

# Rustic Bunting *Emberiza rustica* abundance in the Kostomuksha Nature Reserve and Kalevala National Park (NW Russia) during the years 2015–2021

SERGEY A. SIMONOV<sup>1\*</sup>, MARIA V. MATANTSEVA<sup>1</sup>, YURI A. KRASOVSKY<sup>2</sup> AND IRINA S. GAYDYSH<sup>2</sup>

<sup>1</sup> Institute of Biology, Karelian Research Centre, Russian Academy of Sciences (KarRC RAS), 11 Pushkinskaya Str., Petrozavodsk, 185910, Russia

<sup>2</sup> Kostomuksha Nature Reserve and Kalevala National Park, 2 Priozyornaya St., Kostomuksha, 186930, Russia

\* Corresponding author: [ssaves@gmail.com](mailto:ssaves@gmail.com); phone: +79114027025

Simonov, S.A., Matantseva, M.V., Krasovsky, Y.A. and Gaydysh, I.S. 2023. Rustic Bunting *Emberiza rustica* abundance in the Kostomuksha Nature Reserve and Kalevala National Park (NW Russia) during the years 2015–2021. *Baltic Forestry* 29(1): id 632 (Brief report). <https://doi.org/10.46490/BF632>.

Received 19 June 2022 Revised 29 June 2023 Accepted 4 July 2023

## Abstract

In the late 20<sup>th</sup>–early 21<sup>st</sup> centuries, the Rustic Bunting *Emberiza rustica* population declined worldwide, including Karelia, NW Russia, the northern periphery of its breeding range. At the onset of the 21<sup>st</sup> century the Rustic Bunting disappeared from the southern parts of Karelia and turned from common to rare species in its northern parts. However, surveys carried out in 2015–2021 in the Kostomuksha Nature Reserve and Kalevala National Park – large neighbouring protected areas in NW Karelia – revealed a quite steady, although relatively low, breeding densities of the species (2.9–5.6 ind./km<sup>2</sup>). Such stable parameters of the abundance make this species common in the area in question. Furthermore, the species occurrence along survey routes seems to be slightly rising over the said time period, giving us hopes for a recovery of Rustic Bunting numbers, at least in protected areas containing extensive pristine boreal forests with habitats favourable for the species.

**Keywords:** Rustic Bunting, *Emberiza rustica*, abundance, population dynamics, northern taiga, pristine forests, red-listed species, nature protection

## Introduction

Rustic Bunting, *Emberiza rustica* is a widespread species in the Palearctic boreal zone (Naumkin et al. 2020, Rymkevich and Noskov 2020). Russian Karelia is the western periphery of the breeding range for this species (Yakovleva and Khokhlova 2020). In the 20<sup>th</sup> and 21<sup>st</sup> centuries the species numbers and the western boundary of its distribution fluctuated widely (Yakovleva and Khokhlova 2020). In Karelia, the Rustic Bunting has been known to occur since the second half of the 19<sup>th</sup> century (Sievers 1878). In the late 19<sup>th</sup>–early 20<sup>th</sup> centuries the species expanded westwards to Nordic countries (Merikallio 1958, Malchevsky and Pukinsky 1983, Dale and Hansen 2013, Naumkin et al. 2020).

Since the 1940s, however, the species in Finland has been declining and eventually stopped breeding in its southern parts (Valkalama et al. 2014, Rymkevich and Noskov 2020). Since the late 1990s, the limit of its distribu-

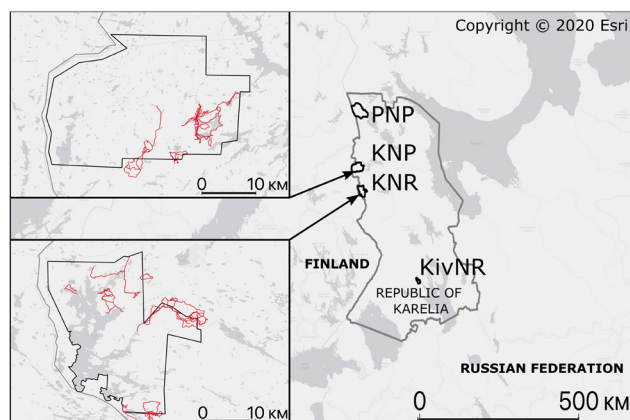
tion has been regressing north-eastwards (Dale and Hansen 2013, Edenius et al. 2017). Since the late 20<sup>th</sup> century, a decline in the species numbers has been reported also in other Nordic countries (Dale and Hansen 2013) and in North-West Russia (Khokhlova et al. 2001, Khokhlova and Artemiev 2007, Sazonov 2011, Rykova 2013, Yakovleva and Sukhov 2017, 2020, Rymkevich and Noskov 2020). In the last two decades this process has covered virtually all of the species' distribution range (Edenius et al. 2017), and the Rustic Bunting is now considered a rare species almost everywhere (Naumkin and Preobrazhenskaya 2020, Rymkevich and Noskov 2020). In the western parts of the distribution range, including Karelia, the numbers of Rustic Bunting have decreased dramatically, and by the beginning of the 21<sup>st</sup> century the species entirely disappeared from its suboptimal habitats (Khokhlova and Artemiev 2007, Lindström et al. 2010, Sazonov 2011, Dale and Hansen 2013, Väisänen and Lehtikoinen 2013, Mishchenko 2017, Naum-

kin and Preobrazhenskaya 2020, Rymkevich and Noskov 2020, Yakovleva and Khokhlova 2020, Yakovleva and Sukhov 2020).

Thus, the Rustic Bunting population declined worldwide. Possible factors include increased logging in the breeding range (BirdLife International 2021). Most researchers, however, consider this decline in the abundance is due to challenges along flyways and wintering grounds, such as large-scale trapping together with agricultural intensification and shrinking of foraging areas (Valkama et al. 2011, Dale and Hansen 2013, Edenius et al. 2017, Naumkin et al. 2020, Yakovleva and Khokhlova 2020, BirdLife International 2021). According to the IUCN threat taxonomy (Battisti et al. 2016), main threats affecting this bunting can be classified as threats 5.1 “Hunting and collecting terrestrial animals” and 5.3 “Logging and wood harvesting”.

In view of the global population decline, the species has been uplisted to the IUCN Vulnerable (VU) status (BirdLife International 2021). The same status was given to this species in the Red Data Book of the Russian Federation (2001). The status of Rustic Bunting in the Red Data Book of the Republic of Karelia (2020) is near threatened (3, NT), i.e. a rare species that may be vulnerable to endangerment in the near future.

Therefore, it is necessary to continue monitoring the species' abundance and distribution, and to conserve its current habitats. Such monitoring in Karelia is implemented, e.g. in the Kivach Nature Reserve (Figure 1). However, this nature reserve is situated in the southern part of the Republic, where Rustic Bunting numbers are at a low level now (Yakovleva and Sukhov 2020). The current situation with the Rustic Bunting in central and northern Karelia has been studied much less, and in the past decade the species has been known as a common breeder only in the Paanaajarvi National Park (Figure 1), the very north of Karelia (Yakovleva and Khokhlova 2020).



**Figure 1.** Locations of the above-mentioned protected areas of the Republic of Karelia, NW Russia, and Europe: KNP – Kalevala National Park; KNR – Kostomuksha Nature Reserve; PNP – Paanaajarvi National Park; KivNR – Kivach Nature Reserve, and our transects in the KNP and KNR

Our communication reports 2015–2021 data on the occurrence of the Rustic Bunting in the neighbouring Kostomuksha Nature Reserve (KNR) and Kalevala National Park (KNP) – two of Karelian key protected areas (PAs) occupying extensive areas in the north-west of the Republic (Figure 1). These PAs feature large expanses of pristine boreal forests, numerous wetlands, and ramified lake-river systems. This is a combination favourable for the habitation of the Rustic Bunting, a typical north-boreal species, which favours wet and sparse forests of different tree species compositions, often situated along waterbodies (Naumkin et al. 2020, Rymkevich and Noskov 2020, Yakovleva and Khokhlova 2020). The aim of our report is to demonstrate current parameters of the Rustic Bunting abundance in the western part of Karelia, namely in the KNP and KNR (Figure 1).

## Material and methods

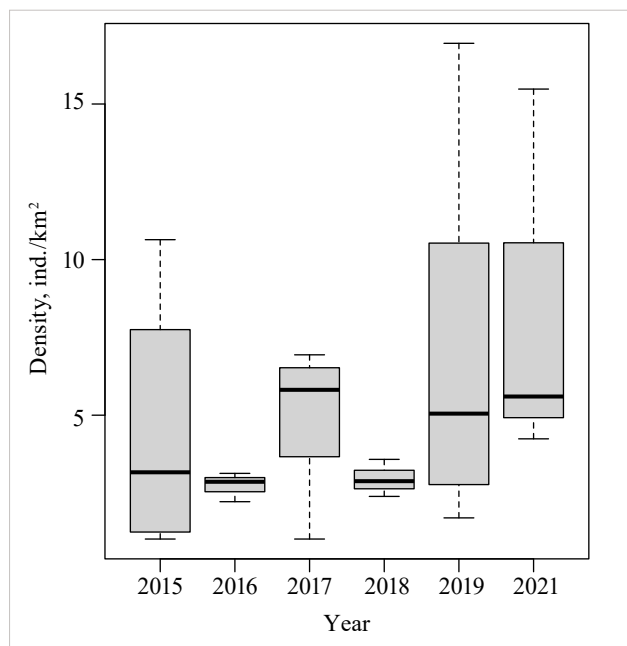
We surveyed for Rustic Bunting adults and breeding pairs in 2015–2019 and 2021 on 39 transects in the KNR (64°28' N, 30°16' E) and 19 transects in the KNP (64°59' N, 30°12' E) (Figure 1), including buffer zones of these PAs (Figure 1). Sampling was done using the transect method, establishing the 25 + 25 m belt with geotagging of every bird. We provided surveys in June, July and early August. We did not have the possibility to conduct our study at the same time every year, so we had to thoroughly recognize adult individuals and exclude juvenile birds in the latest period of observation. Therefore, we registered birds not only by their songs but by their other voice signals as well, which was especially topical in July and August. We also mapped broods, registering adult individuals. All registrations were obligatory proofed by visual observations and photography in most cases.

We started travelling along all routes under the same weather conditions (no precipitation, partly cloudy or clear weather, wind speed is in the range of 1–3 m/s) in morning hours (since 5–6 a.m.). The length of the routes varied from 5 to 10 km. To ensure proper navigation, we used GPS tracker devices with Android OS and navigation software (Vazquez 2020). Our average speed varied in different biotopes from 1 to 2 km/h. The transects covered all types of biotopes within the studied area (Figure 1).

Statistical treatments of data obtained were performed in the *R* environment (Posit 2021).

## Results

We found that the most densely populated habitats in the KNR and KNP were wet pine and mixed forests along waterbodies and in mire margins, where Rustic Bunting median numbers reached 4.08 ind./km<sup>2</sup> (interquartile range, IQR = 6.06 ind./km<sup>2</sup>) and median breed-



**Figure 2.** Shifts in the Rustic Bunting relative density revealed along the transects surveyed in the Kostomuksha Nature Reserve and Kalevala National Park during the years 2015–2021

ing density was 1.87 pairs/km<sup>2</sup> (IQR = 2.12 ind./km<sup>2</sup>). Rustic Buntings occurred also in central parts of pine and pine-dominated mixed forests (median number = 1.23 ind./km<sup>2</sup>, IQR = 3.09 ind./km<sup>2</sup>, and median breeding density = 0.49 pairs/km<sup>2</sup>, IQR = 1.62 ind./km<sup>2</sup>) and in spruce-dominated mixed forests (median number = 0.91 ind./km<sup>2</sup>, IQR = 0.71 ind./km<sup>2</sup>, with only 1 breeding attempt in this habitat).

The Rustic Bunting median number in the KNP along all transects where the species was encountered (with non-zero occurrence) was 4.86 ind./km<sup>2</sup> (IQR = 3.57 ind./km<sup>2</sup>), and the median breeding density was 2.77 pairs/km<sup>2</sup> (IQR = 3.37 pairs/km<sup>2</sup>). The median number along the transects with non-zero occurrence in the KNR was 4.24 ind./km<sup>2</sup> (IQR = 3.74 ind./km<sup>2</sup>), and the median breeding density was 2.73 pairs/km<sup>2</sup> (IQR = 1.82 pairs/km<sup>2</sup>). The Rustic Bunting median numbers for all transects with non-zero occurrence in both PAs for 6 seasons were 4.83 ind./km<sup>2</sup> (IQR = 3.56 ind./km<sup>2</sup>), and the bird abundance in 2015–2021 varied significantly among different habitats (Figure 2). Furthermore, the species occurrence along survey routes seems to be slightly rising over the said time period (Figure 2).

## Discussion

As mentioned above regarding 2017, the Rustic Bunting was named a common breeder only in the very north of Karelia, i.e. in the Paanajarvi National Park (Yakovleva and Khokhlova 2020). However, our results indicate that this species regularly bred also in the PAs situated south of Paanajarvi, i.e. in the KNR and KNP (Figure 1),

at least in 2015–2021. Censuses have demonstrated that during this period the Rustic Bunting in the KNR and KNP was a species with relatively stable breeding densities of 0.1–0.7 pairs/km<sup>2</sup> in the mixed forests of different types. According to the abundance scores (Tsybulin 2009) matched against the scale suggested by A.P. Kuzyakin (1962), the status of this species in the surveyed PAs is changing from rare to common in some sites, especially lately. The species abundance is, of course, still lower than the level recorded in Karelia at its peak, i.e. from the 1960s to the mid-1990s (Yakovleva and Khokhlova 2020), when it was 10–17 pairs/km<sup>2</sup> in coniferous and deciduous forests (Zimin et al. 1993), and 5 pairs/10 ha in very wet and sparse spruce and mixed forests (Yakovleva and Sukhov 2017). Rustic Bunting numbers in different sites in KNR in the 1990s were between 2.8 and 12.5 pairs/km<sup>2</sup> (Sazonov 1997). Nonetheless, the species abundance in our surveys was much higher than the current levels reported for more southern parts of Karelia, namely the Kivach Nature Reserve, where breeding pairs have been encountered in the past decades on single occasions not every year (Yakovleva and Sukhov 2020).

We believe the regular breeding of this species, which is considered rare in almost all of Karelia (Yakovleva and Khokhlova 2020) can be attributed to the fact that the KNR and KNP have habitats preferred by this species. The preferred habitats of Rustic Bunting are wet sparse forests with different tree species compositions, wet open woodland along creeks and lakes, margins of Sphagnum bogs and wet meadows, treed transition mires and fens (Naumkin and Preobrazhenskaya 2020, Naumkin et al. 2020, Rymkevich and Noskov 2020, Yakovleva and Khokhlova 2020). In the PAs in question, with their abundant taiga expanses, wetlands, rivers, and lakes, plenty of such habitats are available to the birds.

Considering that despite the population decline the Rustic Bunting remains a regular breeder in most of its distribution range (Naumkin and Preobrazhenskaya 2020, Naumkin et al. 2020), the existence of PAs with a sufficient number of favourable habitats and regular occurrence of the species in the studied areas give hopes for a possible recovery of the population, at least in some parts of the range. Meanwhile, it is also should be noted that a local increase of Rustic Bunting number in the PAs could also be caused by the crowding effect (Schmiegelow et al. 1997, Vallejos et al. 2020). Both PAs surrounded by areas with on-going transformation, including logging and other human activity. Birds from adjacent transformed habitats could move to pristine habitats of the PAs. In this context, it is especially important to maintain PAs with the stable Rustic Bunting breeding in their current state, with strict protection regulations and limitation of visitor numbers, e.g. in view of fire risk, which depends on human visitation frequency. It is the preservation of large pristine taiga expanses that can guarantee the natural recovery and subsequent maintenance of the abundance of this species

provided that the situation along flyways and in wintering grounds is back to normal.

## Conclusions

The data collected in the study prove that the Kostomuksha Nature Reserve and Kalevala National Park are areas where Rustic Buntings continued to breed annually, at least in the 2015–2021 period. The optimistic population parameters of this species in the said protected areas is the first sign of the possibility that the Rustic Bunting abundance may recover at least in some areas with preferable conditions since the beginning of its global population decline.

## Acknowledgements

We are grateful to S.V. Tarkhov, Director of the Kostomuksha Nature Reserve, for providing financial support which made our field surveys feasible. O.S. Kislova, staff professional linguist of the Karelian Research Centre, RAS, translated the manuscript into English, for which we express to her our sincere gratitude. The authors appreciate careful reading of the manuscript by the editors and anonymous reviewers and their many insightful comments and suggestions. This brief communication was prepared under the scope of project #FMEN-2022-0003 implemented by the Karelian Research Centre, RAS.

## References

- Battisti, C., Poeta, G. and Fanelli, G.** 2016. An Introduction to Disturbance Ecology. Cham: Springer, 178 pp.; <https://doi.org/10.1007/978-3-319-32476-0>.
- BirdLife International. 2021. Species factsheet: *Emberiza rustica*. URL: <http://www.birdlife.org> (retrieved on 21 October 2021).
- Brommer, J., Lehikoinen, A. and Valkama, J.** 2012. The breeding ranges of Central European and Arctic bird species move poleward. *PLoS One* 7(9): e43648; <https://doi.org/10.1371/journal.pone.0043648>.
- Dale, S. and Hansen, K.** 2013. Population decline in the Rustic Bunting *Emberiza rustica* in Norway. *Ornis Fennica* 90(4): 193–202.
- Edenius, L., Choi, Ch.-Y., Heim, W., Jaakkonen, T., Jong, A.D., Ozaki, K. and Roberge, J.-M.** 2017. The next common and widespread bunting to go? Global population decline in the Rustic Bunting *Emberiza rustica*. *Bird Conservation International* 27: 35–37; <https://doi.org/10.1017/S0959270916000046>.
- Khokhlova, T.Yu. and Artemiev, A.V.** 2007. Osnovnyie itogi mnogoletnego ornitologicheskogo monitoringa v zonie konsentratsii granits arealov ptits na sieviero-zapadie Rossii (Kareliia, Zaoniezhiie) [The main results of long-term ornithological monitoring in the zone of concentrations of the borders of bird ranges in the North-West of Russia (Karelia, Trans-Onega area)] In: Dinamika chislenosti ptits v nazemnykh landshaftakh: Materialy Vsierossiskogo sovieshchaniia (Moskva, 21–22 fevralia 2007 g.). Moscow: ‘A.N. Severtsov’ Institute of Ecology and Evolution, Russ. Acad. Sci., p. 60–74 (in Russian with English abstract).
- Khokhlova, T.Yu. and Artemiev, A.V.** 2011. Znachenie zeli-onogo poiasa Fennoskandii dlia sokhranieniia taiozhnogo ornitokompleksa Evropy [The significance of the Green Belt of Fennoscandia for the conservation of the taiga bird community of Europe]. *Transactions of Karelian Research Centre of the Russian Academy of Sciences* 2(12): 127–132 (in Russian with English abstract).
- Khokhlova, T.Yu., Artemyev, A.V. and Yakovleva, M.V.** 2001. Predvaritelnyie itogi ornitofaunisticheskogo obsledovaniia raiionov Segozera i Vygozera [Preliminary results of the avifauna survey of the Lake Segozero and Lake Vygozera areas]. In: Gromtsev, A.N. and Krutov, V.I. (Eds.) Inventarizatsiia i izuchenie biologicheskogo raznoobrazii na territorii Tsentralnoi Karelii. Petrozavodsk: KarRC RAS, p. 119–133 (in Russian with English abstract).
- Kuzyakin, A.P.** 1962. Zoogeografiia SSSR [Zoogeography of the USSR]. In: *Uchionyie zapiski Moskovskogo oblastogo pedagogicheskogo instituta imieni N.K. Krupskoi [Proceedings of ‘N.K. Krupskaiia’ Regional Pedagogic Institute, Moscow]* 109(1): 3–82 (in Russian).
- Lehikoinen, A. and Virkkala, R.** 2016. North by north-west: climate change and directions of density shifts in birds. *Global Change Biology* 22: 1121–1129; <https://doi.org/10.1111/gcb.13150>.
- Lindström, Å., Green, M. and Ottvall, R.** 2010. Monitoring population changes of birds in Sweden. Annual Report 2009. Lund (Sweden): Department of Biology, Lund University, 76 pp.
- Lindström, Å., Green, M., Paulson, G., Smith, H.G. and De-victor, V.** 2013. Rapid changes in bird community composition at multiple temporal and spatial scales in response to recent climate change. *Ecography* 36: 313–322.
- Malchevskii, A.S. and Pukinskii, Yu.B.** 1983. Ptitsy Leningradskoi oblasti i sopredelnykh territorii. T. 2. Vorobinyie [Birds of the Leningrad region and contiguous lands. Vol. 2. Passeriformes]. Leningrad: Leningrad University Press. 504 pp. (in Russian).
- Mericallio, E.** 1958. Finnish Birds: Their Distribution and Numbers. Fauna Fennica, Vol. 5. Helsinki: Societas pro Fauna et Flora Fennica, 181 pp.
- Mishchenko, A.L.** (Ed.) 2017. Otsenka chislenosti i ieio dinamiki dlia ptits Evropeiskoi chasti Rossii (rezultaty proekta “European Red List of Birds”) [Estimate of abundance and its dynamics for birds of the European part of Russia (results of the ‘European Red List of Birds’ project)]. Moscow: BirdsRussia, 63 pp. (in Russian).
- Naumkin, D.V. and Preobrazhenskaia, E.S.** 2020. Ovsianka-remez *Emberiza rustica* [Rustic Bunting *Emberiza rustica*]. In: Kalyakin, M.V. and Voltsit, O.V. (Eds.) Atlas gnezdiashchikh ptits evropeiskoi chasti Rossii [Atlas of the breeding birds of the European part of Russia]. Moscow: ‘Phyton XXI’ Publ. House, p. 840–842 (in Russian).
- Naumkin, D.V., Preobrazhenskaya, E.S. and Kalyakin, M.V.** 2020. Rustic Bunting *Emberiza rustica*. In: Keller, V., Her-rando, S., Voříšek, P. et al. 2020. European Breeding Bird Atlas 2: Distribution, Abundance and Change., Barcelona: European Bird Census Council (EBCC) and Lynx Edicions, p. 876–877.
- Posit. 2021. RStudio Desktop, release 2021.09.1 [Computer software]. Posit, PBS, 250 Northern Ave., Boston, MA 02210, USA. URL: <https://posit.co/products/open-source/rstudio/>.
- Rykova, S.Yu.** 2013. Ptitsy Bielomorsko-Kuloiskogo plato [Birds of the White Sea-Kuloi Plateau]. Moscow: The Ministry of Natural Resources and Environment of Russia; Arkhangelsk: Pinega State Reserve, 188 pp. (in Russian).
- Rymkevich, T.A. and Noskov, G.A.** 2020. Ovsianka-remez *Emberiza rustica* [Rustic Bunting *Emberiza rustica*]. In: Nosk-



- ov, G.A. Rymkevich, T.A. and Gaginskaya, A.R. (Eds.) Migratsiia ptits sieviero-zapadnoi Rossii [Migrations of Birds of Northwest Russia]. Passerines. Saint Petersburg: 'Renomnee' Publ. House, p. 453–458. (in Russian); <https://doi.org/10.25990/renomespb.wqr9-8n23>.
- Sazonov, S.V.** 1997. Ornitofauna zapovednikov i natsionalnykh parkov sieviernoi taigi vostochnoi Fennoskandii i ieio zoogeograficheskii analiz [Avifauna of nature reserves and national parks of the Northern taiga in Eastern Fennoscandia and its zoogeographical analysis]. Petrozavodsk: KarRC RAS, 116 pp. (in Russian).
- Sazonov, S.V.** 2011. Ptitsy taigi Bielomoro-Onezhskogo vodorazdiela [Birds of taiga of the White Sea-Onega watershed]. Petrozavodsk: KarRC RAS, 502 pp. (in Russian).
- Schmiegelow, F.K.A., Machtans, C.S. and Hannon, S.J.** 1997. Are boreal birds resilient to forest fragmentation? An experimental study of short-term community responses. *Ecology* 78(6): 1914–1932; [https://doi.org/10.1890/0012-9658\(1997\)078\[1914:ABBRTF\]2.0.CO;2](https://doi.org/10.1890/0012-9658(1997)078[1914:ABBRTF]2.0.CO;2).
- Sievers, R.** 1878. Ornitologiska anteckningar under resor i guvernementet Olonets, sommarne 1875 och 1876 [Ornithological notes made during travels in the Governorate of Olonets, the summers of the 1875 and 1876]. *Meddelanden af Societas pro Fauna et Flora Fennica* 2: 73–111, (in Swedish). Available online at: <http://ia802600.us.archive.org/5/items/meddelandenafsoc02soci/meddelandenafsoc02soci.pdf>.
- Simonov, S.A. and Matantseva, M.V.** 2020. Analysis of the current status of avifauna in Kostomuksha State Nature Reserve and Kalevala National Park (North-West Russia), taking into account influence from adjacent areas. *Nature Conservation Research* 5(3): 51–65.
- Tsybulin, S.M.** 2009. Ptitsy Altaia: prostransvienno-vremennaia differentsiatsiia, struktura i organizatsiia nasielieniia [The birds of Altai: the spatiotemporal differentiation and the community structure and organisation]. Novosibirsk: 'Nauka' Publ. House, 234 pp. (in Russian).
- Väisänen, R.A. and Lehtikoinen, A.** 2013. Suomen maalinuston pesimäkannan vaihelut vuosina 1975–2012 [Monitoring population changes of land bird species breeding in Finland in 1975–2012]. *Linnut vuosikirja* 2012. Helsinki: BirdLife Suomi – Finland, Finnish Museum of Natural History, SYKE, p. 62–81 (in Finnish with English abstract).
- Vallejos, M.A.V., Padial, A.A., Vitule, J.R.S. and Monteiro-Filho, E.L.A.** 2020. Effects of crowding due to habitat loss on species assemblage patterns. *Conservation Biology* 34(2): 405–415; <https://doi.org/10.1111/cobi.13443>.
- Valkama, J., Saurola, P., Lehtikoinen, A., Lehtikoinen, E., Piha, M., Sola, P. and Velmala, W.** 2014. Suomen Rengas-tusatlas. Osa II [The Finnish Bird Ringing Atlas; Vol. II]. Helsinki: Finnish Museum of Natural History, Ministry of Environment, 784 pp. (in Finnish).
- Valkama, J., Vepsäläinen, V. and Lehtikoinen, A.** 2011. Suomen III lintuatlas [The Third Breeding Bird Atlas of Finland]. Helsinki: Finnish Museum of Natural History, Ministry of Environment, (in Finnish). Retrieved from <http://atlas3.lintuatlas.fi> (accessed on 21 October 2021).
- Vazquez, J.** 2020. OruxMaps GP, version 8.0.1GP [Computer software]. Avenida de Salmoral, La Ponderosa de la Sierra, 28492, Madrid, Spain. URL: <http://oruxmaps.com>.
- Virkkala, R., Rajasärkkä, A., Heikkinen, R.K., Kuusela, S., Leikola, N. and Pöyry, J.** 2018. Birds in boreal protected areas shift northwards in the warming climate but show different rates of population decline. *Biological Conservation* 226: 271–279; <https://doi.org/10.1016/j.biocon.2018.08.015>.
- Yakovleva, M.V. and Sukhov, A.V.** 2017. Ovsianka-remez v zapovednike "Kivach" [The Rustic Bunting in the Kivach reserve]. *Russian Journal of Ornithology* 26(1409): 726–731 (in Russian with English abstract).
- Yakovleva, M.V. and Sukhov, A.V.** 2020. Ptitsy zapovednika "Kivach" i iego okrestnostei [Birds of the Kivach Nature Reserve and its surrounding areas]. Petrozavodsk: 'Forever' Publ. House, 383 pp. (in Russian).
- Yakovleva, M.V. and Khochlova, T.Yu.** 2020. Ovsianka-remez *Emberiza rustica* Pall. [Rustic Bunting *Emberiza rustica* Pall.]. In: Kuznetsov, O.L. (Ed.) Krasnaia kniga Respubliki Kareliia [The Red Data Book of the Republic of Karelia]. Belgorod: 'Constanta' Publ. House, p. 345–346 (in Russian). Available online at: <https://ecology.gov.karelia.ru/upload/iblock/b76/Krasnaya-kniga-Respubliki-Kareliya.pdf>.
- Zimin, V.B., Sazonov, S.V., Lapshin, N.V., Khokhlova, T.Yu., Artemyev, A.V., Annenkov, V.G. and Yakoveva, M.V.** 1993. Ornitofauna Karelii [Avifauna of Karelia]. Petrozavodsk: KarRC RAS, 220 pp. (in Russian).