Role of predators, winter weather, and habitat on white-tailed deer fawn survival in the south-central Upper Peninsula of Michigan

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Abstract  We captured and immobilized twenty adult black bears (Ursus americanus; 8 male, 12 female) that we fitted with VHF collars, and 2 yearlings (1 male, 1 female) during May–August 2012. We placed sixty-four remote infrared cameras throughout the study area to estimate white-tailed deer (Odocoileus virginianus) abundance. We also placed 32 black bear hair snares in preparation for June–July 2013 sampling to estimate black bear abundance. We obtained response rates of 21.9% and 0.01% from coyotes (Canis latrans) and wolves (C. spp.) to broadcasted coyote group-yip howls, respectively. We met with the local Michigan Department of Natural Resource wildlife biologist and wildlife stakeholder groups to establish formal communications and provide information about project activities and accomplishments. We hired one seasonal technician and hosted 2 volunteers that assisted with field work activities. We initiated the hiring process for 5 seasonal technicians to assist with winter field work.
Summary

- We captured and immobilized 20 adult black bears (8 male, 12 female) and 2 yearlings (2 male), and fitted all adults with VHF collars.
- We placed sixty-four remote infrared cameras throughout the study area to estimate white-tailed deer abundance.
- We established 32 black bear hair snares in preparation for June–July 2013 sampling to estimate black bear abundance.
- We obtained a coyote response rate (RR) of 21.9% and wolf RR of 0.6% to broadcasted recordings of coyote group-yip howls during howl surveys.
- We met with the local Michigan Department of Natural Resource wildlife biologist and wildlife stakeholder groups to establish formal communications and inform the local community about project activities and accomplishments.
- We hired one technician and hosted 2 volunteers from Northern Michigan University to assist with May–August field work. We initiated hiring of 5 seasonal technicians to assist with winter field work.
Introduction

Management of wildlife is based on an understanding, and in some cases, manipulation of factors that limit wildlife populations. Wildlife managers sometimes manipulate the effect of a limiting factor to allow a wildlife population to increase or decrease. White-tailed deer (*Odocoileus virginianus*) are an important wildlife species in North America providing many ecological, social, and economic values. Most generally, factors that can limit deer numbers include food supply, winter cover, disease, predation, weather, and hunter harvest. Deer numbers change with changes in these limiting factors.

White-tailed deer provide food, sport, income, and viewing opportunities to millions of Americans throughout the United States and are among the most visible and ecologically–important wildlife species in North America. They occur throughout Michigan at various densities, based on geographical region and habitat type. Michigan spans about 600 km from north to south. The importance of factors that limit deer populations vary along this latitudinal gradient. For example, winter severity and winter food availability have less impact on deer numbers in Lower Michigan than in Upper Michigan.

Quantifying the relative role of factors potentially limiting white-tailed deer recruitment and how the importance of these factors varies across this latitudinal gradient is critical for understanding deer demography and ensuring effective management strategies. Considerable research has demonstrated the effects of winter severity on white-tailed deer condition and survival (Ozoga and Gysel 1972, Moen 1976, DelGiudice et al. 2002). In addition, the importance of food supply and cover, particularly during winter, has been documented (Moen 1976, Taillon et al. 2006). Finally, the role of predation on white-tailed deer survival has received considerable attention (e.g., Ballard et al. 2001). However, few studies have simultaneously addressed the roles of limiting factors on white-tailed deer.

The overall goal of this project is to assess baseline reproductive parameters and the magnitude of cause-specific mortality and survival of white-tailed deer fawns, particularly mortality due to predation, in relation to other possible limiting mortality agents along a latitudinal gradient in Michigan. We will simultaneously assess effects of predation and winter severity and indirectly evaluate the influence of habitat conditions on fawn recruitment. Considering results from Lower Michigan (Pusateri Burroughs et al. 2006, Hiller 2007) as the southern extent of this gradient, we propose three additional study sites from south to north across Upper Michigan. Because of logistical and financial constraints, we propose to conduct work sequentially across these study areas. The following objectives are specific to the Upper Michigan study area but applicable to other study areas with varying predator suites.

Objectives

1. Estimate survival and cause-specific mortality of white-tailed deer fawns and does.

2. Estimate proportion of fawn mortality attributable to black bear (*Ursus americanus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), and wolf (*C. spp.*).
3. Estimate number and age of fawns killed by a bear, coyote, bobcat, or wolf during summer.

4. Provide updated information on white-tailed deer pregnancy and fecundity rates.

5. Estimate annual and seasonal resource use (e.g., habitat) and home range of white-tailed deer.

6. Estimate if familiarity of an area to each predator species affects the likelihood of fawn predation.

7. Assess if estimated composite bear, coyote, bobcat, and wolf use of an area influences fawn predation rates.

8. Describe association between fawn birth site habitat characteristics and black bear, coyote, bobcat, or wolf habitat use.

9. Estimate seasonal resource use (e.g., habitat, prey) and home range size of black bear, coyote, bobcat and wolf.

Study Area

The second phase of this study spans about 1,000 km² (386 mi²) within Deer Management Unit (DMU) 036 in Iron County (Figure 1). The general study area boundaries follow State Highway M-95 on the east, US Highway 41/28 on the north, US Highway 141 on the west, and State Highway M-69 on the south. The core study area, where most capture efforts and population surveys will occur, is north of the Michigamme Reservoir and includes state forest, commercial forest association, and private lands. The overall study area will comprise a minimum convex polygon that will include the composite locations of all telemetered animals. We selected this study area because it occurs within the mid-snowfall range, receiving about 180 cm of snowfall annually (about 53 cm more snowfall annually than the phase 1 study area near Escanaba). Deer in this area migrate longer distances and exhibit yarding behavior during most winters as compared to Escanaba where deer migrate only short distances or are non-migratory (Beyer et al. 2010) and yard less frequently.

Accomplishments

Black Bear Capture and Monitoring

From 1 May to 31 August 2012, we captured 22 black bear (*Ursus americanus*; 12 females, 10 males) using barrel traps and Aldrich foot snares (Table 1). We immobilized captured bears and weighed, sexed, recorded morphometrics, and evaluated each individual for injury. We collected samples of blood, saliva, hair, and scat for later analysis. We estimated body condition index (BCI) and recorded bioelectric impedance assessment (BIA) as 2 measures of body condition. Each bear received uniquely numbered blue ear tags and we removed a vestigial premolar to estimate age. We fitted adults (n = 20; 12 females, 8 males) with very high frequency (VHF) radio-collars. Two bears (1 male, 1 female) slipped their VHF collars shortly after release. We relocated bears 3 times since capture to monitor movements.
Deer Camera Survey
We pre-baited sixty-four sites throughout the study area (Figure 2) with 7.5 l of whole kernel corn beginning 11 August and re-baited sites at 3-day intervals. We placed remote infrared cameras at each of the pre-baited sites beginning 21 August. In early September, we will retrieve cameras. From camera images, we will estimate deer abundance/density for the 298.1 km² sampling area using an occupancy modeling approach (Royle and Nichols 2003).

Black Bear Hair Snares
We established hair snares (n = 32 of 64) for collecting black bear hair samples during June–July 2013 to estimate abundance throughout the study area. Project personnel placed a single snare in each cell of a 6.25 km² grid (Figure 2) in preparation for use in summer 2013. Each snare consists of a strand of barbed wire attached to the outside of three trees and 50 cm above ground.

Coyote Abundance Estimation
As of 31 August, we completed 4 howl surveys at 40 sites (Figure 3). We obtained a coyote response rate (RR) of 21.9% to recorded coyote group-yip howls but only recorded one wolf response (RR = 0.6 %). Collection of howl survey data is ongoing, with 4 more surveys planned for September–October. We will estimate coyote abundance using an occupancy modeling approach (Royle and Nichols 2003).

Public Outreach
On 4 occasions during May–August, we were assisted by 2 student volunteers from Northern Michigan University chapter of The Wildlife Society to conduct black bear immobilization and handling.

We facilitated fieldwork requirements for a high school student internship from the Mississippi School for Mathematics and Science.

We met with local wildlife biologist Monica Joseph and members of public interest groups (e.g., U.P. White-tails Unlimited, Wildlife Unlimited, U.P. Trappers Association) on 25 June to update stakeholders on the plans and progress of the research.

We are updating the project website to include information regarding the new study area and results from phase 1 (http://fwrc.msstate.edu/carnivore/predatorprey/).

Technician Hiring
We hired one technician (Cody Norton) this quarter, and have posted an announcement to hire 5 technicians to assist with winter field work. We will make final hiring selections in October.

Publications
Work to be completed (September–December 2012)

Radio-telemetry
We will continue to monitor collared black bears once monthly until we verify den locations.

Deer Abundance Estimation
We will use photos collected from trail cameras to estimate abundance and densities of males, females, and fawns using occupancy modeling following Royle and Nichols (2003). Survey photos may also allow a supplemental abundance estimate for black bears.

Deer Trapping
We will begin capturing deer using Clover traps the first week of January 2013. We will hire additional technicians for winter trapping to increase our trapping efficiency and decrease time deer are in traps.

Black Bear Den Checks
We will conduct den checks on male black bears in mid-December to replace VHF collars with GPS radio-collars.

Bobcat Hair Snares
We will begin assembly of bobcat hair snares and prepare deployment sites in September–October. We will pre-bait snare sites in mid-December and deploy hare snares for 8 weeks beginning mid-January, and collect hair samples at weekly intervals. Bait will consist of road-killed deer carcasses, deer from local game processors, or beaver carcasses collected from private trappers. We will send hair samples to a genetics laboratory for analyses.

Winter Track Surveys
We will begin winter track surveys for wolves at first snowfall, likely in late November or early December, and will continue until we identify number of packs and individuals/pack within the study area. We will conduct track surveys via truck, snowmobile, or ATV 24–48 hours after snowfall to allow for animal movement. Once identified, we will follow wolf tracks until we confirm number of individuals traveling together. We will use numbers of independent
tracks in each group to estimate minimum abundance. When possible, we will also identify and use track detections of bobcats to derive rates of track deposition.

Public Outreach
We will update project brochures with preliminary results, then print and distribute them.

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Bob Doepker, MDNR
Kurt Hogue, MDNR
Jason Peterson, MDNR
Marvin Gerlach, MDNR
Jason Neimi, MDNR

Literature Cited


Table 1. Capture data for 22 black bears, Upper Peninsula of Michigan, 1 May–31 August 2012.

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Figure 1. Location of phase 1 and 2 study areas and Michigan Department of Natural Resources Deer Management Units, Upper Peninsula of Michigan, 2012.
Figure 2. Locations of 32 hair snares and 64 cameras to estimate black bear and white-tailed deer abundance, respectively, Upper Peninsula of Michigan, 2012.
Figure 3. Locations of 40 howl survey sites to estimate coyote abundance, Upper Peninsula of Michigan, 2012.