Breeding of Reed Warblers *Acrocephalus scirpaceus* in small reed beds

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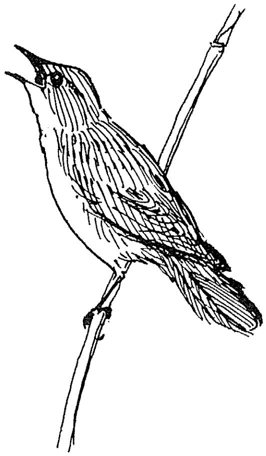
(Med et dansk resumé: Ynglesucces hos Rørsanger Acrocephalus scirpaceus *i små tagrørbevoksninger)*



Introduction

Nest failures of Reed Warblers *Acrocephalus scirpaceus* are largely attributable to nest predation, especially during the egg stage (Schulze-Hagen 1991). Also, in some areas, Reed Warblers are the main host species of Cuckoos *Cuculus canorus* and many nests are parasitized (e.g. Moebert 1952, Blaise 1965, Wyllie 1975). Selecting a safe nest site can thus be of crucial importance to nest success and nest predation and brood parasitism should be major forces in the evolution of nest site selection.

Occasionally, Reed Warblers are found nesting in very small reed beds (Öhlschlegel 1984, Impekoven 1990). However, one would expect small reed beds to be sub-optimal as nest sites simply by providing less cover for nests and nest activities. Breeding of Reed Warblers in small reed beds is also of special interest, as nowadays potential breeding habitat is created in many places where reeds *Phragmites australis* invade man-made pools or wet meadows where grazing and haymaking have ceased.

Study area

Data were collected in 1989-91 2 km SW of the city of Århus in eastern Jutland, Denmark, on an 8 ha wet meadow where cattle grazing ceased in 1970. A stream runs through the meadow and the area is usually flooded every winter. Reeds invaded during the 1980s and now 31 small isolated reed beds with a total area of 3950 m^2 are scattered over the area. Only little expansion of reeds was seen during the study years.

Five of the reed beds were growing over standing water throughout summer, two partly so, and the rest were growing on dry ground. Eight of the reed beds were of poor stature and were almost totally blown down by wind and rains during summer. In the wetter parts of the area the reed beds were surrounded by pure stands of *Glyceria maxima*, whereas *Phalaris arundinacea* dominated on more dry ground and small patches of *Urtica dioica* and *Epilobium hirsutum* were found on the dry margins. A few scattered willows *Salix* spp. also occurred.

Material and methods

Data relate to 102 nests found by systematically searching the reed beds once each week from 1 June to mid-August. Nests were checked as often as required to obtain basic breeding data, i.e. commencement of egg-laying, clutch size, number of hatched and fledged young, and nest fate (failure/success).

Daily survival rates of nests were calculated according to Mayfield's (1975) exposure method considering the egg stage and the nestling stage separately. Nests were taken to be exposed for 15 days during the egg stage and for 10 days during the nestling stage (Brown & Davies 1949); nest success was calculated as the product of nest survival estimates for the two periods. Calculation of variance estimates of the daily survival rates followed Hensler & Nichols (1981), and I tested for differences by using two-tailed z-tests. Other statistical tests referred to are described in Sokal & Rohlf (1981).

Planimetry, based on field measurements, were used to compute the areas of the reed beds to the nearest five square metres.

Results

Nest placement

Of 31 reed beds, 22 were used as nest sites in at least one of the study years; 12 were used every year (Tab. 1). Six of the nine reed beds never used were of poor stature; however, when well-developed in height and density even some of the smallest reed beds were used in some years (e.g. successful nests in reed beds 1 and 2).

All nests were placed in reeds. The mean height above ground was 0.98 m (n = 99). Extremes were 0.3 m and 1.6 m, with 84% in the range 0.7-1.4 m. The mean number of stems supporting nests was 4.5 (n = 96). The range was 2-12 stems, with 83% of nests supported by 3-6 stems. Two percent of the nests were built on old stems alone, 59% on a mixture of old and new stems, and 39% on new stems.

Egg-laying and clutch size

In first clutches the median dates of first egg were 6 June, 2 June and 15 June, respectively, in 1989, 1990 and 1991. The difference between years is significant (Kruskal-Wallis test, H = 9.38, df = 2, $p < 0.01$). However, pairwise comparisons showed that median first-egg dates only differed significantly between the two years 1990 and 1991 (Mann-Whitney U-test, U = 238.5, $p < 0.01$). Overall, first-egg dates of all clutches ranged from 25 May to 3 August; 15% (range 13-17) of pairs reared a second brood.

The mean size of first clutches was 4.31 (SD = 0.47, n = 26). Ten second clutches and 21 replacement clutches had a mean size of 3.65 (SD = 0.55). Full clutches varied from two to five eggs (Tab. 2). Median clutch size did not differ significantly between years (H = 5.21, df = 2, n.s.).

Tab. 1. Area af reed beds and numbers of breeding pairs and nesting attempts.
Areal af tagrørbevoksningerne og antal af ynglepar og yngleforsøg.

Bed no. *Bevoksning nr*	Area (m^2) *Areal (m^2)*	Pairs (nesting attempts) *Par (yngleforsøg)*		
		1989	1990	1991
1	20	1(3)	0	1(1)
2	25	0	0	1(2)
3	50	0	0	1(1)
4	55	0	0	1(1)
5	75	1(1)	1(3)	0
6	75	1(2)	1(1)	1(1)
7	90	1(1)	1(1)	0
8	90	1(1)	1(1)	1(1)
9	95	1(1)	1(1)	1(1)
10	100	1(1)	0	0
11	115	1(1)	1(1)	1(1)
12	130	1(1)	1(2)	1(2)
13	145	1(1)	1(1)	0
14	165	1(2)	3(5)	1(2)
15	180	1(2)	1(2)	1(1)
16	190	1(1)	1(1)	0
17	195	1(2)	1(3)	1(1)
18	235	1(1)	1(3)	1(2)
19	255	2(3)	1(2)	0
20	300	1(2)	2(2)	1(2)
21	395	3(4)	2(4)	2(4)
22	485	3(4)	3(6)	3(6)
Total *I alt*	3465	24(34)	23(39)	19(29)

Hatching and fledging

Of 207 eggs present just before the clutches hatched, 16 (8%) failed. The proportion of nests containing unhatched eggs did not vary between years (G test, G = 2.26, df = 2, n.s.).

In six nests included in Tab. 2 the number of fledged young could be determined, but not clutch size (in three, a Cuckoo egg disappeared and the Reed Warbler pair successfully reared their brood; in another three the nest was found early in the nestling stage). Of 221 young hatched, 190 (86%) fledged successfully.

Overall, the mean number of fledged young in successful nests was 3.45 (Tab. 2); no significant differences were apparent between years (H = 1.14, df = 2, n.s.).

Nest success and production of young

Of the 89 nests under observation during the egg stage, a total of 31 failed. Sixteen nests were parasitized by Cuckoos, 11 were robbed by predators, three were deserted, and one failed due to damage by high winds. During the nestling stage 61 nests were under observation; three were lost to predators, one failed due to nest parasitism and one was damaged in a storm. Overall, 86% of losses were due to nest parasitism and predation. The proportion of nests parasitized during the study years (21%, 16% and 15%) did not vary between years (G = 2.45, df = 2, n.s.).

The daily survival rate of nests during the different nesting stages is given in Tab. 3. The differences between years are not significant (egg stage: z = 0.06-1.12, n.s.; nestling stage: z = 0.20-0.52, n.s.). However, the daily survival rate of nests was lower during the egg stage than during the nestling stage in 1989 (z = 2.42, $p < 0.02$) and in 1990 (z = 2.40, $p < 0.02$).

Overall, nest success was 56.1% (range 52.3-63.8); 1.86 (1.74-1.97) young were produced per

Tab. 2. Frequency distributions of clutch sizes and of number of young fledged from successful nests.
Antal æg pr kuld og antal udfløjne unger pr vellykket yngleforsøg.

	Clutch size *Æg*						No. young fledged *Udfløjne unger*						
Year *År*	2	3	4	5	x̄	SD	1	2	3	4	5	x̄	SD
1989		1	12	3	4.13	0.50	2	2	4	9	1	3.28	1.13
1990		4	14	5	4.04	0.64		1	7	9	3	3.70	0.80
1991	1	4	13		3.67	0.59	1	2	4	10		3.35	0.93
1989-91	1	9	39	8	3.95	0.61	3	5	15	28	4	3.45	0.96

nest and 2.88 (2.46-3.22) young were produced per pair.

Discussion

Clutch and brood sizes in the study area were similar to those found in other studies; in fact, average sizes of clutches and broods of Reed Warblers vary little over large geographical areas (e.g. Bibby 1978, Beir 1981, Öhlschlegel 1981, Nilsson & Persson 1986).

In two studies of Reed Warblers in England the nest success was calculated by means of Mayfield's (1975) exposure method, making direct comparisons possible. The overall nest success in my study (56.1%) was higher than the 45.2% determined from an extensive sample of BTO Nest Record Cards (Bibby 1978), but slightly lower than the 57.4% and 62.0% found in two larger reed beds by Bibby & Thomas (1985) in a one year study. However, nest success in the most successful year (1991) during the present study was 63.8%. Schulze-Hagen (1991) reviewed breeding data from ten Reed Warbler studies and found an overall breeding success (fledged young per egg laid) of 45%, compared with 59% in the present study. Clearly, the small reed beds in my study area were not sub-optimal in terms of nest success.

However, the overall number of young produced per pair and proportion of pairs rearing a second brood in my study (2.88 and 15%) were lower than found in large reed beds in England (3.5 and 26%, Brown & Davies 1949), Germany (3.7 and 23%, Öhlschlegel 1981), and Sweden (3.6 and 32%, Nilsson & Persson 1986), and in linear reed growths in Germany (4.1 and 68%, Thielemann 1965).

Each year the small reed beds were somewhat damaged during winter by flooding and winter weather and in fact only 2% of nests were built on old stems alone. Catchpole (1974) found that 40% of nests in larger reed beds were built on old stems alone and stated that old reeds were extremely important, especially for early nest sites. Furthermore in late summer, some reed beds were totally blown down by wind and rains and some partly so. Consequently, the small reed beds were less suitable both for early and for late nesting. More extensive reed beds and linear reed growths along watercourses are, of course, also damaged by weather.

Tab. 3. Daily survival rates of nests during the egg and nestling stage.
Overlevelsesrater af reder med æg og reder med unger.

Year *År*	Nests *Reder*	Nest days *Rededage*	Losses *Mislykkede yngleforsøg*	Daily survival (±SE) *Overlevelse pr dag (±SE)*
Egg stage *Ægperioden*				
1989	27	267	10	0.963 (±0.012)
1990	36	383	14	0.963 (±0.010)
1991	26	313	7	0.978 (±0.008)
1989-91	89	963	31	0.968 (±0.006)
Nestling stage *Ungeperioden*				
1989	19	169	1	0.994 (±0.006)
1990	23	222	2	0.991 (±0.006)
1991	19	182	2	0.989 (±0.008)
1989-91	61	573	5	0.991 (±0.004)

However, it is obvious that even a little damage can make small reed beds unsuitable as nest sites, whereas in larger reed growths some suitable areas of reeds normally are left available for occupation.

In conclusion, it appears that the lower reproductive output in the small reed beds was caused more by the pairs having little opportunity to rear two broods per year than by low nest success.

Resumé

Ynglesucces hos Rørsanger *Acrocephalus scirpaceus* **i små tagrørbevoksninger**

Tab af æg er hovedårsagen til mislykkede yngleforsøg hos Rørsanger (Schulze-Hagen 1991), og mange steder er Gøg *Cuculus canorus* den hyppigste årsag (f.eks. Wyllie 1975). Valget af et sikkert redested er således en afgørende faktor for ynglesuccesen.

Rørsanger yngler normalt i rørskove af en vis størrelse, men kan også forekomme i små isolerede bevoksninger af tagrør. Man kunne imidlertid forvente en ringere ynglesucces i små tagrørbevoksninger, som umiddelbart synes mindre egnede som skjul for reder og for redeaktivitet i det hele taget.

I 1989-91 blev ynglesuccesen undersøgt hos Rørsangere ynglende i små bevoksninger af tagrør på en tidligere kreaturafgræsset eng 2 km sydvest for Århus. Hvert år blev tagrørbevoksningerne eftersøgt for reder ugentligt fra 1. juni til midten af august og rederne kontrolleret i det omfang, det var nødvendigt for at fastslå æglægnings- og klækningstidspunkt, antal æg, klækningssucces, antal unger og udfaldet af yngleforsøget. Redesuccesen blev beregnet i henhold til Mayfield (1975).

Antal par og yngleforsøg i tagrørbevoksningerne ses af Tab. 1. Rederne hang i 2-12 stængler i en højde af 0,3-1,6 m over jord- eller vandoverfladen. To procent af rederne hang i gamle stængler, 59% i både gamle og nye og 39% i kun nye. Starten på æglægningen strakte sig fra 25. maj til 3. august, og 13-17% af parrene opfostrede to kuld pr sæson. Antal æg pr kuld og antal udfløjne unger pr vellykket yngleforsøg (Tab. 2) afveg ikke fra resultater af andre undersøgelser (f.eks. Bibby 1978). Af de fuldrugede æg klækkede 92% (n = 207).

I alt 92 yngleforsøg blev fulgt, hvoraf 36 mislykkedes. Tabene skyldtes redeparasitisme fra Gøg (17 reder), prædation (14), forladte reder (3) og vindforhold (2). Yngleforsøgene mislykkedes hyppigere i ægperioden end i ungeperioden (Tab. 3); forskellen er statistisk signifikant (p < 0,02), undtagen i 1991. I alt lykkedes 52,3-63,8% af yngleforsøgene (mindst én udfløjen unge), og ungeproduktionen var 1,74-1,97 unger pr yngleforsøg og 2,46-3,22 unger pr par.

Redesuccesen var ikke ringe, i 1991 (63,8%) endda særdeles høj (jvf. Bibby & Thomas 1985). Andelen af par i de små tagrørbevoksninger, der opfostrede to kuld pr sæson, var derimod lavere end i større tagrørbevoksninger andre steder (f.eks. Öhlschlegel 1981, Nilsson & Persson 1986).

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