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Breeding ecology of alpine Fieldfares Turdus pilaris

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An alpine breeding population of Fieldfares was studied on Hardangervidda, southern Norway in 1981–1983 within a 3 km² large bog/delta system where nearly all nests were placed in *Salix*-bushes. The population size varied annually from zero to 26 pairs. The onset of breeding depended on flooding and snow melting of the bogs. The prelaying period lasted about two to three weeks. Egglaying was very synchronous and occurred mainly during the second week of June. One egg was laid per day and replacement clutches were rare. The mean clutch size was 4.76±0.16 (*SE*) and the most frequent clutch size 5. No seasonal variation of clutch size was found. Incubation started before egglaying had terminated. This resulted in an asynchronous hatching, which took 1–2 days. The incubation period averaged 12.8±0.30 (*SE*) days. Predation was the most important cause of loss of eggs/young (56.0 %) in 1982, but zero in 1981. Nest desertion accounted for 54.5 % of the losses in 1981, but only 16.0 % in 1982. Hatching success of eggs in a successful nest was in both years similar and averaged 87.5 %. In nests which produced at least one young, 3.6 and 3.8 young fledged during the two years. An average pair produced of 1.6 and 1.0 fledglings.

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1. Introduction

The Fieldfare *Turdus pilaris* is an abundant and wide ranging bird species in Fennoscandia (Haftorn 1971). In western Norway Fieldfares frequently breed from the outer islands in the coastal archipelago, through the lowland and subalpine woods up in the middle alpine regions (Willgohs 1951, Haftorn 1971).

In recent years several aspects of the Fieldfare's breeding ecology have been studied, both within and at the margin of its range in Europe (e.g. Andersson & Wiklund 1978, Furrer 1979, 1980, Hogstad 1983, Hohlt 1957, Lübcke 1975, Otto 1979, Slagsvold 1979, 1980a,b, 1982b, Slagsvold & Sæther 1979, Sæther 1979a,b, Wiklund 1982). All field studies, however, have been made in low altitude woodland or subalpine birch woods.

This paper describes the Fieldfare's breeding ecology at an extreme breeding habitat, the alpine region, and the differences in the ecology of lowland and alpine populations.

2. Study area

The Fieldfare population was located in Langvassmyra (and its surroundings), a 3 km² low alpine delta/bog-system on Hardangervidda, southern Norway (1223 m a.s.l., 60° 17′ N, 07° 25′ E). This wetland system is dominated by *Carex/Sphagnum*-bogs and well developed *Salix*-belts along the rivers and brooks (Fig. 1). Langvassmyra is surrounded by gently sloping low alpine heaths in the south and the north. Snow melts at a considerably different rate on the two main slopes, which consist of wet and dry meadows characterized by grasses (*Anthoxanthum odoratum, Deschampsia flexuosa, Nardus stricta, Carex* spp., *Ericaceae*; patches of *Betula nana* and low *Salix* spp. Drier parts/moraine hills are covered by lichen, mosses and in some areas *Juncus trifidus*. Small and large stones are scattered in the terrain.

Potential predators on Fieldfare nests (egg/young) are Red Fox *Vulpes vulpes*, Stoat *Mustela erminea*, Raven *Corvus corax* and Common Gull *Larus canus*. Gyr Falcon *Falco rusticolus* and Merlin *F. columbarius* occur sporadically in the summer.

Monthly mean temperatures during the breeding seasons are given for both years (Table 1).

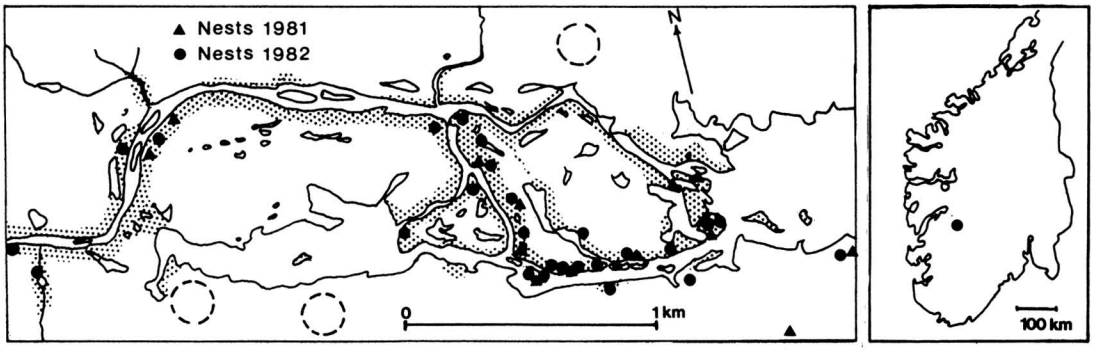

Fig. 1. Location of Fieldfare nests in the Langvassmyra study area during 1981 and 1982. Stippled areas indicate available *Salix* shrub. The three circles indicate additionally breeding pairs in 1982 (nests not found).

3. Methods

Two persons searched nests in June-August in 1981 and 1982; in 1983 the nests were searched in July at the time of normal hatching. In 1981/1982 numbers of eggs/young and habitat characteristics were recorded and the position of the nests were plotted on a map. Population size was estimated on the basis of nests. This is the only usable method for the Fieldfare when more than a few pairs are established in an area. Probably all nests in the bog/delta area were found, but a few nests may have been undetected in the alpine heath part of the study area in 1982 — three nesting areas are indicated (Fig. 1). The timing and rate of egglaying, clutch size, incubation period and loss of eggs/young were determined from repeated visits to the nest. Behaviour of the adults (e.g. warning, attacking predators) was also recorded.

A few nests were found after the egglaying period. They were back-dated by the average incubation period of other nests.

A nestling Fieldfare has been considered a fledgling when 8-10 days old; if nests are visited after that age the juveniles will leave the nests.

4. Results

4.1. Spring arrival, establishment and population size

On the west coast, at the same latitude as the study area, Fieldfares usually arrive in the second week of April. About one week later they are seen in the inner fjords districts, near the western edge of Hardangervidda (e.g. Haftorn 1971, and unpubl. spring arrival scheme, Norsk Ornitol. Forening). In mild winters small flocks of Fieldfares may overwinter in the lowland (Håland et al. 1982).

Even though there are no detailed studies on the spring arrival to the mountains, observations indicate that Fieldfares are waiting in the lowland until snowfree patches occur higher up. In the subalpine birch zone, at 600-900 m a.s.l., Fieldfares seem to arrive around 10 May. Higher up, in the low alpine region, 1000-1250 m a.s.l., Fieldfares are seen straying on the snowfree patches around 20 May (own obs., 1980-82). The prelaying period on the breeding ground lasts two to three weeks, a period Fieldfares use for selecting nests sites and build their large, conspicuous nests. Much agression between Fieldfares occurred, during the week preceding egglaying (especially the first week of June 1981). Fieldfares were then seen chasing each other, both near their nest sites and over the low alpine heaths where they normally feed and collect nesting material.

The breeding population in the Langvassmyra area was less than 10 pairs during 1978-1980, but at least some pairs bred each year (own observations). In 1981 the population comprised 14 pairs. By 1982 the population had nearly doubled, since 26 nests were found and another three pairs probably breed. In 1983, only two possible nesting areas (warning adults) were recorded on the southern sloping heat, and no pairs nested in the *Salix*-bushes.

Table 1. Monthly mean temperature at Finse (30 km north of the study area), northern part of Hardangervidda, 1222 m a.s.l. during 1981 and 1982. Numbers in parentheses are deviation from the standard normal period 1930-1960.

	May	June	July
1981	1.2 (+0.3)	3.4 (−1.3)	6.6 (−1.4)
1982	−0.1 (−1.0)	4.6 (−0.1)	8.5 (+1.5)

Table 2. Clutch size of the Fieldfare in Langvassmyra, Hardangervidda in 1981-82.

	Clutch size 2	3	4	5	6	7	8	*n*	Mean	*SE*
1981	-	-	2	5	4	-	-	11	5.18	0.23
1982	1	1	10	13	1	-	1	27	4.59	0.19
Total	1	1	12	18	5	-	1	38	4.76	0.16

Table 3. Losses of Fieldfare nests and eggs in Langvassmyra 1981 and 1982 during the whole nest-period.

	1981 *n*	%	1982 *n*	%	Total *n*	%
Total number of nests	11		25		36	
Whole nests lost:						
predated	0		14	56	14	39
deserted	6	55	4	16	10	28
Total	6	55	18	72	24	67
Total number of eggs laid	48		109		157	
Eggs lost:						
predated	0		39	36	39	25
deserted	7	15	7	6	14	9
disappeared	1	2	0		1	1
unhatched	5	10	8	7	13	8
Total	13	27	54	50	67	43

4.2. Nest site selection

Above the tree limit, Fieldfares nest mostly in the low alpine region, rarely in the middle region (own observations on Hardangervidda). Nests may be in various natural nest habitats (*Salix* bushes, large stones, ground), but also on various man-made constructions (huts, bridges).

Within the study area most nests (36; 90 %) were build in *Salix*. Of the remaining four, two were on a hut and two on the ground. As Fieldfares clearly preferred *Salix* bushes (see also Fig. 1), most nests are located relatively close to rivers and brooks where the *Salix*-belts grow and Fieldfares are able to place their nests at various distances from the outer (nearest river) edge. Of 20 nests with exact location (1982 only), 16 (80 %) were placed in the outer half (nearest river) of the *Salix*-belts. On an average, *Salix*-belts were 20±9.8 (*SE*) m wide at those sites where nests were located. Bushes selected for nest site in 1982 were on an average 1.15±.04 (*SE*) high ($n = 24$), ranging from 0.7 to 1.5 m. Bushes lower than 0.7 m were never used, although they were readily available. Nests were on average placed about 0.7 m above ground (both years pooled, no differences between years) and 2/3 up in the bushes, ranging from 0.1 to 1.0 m from the top of the bushes.

4.3. The timing of egglaying

The first nests were initiated during the first week of June. Timing of egglaying was synchronous: over 80 % of the nests were initiated during one week. The mean date (±*SE*) of first egg was 10 June (± 3 days; $n = 11$) in 1981 and 12 June (± 3 days; $n = 23$) in 1982. Six nests found within 3 km from study area in 1983 were initiated between 19 and 22 June.

Eggs were laid daily (26 eggs from seven nests), except that egglaying was interrupted for one day in a three-egg clutch. Relaying after loss of eggs and/or young seems infrequent; one late clutch in 1981 may be such a case. No true second clutches seem to occur.

4.4. Clutch size

The mean clutch size for the two years was 4.76±0.16 (*SE*). The mean clutch size did not differ between the two years ($t = 1.15$, $P<0.10$, $df = 36$). The most frequent clutch size was five in both years, but in 1981 6-egg clutches were significantly more frequent than in 1982 (Fishers test, $P<0.025$; Table 2). There was no general seasonal trend in clutch size. Eight incubated, complete clutches found outside study area in 1980-83 averaged 4.75±0.36 (*SE*), five eggs being most frequent.

4.5. Incubation and hatching

In 1982 six nests were visited 1-2 times daily. In these clutches incubation started at least from the third egg. Then an adult was observed sitting tight and the eggs were warm.

In five nests (1982) where conclusive data were obtained, hatching of the first and the last egg differed by 1-2 days. Incubation time, defined as the time from laying the last egg until it hatched in the six clutches, averaged 12.8 days ± 0.30 (*SE*).

4.6. Causes of losses, nesting successs and production of young

The extent and pattern of losses varied between the two years. In 1981 no nests were predated, in contrast to 56 % in 1982 (Table 3;

Table 4. Nesting success and production of young of the Fieldfare in Langvassmyra 1981 and 1982.

	1981	1982	Total
Nests with > 1 egg	11	25	36
Nest producing > 1 fledgling	5	7	12
% successful clutches	45	28	33
No. of eggs laid	48	109	157
No. of nestlings hatched	35	55	90
No. of fledglings	18	26	44
% fledglings of eggs laid	38	24	28
No. of fledglings/nest	1.6	1.0	1.2
±*SE*	±0.64	±0.38	±0.34
No. of fledglings/successful nest	3.6	3.8	3.7
±*SE*	±0.62	±0.68	±0.45

Fishers' Test, $P<0.01$). Eight nests were predated during incubation and six during the first five days of the nestling period, resulting in significantly fewer eggs being hatched in 1982 (Table 3; $\chi^2 = 7.41$, $P<0.05$). More nests were deserted in 1981 than in 1982 (Table 3; Fishers' Test, $P<0.05$). Partial losses during incubation were rare, only one egg in 1981. Hatching success of eggs in successful nests was similar during the two years; 87.5 % in 1981 vs 87.3 % in 1982 (from Table 3). 24 % of the eggs laid in 1982 resulted in fledglings, against 38 % in 1981 and 28 % for the two years combined (Table 4). On an average, the annual production varied between 1.0 and 1.6 young per established pair (Table 4); in 1981 it was presumably somewhat higher due to an assumed replacement clutch, initiated June 25. The average number of fledglings in successful nests (both years) was 3.7±0.45 (*SE*), ranging from one to five young per nest.

5. Discussion

5.1. Fluctuations in population size

The Fieldfare population studied in Langvassmyra represents the upper limit in the altitudinal breeding range in southern Norway. It is exposed to a rather cold and unpredictable environment. Great fluctuations in population size to be characteristic. This corresponds to the general phenomenon that bird populations do vary more on the edge of their range than in more central areas and optimal habitats (eg. Järvinen 1979). Extensive fluctuations in Fieldfare populations seem to be a common phenomenon (e.g. Moksnes 1973). This applies also in winter quarters, and is probably due to a flexible migration strategy (Sæther 1979a). Whether these local variations do reflect population changes on a larger, regional scale is unknown.

5.2. Nest site selection

Nest sites were selected in the parts where the snow melted first. The snow melted first along the central and southern river (see Fig. 1) because the river ice breaked up first there and flooded the bog area. Pairs nesting in *Salix*-bushes could commence their nest-building before the ground had dried up, and hence start earlier than ground-nesting pairs. Nests in *Salix*-bushes are probably also safer against ground-dwelling predators than nests on the ground. Since most nests in the present study were situated in *Salix* on an island safe from the main predator, the Red Fox, these data cannot be used to solve which anti-predator factor is most important: nesting in *Salix*-bushes or on a predator-free island. It could be mentioned that two ornithologists in June 1982 observed a Red Fox successfully robbing Fieldfare nests in *Salix*-bushes in a nearby valley. However, according to published data, Fieldfares seem to build their nests as high above the ground as possible, probably to avoid mammalian predators, and only on ground when trees or other obstacles are missing (Hohlt 1957, Willgohs 1951, Olstad 1934, Pulliainen 1978).

5.3. Timing of egglaying

Egglaying in this Fieldfare population is among the latest recorded, corresponding to a late season in northernmost Norway (Finnmark; Slagsvold & Sæther 1979), and late relaying in NE-Finnish Forest Lapland (Pulliainen 1978). Egglaying at the same latitude as the study area but in coastal lowland in western Norway occurs in the beginning of May (own observations) or about one month earlier than in the study area.

That no Fieldfares bred in the bog area in 1983, and that those nesting nearby nested extremely late, may be a result of severe conditions; this year much snow remained into the middle of the summer and the early summer was rather cold. Slagsvold & Sæther (1979) have found that the annual variation in the mean data of laying in Fieldfares is closely

correlated with the earliness of the spring (measured as birch leafing time), although they found marked differences between nearby populations (also shown by Furrer 1979). That egglaying occurred two to three weeks before leafing of the *Salix* confirms Slagsvold's (1977) suggestion that at high latitude and altitude egglaying is relatively earlier.

The timing of breeding in Fieldfares breeding in the alpine zone is *a priori* affected by the timing of snow melt as no food nor nesting sites are available before snowfree areas occur, although the "fine tuning" of the onset of breeding may be affected by several other factors such as food abundance and the occurrence of predators (e.g. Byrkjedal 1980). The timing of egglaying seems to be adapted for hatching to take place at the main emergence period for *Tipula* sp. (end of June/beginning of July (Hofsvang 1974, own observations). *Tipula* sp. (mainly *exisa*) are a readily available food and probably very important for nestling Fieldfares (own observations). Earthworms, their main food in the lowland (Meidell 1937, Otto 1979), are scarce in alpine heaths, they are only available at a density of about 10% of a typical lowland field (T. Solhöy, pers. comm., unpubl. IBP-data).

5.4. Clutch size

Clutch size in the Fieldfare varies throughout its range, the most common clutch being 5 or 6 eggs (Hohlt 1957, Lübcke 1975, Pulliainen 1978, Otto 1979, Slagsvold & Sæther 1979). According to Slagsvold & Sæther (1979) no increase in clutch size with increasing degree of latitude seems to occur, but their data indicate an opposite trend (their table 4; cf. also Otto 1979). The low clutch size in the present study corresponds to the clutch size reported from N Norway (Slagsvold & Sæther 1979).

There is a negative linear correlation between altitude and clutch size (Fig. 2, which presents data from the present study and published ones from the same latitude, 60°-61° N lat.; $r = -0.97$, $P<0.001$). Slagsvold (1982a) found a similar sinking trend between two localities in Central Norway, and it is also true for several other bird species (e.g. Klomp 1970). The different hypotheses concerning the possible advantages in reducing clutch size have been reviewed and discussed by Slagsvold (1982a).

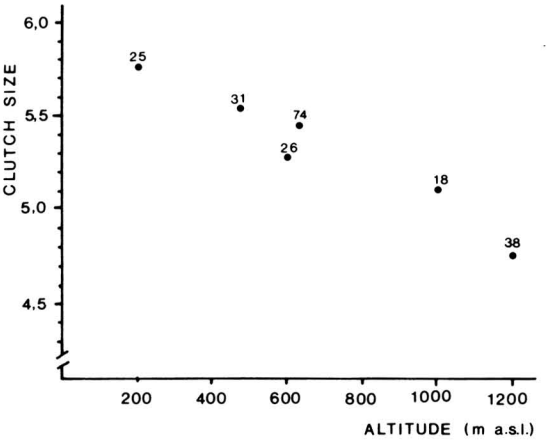

Fig. 2. Regression of Fieldfare clutch size upon altitude in western Norway, between 60° N and 61° N. Numbers of nests indicated. Data from localities 200-600 m a.s.l. from Otto (1979); locality 1000 m a.s.l. from Innes (1979); 1200 m a.s.l. from present study.

5.5. Production of young and causes of losses

The number of fledged young per successful nest in this study (3.6 and 3.8) do not deviate from other populations at lower altitudes (Hogstad 1968, Sæther 1979b). However, as predation is high in Hogstad's study (1968, 1983), the overall production in my population seems to be better than in Hogstad's subalpine birch wood population (average for his 10 year study; 0.8 young per established pair, varying between 0 and 2.2). From Germany Gülland et al. (1972), reported 2.4 young per established pair.

The high rate of desertion in 1981 was probably a result of a Gyr Falcon raided the bog area. The next day 6-7 days old young were found dead on the ground under three nests (also one adult), no one with signs of external wounds. The cold June 1981 (Table 1), with 2/3 of the night temperature below zero may also have resulted in a bad body-condition for several of the adults. The high predation rate in 1982 might be due to a high predator density since there were two Red Fox dens nearby in 1982 but none in 1981, and Stouts were observed 10 times more frequently in 1982 compared to 1981 (Håland and Byrkjeland unpubl.). The rodent population peaked (and crashed) in late May/early June 1982.

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