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IMPROVING BLACKBIRD POPULATION CONTROL WITH TARGETED BAITING PROGRAMS: BIOLOGICAL CONSIDERATIONS

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Introduction

Mixed-species flocks of blackbirds, often dominated by red-winged blackbirds (*Agelaius phoeniceus*), are well known for their ability to damage crops such as sunflower. In an effort to reduce damage, managers have been working to reduce blackbird populations by applying an avicide to feeding areas around spring blackbird roosts. Currently, bait is applied near active roosts for consumption by any member of a target species. By focusing on certain segments of target populations, managers may be able to improve the efficacy of baiting programs. This would allow managers to increase total effect of population reduction without increasing the number of birds culled. Logistical constraints may limit opportunities for targeted baiting in some years.

Redwings breeding in the northern Great Plains (NGP) winter primarily in the southern United States. As spring arrives, the NGP population of redwings migrates north, congregating in large vegetation-choked wetlands along the way. The population is lowest during this time of the year, prior to reproduction. From mid-May through June, the population almost doubles due to reproduction. Redwings spend the rest of the summer in the NGP, preparing for fall migration to wintering areas. Prior to and during fall migration, redwings can be responsible for substantial damage to crops such as sunflower. Due to a natural annual mortality rate close to 50%, the population will decrease in size until the next year's reproduction. A spring baiting program enjoys the advantage of a natural low in population size, increasing the potential magnitude of any effect, and reducing the potential for compensatory mortality to reduce efficacy.

Redwings are a polygynous species, meaning that males commonly breed with more than one female. The sex ratio in the overall population is approximately 50:50, resulting in a population of "floater" males that do not breed. The floater population consists of second year (SY) males, with a distinctive female-like plumage, and after second year males (ASY), with the traditional jet-black plumage and red epaulets. Researchers suspect that one male is functionally equivalent to another with regard to reproduction. As a result, a baiting program that targets males will reduce the population by the number culled, but will probably not yield an additional benefit due to decreased reproduction.

In contrast to the males, almost all female redwings breed. Culling a female redwing will result in the removal of the female, plus the removal of her potential offspring. In general, SY females begin breeding later, and produce fewer offspring, than ASY females. Therefore, the bonus due to decreased reproductive output will be higher for ASY female than for SY females.

A targeted spring baiting program is possible because of the asynchronous migration schedules for different age and sex classes of red-winged blackbirds. Breeding ASY males face strong competition for territories. As a result, breeding males migrate first and soon disperse to establish territories. SY males arrive later than ASY males, and are slower to disperse. Females generally arrive later than ASY males, and disperse slowly from spring roosts (Greenwood and Weatherhead 1982). A spring baiting strategy that targets females would begin later, and last longer, than a strategy that targets ASY males.

Methods

In order to simulate the effects of targeted baiting, we created a hypothetical population of blackbirds and used Leslie matrices to project the potential effects of different baiting programs (Figure 1). The model constructed was a deterministic, stage structured, birth-pulse model (census occurs just prior to reproduction and baiting occurrs just prior to census). Therefore, the model will project the population on June 1 of each year (post-harvest, pre-reproduction). The stage structure of the model includes entries for SY males, ASY males, SY females, and ASY females. Reproduction is assumed to depend only on the number of females (as redwings are a polgynous species), all females breed, and survival within a stage is assumed to be constant throughout the year. In practice, ASY females can be difficult to separate from SY females during a baiting program. Therefore, similar reproductive rates were chosen for ASY females and SY females in this model.

The initial population of the hypothetical population was set at 27 million birds, equally divided into the four age/sex classes. The reproductive rate and survival rates (Figure 1) used were chosen because they are near the center of the range of rates reported in the literature (Dyer et al. 1977, Fankhauser 1967, Searcy and Yasukawa 1981). In order to assess the selected population parameters, the first model considered demonstrated density independent population growth and no annual harvest (e.g. no baiting program). Second, we considered a model with an annual harvest of 2 million birds, equally distributed between the four age/sex classes (e.g. a non-targeted baiting program). The final simulation considered a targeted baiting program, with a harvest of 1.5 million females (0.75 million ASY, 0.75 million SY) and 0.5 million males (0.25 million ASY, 0.25 million SY). Populations were projected for 5 years, and the annual population growth rate (R) for each model was noted.

Results

Under the first model, simulating no baiting program, the hypothetical population of blackbirds increased slightly (R = 1.03), indicating that the selected survival and reproduction rates are reasonable. At the end of five years, the population had grown from 27 million to 30.4 million birds. Based on the second model (non-targeted baiting program), the population moved from growth to decline, and exhibited an annual population growth rate (R) of 0.944 in the fifth year. After five years, the population subjected to the non-targeted baiting program had declined to 22 million blackbirds. Under the targeted baiting regime, the population decline was more pronounced (R = 0.899) in the fifth year. At the end of five years, the population had declined from 27 million to 19.8 million blackbirds. The projections indicate that a targeted baiting program can increase the efficacy of a population reduction program without increasing the total number of birds removed by baiting.

Conclusions

If a spring baiting program is considered as a viable management option, a targeted program has the potential to improve the overall efficacy of the operation. Removing females should result in a greater population decrease than would be observed by removing a similar number of males. Logistical difficulties, particularly regarding spring weather, may complicate targeted baiting in some years. Culling any number of birds, even males, will reduce the spring population by at least the number removed.

All of these models assume density independent population growth, a simplification that could cause projected results to differ from results observed in the field. Complicating factors, including density dependent reproduction and compensatory mortality, are difficult to project but may reduce the between-year effects of any baiting program. The third model (targeted baiting) imposes an artificially skewed sex ratio, which may not be maintained in the field. Still, these simulations quantitatively demonstrate the potential of targeted baiting programs to improve the efficacy of population management programs.

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Figure 1. Leslie matrix used to describe the hypothetical population of red-winged blackbirds.

$$\begin{bmatrix} N_{SM,t+1} \\ N_{AM,t+1} \\ N_{SF,t+1} \\ N_{AF,t+1} \end{bmatrix} = \begin{bmatrix} 0 & 0 & f_{SF}(1-sr)S_{SM} & f_{AF}(1-sr)S_{SM} \\ S_{AM} & S_{AM} & 0 & 0 \\ 0 & 0 & f_{SF}(sr)S_{SF} & f_{AF}(sr)S_{SF} \\ 0 & 0 & S_{AF} & S_{AF} \end{bmatrix} x \begin{bmatrix} N_{SM,t} \\ N_{AM,t} \\ N_{SF,t} \\ N_{AF,t} \end{bmatrix} - \begin{bmatrix} H_{SM} \\ H_{AM} \\ H_{SF} \\ H_{AF} \end{bmatrix}$$

where:

S_{AM} = Annual Survival of ASY Males (0.55)
S_{SM} = Annual Survival of SY Males (0.45)
S_{AF} = Annual Survival of ASY Females (0.55)
S_{SF} = Annual Survival of SY Females (0.45)

f_{SF} = number of chicks per SY Female / year (2.1335)
f_{AF} = number of chicks per ASY Female / year (2.1335)
sr = proportion of females produced by reproduction (0.5)
1-sr = proportion of males produced by reproduction (0.5)

$N_{SM,t}$ = Number of SY Males in year t (similar for N_{AM},N_{SF},N_{AF})
$N_{SM,t+1}$ = Number of SY Males in year t+1 (similar for N_{AM},N_{SF},N_{AF})
H_{SM} = Number of SY Males harvested (similar for H_{AM}, H_{SF}, H_{AF})

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The 2001 Sunflower Research Workshop, sponsored by the National Sunflower Association, took place on January 17 and 18, 2002, at the Ramada Plaza Suites, Fargo, ND. The workshop was very well attended and received by public and private researchers from the United States and Canada, as well as other interested parties.

This volume contains nearly all the presentations given at the 2001 workshop. Some of the papers are summarized or abstract form.

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Questions regarding these proceedings may be directed to the National Sunflower Association, 4023 State Street, Bismarck, ND 58503.

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