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The effect of summer cottages on land bird numbers in a Finnish archipelago

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The effect of summer cottages on land bird numbers was studied in the archipelago of SW-Finland. Bird fauna was very similar on cottage and non-cottage islands, with the following exceptions: The Wagtail *Motacilla alba* was significantly ($P < 0.05$) more abundant on cottage islands. The Oystercatcher *Haematopus ostralegus* and the Willow Tit *Parus montanus* were nearly significantly ($P < 0.10$) more abundant on non-cottage islands. In the grouping of species based on nesting habits, birds nesting in nest boxes and other man-made structures were more abundant on cottage islands. The mean species richness and the Shannon-Wiener diversity index *H'* were significantly greater on cottage islands than on non-cottage islands. However, if the data are combined and treated as one sample for cottage islands and the other for non-cottage islands, the differences in species richness and diversity between island groups disappear.

1. Introduction

Leisure time has increased simultaneously with standard of living in western countries. In southwestern Finland the number of summer cottages has increased from 18 000 in 1970 to 30 000 in 1987, and the forecast for the year 2010 is 55 000 (Finland Proper Regional Planning Authority, unpubl.). The shores are gradually being built up, and concern is felt about the effects of summer cottages and other recreational activity on wildlife.

There are few studies dealing with the effect of cottage settlement on birds. When Robertson and Flood (1980) and Clark et al. (1983, 1984) studied the effect of cottages in Ontario, Canada, and Willamo (1987, 1988) in southern Finland, they found out that habitat change was the most important factor determining the impact of cottages on bird life. These papers did not offer direct conclusions as to deterioration or amelioration of the environment due to cottages. As Götmark (1989) concluded in his review, more studies are needed to predict the effects of summer cottages on birds in different bird communities, habitats and geographical areas.

This paper deals with the effect of summer cottage settlement on land birds in the archipelago of SW-Finland. The main questions asked in the study are as follows:

1. Do cottages alter distributions of birds?
2. Which species and species groups are most affected by cottages?
3. Are cottages situated in habitats that were

originally best or worst for birds, thus biasing present population density comparisons?

2. Material and methods

2.1. Study areas

The islands studied are situated in the archipelago of southwestern Finland in the municipalities of Korppoo, Nauvo and Parainen. The archipelago is a popular recreational area, and the number of cottages is increasing rapidly. We selected 40 pairs of islands, such that one island in each pair had one or more cottages, while the other had none. The paired islands were close to each other (100 m–2000 m) and as similar as possible in their area, topography and exposure to open sea. The areas of the islands ranged from 0.16 ha to 17 ha in the non-cottage group (mean 3.3 ha) and from 0.15 ha to 13 ha in the cottage group (mean 3.5 ha). All the cottages were built at least five years before the study and most of them were more than ten years old. The islands studied were mostly small, since the majority of large (over 20 ha) islands have cottages and non-cottage comparisons are difficult to find for them.

2.2. Census methods

The censuses were made between 1 and 17 June in 1988 and 1989. All land birds were presumed to be breeding pairs. Each island was assessed once between 4.00 and 9.00 a.m. (standard time), and the islands of a cottage – non-cottage island pair were visited in succession, beginning in turn from the island with and without cottages. The islands were assessed as a single study plot, with one or two persons walking around the island and counting all birds, excluding clearly overflying ones that did not live on the island. In addition to land birds, the number of waders was also counted. There are two wader species in the data, the Oystercatcher *Haematopus ostralegus* and the Common Sandpiper *Actitis hypoleucos*. Latin names in this paper follow Cramp and Simmons (1977–1988).

In principle, the method is a spot mapping method (Verner 1985), with one visit. Haila and Kuusela (1982) estimated the efficiency of this census method as 70–90 % of the standard mapping method. Shannon's diversity, rarefaction curves and species-abundance distributions were similar in both censuses of Haila and Kuusela (1982). Because the time needed in a one-visit method is considerably less than in the mapping method, the benefits of an increase in sample size overcome the lower efficiency.

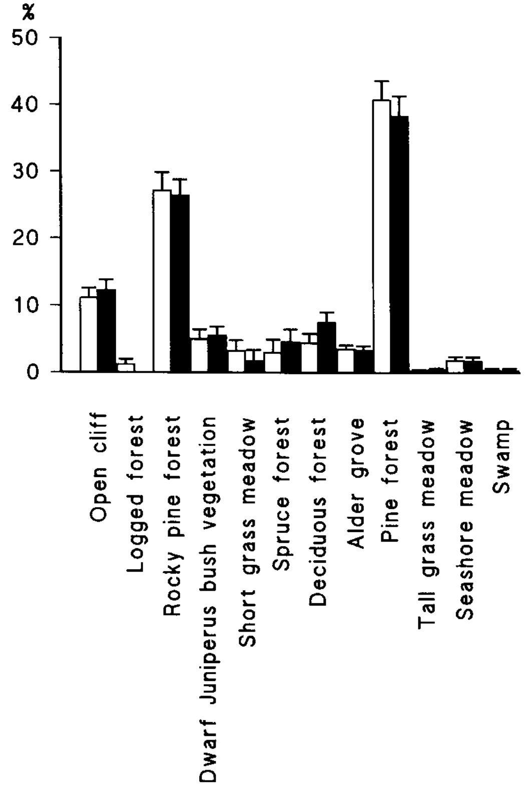

Fig. 1. Mean percentage cover and standard errors of least square means (error bars) of vegetation types on islands with and without summer cottages (open bars = no cottage, solid bars = cottage).

A census of vegetation types was undertaken in the same visits to determine possible habitat differences between islands with and without cottages, and to study the effect of habitat on bird populations compared to the cottage effect. The percentage of vegetation cover was estimated by walking around the islands and sketching the borders of vegetation types on maps. The classification of vegetation was as follows:

1. Open cliff
2. Dwarf juniper bush vegetation

3. Short grass meadow with tall juniper bushes
4. Seashore meadow
5. Alder grove
6. Tall grass meadow
7. Swamp
8. Rocky pine forest
9. Pine forest
10. Deciduous forest
11. Spruce forest
12. Logged forest

The mean percentage cover for different vegetation types for cottage and non-cottage islands is shown in Fig. 1. The paired t-test made by calculating cover differences between islands in each pair did not show significant differences in any of the vegetation types in island groups (Table 1). It is concluded that the covers of the vegetation types in cottage and non-cottage islands in the present data are similar.

2.3. Statistical analyses

The underlying hypothesis of factors affecting bird distributions affected the selection of statistical methods. Haila (1983) has suggested that in small islands near each other habitat composition is the main factor regulating land bird distributions. Within patches of suitable habitat composition, birds are randomly distributed, i.e. interactions within and between species are of minor importance. In statistical terms, this means that the number of birds of a species will be Poisson-distributed in suitable habitats throughout the whole archipelago or all the study islands combined.

In the present data, accepting Haila's hypothesis as the basis of statistical analyses, bird numbers between cottage and non-cottage islands can be tested with the binomial test (Sokal & Rohlf 1981: 78). The hypothesis may not hold with abundant species, because the probability that a bird will settle on an island depends on the number of birds already present (Haila 1983). Because most of the species in this study are territorial, distributions may be more even than the Poisson or the binomial distribution, which makes the statistical tests conservative. Similarly, in tests where many species are combined, there is a possibility that species interactions will affect distributions. However, Poisson and binomial distributions may be seen as the best approximation of the characteristics of the present data, since according to Haila (1983), interactions between individuals and species of land birds in the archipelago are not large enough to seriously distort the distributions.

The Shannon-Wiener diversity index H' was calculated from the formula

$$H' = -\sum_{i=1}^{n} p_i \log p_i ,$$

where pi is the number of pairs in species i divided by the number of pairs in all birds in a sample. The formula for the evenness index was

$$\frac{1 \Big/ \sum_{i=1}^{n} p_i^2 - 1}{\exp(H') - 1},$$

recommended by Alatalo (1981).

Since the area of an island largely determines the total number of birds, species richness (number of species) and diversity H', they were tested with two-way analysis of covariance, with the area of an island as the covariate and the island pair and presence/absence of cottage the class variables. Island area and species richness were log-transformed and bird number transformed with the square root transformation. Linearity of responses of transformed bird numbers, species richness, diversity and evenness to logarithm of area were controlled from plots and residuals. The equality of variances was tested with Cochran's test and the normality of residuals with the Shapiro-Wilk test.

The confidence intervals with respect to bird number, species richness, diversity and evenness of combined data for cottage and non-cottage groups were estimated with the Jackknife method (Zahl 1977, Heltshe and Forrester 1983). The data were pooled not to try to extrapolate the findings to very large islands, but to show how cottage settlements affect larger areas with many islands.

The statistical analyses were performed with the SAS statistical package (SAS Institute Inc. 1989), and with personal programs in the case of Jackknife estimates.

3. Results

3.1. Species composition

The frequencies of single bird species on islands with and without cottages are shown in Table 2. The only $P < 0.05$ significant difference between island types was for the Wagtail *Motacilla alba*, which was more abundant on cottage islands. The Oystercatcher *Haematopus ostralegus* — a wader — and the Willow Tit *Parus montanus* were more abundant on non-cottage islands ($P < 0.10$).

To determine which kind of bird species were most affected by cottages, the species were grouped by their nesting habits, main food during nesting time, habitat preference and migration distance. To make the groupings as objective as possible, they were made *a priori* without reference to the data. The groupings were based on von Haartman et al. (1963, 1967), von Haartman (1969) and Cramp and Simmons (1977–1988), and they are shown in the Appendix.

In the grouping based on nesting habit, birds nesting in nest boxes and man-made structures both clearly favour cottage islands (Table 3). The frequencies of ground, bush and tree-nesting birds were similar on cottage and non-cottage islands. Ground, bush and tree-nesting species groups can also be formed irrespective of nesting in nest boxes or man-made structures, since most species belonging to the latter groups also have natural nesting places in the archipelago. If nest box birds are combined with other birds nesting in trees, there are 158 birds on non-cottage islands, 178 birds on cottage islands and the probability of deviation from the 1:1 ratio is 0.300. Furthermore, birds nesting in buildings and other man-made structures may have natural nesting places as well. If the Wagtail *Motacilla alba* is combined with ground-nesting birds, there are 91 birds on non-cottage islands and 89 birds on cottage islands ($P = 0.941$). When two other birds nesting in man-made structures, the Spotted Flycatcher *Muscicapa striata* and the Blackbird *Turdus merula*, are combined with birds nesting in bushes, there are 23 birds on non-cottage islands and 30 birds on cottage islands ($P = 0.410$). These tests further confirm that the only groups affected by cottages are birds nesting in nest boxes and man-made structures.

In the grouping based on main food during nesting time, birds eating flying insects are significantly more abundant on cottage islands (Table 3) than on non-cottage islands. However, all the species in this group are also favoured by cottages for their nesting habits, since they nest in nest boxes or man-made structures. Probably birds eating flying insects find more nesting places rather than more food near cottages. Other groups are equally abundant on cottage and non-cottage islands.

In the grouping based on habitat preference, birds were evenly distributed in cottage and non-cottage islands in all groups (Table 3). It should be noted that the grouping was based on the situation on the mainland, and in the mosaic and patchy environment of the archipelago the habitat utilization of different species overlaps to a large extent (Haila and Hanski 1987). In the grouping based on migration distance, there was a tendency for intra-European migrants to be more common on cottage islands (Table 3).

3.2. Number of birds, species richness, diversity and evenness

Number of birds, species richness, diversity and evenness were tested with ANCOVA, with the logarithm of island area as the covariate. Species richness and diversity appeared to be significantly greater on cottage islands than on non-cottage islands (Fig. 2, Table 4). Total bird number was also higher on cottage islands, but without statistical significance. Species evenness was the same in both groups. Accordingly, a cottage island has on average more species and slightly more birds, and thereby greater diversity than a non-cottage island. Community structure can also be studied with the

Table 1. Paired Student's t-test of the percentage covers of vegetation types of cottage and non-cottage island pairs (n = 40). Arcsin-transformation of percentage covers used in t-test.

Vegetation type	t	Probability
Open cliff	0.99	0.33
Dwarf Juniperus bush vegetation	0.38	0.70
Short grass meadow	–0.71	0.48
Seashore meadow	–0.34	0.74
Alder grove	0.81	0.43
Tall grass meadow	0.97	0.34
Swamp	0.23	0.82
Rocky pine forest	–0.06	0.95
Pine forest	–0.60	0.55
Deciduous forest	1.62	0.11
Spruce forest	0.37	0.71
Logged forest	–1.36	0.18

rarefaction method (James & Rathbun 1981). In this data, the rarefaction curves of cottage and non-cottage islands were almost identical in the range of bird numbers observed on islands (max. 33 bird pairs).

These analyses were made from the values for each separate island, i.e. the mean number of birds, species richness and diversity of a given island were analysed. If the data from non-cottage islands are combined, 33 species and 272 pairs are found,

Table 2. The number of bird pairs in islands with and without cottages. Deviations from 1:1 ratio tested with two-sided binomial test (Sokal & Rohlf 1981:78), when n > 3.

Species	Islands without cottage	Islands with cottage(s)	Probability
Acrocephalus scirpaceus	1	1	..
Actitis hypoleucos	4	4	1
Anthus trivialis	7	7	1
Carduelis chloris	3	7	0.344
Carduelis spinus	8	6	0.791
Carpodacus erythrinus	1	0	..
Columba palumbus	2	0	..
Corvus corax	1	0	..
Corvus cornix	11	7	0.481
Delichon urbica	0	4	0.125
Emberiza citrinella	1	0	..
Emberiza schoeniclus	1	0	..
Erithacus rubecula	0	1	..
Ficedula hypoleuca	5	12	0.143
Fringilla coelebs	79	92	0.359
Haematopus ostralegus	15	6	0.078 °
Hirundo rustica	0	2	..
Loxia spp.	1	1	..
Luscinia luscinia	1	0	..
Motacilla alba	11	24	0.041 *
Muscicapa striata	2	4	0.687
Oenanthe oenanthe	8	11	0.648
Parus ater	1	0	..
Parus caeruleus	1	0	..
Parus cristatus	21	24	0.766
Parus major	8	13	0.383
Parus montanus	10	3	0.092 °
Phoenicurus phoenicurus	0	1	..
Phylloscopus sibilatrix	0	1	..
Phylloscopus trochilus	41	35	0.567
Pica pica	0	1	..
Prunella modularis	1	0	..
Regulus regulus	7	7	1
Sturnus vulgaris	0	3	..
Sylvia atricapilla	1	0	..
Sylvia borin	4	1	0.375
Sylvia communis	6	7	1
Sylvia curruca	4	5	1
Tetrao tetrix	2	0	..
Turdus merula	0	3	..
Turdus philomelos	0	2	..
Turdus pilaris	3	8	0.227
Total	272	303	

(° P < 0.10; * P < 0.05; ** P < 0.01; *** P < 0.001) whereas cottage islands had a total of 31 species and 303 pairs. Diversity and evenness were about the same in the combined data. The 5 % confidence limits of Jackknife estimates do not reveal significant differences in any of these parameters (Fig. 3). Thus, on average a cottage island had more bird species and greater diversity than a non-cottage island, but the differences disappeared when the bird numbers for many islands were pooled.

4. Discussion

4.1. Effect of cottages on species composition, species richness and diversity

The presence of cottages increased the number of birds nesting in man-made structures and nest boxes. Willamo (1987, 1988) and Martin and Lepart (1989) found the same pattern, that is, nest box birds and birds nesting in man-made structures were more abundant near cottages. The species that especially stood out as favouring cottages was the Wagtail *Motacilla alba*. It is an original and common breeding bird of the archipelago, naturally nesting in ground and rock hollows; buildings offer it good nesting sites. The Willow Tit *Parus montanus* and the Oystercatcher *Haematopus ostralegus* were found to be more abundant on non-cottage islands but only with a significance level of P < 0.10.

An island has, on average, greater species richness and diversity if it has a cottage. The mean species richness of cottage islands was 0.8 species greater than that of non-cottage islands. The Shannon-Wiener diversity index *H'* is a com-

Table 3. Bird frequencies on islands with and without cottages. Birds grouped by nesting habits, main food during nesting time and habitat preferences (Appendix). Nesting habits: bushes = small trees, bushes and tall herbs. Man-made structures = Buildings and other man-made structures excluding nest boxes. Habitat preference: Forest-bush = both forest and bushy vegetation. Deviation from 1:1 ratio was tested with two-sided binomial test (Sokal & Rohlf 1981: 78).

Grouping factor	Group	Islands without cottage	Islands with cottage(s)	P	
Nesting habits	ground	80	65	0.245	
	bushes	21	23	0.880	
	trees	143	149	0.770	
	nest boxes	15	29	0.049	*
	man-made structures	13	37	0.0009	***
Main food	ground invertebr.	46	60	0.206	
	foliage insects	111	103	0.632	
	flying insects	7	22	0.008	**
	insects in general	79	96	0.226	
	herbs & invertebr.	0	4	0.125	
	seeds	13	14	1	
	omnivorous species	12	8	0.503	
Habitat preference	open habitat	40	52	0.251	
	edge	30	33	0.801	
	forest-bush	51	48	0.841	
	deciduous forest	25	29	0.683	
	coniferous forest	39	42	0.824	
	all kinds of forest	87	99	0.420	
Migration	tropical	76	84	0.580	
	intra-European	121	150	0.089	°
	short distance	23	20	0.761	
	sedentary	52	49	0.842	

(° P < 0.10; * P < 0.05; ** P < 0.01; *** P < 0.001)

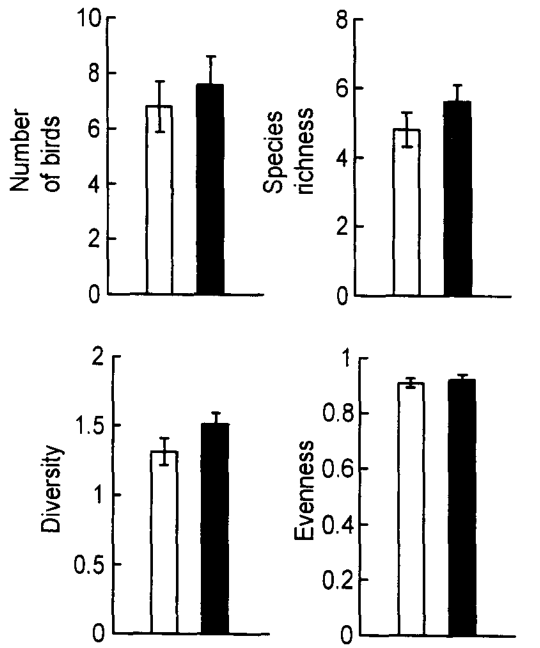

Fig. 2. Mean number of birds, species richness, Shannon-Wiener diversity *H* and evenness $(1/\Sigma p_i^2-1)(e^H-1)$ on islands with and without cottages (open bars = no cottage, solidhatched bars = cottage). Mean and S.E. of mean; n = 40.

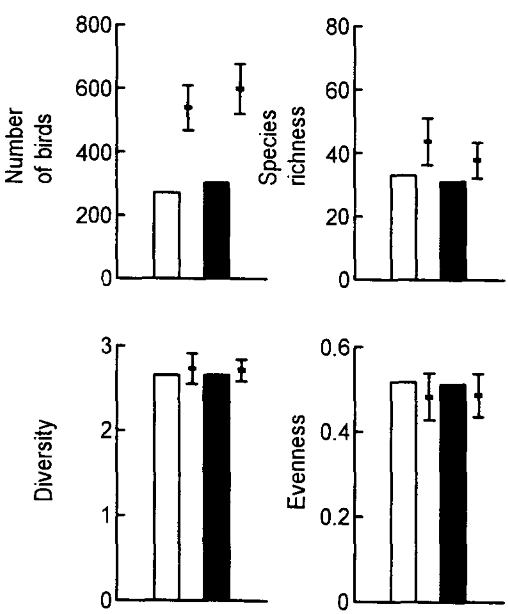

Fig. 3. Total number of birds, species richness, Shannon-Wiener diversity *H* and evenness $(1/\Sigma p_i^2-1)(e^H-1)$ of pooled data of cottage and non-cottage islands. Original values represented as bars (open bars = no cottage, solid hatched bars = cottage), Jackknife means and 95% confidence limits as vertical lines. (Note that Jackknife means do not necessarily coincide with original values.)

bination of species richness and evenness; in this case the increase in diversity on cottage islands was caused by greater species richness, since evenness indices were similar on cottage and non-cottage islands. Contrary to these findings, Robertson and Flood (1980) observed decreased diversity near cottages; species richness remained fairly constant and species evenness was significantly lower in disturbed areas.

The differences observed between cottage and non-cottage islands are not very interesting when the ornithological values of islands are evaluated. The Wagtail also appeared on non-cottage islands and the Oystercatcher and the Willow Tit on cottage islands, so that the presence of cottage settlement will probably not lead to severe changes in their numbers in the archipelago. The greater species richness and diversity observed on cottage islands is due to the increase in the number of nest box birds and birds nesting in man-made structures. These are not very important to conservation aims in the archipelago, being common on the mainland and many of them breeding in considerable numbers also on non-cottage islands. Since diversity and species richness differences evened out when the data for each island group were combined, differences found on single islands cannot be extrapolated in a simple manner to larger areas of many islands.

4.2. Habitat changes and bird communities

The reason for the census of vegetation in this study was to determine whether cottages are originally situated in places having a characteristic vegetation. The analysis of the vegetation did not uncover any features characteristic of either island group. Thus, it seems probable that the vegetation was similar in the island groups also before cottage settlement. The vegetation types and their covers do not necessarily measure all vegetation features that affect bird populations: a large tree for nesting in, an open patch in a forest, the amount of edges or some other unknown factor may lead a bird to the decision to breed on an island. However, these factors are probably unrecognizable also to cottagers, so that the distribution of cottages is random with respect to vegetation on study islands. Although, the observation of similarity of vegetation between different island categories is also a matter of methods and precision of detail, it seems reasonable to conclude that cottage occupants do not practice extensive vegetation management in the study area.

Contrary to these findings, Robertson and Flood (1980) and Clark et al. (1983, 1984) and Willamo (1987, 1988) found considerable changes in vegetation because of cottages, and these changes also had an effect on birds. Robertson & Flood (1980) observed that cottages in Ontario, Canada created extensive edge habitat affecting bird numbers — a phenomenon present in Finnish archipelagos even without human impact (Martin & Lepart 1989) — while Clark et al. (1983), also in Ontario, found canopy volume, tree density, and amount of understory as the most important characteristics determining bird species composition. Willamo (1987) found on the mainland of Finland that cottage surroundings had more deciduous trees and less spruce than non-cottage control sites. This shift in tree species proportions did not occur in the present data, perhaps because spruce and deciduous trees were sparse and pine dominated on most islands (Fig. 1) due to climatological and edaphic factors and the small size of the study islands. Openness of our study islands, consisting of relatively small islands that dominate the middle and outer zone of the archipelago, decreases the need of vegetation management. It is probable that in mainland seashores and on large islands of the inner archipelago, where forests resemble those of Willamo's (1987,1988) study sites, cottagers manage surroundings by, e.g., harvesting shady spruces and favouring deciduous trees; the effect of cottages on birds may then be larger. Habitat changes brought about by cottages on our study islands are the cottage itself, other buildings, nest boxes, paths,

Table 4. ANCOVA of number of birds, species richness and diversity *H'*. Cottage and non-cottage islands were *a priori* paired according to size and closeness, and in ANCOVA the island pair is used as a block variable.

	df	Mean square	F	Probability
Number of birds (square root transf.)				
cottage/no cottage	1	0.372	1.92	0.174
island pair	39	0.549		
log area (covariate)	1	1.924		
error	38	0.194		
Species richness (logarithmic transf.)				
cottage/no cottage	1	0.632	4.33	0.044*
island pair	39	0.201		
log area (covariate)	1	1.706		
error	38	0.146		
Diversity H'				
cottage/no cottage	1	0.678	4.73	0.036*
island pair	39	0.191		
log area (covariate)	1	1.601		
error	38	0.143		
Evenness $(1/\sum p_i^2-1)/(e^{H'}-1)$				
cottage/no cottage	1	0.000711	0.38	0.540
island pair	39	0.00937		
log area (covariate)	1	0.00162		
error	37	0.00186		

(° $P < 0.10$; * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$)

some refuse, and perhaps a small garden. Direct human disturbance of birds is probably of minor importance, since the critical times of breeding are in April, May and early June, when cottages in Finland are used mainly at weekends or not at all. The overall resemblance of vegetation on cottage and non-cottage islands can also be seen in the bird data. When birds were grouped according to their habitat preference, there were no significant differences between cottage and non-cottage islands in any of the groups. Cottages did not seem to have any clear effect on any specific group when grouping was made according to migration distance; changes in, e.g., numbers of sedentary birds would indicate important changes in wintering conditions or landscape features.

The criterion used to measure the effect of cottage settlement in this study, bird numbers, reflects changes in the process of breeding place selection. Human disturbance may also have an effect later in the breeding season. However, most small, land bird species are probably quite insensitive to the kind of direct disturbance cottage occupants may produce. It should be noted that the non-cottage islands in the study are also affected by human presence; many non-cottage islands are often visited by boaters. Rather than predicting a situation totally without cottages, the study deals with the consequences of additional cottage building in the archipelago, which perhaps is of more applied use.

As a conclusion, we did not find any remarkable differences in the bird fauna as a result of cottages. Cottage settlement favoured bird species which breed in nest-boxes or which find their nesting places in cottages or other man-made structures. Definite examples of the effect of human disturbance were not found in the species occurring in these data. However, a concern for rare birds (such as the Sea Eagle *Haliaetus albicilla* or Caspian tern *Sterna Caspia*), as well as for seabird colonies, demands further studies concerning the relationship between birds and recreational activities in archipelagos.

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Selostus: **Kesämökkien vaikutus maalinnustoon Turunmaan saaristossa**

Tutkimme kesämökkien vaikutusta pienillä saarilla (0.16–17 ha) pesivien maalintujen laji- ja parimääriin Lounais-Suomessa Nauvon ja Korppoon saaristossa. Kesämökkien määrä on kasvanut saaristossa viime vuosikymmeninä ja kehitys tulee jatkumaan samansuuntaisena. Tutkitut saaret sijaitsevat lähinnä väli- ja ulkosaaristovyöhykkeissä, missä monet saarista ovat pieniä ja kesämökit ainakin näennäisesti dominoivat saaren maankäyttöä.

Vertailimme tutkimuksessa parittain samankokoisia lähekkäisiä mökittömiä ja mökillisiä saaria. Yhteensä saaripareja oli 40. Alue on kesäkaudella kohtalaisen tiiviissä virkistyskäytössä, joten mökittömätkään saaret eivät edusta ehdotonta luonnonrauhaa. Toisaalta virkistyskäyttö ajoittuu molemmissa saarityypeissä pääosin keskikesään, jolloin maalintujen pesintä ei ole kriittisessä vaiheessa. Tutkitut saaret eivät eronneet kasvillisuudeltaan, joten kesämökit eivät olleet muuttaneet lintujen elinympäristöjä. Saariston pienillä männikköisillä saarilla mökkiläisillä ei ole tarvetta muuttaa lähiympäristön puulajisuhteita.

Selvitimme kesämökkien vaikutusta lajikoostumukseen, parimääriin ja diversiteettiin. Tutkimuksessa todettiin, että mökkisaarilla oli enemmän lajeja ja suurempi diversiteetti kuin mökittömillä saarilla. Todennäköisin lisäys linnustoon on västäräkki, joka oli huomattavasti yleisempi mökkisaarilla. Ryhmittelimme tavatut lintulajit pesimätavan, ravinnonkäytön, elinympäristön ja muuttotavan mukaan. Varsinkin rakennuksissa ja pöntöissä pesivät lajit yleistyivät kesämökkien myötä. Muiden ekologisten ryhmittelyjen perusteella lajisto ei eronnut tai erot liittyivät rakennuksissa ja pöntöissä pesiviin lintulajeihin.

Yleisesti voidaan lisääntyneen mökittymisen todeta vaikuttavan positiivisesti maalinnustoon pienillä karunpuoleisilla saarilla tutkimusalueellamme. Toisaalta vaikka kesämökeillä on positiivinen vaikutus pesimälinnuston lajimääriin ja lajis-

ton diversiteettiin saaria parittaisesti verrattaessa, häviävät erot kun verrataan kaikkien 40 mökkisaaren yhdistettyä lajimäärää ja diversiteettiä mökittömien saarten vastaaviin arvoihin. Tämä viittaa siihen, että laajalla saaristoalueella kesämökkien yhteisvaikutus maalinnustoon ei ole positiivinen. Kesämökkien lisääntymisen myötä yleistyvät lajit eivät myöskään ole luonnonsuojelubiologisesti erityisen mielenkiintoisia.

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Appendix. Grouping of species by their nesting habits, main food during nesting time, habitat preferences and migration distance (Haartman et al. 1963, 1967, Haartman 1969, Cramp & Simmons 1977–1988). For complete species names see Table 2. Nesting habits: m.-m. struct. = buildings and other man-made structures excluding nest boxes; bushes = small trees, bushes and tall herbs. Habitat preference: forest-bush = forest and bushy vegetation.

Species	Nesting habit	Main food	Habitat preference	Migration
Acr sci	bushes	ground invertebr.	open habitats	tropical
Act hyp	ground	ground invertebr.	open habitats	tropical
Ant tri	ground	foliage insects	forest	tropical
Car chl	bushes	seeds	edges	short distance
Car spi	trees	seeds	coniferous forest	short distance
Car ery	bushes	seeds	edges	tropical
Col pal	trees	herbs & invertebr.	edges	intra-European
Cor cor	trees	omnivorous	forest	sedentary
Cor nix	trees	omnivorous	edges	short distance
Del urb	m.-m.struct.	flying insects	open habitats	tropical
Emb cit	ground	ground invertebr.	edges	short distance
Emb sch	ground	ground invertebr.	open habitats	intra-European
Eri rub	ground	ground invertebr.	coniferous forest	intra-European
Fic hyp	nest boxes	flying insects	deciduous forest	tropical
Fri coe	trees	insects	forest	intra-European
Hae ost	ground	ground invertebr.	open habitats	intra-European
Hir rus	m.-m.struct.	flying insects	open habitats	tropical
Lox spp.	trees	seeds	coniferous forest	sedentary
Lus lus	ground	ground invertebr.	edges	tropical
Mot alb	m.-m.struct.	ground invertebr.	open habitats	intra-European
Mus str	m.-m.struct.	flying insects	forest-bush	tropical
Oen oen	ground	ground invertebr.	open habitats	intra-European
Par ate	nest boxes	foliage insects	coniferous forest	sedentary
Par cae	nest boxes	foliage insects	deciduous forest	sedentary
Par cri	trees	foliage insects	coniferous forest	sedentary
Par maj	nest boxes	foliage insects	deciduous forest	sedentary
Par mon	trees	foliage insects	deciduous forest	sedentary
Pho pho	nest boxes	insects	coniferous forest	tropical
Phy sib	ground	foliage insects	deciduous forest	tropical
Phy tro	ground	foliage insects	forest-bush	tropical
Pic pic	trees	omnivorous	edges	sedentary
Pru mod	bushes	ground invertebr.	coniferous forest	intra-European
Reg reg	trees	foliage insects	coniferous forest	sedentary
Stu vul	nest boxes	insects	edges	intra-European
Syl atr	bushes	foliage insects	deciduous forest	intra-European
Syl bor	bushes	foliage insects	forest-bush	tropical
Syl com	bushes	foliage insects	edges	tropical
Syl cur	bushes	foliage insects	forest-bush	tropical
Tet tet	ground	herbs & invertebr.	edges	sedentary
Tur mer	m.-m.struct.	ground invertebr.	forest-bush	intra-European
Tur phi	bushes	ground invertebr.	coniferous forest	intra-European
Tur pil	trees	ground invertebr.	edges	intra-European