Physiological Response and Habituation of Endangered Species to Military Training Operations

Conservation
CS-1396

Background:

Organisms must respond to unpredictable, novel, and dangerous conditions in their environment to maintain survival and reproduction. Response of wildlife populations to human disturbance has long been of concern to ecologists, which is reflected in strong regulations (e.g., the Endangered Species Act of 1973, as amended) requiring federal agencies to assess the effects of their actions on listed species. Physiological indicators of stress have been suggested as surrogate measures of human-induced stress in species of concern, notably measures of energy expenditure and the adrenocortical response. Human-related stressors characteristic of military operations that are episodic, unpredictable, and varying in intensity have received relatively little attention in terms of physiological response. Mission-critical military training and testing have been impacted by known, unknown, or potential impacts on endangered species. This project evaluates physiological indicators of stress in two endangered avian species, the black-capped vireo and golden-cheeked warbler, to determine the sensitivity and plasticity of their response to military training disturbance.

Objective:

The objectives include: (1) develop "dose/response" models for the physiological response of selected endangered species to military stressors; (2) determine the capacity of species of concern to habituate to "non-threat" disturbances; and (3) test predictive models for physiological stress response based on life history characteristics and taxonomic affiliation.

Process/Technology Description:

Five field experiments on wild populations of three avian species (black-capped vireo, white-eyed vireo, and golden-cheeked warbler) will be conducted to provide data necessary to meet the project's objectives. These experiments will utilize state-of-the-art hormone assays and remote telemetry technologies to evaluate adrenocortical response, habituation, and energy expenditure in response to military training disturbance. Experiment 1 will test whether individuals modulate their corticosterone levels relative to the duration and type of disturbance. Experiment 2 will determine energy expenditure during an exposure to disturbance by using remote telemetry to monitor heart rate in free-flying individuals. Experiment 3 will evaluate changes in target tissue sensitivities and negative feedback mechanisms of the hypothalamic-pituitary-adrenal axis as a measure of chronic stress in wild populations. Experiments 4 and 5 will use corticosterone and heart rate measures to evaluate habituation to disturbance over different time scales. Final research questions will use data from these experiments to test hypotheses related to disturbance response based on life history characteristics.

Photo by Karly Moore

Black-Capped Vireo Female Incubating Eggs.

Expected Benefits:

This research will fill knowledge gaps of selected endangered species on the threshold level of disturbance necessary to elicit a physiological response and modulation of this response to repeated disturbance. It also will provide a predictive framework for physiological response to disturbance. (Anticipated Project Completion - 2009)

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