Laying and clutch size of the Treecreeper *Certhia familiaris* in south-western Sweden

ANDERS ENEMAR

— Abstract —

Breeding data were collected on an unringed Treecreeper population nesting in artificial nest sites (nest pockets) of two sizes, erected in predominantly deciduous forests in south-western Sweden. From 1982 through 1992, 459 breeding attempts were recorded. The earliest and latest dates of laying were 29 March and 26 June. The distribution of first egg dates showed three peaks: one in April and early May (first clutches), one from late May through June (probable second clutches), with a narrow peak in between (replacement clutches). Clutch size was related to laying date in a curved fashion peaking in early May with a mean of 5.93. Overall mean clutch size was 5.48 with a range of 3-7. About a third of the successful breeding attempts (n=37) were followed by another attempt in a nest pocket nearby, considered to be genuine second clutches. The sizes of these first and probable second clutches were 5.46 and 5.03, respectively. Clutch size in large and small nest pockets did not differ although the large pockets were preferred as nest sites.

Anders Enemar, Department of Zoology, University of Göteborg, Medicinaregatan 18, S-413 90 Göteborg, Sweden.

Introduction

This study of the breeding biology of the Treecreeper *Certhia familiaris* started some fifteen years ago and was based on a new and very simple type of artificial nest site, here called nest pocket. At that time the breeding biology of this species was poorly known and my aim was to collect data on basic parameters, such as the timing of the breeding period and the seasonal variation in clutch size. I did not know then that Markku Kuitunen had started a very detailed field study of the same species in Finland (Kuitunen 1989). I present my findings in the hope that they might be useful to those who study regional variation and related problems.

My study is purely descriptive and has of necessity been carried out as a "spare time project". This means that the field work has been restricted to the ever too short weekends. This is a serious drawback in view of the fact that the Treecreeper populations are relatively sparse with a territory size of about 10 ha in deciduous forests (Schnebel 1972). As a consequence, many nest pockets distributed over a large area are required in order to obtain enough data. Another shortcoming is that I have not had time to trap and ring the breeding birds.

Study area and methods

The study area is situated about 10 km south-east of Göteborg in south-western Sweden (57°39'N;12°4'E), mainly within the Gunnebo recreation grounds near the town of Mölndal. Deciduous forests predominate in the area but are interspersed with a few patches of spruce and clumps of larch. Oak is very common and represented by small areas of pure oak wood. Other deciduous trees are beech, ash, maple, birch, sallow and poplar. The southernmost and smaller part of the study area is situated outside Gunnebo and extends into the adjacent coniferous forests where spruce predominates.

The special "nest-boxes" used in this study, the nest pockets, consist of pieces of roofing-felt which were cut out and attached to the tree trunks in a way that imitates the peeling bark which Treecreepers often use as natural nest sites. These artificially provided "flap sites" are shown in Fig. 1. Two sizes of nest pockets were used. The volume of the large pocket was 0.4 to 0.5 dm³, and the small one about half this volume.

In 1982 the study area (about 9 km², 3 km² of which are open fields) was provided with 300 nest pockets at mean intervals of 70 m along tracks of a total length of about 20 km. The pockets were inspected from about
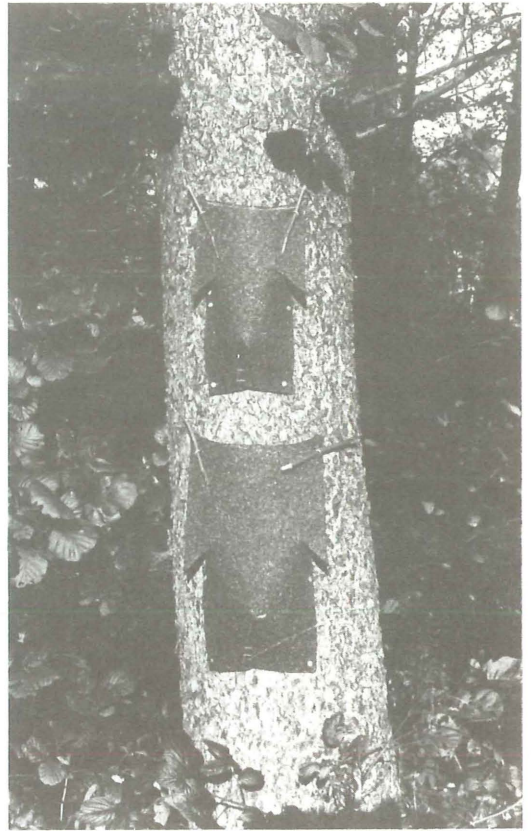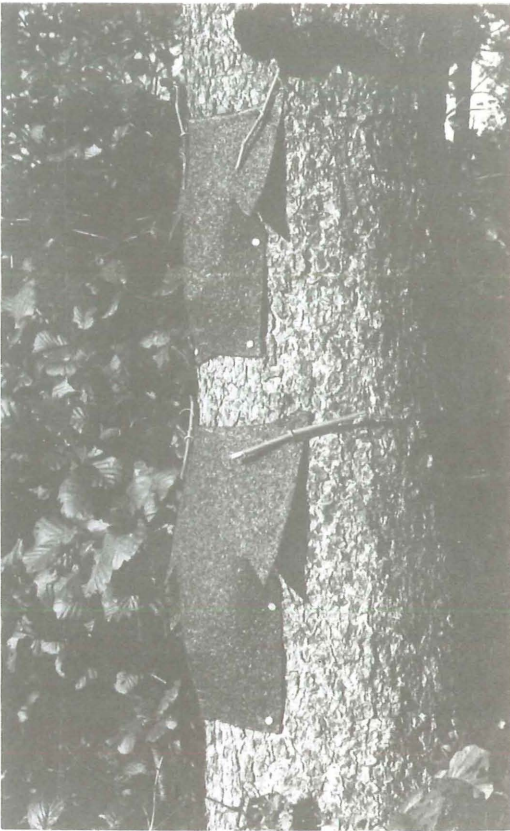
Fig. 1. Nest pockets of the two sizes used as nest sites for Treecreepers in this study. The volume under the openings is 0.45 dm³ for the large and 0.25 dm³ for the small pocket.

Häckningsfickor av de två storlekar som använts som boplats för trädkrypare in denna undersökning. Volymen under öppningarna är respektive 0,45 och 0,25 dm³.

1 April to about 1 July, part of them weekly but mostly at intervals of 10 to 14 days. Some nests were visited more frequently.

The clutch sizes refer to complete clutches documented by repeated visits or by transilluminating the eggs (Enemar & Arheimer 1980). The date of laying was in most cases calculated assuming that the Treecreeper lays one egg a day, which was confirmed for several nests.

If not otherwise stated, Student's t-test has been used to test whether differences were significant.

In the 11 years from 1982 to 1992, 459 breeding attempts (at least one egg laid) took place in the 300 nest pockets, giving a yearly mean of 37 ± 10 (S.D.), with a range from 19 to 54.

Results

Time of laying

The Treecreeper has a long laying season. The earliest and latest first egg dates during the 11-year period were 29 March and 26 June. The distribution of the first egg dates, divided into 5-day periods, is presented in Fig. 2, which shows three peaks. The first and largest one consists of clutches laid in April and early May, apparently being first clutches, presumably including a minor proportion of replacement ones. The last peak consists of clutches laid from late May through June, no doubt representing second and replacement clutches in unknown proportions. The diagram, being otherwise characteristic of a double-brooded species, is disturbed

Table 1. Mean dates of laying start and mean size ±S.D. of early (first egg before 11 May) and late clutches (first egg after 20 May) in the study area from 1982 to 1992. Late breeding periods with fewer than five studied clutches are excluded. n = number of clutches.

Medeldatum för värpstarten och medelstorleken för tidiga (värpstart före 11 maj) och sena kullar (värpstart efter 20 maj) i undersökningsområdet åren 1982 – 1992. Sena häckningsperioder med mindre än fem studerade kullar är uteslutna. n = antalet kullar.

Year År	Early breeding period Date *Datum*		n	*Tidigare säsongdelen* Clutch *Kull*	n	Late breeding period Date *Datum*	n	*Senare säsongdelen* Clutch *Kull*	n
1982	23	April	13	5.65 ±0.65	13	8 June	7	4.43 ±0.98	7
1983	23	April	27	5.69 ±0.88	26	8 June	11	5.09 ±0.94	11
1984	25	April	17	5.75 ±0.68	16	-			
1985	2	May	20	5.57 ±0.69	19	12 June	6	5.00 ±1.26	6
1986	4	May	13	6.00 ±0.58	13	2 June	7	5.71 ±1.11	7
1987	3	May	9	5.89 ±0.68	9	17 June	7	4.29 ±0.76	7
1988	29	April	10	5.44 ±0.53	9	12 June	12	4.83 ±1.11	12
1989	19	April	15	5.29 ±0.72	14	-			
1990	14	April	24	5.25 ±0.53	24	-			
1991	22	April	23	5.72 ±0.61	25	2 June	6	4.67 ±0.93	8
1992	18	April	16	5.00 ±0.63	16	4 June	8	5.00 ±0.93	8
All *Alla*	23	April	187	5.55 ±0.71	184	8 June	64	4.89 ±1.01	64
ANOVA	p	<0.001***		<0.01**		<0.05*		<0.3 ns	
Mean of seasonal means	23	April	8	5.57 ±0.30	11	8 June	8	4.88 ±0.44	8

by a significant and narrow peak in the middle of May. According to the field data, this peak mainly consists of clutches from 1982, 1983 and 1991. In these years, periods of heavy rain occurred during April causing many Treecreepers to desert their soaked nests with eggs or small young. Most of the middle peak is therefore considered to represent the ensuing replacement clutches.

However, seasons without rainy periods have also contributed to the middle peak of the diagram, because a number of nests were robbed in April or deserted for unknown reasons and consequently followed by renesting in many cases. Therefore the data from the middle of May, days 11 to 20, have been omitted from certain calculations and comparisons below in order to minimize the effects of the replacement clutches. In the following, the early clutches, with the first egg laid before 11 May, and the late ones, with the first egg after 20 May, are sometimes treated as roughly representing true first and second clutches.

The mean dates of laying differed significantly between the years studied (Table 1) showing a time span of three weeks for the early (first) clutches and two weeks for the late (second) ones.

Seasonal variation in clutch size

The number of eggs in complete clutches varied from three to seven with six the most abundant clutch size,

making up 45 percent of all clutches (Table 2). After grouping the clutches of all years into 10-day periods on the basis of the first egg dates, the mean clutch size shows an increase during April, reaching a peak level covering most of May, followed by a decline in June (Table 2, Fig. 4). The curve tends to peak in the first 10-day period of May, which is indicated by both the mean clutch size and the number of 7-egg clutches when compared with the adjacent periods.
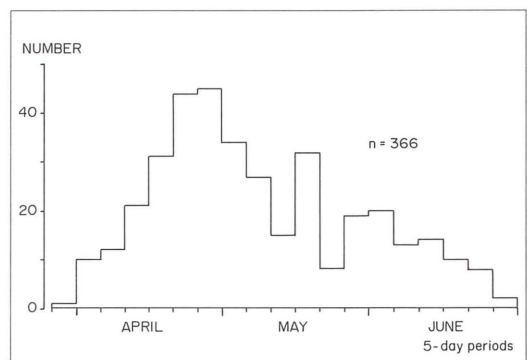

Fig. 2. The distribution of "first-egg dates" of 322 clutches. Clutches were divided into 5-day periods.

Fördelningen av datum för häckningsstarten på fem-dygns-perioder för 322 kullar.

95

Table 2. Distribution of clutches of different sizes over 10-day periods (last period in May 11 days) together with calculated mean clutch size of the same periods.

Fördelning av äggkullarna av olika storlek på tiodagarsperioder (sista perioden i maj 11 dagar) samt medelkullens storlek för samma perioder.

| No. of eggs Ägg- antal | Date of laying start *Värpdatum* | | | | | | | | | | Total |
	March 22-31	April 1-10	11-20	21-30	May 1-10	11-20	21-31	June 1-10	11-20	21-30	Summa
3	-	-	1	-	-	-	-	-	4	-	5
4	-	3	2	6	-	1	2	8	10	3	35
5	1	13	27	27	14	11	11	4	5	2	115
6	-	5	18	44	30	27	11	7	2	-	144
7	-	-	-	4	10	4	4	1	-	-	23
n	1	21	48	81	54	43	28	20	21	5	322
Mean clutch *Medelkull*	-	5.10	5.29	5.57	5.93	5.79	5.61	5.05	4.24	4.40	5.48
S.D.	-	0.62	0.65	0.71	0.67	0.64	0.83	1.00	0.90	0.95	0.78

Apparently clutch size was related to laying date. The linear regression of the size of early clutches on date (laying start before 11 May) of all years is represented by the equation $y=4.75+0.03x$, where y is clutch size and x is date with $1 = 1$ April. The correlation is highly significant ($r=0.33$, $df=178$, $p<0.001$). The corresponding equation for late clutches (laying start after 20 May) is $y=8.84-0.06x$ ($r=-0.60$, $df=67$, $p<0.001$), also indicating a significant relation between clutch size and laying date.

The mean laying dates as well as the mean clutch sizes differed significantly between the years, with the exception of the size of late clutches (no doubt because of their high S.D. values) (Table 1). The annual mean clutch size might therefore vary in relation to the mean laying date of the season. This presumed "calendar effect" is confirmed for early clutches. They increased significantly in size with the progress of the season (Fig. 3, $r=0.70$, $df=9$, $p<0.02$) whereas the late clutches showed a non-significant tendency to decrease (Fig. 3, $r=-0.53$, $df=6$, $p<0.2$).

The first and probable second clutches

As mentioned above, the breeding Treecreepers were not individually colour-ringed. Therefore true second clutches could not be distinguished from first and replacement ones with certainty. Because breeding density was low, it rarely happened that two neighbouring nest pockets were used for breeding
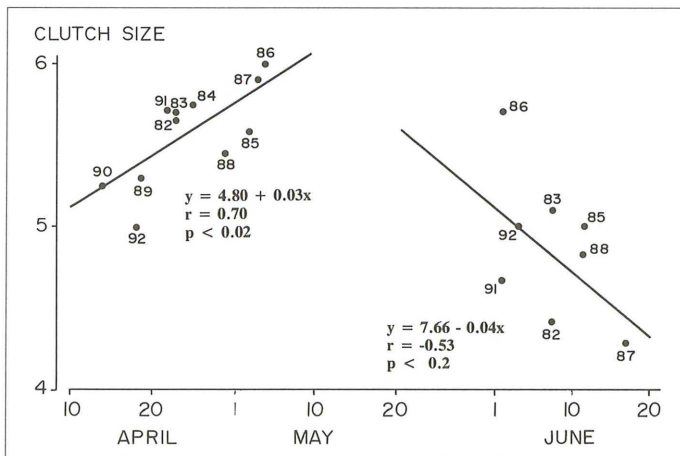

Fig. 3. Annual mean clutch size in relation to average laying date. Regression lines are presented for clutches with laying start before 11 May (left) and after 20 May (right).

Den årliga medelkullens beroende av medeldatum för äggläggningens start. Den vänstra linjen representerar kullar med värpstart före 11 maj, den högra motsvarande efter den 20 maj.

simultaneously by two pairs. It seems reasonable, therefore, to ascribe two consecutive breeding attempts in two nearby pockets to the same pair. As a consequence, the new clutch was considered to be a genuine second one in cases when laying in the second nest started soon after the successful fledging of the first brood. It is of course possible that a proportion of such second layings were started by intruding pairs. On the other hand, some pairs may have escaped observation by laying far from their first nest or by choosing a nest site other than the nest pockets. Conclusions regarding the size and frequency of second and other repeat clutches in this study should therefore be looked upon as preliminary.

The number of second clutches, identified with the aid of the described "nearby nest criterion", is 37, with first egg dates from 16 May to 26 June. Their mean number of eggs was 5.03 ±0.90 (S.D.), which is less than the 5.46 ±0.65 eggs of the corresponding first clutches, laid from 3 April to 8 May (p<0.05). The mean date of the laying start for these second and first clutches was 2 June and 21 April, respectively. As expected, these mean clutch sizes are consistent with those of the corresponding 10-day periods presented in Table 2.

The mean combined size of first and second clutches of pairs laying two clutches was 10.49±1.32 and did not vary significantly in relation to the variation in the laying date. In early breeding pairs (start of second clutch in May) the two clutches were of equal size (5.19 ±1.0l and 5.25 ±0.68, df=30, p<0.8), whereas those of the late pairs (start of second clutch in June) differed (5.67 ±0.66 versus 4.86 ±1.01, df=40, p<0.01). Double-brooded early and late pairs therefore produced a similar number of eggs (10.43 ±0.96 and 10.52 ±1.24, df=35, p<0.5).

The number of manifested successful breedings with the first egg laid not later than 5 May is 101. These broods fledged early enough to leave sufficient time for the raising of a second brood. According to the "nearby nest criterion", 35 out of the 101 broods were followed by a second clutch, i.e. an annual mean frequency of 37% ±22%. This indicates that about a third of the successful first broods were followed by a second breeding attempt in the study area.

The probable replacement clutches

After a breeding failure, nest building and egg laying sometimes took place in a nearby nest pocket. I presume, as for the second clutches, that most of these clutches were laid by the failing pair and thus should be denoted as replacement clutches. Out of 382 breeding attempts with a known course of events, 65 (17%) were robbed, mostly by the Great Spotted Woodpecker, *Dendrocopos major,* and 91 (24%) were deserted, often during periods of heavy rain. Only 29 (19%) of these failures were

Table 3. Mean clutch size ±S.D. (n) in large and small nest pockets given for each month of the breeding season.

Medelkullstorleken i stora och små häckningsfickor för varje månad för sig under häckningssäsongen.

Pocket *Fick-* size *storlek*	April	May	June
Large *Stor*	5.32 ±0.67 (79)	5.83 ±0.69 (54)	4.45 ±0.94 (20)
Small *Liten*	5.57 ±0.93 (21)	5.74 ±0.71 (27)	4.73 ±1.01 (11)
p of difference *p för skillnad*	<0.3 ns	<0.6 ns	<0.5 ns

followed by renesting in a nearby nest pocket. This proportion of replacement clutches is probably too low and will be discussed further below.

Most replacement breedings were started in May. Out of the 29 cases mentioned, only three had their first egg laid in either April or June. The replacement clutches were larger than their corresponding first clutches as long as they belonged to the ascending part of the "calendar curve". The difference was significant when clutches were replaced during April and May (5.46 ±0.58 and 5.85 ±0.61, df=50, p<0.05).

The clutch size in small and large nest pockets

Out of the 200 nest pockets in the northern part of the study area, 91 were small and 109 large. This proportion was the same in 1982 through 1989. Thereafter some lost or destroyed small pockets were replaced by large ones. Both sizes were used as nest sites, and 153 clutches laid in large pockets can be compared with 59 in the small ones (Table 3). Obviously clutch size was not influenced by the capacity of the nest site. This conclusion is supported by the fact that the largest clutches, those with seven eggs, are uniformly distributed over the large (9) and small (6) pockets (χ^2 =0.172, p<0.90).

Out of 188 nests from the years 1982 – 1989 with invariable numbers of large and small nest pockets, 62 were placed in the small and 126 in the large ones. This proportion differs significantly from the one expected from a random distribution (χ^2 =11.85, p<0.001). The preference for the large pockets is also demonstrated by the fact that the percentage of nests in the small pockets (y) increases only when the total number of nests (x) rises, that is when the number of empty large pockets declines. This regression is significant (y=1.1x + 2.5, r=0.75, df=6, p<0.05).

Discussion

The laying and clutch size of the Treecreeper in southwestern Sweden can be compared with those of other investigated populations, first and foremost with

Kuitunen's (1987) results from southern Finland and also with the English nest card material, published by Flegg (1973), and with Aleknonis' results from Lithuania (Aleknonis 1984, Kuitunen & Aleknonis 1992), all of which comprise a large number of studied nests. Other investigations are based on about 50 or fewer nests referring to populations in Germany (Löhrl 1979, Schönfeld 1983). These samples are in many respects too restricted to allow adequate comparisons.

The laying season

The earliest laying date in my study area was 29 March, and 13 April in southern Finland (Kuitunen 1987). The annual variation was however considerable in southwestern Sweden, and the mean laying date for first clutches during the eleven seasons was 23 April, which does not differ much from 27 April for six seasons in Finland and from 25 April in Lithuania (Kuitunen & Aleknonis 1992). In both Finland and Sweden the bulk of first clutches were laid from 10 April to 10 May. New clutches were found in declining numbers through June in both studies; in Finland one clutch was even started after 1 July. Laying was reported to start from around the end of March and the beginning of April in England (Flegg 1973) and Germany (Schönfeld 1983), where the beginning and duration of the laying season are similar to those in south-western Sweden.

The Treecreeper is an early breeder compared with other resident species in my study area, which also has a dense population of Great Tits *Parus major*. The average time difference between the laying starts of the two species was 13.5 days (range 9 to 19 days) when the mean laying dates of the first five clutches from each of six seasons are compared.

Clutch size

The overall mean clutch size is generally used when regional comparisons are made. Kuitunen (1987) examined the geographical variation in clutch size using his own results and information from the British Isles, Germany, Hungary, Lithuania, and from elsewhere in Finland and found no clear trends. The mean clutch size of this study, 5.48 ±0.78, is very close to that of southern Finland, 5.43 ±0.71. The mean size of 56 Lithuanian clutches from nests in natural cavities is however larger, 5.82 ±0.66 (Kuitunen & Aleknonis 1992). The difference is significant (p<0.001).

Flegg (1973), using the English nest card material, showed that the clutch is slightly larger at the peak of the season than at the beginning or end. Kuitunen (1987) found a similar and more pronounced clutch size profile in Finland. He compared his seasonal convex curve with those of the English and Lithuanian populations. He noticed a possible trend from the north or northeast to the south or southwest with a higher and

Tab. 4. Clutch size distributions of the Treecreeper in southern Finland (Kuitunen 1987) and southwestern Sweden (this study).

Storleksfördelningen för äggkullar av trädkrypare i södra Finland (Kuitunen 1987) och sydvästra Sverige (denna studie).

		Clutch size *Kullstorlek*					Total
		3	4	5	6	7	*Summa*
S Finland	n	2	15	152	112	18	299
	%	1	5	51	39	6	100
SW Sweden	n	5	35	115	144	23	322
	%	2	11	35	45	7	100

slightly later peak in the north or northeast. This trend was supported by clutch size data from elsewhere in Finland, although the sample sizes were small.

The fact that the clutch size of the Treecreeper is related to the laying date means that the size of the overall mean clutch is not very useful for comparative analyses, unless the proportions and the timing of the different categories of clutches in the samples are known and considered. Most of the published samples consist of data from about 50 or fewer nests from too few seasons to make them suitable for comparative analyses. Therefore, comparisons in the following will mainly be made with the results of Kuitunen's study, which was carried out in spruce forests.

The clutch size range was the same in Finland and Sweden, from three to seven eggs. Clutch size distributions for the two areas are given in Table 4.

The pattern of distribution differs between the samples ($\chi^2 = 18.26$, p<0.01). The most common clutch consists of five eggs in Finland and six in Sweden. This difference might be a consequence of the larger proportion of nesting failures in the Swedish study area, followed by a higher number of replacement clutches in May when the clutch size curve peaks. The effect of this on the overall mean clutch is counteracted by a greater number of small clutches in the Swedish sample.

The Finnish first clutches (mean size 5.35 ±0.62) are somewhat smaller than the probable first clutches, i.e. those laid before 11 May, in Sweden (5.52 ±0.90, p<0.05), whereas Kuitunen's second clutches (5.53 ±0.89) are larger than the presumed second clutches in my study (5.03 ±0.90, p<0.02). The replacement clutches are large (6.25 ±0.71) though very few in the Finnish sample and do not differ statistically from the probable replacement clutches in Sweden (5.85 ±0.61, p<0.2). A consequence of the reversed size relations of the early and late clutches in the two countries is that the overall average clutch sizes converge at about the same level.

The relation between clutch size and laying date is similar in southern Finland and south-western Sweden.

The clutch size curves largely run in parallel (Fig. 4) although the peak of the Finnish curve is considerably higher than the Swedish one and appears about 12 days later.

The annual mean clutch size of the early season (before the peak of the clutch size curve) is related to the mean laying time of the season in the same way in southern Finland and south-western Sweden. This is expected when considering the above-mentioned similar "calendar effects" within seasons in the two study areas. The regression lines run practically in parallel with the Swedish one 0.18 eggs higher. Both show an increase corresponding to 0.03 eggs per day that mean laying date is delayed. The annual mean clutch sizes of the late season are not compared because a statistically significant regression was not found in my study.

The results of the comparisons above show unequivocally that the overall mean clutch size of a study area is a rather empty concept. The timing of the laying and variation in the clutch size within seasons may differ between areas in spite of equal overall clutch sizes. To discover and describe these differences, as is attempted in this report, is the necessary basis for the more important step to interpret and explain the differences ecologically. This remains to be done.
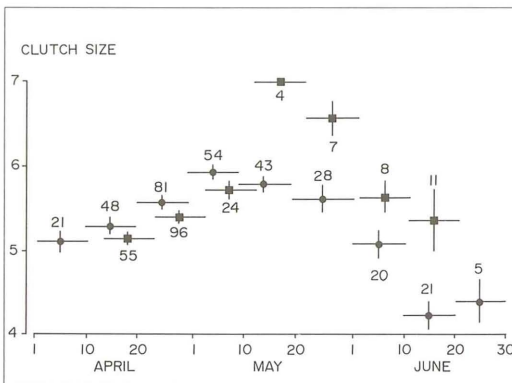

Fig. 4. Clutch size in relation to laying date in south-western Sweden (circles, this study) and in southern Finland (squares, Kuitunen 1987). The horizontal lines indicate the 10-day period for which the average value was calculated. The vertical lines indicate standard error. Sample sizes are given for each period.

Kullstorlekens ändring i relation till datum för värpningens start i sydvästra Sverige (cirklar, denna undersökning) och i södra Finland (kvadrater, Kuitunen 1987). De horisontella linjerna täcker den 10-dagarsperiod för vilken medelvärdet uträknats. De vertikala linjerna anger storleken av medelvärdets medelfel. Siffran vid varje period anger antalet kullar.

Repeated layings

It is reasonable to think that the ability of many Treecreepers to raise a second brood after the successful fledging of the first one is adaptive, provided that a second attempt does not too much diminish the parents' prospects of surviving the following winter to breed again next spring. Moreover, after nesting failures in the early part of the season, the adaptive value of producing replacement clutches seems to be unquestionable. With this in view, the frequency of repeated layings appeared to be lower than expected in the study area, at least as regards replacement clutches.

As shown above, only about a third (37%) of the successful breedings were followed by a second clutch, according to the "nearby nest criterion". Some true second clutches may thus have escaped detection for various reasons, but the proportion of double-brooded pairs is low also in Finland (37%, Kuitunen 1987) and in England (less than 20%, Flegg 1973). This indicates that double-broodedness might not unconditionally be the best strategy, although it means the total production of no less than about ten eggs. According to Kuitunen (1987), the productivity of double-brooded pairs, measured as the recruitment of new adults into the breeding population the following season, does not differ from that of single-brooded pairs laying about six eggs in the midst of the season when the clutch size curve culminates. The relative fitness of these alternative strategies probably varies with pairs, seasons and regions. The factors that are of importance for the choice of strategy remain to be identified.

The low frequency of replacement clutches is puzzling because, reasonably, the urge to relay ought to be stronger after a failure than after a successful breeding attempt. Some clutches may have been overlooked due to the shortcomings of the used "nearby nest criterion". However, in Kuitunen's (1987) ringed population only 8% of the failing pairs laid again, a surprisingly low figure.

Kuitunen reports a failure rate of about 30% of the breeding attempts (=number of prepared nest cups) in his nestbox breeding population (Kuitunen and Aleknonis 1992). Losses amounted to about 40% of the 382 breeding attempts (at least one egg laid) in my nest pockets. Eighty-nine of these failures occurred before 1 June, which means that there was enough time to raise a new brood. However, only 29 replacement clutches (nearby nests) were found. This represents a replacement rate of 33%, which seems to considerably exceed the Finnish figure. It is similar to the rate of probable second clutches in my study area.

It is possible that the number of observed replacement clutches depends on the cause of the nesting failure. Out of the 89 unsuccessful attempts, 32 nests were robbed, mostly by the Great Spotted Woodpecker, and

57 were deserted, many of them after being soaked during rainy periods. It seems reasonable to assume that the pairs are adapted to move farther away to renest after robbing than after "voluntary" desertion, to avoid being robbed again by the same predator. If so, using the "nearby nest criterion", fewer replacement nests should be found after robbing than after desertion, thus explaining part of the overlooked cases. In fact, fewer robbed nests were replaced nearby (7, or 22%) than was the case for deserted ones (22, or 39%). However, this difference is not statistically significant ($\chi^2 = 2.609$, p<0.2).

It is also possible that only potentially double-brooded pairs lay replacement clutches, at least when robbing or desertion occurs at the nestling stage of breeding. Although this interpretation is supported by the equal frequencies of the replacement and second clutches, it is merely an assumption. No doubt, further studies of an individually ringed population are badly needed.

Clutch size and choice of nest pocket size

There was no difference in size between the clutches laid in the large and in the small nest pockets (Table 3). This is noteworthy because the number of eggs laid by some hole-nesting passerine species depends to a certain extent on the size of the space or area of the nesting hole (Karlsson & Nilsson 1977). In spite of this, the Treecreeper seems to prefer the large pockets. The advantage of selecting a large pocket is not known. Perhaps the chicks are more effectively raised in the large pockets where crowding is reduced, thereby causing fewer losses. Unfortunately, my data from the nestling period do not allow this hypothesis to be tested.

References

Aleknonis, A. 1984. (Summary:Clutch size of woodland birds of Lithuania.) *Ekologija Ptili Litovckoi SSR* 107-113. Cited after Kuitunen (1987).
Enemar, A. & Arheimer, O. 1980. Trans-illumination of passerine bird eggs in field studies on clutch-size and incubation. *Ornis Scand.* 11:223-227.
Flegg, J.J.M. 1973. A study of Treecreepers. *Bird Study* 20: 287-302.
Karlsson, J. & Nilsson, S.G. 1977. The influence of nestbox area on clutch size in some hole-nesting passerines. *Ibis* 119: 207-211.
Kuitunen, M. 1987. Seasonal and geographical variation in the clutch size of the Common Treecreeper Certhia familiaris. *Ornis Fennica* 64: 125-136.
Kuitunen, M. 1989. *Food, space and time constraints on reproduction in the Common Treecreeper* (Certhia familiaris L.). Thesis, University of Jyväskylä, Finland.
Kuitunen, M. & Aleknonis, A. 1992. Nest predation and breeding success in Common Treecreepers nesting in boxes and natural cavitites. *Ornis Fennica* 69: 7-12.
Löhrl, H. 1979. Zur Brutbiologie einer Population des Waldbaumläufers Certhia familiaris. *Ökologie der Vögel* 1: 127-132.
Schnebel, G. 1972. Die Ökologie der Baumläufer (Certhia brachydactyla) und (Certhia familiaris) in Ostniedersachsen. *Die Vogelwelt* 93: 201-215.
Schönfeld, M. 1983. Beiträge zur Ökologie und zum intraspezifischen Verhalten der Baumläufer Certhia familiaris und C. brachydactyla in Eichen-Hainbuchen-Lindenwäldern unter dem Aspekt der erhöhten Siedlungsdichte durch eingebrachten Nisthöhlen. *Hercynia N.F. Leipzig* 20: 290-311.

Sammanfattning

Trädkryparens Certhia familiaris *värpning och kullstorlek i sydvästra Sverige*

Inledning och metod

Denna studie över trädkryparens häckningsbiologi började för ungefär 15 år sedan och baserades på konstgjorda häckningsanordningar, s.k. häckningsfickor. Dessa bestod av tillskurna stycken av takpapp, vilka nubbades upp på trädstammarna på så sätt att ett utrymme för boet bildades mellan papp och bark (Fig. 1). Från och med l982 stod 300 häckningsfickor till förfogande, uppsatta med i genomsnitt 70 m mellanrum längs tre stråk om tillsammans ca 20 km längd. Undersökningsområdet ligger ca 10 km sydöst om Göteborg, till större delen i Gunnebo fritidsområde, som karakteriseras av ädellövskog i vilken eken ställvis dominerar helt. Vissa avsnitt täcks av uppvuxen planterad granskog. Granskogen är förhärskande i den mindre del av undersökningsområdet, som sträcker sig söderut från Gunnebo. Den totala ytan är ca 9 km², varav ca 3 km² består av öppen terräng.

Under häckningssäsongen inspekterades fickorna från ca 1 april till 1 juli var och varannan vecka, ibland med längre mellanrum, beroende på tillgången till tid. Projektet är av fritidsnatur och fältarbetet har av nödtvång nästan helt begränsats till veckosluten. Trädkryparen förekommer i glesa bestånd och därför måste studierna bedrivas över ett stort område om avsikten är att införskaffa ett tillförlitligt material. Det rena kontrollarbetet blir därför tidskrävande. En besvärande brist i undersökningen är att tid icke funnits för en systematisk färgringmärkning av de häckande fåglarna.

Resultat

Under de 11 säsongerna 1982-1992 har 459 häckningsförsök (minst ett ägg värpt) registrerats i de 300 häckningsfickorna, vilket innebär i medeltal 37 per säsong. Variationen mellan säsongerna har varit betydande, från 19 till 54.

Häckningssäsongen är lång för trädkryparna beroende bl a på att åtskilliga par lägger två kullar. Tidigaste och senaste noterade värpstart är 29 mars resp. 26 juni. I ett diagram (Fig. 2) visas hur värpstarterna fördelats under säsongen. Den första och största av de tre topparna får antas till huvuddelen bestå av förstakullar och den tredje av andrakullar och omläggningar. Den andra och smala toppen stör den tvåtoppighet som kan förväntas av en art med dubbla kullar. Den orsakas av omläggningar vilka blivit särskilt många är då perioder av häftiga regn inträffar i säsongens början. Trädkryparen överger nämligen lätt de i häckningsfickorna nedblötade bona med ägg eller små ungar.

Tidpunkten för häckningssäsongens start kan variera betydligt mellan åren. Medeldatum för den första toppen i Fig. 2 (förstakullarnas start) redovisas i Tabell 1. Skillnaden mellan säsongerna kan uppgå till inte mindre än tre veckor.

Antalet ägg i fulla kullar har varierat från 3 till 7, med 6 som den vanligaste (45% av 322 kullar), allt redovisat i Tabell 2. Av denna framgår också att kullstorleken är datumberoende och stiger under april för att ligga på topp under maj och sedan minska under juni. Därav följer att den genomsnittliga kullstorleken kan förväntas variera mellan åren beroende på när äggläggningen börjar. Det innebär att förstakullarna blir större de år då häckningen börjar senare. Att så också är fallet visas i Fig. 3. Som synes motsvaras detta av en minskning vid senareläggning av andrakullarna, ett samband som beroende på stor spridning ej är statistiskt säkert dokumenterat i mitt material.

För att kunna analysera anpassningsvärdet i trädkryparens sätt att verkställa sin fortplantning måste man säkert kunna veta vad som är förstakullar, omläggningar och andrakullar. Detta är alltså ej möjligt eftersom jag ej färgringmärkt mina par. Särskilt svårt är det att kunna skilja andrakullarna från sena omläggningar. Preliminär information om de olika slagen av kullar har dock införskaffats med hjälp av vissa antaganden, enligt följande. Trädkryparen är glest förekommande, vilket framgår bl a av det låga antalet häckningsförsök per säsong. Förstahäckningarna åtskiljs som regel av långa avstånd. När en lyckad häckning omedelbart åtföljs av en ny äggkull i en häckningsficka i det omedelbara grannskapet har detta tolkats som en andrakull av samma par. På samma sätt har en ny kull i grannskapet efter en rövning eller övergivning tolkats som en omläggning.

Med hjälp av de givna antagandena har kunnat konstateras att 37 par med lyckade förstakullar har värpt andrakullar. Dessa har i genomsnitt varit 0,5 ägg mindre än förstakullarna, dvs 5,0 resp. 5,5 ägg, innebärande att dessa par presterat en sammanlagd "kull" på 10,5 ägg i genomsnitt. Denna sammanlagda kullstorlek har varit oberoende av tidpunkten för äggläggningens start (sena och därmed stora förstakullar följs av små andrakullar, och tvärtom). Av konstaterade lyckade häckningar har 101 varit så tidiga (värpstart senast 5 maj) att gott om tid funnits att hinna föda upp en andrakull samma säsong. I 37 av dessa fall har en andrakull registrerats i grannskapet, vilket antyder att ca en tredjedel av paren i den studerade populationen är "dubbelhäckare". Av de sammanlagt 382 häckningsförsök för vilka resultatet är känt blev 65 rövade, oftast av större hackspett, och 91 övergivna, inte sällan i samband med häftiga regn. Endast 29 av dessa misslyckanden åtföljdes av ny kull i grannskapet, vilket skulle innebära att en förvånande låg andel av paren lägger om. Detta kommenteras nedan.

Av Gunnebo-områdets 200 häckningsfickor representerades 91 av den mindre typen och resten av den större. Som framgår av Tabell 3 värptes lika stora kullar i de båda holktyperna.

Kommentarer

De trädkryparstudier som utförts på andra håll har som regel varit av begränsad omfattning med undantag för den finske ornitologen Markku Kuitunen's (1987, 1989) forskning över arten i södra Finlands barrskogar, vilken resulterat bl a i en doktorsavhandling. Jämförelser har gjorts med i första hand hans resultat.

Medelstorleken för alla kullar uppvisar ingen säker skillnad mellan Sverige och Finland, 5,48 resp. 5,43 ägg, dock att 5-kullen dominerar i Finland (51%), inte 6-kullen som i Sverige (Tab.4). Vidare är förstakullarna något mindre och andrakullarna något större i Finland. Sambandet mellan datum och kullstorlek är likartat i de båda undersökningarna. De båda kullutvecklingskurvorna löper i stort parallellt (Fig. 4). Den årliga medelkullstorleken för perioden före kullkurvans topp är beroende av medeldatum för häckningens start i praktiskt taget samma grad i båda länderna, innebärande en ökning med 0,03 ägg för varje dygn som värpstarten senareläggs. Jämförelse kan ej göras för den senare delen av häckningssäsongen eftersom datumberoendet då ej är statistiskt säkerställt för den svenska populationen.

I den färgringmärkta finska populationen konstaterades att 37% av de lyckade första-kullarna åtföljdes av en andra-kull, alltså samma frekvens som i denna undersökning. Detta antyder att det inte under alla förhållanden är till fördel för trädkryparparen att vara "dubbelhäckare". Mera av utredande studier krävs för

att eventuellt kunna avslöja vilka faktorer som avgör om en förestående häckningssatsning skall riktas mot en eller två kullar.

Den låga andelen omläggningar efter misslyckade häckningar är förvånande och utgör endast 33% för häckningar som avbrutits före den 1 juni, dvs ungefär samma procenttal som för andra-kullarna. Procenttalet är lågt även i Finland (8% av alla misslyckanden). Det ligger nära till hands att misstänka att paren efter rövning eller övergivning lämnar undersökningsområdet och häckar om på annat håll och därför undgår att registreras. Det är också tänkbart, om än mindre troligt, att endast de par, som är inställda på "dubbelhäckning", lägger ny kull efter ett misslyckande. De samstämmiga procenttalen för andrakullar och omläggningar skulle tala för detta.

Det är känt att åtskilliga hålhäckande småfågelarter i viss grad rättar antalet ägg i kullen efter boutrymmets storlek. För trädkryparens del var kullstorleken samma i de stora och små häckningsfickorna. Dock visade trädkryparna en statistiskt säker övervikt för de stora fickorna vid valet av boplats. Anledningen härtill är okänd. Tänkbart är att den trängselbetingade dödligheten bland de växande ungarna är minst i de stora häckningsfickorna. Mitt insamlade material är dock ännu ej av den kvaliteten att detta spörsmål kan belysas.