

2022

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Curt A. Vandenberg  
*Texas A&M University Commerce*

Sarah A. Currier  
*Texas A&M University Commerce*

Jeffrey G. Whitt  
*Texas A&M University Commerce*

Kelly S. Reyna  
*Texas A&M University Commerce*

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### Recommended Citation

Vandenberg, Curt A.; Currier, Sarah A.; Whitt, Jeffrey G.; and Reyna, Kelly S. (2022) "Stress and Predation Impacts on North American Quail Translocations," *National Quail Symposium Proceedings: Vol. 9* , Article 31.

<https://doi.org/10.7290/nqsp09QKMK>

Available at: <https://trace.tennessee.edu/nqsp/vol9/iss1/31>

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# STRESS AND PREDATION IMPACTS ON NORTH AMERICAN QUAIL TRANSLOCATIONS

Curt A. Vandenberg

College of Agricultural Sciences and Natural Resources, Texas A&M University-Commerce, PO Box 3011, Commerce, TX 75429, USA

Sarah A. Currier

College of Agricultural Sciences and Natural Resources, Texas A&M University-Commerce, PO Box 3011, Commerce, TX 75429, USA

Jeffrey G. Whitt

College of Agricultural Sciences and Natural Resources, Texas A&M University-Commerce, PO Box 3011, Commerce, TX 75429, USA

Kelly S. Reyna<sup>1</sup>

College of Agricultural Sciences and Natural Resources, Texas A&M University-Commerce, PO Box 3011, Commerce, TX 75429, USA

## ABSTRACT

Translocations have been used in attempts to bolster or restore native quail populations for >150 years, often with little success. However, with some northeastern United States quail populations undetectable or extirpated, and others across the United States on the extreme decline, translocation as a tool for quail population restoration is becoming increasingly popular. Two factors contributing to translocation failure are physiological stress and predation. Chronic stress associated with translocations can result in weight loss, reduced immune system function, suppressed reproduction, and an altered fight-or-flight response. These stress-induced responses increase vulnerability to predation, the primary cause of quail mortality. Here, we review the relationship between quail translocations, stress, and predation, and recommend future research and best practices to mitigate the impacts of stress and predation on translocated quail. To improve future translocation outcomes, more research is needed on stress mitigation throughout the translocation process (capture, handling, transport, and release). While capture and handling are unavoidably stressful, there is greater potential to reduce stress levels during holding and transport. Recent validation of fecal corticosterone metabolites as a non-invasive method to quantify stress in quail offers a useful tool for testing stress reduction protocols. Preliminary experimental results regarding nutritional supplements and stress levels are inconclusive, but enrichment during temporary holding and access to travel rations may help improve survival in long-distance (>800 km) translocations. We also recommend predator control at release sites, particularly for raccoons (*Procyon lotor*) and other mesomammals.

**Citation:** Vandenberg, C. A., S. A. Currier, J. G. Whitt, and K. S. Reyna. 2022. Stress and predation impacts on North American quail translocations. National Quail Symposium Proceedings 9:149. <https://doi.org/10.7290/nqsp09QKMK>

**Key words:** California quail, *Callipepla californica*, *Colinus virginianus*, corticosterone, ethology, northern bobwhite, population restoration, predation, reintroduction, stress, translocation, wildlife management

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<sup>1</sup> E-mail: [Kelly.Reyna@tamuc.edu](mailto:Kelly.Reyna@tamuc.edu)

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