Changes in the breeding bird fauna of coastal bays in southwestern Finland

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A number of coastal bays were censused in 1937—74. Five species, *Cygnus olor, Gallinago gallinago, Tringa totanus, Acrocephalus scirpaceus* and *Emberiza schoeniclus,* increased markedly, three species, *Anas penelope, A. clypeata* and *Numenius arquata,* decreased markedly, and in two species, *Podiceps cristatus* and *Fulica atra,* the population first went down, then rose again.

The main factor influencing the bird populations of the coastal bays is probably changing land use. Some time after the Second World War (mainly in the 'fifties) grazing of many shore meadows was abandoned. A dense vegetation of tall herbs, reeds, grass and sedge now occupies the meadows. The reed belt became denser through eutrophication of the water and cessation of harvesting and grazing.

1. General remarks

The bird fauna of north Europe has undergone considerable quantitative and qualitative changes within the relatively short period we can overlook, i.e. for most species no more than a century and for a few the time since the first publication of LINNAEUS's Fauna svecica (1746). Considerable energy, and sometimes considerable ingenuity (e.g. VÄISÄNEN 1969), have been applied to demonstrating these changes.

In a recent treatment of the subject (v. HAARTMAN 1972), I listed seven main explanations of the faunal changes. The three most important are:

(1) An amelioration of the climate, which has made north Europe accessible to a number of southerly species, whereas northerly species have been forced to withdraw. The fact that the climate has become more maritime has also played a role.

(2) Changes in nature caused by man and his domestic animals have affected the avifauna both favourably and unfavourably.

(3) Avifaunal changes may be apparent rather than real. The enormous recent increase in ornithological activity and the improvement of methods of species identification may reveal the occurrence of species formerly overlooked.

The first hypothesis, the climate hypothesis, was proposed by JÄGERSKIÖLD (1919), and won support through the work of SIIVONEN and KALELA (1937, see also KALELA 1955, etc.), who found many temporal correlations between the expansion and increase in numbers of bird species on the one hand, and the long-term changes in the temperature conditions on the other.

The fact that the northward movement of the isotherms during the period of climatic amelioration was very modest in comparison with the northward expansion of a number of bird species (v. HAARTMAN 1972, p. 461) casts some doubt on the climate hypothesis, though it does not necessarily disprove it in every case. Small causes may have large effects. It remains to be seen whether climatic changes had this kind

TABLE 1. Number of breeding pairs of Redshanks at nine bays, showing the method of computing q=

Name of the bay	1937	38	39	*M*	40	41	42	43	44	*M*	45	46	47	48	49	*M*	50	51	52
Jokila	—		—	*0*	—		—	—	—	*0*	—	—	—	—		*0*	—	—	—
Kuutoniemi	—	—	—	*0*	1	1	1	—	—	*0.6*	—		—			*0*	—	—	
Kiimluoto		—	—	*0*	—	—	—	—	—	*0*	—		—	—	—	*0*	—	1	
Riilä		1	1	*1*	1	—			1	*0.6*	2	1	2			*1.7*	3	2	1
Toivainen		—	—	*0*	—			—	—	*0*		—	—	—		*0*		—	—
Vuorlahti		—	—	*0*	—	—		—	1	*0.3*		—	—	—	—	*0*	—	—	
Faarinlahti		—		*0*	—				—	*0*		—	1	1		*0.7*	1	—	
Jänissaari	3	—	2	*1.7*	3	3	2		1	*2.3*	2	1		1		*1.3*	1	3	1
Haukluoto (E)	—	—	—	*0*	—	1			—	*0.5*		2		—		*1*			—
Σ				*2.7*						*4.3*						*4.7*			

of trigger effect in the case of avifaunal expansion. Likewise, it remains to be seen whether and how species expanding in an east-west rather than in a south-north direction were favoured by the temperature rise.

In Finland, the climate hypothesis gained most attention in the two decades following 1937, whereas in Sweden the direct or indirect influence of man upon the avifauna was stressed repeatedly (e.g. KOLTHOFF 1907, SELANDER 1953, AHLÉN 1965, 1966 and LARSSON 1969). Of course, the two explanations are not, and have probably never been thought to be, completely exclusive. The supporters of the cilmate hypothesis have never denied the effect of man upon nature, but have not observed that changing land use is, at the present time, more important than any other factor.

Recently, a critical attitude towards the faunistic information available on the expansion of rare bird species was taken by ERIKSSON (1969 a, b). He asks the important question whether the expansion of certain species is real or is merely apparent, being the consequence of improved observation. A satisfactory answer to this question is most likely to be provided by long-term investigation of the avifauna of restricted areas by a single person using standardized methods.

Unfortunately, ornithologists show no more site tenacity than other people in our restless time, and this method of demonstrating avifaunal changes has seldom been employed. I was fortunate enough to be able to study the birds on and around my famile estate, Lemsjöholm (about 60°30' N, 21°47' E), for a period of 40 years. With the exception of a single year during the war, observations usually started in early or mid-May and continued, sometimes with short interruptions, to the end of the breeding season. Much of this time was devoted to other pursuits, but there always remained some spare time for what one may call pure bird watching, including small-scale censuses. The main habitats in which censuses were made were:

(1) Small wooded islands in the vicinity of the coast. It was assumed (incorrectly, as it finally turned out) that censusing these islands would be easier than censusing less well-delimited areas on the mainland.
(2) Treeless, rocky islets in the archipelago near the coast.
(3) Bays on the coast or on larger islands in its vicinity.

The changes in the bird populations proved to be by far the largest in the

ennial averages.

M	55	56	57	58	59	*M*	60	61	62	63	64	*M*	65	66	67	68	69	*M*	70	71	72	73	74	*M*
0		—		1	—	*0.3*	1	—	1			*0.7*	—	1	2	2		*1.3*	1	2	4	3	2	*2.4*
0					—	*0*	1			—	1	*0.7*			—		—	*0*	—		—	—	—	*0*
0.3	—	—	—	1	1	*0.4*	—	2	—	1	1	*0.8*		4	2	2	1	*2.3*	2	1	2	1	2	*1.6*
2	3	3		2		*2.7*	2	2	2			*2*				3	+	*3*	+	+	2	2	+	*2*
0		—	—			*0*		1				*1*						*0?*				—	—	*0*
0	—	—	2		+	*0.7*	3	2		+		*2.5*	2					*2*			+	1	2	*1.5*
0.5	—	—	1		—	*0.3*			—			*0*				1		*1*			—	—		*0*
2	1	1	2	1	2	*1.4*	2	—	3	2	2	*1.8*	3	2	—	2	2	*1.8*	1	1	1	1	1	*1*
0	1	—		—		*0.3*	—			1		*0.5*					—	*0*	—	1	1	—	1	*0.6*
4.8						*6.1*						*10.0*						*11.4*						*9.1*

last-mentioned habitat (3), and definitely smallest on the wooded islands (1). In the present paper, I shall deal only with the bays and their bird population.

2. The coastal bays as an ecological environment

The majority of the bays studied were situated on the mainland, in the commune of Askainen, and on the large island Livonsaari, in the same commune. Only three small bays were situated on smaller islands somewhat farther from the coast, in the adjacent commune of Velkua.

The bays were most often roughly U- or V-shaped, but not seldom more shallow, like the ventral part of the U. They were typically surrounded by meadows, adjoined, in their turn, by cultivated fields and woods.

Since the 'thirties, environmental changes have taken place in most or all coastal bays, owing to changing land use. In earlier times, cattle, horses and, to some extent, sheep were grazed on the shore meadows, usually from the last days of May until early autumn; cattle were also grazed in the forests, and sheep mainly on small islands. Now, horses have disappeared. Except for a riding school, apparently mainly catering for teenage girls, there is only one old horse left in the entire commune, owned by an old farmer. Sheep have likewise disappeared. Cattle have become very few, as is general in south Finland, and nowadays are usually kept in the cowhouse in summertime, in order to keep their milk production sufficiently high. At Lemsjöholm (c. 4 sq.km.), cattle and horses were kept up till the end of 1956. There were about 40 cows and 10—20 horses. Until the end of 1973, a few heifers were kept on a single shore meadow, where typical grazed vegetation remained. In several other parts of the area, grazing was abandoned, usually, I think, in the 'fifties. After the disappearance of the large domestic herbivores, wild herbivores, Elks (at times 20 individuals) and White-tailed Deer (1974 five individuals), occupied the empty niche.

The changes taking place in the vegetation of the bays and their shore meadows when grazing ceased were similar to those reported from lakesides in southern Sweden by LARSSON (1969). It should perhaps be pointed out that the Baltic is brackish on the coast of southwestern Finland. A detailed description of the vegetation of

the shore meadows of the Åland islands has been given by A. PALMGREN (1961).

Cattle keep the grass of the shore meadows short, as if it were cut with a somewhat inefficient lawn-mower. Shores grazed by cows are a very pleasing feature of the scenery, well worth preserving locally. If nothing is done, they will soon disappear in the southern parts of the country.

On hot days the cows also used to graze the aquatic vegetation, reeds, rushes, etc., seaward from the shore-line to a depth of c. one metre. Consequently, in cow-grazed areas there used to be a stretch of clear water between the shore and the border of reeds.

In areas protected from grazing, the reeds soon spread up to the shore-line and invade the shore meadows in sparse patches. A dense vegetation of tall herbs (e.g. *Valeriana officinalis, Angelica, Filipendula ulmaria, Valeriana officinalis, Lythrum salicaria* and *Lysimachia vulgaris),* together with grasses and sedges, changes the neatly "mowed" meadows to something with a certain flavour of a jungle. In July—August, when this "jungle" flowers in white, yellow and purple, it offers a colourful picture. The herb and grass vegetation becomes locally interspersed with willow, and shore groves (alder, bird-cherry, etc.), which were earlier checked by the grazing, invade the borders of the meadow. Locally, pine and spruce have been planted along the upper borders of the shore meadows.

Simultaneously with the change in the shore meadows, another alteration has taken place. In earlier times reeds were harvested for fodder for cattle and sheep. This custom was at its peak during the war, but ended abruptly sometime in the mid-fifties, and as a result the reeds have now generally grown denser than before. Their growth has also been stimulated by the eutrophication of the water. Artificial manure is nowadays used in agriculture on an unprecedented scale, and forest manuring has become important fairly recently. A certain amount of the manure reaches the shore waters through ditches, etc. Also, it seems possible (though so far as I know this point has not yet been properly studied) that the increasingly numerous pleasure motorboats, moving at weekends from the towns of Turku and Naantali to cottages in the archipelago and back again, add to the eutrophication by leaving small amounts of organic substances scattered in their wake.

My friend Nils F r i t z é n, an expert on the avifauna of eutrophic lakes, often remarks that the reeds must have been very empty before the Reed-warbler had established itself as a permanent and locally abundant member of the Finnish avifauna. This is true, but the emptiness may have been made less noticeable by the fact that there were fewer belts of dense reeds than today. Old photographs, which are so much more reliable than our memory in recording environmental changes, testify to the striking difference between then and now.

3. Census methods

The census work was begun in the 'thirties. Methods have advanced considerably since then. Moreover, the censuses were not my main ornithological occupation, but were performed in my spare time. For this reason, the bays were visited with varying intensity in the different years, in some years once or twice, in other years repeatedly. The reliability of the census probably increases with repetition, although it is not known how much. A single visit at the best time of the year (end of May

to the beginning of June), when the growing reeds do not yet hide the bird life, may yield better results than repeated visits at a later date.

Two numerous species, the Mallard and the Goldeneye, do not nest in the bays, but should be included in their fauna, as they spend much of their time there, feeding, and bringing their broods. They were included in the census, but will be omitted here because of difficulties in obtaining reliable estimates. Similarly, the Tufted Duck and the Pochard will be omitted; without searching for nests it is hard to estimate their population size. Neither species is abundant in the bays, but the Tufted Duck is a common breeder in the archipelago. The Wigeon is included here, although it does not nest in the bays, because it is much easier to count than the Mallard.

As a rule, bays with a richer bird life received more visits per summer than bays with few birds. This means that the abundance of some species may have been overestimated in good years and underestimated in poor years. In the 'thirties, and, again, in the late 'sixties and early 'seventies the abundance of the most numerous species, the Great Crested Grebe, was at a peak; census activity was also greatest at the time.

A serious drawback of the study was that the limits of the bays are seldom very distinct. For instance, Lapwings breeding in adjacent fields may well be included among the breeding species of the shore meadows. The censuses made by one of the best bays had to be discarded as the census area had varied from year to year. Such faults must be excused in a study which was not originally intended to be a long-term work. What I aimed at in the 'thirties and early 'fourties was to clarify more static realtions of the fauna, as the relative abundance of the different species. When I started the work, I had no idea that the populations would fluctuate as much as they did.

When the yearly numbers of pairs were estimated, the number used for most species was not the maximum number observed on one visit, but rather the number which was seen relatively constantly. The words "relatively constantly" were interpreted with reference to the habits of the species and other relevant circumstances, which are fairly well known to a person who has studied the subject for decades. The method may sound whimsical, but I think it is the only one possible in the present case. The raw data obtained by this method will not provide abundance figures suitable for comparison with the figures of other investigators, but the results should be comparable *inter se*, i.e. reveal the population trends. The yearly abundance figures were computed twice for every bay, the second time without having access to the first series of figures. The two series agreed sufficiently well.

Of the c. 20 bays visited for at least a few years, I choose nine for the present study. These bays were visited in at least one out of every five years. From the yearly abundance figures the averages for the quinquennia were computed. Table 1 shows, as an example, how the figures were computed for the Redshank. There is a more advanced method of computing abundance figures from an incomplete set of data like those available here (see ELFVING in v. HAARTMAN 1957), but it is too time-consuming to be carried out without the aid of an electronic computer, and there was no opportunity to do this at the present stage of the work.

TABLE 2. Species of the coastal bays and their fluctuations.

Species	Population fluctuations
Podiceps cristatus	decrease — increase
— *auritus*	breeds occasionally
Anas platyrhynchos	not clarified
— *crecca*	rare
— *querquedula*	rare
— *penelope*	decrease
— *clypeata*	decrease
Aythya fuligula	not clarified; large fluctuations in the archipelago
— *ferina*	not clarified
Bucephala clangula	not clarified
Cygnus olor	increase
Circus aeruginosus	breeds occasionally
Fulica atra	decrease — increase
Vanellus vanellus	no trend?
Gallinago gallinago	increase
Numenius arquata	decrease
Tringa totanus	increase
Larus canus	breeds occasionally by bays
— *ridibundus*	occurrence erratic
Saxicola rubetra	rare
Acrocephalus scirpaceus	increase
— *schoenobaenus*	no trend?
Motacilla flava	rare
Emberiza schoeniclus	increase

4. The avifauna

The choice of the species to be included among the birds of coastal bays is to some extent arbitrary. The species considered here are listed in Table 2, together with short remarks on their population fluctuations. The fluctuations are presented graphically in Fig. 1.

Occasional species were omitted from the Table. Of the species listed there, quite a few were too rare to allow definite conclusions with respect to their fluctuations. The Black-headed Gull nested occasionally in colonies, but its occurrence was quite erratic. The fluctuations of the Lapwing may be unreliable, for reasons discussed below. A few species, such as the Mallard and the Goldeneye, were excluded because they were too difficult to census exactly.

Of the remaining ten species, five have shown a marked increase, three have decreased, and two decreased and subsequently increased.

Podiceps cristatus and *Fulica atra.* These two species show nearly identical population fluctuations and may be treated together. The decrease after the peak in the late 'thirties was probably partly caused by severe winters, which killed many Great Crested Grebes and Coots in their winter quarters (v. HAARTMAN 1945). Also, a local reduction of the reed vegetation, resulting from the extensive harvesting during the war years, may have played some role. The subsequent fluctuations of the populations are not easy to understand. Both species remained at a minimum for a prolonged period, though the winters were more favourable. Only recently, have they regained a high level. Fig. 1 indicates that the population of the Great Crested Grebe is still less than half that in the late 'thirties, but most of this difference is due to a single bay, whose large grebe colony disappeared never to return.

I wish to propose a predator-prey relationship as a hypothetical explanation of the oscillation of the populations of the Great Crested Grebe and the Coot. Both species suffer severely from the nest plundering by the Hooded Crow. People visiting the nesting colonies in row-boats are a serious peril to grebes and Coots. The incubating birds leave their nests, and the crows immediately start stealing eggs. What serious predators the crows are, is seen in places to which they carry the stolen eggs to eat them. On a single small island in the vicinity of one of my best bays, in 1973, I found no less than 40 grebe's eggs and some Coot's eggs taken by the crows.

Both in the 'thirties and, again, re-

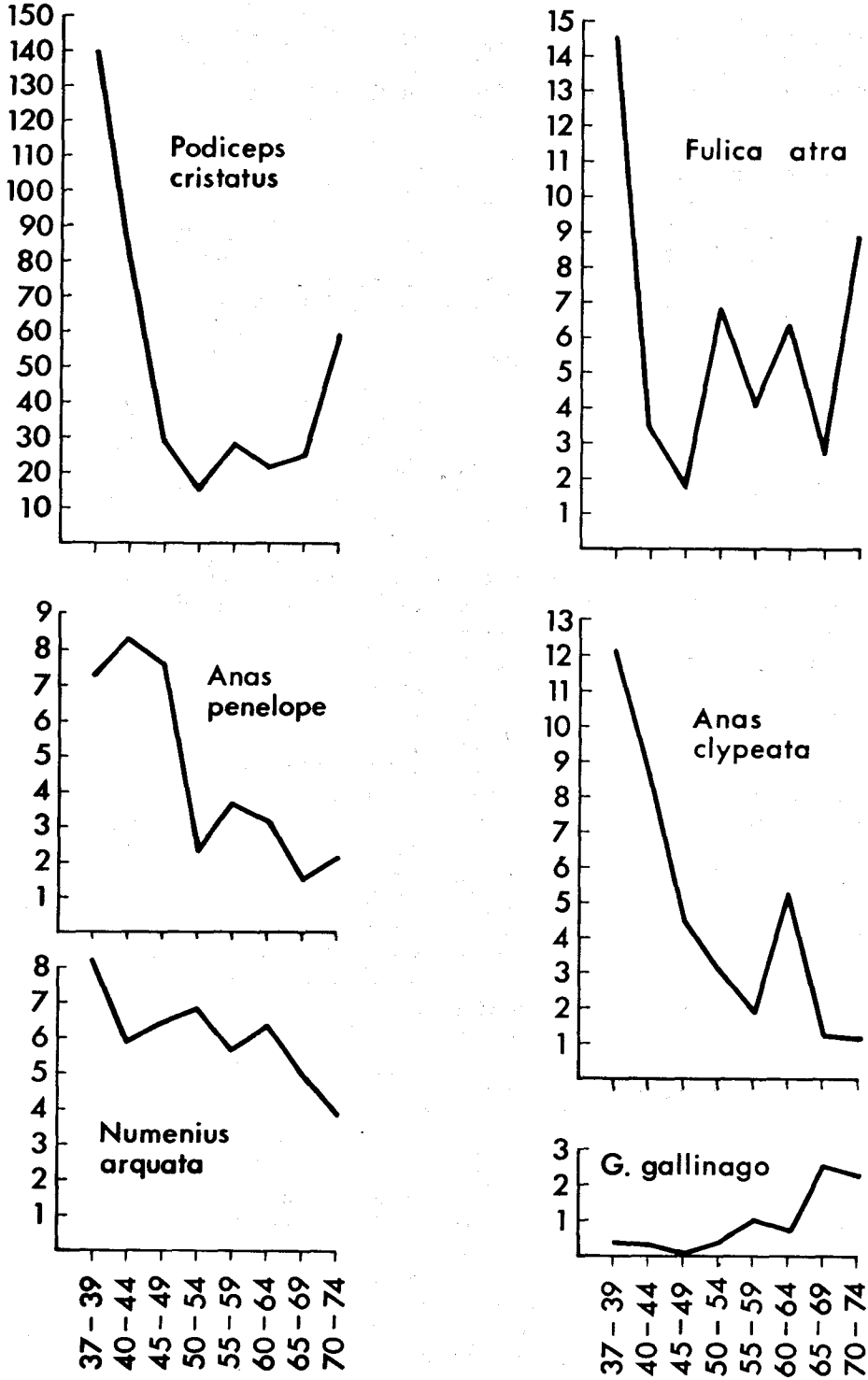
cently, a crow's nest has regularly been found in the vicinity of each of the best bays; in the intervening period, crows were almost absent from Lemsjöholm. The severe egg predation of the crows may well bring down the grebe and Coot populations. This will mean less food for the crows, and consequently their decrease will lead to an increase in the prey species. This will again raise the numbers of the predators, and so on. If predation by the Hooded Crow is a key factor in the population dynamics of the Great Crested Grebe and the Coot, their populations will fluctuate cyclically even without climatic catastrophes or large changes in the environment. The future will show whether the oscillations continue or not.

Anas penelope and *A. clypeata.* The Wigeon and the Shoveler are another pair of species showing a parallel population trend, a very depressing one. In fact, the fatal decrease of these paddling ducks would be evident without censuses. Whereas, in earlier times, they were seen almost daily and often in considerable numbers, they are now observed only a few times every summer, and the numbers of nest records decreased long ago. Flocks of males, approaching a dozen, could be seen in earlier times as the breeding season advanced. Now, even single males are rare. As the Shoveler is a very southerly species in Finland and the Wigeon a very northerly one, it is difficult to attribute their decrease to climatic changes. Environmental changes, on the other hand, may have been decisive. The Wigeon is a meadow grazer, and the change in the structure of the shore vegetation may have affected it unfavourably. Both species rest in the open water near the shore-line; when grazing ceases, this open water becomes occupied by reed vegetation. The nest of the Shoveler is admittedly placed in dense vegetation, but the present cover of the shore meadows may locally exceed the optimum.

Cygnus olor. Originally an escape from a bird pond in Maarianhamina (Mariehamn) in the Åland islands, the Mute Swan first appeared in my area in the late 'thirties. Only recently has it become a regular visitor (v. HAARTMAN 1972). So far, only a single pair has nested near the study area, but several pairs, probably subadult individuals, were seen in the bays, especially in 1973 and 1974. A rapid population increase may, therefore, be expected in the near future.

Vanellus vanellus. The curious rise in the Lapwing population, followed by a decrease, may not be real. A source of error in censusing Lapwings was the difficulty in determining their provenance. In many cases it could not be decided whether they nested on the shore meadows or on adjacent fields. The Lapwing population is known to decrease in cold springs (VEPSÄLÄINEN 1968). Also, tall vegetation makes an area unsuitable for the Lapwing (KLOMP 1953). Therefore, the shore population is probably bound to decrease.

Numenius arquta. In contrast to the Lapwing, the Curlew population underwent a clear decrease. This is the general trend in south Finland, judging by the numbers of nest-cards delivered to the Finnish Society of Sciences in 1954—1974 (v. HAARTMAN 1974). The number of Curlews on migration also seems to have decreased at Lemsjöholm since the 'thirties. The increase and expansion of the Lapwing in Finland has been accompanied by a spectacular broadening of its ecological spectrum. Lapwings nowadays nest on bogs and even on rocky islets in the archipelago (v. HAARTMAN, HILDÉN, LINKOLA, SUOMA-


Podiceps cristatus
Fulica atra
Anas penelope
Anas clypeata
Numenius arquata
G. gallinago
37 – 39
40 – 44
45 – 49
50 – 54
55 – 59
60 – 64
65 – 69
70 – 74

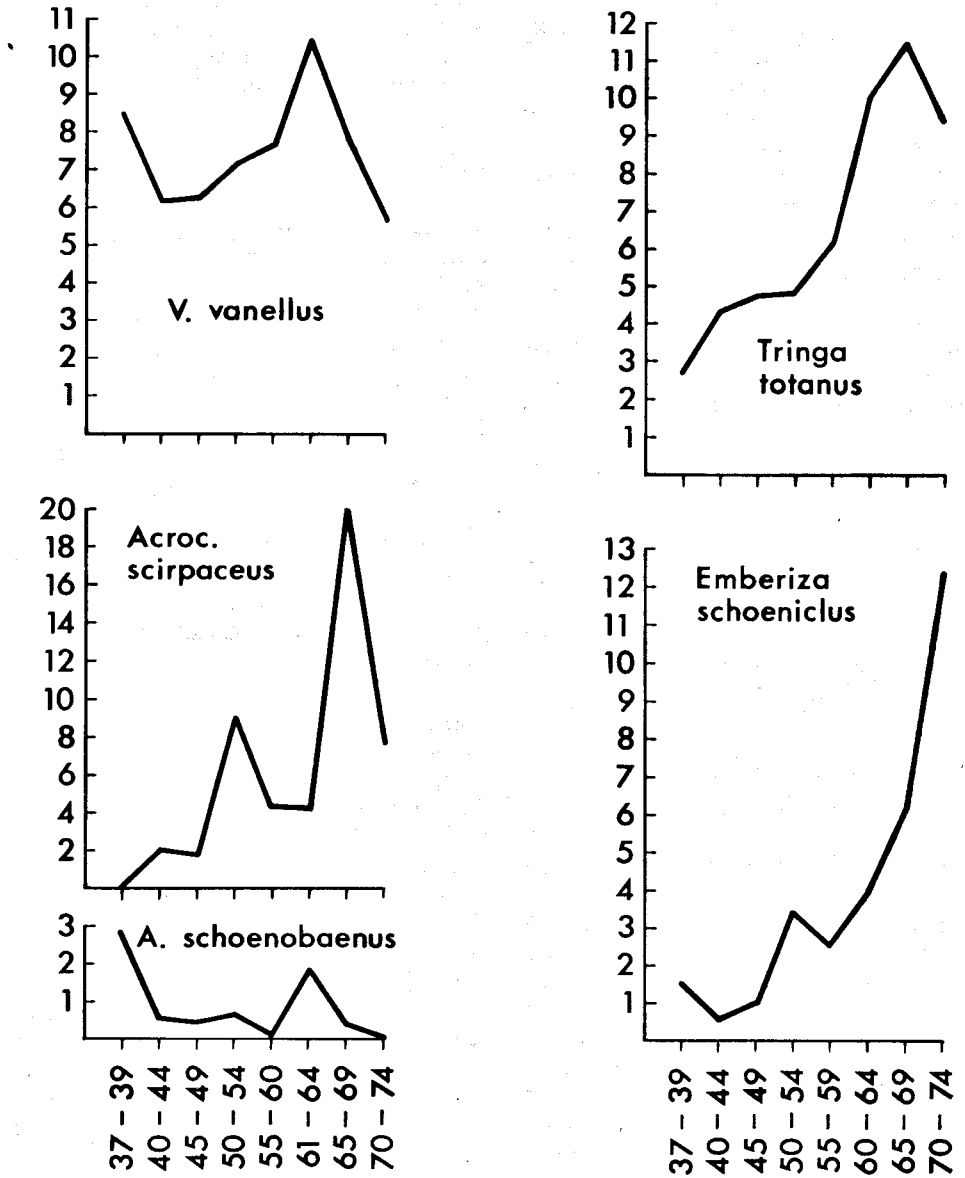


FIG. 1. Average yearly numbers of pairs of eleven bird species at nine shore bays for quinquennia in period 1937—1974.

LAINEN and TENOVUO 1963—1972). In contrast, the Curlew's ecological spectrum has narrowed. In the 'thirties I found it breeding on some small wooded islands and on one treeless island in the archipelago near the coast

(v. HAARTMAN 1945). Nowadays, a person finding a Curlew's nest in habitats of this kind would deserve a prize. In 1930, PALMGREN reported Curlews nesting in rocky pine forests on the Åland islands.

Gallinago gallinago. The Snipe was probably favoured by the vegetational succession of the shore meadows after the cessation of grazing. LARSSON (1969) found it increasing on protected shore meadows in south Sweden.

Tringa totanus. The strong increase of the Redshank is not easy to understand. It took place both in bay meadows protected from grazing and in a shore meadow that was grazed until recently. In the 'fifties, a strong influx of Redshanks was noticed on the archipelago islands and islets, as well.

Acrocephalus scirpaceus and *Emberiza schoeniclus.* The increase of both species is evidently correlated with the changes in vegetation. The Reed-warbler is dependent upon the occurrence of dense clumps of reeds growing in shallow water; the Reed-bunting is more versatile (e.g. FRITZÉN and TENOVUO 1957), utilizing parts of the shore meadows if their vegetation is tall and dense. It is noteworthy that the only larger bay, of those at Lemsjöholm, where the Reed-bunting has not settled permanently is the one where grazing continued until quite recently.

Considering the luxuriance of the shore meadow vegetation, it seems strange that *Saxicola rubetra* and *Acrocephalus schoenobaenus* have not increased so far, not to speak of *Locustella naevia,* which was never observed in the area.

Whereas the Reed-bunting population fluctuated comparatively little, apart from the long-term trend, the Reed-warbler could be numerous in one year and nearly lacking in the next. The number of singing males depends upon the condition of the old reeds after the winter. In some winters the snow and/or ice nearly completely destroyed the standing clumps of old reeds; after other winters these clumps remained intact. One may wonder what happens to the Reed-warblers in springs with poor reed cover. Do they stay silently in the area, some of them eventually taking up territories when the new reeds have grown up, or do they nomadize, or do they give up the region entirely, continuing to migrate to other areas or returning southwards? The summer of 1968, and to some extent, 1969, were top years for the Reed-warbler. The population may well have been five times as large as usual. It would be worthwhile for ornithologists and nature conservationists to collect data on the condition of the reeds in the spring. This is an environmental parameter whose variation is little known.

The time when the first Reed-warblers settled in the region will obviously remain obscure. It is likely that, in the 'thirties, I confused some Reed-warblers with Sedge-warblers, which at that time were thought to be the only *Acrocephalus* species in the region. The histogram of the population size of the Sedge-warbler shows a certain decrease after the late 'thirties and early 'fourties. This decrease is probably artifical, as external conditions have been more favourable for the species recently. It seems natural to conclude that some Reed-warblers were erroneously recorded as Sedge-warblers at the start of my investigation.

In many years the Sedge-warbler is absent from the study area. This surprising lacuna has been overlooked in Finnish faunistic literature (see v. HAARTMAN, HILDÉN, LINKOLA, SUOMALAINEN and TENOVUO 1963—1972).

Selostus: Lounais-Suomen rantalahdelmien pesivän linnuston muutokset

Joukko rantalahdelmia Askaisissa ja Velkuassa tutkittiin 1937—74. Viisi lajia *(Cygnus olor, Gallinago gallinago, Tringa totanus, Acrocephalus scirpaceus* ja *Emberiza schoeniclus)* ylestyivät huomattavasti, kolme lajia *(Anas penelope, A. clypeata* ja *Numenius arquata)* harvinaistuivat huomattavasti, ja kahden lajin *(Podiceps cristatus* ja *Fulica atra)* kanta ensin taantui mutta myöhemmin jälleen ylestyi.

Päätekijä, joka vaikuttaa rantalahdelmien lintukantaan näyttää olevan muuttunut maankäyttö. Toisen maailmansodan jälkeen (pääasiallisesti 50-luvulla) luovuttiin melko yleisesti käyttämästä rantaniittyjä laitumina. Korkea ja tiivis kasvusto on nyt vallottanut rantaniityt. Vesien rehevöitymisestä (ja muista syistä) johtuen ruohikot ovat laajentuneet ja tihentyneet huomttavasti.

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