Трансформация экосистем
Ecosystem Transformation

ISSN 2619-094X Print
ISSN 2619-0931 Online
www.ecosysttrans.com

Article

Long-term dynamics of avifauna and bird population of Chelyabinsk International Airport Balandino, Russia

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Received: 17.11.2021
Revised: 24.12.2021
Accepted: 10.01.2021
Published online: 18.02.2022

DOI: 10.23859/estr-211117
UDC 598.2

Translated by D.M. Martynova

Abstract. Over 30-year study period (1990–2021), 144 bird species, including 54 nesting species, were registered on the territory of the Chelyabinsk International Airport Balandino. Total bird population density varied from 147 ind./km² in 1990 to 215 ind./km² in 2020. In different years, dominant species in this area were *Alauda arvensis*, *Motacilla flava*, *Saxicola rubetra*, *S. torquata*, and *Passer montana*. In the first years of research, a significant decrease in the number of the most widespread species (*Corvus frugilegus*, *C. monedula*, *Columba livia*, *Larus barabensis*, *L. canus*, and *L. ridibundus*), crossing the airfield during seasonal and diurnal (forage) migrations, was revealed. This was caused both by decrease of population of some species (*C. frugilegus*) in the European and Ural-Siberian parts of their range, and by the deterioration of the state of forage lands on the airport territory after the elimination of solid waste landfills and a decrease of farmland areas nearby.

Keywords: avifauna, airfield, nesting, number, population density, dominant, area.

To cite thic article. Gashek, V.A., Zakharov, V.D., 2022. Long-term dynamics of avifauna and bird population of Chelyabinsk International Airport Balandino, Russia. *Ecosystem Transformation* **5** (1), 27–49. https://doi.org/10.23859/estr-211117

Introduction

The study of the fauna and population of birds, their long-term dynamics, even in small areas, promotes understanding the global processes of changing the abundance, distribution, ecological preferences of species, etc. Along the development of aviation, due to a sharp increase in the number of aircrafts and flight speed, and because of environmental changes at airfields, the issues of assessing and predicting the ornithological status of the territory have become of great importance. The birds flying in the range from 100 to 500 m are the greatest danger to aircraft (AC) at the airfield area, especially at the take-off/landing sectors. Flight safety in civil aviation requires constant monitoring of the ornithological situation at the airfield and in adjacent areas. Changes in the ornithological situation over time (daily, seasonal, and long-term) dictate the need to identify and study the reasons

for such changes. In our study, long-term dynamics of the fauna and bird population of the territory of the Chelyabinsk (Balandino) airport was analyzed for the period of 1990–2021. In particular, the study focused on inventorying the avifauna, identifying the nature of occurrence and the status of each species, studying the species structure and population density of nesting birds, as well as searching for the reasons of such changes.

Geographical and ecological characteristics of the environmental conditions of the surveyed area

Chelyabinsk International Airport Balandino named after I.V. Kurchatov (futher on, Balandino) is located in the Metallurgichesky District of the city of Chelyabinsk at the 18-km distance northeastwards from the city center (Fig. 1).

The airfield of Balandino has one runway, which allows to receive aircraft of any type. It is elongated from west to east; the runway with artificial surface (cement concrete) has a landing magnetic track angle of 91/271° and dimensions of 3200 m (including fortified areas, 3500 m) × 60 m. There is no hydrographic network at the airport.

According to the botanical and geographical zoning, the territory of the airport belongs to the northern forest-steppe of the West Siberian Plain (Kulikov, 2005). The location in the forest-steppe zone preconditions open landscape at this site. The entire airfield is located on a partially steppe meadow (Fig. 2). In the northern part, there is a small pine forest (the age of most of the trees does not exceed 30 years), sparse self-seeding plantations of young pines, a few apple trees, boxelder maple, downy birch, and young aspens. The shrubs are presented by common sallow, cinnamon rose, European dwarf cherry, common broom, and Iberian spirea. The vegetation of upland meadows is represented by turf grasses dominated by Volga fescue along with European feather grass, smooth brome, as well as various mugworts, lagy's bedstraw, sickle medick and alfalfa, white sweet clover, yellow sweet clover, burdock, and meadow vetchling.

From the north and west, the airfield is surrounded by agricultural land (fields of grain, potatoes and fodder crops (alfalfa)), as well as deposits overgrown by rosebay willowherb, mugworts, and thistle. There is a large forest area (2700 ha) of Kashtak Bor Natural Monument, stretching westwards. Bolshoe Balandino settlement and the Miass River locate northwards. The settlements of Solnechny and Balandino locate to the northeast and east of the airport.

The settling pond of the Chelyabinsk Metallurgical Plant locates southeastwards; the lakes Pervoe, Vtoroe, Tret'e, and Chetvertoe locate about 10 km to the south. From the south, office buildings and structures of the airport and the terminal adjoin the territory of the airfield; Aeroport settlement locates in about 0.5-km distance southwards.

Within the borders of the airfield area, within the 15-km radius from the control point of the airfield (CPA), and within the 30-km radius from the air approach lanes, there are several objects that contribute to the concentration of birds:

– to the west and north-west, there are numerous shallow lakes with reed beds of border and raft types of overgrowth: Kasargi, Maly Kisegach, Kurgi,

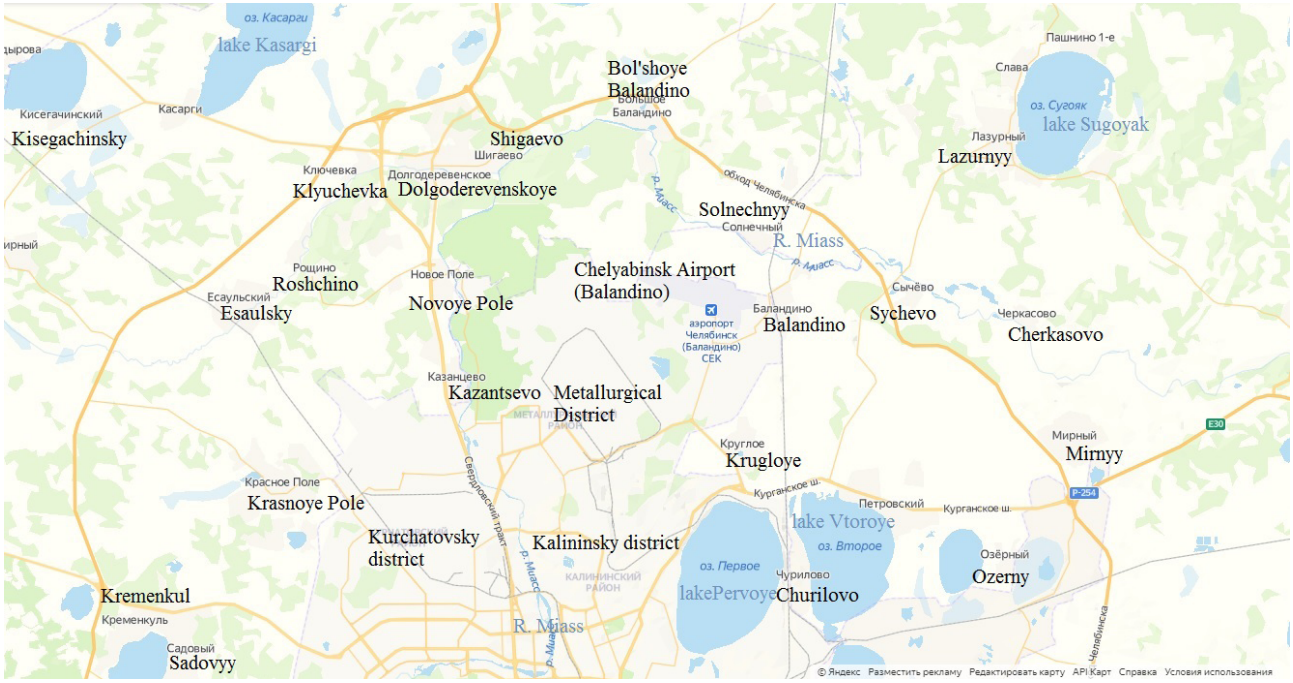

Fig. 1. Location of Chelyabinsk International Airport Balandino.

Fig. 2. Typical airfield landscapes.

Sarsangi, and Uzunkul. Lakes Bolshoe Sagausta (13.5 km northwest from CPA) and Urefta (12.5 km north, northwest from CPA) are the closest to the airfield. Most of the listed lakes are salty;

– there are no large reservoirs to the east; fresh Lake Sugoyak is located13.5 km northeast of CPA.

In 2019–2021, during the reconstruction of the airport, the territory of the airfield has undergone a significant transformation. The land allotment area decreased from 491.7 ha to 408.7 ha due to the construction of a new terminal building in the southern and northern parts and deforestation of areas occupied by aspen-birch groves and clumps of shrubs outside the airport fence. The total area of artificial turf increased from 59.5 ha to 80.9 ha due to the expansion of the apron. In addition, large areas of the soil cover were disturbed in different parts of the airfield, which led to the transformation of the formed meadow-steppe ecosystems. At the same time, the constant movement of people, cars,

and construction equipment also affected the bird communities of the airport.

Materials and methods

The study of the fauna and bird population of Balandino was carried out in 1990, 2007, 2011, 2014–2015, and 2017 within the framework of ecological and ornithological surveys, which lasted from 4 to 12 months in different years, as well as during 2019–2021 in the course of ornithological observations performed by one of the authors in the position of a staff engineer for aviation ornithology at the airport. Quantitative characteristics of the population of the nesting bird species were calculated for the area of the airfield minus the areas of its end sections based on the data of surveys conducted in 1990, 2007, 2011, 2014, 2017, and 2020. Until 2020, this area was 3.79 km², in 2020 (after reconstruction), 2.96 km².

In the course of ecological and ornithological surveys, bird observations were carried out twice a month for 2 days (2 hours each in the morning from sunrise and in the evening until sunset from sites located near the ends of the runway). In 2019–2021, observations were carried out year-round, 5 days a week, mainly from 8 a.m. to 1 p.m., bypassing the entire territory of the airfield around the perimeter. For bird counts, the territory of the airfield was divided into sections with an area from one to several dozen hectares. Within each site, a complete record was applied with mapping of encounters and lek territories. The birds were detected visually using field glasses, as well as by the voices, carcasses, and remains of birds, both shot down by aircraft and crashed on the glass surfaces of the terminal building.

The abundance or populations density was the number of bird individuals per area unit. Bird population density is the number of individuals of all species per area unit (Yudkin, 2002). Species with a share of ≥ 10% of the total population density were considered dominants, the species with a density of at least 1 ind./km² were considered background species (Kuzyakin, 1962).

The distribution of bird species was assessed by categories of relative abundance, using the scale suggested by V.P. Belik (2000) with original modification:

- extremely (very) rare – the species was met no more than 3 times during entire study period (1990–2021);
- rare – met 1–2 times per season;
- small in numbers – met 3–5 times per season;
- few in numbers – met regularly, but not daily;
- common – met 1–10 times per day excursion;
- numerous – met more than 10 times during a day trip.

The reliability of nesting was determined in accordance with the criteria proposed by the Committee of the European Ornithological Atlas, EOAC (The EBCC Atlas..., 1997). Nesting was considered proven by finding nests, eggs, broods, observing birds with food for chicks. Nesting was considered probable when observing birds demonstrating elements of nesting behavior (lekking, mating, restlessness at nests). Nesting was considered possible when observing birds during the nesting period on permanent sites in suitable conditions for nesting.

Species names and listing order are given according to E.A. Koblik et al. (2006) and V.K. Ryabitsev (2008).

Results and discussion

The species composition of birds, noted at the airfield of Balandino, their distribution, and abundance category are presented in Table 1.

The number of species recorded at the airfield has increased from 61 in 1990 to 123 in 2019–2021. The lowest species diversity in 1990 is explained by the fact that the survey was performed by only one person at that time, when main attention was paid to the counts of birds crossing the airfield, so the incomplete identification of the faunal composition was quite natural. The highest indicator of species diversity for the period of 2019–2021 is easily explained by the fact that one of the authors became a full-time employee of the airport, i.e., having more time for research and greater freedom to move around the territory of the airfield. In total, 144 species of birds belonging to 16 orders and 39 families were registered for the 30-year study period, constituting about 50% of the species composition of birds in the Chelyabinsk Region (Zakharov and Gashek, 2012). More than half of all registered species (53%) belong to the order Passeriformes. The share of Charadriiformes and Falconiformes is 14% and 11%, respectively, Anseriformes, 6%. Other orders are represented in the fauna of the airfield insignificantly (3% or less).

Abundance and total population density of birds nesting on the territory of the airfield from 1990 to 2020 are presented in Table 2.

During entire study period, 54 bird species were registered nesting on the territory of the airfield. The share of representatives of the order Passeriformes accounted for 72%, Columbiformes, 7%, other orders were represented by less than 5% each. In 1990, 24 species were noted for nesting, in 2007, 42 species, in 2011, 46 species, in 2014, 45 species, in 2017, 47 species, and in 2020, 36 species. The total bird population density varied from 149 ind./km² in 1990 to 215 ind./km² in 2020 (Fig. 3). The minimum population density was observed in 1990, when the survey was carried out by only one person, whose main task was to count the number of birds crossing the runway. Therefore, errors in accounting for birds nesting in the peripheral areas of the airfield were inevitable.

Table 1. List of bird species noted at the airfield in 1990–2021. Distribution: nest – nesting species; nest? – probably nesting; migr – found during seasonal migration; temp – spend some time on the airfield, coming from neighboring areas; win – wintering, vagr – vagrant species. Abundance categories: com – common, num – numerous, few – few in numbers, small – small in numbers, rare – rare, vr – very rare. "–" – not registered.

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
1	Great crested grebe *Podiceps cristatus* (L., 1758)	–	–	vagr, rare	–	–	–
2	Great cormorant *Phalacrocorax carbo* (L., 1758)	–	–	migr, rare	–	migr, rare	migr, rare
3	Grey heron *Ardea cinerea* L., 1758	migr, small	migr, small	migr, small	migr, small	migr, small	migr, small
4	Greylag goose *Anser anser* (L., 1758)	migr, small	–	–	migr, rare	–	–
5	Greater white-fronted goose *A. albifrons* (Scop., 1769)	–	–	–	migr, rare	–	migr, rare
6	Mute swan *Cygnus olor* (J.F. Gmelin, 1789)	–	–	–	migr, small	migr, small	migr, small
7	Whooper swan *C. cygnus* (L., 1758)	–	–	–	–	migr, small	migr, small
8	Common shelduck *Tadorna tadorna* (L., 1758)	–	–	–	–	–	migr, vr
9	Mallard *Anas platyrhynchos* L., 1758	migr, few	migr, few	migr, few	migr, small	migr, small	migr, small
10	Eurasian teal *A. crecca* (L., 1758)	migr, few	–	–	–	–	–
11	Garganey *A. querquedula* L., 1758	migr, small	–	–	–	–	–
12	Northern shoveler *A. clypeata* L., 1758	migr, small	–	–	–	–	–
13	European honey buzzard *Pernis apivorus* L., 1758	–	–	–	–	–	migr, small
14	Black kite *Milvus migrans* (Bodd., 1783)	–	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com
15	Hen harrier *Circus cyaneus* (L., 1766)	migr, few	migr, few	migr, few	migr, few	migr, few	migr, few
16	Pallid harrier *C. macrourus* (S.G. Gmelin, 1771)	–	–	–	–	–	migr., rare
17	Montagu's harrier *C. pygargus* (L., 1758)	nest?, few	vagr, few	vagr, few	vagr, few	vagr, few	vagr, few

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
18	Western marsh harrier *C. aeroginosus* (L., 1758)	temp, com	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com
19	Northern goshawk *Accipiter gentilis* (L., 1758)	temp, few	vagr, few	–	–	–	vagr, few
20	Eurasian sparrowhawk *A. nisus* (L., 1758)	temp, com	nest?, com	nest, com	nest, com	nest, com	nest, com
21	Rough-legged buzzard *Buteo lagopus* (Pontop., 1763)	migr, com	migr, com	migr, com	migr, com	migr, com	migr, com
22	Common buzzard *B. buteo* (L., 1758)	temp, com	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com
23	White-tailed eagle *Haliaeetus albicilla* (L., 1758)	–	–	–	migr, rare	migr, rare	migr, rare
24	Gyrfalcon *Falco rusticolus* L., 1758	–	–	–	–	–	migr, vr
25	Eurasian hobby *F. subbuteo* L., 1758	–	nest, com	nest, com	nest?, com	vagr, com	vagr, rare
26	Merlin *F. columbarius* L., 1758	–	–	migr, vr	–	–	–
27	Red-footed falcon *F. vespertinus* L., 1766	migr, rare	–	migr, rare	migr, rare	migr, rare	vagr, rare
28	Common kestrel *F. tinnunculus* L., 1758	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
29	Black grouse *Lyrurus tetrix* (L., 1758)	–	–		vagr, com	vagr, com	vagr, com
30	Grey partridge *Perdix perdix* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
31	Common quail *Coturnix coturnix* (L., 1758)	–	nest, com	nest, com	nest, com	nest, com	nest, com
32	Common crane *Grus grus* (L., 1758)	migr, few	–	migr, few	migr, few	migr, few	migr, few
33	Corn crake *Crex crex* (L.,1758)	–	nest, com	nest, com	nest, com	nest, com	–
34	Eurasian stone-curlew *Burhinus oedicnemus* (L., 1758)	–	–	–	–	–	vagr, vr
35	Grey plover *Pluvialis squatarola* (L., 1758)	migr, rare	–	–	–	migr, rare	migr, small
36	Common ringed plover *Charadrius hiaticula* L., 1758	–	–	migr, rare	–	–	–

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
37	Little ringed plover *Ch. dubius* (Scop., 1786)	migr, rare	–	–	–	–	–
38	Northern lapwing *Vanellus vanellus* (L., 1758)	migr, few	nest?, few	vagr, com	nest?, few	vagr, com	nest, com
39	Green sandpiper *Tringa ochropus* L., 1758	migr, small	–	–	–	–	vagr, few
40	Wood sandpiper *T. glareola* L., 1758	–	migr, rare	–	–	migr, rare	–
41	Tringa *Tringa* sp.	–	–	–	–	migr, rare	–
42	Common redshank *T. totanus* (L., 1758)	–	–	–	migr, rare	–	–
43	Ruff *Philomachus pugnax* (L., 1758)	migr, few	migr, few	–	–	–	migr, rare
44	Little stint *Calidris minuta* (Leisler, 1812)	–	migr, small	migr, small	–	–	migr, small
45	Dunlin *C. alpina* (L., 1758)	–	migr, rare	migr, rare	–	–	–
46	Common snipe *Gallinago gallinago* (L., 1758)	–	migr, few	–	–	migr, few	migr, few
47	Great snipe *G. media* (Latham, 1787)	–	–	–	–	–	migr, rare
48	Eurasian woodcock *Scolopax rusticola* L., 1758	–	–	–	–	–	migr, small
49	Black-tailed godwit *Numenius arquata* (L., 1758)	–	–	–	–	vagr, rare	–
50	Black-headed gull *Larus ridibundus* L., 1766	temp, migr; com	vagr, migr; com	vagr, migr; com	vagr, migr; rare	vagr, migr; com	vagr, migr; small
51	Baraba gull *L. barabensis* (Johansen, 1960)	temp, migr, num	vagr, migr; num	vagr, migr; num	vagr, migr; few	vagr, migr; com	vagr, migr; few
52	Common gull *L. canus* L., 1758	–	vagr, migr; com	vagr, migr; com	vagr, migr; rare	vagr, migr; com	vagr, migr, com
53	Common tern *Sterna hirundo* L., 1758	temp, migr; small	vagr, migr; small	vagr, migr; small	vagr, migr; rare	vagr, migr; rare	–

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
54	Common wood pigeon *Columba palumbus* L., 1758	–	nest, few	nest, few	nest, few	nest, few	nest (small), vagr, migr (com)
55	Stock dove *C. oenas* L., 1758	nest?, few	nest?, small	nest?, small	nest?, small	vagr, migr; com	vagr, migr; com
56	Rock dove *C. livia* J.F. Gmelin, 1789	nest (com), temp (num)	nest (few), vagr (num)	nest (few), vagr (num)	nest (few), vagr (com)	nest (few), vagr (com)	nest (few), vagr (com)
57	European turtle dove *Streptopelia turtur* (L., 1758)	–	–	nest, rare	–	–	–
58	Oriental turtle dove *S. orientalis* (Lath., 1790)	–	–	vagr, migr, com	–	–	vagr, migr, com
59	Common cuckoo *Cuculus canorus* L., 1758	–	nest?, small	vagr, migr, com	nest?, small	nest?, small	nest?, small
60	Snowy owl *Nyctea scandiaca* (L., 1758)	–	–	–	win, few	–	win, small
61	Long-eared owl *Asio otus* (L., 1758)	–	–	–	–	vagr, few	nest, com
62	Short-eared owl *A. flammeus* (Pontop., 1763)	–	nest?, com	nest, com	nest?, com	nest, com	nest, com
63	European nightjar *Caprimulgus europaeus* L., 1758	–	vagr, rare	–	–	–	vagr, rare
64	Common swift *Apus apus* (L., 1758)	–	nest, few	nest, few	nest, few	nest, com	nest, com
65	Eurasian hoopoe *Upupa epops* L., 1758	–	vagr, rare	–	–	–	–
66	Black woodpecker *Dryocopus martuis* (L., 1758)	–	vagr, rare	–	vagr, small	–	vagr, small
67	Great spotted woodpecker *Dendrocopos major* (L., 1758)	temp, com	nest, few	nest, few	nest, few	nest, few	vagr, small
68	White-backed woodpecker *D. leucotos* (Bechst., 1803)	–	–	–	–	–	vagr, rare
69	Sand martin *Riparia riparia* (L., 1758)	temp, migr, small	vagr, migr, small	–	–	–	vagr, migr, small
70	Barn swallow *Hirundo rustica* L., 1758	temp, com	nest, com	nest, com	nest, com	nest, com	nest, com
71	Horned lark *Eremophila alpestris* (L., 1758)	–	–	–	–	–	migr, few

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
72	Eurasian skylark *Alauda arvensis* L., 1758	nest, num	nest, num	nest, num	nest, com	nest, num	nest, num
73	Tree pipit *Anthus trivialis* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
74	Red-throated pipit *An. cervinus* (Pall., 1811)	–	migr, rare	–	–	–	–
75	Western yellow wagtail *Motacilla flava* L., 1758	nest, num	nest, num	nest, num	nest, num	nest, num	nest, num
76	Citrine wagtail *M. (citreola) werae* Buturlin, 1908	–	–	–	–	–	migr, rare
77	White wagtail *M. alba* L., 1758	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
78	Red-backed shrike *Lanius collurio* L., 1758	–	–	–	–	nest, small	nest, small
79	Great grey shrike *L. excubitor* L., 1758	–	–	vagr; small	vagr; small	vagr; small	vagr; few
80	Eurasian golden oriole *Oriolus oriolus* (L., 1758)	–	nest?, small	nest, small	nest?, small	nest, small	migr, small
81	Common starling *Sturnus vulgaris* L., 1758	temp, migr; com	nest?, small	vagr, migr, few	migr, small	migr, small	vagr, migr; small
82	Eurasian jay *Garrulus glandarius* (L., 1758)	–	–	–	–	–	vagr, rare
83	Eurasian magpie *Pica pica* (L., 1758)	nest, few	nest, com	nest, com	nest, com	nest, com	nest, com
84	Eurasian jackdaw *Corvus monedula* L., 1758	temp, num	nest? (few); vagr (num)	vagr, num	vagr, com	vagr, com	vagr, com
85	Rook *C. frugilegus* L., 1758	temp, num	vagr, migr, num	vagr, migr, num	vagr, migr, few	migr, rare	migr, rare
86	Hooded crow *C. (corone) cornix* L., 1758	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
87	Common raven *C. corax* L., 1758	temp, com	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com
88	Bohemian waxwing *Bombycilla garrulus* (L., 1758)	migr, win; few	migr, win; few	–	migr, win; few	migr, win; few	migr, win; few
89	Common grasshopper warbler *Locustella naevia* (Bodd., 1783)	–	nest, few	nest, com	nest, com	nest, com	nest, com
90	Sedge warbler *Acrocephalus schoeno-baenus* (L., 1758)	–	–	–	–	–	migr, vr

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
91	Blyth's reed warbler *Ac. dumetorum* Blyth, 1849	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
92	Booted warbler *Hippolais icterina* (M.N.K. Lichtenstein, 1823)	–	–	nest, com	nest, few	nest, com	nest, com
93	Garden warbler *Sylvia borin* (Bodd., 1783)	–	nest, few	nest, few	nest, few	nest, few	migr, few
94	Common whitethroat *S. communis* Lath., 1787	nest, few	nest, com	nest, com	nest, few	nest, com	nest, com
95	Lesser whitethroat *S. curruca* (L., 1758)	–	nest, few	nest, few	nest, few	nest, few	nest, rare
96	Willow warbler *Phylloscopus trohilus* (L., 1758)	–	–	–	–	nest?, small	migr, com
97	Common chiffchaff *Ph. collybita* (Viellot, 1817)	nest, few	nest, com	nest, com	nest, com	nest, com	nest, few
98	Greenish warbler *Ph. trochiloides* (Sund., 1837)	–	–	–	–	nest, small	migr, small
99	Goldcrest *Regulus regulus* (L., 1758)	–	–	–	–	–	win, rare
100	European pied flycatcher *Ficedula hypoleuca* (Pall., 1764)	–	–	–	–	–	migr, few
101	Spotted flycatcher *Muscicapa striata* (Pall., 1764)	nest, few	–	–	–	–	migr, few
102	Whinchat *Saxicola rubetra* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
103	Eurasian stonechat *S. torquata* (L., 1766)	nest, num	nest, com	nest, num	nest, num	nest, num	nest, num
104	Northern wheatear *Oenantge oenanthe* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
105	Common redstart *Phoenicurus phoenicurus* (L., 1758)	–	nest, com	nest, com	nest, com	nest, com	nest, small
106	Black redstart*Ph. ochruros* (S.G. Gmelin, 1774)	–	–	–	–	–	nest, small
107	European robin *Erithacus rubecula* (L., 1758)	–	–	–	–	migr, small	migr, small
108	Thrush nightingale *Luscinia luscinia* (L., 1758)	nest, small	–	–	–	nest, small	migr, small
109	Bluethroat *L svecica* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
110	Fieldfare *Turdus pilaris* (L., 1758)	nest, com	nest, small	nest, small	nest, small	nest, small	migr, vagr; num
111	Redwing *T. iliacus* L., 1766	–	–	–	–	–	migr, com
112	Song thrush *T. philomelos* C.L. Brehm, 1831	temp, migr; com	nest, small	nest, small	nest, small	nest, rare	migr, com
113	Mistle thrush *T. viscivorus* L., 1758	–	–	–	–	migr, small	migr, small
114	Long-tailed tit *Aegithalos caudatus* (L., 1758)	–	vagr, few	–	–	–	vagr, com
115	Eurasian penduline tit *Remiz pendulinus* (L., 1758)	–	–	–	–	migr, small	migr, small
116	Willow tit *Parus montanus* Bald., 1827	nest, few	nest, few	nest, few	nest, few	nest, few	vagr, com
117	Coal tit *P. ater* L., 1758	–	–	–	–	–	vagr, com
118	Eurasian blue tit *P. caeruleus* L., 1758	–	–	–	–	nest?, small	vagr, vagr; few
119	Azure tit *P. cyanus* Pall., 1770	–	nest? (small), vagr (com)	–	vagr; com	vagr; com	vagr; com
120	Great tit *P. major* L., 1758	nest, com	nest, com	nest, com	nest, com	nest, com	nest, small
121	Eurasian nuthatch *Sitta europaea* L., 1758	–	nest, small	nest, small	nest, small	nest, small	vagr, com
122	Eurasian treecreeper *Certhia familiaris* L., 1758	–	–	–	–	–	vagr, vr
123	House sparrow *Passer domesticus* (L., 1758)	nest, com	nest, com	nest, com	–	–	–
124	Eurasian tree sparrow *P. montanus* (L., 1758)	nest, com	nest, com	nest, com	nest, com	nest, com	nest, com
125	Common chaffinch *Fringilla coelebs* L., 1758	nest (com), migr (num)	nest (com), migr (num)	nest (com), migr (num)	nest (com), migr (num)	nest (com), migr (num)	nest (rare), migr (num)
126	Brambling *F. montifringilla* L., 1758	–	–	–	–	–	migr, num
127	European greenfinch *Chloris chloris* (L., 1766)	–	nest, few	nest, few	nest, few	nest, few	vagr, vagr; com
128	Eurasian siskin *Spinus spinus* (L., 1758)	–	–	–	–	migr, com	migr, com

No.	Common and Latin names of species	Distribution					
		1990	2007	2011	2014 – 2015	2017	2019 – 2021
129	European goldfinch *Carduelis carduelis* (L., 1758)	temp, com	nest, few	nest, few	nest, few	nest, few	nest (small), vagr (num)
130	Common linnet *Acanthis cannabina* (L., 1758)	–	nest, small	nest, small	nest, small	nest, small	nest (small), vagr (num)
131	Common redpoll *A. flammea* (L., 1758)	win, com	–	–	win, com	win, com	win, num
132	Arctic redpoll *A. hornemanni* (Holboell, 1843)	–	–	–	–	–	win, num
133	Common rosefinch *Carpodacus erythrinus* (Pall., 1770)	–	–	–	–	–	nest, rare
134	Siberian long-tailed rosefinch *Uragus sibiricus* (Pall., 1773)	–	–	–	–	vagr, com	vagr, com
135	Pine grosbeak *Pinicola enucleator* (L., 1758)	–	–	–	–	–	win, rare
136	Red crossbill *Loxia curvirostra* L., 1758	–	–	–	–	migr, small	migr, small
137	Eurasian bullfinch *Pyrrhula pyrrhula* (L., 1758)	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com	vagr, com
138	Hawfinch*Coccothraustes coccothraustes* L., 1758	–	–	–	–	vagr, small	vagr, small
139	Yellowhammer *Emberiza citrinella* L., 1758	nest, few	nest, few	nest, few	nest, few	nest, few	temp, vagr, com
140	Ortolan bunting *E. hortulana* L., 1758	–	–	–	–	nest, small	nest, small
141	Common reed bunting *Schoeniclus schoeniclus* (L., 1758)	–	–	–	–	–	migr, rare
142	Little bunting *Ocyris pusillus* (Pall., 1776)	–	–	–	–	–	migr, small
143	Lapland longspur*Calcarius lapponicus* (L., 1758)	–	–	migr, rare	–	–	–
144	Snow bunting *Plectrophenax nivalis* (L., 1758)	–	migr, few	migr, few	–	–	migr, few
	Total number of species	**61**	**77**	**76**	**77**	**93**	**123**

Decrease in the number of nesting species in 2020 compared to 2007, 2011, 2014, and 2017 was apparently due to two main reasons. Firstly, this was a decrease of the total area of the airfield by 0.83 km² due to reconstruction of a site in the southern part for the building of a new air terminal and another site in the southwestern part occupied by aspen-birch forest outliers, where most forest- and shrub-associated species nested. The second reason was an increase in the area of artificial coverings by more than 0.2 km² and the construction of new facilities (treatment and some others) with a corresponding decrease of areas occupied by steppe-meadow communities. In addition, there was an extensive disturbance of the soil and grass cover caused by the airfield reconstruction, which led to the transformation of existing ecosystems and the reduction in the area of nesting and feeding grounds.

The disappearance of a number of forest- and shrub-associated species from the airfield avifauna or a decrease in their number, associated with changing of airfield area by excluding the sites occupied by forest outliers and shrubs, is purely formal. Therefore, we consider this discussion to be superfluous. Let us dwell only on the significant changes that have taken place in the fauna and bird population of the airfield. In 2007, 2011, and 2014, whinchat dominated by abundance over European stonechat and significantly outnumbered the last one in the steppe-meadow avian communities; it has sharply reduced its abundance in recent years. The population density of European stonechat, experiencing minor interannual fluctuations, in 2017–2021 exceeded the population density of whinchat four- to fivefold (Fig. 4). Probably, the instability of the interannual abundance of whinchat may be explained by its presence at the eastern border of its range.

Significant changes occurred in the number of house sparrow that nested in 1990–2011 in the buildings located at the airport. In 1990–2011, abundance of this species was 2.5–3.0 times lower than that of European tree sparrow, and since 2014 it was generally absent in the list of birds nesting at the airfield (Fig. 5). The reason for its disappearance is probably related to the general trend, which manifests itself in a large-scale depression in the abundance of house sparrow in the European part of the range (Baranovsky and Ivanov, 2016; BirdLife International, 2004; Leonova and Rakhimov, 2014; Odintseva, 2021; PECBMS, 2009; Zagorskaya, 2014; Zubakin, 2017). No quantitative assessment for the population of house sparrow in the settlements of the Chelyabinsk Region has been carried out; however, we can confidently state that it has been significantly decreasing over the past 10–15 years.

European turtle dove, one pair of which supposedly nested in forest outliers at the airfield in 2011, was never recorded later. The depression of this species throughout its range undoubtedly led to its almost complete disappearance in the Trans-Urals, located on the eastern periphery of the range (Gashek and Krasutsky, 2021; Krasnaya..., 2017).

In recent years, the nesting abundance of common swift has noticeably increased: in 1990, it was totally absent, in 2017 and 2020, its abundance was 5 and 7 ind./km^2, respectively (Fig. 6). This process is probably explained by the increase in the abundance of this species in urban areas in many regions (Garms, 2013; Kolpakova and Odintsev, 2015; Podolsky and Lobachev, 2016; Sokolov, 2010; Zagorskaya, 2021).

Black redstart is worth noting as the species that replenished the nesting population of birds at the airfield in 2020–2021. Three pairs of the European subspecies *Ph. o. gibraltariensis* were first recorded at Balandino in 2020 (Gashek and Zakharov, 2020), two of them nested at the airfield, one more, in the service area of the airport. In 2021, the same number of pairs were registered. In recent decades, the species has been actively spreading to the northeast (Ryabitsev, 2008), and cases of black redstart nesting are increasingly reported in the Southern Urals and Western Siberia (Barbazyuk, 2019; Davygora, 2017; Grazhdan, 2009; Lupinos, 2014; Lupinos et al., 2018; Lyakhov, 2014; Muradov and Mamatov, 2011; Zhimulev et al., 2006; Zhimulev et al., 2011). Ortolan bunting, first noted at the airfield in 2014, was consistently observed in subsequent years as two nesting pairs. It should be noted that in the Trans-Urals, the northern boundary of the species range lies along 56° N (Stepanyan, 1990), which preconditions sporadic distribution and low abundance here. However, in recent years, many researchers have noted an increase in the number of sightings of this species along the northern periphery of the range (Golovatin, 2020; Korovin, 2012, 2014; Korovin and Nefyodov, 2016; Ryabitsev and Ryabitsev, 2014; Tarasov, 2009; Tarasov and Polyakov, 2015).

During the entire observation period, European skylark dominated by abundance, its share in the bird population of the airfield varied from 22% in 1990 to 16% in 2020 (Fig. 7). Western yellow wagtail left the group of dominants only in 2011 (5%); in other periods, its share in the population varied from 14% in 1990 to 19% in 2020. Whinchat entered this group in 2011 and 2014 (11 and 13%, respectively); in 1990 and 2007, it was a subdominant, making up 7 and 9% of total population, respectively; in 2017 and 2020, its share decreased even more, down to 3 and 2%. European stonechat abundance reached maximum in 1990 (16%), in 2017 and 2020, it corresponded to 11 and 13%, in 2007 and 2011, 7 and 9%, respectively. European tree sparrow was in the group of dominants in 1990 (11%) and in 2014 (10%); in other years it was a subdominant by abundance (9% in 2007 and 2011, and 7% in 2020).

Table 2. Species composition, abundance and population density of birds nesting on the territory of the airfield in 1990–2020: "–" – the species did not nest, "?" – no data on species abundance is available.

No.	Species	Number of specimens/Abundance, ind./km²					
		1990	2007	2011	2014	2017	2020
1	Eurasian sparrowhawk *Accipiter nisus* (L., 1758)	–	2/0.5	2/0.5	2/0.5	2/0.5	2/0.7
2	Eurasian hobby *Falco subbuteo* L., 1758	–	2/0.5	2/0.5	2/0.5	–	–
3	Common kestrel *F. tinnunculus* L., 1758	2/0.5	2/0.5	2/0.5	2/0.5	4/1	6/2
4	Grey partridge *Perdix perdix* (L., 1758)	2/0.5	4/1	2/0.5	4/1	6/2	6/2
5	Common quail *Coturnix coturnix* (L., 1758)	–	8/2	6/2	10/3	6/2	8/3
6	Corn crake *Crex crex* (L., 1758)	–	4/1	6/2	10/3	4/1	–
7	Common wood pigeon *Columba palumbus* L., 1758	–	6/2	4/1	4/1	4/1	2/0.7
8	Stock dove *C. oenas* L., 1758	2/0.5	4/1	4/1	2/0.5	–	–
9	Rock dove *C. livia* J.F. Gmelin, 1789	20/5	6/2	4/1	8/2	6/2	6/2
10	European turtle dove *Streptopelia turtur* (L., 1758)	–	–	2/0.5	–	–	–
11	Common cuckoo *Cuculus canorus* L., 1758	–	?	?	?	?	?
12	Long-eared owl *Asio otus* (L., 1758)	–	–	–	–	2/0.5	2/0.7
13	Short-eared owl *A. flammeus* (Pontop., 1763)	–	–	4/1	4/1	4/1	4/1
14	Common swift *Apus apus* (L., 1758)	–	6/2	10/3	8/2	20/5	20/7
15	Great spotted woodpecker *Dendrocopos major* (L., 1758)	–	2/0.5	4/1	2/0.5	2/0.5	–
16	Barn swallow *Hirundo rustica* L., 1758	–	12/3	16/4	14/4	12/3	12/4
17	Eurasian skylark *Alauda arvensis* L., 1758	120/32	100/26	100/26	140/37	100/26	100/34
18	Tree pipit *Anthus trivialis* (L., 1758)	10/3	30/8	40/11	50/13	40/11	30/10
19	Western yellow wagtail *Motacilla flava* L., 1758	80/21	80/21	40/11	120/32	120/32	120/41
20	White wagtail *M. alba* L., 1758	12/3	10/3	12/3	10/3	12/3	12/4
21	Eurasian golden oriole *Oriolus oriolus* (L., 1758)	–	–	4/1	2/0.5	2/0.5	–
22	Eurasian magpie *Pica pica* (L., 1758)	4/1	14/4	14/4	14/4	12/3	12/4
23	Hooded crow *Corvus (corone) cornix* L., 1758	6/2	12/3	14/4	12/3	8/2	6/2
24	Common grasshopper warbler *Locustella naevia* (Bodd., 1783)	–	8/2	20/5	30/8	20/5	20/7

No.	Species	Number of specimens/Abundance, ind./km²					
		1990	2007	2011	2014	2017	2020
25	Blyth's reed warbler *Acrocephalus dumetorum* Blyth, 1849	18/5	12/3	16/4	20/5	16/4	12/4
26	Booted warbler *Hippolais caligata* (M.N.K. Lichtenstein, 1823)	–	–	20/5	16/4	40/11	40/14
27	Garden warbler *Sylvia borin* (Bodd., 1783)	–	10/3	12/3	10/3	4/1	–
28	Common whitethroat *S. communis* Lath., 1787	6/2	40/11	50/13	40/11	40/11	30/10
29	Lesser whitethroat *S. curruca* (L., 1758)	–	10/3	8/2	10/3	6/2	2/0.7
30	Willow warbler *Phylloscopus trohilus* (L., 1758)	–	–	–	–	2/0.5	–
31	Common chiffchaff *Phylloscopus collybita* (Viellot, 1817)	8/2	12/3	14/4	12/3	20/5	6/2
32	Greenish warbler *Ph. trochiloides* (Sund., 1837)	–	–	–	–	4/1	–
33	Whinchat *Saxicola rubetra* (L., 1758)	36/10	60/16	100/26	120/32	20/5	16/5
34	Eurasian stonechat *S. torquata* (L., 1766)	90/24	50/13	80/21	60/16	80/21	80/27
35	Northern wheatear *Oenanthe oenanthe* (L., 1758)	18/5	14/4	20/5	16/4	12/3	10/3
36	Common redstart *Phoenicurus phoenicurus* (L., 1758)	–	10/3	8/2	10/3	6/2	2/0.7
37	Black redstart *Ph. ochruros* (S.G. Gmelin, 1774)	–	–	–	–	–	4/1
38	Thrush nightingale *Luscinia luscinia* (L., 1758)	2/0.5	–	–	–	2/0.5	–
39	Bluethroat *Luscinia svecica* (L., 1758)	8/2	14/4	20/5	14/4	10/3	8/3
40	Fieldfare *Turdus pilaris* L., 1758	–	2/0.5	4/1	2/0.5	–	–
41	Song thrush *T. philomelos* C.L. Brehm, 1831	–	6/2	4/1	4/1	2/0.5	–
42	Willow tit *Parus montanus* Bald., 1827	6/2	4/2	8/2	6/2	4/1	–
43	Eurasian blue tit *P. caeruleus* L., 1758	–	–	–	–	2/0.5	–
44	Great tit *P. major* L., 1758	12/3	6/2	8/2	10/3	12/3	4/1
45	Eurasian nuthatch *Sitta europaea* L., 1758	–	2/0.5	8/2	4/1	2/0.5	–
46	House sparrow *Passer domesticus* (L., 1758)	20/5	20/5	30/8	–	–	–
47	Eurasian tree sparrow *P. montanus* (L., 1758)	60/16	60/16	80/21	90/24	40/11	40/14
48	Common chaffinch *Fringilla coelebs* L., 1758	6/2	10/3	10/3	12/3	10/3	4/1
49	European greenfinch *Chloris chloris* (L., 1758)	–	6/2	8/2	6/2	4/1	–
50	European goldfinch *Carduelis carduelis* (L., 1758)	–	8/2	12/3	10/3	8/2	2/0.7

No.	Species	Number of specimens/Abundance, ind./km²					
		1990	2007	2011	2014	2017	2020
51	Common linnet *Acanthis cannabina* L., 1758	–	4/1	2/0.7	4/1	4/1	2/0.7
52	Common rosefinch *Carpodacus erythrinus* (Pall., 1770)	–	–	–	–	–	2/0.7
53	Yellowhammer *Emberiza citrinella* (L., 1758)	8/2	4/1	6/2	10/3	6/2	–
54	Ortolan bunting *E. hortulana* L., 1758	–	–	–	4/1	4/1	4/1
	Total number of species	**24**	**42**	**46**	**45**	**47**	**36**
	Total number of specimens	**566**	**676**	**840**	**940**	**746**	**636**
	Total bird abundance, ind./km²	**149**	**178**	**222**	**248**	**197**	**215**

The most significant changes occurred in the presence of transit species crossing the territory of the airfield during seasonal and daily (feeding) migrations. These changes primarily affected rook, jackdaw, rock dove, as well as three gull species (Baraba gull, black-headed gull, and common gull). In order to analyze the long-term dynamics of the abundance of these species, we used data obtained by our colleague for the period from the beginning of July to the end of October in 2007, 2011, 2014, 2017, 2020, and 2021. In 2007 and 2011, birds were counted in the eastern part of the airfield, in 2014 and 2017, in the western part, in 2020 and 2021, when walking around the airfield along the perimeter. Despite such differences in the counting methods, general trends in the dynamics of the abundance of these species can be traced quite clearly. In particular, the number of rooks turned out to be maximum in 2007 (6368 ind.). By 2011, it decreased by almost 5 times, down to 1321 ind. (Fig. 8), in 2014, it decreased by almost 14 times. Further changes were no longer significant (73 ind. in 2017 and 42 ind. in 2021). A rather similar pattern was observed for jackdaw (Fig. 8). In 2007, 7835 ind. were observed; by 2011, it decreased by more than 80% (1532 ind.), and in 2014, by almost 48 times, when only 32 individuals of this species were registered. However, later, some increase was observed: 617 ind. in 2017, 282 ind. in 2020, and 316 ind. in 2021. These phenomena can be explained by several reasons:

– a significant reduction in the areas of agricultural land in the vicinity of the airport, which served as important feeding grounds for these two species;

– a decrease in the number of rooks almost throughout the entire territory of its range in Russian (Bragin and Bragina, 2019; Isakov et al., 2019; Ivanchev et al., 2012; Korovin et al., 2018; Marochkina et al., 2015; Shvets and Naumov, 2017).

Jackdaw, being a species not as strongly associated with agricultural land as rook, could probably switch to other types of food, in particular, food waste in the settlements adjacent to the airport. This may explain some increase in its number after 2014.

Apparently, the almost fourfold reduction in the number of rock doves in 2011 compared to 2007 (from 2549 to 680 ind., respectively) and keeping this trend in subsequent years (Fig. 8) was also caused by transformation of agricultural land, which served as an important feeding ground for this species.

The dynamics of gull species has different pattern. There was an outbreak of abundance of all three species in 2011 compared to 2007 (Fig. 9). This cannot be explained in any way, since this peak has observed during the autumn migration, when the causes of a certain phenomenon in the bird's life are hardly tracked by the observer. A further decrease in the number of gulls in comparison with 2011 was probably due to the end of operation and reclamation of MSW landfill of the city of Chelyabinsk in September 2018. The city MSW landfill was located 9 km southwards off the airport; it was one of the main places of accumulation birds on the airfield territory, as well as the source of their flights towards the airport and back. In 2020, the number of gulls counted during the flight over the airfield has increased again. This was probably due to the fact that after the closure of the urban solid waste landfill, birds, which were nesting on the lakes to the south of the airport, reoriented to feeding at the Urefta solid waste landfill, located 12 km northwestwards off the airfield. However, after the reclamation of the Urefta test site, which has been started in the summer of 2021, gulls stopped visiting this area. Apparently, this was the reason for significant decrease of the number of these birds crossing the territory of the airfield.

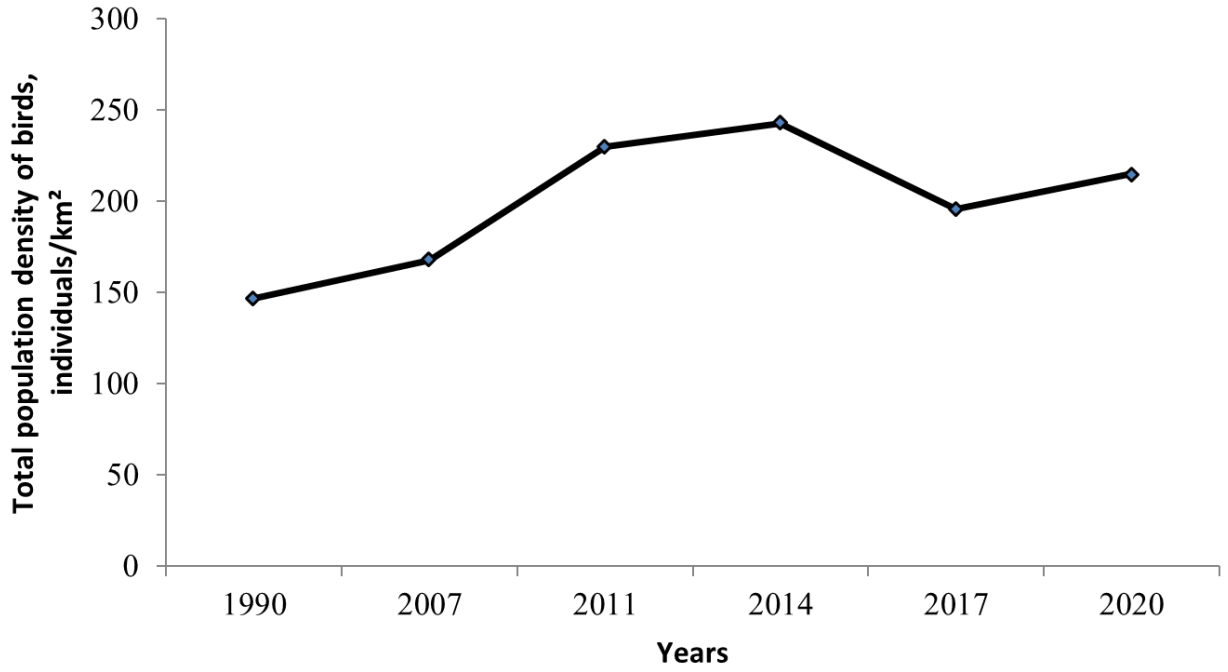

Fig. 3. Long-term dynamics of the bird population density on the airfield.

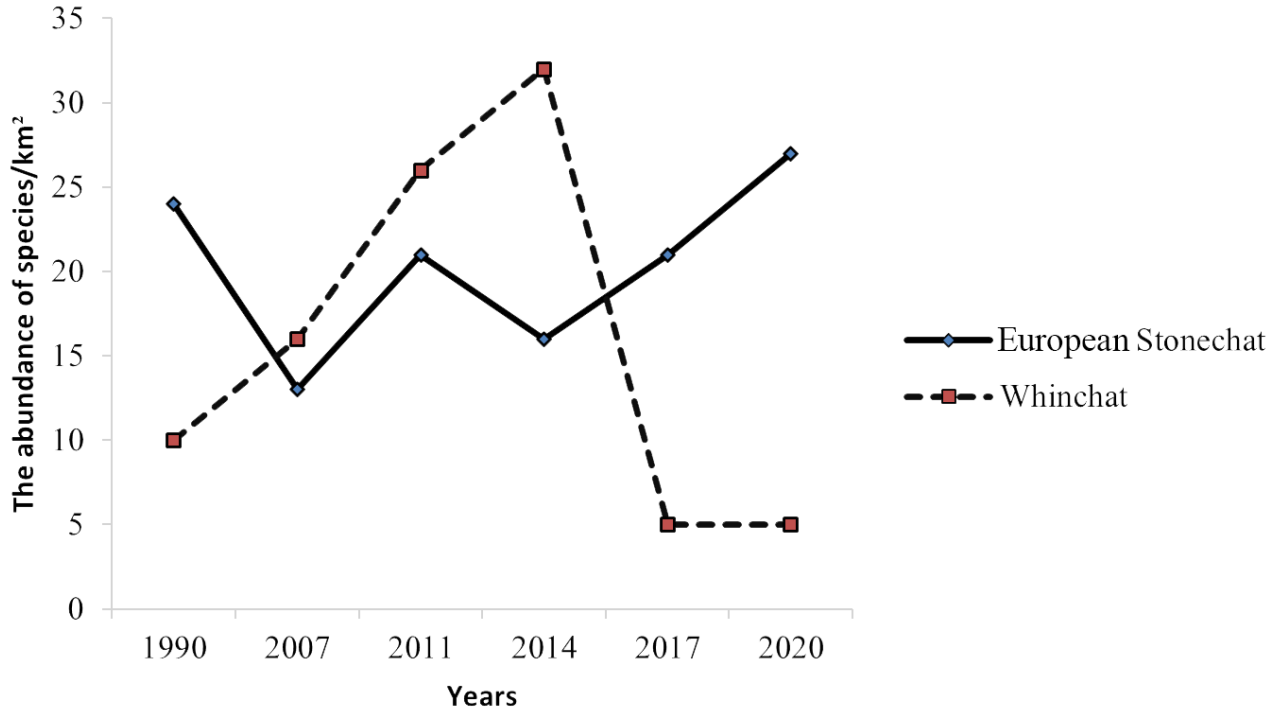

Fig. 4. Dynamics of the population density of whinchat and European stonechat in 1990–2020.

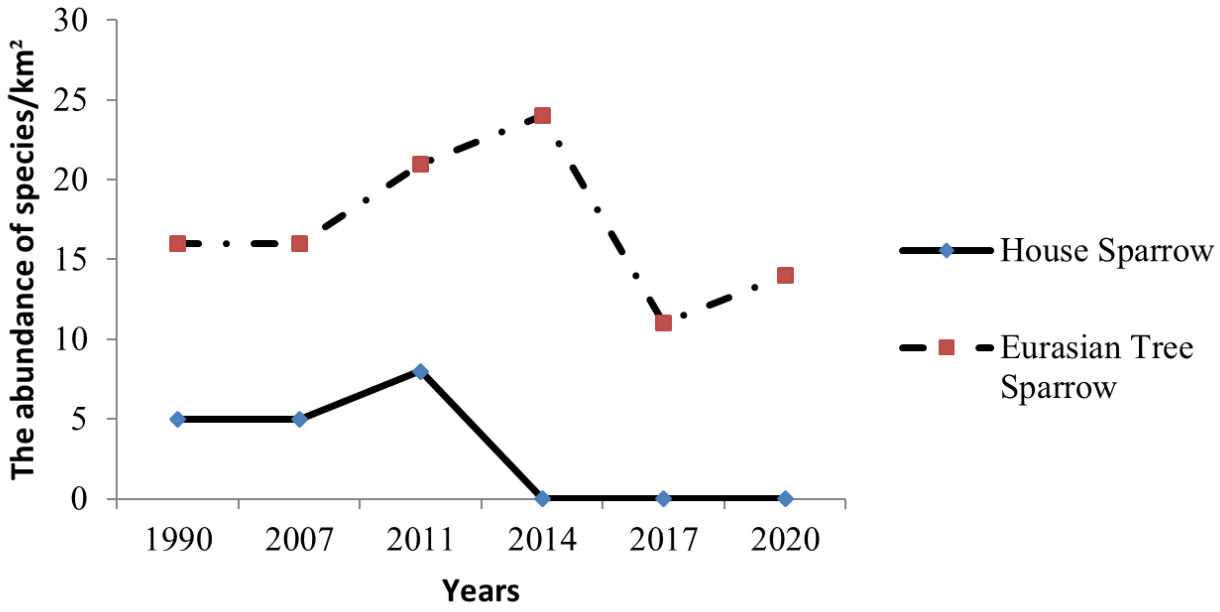

Fig. 5. Dynamics of the population density of house sparrow and Eurasian tree sparrow in 1990–2020.

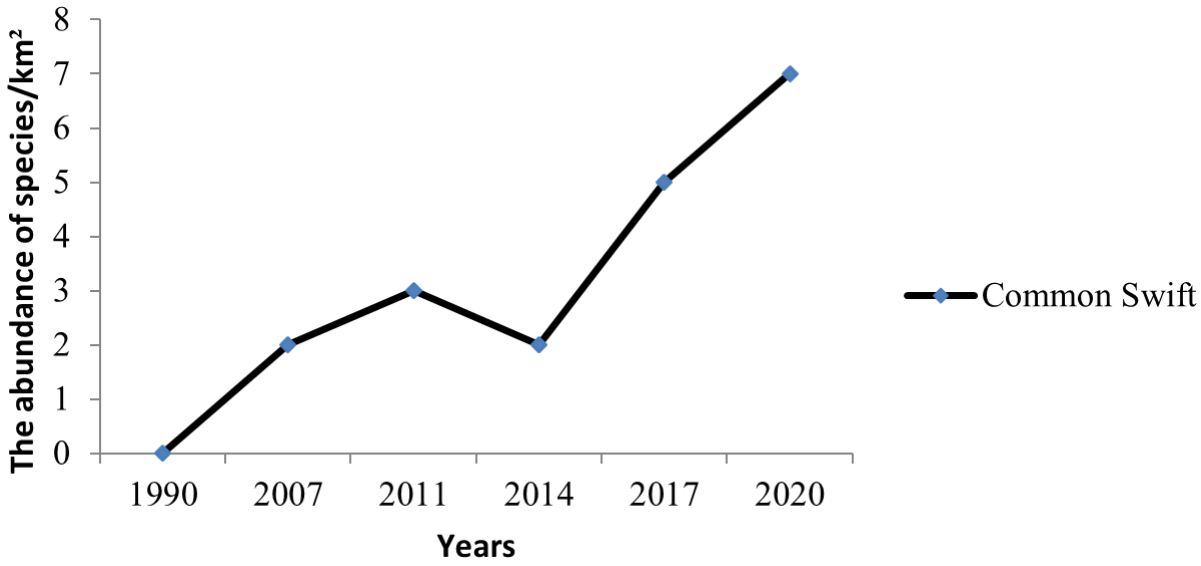

Fig. 6. Common swift population density dynamics in 1990–2020.

Conclusions

In total, 144 bird species were recorded, 54 of which were nesting, on the territory of the Balandino airfield in 1990–2021. The maximum number of nesting species (47) was noted in 2017, the minimum (24), in 1990, when the survey was carried out by only one person (two persons in other years). The total bird population density varied from 149 ind./km^2 in 1990 to 215 ind./km^2 in 2020.

The Eurasian skylark dominated absolutely by abundance throughout the study period; its share in total abundance varied from 16 to 22%. In different years, the group of dominants also included western yellow wagtail, European tree sparrow, whinchat, and European stonechat.

In recent years, the abundance of common swift has increased markedly. The number of transit species (rook, jackdaw, rock dove, Baraba gull, black-headed gull, and common gull) has significantly decreased. These changes are associated with a significant reduction in the area of agricultural land in the vicinity of the airport and the elimination of two solid waste land-

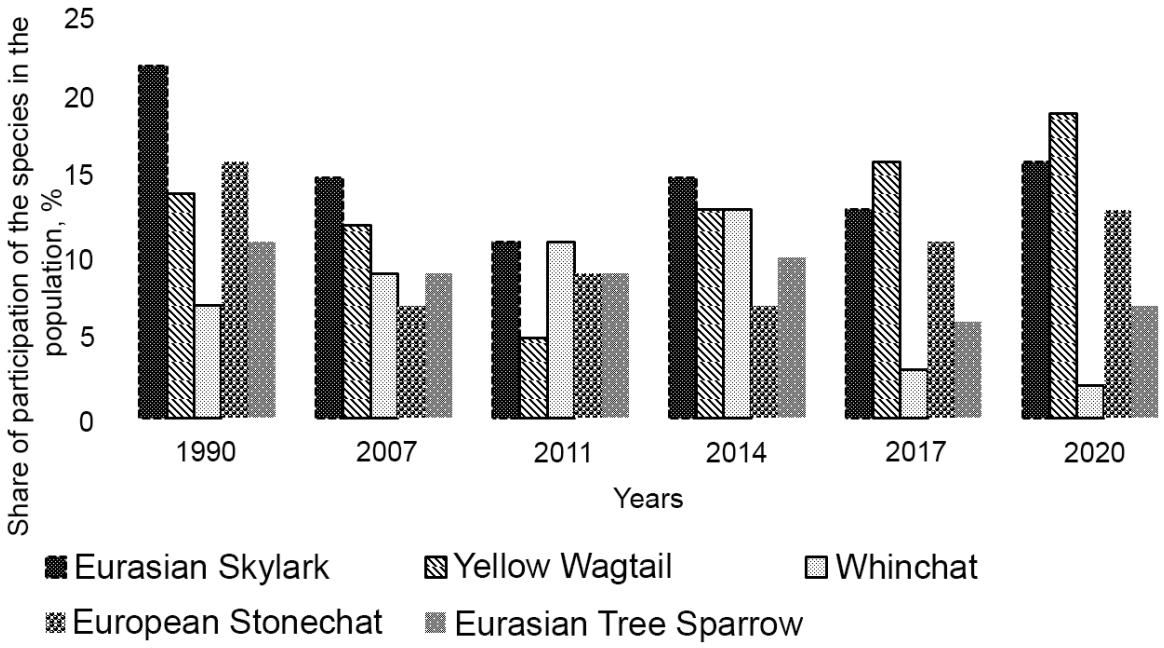

Fig. 7. Dynamics of the dominant species composition of the airfield bird population in 1990–2020.

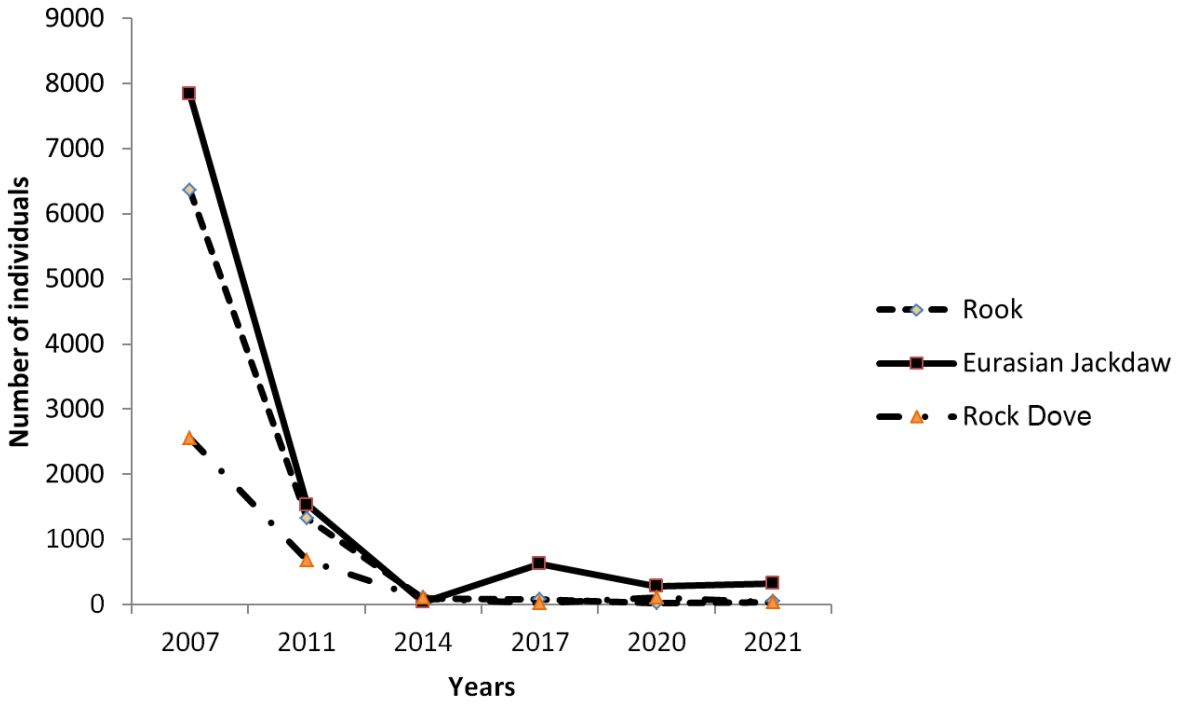

Fig. 8. The number of eurasian jackdaw, rook, and rock dove (ind.) recorded during the flights over the airfield in 2007–2021.

fills located on the airfield territory and serving as important feeding grounds for these species. In addition, a catastrophic decline in the number of rooks throughout the Russian part of its range had a great impact.

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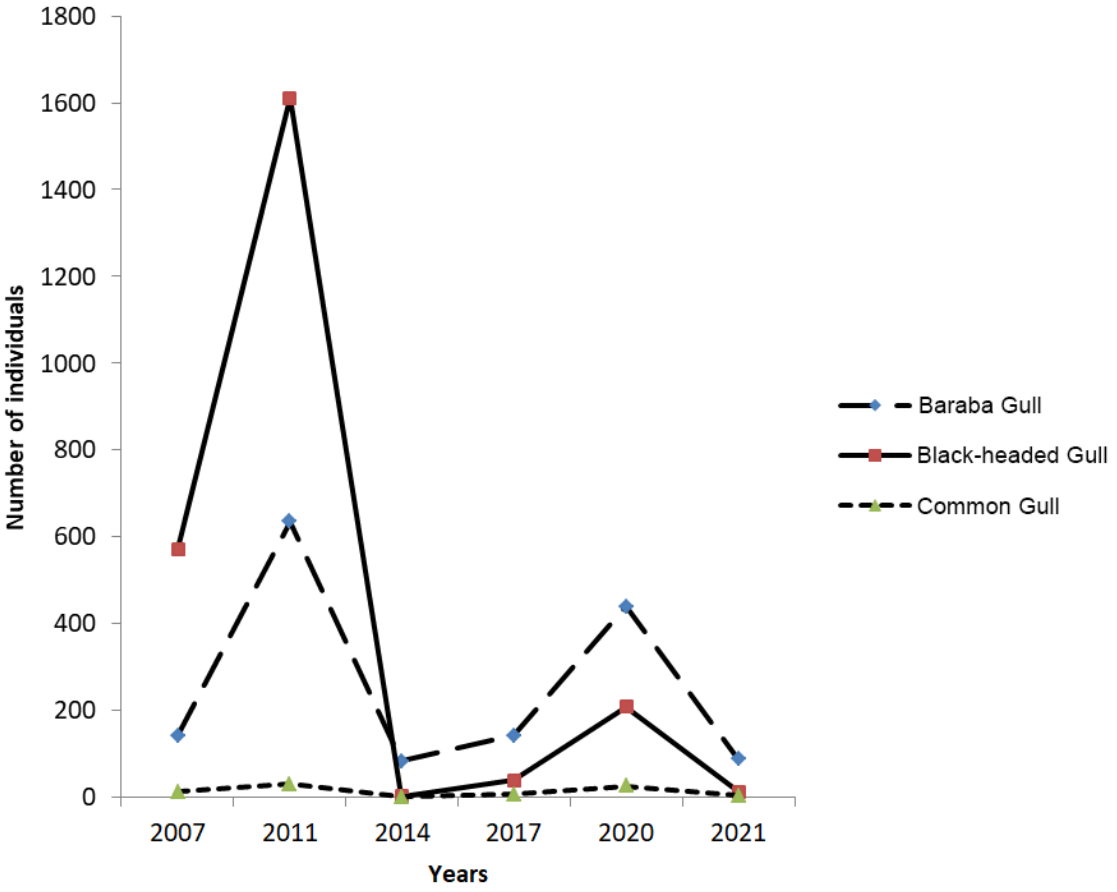

Fig. 9. The number of Baraba gull, black-headed gull, and common gull (ind.) recorded during the flights over the airfield in 2007–2021.

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