



## *Large Mammal Advisory Committee*

# **Assessing the Efficacy of Camera Surveys for Monitoring Deer and Bear at the Deer Assessment Unit Scale**

### **Proposed Start and Completion Date**

March 2012 – June 2013

### **Executive Summary**

This project will augment efforts of the State Wildlife Grant funded Ecoregion Biodiversity Monitoring Project (EBM) to monitor mule deer and black bear occupancy and demography trends at the DAU scale through the use of baited camera stations. It will provide sufficient data for conducting a prospective power analysis for monitoring medium and long term trends for informing game management planning. This project will also fund a more detailed interpretation of survey photographs for collecting demographic information.

### **Statement of Need**

There is an urgent need for improved monitoring of deer and bear populations at the DAU scale, especially for forested landscapes where aerial surveys are limited due to safety concerns, feasibility, and cost. This project will undertake a power analysis assessing the efficacy for camera surveys to provide statistically robust estimates of occupancy and population trends. Occupancy estimation techniques have been used as cost effective surrogates to estimate abundance. This project is expected to demonstrate how a sustained commitment to camera surveys and occupancy modeling at large scales could provide sufficient information for guiding game management decisions such as adjusting tag quotas in areas where other methods are infeasible. For example, the power to estimate a 5% per year declining trend in occupancy of deer over a 10-20 year period would provide strong scientific evidence of a decline for which an adjustment of tag quotas may be warranted. Identification of lesser declines may warrant more modest adjustments in tag quotas.

### **Introduction**

In 2009, EBM began using Reconyx passive infra-red triggered cameras to monitor 10-20 species of mammals in forested habitats. This work began in the C zones and expanded to the B zones in 2011. This project aims to accelerate early implementation of this work in the B and C zones in order to assess the efficacy of camera surveys for monitoring deer populations and trends. For the heavily forested landscapes covering these zones, camera surveys are likely to be safer and more effective than helicopter surveys and inherently less biased than other methods (e.g., road transects) currently in use.

### **Objectives**

- Collect presence-absence information on deer and bear from camera surveys for use in occupancy models
- Collect demographic information on deer and bear for estimating sex ratio, age class distribution, and reproduction

- Conduct a power analysis for calculating the sampling effort and timeframe necessary for detecting trends in occupancy and demographic parameters, under various expected ecological scenarios.

## **Methods**

The study area will include deer zones B2, B3, B5, B6, C1, C2, C3 and C4. Inferences will be made at the aggregate scale of the B and C zones conceptually representing two deer assessment units.

Following the EBM protocol, sampling polygons will be randomly selected without replacement from a grid that overlays the study area. Two camera stations shall be placed 1.6 km apart in each selected polygon. The stations shall be baited to attract a variety of species including deer and bear. The cameras shall be retrieved after 2 weeks and the photos interpreted to identify all species detected within each 24-hour period. Surveys will occur within different sampling polygons during August through November. Hierarchical state space modeling will be used to simultaneously estimate occupancy and detection probabilities as a function of covariates while adjusting for issues of autocorrelation between camera pairs. These methods are recommended as an accurate, cost-effective alternative to counts for monitoring wildlife population status at large spatial scales (Kery and Schaub 2021, MacKenzie et al. 2006).

For each deer and bear detection, demographic information will also be noted for estimating sex and reproductive ratios, and the age class distribution. We will attempt to differentiate individuals and explore hierarchical statistical models for addressing uncertainties in differentiation. Although occupancy modeling will be the main focus of this proposal, we will investigate modeled counts of demographic classes (e.g., sex and antler) as a complementary source of information.

Baiting is likely to bias detection probability, but we will be explicitly estimating and controlling for detection probability as a function of covariates including bait condition. Initial analyses suggest that bears are strongly attracted by the bait, whereas deer are much less so.

The data will be incorporated into existing EBM Access and GIS databases.

A power analysis will be undertaken using estimates of the various occupancy and demographic parameters from the pilot data. The power analysis will use Monte Carlo simulation of expected ecological scenarios including a gradual 1-3% decline in the carrying capacity over 20 years, sudden drops of 10-20% followed by logistic growth recovery, and cyclic fluctuations of 3-10 years as modeled via a 2<sup>nd</sup> order autoregressive process. All models will be run in R and WinBUGS.

## **Products (and estimated dates of completion)**

- Final technical report containing an assessment of the camera survey methods for deer and bear, and the power analysis results. This will include an evaluation of methodology, an assessment of advantages versus disadvantages, and recommendations on whether and how to expand implementation.
- A manuscript submitted for publication in a peer-reviewed scientific journal is planned.

## **DFG Staff**

Project Supervision: Richard Callas, Senior Environmental Scientist Supervisor

Project Lead: Brett Furnas, Environmental Scientist

Technical Assistance with data analysis: Russ Landers, Scientific Aide

Field Work: Other Scientific Aides assigned to EBM

## **Budget**

Activity	Annual Cost	Timeframe
Additional survey equipment and supplies to be purchased	\$8K	Mar 2012 – May 2012
Additional survey effort performed by Scientific Aides	\$9K	Aug 2012 – Nov 2012
Additional survey photo interpretation by Scientific Aides	\$5K	Oct 2012 – Feb 2012
Technical assistance with data analysis including occupancy estimation, ecological modeling and power analysis. Provided by Permanent Intermittent or Scientific Aide.	\$30K	July 2012 – June 2013

## **References**

Kery M and M Schaub. 2012. Bayesian population analysis using WinBUGS: a hierarchical perspective. Academic Press.

MacKenzie DI, JD Nichols, JA Royle, KH Pollock, LL Bailey and JE Hines. 2006. Occupancy estimation and modeling: inferring patterns and dynamics of species occurrence. Academic Press.