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 96 (57 female, 39 male) white-tailed deer (*Odocoileus virginianus*) this quarter in Clover traps including 49 adults, 10 yearlings, and 37 fawns. Thirty-five pregnant does were radiocollared and VIT tagged, including 4 does originally captured in 2010. We also recaptured 4 fawns radiocollared in 2010. No collared adult female, yearling, or fawn mortalities occurred this quarter. There were 589 adult female, 24 yearling, and 250 fawn radiolocations collected during the quarter. We immobilized 7 adult black bears (*Ursus americanus*; 3 male, 4 female) and 6 female yearlings in their dens and 6 cubs (2 male, 4 female) were observed. To estimate carnivore abundance, we deployed 181 hair snares at 44 bait sites and obtained 115 hair samples. We baited 7 locations to live capture coyotes (*Canis latrans*). We conducted 12 carnivore track surveys comprising 523.5 km and detected 45 wolf (*Canis lupus*) tracks with at least one individual, 8 bobcat (*Lynx rufus*) tracks, and 193 coyote tracks. We identified a minimum of 6 individuals in the 7 Mile Marsh Pack and 5 individuals in the Hayward Lake Pack. We analyzed 41 scats (26 coyote and 15 wolf) collected during summer 2009 this quarter. We recorded 149 alternate prey and deer observations. Project staff gave 3 workshops this quarter and began hiring summer technicians.
Summary

- This quarter, 96 (57 female, 39 male) individual white-tailed deer (*Odocoileus virginianus*) were captured, including 49 adults, 10 yearlings, and 37 fawns.

- Thirty-five pregnant does were radiocollared and VIT tagged, including 4 does originally captured in 2010.

- Pregnancy was detected with ultrasound in 100% of adult (*n = 32*) and yearling (*n = 3*) females, but no fawns (*n = 3*).

- We obtained 589 adult female, 24 yearling, and 250 fawn radiolocations during the quarter.

- This quarter, no radiocollared adult female, yearling, or fawn mortalities occurred.

- We immobilized 7 adult black bears (3 male, 4 female), and 6 yearlings (6 female) in their dens and 6 cubs (2 male, 4 female) were observed.

- One hundred eighty one carnivore hair snares were deployed from which 115 hair samples were obtained.

- Seven locations were baited for coyote capture using cable-restraints.

- Twelve carnivore track surveys traversing 523.5 km detected 45 wolf (*Canis lupus*) tracks with at least one individual, 8 bobcat (*Lynx rufus*) tracks, and 193 coyote tracks.

- Track surveys identified a minimum of 6 individuals in the 7 Mile Marsh Pack and 5 individuals in the Hayward Lake Pack.

- We analyzed 41 scats (26 coyote and 15 wolf) collected during the summer of 2009 this quarter.

- We conducted 2 vegetation surveys quantifying vegetation structure, composition, and density this quarter.

- We recorded 149 alternate prey and deer observations this quarter.

- Personnel gave 3 workshops this quarter and began hiring summer technicians.
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 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 and 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 been conducted demonstrating 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) 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 southern 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 (*Canis lupus*) predation.

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:

This study area is centered on a ~900 km² (~350 mi²) area within Deer Management Unit (DMU) 055 in Menominee County. The general study area is bordered on the east by the shoreline of Lake Michigan, on the north by US Highway 2, on the west by US Highway 41, and the south by the town of Stephenson. The core study area includes a mix of forested and agricultural lands and is where capture efforts occur. The overall study area consists of a minimum convex polygon that includes the composite locations of telemetered animals. We selected this study area because of the relatively low snowfall and generally low winter severity. Deer in this area generally migrate only short distances or are non-migratory, making direct comparisons to southern Michigan (i.e., Pusateri Burroughs et al. 2006) easier.
Accomplishments:

Winter Deer Capture

From 17 December 2010–27 February 2011 we captured white-tailed deer to place radiocollars on pregnant females (Figure 1), concluding project deer capture efforts. We captured 96 individual deer (57 females, 39 males) in Clover traps, with an additional 49 recaptures including 4 radiocollared fawns. Individual captures included 49 adults, 10 yearlings, and 37 fawns; 22% were yearling or adult males. The female:maile fawn ratio was 1:0.95. We attempted to collect hair, saliva, body condition scores (BCS), estimate pregnancy of females and rump fat depths with ultrasonography, and attach ear tags (females = yellow, males = blue; Figure 2) to each deer.

Females and males had mean (±SD) BCS (scale: 1 [moribund]–5 [obese]) of 3.0 ± 0.3 and 3.0 ± 0.3, respectively. Eight capture related mortalities occurred, 2 resulted from a vertebrae fracture from the Clover trap, 1 from a broken tibia in the trap, 1 from a trap collapsing on the animal, and 2 were likely related to physiological stress from the capture event. Improved Clover trap design (e.g., tightened netting) appeared to alleviate trap related injuries in 2011 (n = 4), but was higher than 2010 (n = 1). An additional deer mortality occurred during release (fawn collided with tree) and 1 deer capture myopathy occurred post-release, although the deer appeared malnourished at capture. Number of deer captured this winter was greater than 2010 and similar to 2009, likely due to increased snow levels and more active timber cuts this year.

We immobilized 35 pregnant females and fitted them with a radiocollar (model 2610B, Advanced Telemetry Systems Inc., Isanti, MN), and vaginal implant transmitter (VIT; model 3930, Advanced Telemetry Systems Inc., Isanti, MN), including 4 does originally captured in 2010. We monitored temperature, respiration, and heart rate as soon as practical after immobilization and about 10–min intervals thereafter until a reversal drug was administered. We estimated and recorded deer morphometrics, BCS, pregnancy, and maximum (MAXF) and mid-rump (MIDF) fat depths (Table 1) when practical. We also attempted to collect a lower incisor, blood, and urine from each pregnant female. We detected pregnancy with ultrasound in 100% of adult (n = 32) and yearling (n = 3) females, but no fawns (n = 3).

Mean adult doe weight from 2011 (n = 31) was 76.34 ± 14.16, similar to 2009 (n = 32; 73.10 ± 7.90) and 2010 (n = 22; 78.80 ± 7.50 kg). Mean BCS for adult does from 2011 (n = 32) was 3.0 ± 0.4, similar to 2009 (n = 33; 2.9 ± 0.3) but higher than 2010 (n = 26; 2.5 ± 0.4). Mean MIDF and MAXF depth for adult and yearling does in 2011 (n = 33) was 0.55 ± 0.35 mm and 1.08 ± 0.41 mm, respectively. For comparison, MIDF and MAXF values for 2009 were 0.83 ± 1.16 and 1.30 ± 1.85, respectively (n = 34); values for 2010 were 0.73 ± 0.37 and 1.04 ± 0.43 cm (n = 27), respectively.
Deer Mortality

This quarter, no previously radiocollared adult female or yearling (fawns captured and radiocollared in 2009) mortalities occurred. No radiocollared fawns died this quarter and 23 were monitored as of 28 February 2011.

Deer Telemetry

*Adult females*—We monitored adults ≥1 time/week using aerial telemetry. From 2009–2011 captures, 65 radiocollared adult females were being monitored as of 28 February 2011. We collected 589 radiolocations this quarter. Individual adult females (2009–2011) had 1–161 radiolocations depending on capture and censor dates.

*Yearlings*—We monitored yearlings ≥1 time/week using aerial telemetry. There were 2 yearlings (i.e., 2009 fawns) being monitored as of 28 February 2011. We collected 24 radiolocations this quarter. Individual yearlings captured in May–July 2009 had 2–72 radiolocations depending on capture and censor dates. We were unable to relocate 2 yearlings this quarter, presumably due to radiocollar battery failure.

*Fawns*—We monitored fawns ≥1 time/week using aerial telemetry. There were 23 fawns monitored as of 28 February 2011. We collected 250 radiolocations this quarter. Individual fawns had 3–37 radiolocations depending on capture and censor dates. Additionally, 2 radiocollars of 2010 fawns likely failed this quarter and could not be located on 6 subsequent aerial telemetry flights (fawn collar battery life expectancy is 12 months).

Black Bear Den Checks

We immobilized 7 adult black bears (3 male, 4 female) and 6 yearlings (6 female) in their dens this quarter. We replaced Global Positioning System (GPS) collars on all adult bears. These collars were programmed to obtain a location every 35 h until 1 May and then every 15 min. We handled 6 cubs (2 male, 4 female) during den work. Mean litter size was 3.0 cubs (SD = 1.41; Table 2). For each bear, we weighed, collected morphometrics, and implanted a Passive Integrated Transponder (PIT). We placed bears back into their respective dens for recovery. We found yearling BB26 dead outside the den and sent the carcass to the Michigan DNR Diagnostics Laboratory for necropsy. Necropsy results attribute cause of death to aspiration (terminal bacterial), pneumonia, pulmonary congestion, and pulmonary edema. Two den checks remain on 2 male bears.

Bobcat Hair Snares

We deployed hair snares for bobcats and coyotes for 5 weeks starting on 17 January 2011. They will remain set 3 more weeks before being pulled. We deployed snares on a 2.5 km² grid cell system, with one bait site per cell. We moved 12 bait sites within respective cells to reduce
domestic dog visitation and increase bobcat visitation (Figure 3). We combined grid cells truncated by >50% due to the Lake Michigan shoreline with adjacent cells. We deployed 3–6 snares at each site (181 total snares), based on the number of trails that developed during the 2–week pre-baiting period. We collected hair samples (Figure 4) and reset snares as necessary every 7 days. This quarter, we collected 115 hair samples (of target and non-target species) and sent them to the MDNR Wildlife Disease Laboratory in Lansing for genetic analysis.

Coyote Snares

We baited 7 locations for live capture of coyotes for radio telemetry. We will begin captures at active bait sites beginning 1 March.

Wolf Track Surveys and Abundance Estimates

We conducted 12 wolf track surveys from 16 January–28 February 2011, traversing 523.5 km. We also recorded wolf and other carnivore tracks opportunistically while performing other field duties. We detected wolf tracks on 45 occasions (32 included >1 individual). We also observed 193 sets of coyote tracks and 8 sets of bobcat tracks during track surveys. Low snowfall during late January and February prevented more surveys from being completed.

We used track surveys for wolves to estimate the number of packs in the study area and the minimum number of individuals within each pack. Based on 2009 and 2010 summer GPS data, at least 2 packs occurred in the study area (7 Mile Marsh Pack and Hayward Lake Pack; Figure 5). We identified a minimum of 6 individuals in the 7 Mile Marsh Pack (7 observed in 2010) and a minimum of 5 individuals in the Hayward Lake Pack (4 observed in 2010). During track surveys we observed raised leg urinations along 7–Mile Road, North Fox Road, and North Branch of North Fox Road, suggesting territorial marking. We also observed estrous blood in both pack areas suggesting that breeding may occur within both packs. We will conduct track surveys through March, pending suitable tracking conditions.

Carnivore Scat Analysis

We opportunistically collected carnivore scat samples throughout the study area. We placed scats in labeled (i.e., date of collection, species, UTM coordinates) plastic bags before freezing. We collected scat during summers of 2009 and 2010 and shipped them to Mississippi State University, Carnivore Ecology Laboratory to be analyzed for presence of prey species (e.g., deer fawn) hair and other dietary items (e.g., berries and corn). This quarter we analyzed 41 scats (26 coyote, 15 wolf) collected during summer 2009. Proportion of these coyote scats with adult and fawn white-tailed deer hair was 39.0% and 9.0%, respectively. Proportion of these wolf scats with adult and fawn white-tailed deer hair was 30.4% and 12.7%, respectively.

From 2009–2011, we collected 894 scats consisting of 334 bear, 39 bobcat, 288 coyote, 133 wolf, and 100 unknown. From 2009–2011, we have cleaned and sorted 348 samples of which 269 (94
bear, 3 bobcat, 120 coyote, 52 wolf) were analyzed. We identified plant seeds, fawn hooves and hair, unknown feathers and bones, ruffed grouse feathers and feet, snails, and adult deer hair in scats. Analysis of scat is ongoing.

Vegetation Surveys

We quantified vegetation structure, composition, and density at 2 random sites. Random locations were chosen using a generalized random tessellation stratified (GRTS) design that was stratified by habitat classifications. For each location of interest (e.g., mortality site) a random site was randomly chosen from the list of GRTS sampled locations.

Alternate Prey, Carnivore, and Deer Data

This quarter, we recorded 149 alternate prey and deer observations including 90 white-tailed deer, 14 ring-necked pheasants (*Phasianus colchicus*), 15 ruffed grouse (*Bonasa umbellus*), 29 squirrels (*Tamiasciurus spp.*, *Glaucomys spp.*, *Sciurus spp.*), and 1 porcupine (*Erethizon dorsatum*).

Public Outreach

*Workshops:*


*Popular Articles:*


Website

We continue to update the project website (www.fwrc.msstate.edu/carnivore/predatorprey) with images and pertinent information. The website received 356,213 visits in 2010 (equivalent to 975 visits per day or about one visit every 40 seconds). Quarterly and annual progress reports posted on the website were downloaded 13,814 times in 2010 (equivalent to 38 downloads per day).

Project Crew Selection and Hires

We posted an announcement for 4 seasonal wildlife technicians on the Texas A&M job board in early–October and closed the announcement on 19 November. Fifty–two applications were received, evaluated, and scored. We hired 4 individuals for the winter field season:
   Alec Nelson
   Caitlin Ott-Conn
   Nika Levikov
   Meghan Harrigan

Publications


Work to be completed (Mar–May):

Gear Organization, Inventory, and Storage

We will inventory and repair Clover traps before placing in storage (Cusino Wildlife Research Station) at the end of winter. We will similarly organize, inventory, and store all deer trapping and immobilization gear that will not be used until winter 2012.
Radiotelemetry

We will continue to monitor all radiocollared deer ≥1 weekly. Beginning mid-May, we will locate adult females and fawns radiocollared in 2011 twice-daily until 30 d post-parturition to monitor VIT tag expulsion (as available) and obtain locations. After the 30 d post-parturition period we will monitor all deer ≥3 times weekly.

Fawn Capture and Radiocollaring

We will locate radiocollared fawns ≥3 times/week through August, after which they will be located ≥1 time/week. We will investigate mortalities as soon as practical after detecting a mortality signal to determine cause of death. In addition, we will record fawn observations to assist in estimating the temporal range of fawning and twinning rates. Finally, we will monitor and occasionally flush collared fawns to observe whether a sibling is present and estimate the twinning rate.

Carnivore Trapping and Radiocollaring

We will conduct wolf, bobcat, and coyote capture during March–May; black bear trapping will begin in late–April or early–May and continue until about mid–June. We will use Tomahawk and California box traps and #3 Victor soft-catch foothold traps for bobcats; cable neck-restraints, and #3 Victor soft-catch traps to capture coyotes; and MB 750 footholds to capture wolves. We will capture black bears using barrel traps. We will fit captured animals with a GPS collar, uniquely numbered ear tags, obtain weights, determine sex, and evaluate for injury. We will take various morphometric measurements along with blood, hair, fecal, and saliva samples. We will estimate body condition and extract a vestigial premolar to estimate age.

Cluster Investigation

We will initiate investigations of carnivore cluster locations in early–May to obtain information on predation events.

Vegetation Surveys

We will collect vegetation and habitat data at cluster locations, fawn birth site locations, predation sites, carnivore cluster locations and randomly selected predator locations beginning early–May.

Project Staff

We intend to hire up to 10 seasonal wildlife technicians for summer field work.
Carnivore Scat Collection

We will continue to collect scats of focal carnivore species opportunistically throughout the study area for diet analyses. We will record date, GPS location, and species for each scat collected.

Alternative Prey and Deer Observations

We will continue to record daily start and end times in the field, as well as locations and time for each deer and alternative prey species observed. These data will provide an index of relative abundance of alternative prey and deer across the study area.

Public Outreach

We will continue to provide project presentations to the general public, university classes, and interested clubs or organizations. Presentations requested for the next quarter include:
- Menominee Rotary Club, 8 March
- Safari Club Foundation – Northwoods Chapter, April 16
- Wildlife Unlimited of Delta County, 19 May

Protocols and Manuals

All protocols and manuals are in final revision.

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Wildlife Unlimited of Delta County
Karen Brasher – Mississippi State University, Publications Editor/Web Designer
Participating Upper Peninsula landowners
Heather Stricker
Alban Guillaumet
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- Alec Nelson
- NikaLevikov
- Meghan Harrigan
- Caitlin Ott-Conn
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Nick Vinciguerra / Rhonda Houk / Jarrod Hammerly
Julie Jarvey / Christina Rasanen / Karina Lamy
Tanya Wolf / Kevin Smith / Chad Corroy
Lacey Kreiensieck

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Literature Cited:


Table 1. Mean ($\bar{x}$) and standard deviation (SD) of 39 captured adult ($n = 35$), yearling ($n = 3$), and fawn ($n = 1$) female white-tailed deer morphometrics and body condition estimates, Upper Peninsula of Michigan, USA, December 2010–February 2011.

<table>
<thead>
<tr>
<th>Age Class</th>
<th>Adults $\bar{x} \pm SD$</th>
<th>Yearlings $\bar{x} \pm SD$</th>
<th>Fawn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body Weight (kg)</td>
<td>79.3 ± 12.0</td>
<td>51.0 ± 5.2</td>
<td>45.0</td>
</tr>
<tr>
<td>Body Length (cm)</td>
<td>149.8 ± 9.9</td>
<td>125.8 ± 3.8</td>
<td>128.8</td>
</tr>
<tr>
<td>Total Length (cm)</td>
<td>173.3 ± 9.1</td>
<td>152.2 ± 6.2</td>
<td>149.2</td>
</tr>
<tr>
<td>Chest Girth (cm)</td>
<td>91.8 ± 8.1</td>
<td>81.0 ± 3.9</td>
<td>80.3</td>
</tr>
<tr>
<td>Neck Circumference (cm)</td>
<td>38.3 ± 3.1</td>
<td>33.9 ± 3.1</td>
<td>32.1</td>
</tr>
<tr>
<td>Hind Foot (cm)</td>
<td>47.4 ± 2.0</td>
<td>45.4 ± 2.2</td>
<td>43.8</td>
</tr>
<tr>
<td>Tail Length (cm)</td>
<td>23.8 ± 5.2</td>
<td>26.4 ± 3.5</td>
<td>20.4</td>
</tr>
<tr>
<td>Head Length (cm)</td>
<td>32.5 ± 1.4</td>
<td>27.5 ± 1.4</td>
<td>27.6</td>
</tr>
<tr>
<td>Ear Length (cm)</td>
<td>15.5 ± 0.8</td>
<td>14.6 ± 0.5</td>
<td>15.3</td>
</tr>
<tr>
<td>BCS ¹</td>
<td>3.1 ± 0.4</td>
<td>3.0 ± 0.3</td>
<td>3.0</td>
</tr>
<tr>
<td>MIDF ² (cm)</td>
<td>0.6 ± 0.4</td>
<td>0.4 ± 0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>MAXF ³ (cm)</td>
<td>1.1 ± 0.4</td>
<td>0.6 ± 0.2</td>
<td>1.0</td>
</tr>
</tbody>
</table>

¹ Body Condition Score (BCS) for does derived from palpating the scapula, spinal column, rump, and rib cage.
² Maximum rump fat estimate measured above ishial tuberosity of right hind hip.
³ Middle rump fat estimate measured at mid-point between Ilium and ishial tuberosity on right hip.
Table 2. Den check data for 19 black bears, Delta and Menominee counties, Upper Peninsula of Michigan, USA, 17 December 2010–28 February 2011.

<table>
<thead>
<tr>
<th>Species</th>
<th>ID</th>
<th>Capture Date</th>
<th>Age¹</th>
<th>Sex</th>
<th>Body Weight (kg)</th>
<th>Right ear tag</th>
<th>Left ear tag</th>
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</thead>
<tbody>
<tr>
<td>Black bear</td>
<td>BB44</td>
<td>17 Dec 10</td>
<td>Adult</td>
<td>Male</td>
<td>145.1</td>
<td>143</td>
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<td>Black bear</td>
<td>BB28</td>
<td>15 Jan 11</td>
<td>Adult</td>
<td>Male</td>
<td>140.6</td>
<td>1110</td>
<td>100</td>
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<td>Black bear</td>
<td>BB33</td>
<td>21 Jan 11</td>
<td>Adult</td>
<td>Male</td>
<td>99.8</td>
<td>98</td>
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<td>BB16</td>
<td>10 Feb 11</td>
<td>6</td>
<td>Female</td>
<td>N/A</td>
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<td>83</td>
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<td>Black bear</td>
<td>BB25</td>
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<td>Yearling from BB16</td>
<td>Female</td>
<td>20.4</td>
<td>91</td>
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<tr>
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<td>BB26</td>
<td>10 Feb 11</td>
<td>Yearling from BB16</td>
<td>Male</td>
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<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Black bear</td>
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<td>Yearling from BB16</td>
<td>Female</td>
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<td>80</td>
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<td>Black bear</td>
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<td>Female</td>
<td>24.9</td>
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<td>95</td>
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<td>Female</td>
<td>20.4</td>
<td>97</td>
<td>147</td>
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<td>BB24</td>
<td>11 Feb 11</td>
<td>Yearling from BB14</td>
<td>Female</td>
<td>20.4</td>
<td>148</td>
<td>149</td>
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<tr>
<td>Black bear</td>
<td>BB32</td>
<td>17 Feb 11</td>
<td>Adult</td>
<td>Female</td>
<td>70.3</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>Black bear</td>
<td>BB47</td>
<td>17 Feb 11</td>
<td>Cub from BB32</td>
<td>Male</td>
<td>1.4</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
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<td>BB48</td>
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<td>Female</td>
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</tr>
<tr>
<td>Black bear</td>
<td>BB08</td>
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<td>9</td>
<td>Female</td>
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<td>2.0</td>
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<td>1.4</td>
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</table>

¹ Ages were estimated using tooth analyses by the Michigan Department of Natural Resources and Environment.
Figure 1. White-tailed deer Clover trap locations, Upper Peninsula of Michigan, USA, 17 December 2010–27 February 2011.
Figure 2. Neonate fawn (white), female (blue), and male (yellow) white-tailed deer ear tags, Upper Peninsula of Michigan, USA, 2011.
Figure 3. Bobcat hair snare sites ($n = 44$) within a 2.5 km$^2$ grid, Menominee County, Upper Peninsula of Michigan, USA, January–February 2011.
Figure 4. Baited snare site (top) and hair sample captured (bottom) using a modified body snare, Upper Peninsula of Michigan, USA, January–February 2011.
Figure 5. Estimated summer 2009–2010 wolf pack areas based on GPS data from 5 collared individuals. Track locations from January–February 2011 surveys, Upper Peninsula of Michigan, USA.