The bird fauna of abandoned shore pastures

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The bird fauna was studied in grazed shore meadows in 1960 and in the same meadows in 1976, after grazing had ceased. By 1976, the meadows, which were earlier short-cropped pastures, had been invaded by reeds, bushes and young trees.

The main changes in the fauna were the disappearance of ducks from some meadows, the decline of wader populations and the increase of passerine species inhabiting early stages of developing forest. Of the waders, *Charadrius hiaticula* had disappeared completely and *Calidris alpina* was absent from some meadows; in contrast, *Capella gallinago* had settled down as a new species in some meadows. The populations of three abundant waders, *Vanellus vanellus, Tringa totanus* and *Philomachus pugnax* had decreased to a fraction of their earlier numbers. Of the passerines inhabiting open habitats, *Alauda arvensis* remained fairly abundant even when parts of the meadows were invaded by bushes.

It is generally believed that faunistic changes in an area are mainly due to alterations in the vegetation. But changes in the populations of single species may also have many other less obvious reasons, such as fluctuations in reproduction, mortality and dispersal rates, population dynamics over a wider range, disturbance by man, and chance.

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Introduction

The most important reason for local changes in the bird fauna structure is alteration of the vegetation. On the Finnish southwestern coast the community succession from shore to forest is relatively rapid because of the flat topography and the strong land upheaval, which amounts to 5—8 mm a year. But the natural succession has long been delayed or prevented by such human activities as haymaking, grazing, drainage, agriculture, and different forms of lumbering.

Haymaking and pasturing on Finnish coastal meadows decreased markedly after World War II, however, and practically ceased in the 1960s. This, together with the cultural eutrophication of coastal waters, has drastically changed the vegetation of the shores during the last 10—15 years. *Phragmites* sp., especially, has spread enormously, and now forms extensive stands, not seen earlier in our country.

Reexamining the hypotheses put forward to explain faunal changes in northern Europe during the last 100 years, v. Haartman (1972) concluded that an important cause has been alterations in land use, especially the cessation of burn-beating and grazing in forests. Later v. Haartman (1975)

demonstrated changes in the breeding bird fauna of coastal bays in SW Finland and concluded that the main factor influencing bird populations in that area has probably been the cessation of grazing on bay shores.

This paper is a report of changes in the bird fauna of some of the largest meadows on the Finnish southwestern coast, near the town of Pori (61°30'N, 21°40'E). When the senior author made a census in the area in 1960 (Soikkeli 1965), nearly all the meadows were pastured by cattle or horses, which kept the vegetation short and fairly uniform. In the 1960s the same author became more familiar with the bird fauna on these meadows when carrying out an eight years' study on *Calidris alpina*. During the same decade grazing was abandoned on nearly all meadows, resulting in a rapid change in the vegetation (Fig. 1).

In 1975 and 1976 the younger author recensused the birds in this area in order to discover possible changes. We consider this new census important as evidence of the effects of one of the most spectacular and rapid changes in the Finnish countryside — the forestation of former pastures taking place over wide areas in the southern and central parts of the country.

Study area and methods

On the coast by Pori the shore meadows form long belts, whose width ranges from 50 to 100 m, but in places may reach 0.5 km. In 1960, five of the largest meadows were chosen as study areas, their total extent being c. 2 km² (for a more detailed description, see Soikkeli 1965). The main study area (0.33 km²) was located on the widest meadow on the southwestern coast of the district Kokemäensaari. This area was divided by artificial marks into squares of one hectare and the birds were censused during repeated visits throughout the breeding season. The nests were found for about two-thirds of the total pairs censused. The birds breeding on the other meadows were counted during four to seven visits each of them lasting 1—3 hours. The estimates were based on birds singing, giving alarm calls or flushed from the nest, and on the nests found.

In 1975—76, the so-called mapping method (Enemar 1959) was used for passerines and some waders. Nests were found for roughly one-third of the estimated number of pairs. The numbers of ducks were estimated from the nests found, or, in a few cases, from repeated sightings of pairs or males. Areas A and E were visited 14 to 15 times between early April and late July, and the other areas eight to nine times. Descriptions of the meadows are given in Results. Increased experience and the greater time devoted to it made the census in 1976 more accurate than in 1960, except in the main study area.

Our data on the birds in area B in 1957—64 are mainly based on regular observations made by Mr. Alvi Kaukola, a local amateur ornithologist.

In the following results we have not given any diversity indices because we think that their ecological message is obscure or even misleading.

The results of the preliminary study made on the meadows in 1975 have been published elsewhere (Salo & Soikkeli 1975) and may be used to examine annual (1975 and 1976) differences in the populations of some species.

Results

Area A; the main study area, size 0.33 km². Until 1960 this area was intensively grazed by cattle or horses. There were no reeds, bushes or trees. In the early 1960s grazing was abandoned in the major part of the area and it ceased totally during the last years of the decade. In the mid-1960s two ditches were dug to drain the wet middle part of the meadow. In the same years young pines were planted over a few hectares. By 1976, one-third of the area and the whole shore belt (50—100 m wide) carried dense or sparse stands of reeds. Alders, birches and pines had invaded the

FIG. 1. Alterations of vegetation in abandoned shore pastures on the coast of Pori, SW Finland. The main study area (area A) in June 1960 and April 1979 (top), the Leveäkari cape (area B) in June 1958 and April 1979 (middle) and the meadow of Preiviiki (area C) in June 1960 and April 1979 (bottom). The pictures in each pair are from the same place. — Photo M. Soikkeli.

TABLE 1. Birds (no. of pairs) breeding in the main study area (A; 0.33 km²) during (1960) and some years after (1976) grazing.

	1960	1976
Anas acuta	1	—
A. clypeata	2	—
Vanellus vanellus	20—21	1—2
Charadrius hiaticula	5—7	—
Capella gallinago	—	2
Tringa totanus	9—12	5—8
Philomachus pugnax [1]	16—18	4—7
Calidris alpina	8—9	3
Alauda arvensis	20—30	15—18
Anthus pratensis	2	3
Motacilla flava	1	4
M. alba [2]	—	1
Acrocephalus scirpaceus	—	1
A. schoenobaenus	—	1
Saxicola rubetra	—	1
Emberiza schoeniclus	—	4
No. of species	10	13
No. of pairs	c. 94	c. 47
Pairs/km²	283	142

Notes. [1] No. of nests. [2] Nesting in a wooden box washed ashore.

area, in two places forming stands 3—7 m high and up to 150 m wide. A shallow pond favoured by ducks in 1960 was completely occupied by reeds and the rush *Scirpus* sp..

From 1960 to 1976, the number of bird species increased but the total density decreased to a half what it was earlier (Table 1). Both ducks and *Charadrius hiaticula* disappeared. Although most wader species still bred in the area in 1976, their densities were only a fraction of the former numbers. Of the dominant species in 1960, *Vanellus vanellus* declined to one-tenth of its former population (but in 1975 there were 8—10 pairs). All the new species of passerines, except *Motacilla alba*, require habitats with reeds or bushes. *Alauda arvensis* was still clearly dominant.

Area B; Leveäkari, size 0.07 km². This meadow on a small cape was left out of the study area in 1960, but its bird fauna was watched intensively by other ornithologists at that time, especially Mr. Alvi Kaukola. In the following we compare his and our data from 1957—64 with the census data from 1976.

The area was grazed intensively to the late 1960s. In 1960 it carried scattered juniper bushes, young pines and a few spruces, none of them being higher than about 1 m. The trees were damaged each year by cattle. Being fairly high (1—1.5 m above sea level) and almost surrounded by water, Leveäkari was earlier a favoured breeding ground for ducks and waders.

TABLE 2. Birds (no. of pairs) breeding on the cape Leveäkari (B; 0.07 km²) during intensive grazing (1957—64) and some years after grazing ceased (1976). Estimated averages for 1957—64 in parentheses.

	1957—64	1976
Anas platyrhynchos	0—1 (0)	—
A. acuta	1—6 (2)	—
A. crecca	0—1 (0)	—
A. querquedula	0—2 (0)	—
A. clypeata	0—8 (4)	—
Aythya marila	1—4 (2)	—
A. fuligula	0—2	—
Haematopus ostralegus	0—1 (1)	—
Vanellus vanellus	4—7	1
Charadrius hiaticula	5—7	—
Arenaria interpres	0—1 (0)	—
Tringa totanus	6—9	1
Philomachus pugnax	2—5 (3)	1
Calidris alpina	1—5 (3)	—
Alauda arvensis	4—8	4
Anthus pratensis	1—3	—
Motacilla flava	2—4	1
M. alba	1—3	—
Oenanthe oenanthe	0—1	—
Saxicola rubetra	—	1
Carpodacus erythrinus	—	1
No. of species	19	7
No. of pairs	c. 45	10
Pairs/km²	c. 700	c. 150

By 1976 the reed belt had spread along the shore line, alders had grown to 3—5 m on the northern shore, and the pines and spruces had also reached a height of 3—5 m.

The numbers of both species and pairs decreased markedly between the two censuses (Table 2). In 1957—64, as many as five to seven duck species were breeding in the area, whereas in 1976 there were none. The fate of the waders was nearly the same; 15—20 years earlier there were five to seven species and c. 25 pairs, but in 1976 only three species and three pairs were left. Earlier a lek of 10 to 15 *Philomachus pugnax* males was established in the middle of the area every spring but at the turn of the 1970s they failed to reappear. *Anthus pratensis, Motacilla alba,* and *Oenanthe oenanthe* did not breed there in 1976, but new breeding passerines were *Saxicola rubetra* and *Carpodacus erythrinus. Alauda arvensis* still occurred in reasonable numbers. *Corvus corone* bred for the first time in this area the year after the census, in 1977.

TABLE 3. Birds (no. of pairs) breeding on shore meadows in Preiviiki and Paarnoori (C; 0.45 km²) during (1960) and some years after (1976) grazing.

	1960	1976
Vanellus vanellus	38—56	2
Charadrius hiaticula	3	—
Capella gallinago	—	2
Numenius arquata	4—5	2
Tringa totannus	18—35	4—6
Philomachus pugnax	9—15	2—3
Calidris alpina	7—9	—
Alauda arvensis	8—15	6—8
Motacilla flava	8—12	3
M. alba	—	1
Acrocephalus scirpaceus [1]	..	2
A. schoenobaenus [1]	..	4—6
Sylvia curruca	—	1
Phylloscopus trochilus	—	1
Saxicola rubetra	—	1
Emberiza schoeniclus [1]	..	9—10
No. of species	8	14
No. of pairs	c. 123	c. 44
Pairs/km²	c. 272	c. 98

Note. [1] Some pairs may have bred in a reed stand not censused in 1960.

Area C; Paarnoori and Preiviiki, size 0.45 km². This is a meadow belt ca. 2 km long. In 1960, a larger part of it was intensively grazed but some parts were ungrazed. The grazed part of the area had no reeds or bushes. Grazing ceased completely in the 1960s and the reeds then spread over substantial parts of the meadow, and young stands of alder and pine penetrated into the former meadow.

Between the two censuses the number of species clearly increased but the total density declined to about one-third (Table 3). Ducks were not found breeding in this area in 1960 or in 1975—76. The number of wader species remained nearly the same but their total density was only a fraction of their earlier numbers. *Charadrius hiaticula* and *Calidris alpina* disappeared but *Capella gallinago* was a newcomer. Of the passerines, *Alauda arvensis* remained fairly abundant, here too. As many as seven new passerines occupied the area. *Sylvia curruca, Phylloscopus trochilus* and *Saxicola rubetra* are concomitants of young tree stands and bushes. But both *Acrocephalus* species and *Emberiza schoeniclus* may already have been breeding in a dense reed stand in 1960, as these reeds were not included in the study area that time.

Area D; Lankoori, size c. 0.25 km². The part of the meadow that was censused was situated west of the small bay Havento-ojanlahti. The meadow, which bore sparse stands of reeds in both 1960 and 1976, has never been grazed. Between the censuses alder in-

TABLE 4. Birds (no. of pairs) breeding on an unfertile shore meadow, which was never grazed (D; 0.25 km²), in 1960 and 1976.

	1960	1976
Vanellus vanellus	1—2	3—4
Capella gallinago	—	1
Numenius arquata	2	1
Tringa totanus	1	2—3
Philomachus pugnax	1—3	3—4
Calidris alpina	1	5
Alauda arvensis	15—20	5—8
Motacilla flava	1	2—3
No. of species	7	8
No. of pairs	22—30	22—29
Pairs/km²	c. 104	c. 102

vaded parts of the area and the reed-free meadow patches became fewer. Simultaneously, new meadow developed on mudflats, which are the most favoured foraging area for migrating waders on the coast.

The numbers of species and total breeding pairs were almost equal during the two censuses (Table 4). In four wader species the numbers seemed to have increased. This is the only area where no new passerines settled.

Area E; Fleiviiki, size c. 0.40 km². This area does not lie on the Baltic coast but on the mouth of the Kokemäenjoki, which forms the northeast border of the meadow. On the opposite side of the meadow are alder stands 5—8 m high. About 60 % of the area has been intensively pastured and it is the only meadow in the whole study area that is still grazed. The ungrazed part was earlier mostly wet and covered with herbs, sedges and grasses, but no willow or other bushes. By 1976, the ungrazed part had totally changed. Dense willow bushes up to 3 m high occupied large areas, although there were still patches without bushes. On the southwestern side birch and alder had penetrated the former open meadow. Unfortunately, in the census of 1960 no distinction was made between pairs breeding in grazed and ungrazed parts of the meadow.

In 1976, there were many more species than in 1960 (Table 5). Most of the new species were passerines inhabiting the young forest and bushes of the ungrazed area. Despite the greater number of species, the total density of birds was only slightly higher than in 1960. Although smaller in area, the ungrazed part contained more breeding species than the grazed part.

This is the only one of the meadows studied where ducks were still breeding in some quantity. Because of difficulties with the census method their

TABLE 5. Birds (no. of pairs) breeding on the Fleiviiki meadow (E; c. 0.40 km²), which was partly grazed in both 1960 and 1976. Birds on the ungrazed part of the meadow (roughly half of the total area) in parentheses.

	1960	1976	
Anas platyrhynchos	?	+	(—)
A. clypeata	4—6	2—3	(—)
A. querquedula	+	2—3	(1)
Aythya ferina	?	1	(1)
Vanellus vanellus	30—40	21—23	(—)
Capella gallinago	?	2—3	(1)
Numenius arquata	3	5—6	(4)
Tringa totanus	15—25	15—20	(2)
Philom. pugnax	20—35	10—15	(—)
Calidris alpina	5—7	4	(—)
Alauda arvensis	?	8—12	(—)
Anthus pratensis	?	6	(3)
Motacilla flava	3—4	19—22	(10—11)
Acroceph. schoenob.	—	2	(2)
Phyllosc. trochilus	—	4	(4)
Sylvia borin	—	3	(3)
Saxicola rubetra	—	1	(1)
Emberiza schoeniclus	—	5—8	(5—8)
No. of species	8	18	(11)
No. of pairs	c. 97	c. 123	(36)
Pairs/km²	c. 242	c. 308	(180)

numbers must be regarded as tentative. All the wader species recorded in 1960 were still breeding in 1976, although their total density had slightly decreased. Besides the new species, the most spectacular changes in the passerines were the increases in *Alauda arvensis, Anthus pratensis* and *Motacilla flava.* They are so easy to census that these increases must be real.

Concluding remarks

In two areas (A and C) that were grazed intensively up to and including 1960, the number of species subseqently increased as the vegetation changed, but by 1976 the total bird densities had decreased to a half or third of their earlier numbers (Tables 1 and 3). In area B, where grazing was also discontinued, the number of species and the density decreased to a fraction of the figures in 1957—64 (Table 2). In reality, the decrease was not as abrupt as shown by the three lowest lines of Table 2, since the comparison is made between numbers compiled from several years and data for only one year (1976). The great diversity of the bird fauna in 1957—64 was apparently due to its location on a cape and to the occurrence of low bushes. Thus, this area is not comparable with the other formerly grazed meadows, which had water on only one side and lacked trees and bushes. In area D (Table 4), with ungrazed vegetation, only slight changes occurred, apparently because the vegetation had altered less than in the rest of the study area (except the pastured part of area E). The many new bird species in the undisturbed part of area E (Table 5) reflect the rapid changes in the vegetation.

Our results agree well with those obtained by Larsson (1969) in his study of Swedish shore meadows: the bird fauna is generally more varied in ungrazed areas than in grazed ones (especially our main study area, Table 1). Larsson's (1969) observation that only a few species are common to grazed and ungrazed areas did not hold true in our study. On the meadows by Pori many species recorded in an area during grazing were still found there after the vegetation had changed. This was probaly because our areas were larger and more varied than those studied by Larsson, and thus still had patches that were suitable habitats for waders.

Bird populations are thought to change in response to alterations in the vegetation. This has been deduced from the fact that they show a temporal correlation with the succession of vegetation, and from what is generally known of the environmental demands of different birds species. The reasoning is valid when a group of ecologically similar species, such as ducks, waders or passerines, is concerned. But trends in the population of a single species may parallel alterations in the vegetation, although not actually connected with the vegetation change itself. The possible reasons for the trends include changes in the reproductive or mortality rates within and near the study area, changes in the rate of dispersal to and from the area, (connected with the former rates and with the population dynamics of the species over a wider range), disturbance by man during breeding, and chance. It is easier to note a change in the density of a species than to distinguish the reasons for it.

For example, *Anas acuta* and *A. clypeata* disappeared from two meadows during this study. But *A.*

acuta had already declined on the same meadows before pasturing was abandoned (Kaukola 1968). *Charadrius hiaticula* disappeared completely and *Calidris alpina* decreased or disappeared, which might be attributed to changes in the vegetation. But recently a decreasing trend has become evident in several other populations of *Ch. hiaticula* on the west coast of Finland (O. Hildén, pers. comm.), and the decrease of *C. alpina* occurred after some years of poor reproduction (Soikkeli 1970, 1974) which was mainly due to increased predation by *Corvus corone* and, in the main study area, also by *Larus canus*. *Tringa totanus* has a broad ecological amplitude (Larsson 1976) and continued to breed in our study areas. But a general increase appears to have taken place in the Finnish population (e.g. v. Haartman 1975) and without this the species might be scarcer in our study areas, since there would be fewer birds trying to settle down for breeding.

We consider that some general trends found by us, such as the decrease of wader densities and the increase in the numbers of passerine species, are due to the vegetation succession, but the reasons for changes in many single species remain obscure.

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Selostus: **Merenrantaniittyjen linnuston muutoksista Porissa**

Kirjoitus käsittelee merenrantaniittyjen linnuston muutoksia 1960—76 Porin rannikolla. Täällä kuten monin paikoin muuallakin Suomessa laiduntaminen rantaniityillä lakkasi 1960-luvulla. Tästä oli seurauksena niittyjen kasvillisuuden nopea muutos, jota luonnehtivat erityisesti ruo'on leviäminen ja niittyjen pensoittuminen sekä alkava puuston kasvu.

Parhaiten tutkitulla alueella Kokemäensaaren Etelärannalla (taul. 1) sorsalinnut hävisivät, kahlaajien tiheydet pienenivät ja uusia, ruoikon ja pensaikon varpuslintuja asettui paikalle. Varsinaisen Leveäkarin linnusto muuttui jyrkästi (taul. 2). Vertailuajanjaksona 1957—64 pesineet monet sorsalinnut hävisivät, kahlaajat hävisivät tai pesivät vain yksin parein, mutta varpuslinnuista asettuivat uusina lajeina pesimään pensastasku ja punavarpunen.

Preiviikin ja Paarnoorin niityt (taul. 3) kasvoivat paikoin umpeen ruoikkoa, ja täälläkin kahlaajat vähenivät ja varpuslinnut lisääntyivät. Linnuston muutos oli vähäisin Yyterin Lankoorin niityllä ns. lietteiden pohjoispuolella (taul. 4). Tätä niittyä ei ole koskaan laidunnettu, mutta silläkin ruoikko on levinnyt.

Kokemäenjoen suiston puolella Fleiviikin niityn linnusto (taul. 5) osoittaa, mikä merkitys laiduntamisella on monien lajien runsauteen ja toisten puuttumiseen (1976: laiduntamattoman osan linnut suluissa). Esim. kahlaajalintujen määrät eivät ole mainittavasti muuttuneet, mutta metsittyvälle osalle on tullut jo nuoren lehtimetsän lajeja.

Linnuston muuttuminen katsotaan yleensä, kasvillisuudesta johtuvaksi, jos se tapahtuu samaan aikaan kuin kasvillisuuden muutos. Näin voidaan päätellä, kun ekologisesti samankaltainen linturyhmä, kuten sorsalinnut tai kahlaajat, vähenee tai lisääntyy. Yksittäisten lajien tiheyden muutokset voivat johtua monista muistakin syistä, kuten esimerkiksi syntyvyyden ja kuolevuuden sekä toiseen paikkaan siirtyvyyden muutoksista, lajin leviämisdynamiikasta laajemmilla alueilla, pesimäaikaisesta ihmisen häirinnästä ja sattumasta. Näin ollen linnuston muutoksia ei tulisi yksioikoisesti päätellä vain kasvillisuudesta johtuviksi.

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