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DAVID G. DAWSON

Ecology Division D.S.I.R.
Goddards Lane
Havelock Norths, New Zealand

House Sparrow, *Passer domesticus* (L.), breeding in New Zealand*

House Sparrow, *Passer domesticus* (L.), breeding in New Zealand is described. Data on clutch-size and nestling mortality are given for each part of the breeding season. Annual variations are considered in the light of evolution of clutch-size and population regulation.

House Sparrows, *Passer domesticus* (L.) in New Zealand can raise three or, rarely, four broods per year. Laying began in September and ended in January, but differences in the dates of laying were found between three areas.

Breeding statistics are given for two areas. The mean size of clutch is 3.8; 71% of the eggs hatched at Christchurch and 82% at Hawkes Bay. 43% of the eggs at Christchurch and 50% at Hawkes Bay resulted in flying young — 1.6 and 1.9 per nest.

Nestling survival of these sparrows is lower than is usual for hole-nesting birds. Clutch-size remained nearly constant but egg and nestling mortality decreased as the season progressed. First-year females had poorer breeding success than older birds. Clutches of five had the highest breeding success but this was probably due to most of these being laid by older females; when considered separately older females had an optimum clutch of four, but the lower success of clutches of four laid by first-year females had the effect of reducing the overall success for this clutch-size.

* The whole data were submitted for publication in "Notornis".

Year to year variation in clutch-size and hatching success was very small, but nestling survival varied greatly.

No evidence could be found in nine years' data for fledgling production to be "density-dependent" nor for it to be a "key factor" in annual population changes.

MEETING DISCUSSION

P. WARD: Do you know anything about clutch sizes of the House Sparrows in New Zealand shortly after their introduction into the country?

D. G. DAWSON: T. W. Kirk (N. Z. Inst. Trans. Proc. 1891) claimed large clutches and more productive breeding in a variety of ways.

W. KEIL: How many breeding pairs (absolute number) do you have in the different study areas? How many boxes do you have in the study areas? How large is the influence of weather, especially temperature, during breeding time? We have in our study area in Hesse (The German Federal Republic) a large number of breeding pairs under the roofs of farmhouses. We found out that at the temperature of 60°C (or higher) during feeding time, the mortality of the young goes up (75-90%).

D. G. DAWSON: The number of pairs varied from year to year, averaging about 20 at Shirley, 5 at Hoon Hay, 10 at Lincoln and 20 at Havelock. Temperatures in the boxes must have rarely, or not at all, reached critical level — I did not study natural nests in susceptible positions.

R. M. NAIK: Is the number of nest boxes occupied by the sparrows a good index of the density of breeding population in your area? Is there any competition between the sparrow and any other animal for the nest boxes in your area?

D. G. DAWSON: (1) Perhaps not, but it is all that I have; (2) very little — I have once recorded an interaction with starlings, *Sturnus vulgaris*.

S. C. KENDEIGH: Did you band or mark your birds? How persistently did the same female lay subsequent clutches in the same box or did they shift sometimes to other boxes?

D. G. DAWSON: Some banding was done. There was some shift of females between boxes, but for the most part females persisted in the same box throughout the season.

PH. GRAMET: Les résultats présentés sous entendent qu'un couple de Moineaux domestiques conserve le même site de nidification au cours de toute la durée de son activité sexuelle saisonnière.

Ceci ne semble pas être le cas pour la population que nous étudions et une exploitation des données numériques par nichoir, sans connaître avec certitude l'identité des deux partenaires du couple (ou du moins de la femelle) risquerait d'être erronée. Le critère retenu serait en effet, dans ce cas, le nichoir et non le couple. Une précision à ce sujet, me rassurerait.

D. G. DAWSON: Answers to your questions were covered in the written paper. Successive clutches were distinguished only for Shirley and Havelock. My observations were not quantitative, but I saw many marked females feeding successive broods of the same nest and have recorded few changes of site within a summer.

M. I. DYER: What is the relation between egg size and clutch size to subsequent production of young?

D. G. DAWSON: Egg size was related to the time of the year, but this has very little direct effect on hatching. Nestling survival may be related to egg size.

C. C. H. ELLIOTT: In a previous slide, clutches of 5 gave a mean number of fledged young of 2.04 and clutches of 3.83, 2.34. This does not seem to indicate that the clutch size 5 gives the largest number of surviving young. I understand, however, that these clutches are produced in the same boxes, the clutch of 5 comes first and smaller ones later, so the difference is probably seasonal and not related to age at all. Other factors may also be involved in different birds.

D. G. DAWSON: The clutches of 5 could have been laid at *any* time in the same year and not necessarily before those in row "B". Seasonal effects were investigated in the paper and were insufficient to account for the large differences between the rows.

R. F. JOHNSTON: In view of the persuasiveness of the model of D. Lack, derived from *Apus*, concerning maintenance of different clutch sizes in a population, it is surprising that you do not pay much attention to it. Is there some special reason for your doing this?

D. G. DAWSON: I did consider the possibility of year to year variation in the "optimum" clutch briefly, but samples in any one year were too small for a well-founded conclusion.

P. R. EVANS: The first sparrows to breed seemed to have the lowest fledging success. If these breeding birds are adult, why do they breed so early? Does this enable them to get in more broods per season than by starting later?

D. G. DAWSON: Yes, I think so. The number of breeding attempts per nesting box was certainly related to the time when the first clutch was laid. The large number of "repeat" clutches shown in New Zealand lends support to a division of the season by date, rather than by order of laying.

W. B. YAPP: Have you taken any account of the argument of Mountfort (J. Anim. Ecol. 1962) that the modal clutch size is not that to be expected by natural selection?

D. G. DAWSON: Yes.