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Rain call dialects of the Chaffinch *Fringilla coelebs* in the archipelago of SW Finland

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In the greater part of Finland, the rain call of the male Chaffinch is hüitt, but in the south of the vast SW archipelago of Finland "hüitt" was found to be replaced by "rrüp". When c. 80 km of the boundary between these call dialects were mapped, little overlap was found, usually at most a few km. At one site there was a bulge of "hüitt" males into the area of the "rrüp" males. Individuals using the one dialect were only exceptionally heard so deep in the area of the other as to be out of hearing distance of the users of their own dialect. In an area c. 20 km NE of the continuous range of the "rrüp" dialect, 19 "rrüp" males were recorded during a period of 55 years. They were heard for a few days, but as they were not ringed, it was impossible to decide whether they had stayed and relearnt the call from the surrounding males, or were floaters. "Rrüp" males were also occasionally recorded in other parts of the "hüitt" area in Finland. In part of Karelia and the Leningrad district, a "rrüp" type dialect has long been known to prevail, though detailed information on its boundaries is not available. Factors possibly influencing the development of the archipelago dialect are discussed.

1. The rain call — what is it?

The one-syllable "rain" call is a signal of the male Chaffinch given in the breeding season (Heinroth & Heinroth 1926), only occasionally later. It is uttered in numerous situations when the drive to sing is weak or blocked, e.g. during rain, or just before or after rain (Bergman 1953, Poulsen 1958, Curry-Lindahl 1958; Detert & Bergmann 1984 doubt any connection with rain). Lepiksaar (1942) also connects the call with cold weather, Sokolowski (1965) with at least nine different situations, all of them in some way frustrating, as loss of nest, egg or young, lack of food (in caged individuals), strange sounds or objects, appearance of potential nest-plunderers and different meteorological factors. It is further uttered in many situations in which it seems "impossible to detect any motivation" (Poulsen 1958; also Marler 1956, Haftorn 1971, Rootsmäe & Veroman 1974). Nestlings become silent when they hear the call; in other males it induces rain calling (Marler 1956).

2. The archipelago dialect

On 7 June 1985 on small islands in the municipality of Houtskär in the vast archipelago of SW Finland (Fig. 1), the authors heard male Chaffinches giving buzzing or burring rain calls, which phonetically may be written rrüp, instead

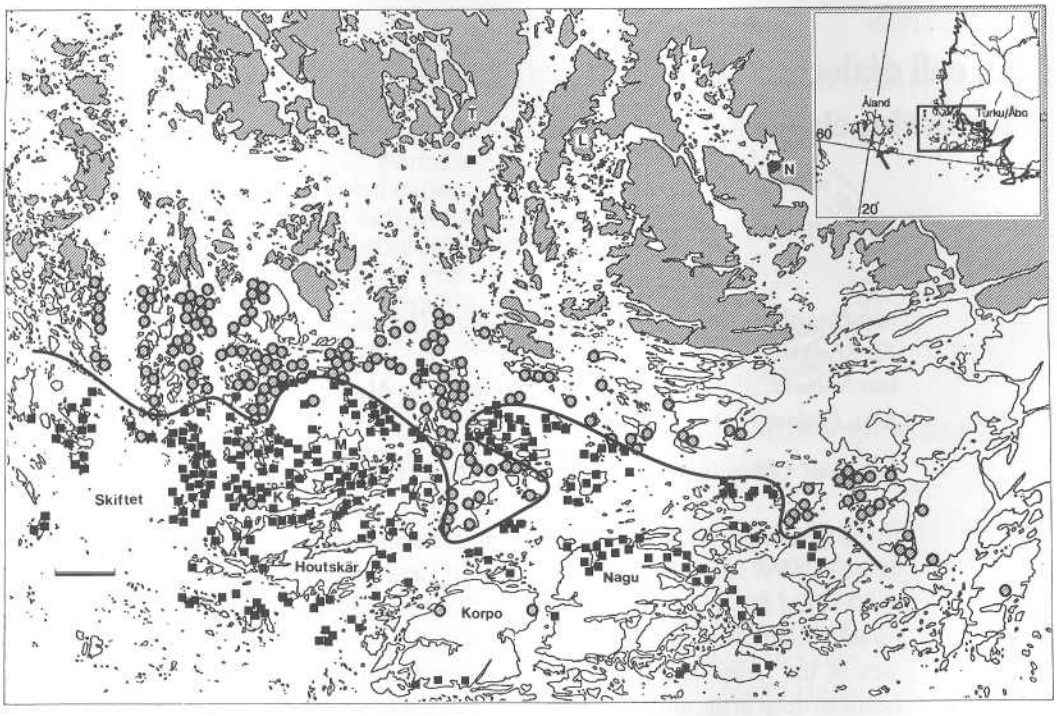

Fig. 1. Distribution of the rain call dialects in an area of the archipelago of SW Finland. The squares (rrüp call) and the circles (hüitt call) indicate individual males. In the hatched areas only the hüitt type call was heard on several excursions during the years, but the individual males were generally not recorded. Males heard in different years on the same island were considered to be different individuals (few islands were investigated in more than one year). K = Kivimo, L = Lemsjöholm, M = Mossala, T = Taivassalo, Å = Åvensår. The arrow on the general map shows the municipality of Lemland. Scale 5 km.

of the hüitt (or hütt, sometimes also hüthüt) customary in most of the country. The excursion was continued to other islands in the vicinity, and on none of them did we hear the hüitt call. Instead, at least nine additional rrüp finches were heard.

In the following summers, in 1986–1991, the occurrence of the diverging dialect was further studied. At the census work carried out in the archipelago by the junior author (M. v. N.) alone, or in the company of the senior one, the call type of the finches was recorded. In all, along the c. 80 km long border between the dialects about 420 males were classified, about two thirds of them using the rrüp call. Censuses were carried out from mid-May to early July, well within the period when the rain call was heard, i.e. from the beginning of April to the end of July. The population size of the Chaffinch stayed fairly constant during the years of the study. On fifteen small islands in the hüitt area, censused during the years 1985–1991, the number of pairs varied between 23 and 30 annually.

In the present study the two types of rain calls were in the main distinguished from each other by ear. Microgeographic differences in the distribution of the calls that cannot be identified by ear are thus not dealt with in this paper. As from summer 1988, tape-recordings of the calls were made, using a microphone mounted on a parabolic reflector.

Sonagrams of the two types of the rain calls are shown in Fig. 2. The rising pitch in the beginning of both call types in Fig. 2 seems to be almost identical, but as the pitch falls and eventually vanishes in the hüitt call, it starts to oscillate, with about four pitch tops, in the rrüp call.

Generally there was a surprisingly sharp boundary between the dialects (Fig. 1). North of the boundary the prevailing call was hüitt, south

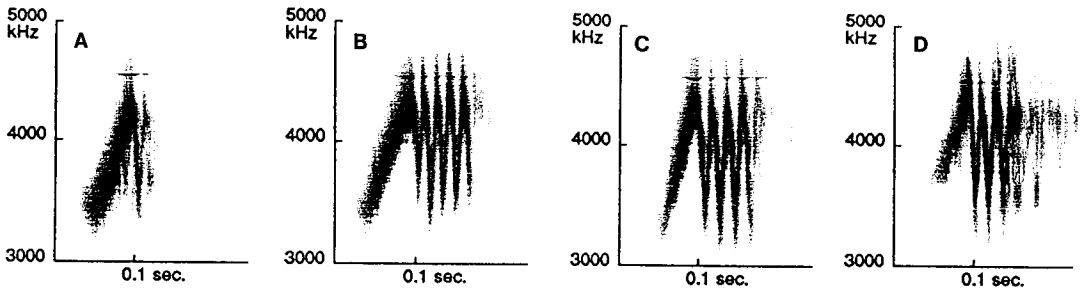

Fig. 2. A) Hüitt sound (Lemsjöholm), B and C) rrüpp sounds (Nagu, Mielis and Houtskär, Kalvholm) and D) rrüp sound (Åland, Lemland).

of it rrüp. Overlap existed only very locally. The rain call seemed mostly to be of one type on each of the islands. The border between the dialects therefore runs between the islands, over the water, but generally not over land areas. The boundary did not follow any geographical hiatus other than water. On one site SE of Åvensår (Å in the map) there was a bulge of hüitt males into the area of rrüp males. This bulge consists to a great part of one large island (Norrskata), on which the Chaffinches used the hüitt type of the call.

Few males appeared to be out of hearing distance of any male of the same dialect. Of the mapped Chaffinches, a single rrüp male (1986 south of Taivassalo – T in the map) was so isolated as to lack contact with other users of his dialect. Two hüitt males on the large island of Korpo (see Fig. 1) in the rrüp area may have been deprived of sound contact with their equals, and a further male west of Kivimo (K in the map) was almost certainly so. The rarity of the alternative dialect in the "wrong" area tallies with the hypothesis that it is fixed in young males in their first breeding season by listening to their neighbours.

Time did not allow us to investigate the total extent of the rrüp dialect area, but some observations are available from the archipelago west of our map. In July 1949 and 1951 the senior author noticed Chaffinches which used the rrüp type of the call on the Åland islands. Sick (1950) quotes an oral communication by Prof. Pontus Palmgren, who had heard an alternative to the hüitt call, probably this very rrüp call, on the Åland islands. Prof. Palmgren was mainly active on the islands in the late 1920's and early 1930's and his observations are probably the very first ones of the rrüp dialect in SW Finland. In the summer of 1988, Dr. T. Stjernberg (oral communication) recorded Chaffinches with the rrüp call on four occasions on the island Vårdö in the Åland archipelago, about 35 km straight west of the rrüp area mapped by us.

The junior author made excursions on the main Åland islands during 2–12 May 1989. The excursions included a trip ranging from the southernmost to the northernmost parts of the islands (approx. 45 km). On most of the Åland islands the hüitt type of the rain call seemed to prevail. In the southernmost part of the islands (the municipality of Lemland, indicated with an arrow in Fig. 1), however, all recorded rain calls (4 males) were of the rrüp type. One additional male uttering the rrüp call was heard in the middle part of the islands (near Lake Holmsjön, Finström), where otherwise only the hüitt call occurred.

On Lemsjöholm and the surrounding archipelago (L in Fig. 1) the senior author kept records of rrüp Chaffinches in 1936–90. This area is situated about 20 km NE of the continuous range of rrüp Chaffinches, as shown in our map. No rrüp Chaffinches were heard in 1936–49, thereafter 2–6 per decade. It is noteworthy that no rrüp males were heard at Lemsjöholm before the 1950's. The rise in their numbers cannot have been caused by differences in the observation activity, as this was lowest in the 80ies. The first rrüp male was recorded on April 11th, and the last on June 30th. Many rrüp males were observed only once; on later visits to the site no rrüp call

was heard. The longest period a rrüp male was recorded amounted to 10 days. One of the males listed above used rrüp and hüitt alternately. These observations indicate that the males dropped the rrüp in favour of hüitt, uttered by nearby males, or that they were "floating" individuals. It is likely that they were born the year before the observation, as in Finland ringed Chaffinch nestlings (Bergman 1939a) are much less site-tenacious than adults.

Single Chaffinches using the rrüp call were further heard as follows: 1942 in the archipelago of Pellinge E of Helsinki (L. v. H.), 1955 in Henriksberg, Hanko peninsula (L. v. H.), 1957 in Danskog, Hanko peninsula (L. v. H.), and 1986 on a small island off Naantali about 10 km E of Lemsjöholm, vacillating between rrüp and hüitt calls (M. v. N.).

The 1986 male, as also those found in the Lemsjöholm area (L in the map) may safely be considered immigrants from the rrüp area in the SW archipelago. The provenance of the 1942, 1955 and 1957 males (see above) is obscure. The same applies to a single rrüp male observed in 1930 by Bergman (1939 b) — the only one heard during 9 years of research in the archipelago SW of Helsinki. In contrast to the rrüp males recorded at Lemsjöholm, this one stayed for the entire breeding season, retaining its dialect, and causing considerable astonishment in its 11-year-old observer.

It has long been known that Chaffinches in SE Finland and adjacent areas of the USSR (Räsänen 1924) have a rain call similar to or identical with the rrüp call heard by us in the SW archipelago. The rrüp calls in populations separated by long distances may (sonagrams, Thielcke 1969) be only slightly different.

Räsänen (1924), who first noticed this deviating version of the rain call on the Karelian isthmus, transcribed it as "krik" and stressed its warbling character. He believed it to be an extra song, which it may be in a way, but did not realize that it substituted for the hüitt call. Hortling (1930, 1946), an eminent linguist by profession, also referred to it as a song. Räsänen went so far as to think of the Karelian "song race" as a subspecies, but Hartert (1932–38) gave the subspecies idea a death blow when he included "karelicus" among the synonyms of the nominate race of the Chaffinch.

3. Comparisons

Dialects of the rain call have been found from the Azores in the south (Marler & Boatman 1951) to Finland in the north; Sick (1939, 1950) and Poulsen (1958) list about half a dozen of them; with all microdifferences (Baptista 1990) their numbers may be legion. At the present time it is difficult to obtain even a rough idea of the geographic distributions of the major variants. The discovery of an overlooked, isolated rrüp area in SW Finland proves that considerable surprises may still be expected. As in the Finnish archipelago, the boundary between the rain call dialects seems to be fairly sharp elsewhere as well. In a city area in Germany, a few blocks formed a boundary which completely separated two dialects from each other. Where the dialects were not separated by any uninhabitable gap, there was a narrow zone of overlap, in which both types, and also intermediate calls, were heard (Sick 1939). In a south German area of about 30 × 6 km, mainly circumscribed by three lakes, Baptista (1990) distinguishes three basic types of rain calls (the hui, the huit and the "rülsch" call). In the "rülsch" call the final part modulates in a frequency of more than 40 times per second. Slight overlap of the dialects occurred here and there, as in SW Finland. Along a minor sector of the border between the dialects, there was a c. 7 km long and barely 1 km wide area with males using a "hybrid" between the rülsch and the huit calls ("hreet"); a few hybrid callers were also found scattered elsewhere. Thielcke (1968) stressed the mosaic-like distribution of the Chaffinch dialects. The sharpness of the borders between dialects has been noticed in other species as well. For instance, in *Zonotrichia leucophrys* an abandoned fence row formed the boundary between two song dialects (Baker 1975). In contrast, *Zonotrichia capensis* showed changes in trill intervals at the boundaries between major vegetation zones in a mountain area (Handford & Nottebohm 1976).

4. Ontogeny

According to Heinroth & Heinroth (1926), the hüitt call did not develop in male Chaffinches raised in isolation. In contrast, chicks hand-raised by Poulsen (1951, 1958) from 5 days of age, developed a perfectly normal hüitt call. He con-

cluded that the call is inborn but assumed, like other scholars, that the dialectal alternatives of the hüitt call may develop through imitation (e.g. Sick 1950, Peitzmeier 1955, Poulsen 1958). Unfortunately, an experiment with hand-raised Bornholm Chaffinches, which have a dialect of their own, failed because of their premature death (Poulsen 1958). Experiments performed by Nottebohm (1967) indicate that the hüitt call does not develop without sensory feedback: hand-reared males deafened at 3–4 months of age gave abnormal calls, but when deafened as adults they retained the normal call.

There is at any rate considerable evidence (Thielcke 1969) that the dialect is acquired by the young males by copying their neighbours when settling in a territory. This would explain, for instance, why practically all males within an area use the same call. When birds match their songs with their neighbours during matching bouts, this may lead to a loss of deviating vocalizations in the population. This phenomenon ("matched countersinging") is documented for many species (see Baptista and Morton 1988).

Conrads (1966) discusses the different range patterns of the rain call dialects on the one hand, and the song dialects on the other. Chaffinch song dialects do not necessarily appear as all-or-nothing phenomena, but rather as different frequencies of song types, of which a single male may use as many as half a dozen. Conrads assumes that song and rain calls are learned at different life phases of the male.

Not only the Chaffinch may learn the rain call, but also males of the Brambling *Fringilla montifringilla*, when isolated in a Chaffinch population far south of the normal range of the Brambling population. Thus, a male Brambling at Lemsjöholm imitated the hüitt (and fink fink) of the surrounding Chaffinch population so perfectly that it demanded considerable time to establish that it really was he, who uttered the call (cp. also Hildén's observations on Valsörarna in the Bothnian Bay, v. Haartman et al. 1963–72).

5. Evolution

Our first hypothesis was that the rrüp call is more audible, (cp. also Morton 1986) in the noise of wind and surf, and frequent fog (Johansson 1948 in the archipelago. But the similar or identical "karelian" rain call is given in a continental area, in which the external conditions are in many respects the opposite of those in the archipelago.

It has been almost a dogma of etho-ecology that behaviour evolves in close connection with the milieu, both biotic and abiotic. One therefore, with some reluctance, recalls the fact that human dialects, including languages, do not bear the stamp of the environment in which they have arisen. Is this possibly the case with bird dialects also? For *Zonotrichia leucophrys*, Baker (1975) proposes a model in which mere chance plays an important role in the evolution of dialects. A one-year-old male may colonize a patch of chaparral regenerating after fire, before he has completed song learning. If so he may develop a deviating song, which is then passed to his progeny. Baptista (1990) also considers geographic isolation a pre-requisite in the development of dialects. Geologically speaking, the SW archipelago of Finland has existed for a relatively short time. Post-glacial land-upheaval here amounts to 50–53 cm/century (Glückert 1976). This means that a large part of the archipelago studied by us was not visible, say, 2000 years ago, and even less of it was forested. A fragmented environment like this archipelago offers, of course, conditions for both founder effects and isolation.

Dialects, animal as well as human, may play a role in assortative mating (e.g. Nottebohm 1975, Handford & Nottebohm 1976, but see Trainer 1983 and Zink & Barrowclough 1984). If the female reacts positively to her own rain call dialect, she is likely to choose a mate who shares more genes with her than do males that have another dialect. Homogamy could thus add to the spread of her genes. The slightly warning effect of the rain call, one male reacting to the call of another (Poulsen 1951, Marler 1956, Baptista 1990) and young reacting to their fathers, would likewise select for standardisation. Song on the other hand, facilitates individual recognition, selection in this case favouring some diversity. The phenomenon that the ranges of song and call dialects do not coincide in the Chaffinch, may be a consequence of this teleonomical (Lorenz 1978) difference.

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Sammandrag: **Bofinkens *Fringilla coelebs* "rain call" dialekter i SV Finlands skärgård**

I den största delen av Finland kan bofinkens regnläte ("rain call") betecknas med hüitt, men i södra delen av Skärgårdshavet påträffades bofinkar med lätet rrüp. Ca 80 km av gränsen mellan de två typerna av regnlätet kartlades. Gränsen var skarp och de två typerna av lätet skiljdes vanligen åt av vatten. Däremot förekom vanligen endast den ena typen av lätet på varje enskild holme. Skillnaden mellan regnlätena visualiseras med sonagram. I ett område ca 20 km från den kontinuerliga gränsen för rrüp-dialekten, observerades 19 rrüp-hanar under en period av 55 år. De hördes under några dagar, men det är oklart om de kvarblev och lärde sig grannfåglarnas hüitt-läte eller om de var kringstrykande fåglar. Varianter av bofinkens normala regnläte har påträffats även på andra håll. Faktorer som påverkar utvecklingen av dialekterna diskuteras. Eftersom praktiskt taget alla hanar inom ett område använder samma regnläte, förefaller det sannolikt att nyetablerade hanarna kopierar lätet från sina grannar under revirbildningen.

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