 43 species with a total average number of 423 ind./km^2. The specific features and originality of the subalpine community living in severe meteorological conditions of highlands have lead to the formation of a peculiar set of birds, which species are recorded nowhere else except the mountains. Among the unique species it should be mentioned the Caucasian Black Grouse (2.6 ind./km^2), Chukar Partridge (3.5 ind./km^2), Common Rock Thrush (2.4 ind./km^2), Blue Rock Thrush (2.1 ind./km^2), Water Pipit (3.6 ind./km^2), Shore Lark (3.5 ind./km^2), Black Redstart (9.4 ind./km^2) and some others. In addition to narrow specialists, there are also the species typical for plains: Common Quail (2.3 ind./km^2), Eurasian Skylark, Common Whitethroat (5.4 ind./km^2), Whinchat (10.3 ind./km^2), European Stonechat (10.5 ind./km^2), Northern Wheatear (8.9 ind./km^2), etc. The most abundant are the Eurasian Skylark (54.9 ind./km^2), Grey Partridge (44.7 ind./km^2), and Red-fronted Serin (36.5 ind./km^2). It is noteworthy that typical mountain bird species inhabiting the subalpine belt are characterized by sedentary or, more precisely, sedentary-roaming lifestyles out of the breeding season, whereas adapted populations of the species of the plains, nesting in the same belt, are migratory. The intensity of livestock grazing that regulates the height and density of grass cover in subalpine meadows can provide a considerable effect on the qualitative and quantitative composition of meadow birds, including their territorial distribution in the mountainous Daghestan and in High-mountain Province as well. In the last 2–3 decades in the mountainous regions of Daghestan the number of grazed livestock has been decreasing that, presumably, may negatively affect the local faunal communities due to the excessive overgrowing of meadows. It can be well illustrated by an example though not from High-mountain but Intra-mountain Daghestan. Thus, the Gunibsky experimental plot of the Mountain Botanical Garden (MBG) (1,900–2,000 m, 5–7 ha), free of any anthropogenic impact including livestock grazing, had the grass height equalling to 70–80 cm with 100% projective cover. As a result, no birds were revealed there during the counts, whereas the cultivated areas (3 ha) adjacent to the experimental plot supported the Red-backed Shrike (11 ind./km^2), Common Whitethroat (5 ind./km^2), Red-fronted Serin (8.3 ind./km^2), European Goldfinch (10 ind./km^2), Whinchat (13.3 ind./km^2), and Common Rosefinch (16.6 ind./km^2). This suggests that the livestock grazing has a regulating effect on the composition of the birds nesting and feeding on pastures since the changes in grass cover alter not only a pattern of the nesting habitat but also the structure of feeding habitats as well (Ostashchenko 2006; Lebedev et al. 2010). Describing the current status of the Caucasian Black Grouse as the second neoendemic species of the Caucasus, we should note that its population density in the studied highlands varies from 0.8 to 4.5 ind./km^2, and a major part of it is also concentrated in the High-mountain Daghestan. The Caucasian Black Grouse in highlands mosaically inhabits shrub thickets and subalpine meadows along the upper forest boundary. The current number of this species in the entire Daghestan is estimated as 1,100 pairs (Vilkov & Pishvanov 2000). At present, the species status in the ecoregion is relatively stable. The main limiting factors are severe and snowy winters, grazing, shepherd dogs and episodic shootings of birds.

The third place is occupied by a bird community of agro landscapes (fields, orchards, vegetable gardens). It is composed of 41 species with a total average abundance of

431 ind./km^2. The distinctive feature of these birds is mosaicity and local character of their distribution, determined by the boundaries of agricultural landscapes. The most abundant are the Eurasian Skylark (50.3 ind./km^2), Eurasian Tree Sparrow (41.1 ind./km^2) and Grey Partridge (39.9 ind./km^2). The population density of individual species in agricultural landscapes reaches their peak values, since the area has both easily accessible forage for birds-gatherers (Rock Dove (20.1 ind./km^2), House (4.6 ind./km^2) and Tree Sparrows, Red-fronted Serin (16.6 ind./km^2), European Goldfinch (9.8 ind./km^2), etc. and various shelters, represented by shrub thickets and high grass. Besides, these territories propose quite suitable nesting habitats for birds of open landscapes thus supporting annual breeding of the Grey Partridge, Common Quail (2.3 ind./km^2), Eurasian Skylark, Whinchat and European Stonechat (11 and 8.9 ind./km^2), Red-backed Shrike (16.4 ind./km^2), Common Rosefinch (10.2 ind./km^2), etc. However, the structure of breeding birds in agro landscapes is highly unstable since the ecological niches presented there can satisfy the needs of only a limited group of birds. For the same reason the bulk of birds only feed in agro landscapes, and for shelter in bad weather and for breeding they fly to other, more suitable habitats. In fact, the last 2–3 decades in the High-mountain Daghestan, similarly to other mountain regions of the republic, has shown a steady trend towards the lesser exploitation of agricultural lands that, according to the information from local residents, has led to a dramatic decrease in the number of Rock Doves, Grey Partridges, Common Quails and Eurasian Tree Sparrows. At the same time, the remained agrolandscapes, additionally to breeding species, regularly continue attracting the migratory birds using agricultural lands as key ecological channels, by which the migrants step-by-step move along the Transcaucasian Flyway. Regular migrants include the Eurasian Bee-eater, Common Hoopoe, Eurasian Skylark, Red-backed Shrike, Whinchat and European Stonechat, etc. (Vilkov 2010).

The fourth place is occupied a community of birds of cliffs and rock outcrops, uniting 31 species with a total average abundance of 206 ind./km^2. This type of landscapes is typical for High-mountain Daghestan (mainly for its north-western part). A high bird species diversity of these areas is because despite the harsh habitat conditions with a strict specificity of the species arrangement, these landscapes support not only stenotopic taxa such as the Water Pipit (3.6 ind./km^2), Red-billed Chough, Blue Rock Thrush (3.3 ind./km^2), Wall Creeper (5.3 ind./km^2), Chukar Partridge (10.1 ind./km^2), Güldenstädt's Redstart (8.3 ind./km^2) and some others, but also adapted populations of birds of the plains – the Common Swift (3.6 ind./km^2), Northern Wheatear (8.9 ind./km^2), etc. The most abundant are the Rock Bunting (24.4 ind./km^2), Red-fronted Serin (16.5 ind./km^2), Common House Martin (11.8 ind./km^2) and Red-billed Chough (10.8 ind./km^2). A characteristic feature of the ecology of these birds is their sporadic distribution and static habitat borders, associated with the concentration of preferred resources (nesting habitats, shelters, etc.) in local areas of the mountains. Thus, in some regions of High-mountain Daghestan, there can be found "nesting cliffs" with a negative slope (45–50 degrees) arranged as a niche, where, according to local residents, colonies of the Common House Martin, numbering up to 5–15 nesting pairs, have been nesting for many years. It is curious that such kind of colonies of the species, built in grotto-like covers, are widespread at different altitudes and southern slopes of mountains of southern expositions from Piedmont to High-mountain Daghestan. Similar breeding habitats are also typical for the Eurasian Crag Martin (average total abundance – 7.5 ind./km^2) but, unlike the Common House Martin, it prefers breeding in separate pairs or in a small colony of 3 to 7 pairs.

In the fifth place in terms of the species variation there is a community of synanthropic and conventionally synanthropic birds, uniting

28 species with a total average abundance of 232 ind./km^2. Typical representatives of the synanthropic group of birds include the Rock Dove, Common Magpie (5.1 ind./km^2), Hooded Crow (3.1 ind./km^2), House (4.6 ind./km^2) and Eurasian Tree Sparrows. It is noteworthy that the Common Magpie, Hooded Crow and House Sparrow are not found in all settlements of High-mountain Daghestan, whereas the Eurasian Tree Sparrow and the Rock Dove inhabit almost all residential landscapes of the highlands. All the above-mentioned synanthropic species have penetrated into mountainous areas since ancient times following human beings and since then always prefer urbanized landscapes, where different types of anthropogenic forage and suitable shelters can be found. Many rodents, available there, also promote the breeding of the Little Owl (2.1 ind./km^2), which can be considered as a conventional synanthropic, because inhabits practically all settlements of mountainous Daghestan (Vilkov, 2007). The most abundant species, in addition to typical synanthropic such as the Eurasian Tree Sparrow (52.2 ind./km^2) and Rock Dove (23.3 ind./km^2), also include conventional synanthropic such as the Rock Bunting (22.5 ind./km^2) and Common Blackbird (21.6 ind./km^2), typical for High-mountain Daghestan. The most typical conventional synanthropic include the Eurasian Jay (6.6 ind./km^2), Great Tit (8.4 ind./km^2), Black Redstart (9.4 ind./km^2), Gray and White Wagtails (7.7 and 8.1 ind./km^2) and some others. According to the original data and inquires, a major part of the synanthropic bird population is sedentary or semi-sedentary as they occur in residential landscapes all year round, including the autumn-winter season. The only exception is their short-term departures to feeding areas located on the outskirts of villages. Most of the conventional synanthropes, occurring in settlements, periodically move to adjacent territories in search of more suitable forage or breeding habitats. In the autumn-winter season, such conventional synanthropic as the Hobby Falcon, Common Swift, Common Hoopoe, Barn Swallow, Common House Martin, wagtails, wheatears, Black Redstart and Eurasian Robin migrate to their wintering grounds. However, part of the Eurasian Wren population (1.4 ind./km^2) still remain in villages for winter. During the winter and early spring such birds as the Red-billed Chough, Common Raven and some others, usually not showing synanthropic, penetrate to the outskirts of villages, where sufficient food and suitable shelters can be found. It should be emphasized that the number of the Hooded Crow in the studied anthropogenic landscapes is extremely limited, and it is very important since its low numbers ensure the safety of a vulnerable community of mountain birds from this dangerous nest-destroyer. In the absence of suitable nesting trees in some settlements, the Hooded Crow fly to nest in adjacent forests, located as far as 500 and more meters away, where it nests on tall trees along the forest periphery. However, the nesting birds regularly return to feed in "their" settlement.

The sixth place is occupied by a tree-shrub bird community, uniting 28 taxa with a total average abundance of 215 ind./km^2. The most abundant species are the Rock Bunting (29 ind./km^2), Caucasian Chiffchaff (26 ind./km^2) and Red-fronted Serin (14.4 ind./km^2). Such habitats as shrubs and solitary trees in the north-western and central parts of High-mountain Province are usually used by non-breeding birds as temporary shelters, as we have discussed above. In conditions of the deforested south-eastern highlands dominated by mosaic shrub thickets in subalpine meadows and sibljak-covered arid slopes with frequent winds and the deficit of forage, shelters and nesting habitats, the role of such refuges dramatically increases since birds not only regularly feed and hide in them but also nest annually. The breeding group of these habitats consists of the Chukar Partridge (13.3 ind./km^2), Common Blackbird (3 ind./km^2), Red-backed Shrike (2.5 ind./km^2), European Goldfinch (14.3 ind./km^2), Red-fronted Serin 6.7 ind./km^2), Common Whitethroat (0.8

ind./km^2), Rock Bunting (36 ind./km^2), etc. The species variation in breeding birds proves that the harsh bioclimatic conditions of the High-mountain Province can support not only highly specialized mountain taxa, but also adapted populations of ecologically plastic bird species of the plains, which have formed stable long-term relationships with local habitats. To be more persuasive, we will illustrate this. Thus, during the annual counts (2006–2010) in the vicinity of Tlyarosh Village (Charodinsky District) (Vilkov 2013a), on the same bushed subalpine meadow (1,550–1,600 m) the same male of the Red-Backed Shrike with a very noticeable defect of his right wing was recorded every year. The presence of this distinctive character in a particular bird can be regarded as equal to the reliable ringing data. Indeed, this bird from year to year bred in the same site within a radius of 100–150 m from the initial point of its nesting record. In fact, the given example suggests a strong long-term relationship with the nesting site not only of a particular bird but also, probably, of the entire micropopulation adapted to the conditions of the mountains. And, as observations in other regions of High-mountain and Intra-mountain Daghestan have shown (Vilkov 2010; 2011a, b; 2013a), such habitat fidelity of micropopulations is recorded for many species of migratory birds of the plains preferring the same areas for many years. As for the fidelity to inverted habitats in the deforested south-eastern part of High-mountain Province, there, in the absence of woodland areas, suitable breeding habitats for some forest bird species are replaced by outcrops and piles of stones with mosaic shrub thickets. Thus, on 24 September 2015 we encountered a Eurasian Wren and a Eurasian Robin on a juniper-covered rocky slope surrounded by alpine meadows. The site was located at an altitude of 1,950 m on the right slope of the side gorge 6.5 km southward of Rutul Village (Rutulsky District). Both birds showed clear signs of aggressive territorial fidelity, manifested in loud cries of the birds repeatedly approaching the visitor and, as it were, "squeezing" him from their occupied territories. A similar reaction to the visitor was demonstrated 2 hours later in the same site by the same birds. The above suggests that, despite the harsh conditions of the alpine zone, birds gave a clear preference to the microhabitats that were suitable for them, though located at untypical altitude. In fact, the main part of the local breeding population of the Eurasian Wren (2.5 ind./km^2) and Eurasian Robin (3.2 ind./km^2) are found in their traditional habitats located 250–300 metres down the precipitous slope in a mature mixed-deciduous forest.

The seventh place is occupied by the bird community of alpine meadows and upper forest boundaries, uniting 17 species with a total average abundance of 98 ind./km^2. In High-Mountain Daghestan the alpine zone starts from an altitude of 2,500 m, and its fragments are mosaically scattered. The severe meteorological conditions of the alpine zone, deficit of forage and suitable shelters determine the presence of mainly stenotopic bird groups including Caucasian Snowcock (3.4 ind./km^2), Caucasian Black Grouse (4.5 ind./km^2), Alpine Chough (5.4 ind./km^2), Red-billed Chough, Great Rosefinch (3.7 ind./km^2), Water Pipit (3.6 ind./km^2), Snowfinch (6 ind./km^2), Güldenstädt's Redstart (8.3 ind./km^2), Common Rock Thrush (2.4 ind./km^2), Alpine Accentor (8.3 ind./km^2), etc. The most abundant are the Common Rosefinch (11.2 ind./km^2), Red-billed Chough (10.8 ind./km^2) and Black Redstart (9.4 ind./km^2). Most stenotopic taxa are disjunctively distributed, in accordance with the location of alpine ridges. They are also characterized by diurnal and seasonal movements to lower parts of the mountains. However, despite the harsh conditions of their habitats the alpine meadows are also visited by birds from other bird communities. Among them there are the Common Raven, Eurasian Skylark, Rock Bunting and some others. Observations show that these species are found within the alpine belt in summer time or in the period of seasonal migrations. The species composition and

population density of the alpine bird group are relatively stable, though in recent years, due to the growing hunting pressure, the numbers of the Caucasian Black Grouse and Caucasian Snowcock might decrease. The Caucasian Snowcock, being the third neoendemic taxa, has a very sporadic range in the alpine belt of Daghestan highlands, varying from 1 to 7.3 ind./km^2. A major part of its population is concentrated in High-mountain Province. During winter in highlands the Caucasian Snowcock usually prefers southern mountain slopes, where snow patches is melted under the sun or quicker blown by wind. Seasonal vertical movements are also observed: in the second half of summer the species ascends to summits and crests of mountains where it hides among stones avoiding predators (Golden Eagle), and in winter, with the appearance of snow, it descends to lower mountain belts. In winter the Snowcock prefers the lower half of the alpine belt where it searches for snowless areas finding the forage; in early spring it descents up to the subalpine zone. The factors, limiting the species number, include cold winters with a lot of snow and occasional shooting.

The eight place is occupied with a bird community of hoverers, uniting 13 species with a total average abundance of 19 ind./km^2. This group includes large and middle-sized birds of prey – the Golden Eagle, Common Buzzard, Long-legged Buzzard, European Honey Buzzard, etc. and necrophages – the Griffon Vulture, Lammergeier and Black Vulture. The highest density of hoverers are recorded in the areas of rodents concentration in the subalpine zone, burial grounds for animal refuses, landfills, and mature forests. Human activity has an essential impact on the number dynamics and distribution of necrophagous raptors in Daghestan mountains. It can be negative or positive, depending on the intensity of livestock grazing which number has noticeably reduced (≈5–7 and more times) in the last 2–3 decades, partly due to the emigration of people from mountains to plain regions. A direct persecution of birds of prey by humans (hunting and taking chicks from nests to sell them to falconers, photographers, etc.) also has substantially increased in the recent decade (Vilkov 2014). In addition to the above-mentioned species the hoverers also include the Saker and small falcons – Merlin, Hobby Falcon and Common Kestrel. The Saker, as a nesting migrant, was repeatedly recorded in different regions of mountainous Daghestan. A particular case of its breeding was recorded on 19 August 2003 at the edge of the pine-birch forest in the vicinity of the alpine village of Verkhnee Gakvari (Tsumadinsky District) (Vilkov 2014). A migrating Merlin (3.3 ind./km^2) was twice recorded (20 July 2009 and 23 August 2017) in a subalpine meadow with inclusions of shrub thickets and large orchards in the vicinity of Tsurib Village (Charodinsky District). According to inquires, this falcon was frequently recorded in this site. In contrast to all feathered raptors, the Hobby Falcon in High-mountain Daghestan is directly associated with anthropogenic landscapes because it breeds in nests of the Hooded Crows, and the latter, in turn, are typical synanthropes making their nests in the human neighbourhood or at the periphery of nearby forests. As for the Common Kestrel, it is quite widespread in different habitats of High-mountain Daghestan breeding in cliff niches surrounded by diverse landscapes where it hunts. In addition to typical hoverers the discussed bird group also includes conventional hoverers, namely two species of hawks – the Eurasian Sparrowhawk and Northern Goshawk. They are regarded as "conventional" since they rarely leave forest stands though sometimes move to subalpine and alpine meadows, less frequently - to the nival belt and are often seen in settlements where they catch poultry on farmsteads. This causes their periodical shooting by local residents (limiting factor). A quite significant role of the Northern Goshawk as a key regulator of the number of some bird species should be noted (Belik 2013). Thus, a pair of Northern Goshawks, nested in 2017 and raised two chicks in the regularly surveyed forest of the

Gunib Mountain Botanical Garden of Russian Academy of Sciences (Intra-mountain Daghestan, 1,800– 1,900 m), dramatically reduced the number of average-sized birds, which had been constantly seen in this site since 2014–2016, namely the Eurasian Jay – from 10 to 2 ind./km^2 and Common Blackbird – from 53.2 to 11.7 ind./km^2. Also, the Common Wood Pigeon (2 ind./km^2), Green Woodpecker (6 ind./km^2), Common Buzzard (2.9 ind./km^2) and Long-legged Buzzard (2 ind./km^2) completely disappeared from the study area. Quite possible that having depleted their current forage resources, the Northern Goshawks will further have to hunt on small birds, not only in the given forest but also in adjacent open landscapes that may decrease the number of some small bird species (Belik 2013).

The ninth place is occupied by a community of subnival-nival birds, consisting of 7 species with a total average abundance of 194 ind./km^2. In High-mountain Daghestan the subnival-nival zone starts from 3,000 m. For most bird species the habitat conditions of this zone are extreme, and in this context, similar to the community of alpine birds, the taxonomic structure of this avian group unites narrow specialists well adapted to dwelling in snow-covered areas of mountains and glaciers. The species diversity and ecology of subnival-nival birds have much in common with the alpine species but there are no such taxa as the Caucasian Black Grouse, Wallcreeper and Common Rock Thrush. However, other stenotopic forms are always present (except for the winter season): Caucasian Snowcock (1–5 ind./km^2), Red-billed Chough, Alpine Chough, Alpine Accentor, Güldenstädt's Redstart (2.2 ind./km^2), Snowfinch (6 ind./km^2), and Great Rosefinch (3.7 ind./km^2). The most abundant species are the Red-billed Chough (10 ind./km^2), Alpine Accentor (2.5–14 ind./km^2), and Alpine Chough (5.4 ind./km^2).

The tenth place is occupied by waterbirds, consisting of 6 species with a total average abundance of 209 ind./km^2. The water objects, as intrazonal inclusions of High-mountain Daghestan, are located at different altitudes and, as a consequence, their inhabitants are represented by various hydrophilic birds with a wide range of environmental preferences. These species have insignificant abundance and low population density as the rapid water flow, rocky bottom and rocky-pebble banks make mountain watercourses unsuitable as a habitat for many plain hydrophilic species. This has lead to the formation of a small group of birds, which distribution is directly associated with the mountain hydrological network. It is composed of the species which populations are most adapted to the water bodies and streams in harsh mountain conditions thereby turning them into typical mountain bird species. They are the Common Sandpiper, Gray Wagtail, White Wagtail, and White-throated Dipper. These species use sharp forms of coastal relief for nesting, and watercourses – for feeding. It is interesting that despite the mudflow of 2009 that had radically changed the outlines of banks and pebble beaches of the Karala-Zurger River (near Tlyarosh Village, Charodinsky District, 1,530 m), a micropopulation of the Common Sandpiper, regularly nested there before the mudflow, not only returned in subsequent years to their former breeding area, but significantly increased from 8.5 to 33.3 ind./km^2. In addition to a stable breeding group of mountain hydrophiles, distributed within a branched hydrological network of the highlands, there is also found the Green Sandpiper – a scanty summering species, occurring occasionally along the banks of rivers and shores of water bodies. Thus, two Green Sandpipers were recorded on 10 September, 2000 at the shore of an alpine lake (2,800 m) in the vicinity of Chirag (Agulsky District) where the birds were feeding on *Gammarus* sp., living in shallows of the water body. Another species of the group of mountain hydrophiles is the Marsh Warbler, inhabiting shores of small lakes and spills of mountain watercourses overgrown with macrophytes. This species is widely distributed from Piedmont to High-mountain Daghestan (Vilkov 2010; 2011b). Thus, a solitary

individual of the Marsh Warbler was recorded on 22.08.2011 on a marshy alpine meadow at an altitude of 2,300 m in the spurs of the Nukatl Ridge (Charodinsky District).

And, finally, the 11th bird group is represented by airborne birds, consisting of 6 species of open air environment with a total average abundance of 213 ind./km^2. Despite the single (air) habitat, the population diversity of these birds varies in different parts of High-mountain Daghestan. This is due to the fact that their qualitative and quantitative composition is determined not only by the orography of suitable rocky habitats located at different altitudes, but also by the habitat availability of terrestrial ecosystems. In this regard, geographically distant natural complexes supply birds with different amount of forage, suitable shelters or nesting areas. When feeding, the airborne birds actively use forage resources of their occupied territory, where they are constantly moving following the successively warming by the sun landscape surface since the increased temperature in the "sunspot" epicentre substantially activates the insect activity. In addition, the flying insects form so-called forage "aeroplankton", which components attract airborne birds. In different highland areas the structure and density of aeroplankton prey species greatly vary, directly reflecting in the quantitative structure of the airborne birds. Thus, the presence of the Eurasian Bee-eater, a migrating and summering species of the Daghestan highlands, is primarily determined by the presence of apiaries around which these birds regularly concentrate and feed, irritating beekeepers who regularly shoot them (limiting factor) (Vilkov 2016). For example, only on 7 September 2017 the apiaries located near Tlyarosh Village (Charodinsky District) concentrated, after the rainy weather, over 150–180 Eurasian Bee-eaters, causing panic among local beekeepers as the birds pecked bees directly at bee-entrances of the hives, preventing them from flying out to collect nectar. Also, a long-term trend of all mountain ecosystems in Daghestan is a noticeable decrease in the number of Barn Swallows that has been observed at the macropopulation level over the last 10–15 years (Vilkov 2013b). The decline in abundance of the alpine population of this species is presumably associated with an integrated effect of 3 limiting factors: 1 – the climate mesophilization of mountain ecosystems and reduction in the wetland areas used by the Barn Swallow in the nest-building period (clay intake); 2 – the reduction in the number of livestock and farms where it previously nested; 3 - the application of new building materials (brick instead of natural stone, plastic windows, cermets, etc.), worsening the quality of breeding habitats (farms, houses, etc.).

The specific pattern of the avifauna of High-mountain Daghestan is provided not only by resident communities of typical mountain birds, but also by nesting in the mountains adapted populations of migratory birds of the plains.

The relationships of birds with their mountain habitats (including the species of the plains), having established during a long historical period, lead to the appearance of highly specialized and, as a rule, territorially isolated micropopulations supposedly inhabiting the same habitats for many years.

Conclusively, the avifauna of High-mountain Daghestan is characterized by the cyclic changes in periods of seasonal migrations and the long-term changes under the impact of a set of limiting factors: global warming, reduction in cultivation areas, decreasing livestock population, increasing anthropogenic transformation of the environment, hunting pressure and birds of prey.

The analysis of the collected material provides not only a picture of the species diversity and territorial distribution of birds but also gives a representation of the avifauna abundance of the High-mountain Daghestan.

References

Belik V.P. 2013. [Current changes in the avifauna of the North-Western Caucasus

and their causes] Transactions of Menzbir Ornithological Society (in the memory of E.N. Kurochkin) 2: 208–230. (in Russian).

Böhme R.L., Banin D.A. 2001. [Mountain avifauna of the southern Palearctic. Ecological and geographical analysis]. Moscow University Press, Moscow, 256 p. (in Russian).

Cowie R.I. 1977. Optimal foraging in Great Tits (*Parus major*). Nature 286 (5616): 137–39.

Galushin V.M., Golodushko B.Z. 1963. [Variability and factors determining sizes of hunting areas of birds of prey. In: Proceedings of the 5th Baltic Ornithological Conference] Tartu, pp. 36–40. (in Russian)

Lebedeva N.V., Ponomarev A.V., Savitsky R.M., Arzanov Yu.G., Ilyina L.P. 2010. [Terrestrial fauna as an indicator of grazing pressure] Bulletin of Southern Scientific Centre of Russian Academy of Sciences 6 (4): 84–95. (in Russian)

Ostashchenko A.N. 2006. [The effect of decreasing anthropogenic pressure on birds of Kyrgyzstan. In: Ornithological Studies in Northern Eurasia. Proceedings of the 12th International Ornithological Conference of Northern Eurasia] Stavropol State University Press, Stavropol, pp. 406–407. (in Russian)

Vilkov E.V., Pishvanov Yu.V. 2000. [Rare and scanty bird species of Daghestan. In: Priklonsky S.G. and Zubakin V.A.(eds.). Rare, threatened and poor studied birds of Russia]. RBCU Press, Moscow, pp. 13–29. (in Russian)

Vilkov E.V. 2007. [Owls of Daghestan] Berkut 16 (12): 78–86. (in Russian)

Vilkov E.V. 2010. [Structure and ecological diversity of birds of the High-mountain Daghestan] Bulletin of the Southern Scientific Centre of the Russian Academy of Sciences 6 (2): 52–59. (in Russian)

Vilkov E.V. 2011a. [Materials on the winter bird population of Intra-Mountain Daghestan. In: Zalibekov Z.G. (ed.). Arid ecosystems]. Vol. 17, Part 2 (47): 55–62. KMK Press. (in Russian)

Vilkov E.V. 2011b. [Structure and ecological diversity of birds in Intra-Mountain Daghestan (by the example of Gotsatl Village). In: Birds of the Caucasus: history of study, life in urbanized environment. Proceedings of the scientific conference]. North-Caucasian State Technical University Press, Stavropol, pp. 25–34. (in Russian)

Vilkov E.V. 2013a. [History of study and structural-territorial relationships of birds of High-mountain Daghestan (by the example of Charodinsky and Tlyaratinsky Districts). In: Birds of the Caucasus: history of study, life in urbanized environment. Proceedings of the scientific conference]. Alpha Print, Stavropol, pp. 25–52. (in Russian).

Vilkov E.V. 2013b. Population trends in regular migrants as the basis for a prediction model for conservation of the birds of Eurasia. Russian Journal of Ecology 44 (2): 142–157.

Vilkov E.V. 2014. [Retrospective analysis and the current state of the Saker Falcon (*Falco cherrug*) in Daghestan]. Bulletin of St. Petersburg State University. Series Biology 4: 38 - 48. (in Russian).

Vilkov E.V. 2016. [Features of ecology of bee-eaters *(Merops apiaster, M. superciliosus)* in Daghestan as a region of intensive migrations] South of Russia: Ecology, Development 11 (3): 90 – 105. DOI: 10.18470/1992-1098-2016-3-90-105 (in Russian).

Vilkov, E. 2020. The structure, territorial relationships, and ecology of birds in high-mountain Daghestan', Journal of Wildlife and Biodiversity, 4(1): 8-17.