

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

PROJECT CODE NO.: 06250

TITLE: Elk Research/Management

JOB CODE NO.: 25001

TITLE: Elk Population Survey/Elk Harvest Management

PERIOD COVERED: 1 July 2004 to 30 June 2005

COOPERATING AGENCIES: Department of Conservation & Natural Resources, Bureau of Forestry (BOF) and Bureau of State Parks; Penn State Animal Diagnostics Laboratory, Pennsylvania State University, University Park, Pennsylvania.

WORK LOCATION(S): Cameron, Clearfield, Clinton, Elk, and Potter Counties

PREPARED BY: Jon M. DeBerti

DATE: 8 July 2005

Abstract: Elk (*Cervus elaphus*) marked with radio-collars were used to calculate a mark-resighting population estimator and to monitor elk range expansion. Personnel from the Pennsylvania Game Commission (PGC) and Department of Conservation and Natural Resources' Bureaus of Forestry and State Parks and volunteers conducted a fall 2003 and spring 2004 ground based elk survey. The population estimates resulting from fall 2004 was 477 (95% Confidence Interval 360-595). Known elk mortalities (30) were recorded 31 January 2004 through 31 January 2005. Elk-vehicle collisions (7) and crop-damage kills (6) were the leading causes of known elk mortality. Forty hunters participated in the 6-day elk season from 8-13 November 2004. Thirty-four elk (12 antlered and 22 antlerless) were harvested during the fourth elk season in 70 years. All elk tissue and blood samples tested for chronic wasting disease (CWD), tuberculosis, and brucellosis were negative. I recommend that we continue evaluating the new elk survey for the entire elk range and continue the elk check station to collect biological data and monitor herd health. Additionally, I recommend to continue monitoring cow reproduction and calf survival.

OBJECTIVE

To measure annual changes in demographic characteristics of the elk population, monitor herd distribution, and document elk harvest.

METHODS

As in previous years, elk ≥ 1 year old were captured and fitted with radiocollars (Advanced Telemetry Systems, Isanti, Minnesota, USA). Free-ranging elk were captured using a Pneu-Dart Cartridge (Pneu-Dart Inc., Williamsport, Pennsylvania, USA) dartgun and 1 cc Pneu-Darts. Carfentanil citrate (Wildlife Laboratories, Inc., Fort Collins, Colorado, USA) was used as the immobilizing drug and the antagonist was Naltrexone (Wildlife

Laboratories, Inc., Fort Collins, Colorado, USA). Elk were captured using 1 cc doses of Carfentanil citrate (3 mg/cc). Following processing, each elk received 1.25 cc of Naltrexone (50 mg/cc) intravenously and 3.75 cc subcutaneously.

Each captured adult elk was equipped with a numbered yellow radiotransmitter collar. Transmitters were at 150-151 MHz frequencies and powered by lithium batteries.

Population Survey

Since 1971, annual elk surveys have been used to monitor elk populations. Recent surveys provided 100% aerial coverage of the "Traditional" elk range permitting a population estimate based on Chapman's mark-recapture method (Chapman 1951). However, these annual surveys only provided a minimum number of elk residing in the "Expanded" range, not a population estimate. Elk residing in the expanded range were only counted if associated with radio-collared elk or if their location is known prior to the survey. Thus, the lack of a random sample in the "Expanded" range prevents calculation of population estimates.

To resolve this problem we focused on ground-based capture-recapture methods when identifying potential alternatives. After considering a number of alternatives, we identified Bowden's estimator (Bowden and Kufeld 1995) as a possible alternative (Rosenberry and DeBerti 2003).

Bowden's estimator is a unique variation of traditional capture-recapture methodology. In its basic form, the Bowden estimator divides the total number of animals sighted during a survey by the average number of sightings of marked animals to estimate the population. A favorable quality of Bowden's estimator is that animal sightings can occur within a less structured survey.

Assumptions of Bowden's estimator include: 1) each animal has an equal chance of being marked, 2) the number of times a marked animal is seen is recorded without error (i.e., marks are not lost), 3) sighting effort must be adequate enough to produce ≥ 1 sighting per marked animal and preferably many sightings of marked animals would occur, 4) sightings of unmarked animals are determined without error, 5) likelihood of sighting is independent of marked status, and 6) the population is closed to additions and removals.

There are 3 options for sighting effort. First, predetermined routes could be surveyed by assigned individuals. Second, personnel from the PGC and Bureau of Forestry personnel could be asked to record elk sightings during the course of everyday activities for a predetermined period of time. And finally, a combination of fixed routes and workday sightings could be used.

This survey will be conducted in phases until we find the best methodology that will provide the most repeatable and reliable results. In the fall of 2003, we conducted our first survey using this technique, using limited personnel from Wildlife Management, local WCOs, and LMOs. We used a combination of survey routes and opportunistic sightings. In the spring and fall of 2004 we expanded this effort to include PGC Food and Cover and DCNR (Forestry and Parks) personnel and increased the number of routes conducted.

Recruitment

Radio-collared cows will be monitored from May to August 2005 to determine calf production. Radio-collared cows were frequently to determine if they had calved. Date, age, location, and radio frequency were recorded for all initial sightings of radio-collared cows with a calf. To verify if a radio-collared cow produced a calf, the calf had to be observed nursing the cow or separated from other elk with a single calf. To determine elk calf survival, newborn calves were captured (without immobilization drugs) ≤ 5 days old and fitted with an expandable-breakaway radio-collar equipped with a mortality sensor (Advanced Telemetry Systems, Isanti, Minnesota). Observations of radio-collared cows and calves will continue throughout the next year to verify initial observations and monitor calf survival.

Mortalities

Known elk deaths were recorded from 31 January 2004 to 31 January 2005. Mortalities were recorded by cause, date of death, sex, age, and location for each elk. Field or laboratory necropsies were performed to determine cause of death, when appropriate.

Harvest

Commission personnel manned a check station in Quehanna Wild Area during the 6-day elk season from 8-13 November 2004; successful hunters were required to visit the check station within 24 hours of harvest. All elk were inspected, and a harvest report was completed. Sex, age, weight, antler and body measurements, harvest time and location, hunter information, and previous tagging information were recorded. A central incisor was removed for cementum age analysis. Blood samples were collected in the field by hunters for brucellosis testing. Tissue samples were collected for CWD and tuberculosis.

RESULTS

Population Surveys

This fall (13 September to 8 October), personnel from the Bureau of Wildlife Management, DCNR, and North Central Region conducted the first full effort of the new elk population survey. A total of 25 survey routes were designated across the entire elk range. Opportunistic sightings were also included in calculations.

Seventy-seven survey routes were completed. In addition, 97 opportunistic sightings were included. A total of 1043 (79 marked, 964 unmarked) were observed. There were 40 marked and numbered elk available.

The population estimate resulting from the fall 2004 survey was 477 (95% Confidence Interval 360 - 595). Average number of sightings per marked elk was 1.975.

We are pleased with the results of the new survey; however, we still have some areas that we need to mark animals to better represent the entire population and need to remove/replace the unnumbered transmitters with numbered collars. Furthermore, we need to assign more routes to even out sightings. This should increase precision of estimate.

Based on this result and its comparison with previous years (Figure 1), we are encouraged that it may provide an effective alternative to the current aerial survey.

Recruitment

To measure calf survival, project personnel (with assistance from Food and Cover personnel, local LMO and WCO, DCNR personnel, and deer project personnel) captured 20 newborn calves and equipped them with expandable-breakaway collars with mortality sensors during the 2005 calving season. One collar was shed and all others are living to date. Results of collared cow (n=31) reproduction are pending.

Mortality

I compiled records on 30 known elk mortalities (excluding legal harvest) from 31 January 2004 to 31 January 2005 (Table 1). Elk-vehicle collisions (7), crop damage kills (6), illegal harvests (5), accidental (2), and brainworm (2) were the leading causes of known elk mortality, which stayed the same from 2003 (30).

Harvest

Forty hunters participated in the 6-day elk season from 8-13 November 2003. Thirty-four hunters successfully harvested an elk. Twenty-two antlerless and 12 antlered elk were harvested in Elk, Cameron, and Clearfield Counties. Average dressed weight of cows was 356 lbs and 536 for bulls. Cementum aging analysis showed cows averaged 7.5 years old and 5.7 for bulls (Figure 2). We harvest one cow that was 20.5 years old. All elk tissue and blood samples tested for CWD, tuberculosis, and brucellosis were negative.

RECOMMENDATIONS

1. Continue to evaluate Bowden's estimator for conducting a ground based elk survey.
2. Monitor elk range expansion within the 835 mi² range using radiocollared elk.
3. Monitor movements of translocated nuisance elk using radiotelemetry via vehicle and aircraft.
4. Maintain the elk check station to collect biological data and continue disease testing of harvested elk.
5. Monitor collared newborn calves for survival and capture 20 calves and equip with expandable-breakaway collars equipped with mortality sensors during the 2006 and 2007 calving season.

Table 1. Causes and number of known elk mortalities by sex and age (yr) in Cameron, Clearfield, Clinton, and Elk Counties, Pennsylvania, 31 January 2004 to 31 January 2005.

| Cause | Males | | | Females | | | Unknown | Total |
|------------------------|-------|-------|----|---------|-------|----|---------|-------|
| | <1 | 1 - 2 | >2 | <1 | 1 - 2 | >2 | | |
| Crop Damage | | | 4 | | 1 | 1 | | 6 |
| Highway | 1 | | 2 | 2 | 1 | 1 | | 7 |
| Illegal | | | 2 | 1 | | 2 | | 5 |
| Unknown | 1 | 1 | | 1 | | | | 3 |
| Train | | | 1 | | | | | 1 |
| Accidental | | | 1 | 1 | | | | 2 |
| Brainworm ^a | | 1 | | | 1 | | | 2 |
| Other | | 1 | 2 | | | 1 | | 4 |
| Total | 2 | 3 | 12 | 5 | 3 | 5 | | 30 |

^aConfirmed by necropsy at Penn State University Animal Diagnostics Lab.

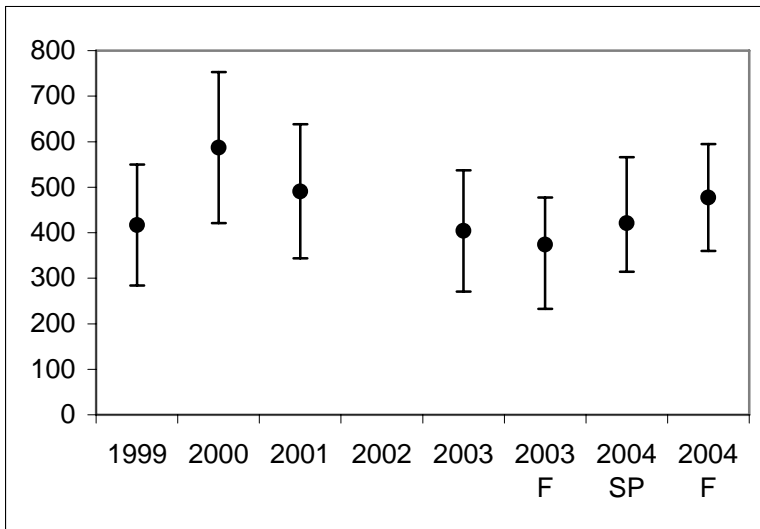


Figure 1. Elk population estimates and 95% confidence intervals from aerial and ground surveys, Pennsylvania, 1998-2004.

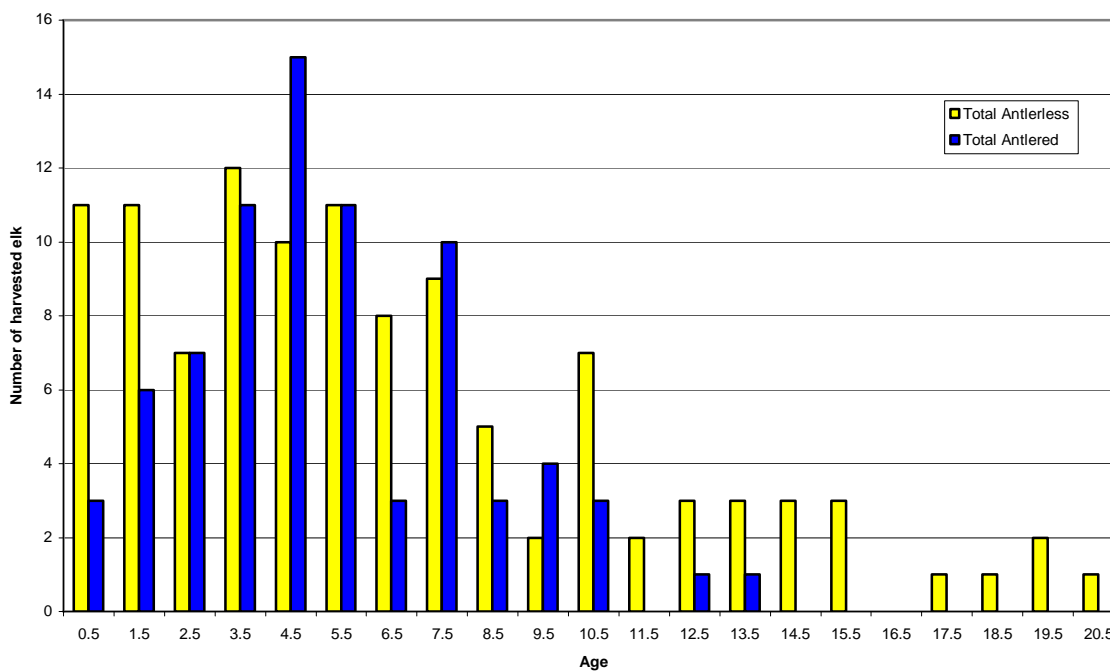


Figure 2. Age of harvested elk in Pennsylvania determined by cementum analysis from 2001-2004 (n=190).