PENNSYLVANIA GAME COMMISSION
BUREAU OF WILDLIFE MANAGEMENT
RESEARCH DIVISION
PROJECT ANNUAL JOB REPORT

PROJECT CODE NO.: 06210

TITLE: White-tailed Deer Research/Management

PROJECT JOB NO.: 21010

TITLE: Survival and Response to Hunting Activity of Female White-tailed Deer.

PERIOD COVERED: 1 July 2004 through 30 June 2005

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

WORK LOCATION(S): Wildlife Management Units (WMUs) 2G and 4B

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DATE: 1 July 2005

Abstract: We captured and attached radio transmitters to 123 female white-tailed deer (*Odocoileus virginianus*) to monitor their survival and dispersal in Pennsylvania. Ninety-one (28 fawns and 63 adults) and 57 (33 fawns and 24 adults) female deer were captured in WMUs 2G and 4B, respectively. As of 30 June 2005, 10 females in WMU 2G and 5 females in WMU 4B had died. Telemetry data continues to be collected.

OBJECTIVES

1) Estimate female survival and mortality causes.

2) Quantify effect of variables on survival.

3) Estimate female dispersal.

4) Estimate density and distribution of hunters on 2 study areas.

5) Monitor home ranges and movements of antlerless deer on these study areas to determine the response of deer to hunting-related activities.

6) Determine if specific environmental factors are related to whether an antlerless deer is harvested by a hunter (e.g., proximity to area closed to hunting, distance from road, etc.).

METHODS

Northern and southern study areas were located in (WMUs) 2G and 4B. Study areas were anchored on the Sproul and Tuscarora State Forests. These WMUs represented 2 of 5 physiographic units within the WMU system and thus provide broad coverage of Pennsylvania. In general, the study WMUs can be characterized as:

Wildlife Management Unit (WMU) 2G is a heavily forested area that experiences high snow fall with a relatively low deer population that exhibits low productivity.

Wildlife Management Unit (WMU) 4B is a ridge and Valley area with a mix of forested ridges and agricultural valleys with a high density deer population that exhibits high productivity.

Based on deer, habitat, and human-related characteristics, the study area WMUs were selected to represent larger groups of WMUs across Pennsylvania.

Study activities will commence on state forests lands on each study area. Over the course of the study, the study area will expand out from state forests. In the first year of deer capture, most deer capture activities will occur in state forests to ensure adequate numbers of marked deer for hunting-related objectives (4-6). In following years, capture activities will expand out into other areas to increase variability of survival covariates, thus improving biological inference of the relationship between survival and covariates (Steury et al. 2002).

We used drop nets (Conner et al. 1987), rocket nets, and modified Clover traps (Clover 1954, McCullough 1975) baited with corn to capture deer. Deer captured using drop-nets and rocket nets were sedated with a light, intramuscular (IM) dose of xylazine hydrochloride (XYL), and face-masked. XYL was delivered via hand syringe at about 0.6 mg/kg body weight, or about 20 mg for a fawn, 30 mg for a yearling, and 40 mg for an adult. These dosages were well below the dosage recommended by Bubenik (1982) for immobilization of white-tailed deer using xylazine alone; complete sedation was not required to facilitate handling deer tangled in the nets. Deer captured with Clover traps were manually restrained and face-masked.

After capture, all deer were fitted with an ear tag in each ear. All suitable female deer were fitted with standard VHF radiocollars that use microchip technology to indicate time of mortality (if it occurs), and released at the capture site. Fourteen deer were fitted with GPS radiocollars that will obtain detailed movement (e.g., bi-hourly locations) information during the hunting season. Handling protocols were approved by the Pennsylvania State University (PSU) Institutional Animal Care and Use Committee.

Deer held with manual restraints (by personnel or hobbling) were immediately released after individual markers were applied. Chemical immobilizations were antagonized with IM injections of tolazoline hydrochloride (TOL; 4.0 mg/kg) because it provides a more consistent antagonism of xylazine than yohimbine hydrochloride (Kreeger 1996).

Survival and locations of radio-collared deer were monitored at varying intervals throughout the year. During capture periods, deer survival was monitored at least once per week. Following capture periods, we collected at least 2 locations per deer per week. Telemetry effort depended on availability of personnel (e.g., biologist aides and graduate student).

Mortalities were investigated within a day or 2 of detection. Field examinations to determine cause of death were performed when possible; however, if cause of death was uncertain and the carcass was in suitable condition, animals were taken to the Animal Diagnostics Laboratory at Penn State University for a complete necropsy.

Non-hunting survival of white-tailed deer may be influenced by numerous covariates, such as winter severity, condition of deer, age of deer, predation, and human-related factors such as road density. To assess effect of these covariates on non-hunting survival of female white-tailed deer, measurements of

these variables for home ranges of individual deer will be modeled in relation to the deer's survival using logistic regression (Hosmer and Lemeshow 1989). Home ranges will be estimated using Kernal methods. Recommended sample sizes of locations of at least 30 locations per animal (Seaman et al. 1999) may not be logistically possible with personnel funding available. As a result, a subset of radio-collared deer may be located at least twice a week throughout the non-capture period. For radio-collared deer without sufficient home range sample sizes, including deer that die prior to accumulation of at least 30 locations, we will create circular buffers within which habitat characteristics will be assessed. These buffers may be based on the median home range sizes of the subset of radio-collared deer for each study area (Vreeland et al. 2004). To quantify the relationship between covariates and deer survival, a series of candidate models containing likely combination of covariates will be developed with the best model(s)chosen using AIC methods (Burnham and Anderson 1998).

Dispersal will be estimated for deer captured as fawns (<1 year of age). Home range locations established prior to 1 year of age will serve as the natal range from which dispersal will be measured. This definition of natal ranges is reasonable because dispersal rarely occurs in white-tailed deer prior to 1 year of age. Dispersal will be estimated similarly to survival using Kaplan-Meier staggered entry design (Pollock et al. 1989) with dispersal analogous to death.

Aerial surveys will be conducted during the regular rifle season to determine the density and distribution of hunters (Stedman et al. 2004, Diefenbach et al., in review). Fixed-wing aircraft will fly east-west transects across each study area, pending acceptable weather conditions, and observers will mark the locations of hunters on a tablet PC with a digital pen. All data will be geo-referenced and analyzed in a Geographic Information System. Hunter densities will be estimated using distance sampling methods (Buckland et al. 2001) and hunter distribution will be modeled with the Resource Selection Function approach developed by Manly et al. (2002).

Statistical models will be developed to estimate hunter density and distribution as described above, and the telemetry data will provide information on deer movements and home ranges. Models of hunter distribution from the aerial surveys and estimates of deer home ranges from telemetry data will be used to determine if deer with home ranges farther from roads (on public lands), or near areas closed to hunting (private lands) have lower harvest rates. In addition, the telemetry data from GPS radiocollars will be used to investigate deer movements in response to hunting pressure.

RESULTS

From January to April 2005, 238 white-tailed deer were captured (Table 1). Clover traps captured 52% of the deer followed by drop nets (38%), and rocket nets (10%).

In WMU 2G, 144 deer were captured on the Sproul State Forest, State Game Lands 100, and neighboring private lands. Seventy-five females were collared. As of 30 June 2005, 60 deer were being tracked.

In WMU 4B, 94 deer were captured on the Tuscarora State Forest. Forty-eight females were collared. As of 30 June 2005, 40 deer were being tracked.

To date, 15 mortalities have been recorded, 10 in WMU 2G and 5 in WMU 4B. Three of these deaths were directly related to capture, and 12 were due to other causes including possible vehicle collisions. Survival and movement data continue to be collected and have not been analyzed at this time.

RECOMMENDATIONS

1. Continue telemetry monitoring of survival and movements through at least December 2007.

2. Expand capture activities out from state forests for the 2006 winter trapping season.

3. Continue deer capture activities each winter through April 2007.

4. Conduct hunter survey flights during the 2005-06 regular firearms season on each study area.

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Table 1. White-tailed deer captures (totals including recaptures reported in parentheses) by sex and age class from January - April 2005 in WMUs 2G and 4B, Pennsylvania. An adult is classified as an animal 1.5 years old or older. Totals do not include 3 trapping-related mortalities.

	WMU		
Sex/age class	2G	4B	Total
Male adults	23 (7)	16 (0)	39 (7)
Male fawns	30 (3)	21 (5)	51 (8)
Female adults	63 (9)	24 (2)	87 (11)
Female fawns	28 (6)	33 (7)	61 (13)
Total	144 (25)	94 (14)	238 (39)