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Randal S. Stahl
USDA-APHIS-Wildlife Services, randal.s.stahl@aphis.usda.gov

John J. Johnston
USDA-APHIS-Wildlife Services

George M. Linz
USDA/APHIS/WS National Wildlife Research Center, george.m.linz@aphis.usda.gov

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National Sunflower Association
4023 State Street
Bismarck, ND 58503-0690

(701) 328-5100
fax (701) 328-5101
(888) 718-7033

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Randal S. Stahl[1], John J. Johnston[1], and George M. Linz[2]
1. USDA/APHIS/WS/NWRC, Fort Collins, CO 80521
2. USDA/APHIS/WS/NWRC, Bismarck, ND 58501

Abstract

DRC-1339 is a pesticide used to induce mortality in pest birds and is being used successfully to reduce bird damage to a variety of agricultural products. The feasibility of using live decoy traps baited with DRC-1339-treated rice baits is being evaluated for reducing blackbird damage to sunflower in North Dakota. To estimate the take associated with the use of the DRC-1339-treated rice baits, we developed a bioenergetics simulation to estimate bait consumption by red-winged blackbirds, yellow-headed blackbirds and common grackles. This simulation incorporates a module to estimate mortality based on the amount of treated bait eaten by individual birds and the species-specific dose response to DRC-1339. Simulation results for mixed gender populations of varying species composition are presented.

Introduction

Our bioenergetics simulation we have developed is based on the approach of Campbell (1977) and estimates the caloric requirement a bird needs to maintain its core body temperature based on a net energy flux with its surrounding physical environment. The current model allows the user to estimate the baiting efficacy of a 2% DRC-1339 treated rice bait applied in a 1 to 25 dilution with untreated rice bait for the control of red-winged black birds (RWBL), yellow headed black birds(YHBL) and common grackles (COGR)using a live decoy trap.

Methods

The simulation we are presenting uses the biometric data for the three species as presented in Table 1. The model estimates mortality based on consumption for a randomly generated bird of one of the three species with a randomly estimated body mass and gender. We used the population distributions were for observations made in North Dakota for the years 2001 and 2002 in Safratowich et al. (2004). For 2001 the population was fixed at 15% COGR, 60% RWBL, and 25% YHBL. For 2002 the population was fixed at 18% COGR, 61 % RWBL and 21% YHBL. For both years the gender distribution was set at 50/50 for all species. Estimates for mortality were made for the months of July, August, September and August.

Table 1. Biometric data for the bird species included in the simulation.

Species	Gender	Mass (g)[1]	Core Body Temperature (^{o}C)[2]	LD_{50} (mg/kg)[3]
Red-winged blackbird	M	65.5 $\pm$ 7.4	42.3	6.03
	F	42.5 $\pm$ 4.8		
Yellow headed blackbird	M	94.4 $\pm$ 5.7	42.4	6.03
	F	52.9 $\pm$ 3.9		
Common Grackle	M	122.5 $\pm$ 8.6	43.1	1.00
	F	96.3 $\pm$ 7.0		

1. Vales are means $\pm$ 1 standard deviation from Linz et al. (1995)

2. Values from Wetmore (1921).

3. Values from Eisemann et al. (2005)

Table 2. Minimum and maximum daily air temperature by month.

Month	Minimum temperature (^{o}C)	Maximum temperature (^{o}C)
July	15.0	28.0
August	14.1	27.4
September	8.3	21.4
October	1.8	14.0

Data are for Fargo, ND (source: www.hprcc1.unl.edu).

The model simulation requires the entry of climatic data for the day of the baiting. For all the simulations the inputs were a sunny, cloudless day with no wind. The maximum and minimum daily air temperatures for the four months used in the simulation are presented in Table 2.

All simulations were based on the application of 0.48 kg of 2% DRC-1339 treated rice mixed with 11.4 kg of untreated rice bait. For the simulation it was assumed that 2.3 kg of total bait was not consumed.

Mortality estimates in the simulation use a probabilistic approach to convert the population dose response curve based on the LD50 to a probability of mortality for an individual bird (Johnston et al., 2005).

Results

The simulation estimates for mortality as a result of consuming a lethal dose of DRC-1339 broken down by gender and species are presented by month in Figure 1 for the year 2001 population distribution and in Figure 2 for the 2002 population distribution.

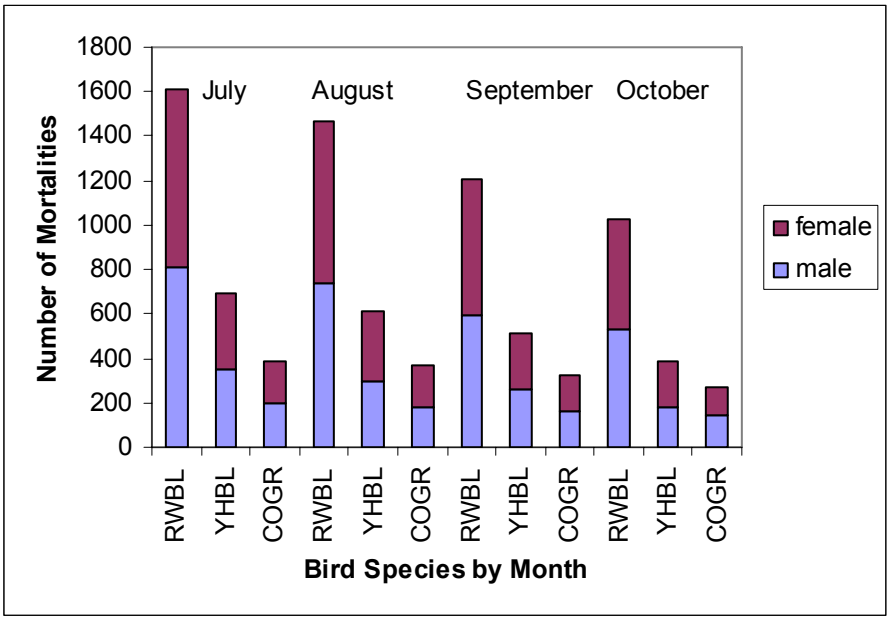

Figure 1. Simulation mortality estimates for red-winged blackbirds (RWBL), yellow headed blackbirds (YHBL) and common grackles (COGR) based on the observed population distribution for the year 2001 by month.

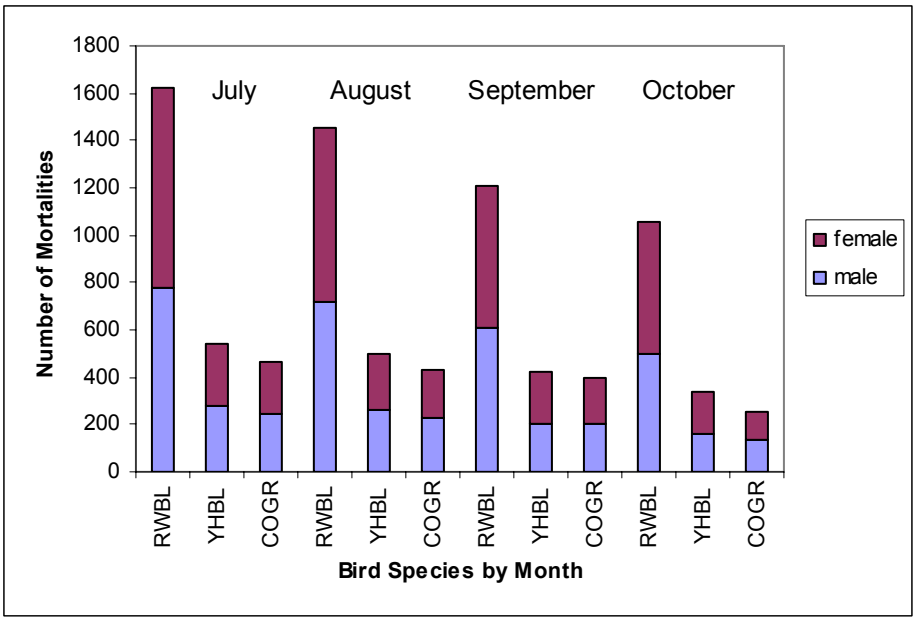

Figure 2. Simulation mortality estimates for red-winged blackbirds (RWBL), yellow headed blackbirds (YHBL) and common grackles (COGR) based on the observed population distribution for the year 2002 by month.

The most notable trend for the two years is that for colder months there are fewer bird mortalities associated with the consumption of a fixed amount of bait. This is due to the increased amount of bait a bird must eat to maintain its core body temperature as the air temperature and other environmental energy inputs decrease in the fall months.

Conclusions

Our simulation provides an estimate of the baiting efficacy of using DRC-1339 rice baits in conjunction with live decoy traps to minimize bird damage to ripening sunflower. Use of the simulation should facilitate the development of using live decoy traps as a management tool.

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