

Estimating Black Bear Occupancy at Jellico Mountain Using Baited Camera Traps

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Introduction

Black bears (*Ursus americanus*) were essentially extirpated from Kentucky by the early 1900s due to habitat loss and unregulated hunting.¹ In the last 20 years, bears have been recolonizing the state as habitat became more available, laws were made, and reintroduction programs were put into place.¹ With the range of black bears extending back into Kentucky, the need for conservation and management increases, especially since their presence can result in conflicts with humans.

Obtaining estimates of density and abundance are common practice for monitoring and managing wildlife species.⁵ These estimates are often achieved using genetic capture-mark-recapture methods, which can be expensive to implement.⁵ Less expensive noninvasive survey methods such as camera trapping can provide data which, when incorporated into occupancy modeling, yield insights into a species abundance.⁵

The objectives of this study were to: (a) estimate black bear occupancy in the Jellico Mountain area of southeastern Kentucky, (b) create occurrence maps of black bears in the Jellico Mountain area, (c) provide useful information to the Kentucky Department of Fish and Wildlife Resources (KDFWR) concerning the feasibility of using occupancy modeling for black bear projects in the future.

Methods

This study took place on Jellico Mountain, an area situated in southeastern Kentucky on the Kentucky-Tennessee border. The area surveyed lies in the Stearns District of the Daniel Boone National Forest in Whitley and McCreary counties, KY. The mountain was divided into grids of 5 km by 5 km. In June, 2018, 18 Covert MP8 cameras were placed (one per grid section) in areas accessible by road (Fig. 1). Each camera was attached to a tree 1 meter off of the ground, facing North or South, and

programed to take pictures at 5 min intervals.³ All of the sites were baited initially with 23 kgs of corn placed 1-2 meters in front of the camera and 0.5 kgs of peanut butter spread on a tree in front of the camera. Each site was checked weekly between June 7 and -July 6, 2018, and bait was added as needed.

Presence/absence data were determined based on whether or not a picture of a black bear was taken each sampling occasion. One week was used as a single sampling occasion. Data were analyzed using the statistical program R with the package “unmarked”.⁴ The data were represented by binary values of “1” (bear present) and “0” (no bears photographed). Additionally, this occupancy model determines probability of occupancy and probability of detection.⁴

An occurrence map for black bears on Jellico Mountain was created by plotting the GPS coordinates of each camera site and indicating which sites were occupied (bear was photographed) and which were not. Covariates of elevation and burn history (burned or unburned) were incorporated into the occupancy model in an attempt to obtain site specific probabilities. Occupancy and detection probabilities permit me to predict the number of weeks it would take to approach a detection probability of 1.

Results

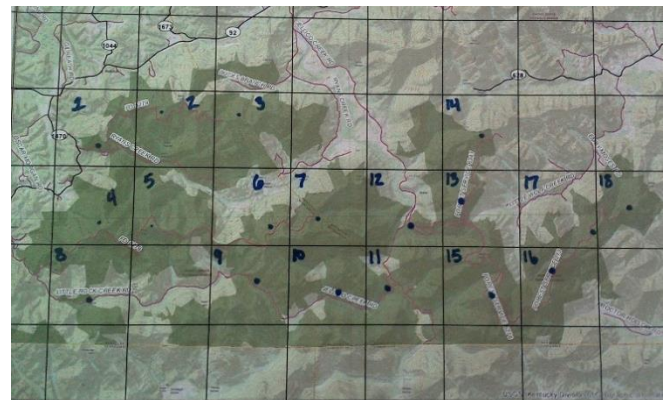


Figure 1. Map of study area surveyed showing grids and camera locations.

Eight of the 18 cameras detected black bears over the course of 5 weeks. Covariates of elevation and burn history were not good predictors of occupancy. For this reason, the covariates were not included, leaving constant detection and occupancy probabilities across all sites. The predicted occupancy probability for bears across Jellico Mountain was 0.449. The predicted detection probability across the landscape was 0.326. Modelling results indicate it would take approximately 5 weeks of camera surveying on Jellico Mountain to reach a 90% chance of detecting a black bear (Fig. 2).²

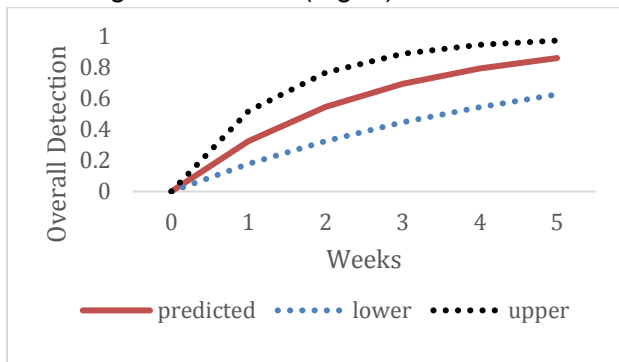


Figure 2. Estimates of overall detection of black bears over time on Jellico Mountain, KY. Dotted lines indicate lower and upper limits predicted by the occupancy model.

Discussion

In 2010, Jellico Mountain was included in a genetic study of black bears, and after 8 weeks of sampling, no bears were detected.¹ An occurrence map generated from this study will allow KDFWR to know where the bears were considered occupied on the mountain when considering future studies. Predictions of overall detection can also be taken into consideration with black bear projects in the future. It gives insight into how long to run surveys in order to help save time and money.

Using noninvasive survey methods, such as camera trapping, and incorporating the data into occupancy modeling has become increasingly popular in the field due to the low cost, and useful information obtained.⁵ Many other long term projects use occupancy modeling over the course of years, and have found it useful in predicting abundance of wildlife species.⁵ Steenweg et al., found that occupancy is a useful metric when considering species distribution as well as an

accurate index for abundance.⁵ Without being able to survey for long periods of time, I cannot predict population abundance, but the information obtained still proves useful. It shows that there are bears in the area as well as providing insights to black bear abundance at Jellico Mountain.

The time periods for one sampling occasion varies in the literature. I incorporated 24 hours and one week as one sampling occasion into my model, and found that one week was a better fit. Many other covariates are also used in occupancy models, such as canopy cover, distance to trails, or % of area developed.⁶ These have positively and negatively predicted occupancy, but were not feasible at my study area due to homogenous habitat, lack of trails, and no nearby development.

Conclusions

From this study, it can be concluded that black bears occupy close to half of the area surveyed at Jellico Mountain and that it takes around 5 weeks of camera trapping to reach a 90% chance of detecting a black bear. We can also note that burn history and elevation were not good predictors of occupancy. When considering no bears were detected in this area in 2010, this information is significant and raises further questions about the black bears in this area (i.e., where did these bears move in from?). The data reported here can assist KDFWR biologists in planning future black bear surveys in the state.

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