

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

Progress Report - 1 October–31 December 2009

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**Abstract** – During this quarter 195 radiolocations were collected from 22 deer fawns (*Odocoileus virginianus*) and a total of 1,134 locations were collected from 48 radiocollared fawns in 2009. Three (14%) of 21 fawn predations in 2009 occurred this quarter. Two hundred twenty-three radiolocations were collected from 23 does during this quarter and 1,543 radiolocations were collected from 36 does in 2009. One (25%) of 4 predations in 2009 occurred this quarter. Two bobcat (*Lynx rufus*), 6 coyote (*Canis latrans*), and 2 wolf (*Canis lupus*) GPS collars were recovered this quarter. A total of 26,856 GPS locations were collected on carnivores this quarter and 209,842 GPS locations have been collected on carnivores in 2009. Two black bears were immobilized in dens during December to replace GPS collars. One male and one female yearling black bear were captured in a den and fitted with VHF radiocollars. Thirteen beaver caches were identified throughout the study area during aerial surveys. One male wolf was illegally killed. Forty-four bait stations were established during December for carnivore hair snare surveys that will be initiated in January 2010.

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## Summary

- During this quarter 195 radiolocations were collected from 22 deer fawns; 1,134 locations were collected from all fawns from capture to 30 December 2009.
- Three radiocollared fawn predations occurred during this quarter; overall, 44% of fawns (21 of 48) were predated in 2009, with coyotes and bobcats the leading predators.
- During this quarter 223 radiolocations were collected from 23 does; 1,543 locations were collected from all does from capture to 30 December 2009.
- One radiocollared doe mortality occurred this quarter and 4 occurred during 2009.
- Carnivore monitoring continued, with 26,856 locations obtained this quarter and 209,842 obtained in 2009.
- No bobcats or coyotes were legally harvested; 5 black bears were legally harvested during the hunting season and one bear was wounded by a hunter.
- One wolf (W02) was illegally killed on 28 November 2009.
- Two black bears (1 male, 1 female) were immobilized in their dens on 12 and 14 December, respectively, and had their collars replaced.
- Beaver cache survey flights during November identified 13 beaver cache sites.
- Bait sites for carnivore hair snares ( $n = 44$ ) were selected and pre-baited this quarter, hair snares will be set in January 2010.
- Vegetation surveys were conducted at 2 predation and 9 random sites during this quarter, 386 were completed in 2009.
- In 2009, 2746 alternative prey observations were recorded.
- Project personnel gave several presentations and collaborated on several mass media project articles and interviews designated for the public and wildlife management sector.
- Activities next quarter will include deer capture, bobcat and coyote capture, carnivore hair snare survey, track surveys, and bear den checks.
- Public relations and communication strategy efforts will continue next quarter, with several presentations already scheduled.

## **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 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, coyote, bobcat, and wolf 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 if familiarity of an area to each predator species affects the likelihood of fawn predation.
6. Estimate if minimum composite bear, coyote, bobcat, and wolf use of an area influences fawn predation rates.
7. Describe association between fawn birth site habitat characteristics and black bear, coyote, bobcat, or wolf habitat use.

## **Study Area:**

This overall study area is about 870 km<sup>2</sup> (~340 mi<sup>2</sup>) within Deer Management Unit (DMU) 055 in Menominee County. 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. DMU 055 was selected because of the relatively low snowfall and generally low winter severity. Deer in this area are largely non-migratory, making direct comparisons to southern Michigan (i.e., Pusateri Burroughs et al. 2006) easier.

## **Accomplishments:**

### Fawn Monitoring

During this quarter 195 radiolocations were collected from 22 deer fawns. Fawn radiolocations were attempted  $\leq 2$  times weekly during the quarter. A total of 1,134 locations have been collected from all fawns combined from capture to 30 December 2009 (Figure 1). Mean number of fawn locations was 23 (range = 1–51). Repeated relocation attempts of 2 fawns has been unsuccessful, presumably due to radiocollar malfunctions within a week of capture.

### Fawn Mortality

Three (14%) of 21 fawn predations in 2009 occurred during this quarter. In 2009, predation ( $n = 21$ ; Figure 1) accounted for 72% of fawn mortalities ( $n = 29$ ), including 10 males, 8 females, and 2 unknowns. Twenty-nine fawn mortalities have occurred from capture to 30 December 2009. Total fawn mortality was 60% of radiocollared fawns ( $n = 48$ ). Unknowns were due to predation before detection and no indication of sex. Sex was not determined because one fawn was predated by coyotes (*Canis latrans*)  $\leq 8$  h of parturition and another was still born and malformed; neither were radiocollared. Coyotes and bobcats (*Lynx rufus*) were the greatest sources of fawn predation (Table

1). Forty-four percent of radiocollared fawns were predated. Fawn predations were greatest during June, with the peak of parturition estimated around 1 June.

### Doe Monitoring

Two hundred twenty-three radiolocations were collected from 23 does during this quarter. A total of 1,543 locations (Figure 2) were collected from all radiocollared does from capture to 30 December 2009. Doe radiolocations were attempted  $\leq 2$  times weekly during this quarter. Mean number of doe locations were 43 (range = 1–83). Repeated relocation attempts of 2 does have been unsuccessful, presumably due to radiocollar malfunctions shortly after capture.

### Doe Mortality

One (25%) of 4 predations in 2009 occurred during this quarter. Site evidence (i.e., scat and carcass) suggested a black bear predated the doe on 1 November 2009. Twelve doe mortalities have occurred from capture to 30 December 2009. Total doe mortality was 33% of radiocollared does ( $n = 36$ ). Predation ( $n = 4$ ) accounted for 33% of radiocollared doe mortalities and 11% of all radiocollared does in 2009. Two predations were by coyotes, 1 by wolves, and 1 by a black bear (Table 2).

### Carnivore Monitoring

A total of 26,856 GPS locations were collected on carnivores this quarter and 209,842 GPS locations have been collected on carnivores in 2009. All bobcat, coyote and wolf collars include a drop-off mechanism programmed to release collars 30 weeks after deployment. This quarter, 2 bobcat, 6 coyote, and 2 wolf GPS collars have been recovered from the study area after successfully being discharged from the animal. This quarter bobcats have worn active collars from 61-73 consecutive days (mean = 67, SD = 8) resulting in 203-211 locations per individual (mean = 207, SD = 6). To date, bobcats have worn active collars from 39-211 consecutive days (mean = 154, SD = 99) resulting in 2469-9543 locations per individual (mean = 6390, SD = 3599; Tables 3, 4). One male bobcat (BC03) has not been located since 16 June despite extensive aerial searches. No bobcats were harvested or killed during the fall trapping season. This quarter coyotes have worn active collars from 61-92 consecutive days (mean = 76, SD = 11) resulting in 166-271 locations per individual (mean = 213, SD = 41). To date, coyotes have worn active collars from 29-211 consecutive days (mean = 178, SD = 68) resulting in 1037-9641 locations per individual (mean = 7770, SD = 2722). Two female coyotes (C03, C08) have not been located since 22 June and 7 October, respectively, despite multiple aerial searches. No coyotes were harvested or killed during the fall trapping and hunting seasons. This quarter wolves have worn active collars from 59-61 consecutive days (mean = 60, SD = 1) resulting in 178-184 locations per individual (mean = 181, SD = 4). To date, wolves have worn active collars from 209-211 consecutive days (mean = 210, SD = 1), resulting in 6880-7041 locations per individual (mean = 6961, SD = 114). One male wolf (W02) was illegally taken on 28 November. This quarter, 7 GPS collars have been recovered from black bears. This quarter all GPS collared black bears have worn active collars 92 consecutive days (mean = 92, SD = 0) resulting in 4133-5841 locations per individual (mean = 4918, SD = 655). To date, black bears have worn active collars from 30-163 consecutive days (mean = 99, SD = 43), resulting in 2735-13892 locations per individual (mean = 8816, SD = 3721; Table 3, 4). Five black bears (3 female, 2 male) were harvested during the fall hunting season and one male black bear was wounded by a hunter.

### Black Bear Den Checks

Two black bears (1 male, 1 female) were immobilized in their dens on 12 and 14 December, respectively, and had their GPS collars replaced. Black bears were immobilized, weighed, and multiple morphometric measurements recorded. Collars were programmed to obtain a GPS location every 35 hours until 1 May and then every 15 minutes. Immobilized bears were placed back into their respective dens for recovery. Female black bear (BB08) had 3 yearlings in the den. Two yearlings (1 male, 1 female) were immobilized, injected with a Passive Integrated Transponder (PIT) tag, received a VHF radiocollar, and placed back in the den. One yearling was not captured.

### Beaver Survey

On 5 and 12 November, aerial flights were conducted throughout the study area to detect fresh beaver caches. Flights were conducted at an altitude of 150-300 m. A total of 712 km of rivers and streams were aerially searched. Thirteen active beaver caches were located. Beaver cache data provides an index of beaver abundance within the study area.

### Carnivore Abundance Surveys

Protocols and data sheets for winter snow track surveys and hair snare surveys were developed during the last quarter and are pending final edits. Winter snow track and hair snare surveys will target and record sign (i.e., tracks and hair) of bobcat, coyote, and wolf.

In December, we contacted local individuals and agencies for bait collection, including venison processors, US Postal Service carriers, and local county road commissions. Bait is being used for attracting bobcats and coyotes to hair snares sites. We secured >20 skinned beaver carcasses from a local trapper. We also collected road-killed deer carcasses (~15) during October-December, as well as deer carcass offal, bones, and hides from local venison processors during the 2009 deer hunting season.

Bait sites for hair snares ( $n = 44$ ) were selected this quarter (Figure 3) and were pre-baited on 17-18 December 2009. Baits were affixed to trees using wire to prevent removal by animals. Hair snares ( $n = 164$ ; Figure 4) were assembled and will be placed at bait sites in January 2010.

A grant for genetic testing samples collected from hair snares was written and submitted to Wildlife Unlimited of Delta County. Wildlife Unlimited approved the grant and agreed to fund \$1500 for bobcat and coyote hair snare work. The group is currently working with other wildlife and hunt groups to fund an additional \$1500.

### Scat Collection

Carnivore scats are collected opportunistically throughout the study area, labeled by date, species, and UTM coordinates, and frozen. No scat samples were collected this past quarter. To date, 362 scat samples consisting of 103 bear scats, 12 bobcat scats, 143 coyote scats, 59 wolf scats, and 45 unknown scats have been collected. Preliminary scat examination identified plant seeds, fawn hooves and hair, unknown feathers and bones, ruffed grouse feathers and feet, snails, and adult deer hair. Samples were sent to Mississippi State University, Carnivore Ecology Laboratory and are

currently being cleaned and sorted. This quarter, 77 scat samples have been cleaned, dried and prepared for analysis. Scats will be analyzed for presence of prey species (e.g., deer fawn) hair and other dietary items (e.g., berries and corn).

### Vegetation Surveys

Eleven surveys quantifying vegetation structure, composition, and density were conducted at 2 predation and 9 random sites during this quarter. In 2009, surveys were completed at fawn predation sites ( $n = 18$ ), VIT tag sites ( $n = 23$ ), predator cluster and non-cluster locations ( $n = 260$ ) as well as random locations ( $n = 85$ ). Vegetation data will be used to estimate if event locations (e.g., birth sites, predation sites) differ in structural vegetation characteristics. For example, fawn birth site locations may occur in areas with increased vegetation structure to provide greater cover and reduce predation risk. Conversely, fawn predation sites may occur in areas with reduced vegetation structure that increases predation risk. Vegetation survey data have been compiled and is currently being analyzed.

### Alternative Prey and Deer Data

Alternative prey and deer observations were recorded (i.e., species, location, time) daily by project personnel to provide an index of relative abundance within the study area. Daily start and end times were also recorded by each individual to determine time afield. Six alternative prey records were recorded during the quarter. As of 30 December, 2746 observations have been recorded.

### Public Outreach

Numerous outreach efforts were conducted for the project including:

- Project meetings with area sportsmen groups:
  - Wildlife Unlimited Meeting and Presentation on 4 December, 2009
- Presentations and mass media:
  - 5 project-related posters were presented at the 2009 annual meeting of the Mississippi chapter of The Wildlife Society in Jackson, Mississippi on 2 October, 2009.
    1. “White-tailed deer survival, reproduction, and condition in the Upper Peninsula of Michigan” – Jared Duquette
    2. “Resource selection by carnivores and white-tailed deer in Michigan’s Upper Peninsula” – Nathan Svoboda
    3. “Linking individual resource use to biological outcomes and population management” – Chris Ayers
    4. “Estimating population size of bobcats in Michigan’s Upper Peninsula” – Heather Stricker
    5. “Estimating Coyote and Gray Wolf Abundance Using Howl Surveys in Michigan's Upper Peninsula” – Tyler Petroelje

To improve our outreach efforts we are developing a communication strategy with the assistance of Dr. James Cantrill, Department Head, Communication and Performance Studies, Northern

Michigan University. In order to improve communication and the transparency of our research results, Dr. Cantrill and his student will hold focus group meetings with several stakeholder groups to acquire feedback as to how we can most effectively communicate the results and management implications of this research to a broader public. The information will also be used to guide our future outreach efforts, as well as encourage further public cooperation with the project. Four hundred project brochures describing research goals and activities have been distributed, five hundred additional brochures have been ordered. The project website is completed (<http://fwrc.msstate.edu/carnivore/predatorprey/>) and updated with current photos and results.

### Project Crew Selection and Hires

Four project intermittent employees were hired for winter field work and will begin employment in early January.

- 1) Chad Corroy
- 2) Lacey Kreienseck
- 3) Kevin Smith
- 4) Rebekah Karsch

### **Work to be completed (January–March):**

#### Winter Deer Capture

Deer trapping will begin 17 January and initially be focused within the core study area. We plan to progressively trap toward the agricultural areas to the north and west of the core study area. Our goal is to capture and radio collar 50 pregnant does.

#### Den Checks

Five den checks (2 male, 3 female) will take place in February. Project personnel will remove GPS radiocollars and replace them with fully charged collars. All animals (except cubs) will be immobilized, weighed, assessed for body condition, and re-collared. Cubs will be weighed, assessed for body condition, and injected with a PIT tag.

#### Carnivore Abundance Surveys

If snow conditions are suitable, a minimum of 18 winter track surveys will be completed to assess carnivore (bobcat, coyote, wolf) abundance in the study area during the next quarter. The study area has been divided into 6 zones, and each zone will be assessed a minimum of 3 times. Other sign (tracks, raised-leg urinations, etc.) will also be recorded as encountered. Carnivore hair snares targeting bobcats and coyotes will be deployed during January 2010 to estimate abundance. Snares will be checked weekly for 6-8 weeks and samples sent to the Michigan Department of Natural Resources in Lansing, MI for genetic analysis.

#### Winter Bobcat and Coyote Trapping



Bobcat and coyote trapping will begin in early February and be focused in suitable habitat and in areas where recent activity (i.e., tracks and hair) has been observed. Bobcats will be captured in cage traps baited with pieces of collected beaver carcasses and commercial call lure. Coyotes will be captured using cable neck restraints. Captured individuals will be immobilized and receive GPS collars.

### Carnivore Scat Collection

Project staff will continue to collect scat samples of focal carnivore species opportunistically throughout the study area. Staff will record date, GPS location, and species for each scat collected for analysis. Samples will be evaluated to estimate diet of each carnivore species throughout the year.

### Alternative Prey and Deer Data

Project personnel will continue to record their daily start and end times in the field, as well as coordinates 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

The project brochure will be updated with preliminary results, printed, and distributed. Additionally, we will continue to work with Dr. James Cantrill, Department Head, Communications and Performance Studies, Northern Michigan University to develop a communication strategy to improve our outreach efforts. Several presentations with various user groups are already scheduled for January-March.

### Protocols and Manuals

Project protocols and manuals will continue to be updated.

### Vegetation Surveys

Surveys quantifying vegetation structure, composition, and density will be conducted at all predation and random locations throughout the study area.

### **Acknowledgements:**

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- Wildlife Unlimited
- Participating Upper Peninsula landowners
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Justin Edge – Michigan Department of Natural Resources

Gordy Zuehlke (Air 3) – Michigan Department of Natural Resources

Neil Harri (Air 1) – Michigan Department of Natural Resources

Dr. Dan O’Brian – Michigan Department of Natural Resources

Dr. Dwayne Etter – Michigan Department of Natural Resources

Dr. Pat Lederle – Michigan Department of Natural Resources

Brian Roell – Michigan Department of Natural Resources

Monica Joseph – Michigan Department of Natural Resources

Bob Doepker – Michigan Department of Natural Resources

Kurt Hogue – Michigan Department of Natural Resources

Bill Rollo – Michigan Department of Natural Resources

Jason Peterson – Michigan Department of Natural Resources

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Bob Steinmetz

Dan Kirschner

Kevin Swille and family

Marvin Parrett

Viau’s Market, Escanaba, MI.

Michigan Meat Processors, Inc.

Table 1. Radiocollared fawn mortality sources from capture–30 December 2009, Upper Peninsula of Michigan.

Mortality Source	No. Occurred
Coyote	8
Bobcat	6
Abandoned suspected	4
Unknown predator	3
Vehicle	2
Black bear	2
Bald eagle	1
Unknown canid	1
Unknown	1
Still born	1

Table 2. Radiocollared doe mortality sources from capture–30 December 2009, Upper Peninsula of Michigan.

Mortality Source	No. Occurred
Capture related	5
Coyote	2
Black bear	1
Wolf	1
Vehicle collision	1
Drowned	1
Collar related	1

Table 3. Monitoring data for 26 radiocollared carnivores, Upper Peninsula of Michigan, 2 May 2009–1 January 2010.

Species	n	Number of days monitored			Number of locations		
		mean	SD	range	mean	SD	range
Black bear <sup>1</sup>	12	99	43	30-163	8816	3721	2735-13892
Bobcat <sup>2</sup>	3	154	99	39-211	6390	3599	2469-9543
Coyote <sup>3,4</sup>	9	178	68	29-211	7770	2722	1037-9641
Wolf	2	210	1	209-211	6961	114	6880-7041

<sup>1</sup> Data does not include 3 bears with VHF collars or bear (BB02) that slipped GPS collar after 12 days

<sup>2</sup> Bobcat BC03 has not been located since last downloaded on 16 Jun

<sup>3</sup> Coyote CO3 locations were last downloaded on 5 June: GPS battery is no longer working

<sup>4</sup> Coyote C08 locations were last downloaded 1 Sep 09; collar is no longer sending GPS locations remotely

Table 4. Capture and monitoring data for 31 radiocollared carnivores, Upper Peninsula of Michigan, 2 May 2009–1 January 2010.

<i>Species</i>	<i>ID</i>	<i>Capture Date</i>	<i>Age</i>	<i>Sex</i>	<i>Weight (kg)</i>	<i>Ear Tag #'s</i>	<i>Days Monitored</i>	<i>Locations</i> <sup>1,2,3</sup>	<i>Collar Status/Interval</i>
Black bear	BB01	9-Jun-09	Adult	M	145.5	75/76	45	4245	Slipped Collar; 24 Jul 09
Black bear	BB02	21-Jun-09	Adult	M	NA	63/NA	12	994	Slipped Collar; 2 Jul 09
Black bear	BB03	21-Jun-09	Juvenile	F	23.0	55/56	93	8609	Harvested; 21 Sep 09
Black bear	BB04	23-Jun-09	Adult	M	140.9	57/NA	163	13892	Replaced Collar 12 Dec 09
Black bear	BB05	29-Jun-09	Adult	M	79.5	59/60	84	7806	Harvested; 20 Sep 09
Black bear	BB06	30-Jun-09	Adult	F	88.6	61/62	81	7410	Harvested; 18 Sep 09
Black bear	BB07	1-Jul-09	Adult	M	208.7	64/65	67	6078	Slipped Collar; 5 Sep 09
Black bear	BB08	11-Jul-09	Adult	F	83.9	11/12	146	12957	Replaced Collar 14 Dec 09
Black bear	BB09	12-Jul-09	Adult	M	93.0	66/67	145	13257	Active/15 min <sup>4</sup>
Black bear	BB10	12-Jul-09	Juvenile	F	72.3	68/69	30	2735	Slipped Collar; 10 Aug 09
Black bear	BB11	19-Jul-09	Juvenile	F	74.8	70/71	71	6485	Harvested; 27 Sep 09
Black bear	BB12	21-Jul-09	Adult	F	99.8	72/73	136	12719	Active/15 min
Black bear	BB13	23-Jul-09	Adult	M	131.5	77/78	7	7	Harvested; 8 Aug 09
Black bear	BB14	4-Aug-09	Adult	F	68.0	79/80	122	9598	Active/15 min
Black bear	BB15	8-Aug-09	Adult	M	104.3	81/82	15	15	Active/VHF
Black bear	BB16	9-Aug-09	Adult	F	79.4	83/84	15	15	Active/VHF
Bobcat	BC01	4-May-09	Adult	M	12.7	47/48	211	7158	Collar Retrieved
Bobcat	BC02	5-May-09	Juvenile	F	6.6	38/39	NA	NA	NA
Bobcat <sup>1</sup>	BC03	9-May-09	Adult	M	NA	1/2	39	2469	Unable to locate
Bobcat	BC04	16-May-09	Adult	M	10.9	26/27	211	9543	Collar Retrieved
Coyote	C01	4-May-09	Adult	F	14.5	45/46	211	7192	Collar Retrieved
Coyote	C02	5-May-09	Adult	F	10.9	13/14	211	7189	Collar Retrieved
Coyote <sup>2</sup>	C03	8-May-09	Adult	F	12.3	40/41	29	1037	Unable to locate
Coyote	C04	20-May-09	Adult	M	14.3	51/52	211	9573	Collar Retrieved
Coyote	C05	21-May-09	Adult	F	11.4	53/54	211	9641	Collar Retrieved
Coyote	C06	22-May-09	Adult	F	11.8	30/31	211	9523	Collar Retrieved
Coyote	C07	23-May-09	Adult	M	12.5	21/33	211	9433	Active/8 hr
Coyote	C08	31-May-09	Adult	F	10.7	3/4	94	8596	Unable to locate
Coyote	C09	5-Jun-09	Adult	F	NA	NA/NA	211	7745	Collar Retrieved
Wolf	W01	2-May-09	Adult	F	30.5	553/554	211	6880	Collar Retrieved
Wolf	W02	4-May-09	Adult	M	42.3	555/556	209	7041	Collar Retrieved

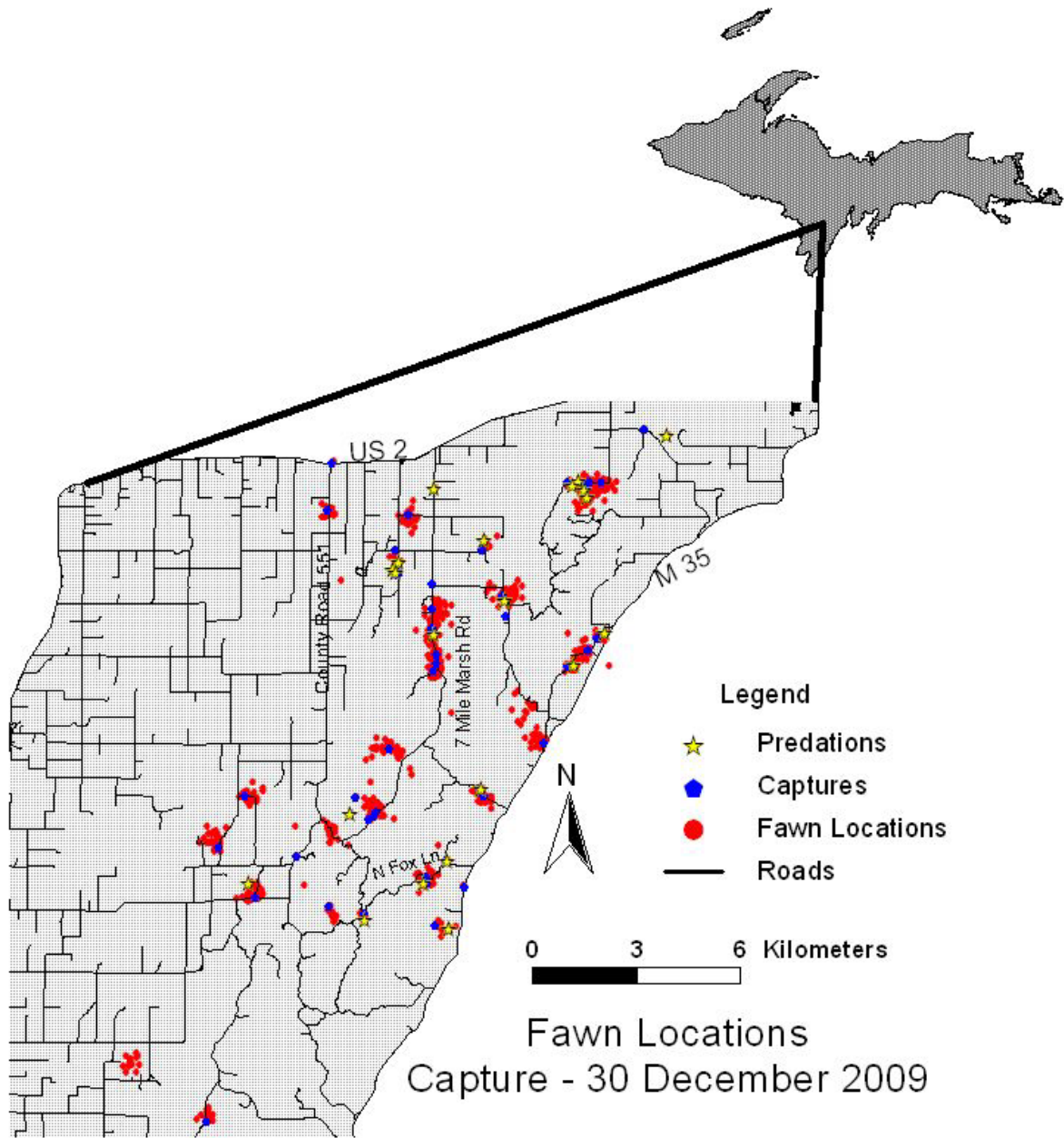
<sup>1</sup> Bobcat BC03 locations were last downloaded on 16 Jun and has not been located since

<sup>2</sup> Coyote C03 locations were last downloaded on 5 June; GPS battery is no longer working

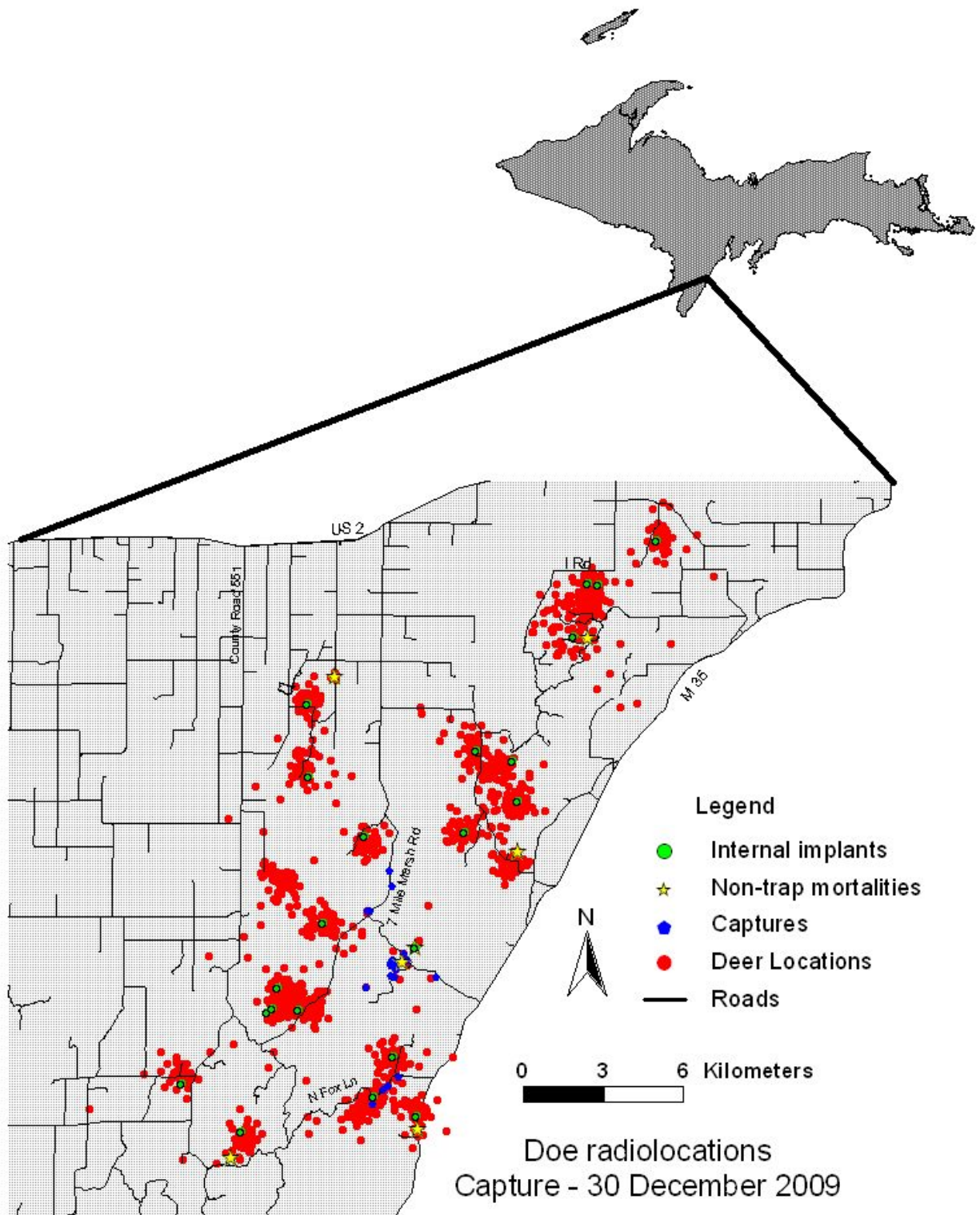
<sup>3</sup> Black bears BB13, BB15, BB16 were collared with VHF collars only

<sup>4</sup> Black Bear BB09 was wounded by rifle hunter on 15 Sep

<sup>5</sup> Coyote C08 locations were last downloaded 1 Sep 09; collar is in maintenance mode and is no longer capable of sending GPS locations remotely



*Figure 1.* Radiocollared fawn capture, predation, and radiolocations from capture–30 December 2009, Upper Peninsula of Michigan.



*Figure 2.* Radiocollared doe capture, internal implant drop, non-trap related mortality, and radiolocations from capture–30 December 2009, Upper Peninsula of Michigan.



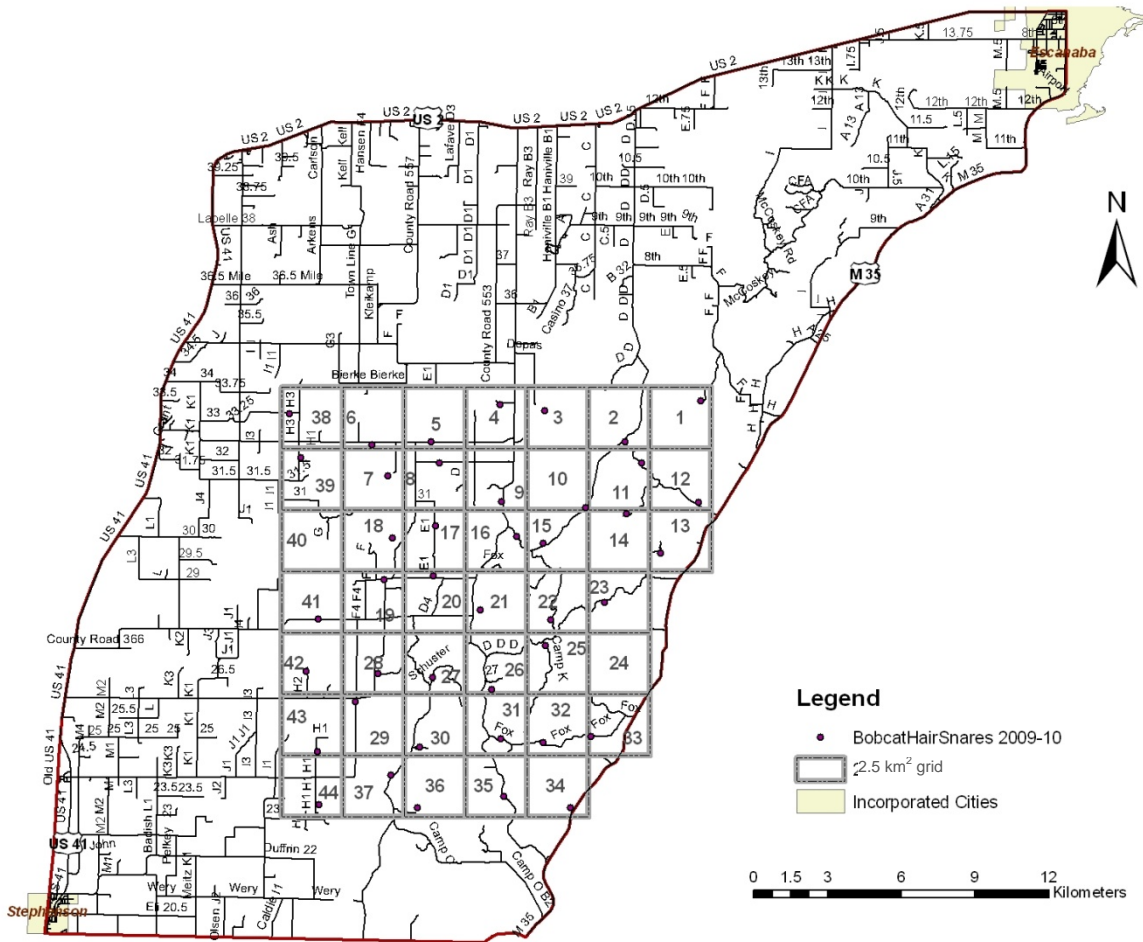


Figure 3. Carnivore hair snare sites within 2.5 km<sup>2</sup> grid cells, Upper Peninsula of Michigan.

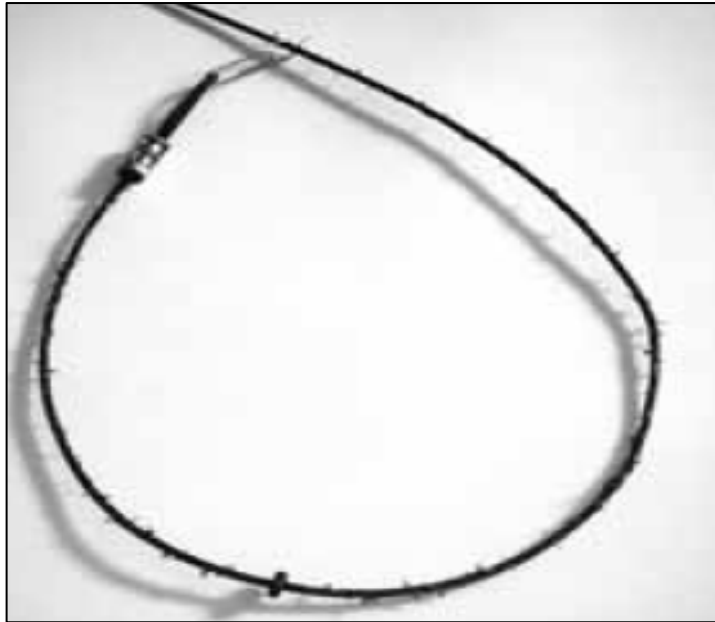


Figure 4. Modified body snare for hair sample collection (from DePue and Ben-David 2008).