Autumn migration strategies of the Sedge Warbler *Acrocephalus schoenobaenus* in Finland: a preliminary report

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Ringing data on the Sedge Warbler recorded in a bay (Laajalahti) in the Gulf of Finland and a lake (Siikalahti) in SE Finland in autumn 1984 are analysed as a contribution to the all-European ringing project proposed by EURING.

The Finnish Sedge Warblers migrate southwards fairly rapidly, reaching southern Europe 2-4 weeks after they have left Finland. The adults leave the breeding grounds soon after their young become independent. The migration of the juveniles culminates in early or mid August.

In Laajalahti most Sedge Warblers accumulated migratory fat from July and early August onwards but in Siikalahti there was only a temporary weight gain in early August. The birds seem to eat reed aphids for fattening, but were probably not able to use them as efficiently in Siikalahti as in Laajalahti, perhaps because the abundance of aphids declined too early in the former place. The vast reed beds along the southern coast of Finland are probably important fattening habitats for the Finnish Sedge Warblers, but the birds still have to interrupt their migratory flight before crossing the Mediterranean.

The suitability of the Sedge Warbler as the object of an international ringing project and the aims of the project are briefly discussed.

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Introduction

In March 1981 EURING, European Union for Bird Ringing, proposed an all-European research program based on ringing. The species selected for the program, which should include as many national ringing centres and European ringers as possible, were the Sedge Warbler *Acrocephalus schoenobaenus* and the Redwing *Turdus iliacus*. Shortly after the EURING meeting, a thorough analysis of the autumn migration strategies of the Sedge Warbler and the Reed Warbler *A. scirpaceus* in western Europe was published by Bibby & Green (1981). They concluded that Sedge Warblers migrate rapidly, flying one long stage, while Reed Warblers migrate more slowly, splitting the journey into substages. The reason for the different strategies was supposed to be geographical differences in the food available to the two species. Though closely related, they have different feeding adaptations, the Sedge Warbler being adapted to eating reed aphids.

The observations of Bibby & Green (1981) and other students of the migration ecology of the Sedge Warbler (e.g. Bibby et al. 1976, Green 1976, Insley & Boswell 1978, Grüll & Zwicker 1982, Jarry 1982, Bibby & Green 1983) form a solid basis for the EURING study on the migration strategies of *Acrocephalus* warblers. The plans and forms for the project were sent to the national ringing centres in November 1983 with a message urging their ringers to participate.

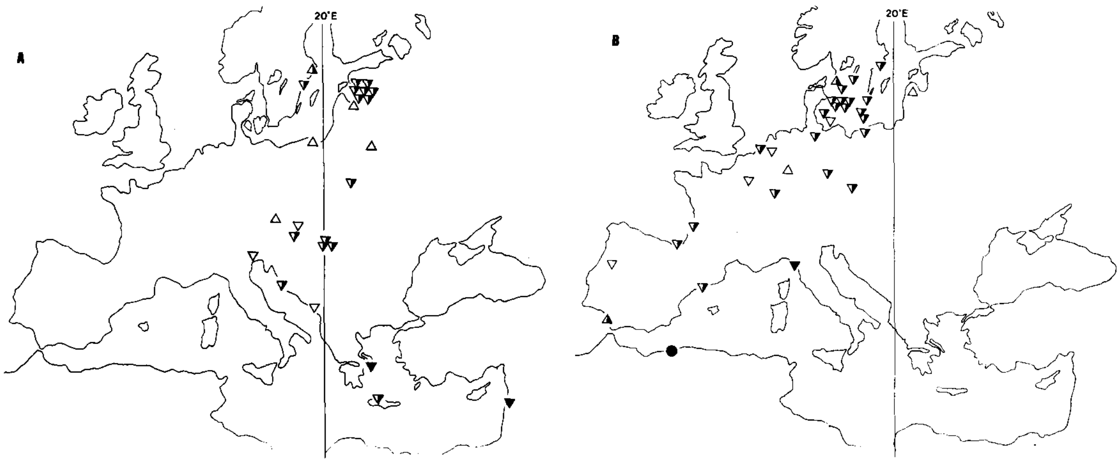
In this article we present some preliminary observations on the migration ecology of the Sedge Warbler and discuss the aims and methods of the Finnish workers contributing to the *Acrocephalus* project, hoping to encourage all the European ringing centres to take part.

Material and methods

By 1984 about 70 000 Sedge Warblers had been ringed in Finland, the annual numbers having increased rapidly in the last few years (Saurola 1981; from 1308 in 1977 to 13 737 in 1984). Most of the birds were mist-netted as juveniles in autumn, the number of nestlings ringed each year was only about 200–400.

The great majority of the Sedge Warblers were ringed along the southern coast, where many ringers have been netting intensively for years, especially in two bays (Laajalahti and Vanhankaupunginlahti) in the vicinity of Helsinki (Saurola 1981). The activity of warbler ringers increased inland in 1984, due to better organization of the project, although almost half of the birds were trapped along the southern coast.

For this preliminary report we analysed the ringing data on Sedge Warblers from the bay Laajalahti (60°11'N, 24°50'E) and the bay Siikalahti (61°33'N, 29°34'E) in 1984. The former is a eutrophic coastal bay west of Helsinki, the latter a eutrophic bay in a lake in Parikkala, southeastern Finland. In these two localities 10 and 11 mist-nets (9 m each) were erected in a single line, which extended from near the forested shore through a reed bed in Siikalahti, and inside a reed bed further from the shore and water's edge in Laajalahti. In addition, extra temporary nets were used near the standard lines in collecting biometrical data. The nets were erected from sunrise to 11.00 or 12.00 in



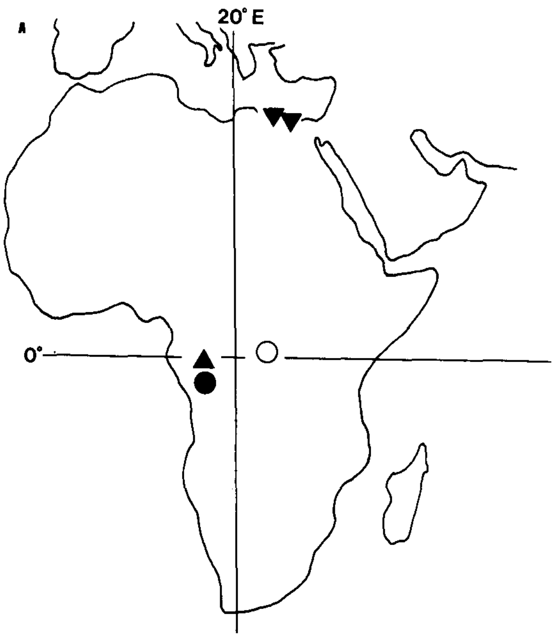


Fig. 1. Foreign recoveries of Sedge Warblers (A) and Reed Warblers (B) ringed in Finland. Black symbols indicate birds killed, black and white retrapped and white found. △ = during spring migration, ▽ = during autumn migration and ○ = during winter.

Laajalahti and throughout the day in Siikalahti, where, however, only the comparable morning catches were used in this analysis. Netting began in early July and continued, with short interruptions, to mid September. The wing lenght (maximum method, Svensson 1984) and the weight (accuracy 0.1 g, Pesola 30 g spring balance) were measured and the amount of subcutaneous fat was estimated (Operation Baltic index from 0 to 5, e.g. Busse & Kania 1970) on all the Sedge Warblers ringed and retrapped.

In order to study the relationship of aphid abundance to the timing of migration and accumulation of migratory fat in the Sedge Warbler the relative numbers of aphids were estimated in the reed beds near the net lines at 10 randomly selected permanent points. The relative numbers of aphids on separate leaves and flowers of five reed stems were estimated once a week using a logarithmic scale (0, 1–10, 11–100, etc.). The estimates and further calculations of the aphid densities were made by the methods of Bibby & Green (1981), which were intended for use in the EURING Acroproject.

The field work was done by Pekka Puhjo, Alf Roberts, Matti Ryynänen, Antero Topp, Erkki Topp and Pekka Topp in Laajalahti, and by Irma Koskimies, Pertti Koskimies and Raimo Latja in Siikalahti.

Results

Migration route and wintering area of Finnish Sedge Warblers. In Fennoscandia the Sedge Warbler is breeding in the northernmost part of its range (e.g. Voous 1960). It has probably increased in numbers in Finland in this century and extended its range, which now covers the whole country (Lammi 1983). The trapping data, however, show a declining trend in Laajalahti since 1980 (see also Väisänen 1984).

The Sedge Warbler winters in tropical Africa south of the Sahara (Moreau 1972). There are only three Finnish ringing recoveries from central Africa, the assumed wintering area (Fig. 1A). One bird ringed in Mali in February and recaptured in Finland in the following May indicates that Finnish birds may also winter in western Africa with British (Bibby et al. 1976) and French (Jarry 1982) conspecifics. The species reaches its wintering grounds in Kenya in December and does not leave until April (Pearson et al. 1979).

Most Sedge Warblers ringed in Finland and recovered abroad are juveniles on their autumn migration through Europe (Fig. 1A). According to these casual recoveries (about half of the birds have been recaptured by ringers, the other half shot or found dead), the warblers migrate southwards from Finland, flying over the eastern Mediterranean Sea or passing along its eastern coast. The strictly southward direction of the migrating Sedge Warblers seems to be a real pattern, because the Finnish Reed Warblers (Fig 1B) have been recovered in western and southwestern Europe, and the probability of being recovered should be the same for the two species. The earliest recoveries south of Finland were made in early July, but most of the recoveries occurred in early and mid August. The migrants seem to reach southern Europe in late August and early September, only 2–4 weeks after the peak abundance in southern Finland.

Timing of autumn migration in southern Finland. The Sedge Warbler arrives in southern Finland in early or mid May. Egg-laying begins in late May or early June and some females lay a second clutch in July.

We analysed the timing of autumn migration in Laajalahti and Siikalahti in 1984 by comparing the daily captures with the standard nets, including ringings and retraps (Fig. 2). It is difficult, however, to interpret the timing of migration from capture totals alone, because an increase in the capture rate can be due to either a real increase in the number of birds present or their more active movements in the reed beds. The fairly constant retrapping percentages suggested a steady exchange of birds throughout the migration period (Fig. 2). Thus, we conclude that the number of birds trapped shows, at least roughly, the overall pattern in the timing of migration, even if there are some short gaps in netting effort.

The autumn migration of adult Sedge Warblers began in early July, shortly after their offspring reached independence, culminated in late July and was finished by mid August (Fig. 2). The birds trapped in Laajalahti and Siikalahti seem to be partly from local breeding populations, partly birds on passage from further north, as was confirmed by some recoveries.

The juvenile warblers do not reach independence until early or mid July and the autumn migration begins shortly after this. According to capture totals, the migration peaked in the first week of August in both Laajalahti and Siikalahti (Fig. 2), which was a fairly normal time in Siikalahti, but about a week earlier than in former years in Laajalahti. The last birds were trapped in late September, when the migration of the Sedge Warbler is over in Finland.

As with the adults, it is difficult to draw definite conclusions regarding the areas of origin of the juvenile Sedge Warblers trapped in Laajalahti and Siikalahti, where hundreds of pairs breed in the neighbourhood of the netting area. The juveniles seem to leave their natal area fairly soon, because in Siikalahti, where a population study has been performed, young ringed in nests before fledging were retrapped in mist nets after 2–4 weeks, but not later (Koskimies, unpubl.). Fairly many full-grown birds, however, remained as long as 10–15 days in the same reed beds. It is impossible to estimate the proportion

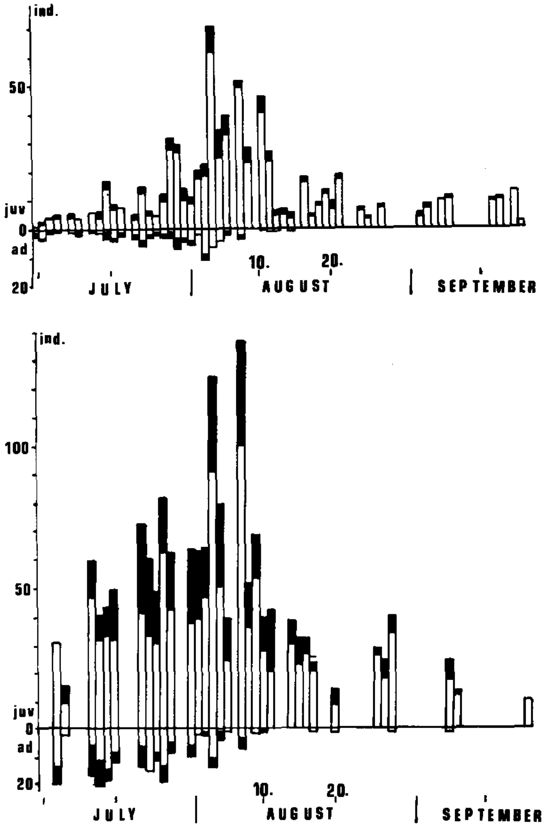


Fig. 2. The daily totals of Sedge Warblers caught in Laajalahti (above) and Siikalahti (below) in standard nets before 12.00 in autumn 1984 (adults above, juveniles below, white = ringings, black = retraps).

of juveniles hatched in other localities and trapped on passage in Laajalahti and Siikalahti, but it seems probable that at least some of the birds arriving from the north stay a few days or even longer in the vast reed beds along the southern coast of Finland.

Accumulation of migratory fat: fat index. Accumulation of migratory fat in Sedge Warblers was studied by weighing the birds and estimating the relative amount of subcutaneous fat. When determined by an experienced ringer, the Operation Baltic index seems to give a fairly good estimate of the stage of fattening in the Sedge Warbler: the mean weights of birds with different indices differed markedly from each other (Fig. 3).

The proportion of juveniles without visible fat exceeded 50 % in Laajalahti in July, but decreased to about 20–30 % after the beginning of August (Fig. 4). The proportion of birds with the highest indices (4–5) remained low (5–15 %).

The final percentage distribution by fat indices showed a similar pattern in the adults, but was

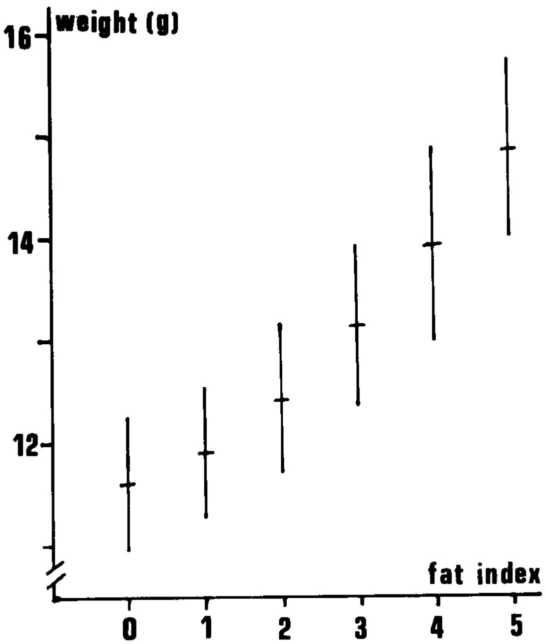


Fig. 3. The mean (± standard deviation) weights of juvenile Sedge Warblers grouped by fat indices (0–5). Records made at ringing in Laajalahti in autumn 1984 (N=1740).

reached as early as mid July, when they started migration. There seems to be annual variation in the fattening, although the general pattern is the same as in 1984.

The mean proportion of juveniles with body fat (index 1–5) in Siikalahti was about 10 % in mid July, being lower than in Laajalahti, but it increased to almost 100 % in mid August.

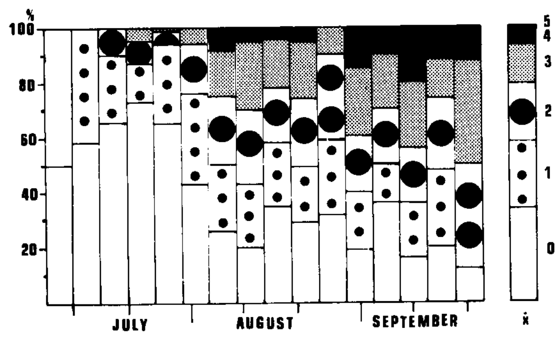


Fig. 4. The percentage distribution of juvenile Sedge Warblers by fat indices in 5-day catches in Laajalahti in autumn 1984. Each bird included only once (when ringed) as in Fig. 3.

Weight. The mean weight of the adults ringed in Laajalahti was 13.0±1.0 g (SD, N=150) and in Siikalahti 12.1±0.9 g (N=114). The difference is highly significant (t-test, P<0.001) and a similar difference was found in the juveniles: Laajalahti 12.2±1.0 g (N=1740) and Siikalahti 11.5±0.7g (N=1124; t-test, P<0.001).

The mean weight of the adults in Laajalahti increased from 12.5 g in early July to about 13.4 g in late July and early August, indicating accumulation of migratory fat. The corresponding increase in Siikalahti (from 11.5 to 12.3 g) took place about one week earlier, though the data are scanty. The few females that were laying a second clutch and were 2–3 g heavier than normal may have contributed slightly to the increasing trend, but a similar increase due to fattening was observed in the males.

The mean weight of the juveniles ringed in Laajalahti decreased markedly towards the end of July (Fig. 5). The juveniles become independent then and are no longer fed by the parents as in early July, soon after fledging, when their weight is, on average, 1 g higher than that of their parents.Fledging is fairly synchronous in the Sedge Warbler population in Siikalahti, occurring in over half of the nests in the same week (Koskimies, unpubl.).

The mean weight of the juveniles increased rapidly in early August (Fig. 5). The slower increase later on can partly be due to the appearance of juveniles from second broods, which are lighter than those from first broods at this time. The daily variation of the mean weight in late August and early September is perhaps due to the cold nights and mornings (temperature often below 0°C), when the birds were lighter than average. In autumn 1983, when the nights were warmer, the weight increase was more even and the daily variation smaller (Koskimies & Saurola, unpubl.).

In Siikalahti the mean weight of the juveniles is more than 0.5 g lower than in Laajalahti in mid July and remains at the same general level through August and early September (Fig. 5).

How can the difference in weights between Laajalahti and Siikalahti be explained? Do the birds breed earlier in Siikalahti, so that the weight of the juveniles trapped in mid July is already at its minimum, or are the young lighter when they become independent? The second alternative seems more plausible to us, but this matter requires more study. The mean weight in Siikalahti has been lower than in Laajalahti in other years as well. The Siikalahti juveniles are, however, able to increase their weight at least temporarily, because in the evening the weight of an individual may be 0.5–1 g higher than in the morning.

The mean weight gain of juveniles ringed and retrapped within 10 days was 0.07 g/day (N=285) in Laajalahti and –0.02 g/day (N=290) in Siikalahti (Fig. 6). Thus, the birds staying a few days in Laajalahti accumulated migratory fat, but in Siikalahti many of them seem to have lost weight. The weight decreased in Laajalahti in July, but in mid August was increasing at the rate of 0.2 g/day (Fig. 6), and after a sudden drop increased again in late August — early September. In Siikalahti the pattern was quite different. The weight change was positive only in early August and towards the beginning of September (Fig. 6). Because of the high standard deviation, however, these patterns must be examined with caution.

The mean weight change of adults in Laajalahti from mid July to early August was 0.04 g/day (N=24) and in Siikalahti -0.08 g/day (N=16). It is difficult to deduce the temporal pattern of the mean weight change from these scanty data, but in both localities the change was negative in July and positive in August.

Reed aphids. The reed aphids, especially the Plum Reed Aphid *Hyalopterus pruni*, are supposed to be an important food source of migrating Sedge Warblers in western Europe (Bibby et al. 1976, Bibby & Green 1981). The relative numbers of aphids (species not identified) during peak abundance was higher in Siikalahti than in Laajalahti, but their temporal distribution was different. In Siikalahti aphids were numerous in mid and late July, but had disappeared almost completely by mid August, whereas in Laajalahti the mass occurrence did not begin until late July and lasted to late August. The mass occurrence of aphids is said to vary enormously both spatially and temporally (Bibby & Green 1981, O. Heikinheimo, pers. comm.), although this is poorly documented, at least in Finland. It should be kept in mind that we have data from only one year.

The migration peak and increase in the mean weight of adult birds was earlier in Siikalahti than in Laajalahti, which accords with the slight difference in the mass occurrence of aphids. The mean weight of the juveniles was fairly stable in Siikalahti, but increased in Laajalahti a few days after the relative abundance of aphids began to increase. However, the mean weight remained high, though fluctuating, after the mass occurrence of aphids was over (Figs. 5, 7).

The most direct evidence of the possible effect of aphid occurrence on the accumulation of migratory fat could be obtained by comparing the mean daily weight change of individual birds with data on aphid numbers. In Laajalahti the weight gain increased simultaneously with aphid abundance and decreased abruptly to nil when the aphid density declined in late August (Fig. 6). The second increase of the mean daily weight gain in early September is more difficult to explain, but the few aphids left at that time were perhaps enough for the smaller number of birds (Fig. 2). The weight change was positively correlated with the relative aphid numbers in Laajalahti (Fig. 8; $y = 0.079x - 0.043$, $r=0.866$, $P<0.05$,

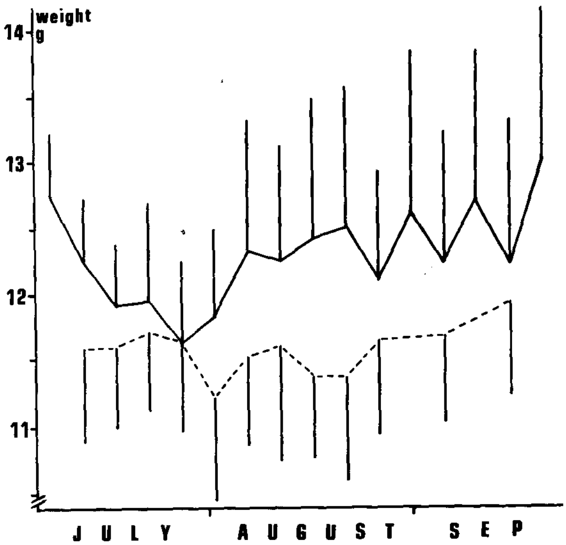


Fig. 5. The mean (± standard deviation) weight of juvenile Sedge Warblers in 5-day catches in Laajalahti (—) and Siikalahti (- - -) in autumn 1984. Each bird included only once (when ringed).

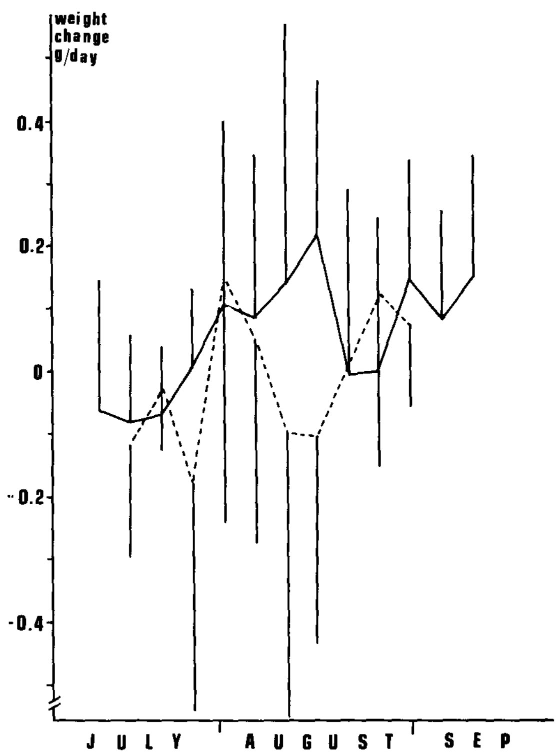


Fig. 6. The mean (± standard deviation) weight change of juvenile Sedge Warblers retrapped within 10 days in 5-day catches in Laajalahti (—) and Siikalahti (- - -) in autumn 1984.

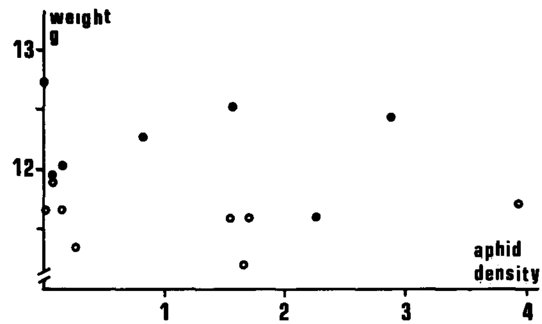


Fig. 7. The mean weight of juvenile Sedge Warblers in relation to aphid density (100 ind. per stem) in Laajalahti (filled circles) and Siikalahti (open circles).

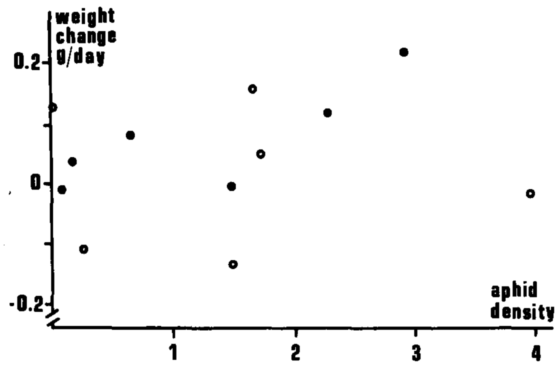


Fig. 8. The mean weight change of juvenile Sedge Warblers in relation to aphid density (100 ind. per stem) in Laajalahti (filled circles) and Siikalahti (open circles).

N=6). It must be kept in mind, however, that the aphid density was estimated only once a week in a restricted area near the netting line, and there may be seasonal differences in aphid occurrence even in different parts of a single reed bed visited by the local warblers on their daily foraging trips.

In Siikalahti the mean weight gain was positive only in early August, when the aphid density was fairly high, although declining (Fig. 6). The weight gain increased again 3 weeks later when there was a small increase in aphid density, but the weight change and aphid density were not correlated in Siikalahti (Fig. 8).

Discussion

The migratory strategy of Finnish Sedge Warblers. The uneven spatial distribution of the autumn recoveries of Sedge Warblers ringed in Finland is probably due to low trapping activity in reed beds along parts of the migration route. As far as we know, Sedge Warblers have been trapped intensively south of Finland in Poland, the German Democratic Rebublic, Austria, Czechoslovakia, Hungary, and, in the last few years, in Estonia (Saurola 1981).

Most birds are recovered in southern Europe in August and early September. The few recoveries of birds shot or found dead seem to be made later than those of retrapped birds (also Saurola 1981). Hence, when judging the timing of passage from the recoveries we should consider only the birds retrapped by ringers. According to Bibby and Green (1981) random recoveries of Sedge Warblers in western Europe occurred, on average, later than mist net captures, the late migrating birds being perhaps more likely to die accidentally. When this is taken into account, it appears that the Finnish Sedge Warblers land several times when passing through Europe and travel more slowly than their British conspecifics, which, according to Bibby & Green (1981), make a non-stop flight from England or northern France across the Mediterranean and the Sahara desert. It is in any case impossible to fly from southern Finland over Europe to Africa without feeding along the route (see also Pearson et al. 1979).

The habitats used for fattening during migration by Sedge Warblers are distributed patchily, in both Europe (Bibby & Green 1981, 1983) and Africa (Pearson et al. 1979). A long journey requires a great amount of food for birds foraging in large flocks in a rather restricted area. The habitats favoured by the species, reed beds and bushy shore meadows, are very productive in the breeding season due to emergence of water insects (e.g. Orians 1980), but in late summer and early autumn the emergence rate is probably low compared with the high demand of fattening warblers. Reed aphids are very abundant at that time, and the birds seem to be searching for areas with mass occurrence of aphids for fuel both in Finland (Saurola 1981, this study) and abroad (Insley & Boswell 1978, Bibby & Green 1981, 1983, Grüll & Zwicker 1982, Pearson et al. 1979).

The Sedge Warblers seem to be able to fatten in southern Finland from late July onwards, when adults begin to leave, probably migrating directly from the breeding grounds (see Insley & Boswell 1978). The high abundance of reed aphids in Siikalahti in July seems to be too early for most juveniles, because their migration does not reach its peak until early August. The juveniles need time to achieve independence and for their wings to grow to their total lenght before the long migratory flight. A high proportion of their energy is perhaps directed to growth of the wings and the full complement of feathers. The wings and tail were growing in many birds between ringing and retrapping. In addition, the juveniles in July have only recently been abandoned by their parents and may be inexperienced and less efficient than the adults in gathering food.

The majority of birds ringed in Laajalahti in July have probably fledged there, but the greater part of birds ringed in August seem to be on passage. In Laajalahti migration appears to reach its peak at the same time when the aphid density is highest and this is apparently one of the fattening areas for Finnish Sedge Warblers.

Bibby & Green (1981) explain the high speed of migration by the more rapid decline of aphid density in southern than in northern parts of the migration route. Along the southern coast of Finland, the peak abundance of aphids occurred at the same time as in England and in France. So the migrating Finnish warblers may face the same environmental conditions as the birds in western Europe, if the patterns of food availability are similar.

To sum up, our preliminary analysis of data from just two localities and only one year support the assumption that the Sedge Warbler has adapted to the occurrence of aphids and uses these insects for fattening. However, the Finnish birds can hardly have enough fuel for a very long non-stop flight over most of Europe and the Mediterranean. Where are the important fattening areas south of Finland? This and other basic questions can be solved only by close co-operation between European ringers in the EURING Acroproject.

Prospects. To stress the importance of international co-operation and the potential of the EURING Acroproject for clarifying many important aspects of the ecology of this particular species, we present the following summary of the main advantages, aims and general methods of the project.

The recent analyses of the autumn migration of the British (e.g. Bibby & Green 1981, 1983), French (Jarry 1982) and Finnish (this study) Sedge Warblers show the many advantages of this species as the object of an all-European study based on ringing:

- During nesting and migration, the Sedge Warbler stays in more or less closely limited habitats, where a great number of birds gather in a relatively small area.
- Adult and juvenile birds remain in the same reed beds so that the breeding success, survival and postnuptial ecology can be studied up to the start of autumn migration, which is impossible for most other bird species.
- In the reed beds birds can be efficiently and selectively mist-netted without "disturbance" by other species.
- The netting efficiency can be standardized, because, in contrast to the vegetation in other biotopes, the reed beds remain more or less stable from year to year and the weather does not greatly affect the catchability of warblers.
- The proportion of birds retrapped some time later in the same place is high enough for studying the fattening and weight patterns.
- The food supply can be studied.

The basic aims of the Acroproject should be:

- to elucidate the migration strategy: migration route and speed, areas of fattening
- to follow population fluctuations
- to study breeding success and survival
- to examine selection of habitat and food
- to map the most important breeding and resting wetlands for conservation
- to make comparisons with the other bird species of reed beds like the Reed Warbler and the Reed Bunting *Emberiza schoeniclus*.

These aims can be achieved by organizing a network of reed bed ringing stations that will function between early July and September. If trapping is not continuous, the netting effort should be as constant as possible in relation to the phase of migration and time of day. The number of nets, and width of the netting strip and its situation in relation to the neighbouring vegetation should be kept constant, too. All ringers should receive detailed instructions and forms to permit standardization of the field work and data recording. For every bird, at both ringing and retrapping, records should be made of the age and sex, wing length, weight, index of subcutaneous fat and hour of handling. In Finland, Reed Warblers and Reed Buntings are handled in the same way.

The amount of food available to Sedge Warblers should be monitored by estimating the relative numbers of reed aphids in representative and randomly selected plots near the ringing station, in our opinion twice a week or at least once every standard 5-day period.

The ringers should be encouraged to ring both the adults and nestlings of the population breeding near the ringing station, and to study the fattening and duration of stay of the breeders. The size of the breeding population should be estimated by mapping the singing males or looking for the nests.

The Sedge Warbler is one of the most suitable species for a large-scale ringing project and the prospect of elucidating the various aspects of its migration strategy and making comparisons with other reed bed birds is most inspiring. Accordingly, we hope that all European ringing centres will take part in the EURING Acroproject from 1986 onwards.

Acknowledgements. We express our sincere gratitude to all the ringers of the Laajalahti and Siikalahti Acroprojects and especially to Pekka Puhjo for gathering the field data with his team and for many inspiring discussions. Harto Lindén and Juha Tiainen made valuable comments on the manuscript.

Selostus: **Ruokokerttusen syysmuutosta Suomessa**

EURINGin, Euroopan rengastustoimistojen yhteistyöelimen, yleiseurooppalaisen rengastusprojektin yhteydessä ruokokerttusen syysmuuton aikaista verkkorengastusta on tehostettu ja vakioitu Suomessa erityisesti vuodesta 1984 lähtien. Valtaosa vuoden 1984 loppuun mennessä rengastetuista n. 70 000 ruokokerttusesta on heinä-syyskuussa etelärannikon ja Etelä-Suomen sisämaan ruoikoissa verkoilla pyydystettyjä nuoria yksilöitä. Kirjoituksessa analysoidaan alustavasti syyskesällä 1984 Espoon Laajalahdella ja Parikkalan Siikalahdella koottua rengastusaineistoa esimerkkinä ruokokerttusprojektin tutkimusmahdollisuuksista.

Suomen ruokokerttuset muuttavat syksyllä etelään, mutta rytikerttuset kaakkoon (kuva 1). Harvojen löytöjen perusteella ruokokerttuspopulaatiomme talvehtii Keski-Afrikassa, joskin Malissa helmikuussa rengastettu ja Suomessa kontrolloitu lintu viittaa laajahkoon talvehtimisalueeseen. Useimmat ruokokerttuset saapuvat Etelä-Suomeen elokuun lopussa tai syyskuun alussa vain 2–4 viikkoa Etelä-Suomessa verkkosaaliiden perusteella todetun nuorten yksilöiden muuton huipun jälkeen (kuva 2). Aikuiset linnut katoavat pesimäalueeltaan pian poikasten itsenäistyttyä, mutta nuoret yksilöt näyttävät viipyvän ruoikoissa pitempään. Syksyllä 1984 ruokokerttusen saalismäärät huipentuivat Laajalahdella ja Siikalahdella elokuun alussa, mutta aikaisempina syksyinä Laajalahdella viikko—puolitoista myöhemmin.

Muuttorasvan kertymistä tutkittiin arvioimalla näkyvän ihonalaisrasvan suhteellinen määrä Operation Baltic–menetelmällä (indeksi 0–5) ja punnitsemalla sekä rengastetut että kontrolloidut yksilöt. Molemmat menetelmät kuvaavat hyvin muutolle valmistautumista (kuva 3). Muuton edetessä yksilöiden,joilla on näkyvää rasvaa, osuus nousee (kuva 4).

Sekä aikuisten että nuorten ruokokerttusten keskipaino oli Laajalahdella (vanhat 13.0 g, nuoret 12.2 g) merkitsevästi korkeampi kuin Siikalahdella (12.1 g, 11.5 g). Aikuisten keskipaino nousi molemmilla paikoilla heinäkuun alusta elokuun alkuun. Nuorten painon lasku Laajalahdella heinäkuussa heijastanee poikasten itsenäistymistä ja emojen ruokinnan loppumista (kuva 5). Keskipaino nousi nopeasti elokuun alussa, mutta tasaantui myöhemmin, jolloin mahdollisesti toisen pesyeen itsenäistyvät poikaset laskevat sitä hieman. Siikalahdella nuorten keskipaino pysyi Laajalahteen verrattuna tasaisen alhaisena läpi muuttokauden ilmeisesti poikasten itsenäistymisestä saakka.

Kontrolloitujen nuorten yksilöiden paino kasvoi Laajalahdella keskimäärin 0.07 g/vrk, mutta väheni Siikalahdella 0.02 g/vrk. Elokuun puolivälissä keskimääräinen painon lisäys oli Laajalahdella 0.2 g/vrk.

Länsieurooppalaisten tutkimusten mukaan ruoikoissa elävät kirvat (erityisesti luumukirva) ovat muutolle valmistautuvien ruokokerttusten välttämätön ravintokohde, jonka saatavuus vaihtelee kuitenkin huomattavasti ajallisesti ja alueellisesti. Kirvojen massaesiintymä todettiin Siikalahdella heinäkuun loppupuolella ja elokuun alkupuolella, Laajalahdella heinäkuun lopulta elokuun lopulle. Kirvojen määrän kasvu ei näyttänyt vaikuttavan nuorten ruokokerttusten keskipainoon (kuva 7). Laajalahdella kotrolloitujen yksilöiden paino kasvoi keskimäärin hieman nopeammin kirvojen määrän noustessa (kuva 8). Toistaiseksi analysoitu niukka aineisto viittaa siihen, että kirvat ovat merkittävä ravintolähde varsinkin Suomen etelärannikon ruoikoissa syysmuutolle valmistautuville ruokokerttusille, joiden täytyy kuitenkin täydentää rasvavarastojaan myös muuttomatkansa varrella Euroopassa. Sisämaassa kirvojen massaesiintymät saattavat romahtaa liian aikaisin muuttorasvan keruuta ajatellen.

Kirjoituksen lopussa tarkastellaan ruokokerttusen soveltuvuutta yleiseurooppalaisen rengastusprojektin kohteeksi.

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