The Movements of Granivorous Passerines on Farmland in Winter

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The populations of some birds on farmland have declined over recent years. Although the causal mechanisms are widely debated, it is now widely accepted that agricultural intensification has been a key factor driving that trend (Benton *et al.* 2003). Demographic studies, including analyses of general ringing data have shown that reductions in the annual survival rates of some seed eating passerines have contributed to, or driven, their population declines (Siriwardena *et al.* 1998). Reversing the declines of key bird species in agricultural environments is now recognised as a high priority with considerable resources, notably through agri-environment schemes, now available to encourage management that aims to halt and reverse those declines (SEERAD 2004, Vickery *et al.* 2004). A number of prescriptions available within the agri-environment schemes aim to increase the availability of seeds through the winter and thus enhance the winter survival of granivorous birds. Knowledge of the normal ranging behaviour of seed-eaters on farmland in winter would permit such targeted conservation measures to be delivered in a cost-effective way by identifying what is the optimal scale and also timing at which to provide winter food sources for birds. For the two winters 2002/03 and 2003/04, the TRG in partnership with BTO Scotland has tried a number of methods in an attempt to quantify how far these birds range within a winter.

The main study area of 25 km^2 was immediately west of Dunfermline in West Fife, where the TRG has been ringing farmland birds since 1995. The three principal study species were Yellowhammer *Emberiza citronella* , Chaffinch *Fringilla coelebs* and Eurasian Tree Sparrow *Passer montanu*s. Four approaches to assessing winter ranging behaviour were trialed in 2002/03: (i) systematic mark-recapture ringing; (ii) radio-tracking; (iii) colour-ringing with systematic resighting; (iv) plumage dying with systematic resighting. The two colour marking methods proved of limited value. The resighting of colour rings proved problematic within our study area and the use of plumage dyes was complicated by variable rates of fading. In the second season, 2003/04 we concentrated on mark-recapture ringing and radio-telemetry. In addition, the Lothian Ringing Group undertook a similar mark-recapture ringing study within a second area around Gifford in East Lothian. Concurrent surveys monitored any changes in bird abundance within the two study areas against which any movements could be placed in context.

In the two winters, over 2,500 captures of finches and buntings were made during the systematic mark-recapture ringing in the two study areas. Recaptures of these ringed birds were used to estimate their likelihood of moving between four ringing sites in West Fife and between three sites in East Lothian. The analyses used a multi-strata modelling approach within the program MARK (White 2002) and generated estimates of the probability of individuals moving between pairs of sites, with associated measures of the error attached to the estimates. Disappointingly, and perhaps even surprisingly, the number of movements detected between ringing sites within both study areas was few; in West Fife, 6 of Yellowhammer, 1 of Chaffinch and 4 of Tree

Sparrow in 2002/03 and 10 of Yellowhammer and 2 of Chaffinch in 2003/04; in East Lothian, 1 of Yellowhammer and 2 of Chaffinch in the one year of operating in that study area. Although movements could be modelled for Yellowhammer and Chaffinch for the first year of the study and for Yellowhammers only in West Fife for the second year, the precision of the estimates of movement likelihoods was not high (Calladine *et al.* 2003, 2004). For example, the greatest likelihood for a movement by an individual between two ringing sites estimated by analyses of mark-recapture ringing data was 37% for Yellowhammers between two sites that were 3 km distant in West Fife in the first year of the study and this had an associated standard error of 17%. Typically, estimates of movement likelihoods were lower with standard errors of similar magnitude to the mean (Figure 1). Therefore, comparison of these estimates, between species, regions, across time or between different regimes of land management would be unlikely to detect any significant differences through a lack of statistical power. A further five species of granivorous passerine (Brambling, *Fringilla montifringilla* European Greenfinch *Carduelis chloris*, European Goldfinch *Carduelis carduelis*, House Sparrow *Passer domesticus* and Reed Bunting *Emberiza schoeniclus*), although caught and ringed, some in reasonable numbers, produced no within-season movements within either study area.

The radio-tracking produced much more satisfactory detailed information on the ranging behaviour of those individuals that were tagged. In late winter (January–February) 2002/03, 10 Yellowhammers, 10 Chaffinches and 8 Tree Sparrows were radio tagged in the West Fife study area. In 2003/04, 8 each of Yellowhammer and Chaffinch were tagged and monitored in the early winter (November-December) and a further 8 of each species in late winter. Restricted detection ranges of the attached radios (frequently less than 300 m) and a short active life span of the small radios attached (usually less than 4 weeks) meant that individuals could not reliably be detected at will. To overcome this, a systematic search was adopted whereby scans for all birds carrying tags were made at each of 59 points throughout the study area. This meant that the number of independent fixes that could be obtained per individual was limited and that 'traditional' analyses of the data (e.g. measurements of home ranges or 'kernels' thereof) were not practical. Alternative analytical approaches were used that considered the distances between systematically determined locations for radio-tagged individuals. Including data from both study seasons for three radio-tagged species, Tree Sparrows tended to range the greatest distances, Yellowhammers were intermediate and Chaffinches ranged the least distance, though the difference between that two was small and not statistically significant (Figure 2)

As well as providing information on ranging behaviour, radio-tracking also provided an opportunity to look at habitat use by the birds and also to find where they were roosting. The importance of small patches of scrub and some stubbles to Yellowhammers and Chaffinches was also supported from field surveys. Tree Sparrows appeared to have the finest habitat requirements of the three main study species, with the most marked preferences for stubbles. Chaffinches were the most generalist in terms of their use of the range of habitats available, including woodland and human sites. All roost sites of radio-tagged birds were found to be within the individual's normal diurnal 'home range'.

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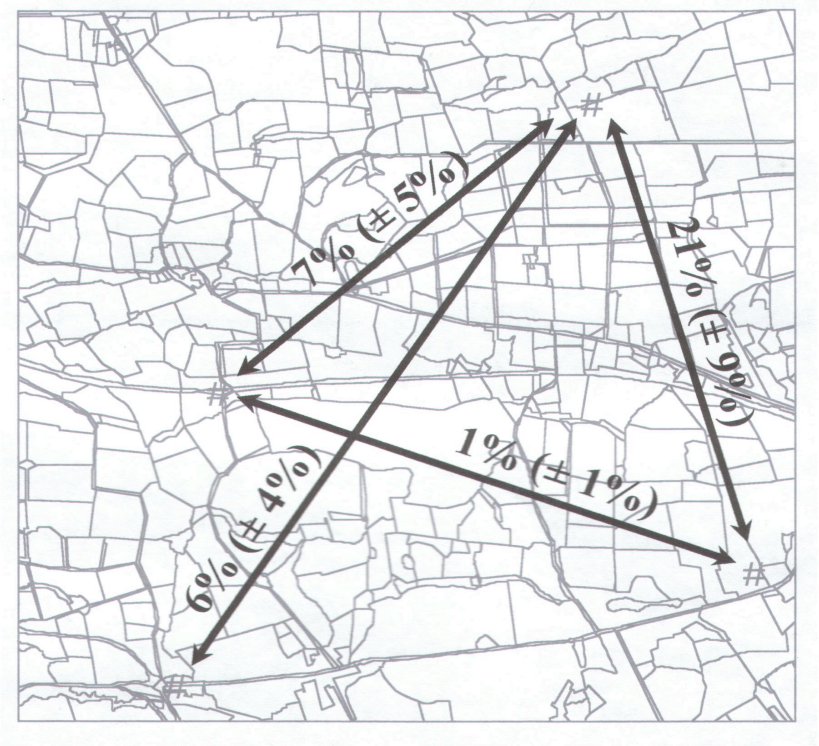

Figure 1 The likelihood of movements of Yellowhamers between ringing sites in West Fife based on mark-recapture ringing during winter 2003/04. The map shows an area 5 km by 5 km.

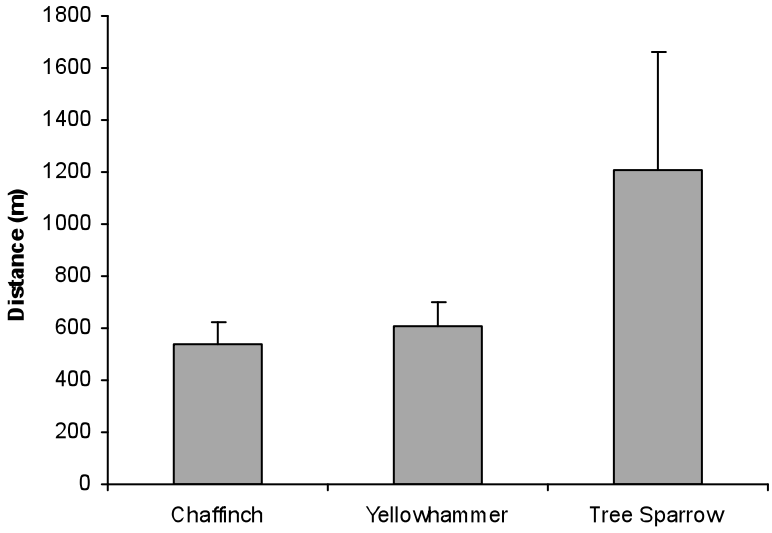

Figure 2 The mean distance (+ 1 SE) between subsequent systematic fixes of radio-tagged granivorous passerines in West Fife during late winter in 2002/03 and 2003/04.