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BLACKBIRD AND STARLING ROOSTING DYNAMICS: MPLICATIONS FOR ANIMAL DAMAGE CONTROL

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Each winter an estimated 350 million starlings, red-winged blackbirds *(Agelaius phoeniceus),* common grackles *(Quiscalus quiscula),* and brown-headed cowbirds *(Molothrus ater)* congregate in roosts in the southeastern United States (Meanley 1971, Meanley and Royall 1976). These birds have been of increasing concern because of agricultural damage claims (Stickley et al. 1976, Dolbeer et al. 1978), reputed health hazards (Monroe and Cronholm 1977), and other nuisance problems associated with them.

Historical population trends (Dolbeer and Stehn 1979) and the source of winter-roosting blackbirds (Meanley 1971, Meanley and Dolbeer 1978, and Dolbeer 1978) have been summarized, but little information on the number of consecutive nights a bird returns to the same roost (roost fidelity) or the dynamics of a winter roost is available. The purpose of this paper is to present information on roost fidelity and population dynamics needed to better understand and manage winter blackbird and starling roosts.

STUDY AREA AND METHODS

The study area was centered 5 km east of Milan, Tennessee, at the Milan Army Ammunition Plant. This has been the area of a major blackbird and starling roost since at least 1965. The circular study area, with a radius of 32 km, was located almost entirely within the Obion-Forked Deer River Basin of west Tennessee, an important agricultural area. Soybeans, corn, cotton, hogs, and cattle are the most important products (Hobson 1978). The topography of the eastern half of the study area was abruptly hilly and sloped gradually westward to undulating regions coursed by wide floodplains of four major streams.

Population estimates were made by block-counting (Meanley 1965 and Outright 1973) all major flightlines as birds left the roost in the morning. Counts were usually made weekly during 1975-76 and every 2-3 days in the next two winters.

Birds fitted with radio transmitters were followed during December 1976 and February-March 1977 and 1978. We monitored 5, 5, and 4 birds (9 common grackles, 4 red-winged blackbirds, and 1 starling), respectively, during these periods. Eleven birds, tagged by personnel of the Denver Wildlife Research Center, arrived in the Milan area during February and March 1977 and were tracked. To reach Milan these birds travelled 300 and 35 km after roost dispersal experiments at Shelbyville and Jackson, Tennessee, respectively.

The density of birds across the study area was measured by surveying birds along six, 32-km routes that radiated from the roost area to the boundary of the study area. Birds were counted while we drove along the routes and during 3-min stops at each 1.6-km interval along the routes. Each route was started 60 min after sunrise and was completed in 150 min. Routes were surveyed weekly. Additionally, we surveyed birds along a feedlot survey route located 20-40 km northwest of the roost in an area heavily used by birds. Birds were counted as we drove the route and during two 10-min stops at 21 cattle and hog feedlots. This route was started about 2 h after sunrise.

RESULTS

The three winters of 1975-76, 1976-77, and 1977-78 were distinctly different in terms of weather and blackbird population trends. Bird numbers in 1975-76 (Fig. 1) increased steadily to over 10 million birds in late February. A regression model with only time and time squared terms was significant ($F = 35.04; P < 0.0001$) in explaining 76%

of the variation.

In 1976-77 populations exceeded 2 million birds only briefly (Fig. 2). That winter, one of the coldest on record for the region, had mean monthly temperatures as much as 9°C below normal and 22 days of snowcover greater than 2.5 cm. The roost was sprayed with a surfactant, PA-14, on 14 January which resulted in a kill of 1.1 million birds or about 92-96% of the resident population at the time of the spray.

A population fluctuation similar to that of 1976-77 also occurred in 1977-78 (Fig 3). This winter was also marked by below average temperatures and a record 42 days of snowcover. A regression model containing terms of time squared, minimum temperature between population estimates, change in average temperature between estimates, and snowcover was significant ($F = 36.26; P < 0.0001$) in explaining 72% of the variation observed.

Population fluctuations in excess of 1 million birds and near 50% of the roosting population were sometimes noted between daily roost counts (Fig. 4). Spearman's Rank Correlation Coefficients for population changes during the periods from 25 December to 1 March showed no significant relationship to average temperature, minimum temperature, change in average temperature, or change in minimum temperature between estimates. These population changes were not correlated with snowcover. We did find significant ($P < 0.002$) positive correlations between the change in the average weekly population estimates and the average weekly temperature ($r = 0.80$), the minimum weekly temperature ($r = 0.76$), the change in average weekly temperature ($r = 0.75$), and the change in minimum weekly temperature ($r = 0.65$). A significant negative correlation between snowcover and weekly population changes ($P \leq 0.0008; r = -0.79$) also was found for the two severe winters. No similar correlations were noted for the mild winter of 1975-76, and population data for the three weeks immediately following the PA-14 treatment were not included in the above analysis.

Analysis of population trends before and after the PA-14 treatment required a different assessment technique. The mean number of birds seen per census route before the treatment ($\bar{X} = 3,484$; SE = 770) did not decline significantly ($P = 0.23$) when compared to the mean number of birds per route after the spray ($\bar{X} = 2,549$; SE = 266) (Fig. 5). There was, however, a significant drop in the mean number seen one week after the spray versus one week prior to the spray ($P = 0.021$). The establishment of five satellite roosts after the treatment, and the associated foraging patterns, invalidated pre- and post-treatment analysis of individual survey routes except for the feedlot survey route which was located well away (12-20 km) from all satellite roosts. Here a visible reduction in bird numbers was apparent for at least nine but not more than 15 days (Fig. 6).

Data from radio-equipped birds yielded information on the patterns of roost fidelity and gave substantial insight into population fluctuations related to temperature and the PA-14 treatment. Birds tagged at the Milan roost stayed an average of 3.5 nights (SE = 0.8) at each roost utilized. This was an average of 17 roosting periods for 14 birds. Five birds tracked in December roosted at one site an average of 4.0 nights (range 1-7), as compared to an average of 3.3 nights (range 1-18) for nine birds tracked in February and March. The number of consecutive nights birds returned to the same roost did not differ significantly when compared in a Wilcoxon Rank Sum test ($P = 0.18$).

For 11 birds tagged elsewhere that moved into the study area, 16 roosting periods averaged 4.4 nights (range 1-11). These birds should not have associated their tagging experience with the Milan area, but they were no less mobile than locally tagged birds. A Wilcoxon Rank Sum test showed no significant difference ($P = 0.18$) in the period of roost fidelity regardless of whether the bird was tagged in or outside the study area.

DISCUSSION

Two distinct blackbird and starling population patterns appeared to be associated with mild and severe winters. The mild winter of 1975-76 gave us the impression of a very stable situation, because population trends were generally consistent and lacked wide count-to-count variation (Fig. 1). Similar patterns were suggested by Meanley (1965,1971) and Crebbs (1960). Cutright (1973) presented similar trends for fall roosts, and Martin (1977) presented reasonably smooth trends for summer roosts. The adequacy of a regression model with only time and time squared terms and a failure to show correlations between population changes and temperature reinforced the feeling that roosting birds stayed in one area for the majority of the winter. Still, the critical and confirming evidence of roost fidelity in mild winters is lacking.

The rapid fluctuations of roosting populations during the winters of 1976-77 and

1977-78 (Figs. 2-4) did not imply the stable conditions evidenced in 1975-76; however, these rapid fluctuations may have been anomalies related to the estimation procedures and not to actual population changes. The correlation of weekly population changes to weather factors and the significance of the regression models in explaining the population variation suggest that much of the variation is indeed real and not linked by estimation error. Our failure to relate daily population changes to weather factors suggests that this variation may have been inherent to estimation process, but it cannot be taken as proof of this phenomenon. The importance of daily fluctuations in measuring population changes remains a judgement decision. Because the relative magnitude of the changes in estimated populations was up to 50%, the regression models explained most of the variation on a weekly basis ($\geq$70%), and because similar fluctuations were not found in the mild 1975-76 winter, we feel the population changes are significant in understanding the degree of dynamic flux occurring in winter roosts.

Our analysis showed that roost site fidelity for radio-equipped birds was not more than 4.4 consecutive nights. This translates to an average daily turnover of at least 23%, although these changes are probably irregularly triggered by weather factors. With such a high turnover rate, rapid daily population fluctuations (Fig. 4) of 50% of the resident population are not improbable.

The extreme fluctuations recorded in the roosting populations, their correlation to weather changes, and the brief duration of roost fidelity should not be totally unexpected, because several researchers have reported roost interchanges (e.g., Fankhauser 1966, Meanley 1971, Johnson 1979, Arnold and Coon unpubl., and Matteson and Meanley, unpubl. Bird Damage Report P-F-34.6, Denver Wildlife Research Center 1976). More specifically, Besser and Bray (unpubl. Bird Damage Report No. 45, Denver Wildlife Research Center 1977) found that after the onset of severe weather in Laurel County, Kentucky, 67% of radio-equipped starlings left the general area completely, while the remaining birds selected new roosting sites in barns.

The ephemeral off-site effects of the PA-14 treatment in 1977 were not surprising and indeed support the hypothesis that winter roosting populations turn over rapidly. Lethal control methods have proven effective in reducing roost site populations (Lefebvre and Seubert 1970, Monroe and Cronholm 1977). However, as this study revealed, lethal control methods may not be effective in reducing populations within a 40-km radius of the roost site because of the high degree of turnover in the roosting population.

It is generally assumed that roost elimination is effective in reducing agricultural damage claims (Russell 1975, Anonymous 1976), but no data supporting this assumption are available. If such rapid turnovers are common in winter roosting populations, then the reduction of roosting populations as a method to relieve man-bird conflicts away from the roost site may need to be reassessed.

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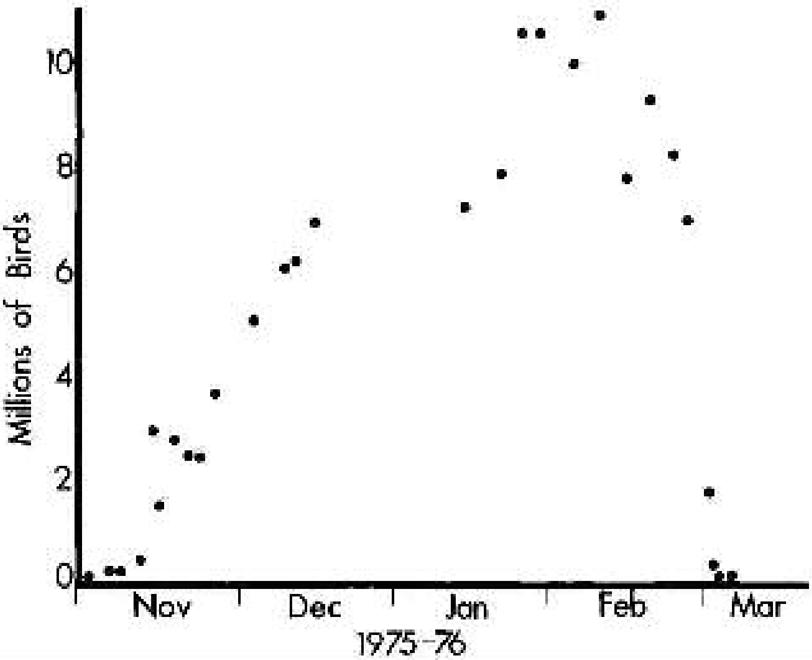

FIGURE 1. Estimated numbers of blackbirds and starlings roosting near Milan, Tennessee, in 1975-76.

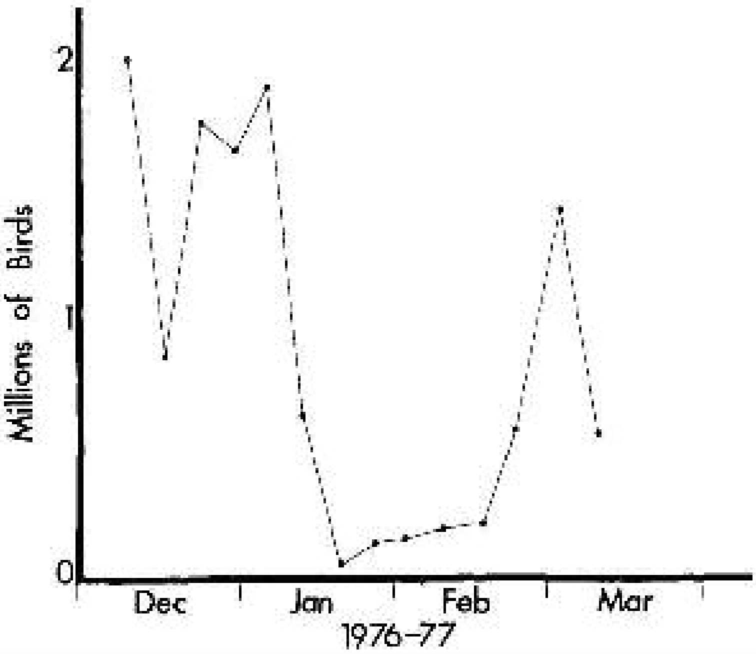

FIGURE 2. Average weekly estimated numbers of blackbirds and starlings roosting near Milan, Tennessee, In 1976-77.

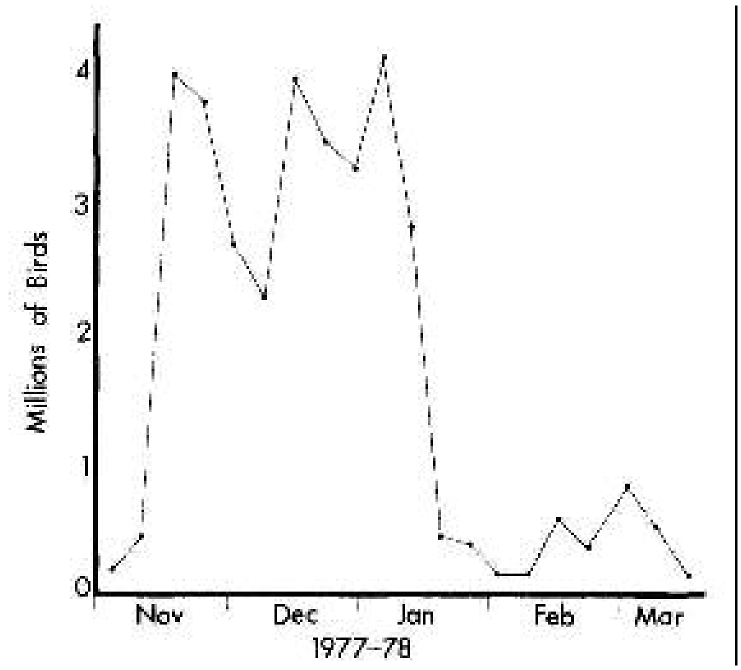

FIGURE 3. **Average weekly estimated numbers of blackbirds and starlings roosting near Milan, Tennessee, in 1977-78.**

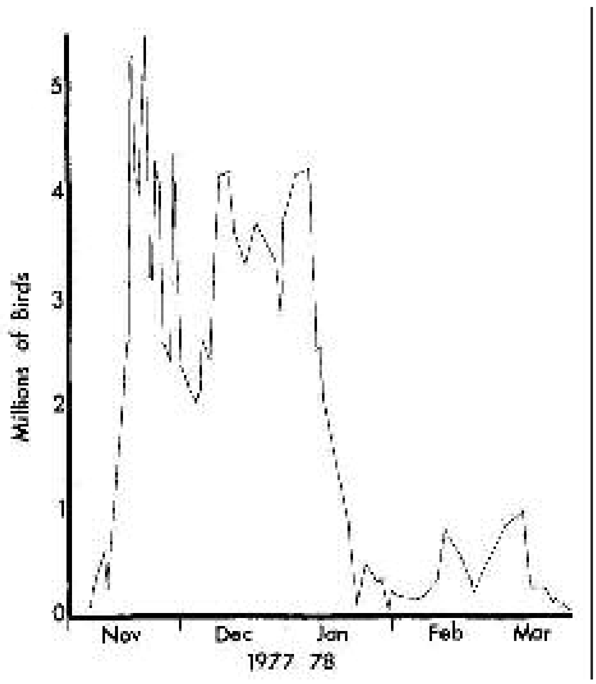

FIGURE 4. **Estimated numbers of blackbirds and starlings roosting near Milan, Tennessee, in 1977-78**

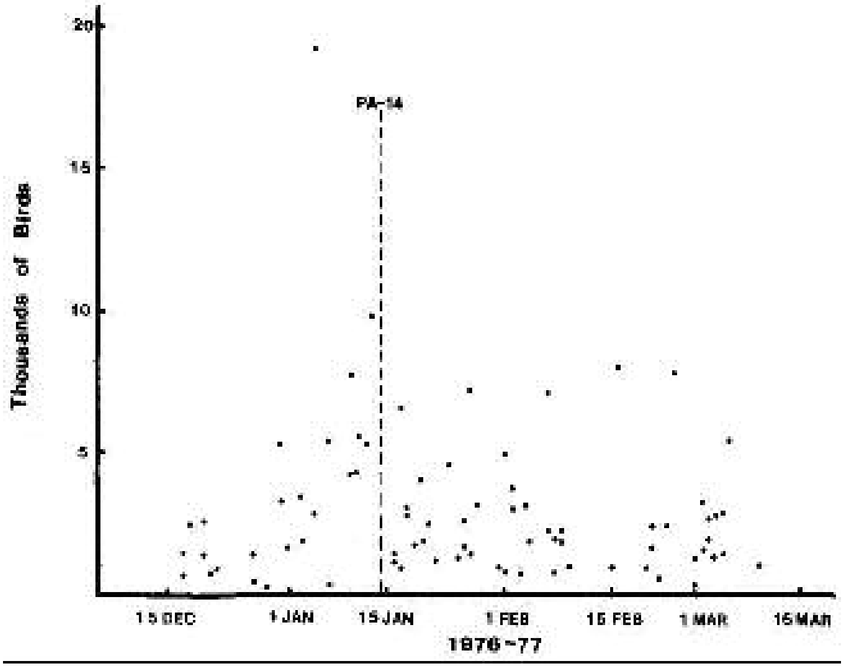

FIGURE 5. Total numbers of blackbirds and starlings counted along each of 6 bird-route-surveys which radiated from the Milan, Tennessee, blackbird roost In 1976-77. The dotted line Indicates the date of the PA-14 treatment.

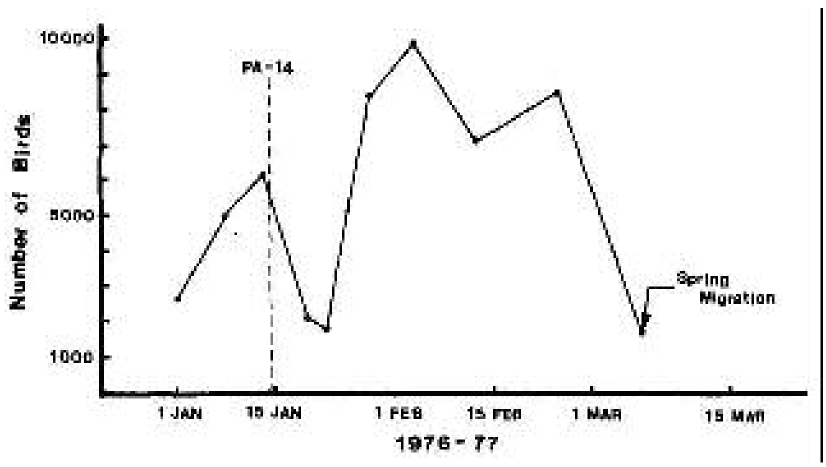

FIGURE 6. Total number of blackbirds and starlings counted In the winter of 1976-77 while monitoring bird densities In the area of 21 cattle and hog feedlots located 20-40 km from Milan, Tennessee. The dotted line Indicates the date of the PA-14 treatment.