Structure and fluctuation of the breeding bird fauna of a north Finnish peatland area

Risto A. Väisänen & Olli Järvinen

Väisänen, R. A. & O. Järvinen 1977: *Structure and fluctuation of the breeding bird fauna of a north Finnish peatland area.* — Ornis Fennica 54:143—153.

Breeding birds were studied on Martimoaapa (65°48'N, 25°11'E) in seven years between 1963 and 1976. The bird fauna is composed of the species of two botanical peatland regions (southern raised bogs, northern *aapa* fens), elements of which are mixed in the area. About 40 species were found breeding. Total density was about 100 pairs/km² and species diversity $H' = 3.06$. As a rule, the density and diversity of the waterfowl, waders, gulls and passerines clearly exceeded the averages found in the raised bog or *aapa* fen regions of Finland.

When spring was warm, rare species of both the northern and southern elements occurred (bred) on Martimoaapa, but when the May temperature was moderate or low, such species were not found in June. Spring temperature influences several factors determining the habitat selection of birds, the most important of which is thought to be the amount of food available. In warm springs, conditions are more favourable for breeding birds, which explains the variation in the richness of the bird fauna from one breeding season to another.

Risto A. Väisänen, Zoological Museum, University of Helsinki, P. Rautatiekatu 13, SF-00100 Helsinki 10, Finland

Olli Järvinen, Department of Genetics, University of Helsinki, P. Rautatiekatu 13, SF-00100 Helsinki 10, Finland

Introduction

Regional trends in the peatland avifauna of Finland have recently been elucidated by Järvinen & Sammalisto (1976), whose analyses were based on 112 censuses made in the 1950s. Very few comprehensive studies are available which describe the bird communities of single peatland areas on the basis of more recent data. The most important peatland areas for birds have hardly been studied at all; there is only a preliminary report by Häyrinen (1965a; see also Häyrinen 1965b) on Kesonsuo, a raised bog in Ilomantsi, E Finland. The first purpose of this study is thus to give a description of Martimoaapa in Simo, one of the best peatland areas for birds in the whole of Finland.

Secondly, as the study period covered more than ten years (1963—76), it was possible to analyse long-term changes and yearly fluctuation in the bird fauna of Martimoaapa. This opportunity was particularly interesting, because the area is situated near the Arctic Circle, in the region where northern and southern faunal elements meet and mix (Järvinen & Väisänen 1973).

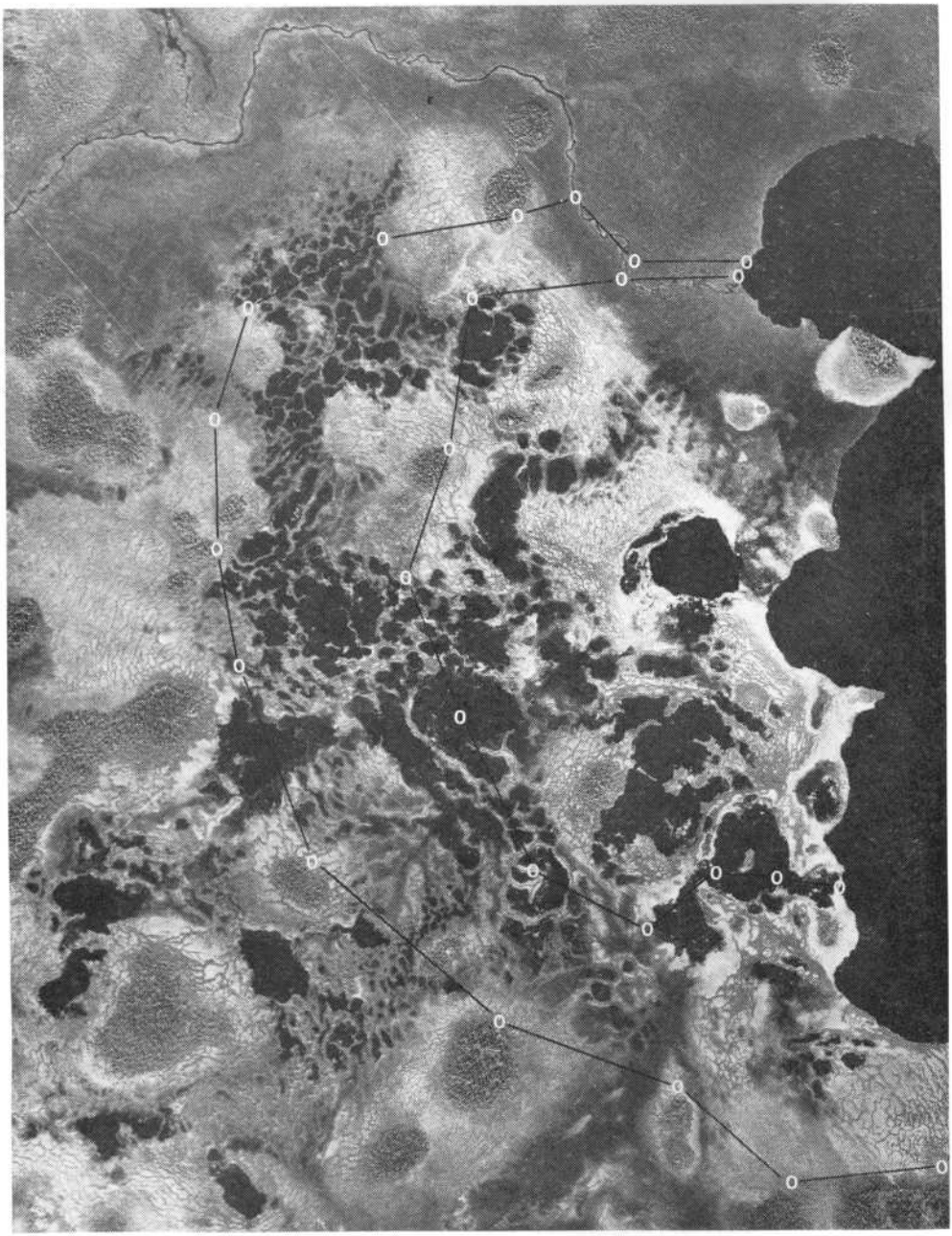

FIG. 1. The central parts of Martimoaapa photographed from the air. The light gray areas are raised bog, the dark gray *aapa* fen and the black water (Lake Martimojärvi seen on right). The motley gray areas are small woods. Two study areas are delimited with white zeros and black lines. The smaller one (2 km²) was censused in 1964 and the larger one (3.5 km²) in 1976. Publication permitted by Topografikunta.

The area is now under governmental protection, and readers should note that it cannot be visited without official permission.

Study area

The study area, comprising Martimoaapa and its surroundings, lies about 20 km from the sea (Bothnian Bay) in the commune of Simo (65°48′N, 25°11′ E). Lake Martimojärvi (about 2.5 km²) lies in the centre of the area, Martimoaapa (about 8 km²) being located south of the lake (Fig. 1). Most of the peatland areas in the region are typical *aapa* fens (RUUHIJÄRVI 1960), but the centre of Martimoaapa is a developing excentric raised bog (S. Eurola, pers. comm.), although it contains minerotrophic elements. Typical *aapa* fens are flooded in spring when the snow melts, but the spring floods on Martimoaapa drain rapidly to the nearby lake. In consequence, vegetation characteristic of raised bogs has been able to develop (S. Eurola & R. Ruuhijärvi, pers. comm.). The central parts now have ombrotrophic ponds, with standing water, covering about half of the area. The *aapa* fen parts have more luxuriant vegetation (especially near a small river, the Martimo-oja, in the NW part of Martimoaapa). A similar, but not so well-developed, mixture of the two peatland complexes occurs on Simoskanaapa in the neighbourhood, and such mixtures can also be found in a number of other peatland bogs in the region (R. Ruuhijärvi, pers comm.). LUHTA (1976) and LYYTIKÄINEN (1976) have given more complete descriptions of the area, in words and photographs.

Material and methods

This study is based on the following censuses and excursions:

1957. L. Sammalisto (pers. comm.) censused 100 ha on Simoskanaapa.

1963. A morning census of a 7-km route by RAV on 3 June. The route has been described by VÄISÄNEN (1965).

1964. Excursion by H. Haapala, K. Uino and RAV on 10 May. A morning census of the 7-km route by RAV on 11 June. The area of greatest ornithological interest (2 km²; Fig. 1) censused once.

1965. A morning census of the 7-km route by RAV on 1 June.

1972. Excursions by U. Häyrinen, I. Kuronen, T. Manner, M. Rapeli, P. Salminen and M. Soini (this group will be denoted UH) in the area, with surroundings, between 20 May and 5 June.

1973. U. Häyrinen and P. Salminen, excursion to Simoskanaapa on 31 May. P. Rauhala on Martimoaapa on 17 June.

1974. A morning census of the 7-km route by RAV and K. Väisänen on 11—12 June. U. Häyrinen on Lumiaapa and Martimoaapa on 8 July.

1975. V. Kaarakka, A.-L. Lassinharju and M. Osara (this group will be denoted VK) excursioned on Martimoaapa between 31 May and 19 June. OJ and RAV on Martimoaapa on 16 June, A. LYYTIKÄINEN (1976) in the area between 28 June and 5 July.

1976. M. Tynjälä censused a 3.5-km² area (Fig. 1) on Martimoaapa once on 16—17 June.

In addition, V.-M. Korpimäki (VMK) has sent his Atlas observations made in the area in 1974—76.

In general, the evaluation of the census results follows the rules proposed by JÄRVINEN (1974).

Quantitative structure of the breeding bird fauna

Density. Tables 1—2 give the census results for Martimoaapa (Table 1) and Simoskanaapa (Table 2). Since not all the pairs breeding in an area are observed during a single visit to a census plot (PALMGREN 1930, ENEMAR 1959; see also HILDÉN 1967), the true densities are apparently of the order of 100 pairs/km². The densities would be roughly doubled, if the area of the ponds was excluded from the calculations. The estimates are also too low

TABLE 1. The numbers of pairs (N) observed breeding in two study areas on Martimoaapa (delimited in Fig. 1): a 2-km² area censused on 11 June 1964 by R.A.V. and a 3.5-km² area censused on 16—17 June 1976 by M. Tynjälä.

Species	1964 N	1964 %	1976 N	1976 %
Gavia arctica	1	0.8	2	0.9
G. stellata	2	1.6	3	1.3
Podiceps auritus	—	—	1	0.4
Anas platyrhynchos	5	4.0	7	3.0
A. crecca	9	7.2	17	7.4
A. penelope	1	0.8	4	1.7
A. acuta	1	0.8	1	0.4
Aythya fuligula	2	1.6	6	2.6
Melanitta nigra	—	—	2	0.9
Mergus albellus	—	—	2	0.9
Anser fabalis	—	—	7	3.0
Cygnus cygnus	—	—	1	0.4
Falco subbuteo	—	—	1	0.4
F. peregrinus	—	—	1	0.4
Vanellus vanellus	—	—	1	0.4
Pluvialis apricaria	—	—	4	1.7
Gallinago gallinago	3	2.4	1	0.4
Lymnocryptes minimus	3	2.4	1	0.4
Numenius arquata	2	1.6	3	1.3
N. phaeopus	—	—	3	1.3
Tringa glareola	8	6.4	11	4.8
T. erythropus	—	—	1	0.4
T. nebularia	—	—	1	0.4
Limicola falcinellus	1	0.8	—	—
Philomachus pugnax	20	16.0	5	2.2
Phalaropus lobatus	2	1.6	2	0.9
Larus marinus	1	0.8	2	0.9
L. argentatus	15	12.0	45	19.5
L. canus	—	—	2	0.9
L. ridibundus	5	4.0	15	6.5
Alauda arvensis	4	3.2	2	0.9
Corvus corone	—	—	1	0.4
Saxicola rubetra	—	—	4	1.7
Acroc. schoenobaenus	—	—	1	0.4
Phylloscopus trochilus	—	—	11	4.8
Anthus pratensis	22	17.6	24	10.4
Motacilla alba	—	—	3	1.3
M. flava	13	10.4	24	10.4
Emberiza schoeniclus	5	4.0	9	3.9
Total	125	100	231	100
	62 pairs/km²		66 pairs/km²	

because the water-birds were censused in June (cf. LINKOLA 1959, SIIRA 1959).

The densities observed on most peatland areas south of Martimoaapa are usually lower (JÄRVINEN & SAMMALISTO 1976, KORPIMÄKI 1975a, b) or similar (TAHVANAINEN et al. 1975), and only exceptionally higher (Kesonsuo in Ilomantsi, E Finland, according to HÄYRINEN 1965a). In northernmost Finland the densities tend to be higher than on Martimoaapa (see the censuses summarized by JÄRVINEN & SAMMALISTO 1976 and JÄRVINEN & VÄISÄNEN 1976).

Species diversity. Diversity was measured with the Shannon function as in JÄRVINEN & SAMMALISTO (1976). Total diversity (H', based on natural logarithms) was 3.06 ± 0.08 (*S.D.*) on Martimoaapa in 1976, but somewhat lower in the smaller area studied in 1964: $H' = 2.68 \pm 0.08$. Both of these values are higher than those reported for any of the five peatland regions studied by JÄRVINEN & SAMMALISTO (1976). Detailed comparison is, however, difficult for several reasons:

First, the areas studied on Martimoaapa do not include much of the poorer parts of the peatland (cf. the results of Simoskanaapa, Table 2) .

Second, the census areas of Martimoaapa (especially that of 1976) combine parts of *aapa* fens and raised bogs, which should, *a priori*, increase diversity.

Third, several species now breeding on Mar-

TABLE 2. The numbers of pairs (N) observed breeding in a 1-km² area censused on Simoskanaapa in June 1957 by L. Sammalisto.

	N	%
Anas crecca	1	1.6
Anser fabalis	1	1.6
Grus grus	1	1.6
Tringa glareola	1	1.6
T. nebularia	1	1.6
Saxicola rubetra	2	3.2
Anthus pratensis	24	38.1
Motacilla flava	31	49.2
Emberiza schoeniclus	1	1.6
Total	63	100

timoaapa were less abundant in the 1950s. Among the more common of these species are *Philomachus pugnax*, the *Larus* species and *Emberiza schoeniclus;* among the less common are *Vanellus vanellus, Pluvialis apricaria* and *Acrocephalus schoenobaenus* (our unpubl. line transect data from the whole of Finland; unpubl. census data of OJ from Heikinjärvenneva peatland area, W Finland; JÄRVINEN & VÄISÄNEN 1977).

Certain conclusions, however, emerge. First, a very good peatland area for birds has relatively little in common with those described by JÄRVINEN & SAMMALISTO (1976). The high diversity on Martimoaapa has already been pointed out. If the species-area curves given by JÄRVINEN & SAMMALISTO (1976:39) are used, 3.5 km² should have 10.4 species, which contrasts sharply with the 38 found in 1976. (This comparison is not very much affected by the fact that densities of species have, in many cases, increased from the 1950s to the 1970s.)

Second, the main difference between Martimoaapa and the peatland areas studied by JÄRVINEN & SAMMALISTO (1976) seems to be the abundance of water on Martimoaapa: water-birds and gulls are more abundant on Martimoaapa, while the two dominant passerines of most Finnish peatlands, *Anthus pratensis* and *Motacilla flava,* are less frequent (as far as is known, they do not profit from the presence of ponds, etc.). In the following, the diversity values for Martimoaapa in 1976 and Tornio-Kainuu (JÄRVINEN & SAMMALISTO 1976) are compared:

	Martimoaapa	Tornio-Kainuu
Water-birds	2.22±0.13	1.90±0.36
Waders	2.23±0.16	2.14±0.10
Gulls	0.83±0.10	—
Passerines	1.78±0.10	1.11±0.05

Evidently, the high diversity of birds on Martimoaapa is due to the high diversity values for gulls and passerines, compared with Tornio-Kainuu, and the relatively high densities of the water-birds and gulls, which is seen in the following tabulation:

	Martimoaapa	Tornio-Kainuu
Water-birds	15.1 pairs/km²	0.4 pairs/km²
Waders	9.4 "	7.6 "
Gulls	18.3 "	0.4 "
Passerines	22.6 "	25.4 "

The species of the bird fauna

If the area is not mentioned in the following, the central parts of Martimoaapa are intended.

Water-birds

The dominant species, according to Table 1 and the data of 1972, are apparently *Anas platyrhynchos, A. crecca* (a flock of 30 males has not been taken into acount in Table 1), *Aythya fuligula* and *Anser fabalis. Anas crecca* is certainly the most abundant duck in the area, since it appears to be characteristic of the surrounding peatlands. Several species are attracted to the bog after the young are hatched; *Anser fabalis* and *Anas crecca* seem to be the clearest examples. Six nests of *Anser fabalis* were found in 1972.

Some rarer water-birds are characteristic of Martimoaapa. The regular breeders include *Gavia stellata* (2—3 pairs) and *Anas penelope* (one or a few pairs), but many other species occur in some years: *Podiceps auritus* (1 pair in the colony of *Larus ridibundus* in 1963 and 1976), *Anas querquedula* (2 pairs at the head of the Martimo-oja on 3 June 1963), *A. clypeata* (1 pair on 31 May 1972), *Clangula hyemalis* (1 ♀ in a pond on 1 June 1972), *Melanitta nigra* (one pair on 3 June 1963 and 17 June 1975, 2 pairs on 16—17 June 1976; all birds seen in the ponds of Martimoaapa), *Mergus albellus* (1 ♀, apparently a breeding one, on 3 June 1963, 1 ♀ on 4 June 1972 and 2 ♂♂ and 1 ♀ on 16—17 June 1976). The Whooper Swan *Cygnus cygnus* will probably join the breeding bird fauna in the near future (4 birds on 30 May 1972, 3 young birds in

Martimojärvi on 12 June 1974, one bird in Martimojärvi on 7 June 1975 and one bird in the middle of Martimoaapa on 17 June 1976).

Birds of prey

Open peatland areas are important hunting habitats for a dozen birds of prey, although they are used for breeding only by the Peregrine *Falco peregrinus* (which can still be found in the area). The following species have been met in the area: *Buteo buteo, B. lagopus* (30 May to 1 June 1972, possibly individuals still on migration; the older records by MERIKALLIO 1958 from the region probably come mainly from the area between Martimojärvi and the chain of hills called Kivalot), *Accipiter gentilis, Circus cyaneus* (a nest found in 1974 by VMK, probably two pairs in the area in 1975 according to AL), *Pandion haliaetus, Falco subbuteo* (one pair breeds in a coniferous forest island of Martimoaapa), *F. columbarius* (belongs to the breeding bird fauna according to LYYTIKÄINEN 1976), *F. vespertinus* (one ad. ♂ on Martimoaapa on 17 July 1962, PITKÄNEN 1964), *F. tinnunculus* (two nests in 1975, AL), *Strix nebulosa* (one nest found in 1974, VMK) and *Asio flammeus.*

Grouse

Lagopus lagopus occurs commonly in the forest islands of Martimoaapa.

Cranes

The population of *Grus grus* has not been studied well enough for a definite evaluation of its density; flocks of non-breeding individuals make the counts comparatively difficult.

Waders

The wader fauna is an interesting mixture of southern and northern elements, the northern elements being more dominant; of the species mentioned in Table 1, *Vanellus vanellus* and *Numenius arquata* are southern, while the rest are northern.

Vanellus vanellus has apparently colonized the area in the 1960s (see KALELA 1955, v. HAARTMAN et al. 1963—72). There are now at least 20 breeding pairs (1975, according to AL) in the whole area, e.g. 5—8 pairs in the N parts of Lumiaapa.

Pluvialis apricaria was found in the raised bog parts of Martimoaapa on 17 July 1962 by E. Pitkänen (pers. comm.), but the later records all come from 1974—76: 1—2 pairs breeding in the raised bog parts of Martimoaapa. One pair on Lumiaapa on 30 May 1972.

Gallinago gallinago and *Lymnocryptes minimus* belong to the *aapa* fen parts of Martimoaapa (see HÄYRINEN 1970, JÄRVINEN & SAMMALISTO 1976).

Of the two curlews, *Numenius arquata* is clearly more abundant than *N. phaeopus:* about 26 pairs of the former were counted on Martimoaapa and adjacent peatland areas in 1972, while there were only 3 pairs of the latter (UH). In certain years *N. phaeopus* may even be absent from Martimoaapa. Its pairs are more often found in the raised bog parts of Martimoaapa (or Simoskanaapa: 2—3 pairs in 1975, AL), while the main population of *N. arquata* breeds on the *aapa* fens. A similar situation was found by RAV in 1959 in the southern parts of the commune of Simo. In a study made in June, 17 pairs of *N. arquata* were found on *aapa* fens in a 6 km × 23 km area, while only one pair of *N. phaeopus* occurred (it was found in a tundra-like habitat, clear-cut forest).

Tringa glareola and *T. nebularia* are common in the area, the former being clearly more abundant than the latter. A few pairs of *T. erythropus* occur in most years (see below). A warning pair with chicks was found on 8 July 1974 near the boundary of Martimoaapa and Lumiaapa.

At least a few pairs of *Limicola falcinellus* breed on Martimoaapa, but exact estimates cannot be given because the species is difficult to census. Difficulties are also encountered in censusing *Philomachus pugnax:* the lek sites attract dozens of male Ruffs in late May and early June (e.g. 80 ♂♂ on 3 June 1963 and 20—40 ♂♂ on 1 June 1965 at the head of the Martimo-oja), but only 5—10 ♀♀ were observed in the censuses made in mid-June. The explanation seems to be that males from larger areas gather in a few lek sites (JÄRVINEN 1974), but the possibility cannot be excluded that females have, to some extent, been overlooked, especially since the species is skulking and semicolonial (DYRCZ et al. 1972, OJ unpubl.).

The breeding range of *Phalaropus lobatus* has been thought to be discontinuous between the Bothnian Bay and Lapland, but the nesting records from Martimoaapa (2 alarmed pairs on 3 June 1963; 2 pairs also in 1964 and 1976) indicate that the discontinuity may be partly due to the almost total lack of excursions to

the wet breeding habitats of the species (see also KOMONEN & KOMONEN 1973).

Gulls and terns

Martimoaapa is probably the northernmost peatland area in Finland where the gull community may be characterized as diverse. The dominant species is *Larus argentatus:* 10—15 pairs in 1963—65, 42 nests in 1972, about 50 pairs in 1974, about 45 pairs in 1976. Colonies of at most 5 pairs were found in three other peatland areas within 30 km of Martimoaapa in the early 1960s (RAV, unpubl.). A few pairs breed in the N parts of Lumiaapa: 2 pairs on 30 May 1972, about 1 pair on 30 June 1975 (AL). The increase of the population has been parallel to that found in the nearby island group of Krunnit, Ii, where 23 pairs bred in 1963 and 129 pairs in 1972 (RAV, unpubl.).

The breeding gulls of Martimoaapa include three additional species. *Larus marinus* is sparse (1 pair in 1963—65, about 3 pairs in 1972, 2 pairs in 1976). *Larus canus* colonized Martimoaapa in the 1970s (an alarmed individual on 16 June 1975, 2 pairs in 1976). The population of *L. ridibundus* has increased about threefold in a decade: 5 pairs in 1963—65, 15 pairs in 1972—76. Four other species deserve mention in this context: *L. fuscus* apparently does not breed in the area, but three individuals were observed on Martimoaapa between 26 May and 4 June 1972. A surprising observation of *Hydroprogne caspia* was made by us on 16 June 1975 (3.30 a.m.). This seems to be the only inland observation of the species made in June (v. HAARTMAN et al. 1963—72). The bird had most probably come from the island group of Krunnit, Ii, where the nearest colony of the species occurs. We had visited the Krunnit colonies two days earlier and were, presumably for that reason, met by the bird with alarm calls and mild attacks. Probably non-breeding *Sterna hirundo* and *S. paradisaea* individuals also occur on Martimoaapa (e.g. 5 *S. hirundo* on 12 June 1974, 2 *S. paradisaea* on 3 June 1972).

Passerines

The two most common species in the area are *Anthus pratensis* and *Motacilla flava.* The third most common passerine is *Emberiza schoeniclus* (e.g. 5—10 pairs in the upper parts of the Martimo-oja). Other passerines are rather sparse, but *Saxicola rubetra* is fairly abundant in the raised bog part. Four singing *Alauda arvensis* were observed on 11 June 1964 (and one on 8 June 1964 on Veittiaapa, S of the River Simojoki), but the excursions made in the 1970s have given poorer results: 2 pairs in 1972 and 1976, 1 pair in 1975. *Acrocephalus schoenobaenus* appeared in Martimoaapa in the 1970s (3 ♂♂ on 4 June 1972 and 2—3 ♂♂ in the latter half of June in 1975 in the upper part of the Martimo-oja).

Human influence is responsible for the breeding of three species in the area: *Hirundo rustica* (in a barn on a peatland meadow in the 1960s), *Oenanthe oenanthe* (clear-felled forest islands) and *Sturnus vulgaris* (in a nest-box designed for *Bucephala clangula* at Martimojärvi in 1975). A singing *Emberiza hortulana* has been recorded twice: 24 May to 4 June 1972 and in 1976 (VMK).

Dynamics of southern and northern faunal elements

VÄISÄNEN (1965) observed that certain southern and northern species breed irregularly on Martimoaapa. For example, *Vanellus vanellus, Numenius phaeopus* and *Tringa erythropus* were found breeding in 1963, but did not breed in 1964, although all three species were observed during an excursion on 10 May 1964. It is thus clear that many more species migrate through the area than breed there, and, which is less obvious, this phenomenon has some relationship with the observed faunal dynamics. In the following, we list all of the more important migrant observations made in the area in spring. This list partially serves the purpose of studying faunal dynamics, but is also given simply because of its ornithological interest. The list also shows the importance of peatland areas for migrating birds.

Migrants on Martimoaapa

Gavia sp. 49 flocks, 1600—1700 exx., above Martimoaapa, moving ENE on 25 May 1972 (6—12 a.m.).

Clangula hyemalis. Flocks in Martimojärvi on 22—26 May 1972, the maximum 40 exx. on 25 May.

Melanitta fusca. One pair in Martimojärvi on 25 May 1972.

M. nigra. 40 exx. above Martimoaapa on 28 May 1972.

Buteo lagopus. 3 moving ENE on 30 May 1972.

Vanellus vanellus. Two individuals in display flight on 10 May 1964, although the species did not breed that year.

Charadrius hiaticula. Nine observations (1—2 exx. each) between 25 May and 4 June 1972.

Arenaria interpres. 2 exx. at Martimojärvi on 26 May 1972.

Limosa lapponica. 1 ex. at Ahvenlampi on 22 May 1972.

Tringa totanus. 4 observations of single birds between 20 May and 4 June 1972.

Calidris temminckii. 11 observations of 1—4 exx. each between 24 May and 1 June 1972.

C. alpina. Migrating flocks: 42+7+1 exx. and two flocks only heard on 22 May, 11 flocks on 24 May, scattered observations up to 30 May 1972. One ex. in display flight on 4 June 1972 and 7 June 1976.

C. ferruginea. 1 ex. on 24 May 1972.

Limicola falcinellus. The maximum: 30 exx. in 8 groups (the largest group 12 exx.) on 30 May 1972.

Phalaropus lobatus. The maximum between 20 and 30 May 1972 about 20 birds (the largest flock 16 exx. on 30 May).

Stercorarius longicaudus. One ex. (display behaviour!) on 17 June 1973.

Numenius phaeopus. A few birds (and a flock of 10 exx.) on 10 May 1964, the individuals fighting with stationary *N. arquata. N. phaeopus* did not breed in 1964.

Tringa erythropus. Several individuals (display song) on 10 May 1964, but no breeding that year.

Luscinia svecica. A few birds between 21 and 26 May 1972.

Anthus cervinus. Two birds on 30 May 1972.

Calcarius lapponicus. One ♂ on 10 May 1964, singing by the Martimo-oja.

Temperature and yearly faunal fluctuations

A comparison of the counts made in 1964 and 1976 reveals that more species bred in 1976 (Table 1). Four of the "new" species should, in our opinion, be disregarded here, as they have increased in larger areas during the interval between the censuses: *Cygnus cygnus, Pluvialis apricaria, Larus canus* and *Acrocephalus schoenobaenus.* In some of the species differences seem to be due to the larger area censused in 1976: *Anser fabalis, Falco subbuteo, Lagopus lagopus, Tringa nebularia, Corvus corone, Saxicola rubetra, Phylloscopus trochilus* and *Motacilla alba.* The difference in *Limicola falcinellus* is probably more apparent than real. The remaining species, however, constitute an interesting group, whose occurrence on Martimoaapa is at first sight highly irregular. The data on these species from all the years studied well are given in Table 3. Regrettably the data from 1972 had to be omitted because the study period was so early. Judged from the records of the different ornithologists visiting Martimoaapa, the data for 1975 are somewhat lower than average (average for 1963—65 and 1974, or the years when the 7-km route was covered) and those for 1976 are somewhat higher.

The table indicates that the irregular species group was represented best in 1963, moderately in 1975—76, and poorly in 1964—65 and 1974. This fluctuation has a correlation with the temperature in May (Table 3): the higher the average temperature, the better is this group represented on Martimoaapa. The data in the table suggest that the average temperature for the period between 1 and 20 May is especially decisive.

HILDÉN (1965) considers that the breeding site is selected in two stages. At the first stage, when the bird settles in a territory and examines its suitability, the general features of the landscape are important. At the second stage, a careful study is made of the territory, and acceptance depends on

TABLE 3. The numbers of pairs of rare southern and northern species censused on a 7-km route on Martimoaapa in different years 1963—76. A plus sign indicates that the species was present (see text for details). Parentheses indicate that the species was observed in the breeding season, but possibly did not breed. Temperatures from the station Oulu A of the Central Meteorological Institute of Finland.

	1963	1964	1965	1974	1975	1976
Southern species						
Podiceps auritus	(1)	—	—	—	—	1
Anas querquedula	(2)	—	—	—	—	—
Vanellus vanellus	2	—	—	—	+	1
Northern species						
Anas acuta	5	1	1	2	+	1
Melanitta nigra	(1)	—	—	—	+	2
Mergus albellus	(1)	—	—	—	—	(2)
Numenius phaeopus	2	—	—	4	+	3
Tringa erythropus	1	—	—	1	+	1
Total rare species	8	1	1	3	5	7
Monthly mean temperatures (°C)						
April	1.1	0.2	0.9	0.3	1.1	0.2
May	11.3	7.7	4.6	5.7	8.9	9.0
Mean temperatures of 10-day periods						
21—30 April	3.1	2.0	6.4	1.1	4.1	—0.5
1—10 May	8.7	5.5	5.6	1.7	8.1	4.0
11—20 May	11.8	6.8	3.3	8.0	12.1	13.2
21—30 May	13.3	11.0	4.8	7.3	6.9	9.7

whether it fulfils certain detailed requirements of the species. It is clear that the study area attracts many species only at the first stage in the selection of the breeding site/habitat, and that they later leave to breed elsewhere. The observations of migrating *Numenius phaeopus, Tringa erythropus, Calidris alpina, Limicola falcinellus, Phalaropus lobatus* and *Calcarius lapponicus* (above) are cases in point. In many species the outcome of the detailed study of the territory differs from year to year (Table 3), which suggests that the average temperature of May is involved in the second stage of the selection of the breeding habitat in many peatland species.

In warm springs, the snow disappears early from the peatland areas, and the ice cover melts rapidly on the ponds and lakes, which speeds up the development of aquatic invertebrate communities. Exact data are not available, but warm springs are characterized by the early emergence of mosquitoes and odonates (e.g. a mass emergence of odonates, probably *Cordulis* or *Libellula*, was recorded as early as 3 June 1963 at the head of the Martimo-oja). HILDÉN (1965:60) points out that in most species food does not seem to have any proximate effect on habitat selection, except in the case of food specialists, but his examples mainly illustrate the effect of the mass occurrence of certain insect larvae in Central European forests on birds. The

situation may be quite different in the habitat selection of water-birds and waders at northern latitudes.

Elsewhere, high numbers of northern birds have often been connected with cold springs (for a review, see HILDÉN 1965:59), but low temperatures did not seem to increase the numbers of northern birds breeding on Martimoaapa. On the contrary, after warm springs (May) both northern and southern species were unusually common. The numbers of the southern species were probably affected by the prolongation of migration in warm springs (see e.g. OTTERLIND 1954).

Acknowledgements. All the persons contributing to the present study with their observations have been of great help; the valuable observations from the early summer of 1972 provided by the group led by U. Häyrinen have been particularly important. We are most grateful for the botanical information received from S. Eurola and R. Ruuhijärvi. The fieldwork was supported financially by the Finnish Cultural Foundation (1975) and the Academy of Finland (1976).

Selostus: Simon Martimoaavan pesimälinnuston rakenne ja vuotuinen vaihtelu

Martimojärven suunniteltu kansallispuisto sijaitsee Simon kunnassa lähellä Perämeren pohjoispäätä, n. 20 km merestä. Alueen suurista avosoista, joista laajimmat 5—10 km:n pituisia, on Martimoaapa (n. 8 km²) ehdottomasti runsaslukuisin ja yksi maan parhaita lintusoita.

Kirjoitukseen on koottu pesimälinnustoa koskevia laskentoja ja muita tietoja vuosilta 1963—76. Martimoaavalla pesii n. 40 avosoiden lintulajia, tiheys on n. 100 paria/km² ja lajidiversiteetti $H' = 3.06$. Vesilintujen, kahlaajien, lokkien ja varpuslintujen tiheydet ja diversiteetit ovat suurempia kuin keidas- ja aapasuoalueiden keskimääräisarvot Suomessa. Pääsyynä tähän on se, että Martimoaavalla yhtyvät keidassuot ja aapasuot omalaatuiseksi kokonaisuudeksi. Suon keskustassa on laaja keidassoita edustava allikkoalue, jolla on parikymmentä suolampea. Tätä ympäröivät Pohjanmaan tyypin aapasuot. Linnusto on myös kirjava sekoitus keidas- ja aapasoiden lajistoa. Martimoaavan keskustasta on 1964 ja 1976 laskettu näytealat (kuva 1), joiden parimäärät esitetään taulukossa 1. Simoskanaavalta laskettu näyteala edustaa seudun karumpien soiden tyypillistä linnustoa (taul. 2).

Allikkoalueella pesii nykyisin n. 45 parin harmaalokkikolonia ja lisäksi 15 paria naurulokkeja ja muutama pari meri- ja kalalokkeja. Tavin jälkeen runsaimmat vesilinnut ovat metsähanhi, sinisorsa ja tukkasotka. Kaakkureita pesii vuosittain 2—3 paria, mutta aikaisemmin kanta on ollut paljon suurempi. Satunnaisempiin pesimäaikaisiin vesilintuihin kuuluvat mustakurkku-uikku, heinätavi, uivelo ja joutsen. Pesimäaikaan Martimojärven alueella on tavattu 12 petolintulajia; vuosittain seudulla pesii enintään kaksi paria kutakin lajia. Kahlaajakanta on erittäin monilajinen; 13 pesivästä lajista mainittakoon töyhtöhyyppä (n. 20 paria Martimojärven alueella), isokuovi, joka on selvästi pikkukuovia runsaampi (lukumääräsuhde n. 10:1), mustaviklo, jänkäkurppa, jänkäsirriäinen ja vesipääsky. Varpuslinnuista ovat niittykirvinen ja keltavästäräkki suon runsaimmat lajit, harvinaisemmista mainittakoon kiuru ja ruokokerttunen.

Toukokuussa Martimoaavalla tapaa suuren määrän pohjoista lajistoa, joka vain osin pesii täällä (mm. 1600—1700 ylilentävää *Gavia* sp. yksilöä 25.5.1972, alleja; kahlaajista tyllejä, lapin- ja suosirrejä, vesipääskyjä jne.). Lämpimiä toukokuita seuraavina pesimäkausina useita eteläisiä ja pohjoisia lajeja on pesinyt Martimoaavan keskustassa, mutta keskimääräisen tai sitä kylmemmän toukokuun jälkeen nämä ovat puuttuneet (mm. mustakurkku-uikku, heinätavi, uivelo, pikkukuovi ja mustaviklo; taul. 3). Mitä korkeampia kevään lämpötilat ovat, sitä suotuisampi Martimoaapa näyttää olevan lintujen pesimäpaikan valintaa ajatellen. Tämä johtunee tarjolla olevasta runsaammasta ravinnosta.

References

DYRCZ, A., J. OKULEWICZ, L. TOMIAŁOJĆ & J. WITKOWSKI 1972: Breeding avifauna on the Biebrza marshes and adjacent territories. — Acta Ornithol. 10:343—422.

ENEMAR, A. 1959: On the determination of the size and composition of a passerine bird population during the breeding season. A methodological study. — Vår Fågelvärld Suppl. 2:1—114.

v. HAARTMAN, L., O. HILDÉN, P. LINKOLA, P. SUOMALAINEN & R. TENOVUO 1963—72: Pohjolan linnut värikuvin. — Helsinki.

HILDÉN, O. 1965: Habitat selection in birds. A review. — Ann. Zool. Fennici 2:53—75.

HILDÉN, O. 1967: Lapin pesimälinnusto tutkimuskohteena (Summary: Investigations on the breeding birds of Lapland). — Luonnon Tutkija 71:152—162.

HÄYRINEN, U. 1965a: Suolinnuston suojelutarpeesta ja -mahdollisuuksista Etelä- ja Keski-Suomessa (Summary: The necessity and possibility of protecting marsh bird populations in South and Central Finland). — Suomen Luonto 24:43—54.

HÄYRINEN, U. 1965b: Kesonsuon linnusto. — Manuscript. Maa- ja metsätalousministeriön luonnonvarainhoitotoimisto, Helsinki.

HÄYRINEN, U. 1970: Suomen suolinnuston regionaalisuudesta ja soiden suojelusta. — *In* E. Kumari (ed.): Linde kahel pool Soome lahte, pp. 84—110, Tallinn.

JÄRVINEN, O. 1974: Suolinnuston laskenta. — Luonto-Liitto ry., Forssa.

JÄRVINEN, O. & L. SAMMALISTO 1976: Regional trends in the avifauna of Finnish peatland bogs. — Ann. Zool. Fennici 13:31—43.

JÄRVINEN, O. & R. A. VÄISÄNEN 1973: Species diversity of Finnish birds, I: Zoogeographical zonation based on land birds. — Ornis Fennica 50:93—125.

JÄRVINEN, O. & R. A. VÄISÄNEN 1976: Species diversity of Finnish birds, II: Biotopes at the transition between taiga and tundra. —Acta Zool. Fennica 145:1—35.

JÄRVINEN, O. & R. A. VÄISÄNEN 1977: Recent quantitative changes in the populations of Finnish land birds. — Polish Ecol. Stud. (in press).

KALELA, O. 1955: Die neuzeitliche Ausbreitung des Kiebitzes, Vanellus vanellus (L.), in Finnland. — Ann. Zool. Soc. "Vanamo" 16(11):1—80.

KOMONEN, A. & M. KOMONEN 1973: Vesipääsky Phalaropus lobatus pesivänä Rovaniemellä (English summary). — Lintumies 8:34—35.

KORPIMÄKI, E. 1975a: Suolinnuston kvantitatiivisista tutkimusmenetelmistä ja tulosten tarkastelusta. — Suomenselän Linnut 10: 46—51.

KORPIMÄKI, E. 1975b: Lappajärven Hirvinevan luonnosta, erityisesti linnustosta. — Suomenselän Linnut 10:93—98.

LINKOLA, P. 1959: Zur Methodik der quantitativen Vogelforschung in den Binnengewässern. — Ornis Fennica 36:66—78.

LUHTA, J. 1976: Martimoaapa — Suomen paras suo (English summary). — Molekyyli 33:10—13.

LYYTIKÄINEN, A. 1976: Martimojärven kansallispuistosuunnitelma (Summary: The proposed Martimojärvi National Park). — Suomen Luonto 35:159—163.

MERIKALLIO, E. 1958: Finnish birds. Their distribution and numbers. — Fauna Fennica 5:1—181.

OTTERLIND, G. 1954: Flyttning och utbredning (Summary: Migration and distribution. A study of the recent immigration and dispersal of the Scandinavian avifauna). — Vår Fågelvärld 13:1—31, 83—113, 147—167, 245—261.

PALMGREN, P. 1930: Quantitative Untersuchungen über die Vogelfauna in den Wäldern Südfinnlands mit besonderer Berücksichtigung Ålands. — Acta Zool. Fennica 7: 1—218.

PITKÄNEN, E. 1964: Falco vespertinus. — Ornis Fennica 41:30.

RUUHIJÄRVI, R. 1960: Über die regionale Einteilung der nordfinnischen Moore. — Ann. Bot. Soc. "Vanamo" 31(1):1—360.

SIIRA, J. 1959: Anas-lajien pesivän kannan arvioimisesta (Summary: Notes concerning the census of breeding populations of species of genus Anas). — Ornis Fennica 36: 98—107.

TAHVANAINEN, J., J. HYYTIÄINEN & K. VARONEN 1975: Suomun-Patvinsuon alueen linnustosta. — Pohjois-Karjalan Luonto 5: 22—26.

VÄISÄNEN, R. A. 1965: Eteläiset ja pohjoiset lajit Simon avosoiden pesimälinnustossa. — Manuscript, Dept. Zoology, Univ. Oulu.

Received April 1977