PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
PROJECT ANNUAL JOB REPORT

PROJECT CODE NO.: 06210

TITLE: White-tailed Deer Research/Management

JOB CODE NO.: 21019

TITLE: Fawn survival and mortality causes in relation to predator populations

PERIOD COVERED: 1 July 2014 through 30 June 2015

COOPERATING AGENCIES: Pennsylvania Cooperative Fish and Wildlife Research Unit, Pennsylvania State University; and Department of Conservation of Natural Resources, Bureau of Forestry

WORK LOCATION(S): Susquehannock State Forest, Potter County; Bald Eagle State Forest, Mifflin and Union counties; and Rothrock State Forest, Centre, Huntingdon, and Mifflin counties.

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DATE: 30 June 2015

ABSTRACT In November 2014, staff was directed to conduct a study on fawn survival and mortality in relation to predator populations. To increase likelihood of detecting early mortalities, vaginal implant transmitters (VITs) were deployed in adult female white-tailed deer during March and April 2015. We monitored 7 VITs and captured 5 fawns from adult females with VITs. In addition, we captured 37 fawns via road and foot searches. As of 30 June 2015, 11 of the 42 fawns have died. To estimate black bear abundance where fawn monitoring was occurring, we overlaid each study area with a 5 km^2 grid pattern and systematically began trapping black bear for marking, with the intent of using mark-recapture models to estimate abundance. As of 30 June, 34 bears had been captured 41 times in 252 trap-nights. Similarly, to estimate relative abundance and spatial occurrence of other mid-sized predators, trail cameras were deployed using the same grid pattern. As of 30 June, approximately two-thirds of the study areas had been sampled for 14 days and pictures of bobcat, coyote, and fisher confirmed. We also wrote 13 articles on various topics related to this study and posted them on the Deer-Forest Blog hosted by The Pennsylvania State University. Many of these articles were cross-posted on PGC social media sites.

OBJECTIVES

1. Estimate fawn survival

2. Determine mortality causes

3. Identify species, sex, and individual identity of predators that consume fawns

4. Estimate relative abundance of black bear, bobcat, coyote, and fisher

5. Compare relative predator abundance and observed predator mortalities

6. Effectively communicate activities and results to the public

METHODS

Fawn Capture, Survival, and Mortality Causes

During the fawning season (May-June), newborn fawns were captured using 2 methods. Adult females fitted with radio-collars and vaginal implant transmitters (VITs) the previous winter will be monitored to detect parturition and capture of newborn fawns (Kilgo et al 2012). We also captured fawns by searching the immediate area where non-transmittered females are observed displaying maternal behavior similar to how fawns were captured previously in Pennsylvania (Vreeland et al. 2004).

Captured fawns were fitted with expandable radio collars and monitored daily until death, transmitter failure, or mid-August. When a radio collar indicateed mortality, the fawn was located and carcass collected and frozen until a complete necropsy was performed. Predation will be assigned only when bite wounds accompanied by hemorrhaging are present (White 1973, Garner et al. 1976, Kilgo et al. 2012). When predation is evident, we will attempt to collect DNA for identification of predator species following procedures described by Kilgo et al. (2012). Survival analyses will follow procedures in Vreeland et al. (2004).

Measuring Relative Predator Abundance

A contiguous grid of 5 km^2 cells was overlaid on each of the 3 study areas where fawns were captured (Susquehannock, Rothrock, and Bald Eagle State Forests). To estimate bear abundance, we grouped cells into blocks of 4, and selected 12 blocks per study area that maximized coverage (Fig. 1).

We randomly selected 1 cell from each block and set a barrel-style trap within the cell using existing roads for access. Traps were baited with waste pastries and checked daily for 7 consecutive days. After 7 days, traps were removed for 12 to 14 days and the process repeated using new cells (1 per block) randomly selected from unused cells. In the Rothrock and Susquehannock study areas, cell selection and associated trapping was repeated a third time. Trapping began 27 May and ended 18 August.

We marked each captured bear with uniquely numbered metal ear tags in each ear. Bears also were weighed, tattooed on the inside upper lip, and a first premolar tooth extracted for age determination. We collected blood samples from all bears, and archived DNA using FTA cards.

During the fall bear hunting season, successful hunters were required to present their bear for inspection at an agency-operated check station within 24 hours of harvest, where we recorded sex, age, harvest location, and ear tag and tattoo information.

We used bears captured in traps as a marked sample and bears killed during the hunting season as a recapture sample to estimate bear abundance in each study area using the unbiased Lincoln-Petersen equation (Seber 1982). Bears with ear tags from previous years were treated as unmarked unless recaptured in the current year to reduce the effects of tag loss, dispersal, and undetected mortality.

To estimate relative abundance and spatial occurrence of other mid-sized predators (e.g., bobcat, coyote, fisher), we selected 50 cells and placed a trail-camera within each cell using existing roads. Trail cameras were placed approximately 1 m above the ground and directed at lures (bobcat urine, Gusto® trapping lure, and synthetic fatty acid scent wafer) placed approximately 2 m in front of the camera. At a subsample of camera sites, lures were placed in the center of a 1 m diameter circle of finely sifted dirt 3 cm deep; otherwise, lures were placed directly on the ground in an area cleared of stem vegetation. In both cases, lures were replenished after each rainfall event.

We removed cameras after 14 days and placed them in 50 new cells 12 to 14 days later, repeating for a third time if necessary until all cells intersecting the study area had been sampled. Photos collected by the cameras were reviewed on a laptop computer and the date, time, species, and location of any deer or predator seen recorded.

Public Communications

Since this study was initiated to address public questions and concerns, it is important to the success of this study to effectively communicate activities and results to the public. We chose posting of short articles on an existing deer research site (The Deer-Forest Blog, http://ecosystems.psu.edu/research/projects/deer) established by the Pennsylvania Cooperative Fish and Wildlife Research Unit and Game Commission (PGC) social media sites (i.e., Facebook, Twitter, etc.).

RESULTS

Fawn Capture, Survival, and Mortality Causes

A total of 42 fawns (5 from VITs, 37 without VITs) were captured between May 15 and June 16, 2015 (Table 1). As fawning season approached, we had 7 adult females with VITs that resulted in 5 captured fawns.

To date, 11 fawns have died and 5 have been censored due to slipped collars. Causes of mortality will be determined following complete necropsies (Table 2).

Measuring Relative Predator Abundance

We maintained bear traps for 14 days in the Rothrock study area, and 7 days in the Susquehannock study area for a total of 252 trap-nights. Thirty-four bears were captured 41 times (Table 3).

Public Communications

We posted 13 study-related articles on the Deer-Forest Blog (Table 4). Many of these also were cross-posted on PGC social media sites.

RECOMMENDATIONS

1. Complete necropsies on all mortalities.

2. Monitor fawn survival and movements through December 2017.

3. Expand winter deer capture locations to increase likelihood of deploying all VIT transmitters prior to the 2016 fawning period.

4. Expand fawn capture search areas beyond state forest boundary in 2016 and 2017.

5. Continue public communication efforts via the Deer-Forest Blog and PGC social media outlets.

6. Collect coordinate locations for bears harvested from townships intersecting study areas in order to explore use of spatially explicit capture-recapture models.

7. Continue marking bears using an annual goal of 250 trap-nights per study area.

LITERATURE CITED

Garner, G. W., J. A. Morrison, and J. C. Lewis. 1976. Mortality of white-tailed deer fawns in the Wichita Mountains, Oklahoma. *Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies* 30:493-506.

Kilgo, J. C., H. S. Ray, M. Vukovich, M. J. Goode, and C. Ruth. 2012. Predation by coyotes on white-tailed deer neonates in South Carolina. *The Journal of Wildlife Management* 76:1420-1430.

Seber, G. A. F. 1982. The estimation of animal abundance and related parameters. Second edition. Griffin, London, England.

Vreeland, J. K., D. R. Diefenbach, and B. D. Wallingford. 2004. Survival rates, mortality causes, and habitats of Pennsylvania white-tailed deer fawns. *Wildlife Society Bulletin* 32:542-553.

White, M. 1973. Description of remains of deer fawns killed by coyotes. *Journal of Mammalogy* 54:291-293.

Table 1. Adult females with VITS, fawns captured from adult females with VITs and fawns captured without use of VITS, May – June 2015, Susquehannock State Forest and Rothrock and Bald Eagle state forests, Pennsylvania. An adult is classified as an animal 1.5 years old or older.

Study Area	Adult females with VITs	Fawns captured from VIT females	Fawns captured without VITs	Total fawn captures
Susquehannock	5	4	20	24
Bald Eagle/Rothrock	2	1	15	18
Total	7	5	35	42

Table 2. Number of fawn mortalities and censors, May – June 2015, Susquehannock State Forest and Rothrock and Bald Eagle state forests, Pennsylvania.

Study Area	Mortality	Censored[1]	Total
Susquehannock	7	4	11
Bald Eagle/Rothrock	4	1	5
Total	11	5	16

[1] – Fawns were censored because of slipped collars, malfunctioning collars, etc.

Table 3. Number of black bears captured and marked, May–June 2015, Susquehannock and Rothrock state forests, Pennsylvania. Trapping results occurring after 30 June, including in the Bald Eagle state forest, are not reported.

Study Area	Trapping Dates	Trap Nights (12 traps/night)	Number of Bear Marked	Number of Recaptures	Total Captures
Susquehannock	23−30 June	84	14	4	18
Rothrock	27 May−3 June	84	11	0	11
Rothrock	23−30 June	84	9	3	12
Total		252	34	7	41

Table 4. Summary of public communications on fawn survival study posted on the Deer-Forest Blog, July 2014 – June 2015.

Date	**Title**	**Authors**
25 June	Decoding the pattern	J. Fleegle
21 June	The race is over – fawn capture update	C. Rosenberry and J. Fleegle
19 June	My, what big ears you have!	C. Rosenberry
12 June	Cooler Critters	J. Fleegle
4 June	Fawns on the run	A. Sperfslage, bio aide
2 June	Winning the 50-yard dash	J. Fleegle
27 May	Fun in the field – 2	J. Fleegle
21 May	Fun in the field	J. Fleegle
18 May	First fawn capture	D. Diefenbach
16 May	Get the cigars ready	J. Fleegle
13 May	Find anything cool?	J. Fleegle
5 May	DEER! – Don't touch that baby	J. Fleegle
25 March	Applying new technology…in the field	K. Wellington, bio aide

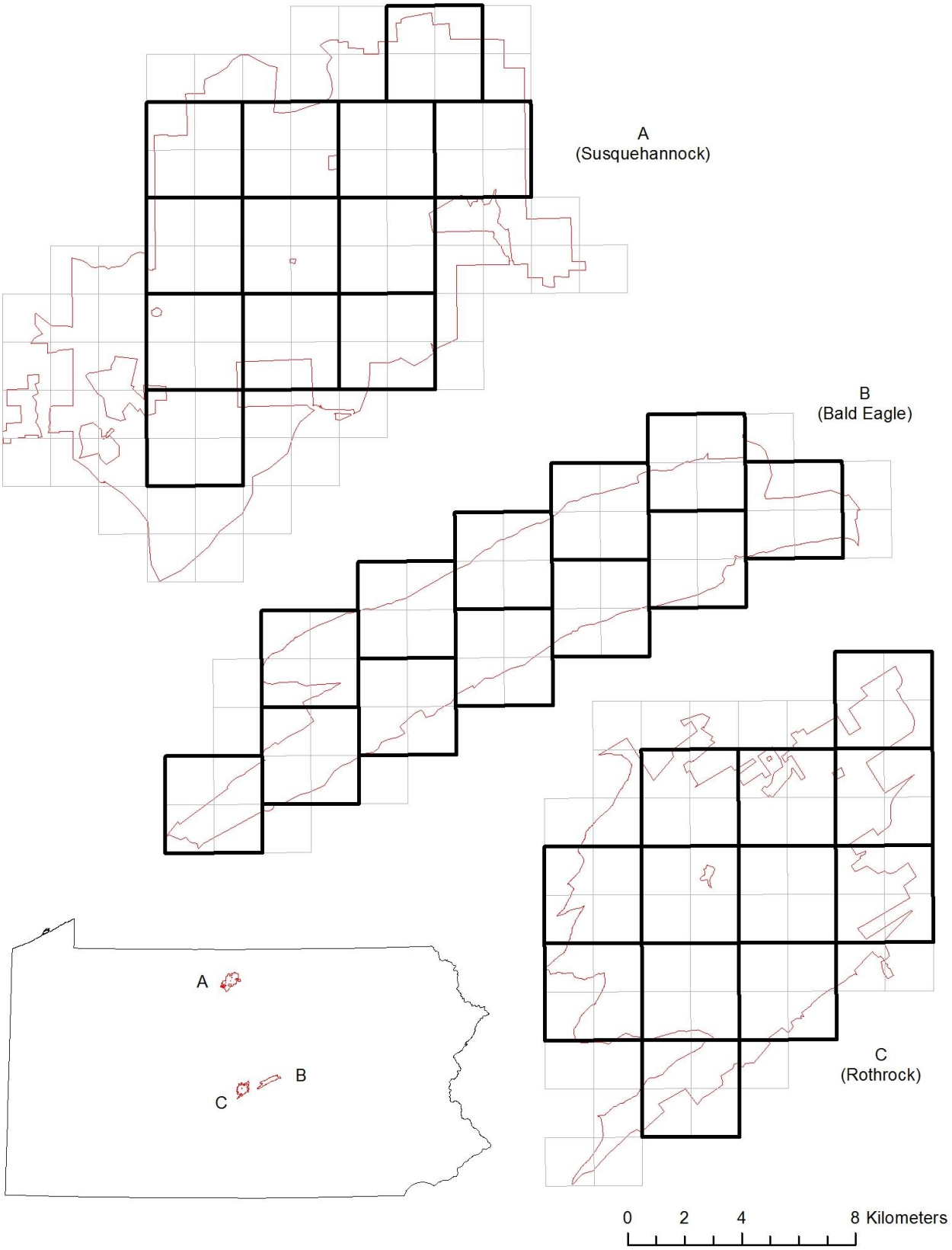

Figure 1. Sampling grids (5 km^2 cells) used to assess relative predator abundance on 3 study areas in the Susquehannock, Bald Eagle, and Rothrock state forests.