Effect of a cold spell on birds in northern Finland in May 1968

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A cold spell with heavy snow occurred in northern Finland on 20—23 May 1968. In places the snow cover reached a depth of 30 cm. The bird deaths during this period correlated with the drop in temperature, snow depth and duration of snowfall. Migrating insectivorous birds, having no reverse migration, suffered the most severe losses, and a few early breeders also succumbed. In all, over 3000 birds, belonging to 42 species, were reported dead, but these certainly represented only a fraction of the total mortality. The species with the greatest numbers of birds found dead were, in descending order of frequency: *Phoenicurus phoenicurus, Oenanthe oenanthe, Anthus trivialis, A. pratensis, Phylloscopus trochilus, Luscinia svecica, Saxicola rubetra, Ficedula hypoleuca, Motacilla flava, Turdus philomelos, Motacilla alba, Vanellus vanellus, Philomachus pugnax* and *Fringilla coelebs*. In most species fewer deaths were reported for females than males.

Birds already spaced out on their territories formed flocks again during the cold period. Escape distances were generally short and many birds were seen in the neighbourhood of dwellings. Almost all the nests of small sized ground-nesting and tree-nesting species were believed to have been destroyed, and only species of greater body size, such as ducks and Curlews, managed to save some of their nests. The effect on the breeding populations was not especially severe. Although the numbers of *Oenanthe oenanthe, Saxicola rubetra* and *Anthus pratensis* were particularly low in 1968, in some cases also in 1969, the disaster was not reflected in the numbers of other species.

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Introduction

Spring migration is highly dependent on the weather. Cold spells and snowstorms may cause reverse migration among early arrivals (e.g. Palmgren 1937, Ahlqvist 1938, Bergman 1949, Marscher 1963, Seilkopf & Westernhagen 1965), but only long periods of cold weather, like that which occurred in spring 1966, lead to serious losses (Orvelius 1966, Svensson 1966, Jõgi 1967, Vepsäläinen 1968). Cold spells are rare in May, but can be catastrophic when they occur (Dorst 1956), as the late migrants have no mechanism of reverse migration. Summer snow may cause nesting failure, but the actual losses are dependent on the cold-hardiness and nest sites of each species (Bengtson 1963, Spjøtvoll 1972, Pulliainen 1978).

In May 1968 an exceptionally cold period occurred in northern Finland and caused considerable damage among late migrants and early breeders. This paper presents data on the catastrophe.

Weather conditions in spring 1968

In April 1968 the temperature was about 1—3°C lower than normal in Finland, but in May the weather was 0.5—4.0°C warmer than usual in the southern and central parts of the country and about normal in Lapland. Melting of the snow cover was on time in southern and central Finland, but somewhat delayed in the north.

The cold spell began on 12 May and reached its climax on 20—24 May (Fig. 1, Table 1). In the western part of the province of Oulu it snowed for three days and nights, but further south the snowfall was not so heavy and soon turned to rain. The mean temperatures on 20—23 May in this area were also very low (Table 1). In Lapland it snowed only a little, but temperatures were very low. On 15 May the snow limit ran through Ylitornio-Pudasjärvi-Suomussalmi (Fig. 2), and Kilpisjärvi in NW Lapland still had more than a metre of snow.

In Oulu the snow reached a depth of about 30 cm, lasting for four days (cover 90—100 %). From 22 May onwards the weather grew rapidly warmer, the last signs of snow disappearing around 26 May.

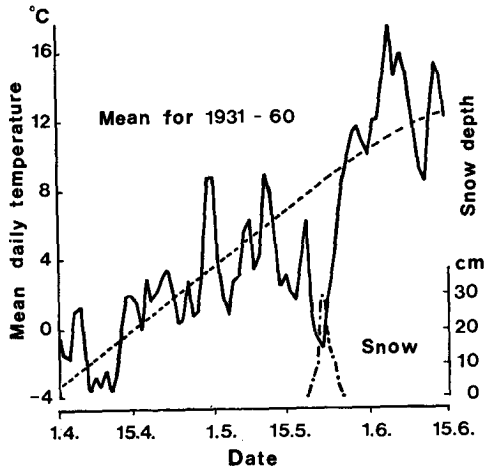

FIG. 1. Mean daily temperature at Oulu airport in spring 1968 and snow depth at the Oulu meteorological station during the cold spell.

Material and methods

The bulk of the material was obtained by the following means:

— The staff and students of the Department of Zoology at the University of Oulu gathered information on live and dead birds in the surrounding of Oulu.

— Notices in five local newspapers and messages on the radio encouraged people to send in any dead birds that they found and information on the catastrophe.

TABLE 1. Weather conditions in the catastrophe area and its periphery. Temperatures (°C) from the Finnish Meteorological Office, snow depths from telephone inquiries.

Locality	Mean temp. 20—23 May	Days of snowfall	Precipitation (mm)	Snow depth (cm)
Catastrophe area				
Nivala	1.0	19—22 May	16.8	(5—) 10
Oulu	0.3	19—22 May	16.6	20—30
Revonlahti	0.3	19—23 May	31.4	20
Vaala (Pelso)	0.6	19—22 May	35.1	10
Periphery				
Kajaani	1.5	19—20, 22 May	11.0	5—10
Kemi	1.0	20—23 May		2—3
		21 May	9.8	
Kruununkylä	1.5	19—21 May	12.7	0
Kuopio	4.0	19—22 May	12.7	0
Kuusamo	—1.1	19—21 May	4.0	3
Pudasjärvi	0.4	19—22 May	11.8	10
		20 May	7.7	
Rovaniemi	0.5	20—21 May	1.4	2—3

— A rapid survey of the weather conditions and the severity of the catastrophe was made by telephoning to a number of people in the province of Oulu.

Bird populations were studied in several areas during the two summers following the spell.

Results

The catastrophe area. The western part of the province of Oulu with a snow depth of 20 cm or more (Fig. 2), accounted for about 90 % of the birds found dead, about 10 % being reported to adjoining communities. A few additional reports were obtained from more peripheral areas: "a lot of birds" perished at Suomussalmi, and a few dead bird were found at Inari, Kittilä, Kuusamo and Iisalmi.

Course of the catastrophe. The first signs of the catastrophe were seen in the morning of the third snowy day, 22 May. Several exhausted birds were brought to the Zoological Museum, and all of them soon died (e.g. *Sylvia curruca, Anthus trivialis, Oenanthe onenanthe, Phoenicurus phoenicurus, Luscinia svecica).* Most of the deaths in Oulu occurred during the period 22—25 May, and many birds collected after this time, especially from other parts of the catastrophe area, had probably died earlier, since decay had already set in when they were examined at the Zoological Museum.

During this period the deaths of a total of about 3000 birds were recorded and detailed data were obtained on 2005 of them; 1719 specimens were examined at the Museum, 43 were observed in the field and information on 243 was obtained from local ornithologists (Table 2). Since the birds that were recovered were presumably only a small fraction of those actually dying, and since only a minor part of the total damage area was checked,

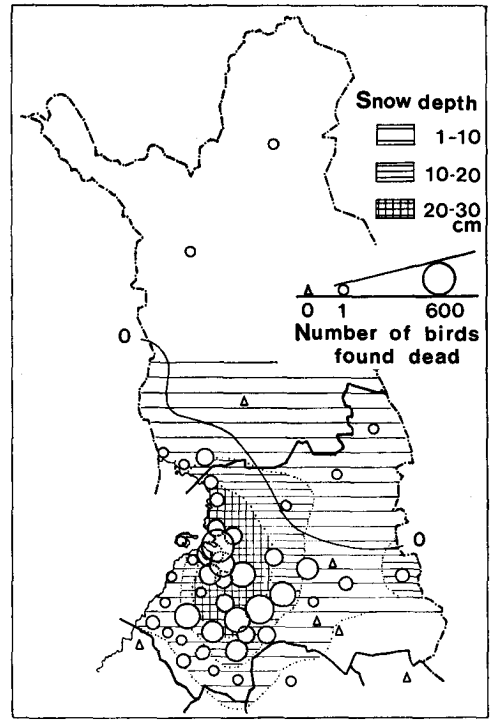

FIG. 2. The distribution of birds found dead due to the cold spell in northern Finland. Estimated snow depth during the cold spell, and the zero line of the snow depth on 15 May 1968 from the report of the Finnish Meteorological Office.

several hundreds of thousands of birds probably succumbed.

In every species for which representative samples (> 10) wer obtained, males outnumbered females among the dead birds (Table 3). At least two reasons can be proposed for this. First, migration was still going on in many of these species and females are known to arrive later than males. Second, females are reported to survive better than males in hunger experiments (Latham 1947).

Behaviour of birds during the cold spell. Escape distances during the cold

TABLE 2. Numbers of birds found dead in the Oulu area during the cold spell in May 1968.

Migrants			
Phoenicurus phoen.	423	*Hirundo rustica*	4
Oenanthe oenanthe	360	*Sylvia curruca*	4
Anthus trivialis	338	*Tringa glareola*	3
A. pratensis	148	*Delichon urbica*	3
Ph. trochilus	146	*Numenius arquata*	2
Luscinia svecica	142	*Jynx torquilla*	2
Saxicola rubetra	84	*Turdus pilaris*	2
Ficedula hypoleuca	80	*Ph. collybita*	2
Motacilla flava	75	*Sturnus vulgaris*	2
Turdus philomelos	65	*Anas acuta*	1
Motacilla alba	26	*Falco tinnunculus*	1
Vanellus vanellus	20	*Charadrius dubius*	1
Philom. pugnax	12	*Tringa nebularia*	1
Fringilla coelebs	12	*Larus ridibundus*	1
Turdus iliacus	7	*Cuculus canorus*	1
Muscicapa striata	7	*Turdus viscivorus*	1
Erithacus rubecula	6	*T. merula*	1
Tringa hypoleuca	4	*Fr. montifringilla*	1
Resident species			
Passer domesticus	6	*Emberiza citrin.*	2
Parus major	5	*Accipiter nisus*	1
Acanthis flammea	2	*Pyrrhula pyrrhula*	1

spell were exceptionally short. I noted the following average distances at Hupisaaret and Vihiluoto:

Species	Escape distance (m)
Turdus philomelos	5—6
Phoenicurus phoenicurus	2—4
Oenanthe oenanthe	2—3
Luscinia svecica	0.5—5
Erithacus rubecula	2
Anthus pratensis	2—5
A. trivialis	2—5
Motacilla alba	2
Fringilla coelebs	1

Birds in poor condition were sometimes easy to catch by hand, and many birds came close to houses or even entered them during the worst days. Most of the birds collected by other observers were taken from gardens and the surroundings of houses. At Kestilä, 114 birds were collected around one courtyard.

Several species, e.g. *Emberiza schoeniclus, Fringilla coelebs* and *Oenanthe oenanthe,* formed flocks during the cold weather. At Vihiluoto some 40 specimens of *Phoenicurus, Oenanthe, Anthus trivialis, A. pratensis, Turdus philomelos* and *Luscinia svecica* formed a loose flock, which remained on a narrow strip of snow-free field close to the forest edges. Similarly, those waders which had lost their nests flocked again, along with those still on migration. At Oulunlahti, 500—700 *Philomachus pugnax* were observed accompanied by smaller numbers of *Tringa nebularia, T. erythropus, T. glareola, Gallinago gallinago, Lymnocryptes minimus* and *Calidris alpina.* Flocks of *Fringilla montifringilla* were seen in many places, and a late flock of *Calcarius lapponicus* was observed at Utajärvi. Territorial singing ceased during the worst days, and *Fringilla coelebs* was not heard singing intensively again until 23 May.

Occurrence of birds before, during and after the cold spell. Most migrants had arrived earlier than normal or at

TABLE 3. Sex ratio of birds found dead during the cold spell.

Species	Males	Females	Sex ratio
Phoenicurus phoenicurus	208	143	1.5:1
Oenanthe oenanthe	220	99	2.2:1
Luscinia svecica	96	23	4.2:1
Anthus trivialis	52	30	1.7:1
Ficedula hypoleuca	51	22	2.3:1
Saxicola rubetra	41	20	2.1:1
Motacilla flava	36	7	5.1:1
Phylloscopus trochilus	36	3	12.0:1
Anthus pratensis	18	8	2.3:1
Turdus philomelos	10	5	2.0:1
Philomachus pugnax	10	1	10.0:1
Fringilla coelebs	9	2	4.5:1
Motacilla alba	6	0	(6.0:0)

the normal time in March, April and the first half of May (Hildén et al. 1968). On 10—12 May strong northbound migration was recorded at the bird station of Tauvo, Siikajoki, for *Anthus pratensis,* (11 May c. 100 exx.) *Phoenicurus phoenicurus, Saxicola rubetra, Phylloscopus trochilus* and *Motacilla flava* (11 May over 200 exx.).

The main stocks of insectivorous birds had just arrived when the cold weather began. A number of species vanished almost entirely during the cold spell; e.g. *Oenanthe, Saxicola, Phoenicurus, Anthus pratensis* and *A. trivialis* were rare or absent in the Oulu area during and after this time. The main stocks of *Phylloscopus trochilus* arrived after the cold spell, and *Ficedula hypoleuca* and *Motacilla flava* also increased greatly in number after that time.

Nests destroyed. Information was gathered on the survival or destruction of nests during and soon after the catastrophe, and ringing data for 1968 also gave clues to the frequency of repeat nesting. Duck nests survived fairly well; it was estimated that only about half the nests of *Anas platyrhynchos, A. acuta* and *A. clypeata* were lost. One *A. platyrhynchos* and two *A. acuta* females incubated their eggs for nearly two months, persisting until July, which suggests that the embryos had been chilled during the cold spell. In all the ducks frequent renesting was observed in the Oulu area in 1968 (see Merilä et al. 1977).

Nearly all the wader nests were reported to have been destroyed, and especially heavy losses were noted in *Vanellus vanellus,* which had been incubating for some time. In many cases *Numenius arquata* was seen incubating valiantly even in 30 cm of snow, with only its long beak visible; about half its nests survived the cold. Counts made in a colony of *Larus ridibundus* before and after the catastrophe showed that about half the nests had survived the cold spell.

Passerines breeding on the ground, such as *Alauda arvensis* and *Anthus pratensis,* suffered heavy losses. Although only one nest of each species was reported to have been destroyed, the actual losses must have been almost total, due to the 20—30 cm snow cover. This was also suggested by small flocks of larks observed by the roadside during the cold spell. Nearly all the known nests of *Turdus pilaris* (8 out of 10) and all those of *T. iliacus* (15) and *Fringilla coelebs* (17) were destroyed. *Parus major* incubating in nest-boxes suffered no losses, but many newly hatched broods of *Sturnus vulgaris* perished. The ringing data showed that the brood size of *S. vulgaris* was significantly lower than usual in Oulu during the period of 1—20 June 1968, namely 3.10 (N = 29) against 3.94 (N = 119) in 1963—67 (Ojanen 1978). Replacement nesting was also common that year.

Effect on breeding populations. The bird fauna was analysed quantitatively in 1967—69 at Hupisaaret, the central park in Oulu, and in two areas SW of Oulu, Kempeleenlahti and Vihiluoto. Censuses were made by mapping the territories once in 1967 by a group of biology students and one to three times in 1968—69 by me with two assistants (Table 4).

The results must be regarded as giving only a rough estimate of the pair numbers. The cold period does not seem to have affected the total numbers of breeding birds. *Vanellus* showed a slight decline in 1968, but the stocks recovered in 1969. The decline apparently hit only a fraction

TABLE 4. Estimated numbers of pairs of breeding birds at Hupisaaret (park; 12 ha), Kempeleenlahti (meadows, bushes; 50 ha) and Vihiluoto (mixed forest, meadows; 25 ha) in 1967—69. Only some of the species included (total results in Ojanen 1970).

Species	Hupisaaret			Kempeleenlahti			Vihiluoto		
	1967	1968	1969	1967	1968	1969	1967	1968	1969
Vanellus vanellus	—	—	—	3	1	4	1	1	1
Gallinago gallinago	—	—	—	..	7	6	—	—	—
Numenius arquata	—	—	—	4	4	5	1	1—2	1
Alauda arvensis	—	—	—	3	1	1	2	1	1
Parus major	9	12	10	..	—	—	3	2	3
Turdus pilaris	18	16	11	..	1	1	4	3	6
T. iliacus	8	12	12	..	—	2	1	1	3
T. philomelos	—	—	—	..	—	—	—	—	1
Oenanthe oenanthe	—	—	—	1	—	—	1	—	—
Saxicola rubetra	—	—	—	6	—	—	—	—	—
Phoenicurus phoenicurus	3	—	—	..	—	—	2	—	1
Acroceph. schoenobaenus	—	—	3	..	63	54	—	—	1
Phylloscopus trochilus	12	16	15	..	17	23	15	19	22
Muscicapa striata	4	4	1	..	—	—	5	2	6
Ficedula hypoleuca	8	5	10	..	—	—	5	1	3
Anthus trivialis	—	—	—	..	—	—	3	1	—
A. pratensis	—	—	—	..	2	5	—	—	—
Motacilla flava	—	—	—	5	3	6	1	1	—
Sturnus vulgaris	7	7	6	..	—	—	2	?	1
Fringilla coelebs	23	27	15	..	—	—	9	14	9
F. montifringilla	4	3	2	..	—	—	5	4	—
Total	117	133	96	..	144	151	(76)	73	82

of the population, and no crash happened as in 1966 (Vepsäläinen 1968).

Small passerines, such as *Oenanthe, Saxicola* and *Ficedula,* seem to have suffered great losses, and the numbers of *Phoenicurus* and *Anthus pratensis* were unusually low in the Oulu area. These results were confirmed by several field observations, although no further census data are available.

In the peatland areas of Pyhäjärvi, slightly to the south of the catastrophe area, Hakala (1971) found that the numbers of *Anthus pratensis* had decreased by 50 % from 1967 to 1968. This may have been due to the same catastrophe, but the numbers of the other bog-inhabiting birds were not affected.

Discussion

Cold tolerance varies greatly between bird species. Early migrants, such as *Sturnus vulgaris, Fringilla coelebs, Turdus iliacus* and *T. pilaris,* supported the cold period well in May 1968. The greatest losses were suffered by those species which overwinter in Africa and arrive late: *Oenanthe oenanthe, Saxicola rubetra, Phoenicurus phoenicurus, Anthus trivialis, Motacilla flava, Phylloscopus trochilus, Luscinia svecica,* and *Ficedula hypoleuca.* These species tolerate extremes of cold less well than their more northerly counterparts (cf. Wallgren 1954). This is seen clearly when pairs of species are compared e.g. *Motacilla*

flava vs. *alba; Anthus trivialis* vs. *pratensis; Turdus iliacus (T. pilaris)* vs. *philomelos.* In all these pairs, the species wintering farther south was more seriously hit by the cold. The reason for death was obviously shortage of food, as small birds cannot manage without food for more than one to two days (Koskimies 1950), and survive an even shorter time in cold, wet weather.

Unincubated eggs of Galliformes and Anatidae can tolerate very low temperatures (see Greenwood 1969, Pulliainen & Rajala 1973). After a cold spell during the laying season in Norway in 1975, no increased egg mortality was observed in *Lagopus lagopus,* only a reduction in the size of the clutches laid after the cold weather (Myrberget & Erikstad 1975). This may be the reason why a considerable number of the duck nests in Oulu survived the cold.

When examining the effects of two cold periods in 1961 on the nesting success in Iceland, Bengtson (1963) found that the following four factors were of importance. (1) The date of laying in relation to the snow periods: the losses were greatest among those species which had laid their eggs just before or during the snow periods. (2) The behaviour of the birds: some species, e.g. *Podiceps auritus, Larus ridibundus* and many ducks, waders and passerines, deserted their nests as soon as the snowfall began. This was the case in Oulu as well. (3) The nest-site selection: species nesting in holes or cavities usually suffered only slight losses (e.g. *Bucephala islandica, Oenanthe oenanthe* and *Plectrophenax nivalis).* (4) The date of hatching in relation to the snow: mortality was high among the young of *Sterna paradisaea,* which hatched two days before the snow in June. Similarly, heavy losses were observed among the newly hatched young of *Sturnus vulgaris* in this study.

Species living in seasonal (or unpredictable) environments have generally evolved high rates of increase (r-strategists according to MacArthur & Wilson 1967), and as in the present case, the populations usually recover rapidly after catastrophes of various kinds.

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Selostus: **Takatalven vaikutuksesta linnustoon Pohjois-Suomessa toukokuussa 1968**

Toukokuun jälkipuoliskolla 1968 sattui Pohjois-Suomessa ankara takatalvi, joka tappoi paljon lintuja ja tuhosi pesiä. Oulun läänin länsiosissa satoi lunta 20—23.5. yhtäjaksoisesti lähes kolme vuorokautta, ja lumipeitteen vahvuus oli lopulta 10—30 cm. Samanaikaisesti vuorokauden keskilämpötilat olivat hyvin alhaisia (taul. 1.).

Oulun yliopiston eläintieteen laitoksen henkilökunta ja opiskelijat keräsivät kuolleita lintuja ja tietoja niistä itse sekä ilmoittamalla radiossa ja sanomalehdissä. Kaikkiaan n. 3000 lintua tavattiin kuolleena (taul 2). Eniten tuhoutui leppälintuja (423), kivitaskuja (360), metsäkirvisiä (338), niittykirvisiä (148), pajulintuja (146), sinirintoja (142), pensastaskuja (84), kirjosieppoja (80), keltavästäräkkejä (75), laulurastaita (65), västäräkkejä (26), töyhtöhyyppiä (20), suokukkoja (12) ja peippoja (12). Kuolleiden, mutta löytymättä jääneiden lintujen määrä oli todennäköisesti monikymmenkertainen. Kaikista tutkituista lajeista koiraita kuoli selvästi enemmän kuin naaraita (taul. 3).

Varpuslinnuista pienet ja keskikokoiset avopesijät menettivät pesänsä yleisesti. Osa suurikokoisemmista lajeista, esim. sorsalinnut ja kuovi, pystyi hautomaan takatalven yli. Takatalven vaikutus pesiviin kantoihin oli odotettua

vähäisempi (taul. 4). Kuitenkin esim. töyhtöhyypän, kivitaskun, pensastaskun, leppälinnun ja niittykirvisen kannat lienevät kärsineet huomattavasti.

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