Maternal Yolk Steroids: A Potential Compensatory Mechanism for Red-winged Blackbirds *(Agelaius phoeniceus)* In North Dakota

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Introduction

Many of the suggested management techniques directed at reducing blackbird breeding populations fail to incorporate the underlying mechanisms regulating populations. Theoretically, removal of individuals from the breeding population should lower the breeding densities and presumably reduce recruitment. However, compensatory responses might occur with decreased breeding densities, but no empirical data are available to test this hypothesis. Much of the underlying compensatory theory is based on differential allocation of resources to reproduction vs. self maintenance at different breeding densities, mainly in the form of depensatory effects of resource limitation on growth and survival. However, as the breeding density in an area changes, social interactions among individuals also change (Whittingham and Schwabl 2002; Pilz and Smith 2004). Recent research has shown maternally derived steroid hormones present in eggs offer a potential compensatory mechanism by which adult social interactions affect offspring growth and survival (Schwabl 1996a; Schwabl 1996b). Gaining insight into the underlying mechanisms regulating red-winged blackbird populations will allow for more effective and efficient management techniques. This study focuses on the effects of density and social interactions on nesting female red-winged blackbirds and the effects of maternally derived yolk steroids on offspring survival.

Methods

Our study site is located within the Prairie Pothole Region of Stutsman County, North Dakota. We conducted nest searches beginning 1 May 2004 through 30 June 2004. In order to experimentally test the effects of increased density on nesting females, we randomly assigned nests to one of the following 3 groups: (1) Treatment females, which were exposed to a simulated increase in density by presenting a caged conspecific; (2) Control females, which were exposed to an empty cage; and (3) Super Control females, which received no presentations. Presentations were conducted 4 times per day, for a length of 30 minutes per presentation. During presentations, behavioral observations were taken of the focal female to assess overall aggressive behavior. Behavioral observations were not conducted on Super Control groups. Presentations were conducted until the number 2 egg was laid, in order to ensure

the effects of simulated increases in density affected yolk steroid allocation. We collected the number 2 egg to analyze for maternal yolk steroid concentrations by radioimmunoassay. Once presentations were concluded, monitoring of nests continued to obtain an overall record of reproductive performance (i.e., final clutch size, number hatched, number fledged). Prior to offspring fledging, each nestling was individually marked with aluminum USFWS bands and 3 color bands. Adult females were captured prior to offspring fledging and fitted with radio-transmitters. Females were then monitored in order to obtain date of independence of offspring, as well as mark-recapture estimates of fledgling survival.

Results

Within our study site several blackbird species were found nesting, including red-winged blackbirds, yellow-headed blackbirds, and common grackles. Marsh wrens also nested on the study site. We located and monitored 106 red-winged blackbird nests. Only 64 of these 106 nests remained active at the time the second egg was collected. Clutch size of nest with 4 egg days (1 egg in the nest for one day = 1 egg day) or greater was 3.4 ± 0.89. Mean egg mass was 4.7g ± 0.41. The mean mass of yolk present in the eggs was 0.8g ± 0.10. No differences were found in percentage of yolk allocated to eggs among groups (Figure 1). Nest success was low overall (18.1%), with the main causes of nest failure being predation and brown-headed cowbird (BHCO) parasitism. Cowbird parasitism was similar between treatments. We found no differences in daily nest survival among groups using Mayfield (1975). We are currently analyzing maternally allocated yolk steroids from the eggs to examine relationships among treatment, aggressiveness, yolk steroid levels, and reproductive success. However, behavioral data on females has been analyzed. Treatment females (i.e., those exposed to a high density environment) spent significantly more time in aggressive interactions than did control females (i.e., those exposed to no increase in nesting density) (Figure 2). Low nest success (~18%) precluded our ability to assess fledgling survival.

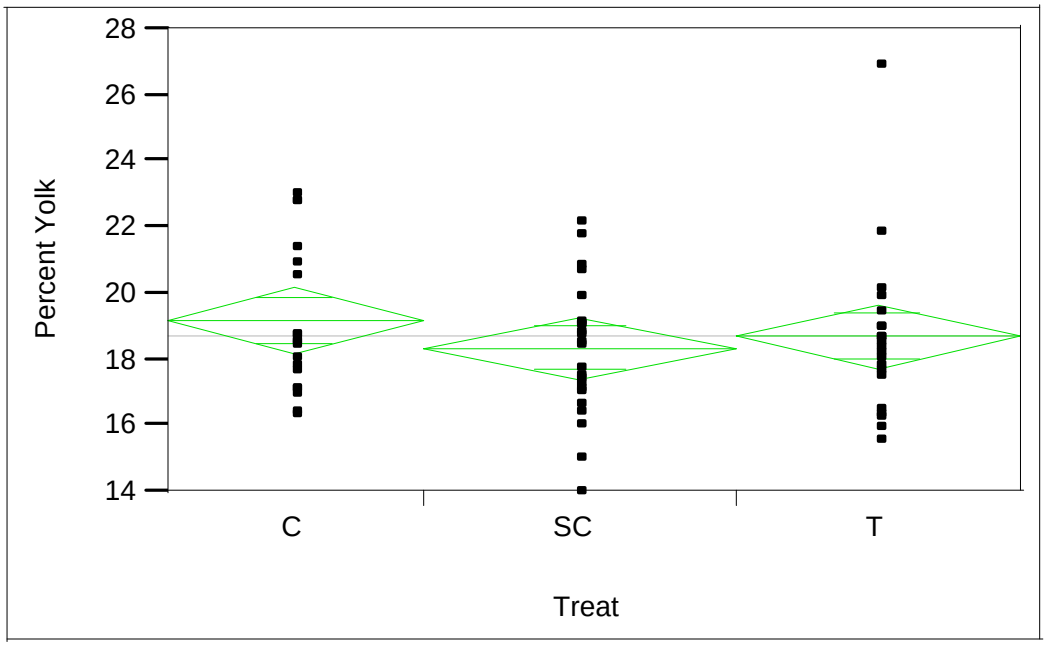

Figure 1. Comparison of percent yolk by mass among control (C), super controls (SC), and treated (T) groups.

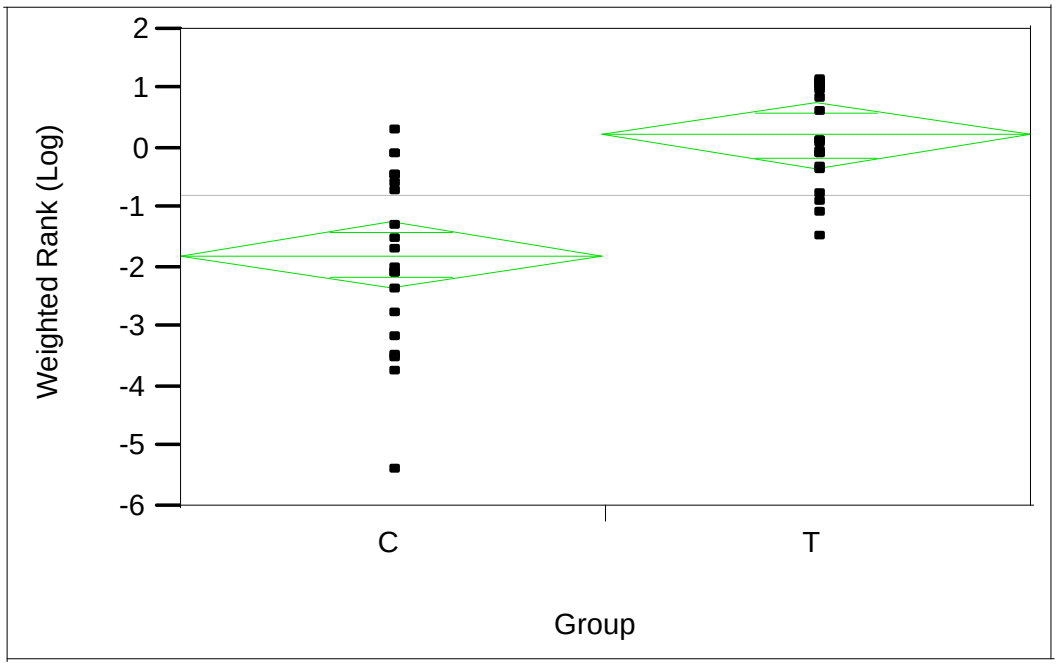

Figure 2. Comparison of female aggressive ranks between control (C) and treated (T) females.

Conclusions

Currently, we are unable to assess the compensatory responses of red-winged blackbirds in periods of high density due to low nest success and incomplete data. However, once yolk steroid analyses are complete, we are confident the results will show yolk steroids have positive relationships with female aggressiveness and that females exposed to high densities will allocate higher concentrations of yolk steroids to their eggs. High concentrations of yolk steroids have beneficial effects in many species, including red-winged blackbirds (Lipar 2001; Lipar and Ketterson 2000), and may offset the negative effects of high nesting density.

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