A Comparative Study on the Physiology of Captive and Wild-Caught Blackbirds

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Introduction

- The red-winged blackbird is a significant pest species on grain crops[1].
- Critical to resolving this human-wildlife conflict is a full understanding of the birds' biology and ecology.
- Much of the current research on blackbirds involve initial behavioral and physiological studies on captive birds in laboratory settings[2], and extrapolation to free-living populations.
- However, captive individuals undergo different stressors than natural populations and have different physiological coping mechanisms[3].
- An important aspect of stress response is the release of the stress hormone, corticosterone (CORT) by the hypothalamus-pituitary-adrenal axis and its action as a negative feedback (Figure 1).
- Individuals under continuous stress, such as wild individuals in captivity, may have a modified stress response, and extrapolating results from captive studies to those in free-living conditions should be done with caution. Furthermore, different species respond differently to captivity. Thus, results from one species may not be applicable to another species.
- The only previous stress physiology study on red-winged blackbirds showed that plasma CORT peaks for males at the start of nest-building[8].
- The current study compares the physiological response of male wild-captive and free-living red-winged blackbirds to an acute stressor during the breeding season in North Dakota. In addition to this study being the first comparative study on red-winged blackbirds, it is the first study to examine the full stress profile in this species.

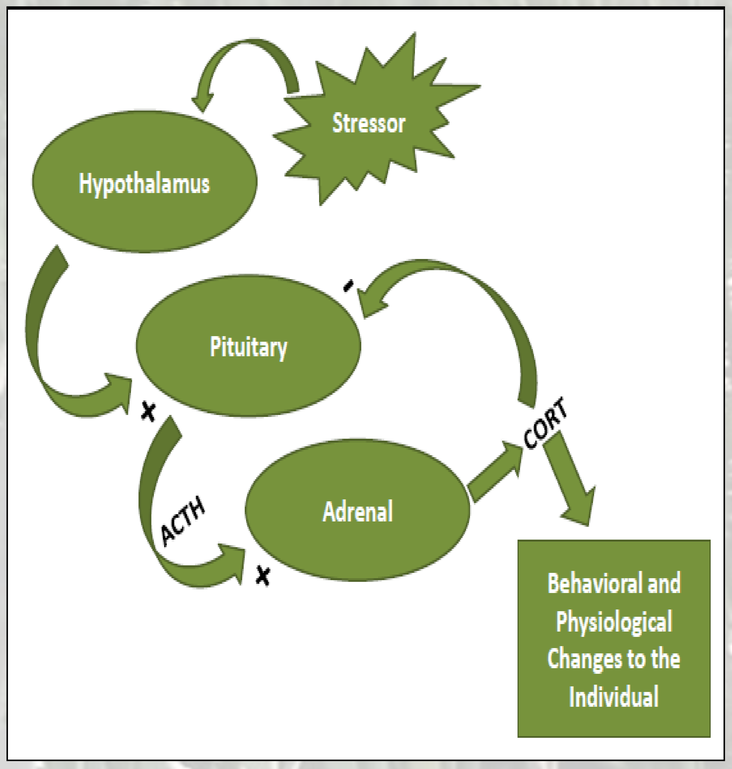


Figure 1: The Hypothalamus-Pituitary-Adrenal (HPA) axis. When exposed to an acute stressor, the HPA is triggered causing a cascade of physiological events, leading to the release of CORT. The HPA is important for maintaining or restoring homeostasis, and helping animals survive stressful episodes by increasing energy through facilitation of metabolic changes that activate glucose stores and inhibit additional glucose storage, as well as behavioral changes that promote escape[4,5]. However, maintaining high levels of glucocorticoids during times of chronic stress has been linked with many physiological consequences that endanger fitness, including hyperglycemia, neuronal cell death, and suppression of the immune and reproductive systems[7]. Thus, CORT acts in a negative feedback loop with the pituitary to inhibit the release of CORT.

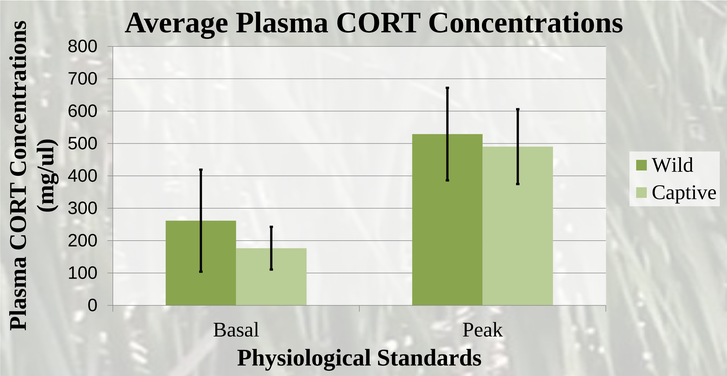
Methods

Wild Males
- Caught in drainage ditch located on edge of NDSU's main campus in Fargo, ND.
- 6 males caught between May 7, 2016 and May 20, 2016.
- 4 males caught between June 9, 2016 and June 23, 2016.
- Mist nets placed along ditch with female call back.
- Male bled from brachial vein within 3-6 minutes of capture.

Captive Males
- Yearlings caught in August and September 2015; housed over-winter at the NDSU-Conservation Research Center, a roofed outdoor aviary.
- Males were sampled between May 23, 2016 and June 1, 2016.
- 2 males were caught each day at the same time to maintain similar amounts of exposure to stress.
- Males were bled within 3 minutes of first seeing a human.

All Males
- Males placed in opaque breathable bag after initial blood draw.
- Bled every 15 minutes after capture for one hour; 5 samples total.
- Blood samples spun down to separate plasma.
- CORT extracted from plasma.
- CORT concentrations analyzed using an enzyme-lined immunosorbent assay, an ELISA kit (ENZO Life Science ADI-900-097).

Results



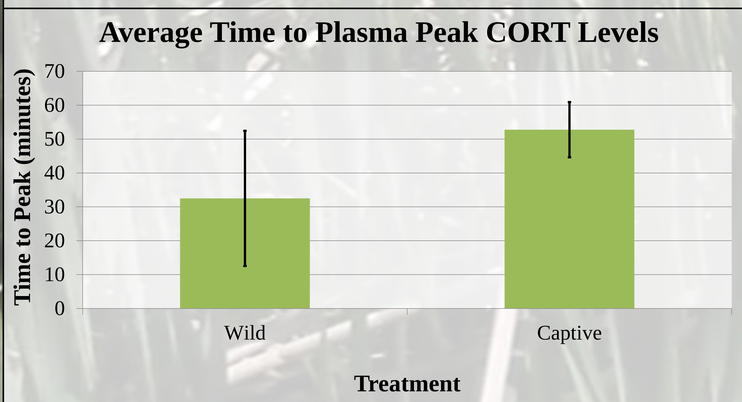


Figure 2 and 3: Average Plasma CORT Concentration and Average Time to Plasma Peak CORT Levels. A t-test was conducted to compare basal CORT concentrations in wild and captive red-winged blackbirds. There was no significant difference in the scores for wild (M=261.722, SD=157.492) and captive (M=176.749, SD=66.040) males; t(18) =1.5641, p=0.1362. A t-test was conducted to compare peak CORT concentrations in wild and captive red-winged blackbirds. There was no significant difference in the scores for wild (M=529.108, SD=142.872) and captive (M=490.361, SD=115.642) males; t(18) =0.576, p=0.5724. A paired-samples t-test was conducted to compare time to peak CORT concentrations in wild and captive males. There was a significant difference in the scores for wild (M=32.48, SD=19.944) and captive (M=52.76, SD=8.142) males; t(18)=-2.983, p=0.0083.

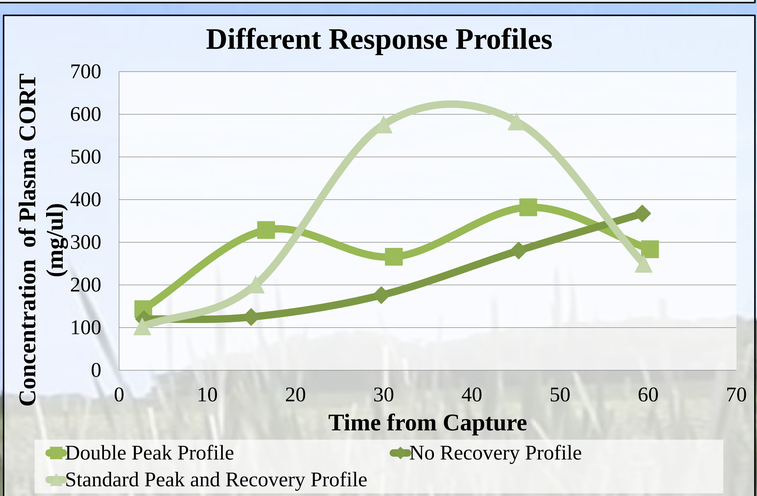


Figure 4: Three CORT response profiles were identified in both wild and captive male red-winged blackbirds. Each line represents a single male's response profile.

Discussion

- Basal and peak CORT concentrations did not differ between wild and captive males, suggesting that captivity does not affect stress physiology in male red-winged blackbirds. However, it is possible that captive males have habituated to captivity, and CORT response may be different for newly captured males.
- Also, our analysis showed that captive male peak CORT concentrations take longer to reach (Figure 3), suggesting that male red-winged blackbirds' stress response is affected by the stressors of captivity, such that captive males are exposed to increased levels of CORT for longer when exposed to an acute stressor than wild males.
- Males exhibited three distinct physiological profile forms (Figure 4). The first profile form is what is normally expected, where CORT levels increase in response to an acute stressor, peak about 30 min. after the stressor, and then concentrations recover to around basal levels[9]. In the second profile form CORT levels increase in response to an acute stressor, peak and start to recover around 15 min., but peak and recover again with repeated handling. In the third profile form CORT levels continue to increase during the 60 min. without any sign of peaking or recovering.
- The second and third profile forms result in birds having high plasma CORT concentrations for extended periods of time, potentially leaving them more vulnerable to the negative effects of CORT[9].
- If captivity does change how males respond to acute stressors, care should be taken in extrapolating results to free-living conditions.
- Our results suggest that further analysis of male stress response in captive and wild populations will be crucial in guiding future research designed to manage blackbird population levels and help resolve this long-lived human-wildlife conflict.

Acknowledgements and Literature Cited

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