The status of the Finnish winter bird census

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SAMMALISTO, LASSE [Zoological Museum, University of Helsinki, Pohjoinen Rautatiekatu 13, SF — 00100 Helsinki 10, Finland] 1974. — *The status of the Finnish winter bird census*. Ornis Fenn. 51:36—47.
The Finnish winter bird census was started in 1956. The census has been made at the turn of the year, and since 1966, also two months later.
As the effects of the sources of error have not yet been fully analysed, not many conclusions can be drawn at this stage. However, it is stressed that population studies of birds can afford a valuable means of detecting environmental changes, a means that seems capable of yielding the required data more rapidly and at lower cost than more traditional means.

Introduction

Interest in bird censuses has increased in recent years, perhaps because of the belief that the results of bird censuses are relevant in environmental monitoring (SVENSSON 1970, JÄRVINEN & MÄKI 1970, WILLIAMSON 1970). "This (belief) is due to several factors, e.g. the extremely well-known systematics of birds, the sufficiently non-hiding habits of most birds, the several trophic levels occupied by birds, and the broad spectrum of environmental conditions to which birds have become adapted" (JÄRVINEN & SAMMALISTO 1973).

Another cause for increasing interest in bird censuses, namely their relevance to theoretically fruitful work in community ecology, is not very important in the case of winter censuses, for reasons discussed below.

Censuses of breeding bird populations, either transect counts (ENEMAR & SJÖSTRAND 1967, EMLEN 1971), point counts (BLONDEL, FERRY, & FROCHOT 1970), or counts based on the mapping method (ANON. 1970) give valuable clues about fluctuations in avian numbers. Moreover, the mapping method should also reveal changes in the relative numbers (diversity, calculated from 'dominance' values, cf. e.g. JÄRVINEN & SAMMALISTO 1973) of different species. Diversity may change owing to environmental change; moreover, the relative contributions of the two components of diversity, species richness and evenness (LLOYD & GHELARDI 1964) to diversity may reflect changes in the environment (JÄRVINEN & SAMMALISTO 1973).

However, we must not expect so widely applicable results from the results of winter bird censuses. One reason for this is the peculiar transect method applied in Finnish censuses (see below); another is that the birds are more mobile in winter and therefore the relative numbers of different species cannot be estimated reliably.

However, even winter bird censuses are useful in estimating changes in bird populations. First, there are many species, mainly granivorous and omnivorous ones, whose whole population, or at least a substantial part of it, spend the entire winter in this country. Accordingly, winter counts for their part give almost as reliable estimates of density changes as do summer bird censuses. Second, as the census is arranged twice each winter, at the turn of the year and at the beginning of March, the results of the winter census may give an idea of how large losses bird populations suffer during the coldest period of the year.

In contrast, it is not possible to estimate diversities because the transect is open-ended, that is, all birds heard or seen are listed. Large or otherwise conspicuous birds can therefore be recorded at considerable distances, but small or otherwise inconspicuous ones only at small distances.

Methods

The winter bird census was started in Finland by Dr. Jukka Koskimies in 1956. It soon aroused great enthusiasm and the length of the census routes rose to more than 3 000 km. within two years. Now, the yearly total length falls constantly between 6 000 and 7 000 km (see Table 1). The censuses are now organised by the Zoological Museum of the University of Helsinki.

The census is made by volunteers, numbering now about 500. In addition, there are assistants on many routes so that the total number of watchers is well above 1 000. The watchers are allowed to choose their routes at will, provided that these do not run parallel or do not cross each other. This is regrettable, since it means that the more remote parts of the country are underrepresented. The Museum has tried to solve this problem by paying the expenses of some of the birdwatchers willing to carry out the census in sparsely inhabited areas, but the resources of the Museum are very limited indeed. The total length of the routes in different grids of the country for the winter 1972/73 is illustrated in Fig. 1. The lengths of the different routes vary widely, from 2 to 30 km., with an average of 11.0 km.; this average has not markedly changed (not more than ± 1 km) from 1960 to 1973. The reasons for the wide variation are different day-lengths in different parts of the country, habitat differences, and the number of watchers censusing a route.

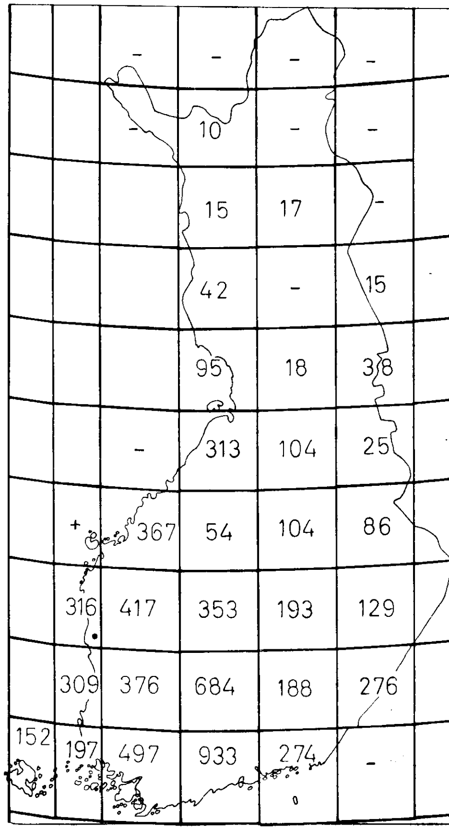

FIG. 1. The values give the number of route kilometres per each square in the winter 1972/73. A + sign means that the route kilometers of the square in question have been added to the values of the nearest latitudinal square, a — sign that there has been no routes on that square. (From SAMMALISTO 1973)

The results from each route are given on a form, where, besides the actual results, the following data, thought to reveal possible sources of error, are asked for: temperature, cloudcover (including possible rain or snowfall), wind direction and force, and visibility at the beginning and at the end of the census. Habitats were scaled according

TABLE 1. Census data.

		1960/61	61/62	62/63	63/64	64/65	65/66	66/67
Km	a Dec/Jan	3887	3855	4240	5274	6158	5709	6114
	b Feb/March							2498
	100 · (b/a)							41
No of routes	Dec/Jan	374	376	399	473	548	505	552
	Feb/March							232
New routes			134	136	178	162	105	154
Abandoned routes			136	122	112	104	152	113
Proportion of routes common with previous year			0,72	0,64	0,61	0,49	0,51	0,48
No of species	a Dec/Jan	93	87	86	86	100	96	99
	b Feb/March							76
	Diff(a—b) in %							23
Km/route	Dec/Jan	10,4	10,3	10,6	11,2	11,2	11,3	11,1
	Feb/March							10,8
Accipiter nisus	a	0,23	0,23	0,19	0,13	0,19	0,21	0,13
	b							0,14
	χ^2							0,21
Accipiter gentilis		0,09	0,10	0,08	0,07	0,09	0,09	0,07
								0,09
								0,74
Lagopus lagopus		0,55	0,68	0,58	0,52	0,31	0,43	0,36
								0,45
								4,08*
Lyrurus tetrix		7,00	7,99	9,90	4,67	4,86	5,27	5,31
								3,21
								166***
Tetrao urogallus		0,78	0,75	0,58	0,63	0,48	0,35	0,33
								0,29
								0,85
Tetrastes bonasia		0,75	0,88	0,88	0,60	0,70	0,51	0,49
								0,31
								13,5***
Perdix perdix		2,40	2,10	0,68	0,86	1,59	1,32	1,26
								1,18
								0,76
Phasianus colchicus		0,65	0,68	1,39	0,85	1,13	1,25	1,90
								1,18
								54,7***
Strix aluco		0,01	0,01	0,01	0,01	0,02	0,02	0,02
								0,03
								0,84
Picus canus		0,02	0,02	0,04	0,03	0,03	0,03	0,02
								0,03
								0,58
Dendrocopos major		1,36	0,94	1,36	0,59	0,51	0,43	1,76
								1,10
								49,1***
Dendrocopos leucotos		0,01	0,01	0,01	0,01	0,02	0,02	0,01
								0,02
								(0,11)

67/68	68/69	69/70	70/71	71/72	72/73	Mean (χ^2 from totals)	r	C.V.
5360	6352	6004	6048	6248	6694	5534		
3223	3252	2450	2967	3799	4231	3203		
60	51	41	49	61	63	52		
474	559	524	535	538	610	498		
287	292	209	261	345	387	288		
65	171	124	147	123	not counted			
145	90	157	133	127	„			
0,44	0,47	0,54	0,52	0,46	„	0,53		
98	91	101	95	95	112	95		
72	69	72	73	75	90	75		
27	24	29	22	20	22	24		
11,3	11,4	11,5	11,3	11,6	11,0	11,12		
11,2	11,1	11,7	11,4	11,0	10,9	11,14		
0,16	0,13	0,16	0,16	0,10	0,17	0,168	—0,615*	0,24
0,14	0,10	0,16	0,11	0,13	0,17			
0,88	0,95	0,03	4,27*	1,87	0,01	0,79		
0,13	0,08	0,13	0,12	0,12	0,07	0,095	—0,337	0,32
0,09	0,13	0,09	0,09	0,09	0,11			
2,88	2,63	1,89	1,53	2,63	2,99	0,41		
0,35	0,37	0,63	0,35	0,19	0,24	0,423	—0,680*	0,29
0,50	0,36	0,29	0,61	0,31	0,36			
10,2***	0,13	37,7***	29,8***	13,0***	12,65***	10,2**		
6,41	4,83	4,52	3,08	3,33	4,15	5,49	—0,752**	0,35
3,85	3,24	2,30	1,90	2,16	2,83			
243***	126***	220***	103***	113***	128***	1092***		
0,31	0,37	0,41	0,23	0,18	0,28	0,437	—0,902***	0,44
0,26	0,28	0,21	0,21	0,18	0,17			
1,57	4,32*	19,8***	0,67	0,01	14,3***	32,5***		
0,71	0,51	0,47	0,42	0,56	0,75	0,633	—0,556*	0,26
0,45	0,42	0,38	0,32	0,47	0,51			
22,4***	3,93	3,29	4,77*	3,37	23,6*	56,2***		
1,03	0,80	0,91	0,46	0,90	0,32	1,13	—0,742**	0,54
1,11	1,14	0,67	0,39	0,50	0,55			
1,28	27,1***	11,4***	2,23	51,2***	33,3***	1,72		
1,35	1,06	1,07	1,20	0,79	0,92	1,10	+0,124	0,31
0,83	0,57	1,05	0,80	0,96	1,08			
47,9***	58,6***	0,07	30,2***	7,85**	6,95**	89,7***		
0,02	0,03	0,02	0,01	0,01	0,02	0,014	+0,421	0,48
0,02	0,01	0,02	0,01	0,01	0,01			
0,00	2,06	0,89	(0,06)	(0,00)	(0,91)	0,13		
0,04	0,03	0,03	0,02	0,04	0,05	0,031	+0,568*	0,29
0,02	0,02	0,01	0,02	0,01	0,04			
2,86	1,51	1,33	0,18	7,22**	0,51	6,35**		
2,86	0,65	0,99	2,93	2,18	3,23	1,52	+0,600	0,71
2,33	0,53	0,77	2,77	2,18	2,89			
21,5***	5,32*	9,30**	1,83	0,01	9,74**	24,9***		
0,01	0,01	0,02	0,01	0,01	0,01	0,012	+0,023	0,30
0,04	0,02	0,02	0,01	0,01	0,01			
7,91**	(0,51)	(0,00)	(0,79)	(0,93)	(0,04)	2,57		

		1960/61	61/62	62/63	63/64	64/65	65/66	66/67
Dendrocopos minor	a	0,07	0,17	0,07	0,05	0,05	0,06	0,05
	b							0,03
	χ^2							1,37
Picoides tridactylus		0,02	0,03	0,01	0,02	0,02	0,06	0,02
								0,05
								5,14*
Dryocopus martius		0,31	0,26	0,17	0,27	0,25	0,12	0,12
								0,16
								1,86
Corvus corax		0,77	0,81	0,71	0,56	0,52	0,33	0,67
								0,57
								2,85
Corvus corone		29,0	30,1	39,0	25,7	28,0	37,5	26,9
								28,2
								8,13**
Corvus monedula		24,8	20,5	24,5	13,4	16,5	21,9	13,3
								8,74
								30,2***
Pica pica		10,5	9,47	10,5	10,1	9,75	9,54	10,6
								11,3
								5,03*
Garrulus glandarius		1,97	1,75	1,51	1,89	1,82	1,39	1,67
								1,91
								5,42*
Perisoreus infaustus		0,11	0,10	0,07	0,07	0,06	0,06	0,10
								0,08
								0,76
Parus major		38,7	38,7	33,0	35,3	37,6	32,3	34,6
								32,5
								24,3***
Parus caeruleus		0,91	1,19	1,22	1,29	1,84	2,18	1,97
								2,27
								7,82**
Parus ater		1,02	1,18	1,87	1,28	1,76	1,31	0,73
								0,67
								0,96
Parus cristatus		4,16	3,48	3,09	3,97	3,34	2,40	2,38
								1,90
								19,1***
Parus cinctus		0,07	0,01	0,02	0,05	0,02	0,02	0,01
								0,02
								(0,31)
Parus montanus		14,2	11,9	9,17	12,5	11,8	8,45	9,54
								7,17
								112***
Aegithalos caudatus		0,57	0,92	0,94	0,81	1,20	1,43	0,52
								0,04
								104***
Certhia familiaris		0,79	0,80	0,75	1,02	0,85	0,63	0,50
								0,25
								24,7*
Cinclus cinclus		0,17	0,15	0,19	0,16	0,21	0,30	0,20
								0,20
								0,01

67/68	68/69	69/70	70/71	71/72	72/73	Mean	r	C.V.
0,07	0,04	0,06	0,06	0,07	0,09	0,069	—0,263	0,45
0,07	0,02	0,03	0,06	0,07	0,06			
0,11	3,00	3,65	0,21	0,21	1,54	2,95		
0,03	0,05	0,07	0,06	0,04	0,04	0,037	+0,723**	0,50
0,02	0,02	0,02	0,06	0,03	0,04			
1,69	5,16*	10,3**	0,00	0,11	0,18	13,5***		
0,11	0,10	0,15	0,13	0,17	0,23	0,184	—0,563	0,39
0,11	0,15	0,10	0,09	0,18	0,29			
0,00	3,93*	3,29	2,95	0,22	3,33	2,59		
0,66	0,82	0,84	0,77	1,10	0,94	0,744	+0,496	0,17
0,73	0,76	0,91	0,64	0,79	1,04			
1,54	1,04	1,06	4,74*	22,6***	2,75	3,35		
28,6	28,6	29,0	26,2	21,3	23,0	28,7	—0,561*	0,17
24,4	28,1	25,9	15,6	17,6	21,5			
127***	2,48	58,0***	988***	165***	23,3***	717***		
12,7	13,3	11,6	11,9	8,9	8,49	15,5	—0,869***	0,37
11,1	10,2	9,05	7,32	4,21	6,27			
43,6***	174***	103***	405***	538***	167***	1041***		
10,2	9,83	10,9	11,0	10,5	12,6	10,4	+0,604*	0,078
10,4	11,1	9,17	8,60	9,89	13,0			
0,91	33,1***	50,1***	111***	8,70**	4,06*	5,93**		
1,56	1,15	1,79	1,65	1,85	1,87	1,68	—0,094	0,14
1,52	1,20	1,30	1,32	1,45	1,52			
0,20*	0,46	25,5***	13,6***	22,2***	18,7***	36,0***		
0,03	0,05	0,07	0,04	0,04	0,02	0,063	—0,785*	0,44
0,07	0,02	0,02	0,07	0,06	0,02			
7,57**	5,54*	9,20**	5,82*	2,77	0,00			
28,6	39,2	42,7	41,1	45,9	52,7	38,5	+0,595*	0,16
30,1	42,0	36,3	37,1	41,4	58,6			
15,5***	42,2***	177***	80,2***	208***	126,9***	8,40**		
1,50	1,65	2,32	2,18	3,07	3,42	1,90	+0,878***	0,39
1,39	2,29	1,82	2,21	2,75	5,04			
1,63	47,4***	20,0***	0,11	7,98	169***	80,4***		
0,73	0,74	0,61	0,67	1,58	1,93	1,19	—0,085	0,40
0,44	0,35	0,39	0,36	0,81	1,39			
27,4***	54,3***	15,5***	33,0***	109***	43,6***	188***		
1,74	1,73	2,27	2,07	2,74	2,97	2,80	—0,647*	0,28
1,32	1,53	1,49	2,28	2,67	3,31			
23,0***	5,11*	52,4***	4,04*	0,43	9,74***	10,4**		
0,01	0,01	0,01	0,03	0,03	0,03	0,025	—0,252	0,78
0,03	0,02	0,02	0,01	0,01	0,02			
6,85**	(2,10)	(0,59)	2,51	3,83*	0,72			
8,04	8,64	11,0	10,7	11,9	12,9	10,8	—0,141	0,18
5,93	8,53	8,78	11,5	11,2	12,8			
124***	0,30	82,6***	13,0***	11,7***	0,69	90,4***		
0,12	0,15	0,46	0,30	2,05	1,12	0,815	+0,076	0,68
0,13	0,09	0,25	0,14	0,89	0,84			
0,41	5,43*	19,9***	19,1***	198***	20,5***	224***		
0,45	0,21	0,24	0,30	0,64	0,84	0,622	—0,512	0,42
0,16	0,16	0,07	0,32	0,52	0,83			
55,9***	2,90	26,2***	0,24	5,67*	0,06	29,9***		
0,19	0,24	0,30	0,21	0,22	0,21	0,212	+0,441	0,22
0,23	0,23	0,30	0,18	0,21	0,30			
1,76	0,03	0,03	0,61	0,22	9,45**	1,26		

		1960/61	61/62	62/63	63/64	64/65	65/66	66/67
Regulus regulus	a	4,65	6,91	6,43	3,59	5,61	3,49	2,26
	b							0,60
	χ^2							276***
Carduelis chloris		1,35	0,44	2,25	1,68	2,00	1,24	1,66
								2,73
								103***
Carduelis carduelis		0,65	0,70	0,23	0,18	0,57	0,23	0,34
								0,01
								80,7***
Carduelis spinus		1,48	0,87	0,43	0,87	20,3	0,66	3,16
								1,92
								97,1***
Acanthis flammea		6,35	16,8	6,22	3,43	12,8	2,79	24,6
								8,98
								2153***
Pyrrhula pyrrhula		11,0	7,26	9,99	5,84	16,8	7,43	13,4
								8,13
								420***
Pinicola enucleator		0,43	1,20	0,34	0,01	1,24	0,25	0,07
								0,15
								11,6***
Loxia curvirostra		1,82	1,13	0,57	0,41	0,98	2,52	0,77
								0,68
								1,70
Emberiza citrinella		66,2	32,7	32,1	27,3	40,5	38,5	38,4
								32,1
								214***
Passer domesticus		31,4	36,7	30,0	30,1	36,9	37,0	45,3
								56,2
								125***

to the density of human inhabitation. From winter 1973/74, onwards, the watchers have also been asked for the thickness of the snow cover, and whether there has been ice in the case of sea or lake routes, whether the route has been censused on foot or when skiing, and whether there are feeding stations on the route. The effect of the latter factors on census results have not yet been analysed, however.

MUNNE (1973) has analysed the separate effects of other factors on census results. Summarizing his results, the sources of error do not affect census results except in few cases. This must be mostly due to the procedure applied, namely that the volunteers are allowed to make the turn-of-the-year census any day between December 26 and January 10, and the later census between February 26 and March 10. This procedure, in most cases, guarantees that the volunteers can choose a day with suitable weather. The length of the census period cannot be a major source of error, except in the results of the turn-of-the-year census in mild winters.

However, there are other sources of error, the control of which is more difficult, and which, therefore, should be borne in mind in evaluating the results of significance tests. These are:

(1) Combination of the above sources of error might increase total error
(2) Extensive irruptions of ordinarily non-migratory birds, such as tits, woodpeckers and crossbills

67/68	68/69	69/70	70/71	71/72	72/73	Mean	r	C.V.
4,36	6,07	3,83	3,04	7,76	7,67	5,05	+0,134	0,36
0,51	3,13	0,70	2,27	5,40	6,13			
1029***	365***	570***	42,8***	191***	87,2***	1374***		
1,37	1,43	1,71	2,80	2,52	2,79	1,79	+0,610*	0,38
1,16	1,80	2,35	2,76	3,04	4,26			
6,90**	18,4***	37,2*	0,12	23,3***	166***	242***		
0,03	0,27	0,20	0,09	0,13	0,11	0,287	—0,727**	0,76
0,03	0,08	0,03	0,06	0,13	0,07			
0,00	37,1***	32,5***	1,64	0,04	5,16*	122***		
3,68	0,53	7,70	1,28	2,23	0,33	3,35	—0,050	1,64
1,71	0,28	12,1	0,41	2,97	0,08			
267***	30,7***	378***	152***	51,6***	69,4***	31,1***		
11,9	4,59	21,5	9,29	27,1	13,6	12,4	+0,403	0,65
13,6	1,28	43,4	11,2	14,3	4,65			
43,9***	682***	2979***	76,1***	1726***	2051***	1159***		
9,45	6,99	9,35	13,0	13,7	7,98	10,1	+0,086	0,33
6,41	6,43	10,1	9,10	8,85	6,52			
223***	9,65**	9,75**	256***	458***	11,6***	1032***		
0,82	0,15	0,57	0,22	0,64	0,11	0,465	—0,270	0,88
0,02	0,15	0,08	0,07	0,38	0,02			
252***	0,00	98,3***	24,2***	28,0***	24,9***	726***		
11,9	0,33	1,68	3,11	4,91	1,17	2,41		
14,9	1,40	3,04	3,61	6,32	0,66			
135***	358***	154***	15,7**	86,6***	68***	583***	+0,253	1,30
35,3	42,7	44,1	51,0	54,6	32,1	41,2	+0,062	0,26
28,8	37,0	38,2	38,3	41,8	50,5			
259***	171***	146***	696***	777***	2235***	494***		
42,0	51,9	60,5	62,9	64,5	67,8	45,9	+0,943***	0,30
47,7	53,9	57,0	56,0	61,1	72,5			
149***	16,2***	34,7***	153***	45,2***	80,4***	83,1***		

(3) Differences in the competence of the watchers
(4) Habitat differences between different years, between the turn-of-the-year and the March census, and between different parts of the country
(5) Abandoning old routes and employing new ones, i.e. the changeability of the routes.

No analysis has been made for point (1), but it is improbable that a combination of sources of error would affect the results greatly since, as mentioned, most censuses have been carried out in good weather. (2) Irruptions are effectively recorded at the numerous bird stations along the Finnish coast. It is more difficult to evaluate (3) the effect of the differences in the watchers' competence. The problem is not so much whether they are differently skilled in identifying birds, but in their competency and willingness to census common birds. Moreover, old people (the age of the watchers ranges from 15 to 70 years) may not hear the calls of, say, tits.

(4) The effect of habitat differences has been studied by MUNNE (1973). He found that census habitats do not vary too much from year to year but habitat distribution is very different at the turn of the year from that of March. In general, only 60 per cent of the turn-of-the-year routes are censused in March (see table 1), and, in addition, the proportion of wilderness habitats is

TABLE 2. Coefficients of variation between years.

Pica pica	0,08	*Dendrocopos leucotos*	0,30	*Tetrao urogallus*	0,44
Garrulus glandarius	0,14	*Passer domesticus*	0,30	*Perisoreus infaustus*	0,44
Parus major	0,16	*Phasianus colchicus*	0,31	*Dendrocopos minor*	0,45
Corvus corax	0,17	*Accipiter gentilis*	0,32	*Strix aluco*	0,48
C. corone	0,17	*Pyrrhula pyrrhula*	0,33	*Picoides tridactylus*	0,50
Parus montanus	0,18	*Lyrurus tetrix*	0,35	*Perdix perdix*	0,54
Cinclus cinclus	0,22	*Regulus regulus*	0,36	*Acanthis flammea*	0,65
Accipiter nisus	0,24	*Corvus monedula*	0,37	*Aegithalos caudatus*	0,68
Tetrastes bonasia	0,26	*Carduelis chloris*	0,38	*Dendrocopos major*	0,71
Emberiza citrinella	0,26	*Dryocopus martius*	0,39	*Carduelis carduelis*	0,76
Parus cristatus	0,28	*Parus caeruleus*	0,39	*Parus cinctus*	0,78
Lagopus lagopus	0,29	*Parus ater*	0,40	*Pinicola enucleator*	0,88
Picus canus		*Certhia familiaris*	0,42	*Loxia curvirostra*	1,30
				Carduelis spinus	1,64

plainly lower in March than in December—January. Both phenomena are probably explained by the fact that most watchers are volunteers looking for rarities, which are more frequent at the new year than in March, especially on wilderness routes. Accordingly, great care should be taken when comparing the results of the new year and March censuses.

In view of all these possible sources of error, it is in most cases not possible, at this stage, to decide whether the changes and fluctuations shown in Table 1 reflect real trends. Of course, it is even more difficult to analyse causally those trends which, nevertheless, seem real. Therefore, comments are restricted to the results shown in the tables. Changeability, as shown in Table 1, seems high: about half of the routes are changed yearly. However, this is in many cases due to a gap of one year in observation; if we consider a longer period, changeability is about half of this. Further, changeability affects the distribution according to habitat and the different parts of the country about equally.

In Table 1, the years before 1960 are not included, because there are no data for their route lengths.

Results

Yearly changes

The results for the period from 1960 to 1972 are shown in Table 1, where all the data considered to be relevant, except the values for the sources of error, are gathered. The numbers for different species are given as ind. / 10 route kilometres. Also, the coefficients of variation, given as fractions of unity, between different years are given in the table. Only those species are included that largely winter in Finland. However, the proportion of migrants and residents of a species' population varies from year to year, as shown in Table 2, where the coefficients of variation are shown in order of size. The extremes, not included in the table, are the Fieldfare (ind./10 km. ranging from 0,11 to 203,0) and the Waxwing (0,12 to 30,2), which often stay longer, if there is a good berry (mostly *Sorbus aucuparia*) crop.

We can divide the species considered in Table 1 roughly into categories according to C.V. values and regression values. The regression values are not given because, for the reasons mentioned above, no density values can be calculated from open-ended transects. Correlation coefficients have therefore been used.

TABLE 3. Correlation of numbers with time; d.f. = 11 (number of years minus two).

	r
Increase	
($p < 0.01$)	
Picoides tridactylus	+ 0.723
Parus caeruleus	+ 0.878
Passer domesticus	+ 0.943
($p < 0.05$)	
Carduelis chloris	+ 0.610
Picus canus	+ 0.568
Dendrocopos major	+ 0.600
Parus major	+ 0.595
Pica pica	+ 0.604
Decrease	
($p < 0.01$)	
Lyrurus tetrix	— 0.752
Tetrao urogallus	— 0.902
Perdix perdix	— 0.742
Corvus monedula	— 0.869
Perisoreus infaustus	— 0.785
Carduelis carduelis	— 0.727
($p < 0.02$)	
Lagopus lagopus	— 0.680
Parus cristatus	— 0.647
($p < 0.05$)	
Accipiter nisus	— 0.615
Tetrastes bonasia	— 0.556
Corvus corone	— 0.561
No significant change	
Accipiter gentilis	— 0.337
Phasianus colchicus	+ 0.124
Strix aluco	+ 0.421
Dendrocopos leucotos	+ 0.023
D. minor	— 0.263
Dryocopus martius	— 0.536
Corvus corax	+ 0.496
Garrulus glandarius	— 0.094
Parus ater	— 0.085
P. cinctus	— 0.252
P. montanus	— 0.141
Aegithalos caudatus	+ 0.076
Certhia familiaris	— 0.512
Cinclus cinclus	+ 0.441
Regulus regulus	+ 0.134
Carduelis spinus	— 0.050
Acanthis flammea	+ 0.403
Pyrrhula pyrrhula	+ 0.086
Pinicola enucleator	— 0.270
Loxia curvirostra	+ 0.253
Emberiza citrinella	+ 0.062

Distribution of r

— 1.0 —	0.601	9	
— 0.6 —	0.201	7	
— 0.2 — +	0.199	10	Highly platykurtic
+ 0.2 —	0.599	8	
+ 0.6 —	1.0	6	

The categories are:

(1) No change during the 13 years of census; fluctuations very small; e.g. the Jay
(2) No change, variation ample; e.g. the Long-tailed Tit.
(3) Considerable, continuing decrease, causing rather large variation; e.g. the Capercaillie.
(4) Considerable, continuous increase, causing rather large variation; e.g. the Blue Tit.
(5) Erratic variation, usually in species which are more or less specialized to some kind of food. E.g. Crossbills, the Siskin, and the Great Spotted Woodpecker.

The overall decrease of gallinaceous birds, which cannot be due to short (3 to 4-year) cycles, and most probably not even to longer (about 10-year) ones, may be attributable to a rapid deterioration of their habitats, or, more probably to a diminution and splitting by man of suitable habitats.

Another sign of the effects of the urbanization is probably provided by the definite trend of increase in House Sparrow populations, which may be even greater than shown by the numbers, since the populations, in larger urban areas, are so large that the birds have not been counted on all routes, owing to lack of watchers.

The increase in the Blue Tit and the Great Tit may be due to the last two very mild winters and exceptionally favourable summers following them. It now seems, at least with respect to the former, that overdensity of the population caused wandering in the autumn of 1973, according to the reports of the coastal bird stations.

Seasonal changes

As pointed out above, comparison between the December—January census and the March census is difficult, since the proportion of sparsely inhabited (by man) areas in smaller in March. The changes from December—January to March are summarized in Table 4.

As seen from table 4 (the March census was not started before 1966),

TABLE 4. Significant changes from Christmas to March at 1 per cent level and at 5 per cent level (bracheted).

Year	66—	67—	68—	69—	70—	71—	72—	Total	Sum of —	0	+
Accipiter nisus	0	0	0	0	—	0	0	0	1	6	—
A. gentilis	0	0	0	0	0	0	0	0	—	7	—
Lagopus lagopus	(+)	+	0	—	+	+	+	+	1	2	4
Lyrurus tetrix	—	—	—	—	—	—	—	—	7	—	—
Tetrao urogallus	0	0	(—)	—	0	0	—	—	2	5	—
Tetrastes bonasia	—	—	(—)	0	(—)	0	—	—	3	4	—
Perdix perdix	0	0	+	—	0	—	+	0	2	3	2
Phasianus colchicus	—	—	—	0	—	+	+	—	4	1	2
Strix aluco	0	0	0	0	0	0	0	0	—	7	—
Picus canus	0	0	0	0	0	—	0	—	1	6	—
Dendrocopos major	—	—	(—)	—	0	0	—	—	4	3	—
D. leuctos	0	+	0	0	0	0	0	0	—	6	1
D. minor	0	0	0	0	0	0	0	0	—	7	—
Picoides tridactylus	(+)	0	(—)	—	0	0	0	—	1	6	—
Dryocopus martius	0	0	(+)	0	0	0	0	0	—	7	—
Corvus corax	0	0	0	0	(—)	—	0	0	1	6	—
C. corone	+	—	0	—	—	—	—	—	5	1	1
C. monedula	—	—	—	—	—	—	—	—	7	—	—
Pica pica	(+)	0	+	—	—	—	(+)	(—)	3	3	1
Garrulus glandarius	(+)	0	0	—	—	—	—	—	4	3	—
Perisoreus infaustus	0	+	(—)	—	(+)	0	0	0	1	5	1
Parus major	—	+	+	—	—	—	+	—	4	—	3
P. caeruleus	+	0	+	—	0	—	+	+	2	2	3
P. ater	0	—	—	—	—	—	—	—	6	1	—
P. cristatus	—	—	(—)	—	(+)	0	+	—	3	3	1
P. cinctus	0	+	0	0	0	(—)	0	0	—	6	1
P. montanus	—	—	0	—	+	—	0	—	4	2	1
Aegithalos caudatus	—	0	(—)	—	—	—	—	—	5	2	—
Certhia familiaris	—	—	0	—	0	(—)	0	—	3	4	—
Cinclus cinclus	0	0	0	0	0	0	+	0	—	6	1
Regulus regulus	—	—	—	—	—	—	—	—	7	—	—
Carduelis chloris	+	—	+	+	0	+	+	+	1	1	5
C. carduelis	—	0	—	—	0	0	(—)	—	3	4	—
C. spinus	—	—	—	+	—	+	—	—	5	—	2
Acanthis flammea	—	+	—	+	+	—	—	—	4	—	3
Pyrrhula pyrrhula	—	—	—	+	—	—	—	—	6	—	1
Pinicola enucleator	+	—	0	—	—	—	—	—	5	1	1
Loxia curvirostra	0	+	+	+	+	+	—	+	1	1	5
Enberiza citrinella	—	—	—	—	—	—	+	—	6	—	1
Passer domesticus	+	+	+	—	—	—	+	+	3	—	4
Sum —	16	16	10	23	16	19	15	23	115		
(at 1 per cent 0	19	16	23	12	20	16	15	12		121	
level) +	5	8	7	5	4	5	10	5			44

some species seem, particularly in certain winters, to increase as the winter advances. However, all these increases seem to be due to observational difficulties. For instance, when the fields are snowless, species such as the Yellowhammer are more scattered than later in the winter, when there is almost always snow in the whole country, and the birds must form flocks. Similarly, it is not easy to detect Partridges on snowless fields, even if they are in flocks. Generally, the numbers of Finnish wintering bird species decrease with advancing winter. There are no reasons why they could increase. The decrease is most marked in tits, the Treecreeper, the Jackdaw, the Bullfinch, the Yellowhammer and the Goldcrest, as seen from the table.

Closing comment

The results of the winter bird censuses yield a vast amount of data for research workers. The data are preserved on punch cards as well as on magnetic tape. Several programmes facilitating the utilization of the data are in progress. However, as the analysis of the effects of sources of error is still far from complete, many of the conclusions inherent in the data cannot be drawn yet. On the other hand, data such as these afford a more inexpensive and a more rapid method of detecting environmental changes than, for example, timeconsuming and expensive chemical analyses. This is why population studies should be encouraged more than has been the case hitherto.

S e l o s t u s: **Suomen talvilintulaskennan nykytilanne.**

Talvilintulaskenta aloitettiin Suomessa v. 1956. Aluksi laskettiin vain vuodenvaihteessa, mutta 1966 lähtien myös kaksi kuukautta myöhemmin.

Koska mahdollisten virhelähteiden vaikutusta ei ole vielä täysin selvitelty, tulosten nojalla ei voi tehdä paljon päätelmiä. On kuitenkin tähdennettävä, että lintupopulaatioita koskevat tutkimukset suovat nopeamman ja halvemman mahdollisuuden todeta ympäristössä tapahtuvat muutokset kuin perinteellisemmät keinot.

Taulukossa 1. on esitetty kaikki tiedot vuosien 1960—72 laskennoista. Riviryhmät ylhäältä alkaen merkitsevät (1) reittikilometrien yhteismäärää, (2) reittien lukumäärää, (3) uusien ja laskematta jätettyjen reittien lukumäärää, (4) samojen reittien osuutta kahtena peräkkäisenä vuonna, (5) lajien yhteismäärää ja (6) reittien keskimääräistä pituutta. Reittien vaihtuvuus on pienempi (n. 25 %) kuin kohdan (4) perusteella näyttää, koska useasti tietyn reitin laskennassa on vain vuoden tauko.

Taulukon 1. lajittaisessa osassa rivillä (a) on yksilömäärä 10 reittikilometriä kohti joululaskennassa ja rivillä (b) uusintalaskennassa. χ^2 -rivit osoittavat joulu- ja uusintalaskennan välisen muutoksen tilastollisen merkitsevyyden. Joulu- ja uusintalaskennan välisten muutosten lajittainen yhteenveto on esitetty taulukossa 4.

Taulukon 1. oikeanpuoleisin sarake (C.V.; variaatiokerroin) mittaa vuosien välistä vaihtelua. Mitä pienempi arvo, sitä vähäisemmät vaihtelut. Lajit on järjestetty variaatiokerrointen mukaiseen järjestykseen taulukkoon 2. Toinen sarake oikealta taulukossa 1. antaa korrelaatiokertoimet kunkin lajin tiheysarvojen (joululaskennassa) ja talvien välillä. Korrelaatiokertoimet paljastavat mahdolliset trendit talvilintujen kannanmuutoksissa. Nämä on järjestetty taulukkoon 3.

Talvilintulaskentareittien peittävyys koko maata ajatellen on esitetty kuvassa 1.

References

ANON. 1970. Recommendations for an international standard for a mapping method in bird census work. Bull. Ecol. Res. Comm. (Lund) 9:49—52.

BLONDEL, J., FERRY, C. & FROCHOT, B. 1970. La méthode des indices ponctuels d'abondance (I.P.A.) ou des relevés d'avifaune par 'stations d'ecoute'. Alauda 38:55—71.

EMLEN, J. T. 1971. Population densities of birds derived from transect counts. Auk 88:323—342.

ENEMAR, A. & SJÖSTRAND, B. 1967. The strip survey as a complement to study area investigations in bird census work. Vår Fågelvärld 26:111—130.

JÄRVINEN, O. & MÄKI, J. 1970. Lintulaskennoista. Lintumies 6:85—90. ('About bird censuses'; in Finnish.)

JÄRVINEN, O. & SAMMALISTO, L. 1973. Indices of community structure in incomplete bird censuses when all species are equally detectable. Ornis Scand. 4: 127—143.

LLOYD, M. & GHELARDI, R. J. 1964. A table for calculating the 'equitability' component of species diversity. J. Anim. Ecol. 33:217—255.

MUNNE, P. 1973. Tiaisten (Parus spp.) levinneisyydestä ja runsaudenvaihteluista Suomessa talvilintulaskentojen perusteella (On the distribution and population fluctuations of the tits, according to the results of winter bird censuses; in Finnish). M.Sc. thesis, University of Helsinki.

SAMMALISTO, L. 1973. Valtakunnallinen talvilintulaskenta 1972/73 (Summary: Finnish winter bird census in 1972/73). Lintumies 8:11—14.

SVENSSON, S. 1970. Bird census work and environmental monitoring. Bull. Ecol. Res. Comm. (Lund) 9:5—6.

WILLIAMSON, K. 1970. The common bird census as a device for monitoring population levels. Bull. Ecol. Res. Comm. (Lund) 9:9—13.

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