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A comparison of farmland avifauna between Finnish and Russian Karelia

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The intensification of agricultural management has reduced the populations of farmland birds throughout Europe, including Finland. During the past 50 years, changes in agricultural practices have been more dramatic in Finnish Karelia than in the adjacent areas in Russia. This unique large scale experimental arrangement was utilised in a field study in 1998 and 1999 when the farmland avifauna was studied using line transect counts (n = 25) and point censuses of night-singing birds (n = 118). The composition and abundance of species in general was rather similar on both sides of the border. However, the species favouring scrub (night-singers) and pastures (*Crex crex, Sturnus vulgaris, Motacilla flava*) were more abundant in Russia whereas species benefiting from cereal cultivation (*Emberiza hortulana, E. citrinella*) or the openness of fields (*Numenius arquata*) were concentrated in Finland. In future, changes in the agricultural policy, e.g. increased establishment of shelter-beds and abandonment of mixed farms in Finland and the privatisation of farms in Russia, are likely to change this pattern.

1. Introduction

In Europe, one of the greatest changes caused by mankind is the clearing of agricultural land and the simultaneous destruction of continuous forest cover (Donald *et al.* 2002). In forest dominated boreal regions, the development of agriculture created a large amount of new open ecosystems with a diverse flora and fauna (Tiainen 2001, Vainio *et al.* 2001). During the 20th century, the intensification of agricultural practices has, however, weakened living conditions for field birds throughout Europe (e.g. Bezzel 1985, Solonen 1985, Hagemeier & Blair 1997, Siriwardena *et al.* 1998). According to Tucker and Heath (1994), 60% of the threatened bird species in Europe live in cultivated areas. In Finland, fields cover only 8% of the land area (Tiainen 2001) and the proportion of bird species living in agro-environments is also lower. There are about 240 breeding bird species in Finland (Solonen 1994, Väisänen *et al.* 1998) of which around 50 species are adapted to the utilisation of field habitats (Solonen 1985). Only 14 of these are true field species which both nest and feed on fields, while the remaining 37 species actively utilise other habitats as well (Tiainen & Pakkala 2001). The proportion of threatened agricultural bird species is also lower in Finland compared to Europe in general. According to Rassi *et al.* (2001), about 19% of our extinct, threatened and near-threatened species are correlated with agricultural habitats.

During the last 50 years, human impact on agricultural environments has drastically differed between Finnish and the adjacent Russian Karelia. Since the Second World War, Finnish agriculture has become more intensive and efficient compared to that in Russia. New cultivation methods, underground drainage, effective machinery and increased use of pesticides, herbicides and fertilisers have increased crop production in Finland (Raatikainen 1986) although the field area has decreased due to the centralisation of production and depopulation of the countryside (National Board of Agriculture 1940–1998). At the same time, the amount of traditional agricultural environments including meadows and pastures has strongly declined in Finland (Vainio *et al.* 2001).

The corresponding changes in agricultural practices have remained smaller in Russian Karelia (Anonymous 2000). Under the Soviet administration, the cultivation of cereals was rare and the fields were primarily used for hay production (Pockney 1991). The number of fields has remained comparatively unchanged during the last few decades (Sunkin 1967, Koboev 1980, 1985, Volkov 1999). The recent poor economic situation has, however, led to the abandonment and overgrowth of fields and a decrease in the number of grazing animals in some areas (Kotiranta *et al.* 1998, Anonymous 2000). Dairy farming still constitutes the most important agricultural sector in Russian Karelia (Anonymous 2000).

Because natural conditions, e.g. climate, bedrock and vegetation, are similar on both sides of the present border (Ahti *et al.* 1968, Myllynen & Saastamoinen 1995, Kotiranta *et al.* 1998), the different history provides an excellent opportunity to study how the breeding avifauna differ between the rather traditionally and more intensively managed agroecosystems. This difference in the exploitation intensity between Finnish and Russian Karelia has been observed to affect the flora of semi-natural grasslands (Jantunen & Saarinen in press) and field edges (Jantunen & Saarinen 2002) whereas butterfly fauna in the field boundaries is rather similar on both sides of the border (Saarinen & Jantunen 2002). This study was carried out to detect whether the differences in agricultural practices reflect on the farmland avifauna. Species declined in Finland due to the intensified agricultural practices (e.g. *Crex crex*) were expected to be more abundant in Russia.

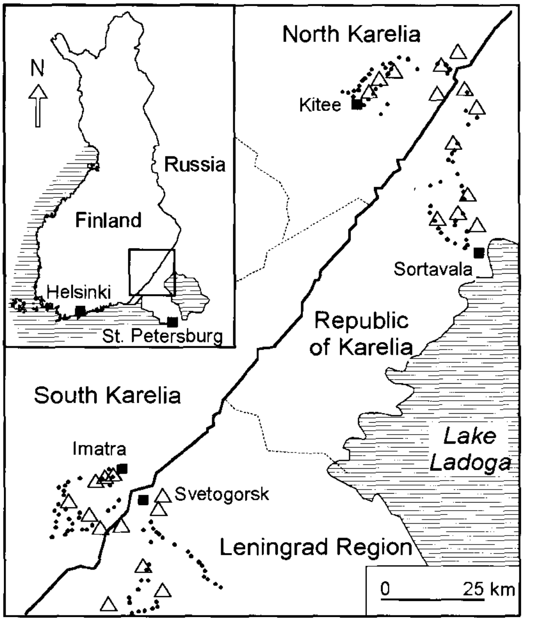

Fig. 1. Location of the study area in the border district of Finland and Russia. Transect count sites (n = 25) are indicated as triangles and point census sites (n = 118) as dots.

2. Material and methods

The breeding avifauna of farmlands was studied using two methods, viz. the line transect count (Järvinen *et al.* 1991) and the point census of night-singing birds (Hildén *et al.* 1991, note the modification in the listening time below). The study sites were mainly selected pair-wisely so that each study site has visually as similar a study site on the other side of the border as possible. The presence of bushes along ditch banks, the topography and the vegetation in general were the criteria used for the subjective selection of the study sites.

There were 12 and 13 line transect sites in Finnish and Russian Karelia, respectively (Fig. 1). In each site, the transect was censused twice in calm and rainless weather between either 9–25 June 1998 or 4–18 June 1999 in order to observe all breeding species. The first count was conducted between 4:00 and 10:00 Finnish time and the second count between 23:30 and 4:00. Each week, the Russian sites were counted first and their Finnish counterparts were censused one to three days later. All counts were made by the first author. The mean length of the transects was 906 m (range 514–1154 m) and 1107 m (720–1830 m) in Finland and Russia, respectively.

Six environmental factors, viz. the surrounding landscape, the amount of bushes and open ditches, the intensity of grazing and field management, and the cultivation of cereals were determined along transects using an order scale (Table 1). These factors (except for the amount of bushes) were not used as criteria for site selection but to describe the quality of the fields along the transect. In Finland, fields along the study transects were more effectively managed and more often cultivated by cereals (Table 1).

The bird fauna was examined on the basis of both single species and four ecological groups, i.e. true field species, edge species, forest species and farmyard species, specified by Tiainen and Pakkala (2001) (see grouping in Table 2). The density of breeding avifauna along each study transect, expressed as pairs/km^2, was estimated using a linear model in which the observations from both the main (50 m wide) and supplementary belt were taken into account (Järvinen & Väisänen 1975, 1977). The correction coefficients for the basic formula (Järvinen & Väisänen 1983)

Table 1. The distribution of study sites in different classes of environmental factors. Differences in environmental factors between countries were tested using a Mann Whitney *U* test. S indicates significant differences after the sequential Bonferroni correction.

Environmental factor	Class	Finland	Russia	Z	P
Surrounding landscape [a]	1	4	1		
	2	7	10		
	3	1	2	–1.454	0.247
Amount of bushes [b]	1	1	0		
	2	2	1		
	3	7	5		
	4	2	7	–1.985	0.068
Amount of open ditches [c]	1	1	0		
	2	6	5		
	3	5	8	–1.112	0.347
Intensity of grazing [d]	1	10	11		
	2	1	1		
	3	1	1	–0.085	0.979
Field management [e]	1	1	7		
	2	1	4		
	3	6	2		
	4	4	0	–3.311	0.001S
Cereal cultivation [f]	1	0	12		
	2	12	1	–4.522	<0.001S

a) 1 = open environments, 2 = both forests and open environments, 3 = mainly forests
b) 1 = low, 2 = continuous cover along one ditch/field edge, 3 = discontinuous cover along many ditches/field edges, 4 = continuous cover along many ditches/field edges
c) 1 = none, 2 = some, 3 = many
d) 1 = none, 2 = irregular, 3 = intensive
e) 1 = none, 2 = some action e.g. set-aside fields, 3 = regular at least in part of the site, 4 = annual
f) 1 = "no", 2 = "yes"

Table 2. The abundance of breeding birds in farmland sites in Finland and Russia, arranged according to their total density in ecological groups. % = the proportion of sites where a species was recorded, den = the mean number of pairs/square kilometre, SD = standard deviation, pairs = the total number of observed pairs. Abbreviations refer to Fig. 2b.

	Finnish Karelia				Russian Karelia			
	%	den	SD	pairs	%	den	SD	pairs
True field species (8)	100	45.1	24.4	143	100	48.5	30.4	178
Motacilla flava (Mfla)	50	6.5	9.0	12	77	12.1	9.9	29
Alauda arvensis (Aarv)	92	9.7	5.4	31	85	8.3	6.4	36
Crex crex (Ccre) **S	25	3.0	6.6	6	92	11.5	9.4	30
Vanellus vanellus (Vvan)	83	7.4	6.3	31	69	6.2	9.2	35
Anthus pratensis (Apra)	67	5.5	5.1	13	77	7.3	5.3	23
Emberiza hortulana (Ehor) ***S	75	9.4	6.4	23	8	0.2	0.9	1
Gallinago gallinago (Ggal)	42	1.3	2.1	8	77	2.0	1.6	16
Numenius arquata (Narq) **S	92	2.3	1.6	19	46	0.7	1.1	8
Edge species (11)	100	78.7	30.4	157	100	103.8	34.7	257
Sylvia communis (Scom)	100	23.9	12.1	44	92	19.0	9.6	42
Acrocephalus schoenobaenus (Asch)	83	16.0	12.6	37	85	26.1	21.2	74
Saxicola rubetra (Srub)	83	13.1	9.2	25	85	14.7	12.4	34
Carpodacus erythrinus (Cery)*	92	7.0	5.0	20	92	12.0	6.4	40
Acrocephalus dumetorum (Adum)	33	5.6	8.6	6	62	12.0	11.9	18
Acrocephalus palustris (Apal)	25	5.7	12.1	7	23	5.4	11.8	6
Emberiza schoeniclus (Esch)	50	3.9	5.3	8	69	6.1	7.8	16
Locustella naevia (Lnae)	42	2.4	3.1	8	92	3.9	2.0	18
Lanius collurio (Lcol)	8	0.9	3.3	1	46	4.2	5.1	6
Locustella fluviatilis (Lflu)	–	–	–	0	23	0.4	0.8	3
Circus cyaneus	8	0.1	0.5	1	–	–	–	0
Forest species (9) *	100	24.3	20.0	65	85	8.4	8.7	24
Emberiza citrinella (Ecit) **S	92	13.5	10.7	29	54	3.2	3.8	9
Turdus pilaris (Tpil)	25	4.2	9.3	7	46	5.0	6.3	10
Pica pica (Ppic)	58	2.6	2.5	10	23	0.7	1.4	3
Asio otus (Aotu)	17	1.3	3.1	2	–	–	–	0
Columba palumbus (Cpal)	33	1.3	2.7	9	–	–	–	0
Corvus corone cornix (Ccor)	25	0.3	0.6	3	15	0.2	0.5	2
Carduelis chloris	8	0.5	1.7	1	–	–	–	0
Falco tinnunculus (Ftin)	25	0.5	0.9	3	–	–	–	0
Streptopelia turtur	8	0.1	0.4	1	–	–	–	0
Farmyard species (9)	83	17.5	23.5	36	77	21.5	23.6	54
Sturnus vulgaris (Svul)	42	2.5	3.2	6	54	12.8	18.4	31
Motacilla alba (Malb)	42	5.4	7.4	6	54	5.0	5.1	8
Columba livia	8	5.0	17.5	7	–	–	–	0
Hirundo rustica (Hrus)	42	1.5	1.9	6	46	2.6	3.5	11
Delichon urbica	–	–	–	0	8	1.0	3.6	3
Passer montanus	8	1.1	3.7	1	–	–	–	0
Apus apus (Aapu)	25	0.8	2.0	8	8	0.1	0.4	1
Passer domesticus	8	0.8	2.8	1	–	–	–	0
Oenanthe oenanthe	8	0.5	1.6	1	–	–	–	0
Other species (16)	92	35.2	38.7	92	100	32.1	30.7	108
Phylloscopus trochilus (Ptro)	83	10.5	10.2	31	77	11.5	10.5	40
Sylvia borin (Sbor)	67	8.6	9.9	23	54	5.7	6.5	15
Fringilla coelebs (Fcoe)	50	5.2	8.5	12	46	3.4	4.5	8

Continues

Table 2. Continued.

	Finnish Karelia				Russian Karelia			
	%	den	SD	pairs	%	den	SD	pairs
Turdus iliacus (Tili)	33	1.6	2.5	4	54	4.5	5.0	14
Luscinia luscinia (Llus)	50	1.7	2.0	7	46	3.5	5.5	14
Anthus trivialis (Atri)	33	1.6	2.8	6	54	2.3	2.7	8
Parus major (Pmaj)	33	2.7	4.2	4	8	0.7	2.7	1
Parus caeruleus (Pcae)	17	2.4	6.2	3	–	–	–	0
Erithacus rubecula (Erub)	–	–	–	0	15	1.0	2.5	2
Muscicapa striata	8	0.9	3.0	1	–	–	–	0
Sylvia curruca (Scur)	–	–	–	0	15	0.7	1.9	2
Emberiza aureola	–	–	–	0	8	0.4	1.4	1
Falco subbuteo	–	–	–	0	8	0.4	1.3	1
Oriolus oriolus	–	–	–	0	8	0.2	0.6	1
Porzana porzana	–	–	–	0	8	0.2	0.6	1
Cuculus canorus	8	0.0	0.1	1	–	–	–	0
Total		203.4	68.5	493		217.4	79.3	621

Significance in Mann-Whitney *U* tests: * $P < 0.05$, ** $P < 0.01$ and *** $P < 0.001$, S = significant after sequential Bonferroni correction

were taken from Väisänen *et al.* (1998). The effect of the total bird density (y coefficient) was taken into account in the calculations except for the forest passerines. The birds observed in the small tree groups on the fields or the bushy outskirts of the nearby forests were included in the estimations but individuals observed in the surrounding forests were excluded from the calculation of the total density of species on the study site.

The point censuses of night-singing birds (*Acrocephalus dumetorum*, *A. palustris*, *A. schoenobaenus*, *Coturnix coturnix*, *Crex crex*, *Locustella fluviatilis*, *L. lanceolata*, *L. naevia*, *Luscinia luscinia*, *Hippolais caligata*) were conducted on 8–25 June 1998 and 7–17 June 1999 between 23:30 and 4:00 by the first author. In Finland, there were 59 and 60 study points in 1998 and 1999, respectively, whereas in Russia there were 59 points in both years. The point censuses were mainly conducted at the same locations in the consecutive years. Half of the study points were situated at the edge of small fields or other bushy field areas (< 2 ha) and the other half on the larger open field areas. All were selected subjectively along the road network. The listening time at each point lasted at least one minute or as long as was necessary to determine the number of all individuals singing in the beginning of the listening period.

The estimated densities on transect sites and the number of night-singing birds on point census sites were compared using a Mann-Whitney *U* test. Because multiple tests lead to the substantial inflation in the overall level of significance and there is a risk of finding differences between the countries by chance, a sequential Bonferroni correction was used within each ecological group, the annual data of night-singing birds and the comparison of the environmental factors. According to Wright (1992) and Chandler (1995), strict application of this correction method severely reduces the power of tests but this can be avoided by choosing a comparison-wise error rate higher than the usually accepted 5%. We used the value of 10% as suggested by Chandler (1995).

Shannon-Wiener diversity ($H' = -\sum_{i=1}^{S}(p_i \ln p_i)$, S = the total number of species, p_i = the proportion of species i), evenness ($J' = H'/\log S$, S = the total number of species) and Berger-Parker dominance ($D = n_{max}/N$, n_{max} = the density of the most abundant species, N = the total density of all species) were calculated using the line transect data and their similarity between Finland and Russia were tested using a 2-tailed t-test. Detrended corre-

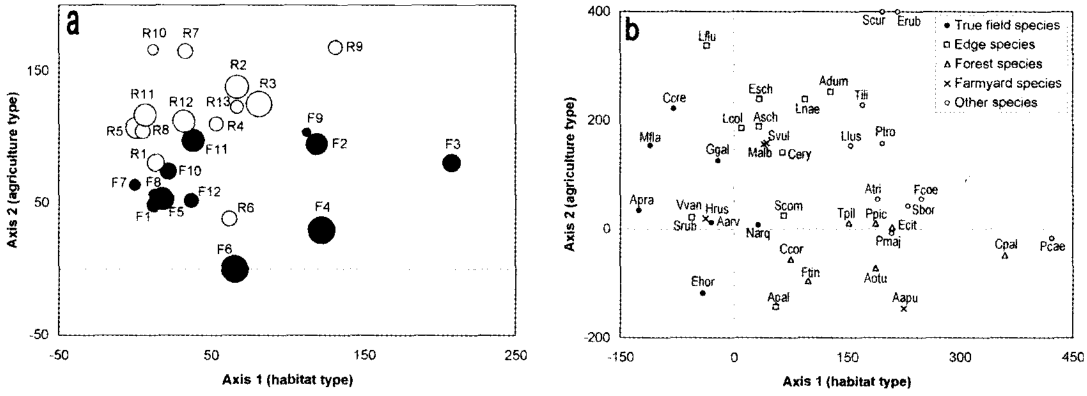

Fig. 2. DCA ordination diagram of the transect count sites (a) and species (b). Finnish sites (F1–F12) are represented by black circles and Russian sites (R1–R13) by open circles. The size of the circle indicates the number of species recorded along the transect. The Eigenvalue is 0.238 for axis 1 and 0.151 for axis 2. See full names of species in Table 2.

spondence analysis (DCA), performed by the PC-ORD 4.0 program (McCune & Mefford 1999), was used to illustrate the distribution of transect sites and observed bird species in the two countries. As rare species may distort the ordination result, 14 bird species found only on one site were excluded from the DCA.

3. Results

3.1. Line transect counts

Altogether 53 breeding bird species were detected during the study. The number of observed species was 45 and 40 in Finnish and Russian Karelia, respectively. The average (± SD) diversity, evenness and dominance index of species were similar in Finland ($H' = 2.64 \pm 0.19$, $J' = 0.91 \pm 0.04$, $D = 0.15 \pm 0.03$) and Russia (2.62 ± 0.21, 0.89 ± 0.02, 0.18 ± 0.05). Correspondingly, the total densities did not differ between the two countries. After the sequential Bonferroni correction, none of the ecological groups differed statistically between the countries but the density of *Emberiza hortulana*, *E. citrinella* and *Numenius arquata* was significantly higher and the density of *C. crex* significantly lower in Finland compared to that in Russia (Table 2).

The study sites were clearly divided into Finnish and Russian groups along axis 2 in the DCA ordination (Fig. 2a, Mann-Whitney *U* test, $Z = -3.536$, $P < 0.001$). The only Russian site placed among the Finnish sites was the only one which was partly under cereals in Russian Karelia. In the species ordination, ecological groups were rather well separated along axis 1 representing a continuum from open to forest habitats (Fig. 2b). Forest species were more characteristic of the Finnish sites, while groups of true field species and edge species comprised species typical for either Finland or Russia, or both. The surrounding landscape (Spearman correlation, $r_S = 0.413$, $P = 0.040$), field management ($r_S = -0.619$, $P = 0.001$) and cereal cultivation ($r_S = -0.744$, $P < 0.001$) correlated significantly with the site scores for axis 2.

3.2. Point census of night-singing birds

The average number of all night-singing birds was significantly higher in Russia (2.76 and 4.05) than in Finland (1.36 and 1.97) both in 1998 and in 1999, also after the sequential Bonferroni correction. Four of the eight observed night-singing species (*C. crex*, *L. luscinia*, *L. naevia*, *A. dumetorum*) were significantly more common in Russia than in Finland in 1998 and/or 1999 (Fig. 3).

4. Discussion

In forested areas, landscape components may go far towards explaining the areal differences in

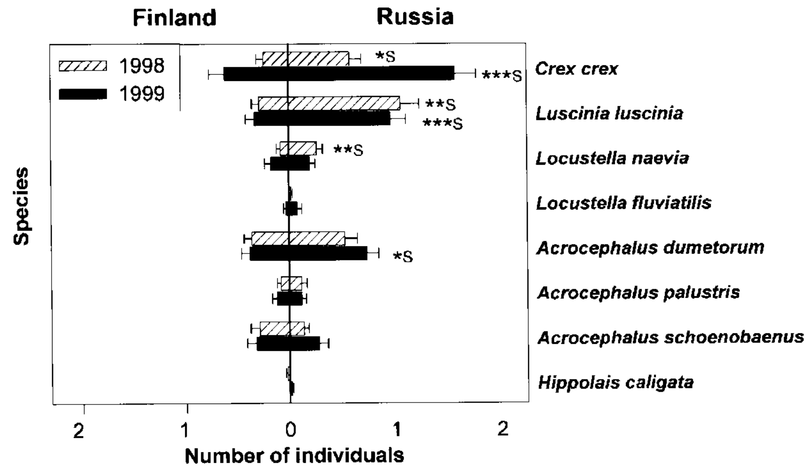

Fig. 3. The average (+ S.E.) number of night-singing birds in Finnish and Russian sites in 1998 and 1999. Asterisks indicate statistically significant differences between the two countries (Mann-Whitney *U* test, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, S = significant after the sequential Bonferroni correction).

species or species group densities (Andrén 1994, Jokimäki & Huhta 1996, Mönkkönen *et al.* 1999). In the case of some species, their occurrence and abundance depend on the large-scale landscape, whereas the quality of the local habitat is more important for others (Jokimäki & Huhta 1996). In our study, the small-scale habitat factors were subjectively selected for the maximum possible similarity on both sides of the border, i.e. the study sites represented field edges with a similar slope and luxuriance of vegetation, and in particular the presence of bushes. Thus, the differences in the bird fauna between Finland and Russia (Table 2) probably mainly reflect the differences in agricultural habitats on a larger scale.

Several seed-eating species such as *E. citrinella*, *E. hortulana* and pigeons were concentrated on the Finnish side of the border. One reason for this could be the almost total lack of cereal cultivation in Russian Karelia (Anonymous 2000). Only one of the 13 transects in Russia lay partly along the cereal field margin and that was the only site in which individuals of *E. hortulana* were observed. Our results are well in agreement with the recent study made in Poland. According to Golawski and Dombrowski (2002), over 60% of the breeding territories of *E. hortulana* were situated on arable fields and only 4% on grasslands. In addition to a more abundant food supply in summer, the cultivation of cereals also benefits over-wintering species such as *E. citrinella* (Lehikoinen 1983). Other habitat requirements of *E. citrinella*, namely sheltered nesting places, high singing places and a chance to feed on the ground were probably satisfied in both Finland and Russia.

In contrast to cereal production, animal husbandry was more common in Russian Karelia, especially in the southern part of the study area (Saarinen *et al.* 2001). This probably explains the higher densities of *M. flava* and *S. vulgaris* on the Russian side of the border. The number of *S. vulgaris* declined in Finland during the 1970's (Rintala *et al.* 2003) due to the sharp decrease in the number of cattle and pastures, especially in southern Finland (Tiainen *et al.* 1989, Solonen *et al.* 1991). Correspondingly, *M. flava* is a species typically preying on insects around grazing animals (von Haartman *et al.* 1963–72) and its population has decreased in southwestern Finland during the last few decades (Kallela & Degerstedt 1985, Yrjölä *et al.* 1986, Turtola *et al.* 1996) due to the intensified cultivation methods (Väisänen *et al.* 1998). On the other hand, the population sizes have not correspondingly decreased on mires in northern Finland and coastal meadows where the strongest populations of *M. flava* occur.

The less active management of open hay fields in Russia (Anonymous 2000) favours the breeding of *C. crex*, probably due to the better feeding (Väisänen *et al.* 1998) and/or sheltering habitats. The species is considered near-threatened in Finland (Rassi *et al.* 2001) although during the last few years the population of *C. crex* has clearly recovered, possibly due to the increase in the number of shelter beds and set-aside fields (Tiainen & Pakkala 2001). The density of *C. crex* was, however, still almost four times higher in

Russia than that in Finland, which probably contributes to the current expansion of *C. crex* in Finland.

By contrast, another species living in open hay fields, namely *N. arquata*, was three times more abundant in Finland than in Russia. This was surprising, because *N. arquata* has been observed to prefer grasslands rather than tillage for both its nesting and foraging habitats (Berg 1993, Valkama *et al.* 1998). In addition, the use of machines directly destroys nests and nestlings (Ylimaunu *et al.* 1987, Valkama & Currie 1999) and many modern agricultural practices decrease the availability of food, i.e. the amount of worms and other invertebrates in the soil (Wilson *et al.* 1999). Possibly, the vegetation in Russian hay fields mown only once a summer is too high for *N. arquata*, which demands habitats with an open view (Solonen 1983) or other factors (e.g. nest predation, hunting) have decreased the Russian population of *N. arquata* more than the Finnish one. Hay fields in Russia are also often burned over in the spring during the nesting time of *N. arquata*. At least four of the 13 transect sites in Russia were burned over during the study period and in three of them no *N. arquata* were observed during the censuses.

In point censuses, the higher abundance of species preferring scrub habitat was more obvious than in the transect counts (Fig. 3). Two edge species (*L. naevia* and *A. dumetorum*) and *L. luscinia* also inhabiting scrub were more abundant in Russia. The point censuses, in comparison to the transect count data, possibly better represented the landscape level differences between the countries due to the more numerous and randomly selected sites, although the short observation time per census site decreased the possibility to detect occasionally quiet males.

The farmland avifauna and the number of species were rather similar in Finnish and Russian Karelia despite the differences in land-use and the structure of field habitats. Some scrubs and pastures favouring species were more abundant in Russia whereas species benefiting from openness of fields and cereal cultivation were concentrated in Finland. In future, this pattern in the farmland bird fauna in the border district may change due to the decline of cultivation in small mixed farms in Finland and the privatisation of farmlands in Russia. These changes will probably increase the number of bushy habitats in Finland and the number of cereal fields in Russian agricultural landscapes. In addition, if the amount of organic farming or the use of genetically modified organisms increases, the farmland avifauna will meet more contrasting changes in food and habitat supply of fields (Chamberlain *et al.* 1999, Wilson *et al.* 1999).

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Selostus: **Maataloustoiminnan erot näkyvät Suomen ja Venäjän Karjalan peltolinnustossa**

Maatalouden tehostumisen myötä monien peltolintujen kannat ovat viime vuosikymmeninä pienentyneet niin Suomessa kuin muuallakin Euroopassa. Sotien jälkeen maatalouden muutokset ovat olleet Kaakkois-Suomessa voimakkaampia kuin ympäristöoloiltaan samanlaisilla lähialuilla Venäjällä. Tätä ainutlaatuista "koejärjestelmää" hyödynnettiin vuosina 1998 ja 1999 maatalousympäristöjen pesimälinnustotutkimuksessa. Lintulajistoa ja sen runsautta tutkittiin rajan molemmin puolin sekä linjalaskentojen (n = 25) että pistelaskentojen (n = 118) avulla. Molemmissa maissa puolet laskentapisteistä edusti pienikuvioisia pensaikkoisia peltoaukeita (< 2 ha) ja puolet laajempien ja avoimempien peltojen reunoja. Pistelaskennassa havainnoitiin vain yölaulajia (klo 23:30–4:00). Kahdeksasta havaitusta lajista neljä (ruisrääkkä, satakieli, pensassirkkalintu ja viitakerttunen) oli Venäjällä runsaampia kuin Suomessa. Linjalaskentakohteet valittiin pareittain rajan molemmin puolin kasvillisuudeltaan mahdollisimman samankaltaisista ympäristöistä. Lisäksi kohteilla arvioitiin järjestysasteikolla kuutta linnustoon vaikuttavaa muuttujaa: lähiympäristön laatua, pensaikon ja avo-ojien määrää, laidunnuksen ja peltokäytön voimakkuutta sekä viljanviljelyä. Kullakin linjalla tehtiin kaksi laskentaa, ensimmäinen aamulla

(4:00–10:00) ja toinen yöllä (23:30–4:00). Linjalaskennoissa havaittiin yhteensä 53 lajia, joista 45 tavattiin Suomessa ja 40 Venäjällä. Kokonaistiheydessä ei ollut eroja maiden välillä, mutta yksittäisistä lajeista peltosirkku, keltasirkku ja isokuovi olivat runsaampia Suomessa ja ruisrääkkä Venäjällä. Vähäisistä laji- ja parimääräeroista huolimatta kohteet jakautuivat DCA-ordinaatiossa selvästi maakohtaisiin ryhmiin. Yksi Venäjän kohteista sijoittui kuitenkin suomalaiskohteiden joukkoon; linja kulki osittain viljapellon vieressä. Viljanviljelyn lisäksi suomalaiskohteille oli tyypillistä voimakas peltokäyttö, kun taas venäläiskohteet olivat useammin laidunkäytössä. Pensaikoissa elävät lajit puolestaan painottuivat Venäjälle, erityisesti pistelaskennoissa. Viljanviljelyn yleisyys Suomessa Venäjän Karjalaan verrattuna selittänee erityisesti pelto- ja keltasirkun suuremman tiheyden rajan tällä puolella. Vastaavasti karjatalouden ja ennen kaikkea laidunnuksen yleisyys Venäjän Karjalassa todennäköisesti selittää ruisrääkän, kottaraisen ja keltavästäräkin painottumisen Venäjän puolelle. Erityisesti ruisrääkkä näytti hyötyvän Venäjän peltoympäristöjen vähäisemmästä hoidosta. Isokuovin suurempi tiheys Suomen puolella yllätti, sillä tehokkaan viljelytoiminnan on todettu haittaavan lajin pesintää ja ruokailua. Venäjällä yleiset kevätkulotukset ja peltojen sulkeutuneempi kasvillisuus eivät ilmeisesti miellytä kuovia. Maatalouspoliittiset muutokset, kuten pientilojen väheneminen Suomessa ja maatilojen yksityistäminen Venäjällä, heijastunevat myös jatkossa raja-Karjalan peltolinnustoon.

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