

Clutch size and breeding success in some hole nesting passerines in Central Sweden

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Clutch size and breeding success were studied in nest box populations of *Ficedula hypoleuca*, *Parus major*, *P. caeruleus*, and *P. palustris* in predominantly coniferous forest in Central Sweden (60°19' N, 16°56' E). Desertions and complete losses were very rare in all species. The average clutch size was 6.20 for 961 clutches of *F. hypoleuca*, 7.83 for 209 first clutches and 6.5 for 32 second clutches of *P. major*, 9.3 for 7 clutches of *P. caeruleus*, and 7.9 for 45 clutches of *P. palustris*. The average proportion of second clutches in *P. major* was 15 per cent, but varied between 0 and 43 per cent in any one year. Only a few per cent of the eggs laid failed to hatch in each species. In comparison with other studies nestling mortality was unusually low, less than 9 per cent in *F. hypoleuca*, 3 per cent in first broods of *P. major*, zero in *P. caeruleus*, and practically zero in *P. palustris*.

Although geographical variation in clutch size raises important ecological questions (cf. VON HAARTMAN 1967) there are few published reports on clutch size and breeding success from Sweden (ENEMAR 1948, JANSSON 1960, HANSON *et al.* 1966).

This paper concerns clutch size and nesting success in the Pied Flycatcher *Ficedula hypoleuca*, the Great Tit *Parus major*, the Blue Tit *P. caeruleus* and the Marsh Tit *P. palustris*, breeding in nest boxes in the neighbourhood of Tärnsjö (60°19' N, 16°56' E) in Central Sweden. The investigation which took place between 1952 and 1963 was carried out in two areas, 15 km. WSW and 10 km. NNE of Tärnsjö respectively.

The vegetation of the areas is predominantly spruce *Picea abies* and pine *Pinus sylvestris* with birch *Betula pubescens* subdominant and sporadically other deciduous trees such as alders *Alnus* spp. and aspen *Populus tremula*.

The average age of the conifer stands was about 40 years. The field layer was mostly dominated by low shrubs such as *Vaccinium myrtillus*; elsewhere it was characterized by grasses and forbs. The areas changed comparatively little during the course of the study.

The number of nest boxes was increased during the period of study from 56 in the first years to nearly 200 in the final year (cf. Table 1, which also gives the number of boxes occupied in each year). All boxes were made from a material similar to bakelite. They do not seem to be particularly suitable for the birds since they tend to become moist. Thus the mortality of nestling Pied Flycatchers in the period 1964—1970 amounted to approximately 11 per cent in bakelite boxes as compared with slightly above 1 per cent in wooden boxes or boxes made from a mixture of wood and cement (unpubl. results).

The boxes were erected along roads at intervals of at least 50 m. Since the

TABLE 1. Number of nest boxes in different years of the study with number of boxes occupied (in brackets).

| | | | | | | | | |
|------|----|------|------|-----|-------|------|-----|-------|
| 1952 | 56 | (21) | 1956 | 99 | (89) | 1960 | 123 | (118) |
| 1953 | 56 | (50) | 1957 | 122 | (110) | 1961 | 177 | (156) |
| 1954 | 53 | (45) | 1958 | 123 | (114) | 1962 | 190 | (182) |
| 1955 | 53 | (52) | 1959 | 123 | (117) | 1963 | 198 | (177) |

roads are nowhere particularly close to each other the number of boxes per unit area was low. It is thus highly unlikely that differences in breeding density should have influenced clutch size as found for the Great Tit in the Netherlands by KLUIJVER (1951) and in England by LACK and his co-workers (LACK 1966, p. 29).

The boxes were inspected at least three times every breeding season: 1) when clutches were completed, 2) when the young were halfgrown and 3) immediately after fledging. On the basis of these observations it cannot be ruled out that certain losses of eggs might have passed unnoticed. Although nothing is known about these losses, if any, or their variations between years, they can be assumed on the basis of other investigations to be negligible. Losses of

hatched young are probably a more serious source of error, although any young which died in nest would have been recorded at the post-fledging inspection.

Desertions and complete losses of clutches were extremely rare, about two per cent in the Pied Flycatcher and practically none in the tits.

For most species dealt with in this study a number of investigations have shown that clutches laid later in the season tend to be smaller than those laid earlier (cf. KLOMP 1970, p. 18ff). Except for the Great Tit where first and second clutches are treated separately, no separation between early and late clutches has been made in the present account, so a lower average clutch size in one year may be partly due to a higher proportion of late broods in that year.

TABLE 2. Clutch size in the Pied Flycatcher *Ficedula hypoleuca* near Tärnsjö, Central Sweden in the period 1952–1963.

| Year | Clutch size | | | | | | n | x | S.E. |
|-------|-------------|------|------|------|-----|-----|-------|------|-------|
| | 4 | 5 | 6 | 7 | 8 | 9 | | | |
| 1952 | | 1 | 11 | 1 | | | 13 | 6.00 | ±0.11 |
| 1953 | | 4 | 32 | 5 | | | 41 | 6.02 | ±0.07 |
| 1954 | 1 | 3 | 23 | 11 | | | 38 | 6.16 | ±0.11 |
| 1955 | | 6 | 29 | 8 | | | 43 | 6.05 | ±0.09 |
| 1956 | 1 | 9 | 43 | 16 | 1 | | 70 | 6.10 | ±0.08 |
| 1957 | | 1 | 49 | 21 | 3 | 2 | 76 | 6.42 | ±0.08 |
| 1958 | 3 | 13 | 51 | 23 | 1 | 1 | 92 | 6.10 | ±0.08 |
| 1959 | | 3 | 41 | 35 | 2 | | 81 | 6.44 | ±0.07 |
| 1960 | | 3 | 54 | 40 | 2 | | 99 | 6.41 | ±0.06 |
| 1961 | 2 | 12 | 67 | 39 | 4 | 3 | 127 | 6.31 | ±0.07 |
| 1962 | 3 | 6 | 87 | 36 | 3 | 2 | 137 | 6.26 | ±0.06 |
| 1963 | | 43 | 76 | 22 | 3 | | 144 | 5.90 | ±0.06 |
| Total | 10 | 104 | 563 | 257 | 19 | 8 | 961 | 6.20 | ±0.02 |
| In % | 1.0 | 10.8 | 58.6 | 26.7 | 2.0 | 0.8 | 100.0 | | |

TABLE 3. Clutch size in first clutches of the Great Tit *Parus major* near Tärnsjö, Central Sweden in the period 1952—1963.

| Year | Clutch size | | | | | | | | | | n | x | S.E. |
|-------|-------------|-----|-----|------|------|------|-----|-----|-----|--|-------|------|--------|
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | | | |
| 1952 | | | | | 4 | 3 | | | | | 7 | 8.43 | ± 0.20 |
| 1953 | | | | 4 | 4 | | | | | | 8 | 7.50 | ± 0.19 |
| 1954 | | | 1 | 3 | 1 | | | | | | 5 | 7.00 | ± 0.32 |
| 1955 | | | 1 | 2 | 4 | | | | | | 7 | 7.43 | ± 0.30 |
| 1956 | 1 | 1 | 3 | 5 | 3 | 2 | 1 | | | | 16 | 7.13 | ± 0.39 |
| 1957 | | 1 | 4 | 11 | 7 | 5 | | | | | 28 | 7.39 | ± 0.20 |
| 1958 | | | | 8 | 9 | | | | | | 17 | 7.35 | ± 0.12 |
| 1959 | | 1 | 2 | 3 | 14 | 9 | | | 1 | | 30 | 8.10 | ± 0.23 |
| 1960 | | | | | 8 | 2 | 3 | 1 | | | 14 | 8.79 | ± 0.28 |
| 1961 | | 1 | 2 | 3 | 10 | 3 | 2 | | | | 21 | 7.86 | ± 0.27 |
| 1962 | | | 1 | 2 | 22 | 8 | 1 | | | | 34 | 8.18 | ± 0.12 |
| 1963 | | | 1 | 4 | 15 | 2 | | | | | 22 | 7.82 | ± 0.14 |
| Total | 1 | 4 | 15 | 45 | 101 | 34 | 7 | 1 | 1 | | 209 | 7.83 | ± 0.07 |
| In % | 0.5 | 1.9 | 7.2 | 21.5 | 48.3 | 16.3 | 3.3 | 0.5 | 0.5 | | 100.0 | | |

Clutch size

The Pied Flycatcher

The data on clutch size in the Pied Flycatcher are summarized in Table 2. The average clutch size is 6.20, compared to 6.2 as recorded by JANSSON (1960) and 6.3 by ENEMAR (1948), and 6.30 by VON HAARTMAN (1969, p. 124) from Lemsjöholm in Finland.

Some investigators have found that the clutch size in the Pied Flycatcher tends to be smaller in years when breeding starts late (cf. LACK 1966, p. 102ff). The low clutch size in 1963 seems to be explicable on these grounds since breeding was about 10 days later that year.

The Great Tit

Data on clutch size in the Great Tit are given separately for first and second clutches in Tables 3 and 4. The number of second clutches varied considerably. Before 1958 no second broods occurred and the same was true in 1960 (the same thing happened again in the period 1964—1968, otherwise not included in this treatment). But in 1959 no less than 43 per cent of the pairs had a second clutch. The average for the whole period 1952 to 1963 is about 15 per cent, i.e. somewhat lower than that reported from Lemsjöholm by VON HAARTMAN (1969, p. 46).

TABLE 4. Clutch size in second clutches of the Great Tit *Parus major* near Tärnsjö, Central Sweden in the period 1958—1963 (no second clutches were laid in 1952—1957).

| Year | Clutch size | | | | | | | | n | x |
|-------|-------------|---|---|---|---|---|---|--|----|-----|
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | | |
| 1958 | 1 | | | | | | | | 1 | 3.0 |
| 1959 | | 1 | 2 | 2 | 4 | 2 | 2 | | 13 | 6.8 |
| 1960 | — | — | — | — | — | — | — | | — | — |
| 1961 | | 1 | | 1 | 3 | 1 | 1 | | 7 | 6.9 |
| 1962 | | | | 2 | 2 | | 1 | | 5 | 7.0 |
| 1963 | | 1 | 2 | 2 | | 1 | | | 6 | 5.7 |
| Total | 1 | 3 | 4 | 7 | 9 | 4 | 4 | | 32 | 6.5 |

The average size of first clutches, 7.83, is rather lower than that reported from Lemsjöholm (VON HAARTMAN l.c.), which was as high as 9.90. The same is true of the second clutches, 6.5 as compared with 7.85 in VON HAARTMAN's material.

The Blue Tit

Except for 1958 when two pairs bred in the boxes there has only been one pair in each year 1959—1963. The clutch size was 7 and 10 eggs in 1958, 13 in 1959, 11 in 1960, 9 in 1961, 8 in 1962 and 7 in 1963. A second clutch has only been found once, in 1959, when one numbering 8 eggs was laid.

The Marsh Tit

The average size of 45 clutches of this single-brooded tit was 7.7 eggs (Table 5). The Marsh Tit is absent from Finland and no Scandinavian data based on a large enough material seem to be available for comparison.

Breeding success

Breeding success, here defined as the number of eggs hatched and the number of young fledged disregarding the extremely few desertions and complete losses which have occurred, is given for each species below.

The Pied Flycatcher

Breeding success for the Pied Flycatcher is given in Table 6. As noted above the proportion of complete losses was very low. Also the percentage of eggs hatched and of young fledged compare favourably with data summarized by LACK (1966, p. 105).

The Great Tit

Data on breeding success for first broods of Great Tits are given in Table 7. Regrettably the breeding success of second broods has not been satisfactorily determined due to lack of records in late summer. The success of first broods is very high. Only two per cent of the eggs failed to hatch and only three per

TABLE 5. Clutch size in the Marsh Tit *Parus palustris* near Tärnsjö, Central Sweden in the period 1952—1963.

| Year | Clutch size | | | | | | n | x |
|-------|-------------|----|----|---|----|----|----|------|
| | 6 | 7 | 8 | 9 | 10 | 11 | | |
| 1952 | 1 | | | | | | 1 | 6.0 |
| 1953 | | | 1 | | | | 1 | 8.0 |
| 1954 | 1 | 1 | | | | | 2 | 6.5 |
| 1955 | | 2 | | | | | 2 | 7.0 |
| 1956 | | 1 | | | 2 | | 3 | 9.0 |
| 1957 | 1 | 1 | 2 | 1 | | | 5 | 7.6 |
| 1958 | | 1 | 2 | | | | 3 | 7.7 |
| 1959 | | 1 | 1 | 2 | 1 | | 5 | 8.6 |
| 1960 | | 2 | 1 | 1 | | | 4 | 7.8 |
| 1961 | | | 1 | 2 | 1 | | 4 | 9.0 |
| 1962 | 1 | 2 | 4 | 2 | | 1 | 10 | 8.1 |
| 1963 | 1 | 1 | 3 | | | | 5 | 7.4 |
| Total | 5 | 12 | 15 | 8 | 4 | 1 | 45 | 7.93 |

TABLE 6. Breeding success in the Pied Flycatcher *Ficedula hypoleuca* near Tärnsjö, Central Sweden in the period 1952—1963.

| | Clutch size | | | | | | Total |
|---------------------------|-------------|------|------|------|------|------|-------|
| | 4 | 5 | 6 | 7 | 8 | 9 | |
| Number of clutches | 10 | 104 | 563 | 257 | 19 | 8 | 961 |
| Total number of eggs laid | 40 | 520 | 3378 | 1799 | 152 | 72 | 5961 |
| Number of eggs hatched | 40 | 470 | 3249 | 1680 | 127 | 69 | 5635 |
| In % | 100.0 | 90.4 | 96.2 | 93.4 | 83.6 | 95.8 | 94.53 |
| Number of young fledged | 38 | 438 | 3018 | 1476 | 109 | 64 | 5143 |
| In % of eggs hatched | 95.0 | 93.2 | 92.9 | 87.9 | 85.8 | 92.8 | 91.26 |

TABLE 7. Breeding success in the Great Tit *Parus major* near Tärnsjö, Central Sweden in the period 1952—1963, first broods.

| | Clutch size | | | | | | | | | Total |
|---------------------------|-------------|-------|-------|------|------|------|-------|-------|-------|-------|
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Number of clutches | 1 | 4 | 15 | 45 | 101 | 34 | 7 | 1 | 1 | 209 |
| Total number of eggs laid | 4 | 20 | 90 | 315 | 808 | 306 | 70 | 11 | 12 | 1636 |
| Number of eggs hatched | 4 | 20 | 90 | 309 | 800 | 292 | 65 | 11 | 12 | 1603 |
| In % | 100.0 | 100.0 | 100.0 | 98.1 | 99.0 | 95.4 | 92.9 | 100.0 | 100.0 | 97.98 |
| Number of young fledged | 4 | 19 | 89 | 301 | 775 | 279 | 65 | 11 | 12 | 1555 |
| In % of eggs hatched | 100.0 | 95.0 | 98.9 | 97.4 | 96.9 | 95.5 | 100.0 | 100.0 | 100.0 | 97.00 |

cent of the young died in the nest. These figures, like those for the Pied Flycatcher, compare favourably with data from other investigations.

The Blue Tit

All eggs laid except one in the clutch of 13 hatched and all young fledged, including those of the only second clutch recorded during the period.

The Marsh Tit

Nesting success was very high also in the Marsh Tit as seen from Table 8. Only four out of 357 eggs failed to hatch and only two young died in the nest.

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TABLE 8. Breeding success in the Marsh Tit *Parus palustris* near Tärnsjö, Central Sweden in the period 1952—1963.

| | Clutch size | | | | | Total | |
|---------------------------|-------------|----|-----|----|----|-------|-----|
| | 6 | 7 | 8 | 9 | 10 | | 11 |
| Number of clutches | 5 | 12 | 15 | 8 | 4 | 1 | 45 |
| Total number of eggs laid | 30 | 84 | 120 | 72 | 40 | 11 | 357 |
| Number of eggs hatched | 30 | 84 | 118 | 71 | 39 | 11 | 353 |
| Number of young fledged | 30 | 84 | 116 | 71 | 39 | 11 | 351 |

Selostus: Eräiden kololintujen munamäärä ja pesinnän onnistuminen Keski-Ruotsissa.

Pöntössä pesivien kirjosieppojen, talitiaisten, sinitiaisten ja viitatieisten munamäärästä ja pesinnän onnistumisesta on tehty havaintoja kahdentoista vuoden ajan Keski-Ruotsissa sijaitsevalla pääasiassa havumetsää kasvavalla alueella. Taulukossa 1. on esitetty tarjolla ja käytössä olleiden pönttöjen määrät. Kirjosiepon pesyekoko oli keskimäärin 6.20 ± 0.02 (Taul. 2), talitiaisen ensimmäisten pesyeitten 7.83 ± 0.07 (Taul. 3), talitiaisen toisten pesyeitten 6.5 (Taul. 4), sinitiaisen 9.3 ja viitatieisen 7.93 (Taul. 5). Pesyeiden hylkääminen ja koko pesyeen tuhoutuminen oli poikkeuksellista. Kirjosiepolla kuoriutui munituista munista yli 94 % ja kuoriutuneista poikasista selviytyi lentokykuisiksi yli 91 % (Taul. 6). Talitiaisella oli ensimmäisten pesyeitten kuoriutumisprosentti 98 ja kuoriutuneista poikasista lähti lentoon 97 %. (Taul. 7). Myös sini- ja viitatieaisella (Taul. 8) olivat sekä haudonta- että pesäpoikasvaiheen menetykset lähes olemattomat.

References

- ENEMAR, A. 1948. Några erfarenheter från fem års holkfågelstudier. *Vår Fågelvärld* 7: 105—117.
- VON HAARTMAN, L. 1967. Geographical variations in the clutch-size of the Pied Flycatcher. *Ornis Fennica* 44:89—98.
- VON HAARTMAN, L. 1969. The nesting habits of Finnish birds. I. Passeriformes. *Commentationes Biologicae* 32:1—187.
- HANSON, S. Å., LENNERSTEDT, I., MYHRBERG, H. & NYHOLM, E. 1966. Holkestudier vid Ammarnäs 1965. *Fauna och Flora* 61:225—254.
- JANSSON, K.-E. 1960. Några siffror och rön från sju års studier av småfåglar häckande i holk. *Vår Fågelvärld* 19:127—136.
- KLOMP, H. 1970. The determination of clutch-size in birds. A review. *Ardea* 58:1—124.
- KLUIJVER, H. N. 1951. The population ecology of the Great Tit, *Parus m. major* L. *Ardea* 39:1—135.
- LACK, D. 1966. Population studies of birds. Clarendon Press, Oxford.
- Received January 24, 1972.*