

**Population Analysis for White-tailed Deer
in the Village of Cayuga Heights, New York**

May 2013

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Introduction

Many communities face overabundant populations of white-tailed deer (*Odocoileus virginianus*) in suburban areas and a concomitant increase in human-wildlife conflicts (DeNicola and Williams 2008, DeNicola et al. 2000, DeNicola et al. 2008). Knowing the abundance and distribution of white-tailed deer is important for making population management decisions, and estimates of population size before and after a management action is how the success of a management program is often judged (Lancia et al. 1994).

Camera-trapping has been recently used to estimate population size for big cats (Karanth and Nichols 1998) and free-ranging deer (Jacobsen et al. 1997, Koerth et al. 1997). This method has the advantage that physical “recapture” of animals is not needed to get reliable data to use with capture-recapture models. Curtis et al. (2009) documented that using infra-red triggered cameras and the program NOREMARK (White 1996) was a reliable method for estimating abundance of suburban white-tailed deer herds. Data gathered during earlier deer studies conducted in Cayuga Heights were used to validate this technique and models.

The capture and tagging of deer during December 2012 in the Village of Cayuga Heights provided a known, marked population of deer necessary for an abundance estimate using mark-recapture analyses (DeNicola 2012, Table 1). By conducting a photo survey with infrared-triggered cameras soon after the deer tagging and sterilization was completed, we are able to estimate herd size with good confidence in the results.

Methods

The Village of Cayuga Heights (1.8 square miles) was divided into 12 equally-sized sections by overlaying a grid of approximately 100-acre blocks over a map of the community.

Twelve infrared-triggered, digital cameras (Cuddeback, Non Typical, Inc. Green Bay, WI) were deployed over bait piles on properties with high probability of deer activity within each block. It was intended that each camera would “capture” a large sample of the deer population for that 100-acre block. In accordance with our NYSDEC permit, technicians were granted permission by each landowner before setting up the cameras and putting out bait for deer.

Camera sites were baited daily with approximately 14 pounds of dry, shelled corn for two days prior to the camera deployment on 4 January 2013. Once the cameras were operating, the bait was increased to as much as 30 pound per day at sites with higher deer activity and less than 14 pounds if there was bait left from the previous day. The short pre-baiting period was sufficient considering that the deer were acclimated to bait sites with corn for deer trapping less than one month prior to the camera survey, and the deer recognized the corn bait quickly. The cameras were set to run continuously for 24 hours per day, with a preset delay of 4 minutes between pictures. Every other day during the field survey, the memory cards in the cameras were changed so that technicians could confirm the cameras were functioning properly.

On 12 January 2013, the photo survey was completed, and cameras were removed. Technical difficulty with one of the cameras resulted in the loss of pictures for the first 3 days but enough pictures were taken in 5 days ($n = 3,764$ photos) with all 12 cameras functioning to run the statistical analysis for population estimation.

After the cameras were removed from the field, all the pictures containing deer were sorted by site and numbered. Each picture was then closely studied, and any legible ear tag number was recorded. We also recorded the total number of deer, the number of unmarked deer, and the number of unidentifiable marked deer for each photo. The number of bucks was recorded in each picture, but these data were not completely reliable, as some bucks had shed their antlers by early January. From these photographic data, the total number of times each identifiable, marked deer was observed was entered into the program NOREMARK (White 1996), along with the total number of unmarked deer, and the total number of marked deer known to be alive in the population during the survey.

In addition to program NOREMARK, we also experimented with hierarchical capture-recapture models (Royle and Young 2008, Gardner et al. 2009, Royle et al. 2009) that incorporate trap-site and camera-location data into the population estimate. These techniques use spatial information to include the likelihood of finding an animal in the population based on

animal movements associated with camera recaptures. These analysis methods include the GPS coordinates for wherever individuals are detected. This method may provide an improvement over previous techniques that provided only a single point estimate of abundance or density. While these spatially-explicit, capture-recapture (SECR) methods are computationally more intensive, they allow researchers and wildlife managers to identify and understand patterns, such as potentially associating hotspot areas of greater deer density with habitat, road, or housing densities.

Royle et al. (2009) developed SPACECAP, an SECR model developed in R programming, which is not only uses the photographic images and capture history, but also uses camera-trap location data to address the issues related to individual heterogeneity in estimating capture probabilities that is prevalent in the conventional capture-recapture analyses. We attempted to use the program SPACECAP to analyze camera-trap data for deer in the Village of Cayuga Heights, and compared results to those for program NOREMARK. This required completely reformatting the camera data with deer sightings, and creating 3 different input files to run SPACECAP. Once data were input, the program took approximately 10 hours to run the analysis and provide output information.

Results

The total number of marked deer that were identifiable in the pictures was 138. The total number of marked deer in the Village of Cayuga Heights used for analysis was 171 (Table 5). We adjusted this number to remove 2 marked deer that died before the photo survey was conducted, and then added 3 deer marked by Cornell University that were identified in pictures. For deer not seen in the camera survey, several were located and observed while tracking collared marked deer using radio-telemetry (Table 4). Therefore, those deer were known to be alive and in the Village during the photo survey. For deer that were not collared, and not moving with a radio-collared deer, it is impossible to know for certain if they were still in the community and alive. Because of this uncertainty, deer that were not photographed and found on the extreme edges of the village were identified (Tables 8 and 9). We decided to run the analysis 2 times; once with all the possible live deer included in the total, and once without deer living near the edge of the community.

Since deer capture and tagging were completed in December 2012, there have been 15 recorded deaths for marked deer (Tables 6 and 7). Seven of the deer died as a result of deer vehicle collisions. Two of the deaths were assumed to be caused by the complications of old age because those deer were trapped during earlier deer studies conducted in the Village, and both were at least 13 years old. Two deer dispersed from Cayuga Heights, and were legally killed by hunters on Cornell University lands. One deer died shortly after release, and this animal was presumed to have succumbed from complications associated with either capture or surgery. It was not possible to determine the cause of death for 3 deer because their carcasses were too decomposed.

Initial deer population estimates generated by program NOREMARK were conducted in two ways. The first population estimate ($n = 214$) and associated 95% confidence interval (201-227) include all deer known to be alive (via photo confirmation or radio-telemetry observations) in the area during the time of the survey (see Tables 8 and 9). The second population estimate ($n = 227$) and 95% confidence interval (213-242), includes an additional 10 deer likely to be alive in the community (Table 8), but that did not appear on photos during the camera survey. A reasonable estimate of deer abundance in Cayuga Heights based on these two analyses is 225 deer, or a density of approximately 125 deer per square mile.

The SECR model provided an unreliable estimate of deer abundance in the Village using spatial information based on the camera locations. SECR models utilize a binomial process (e.g., a marked deer is seen on a particular day, or not). Thus we lose all of the daily data we have (e.g., multiple pictures of a tagged deer at one or more camera stations in a given 24-hour period). Also, the SPACECAP model does not utilize unmarked deer whatsoever in the population estimate. After consultation with program developers, we determined that these issues with SECR models made them inappropriate for our deer photo dataset. The output from program NOREMARK will provide a reliable estimate of deer abundance as it has in the past.

Based on our photo survey and discussions with A. DeNicola concerning untagged female deer observed while trapping, we believe there may be 6 untagged, adult female deer in the community during early January 2013. These observations include: 1 doe near 109 Cayuga Heights Rd (with doe C112); 2 adult does in Palmer Woods; 1 doe with an unmarked fawn near south North Sunset Drive; 1 doe with an unmarked fawn near north North Sunset Drive; and a lame doe in the The Parkway/Upland Rd. area. It is impossible to know for certain if there are

more untagged, female deer in the Village, as it is sometimes difficult to distinguish button bucks from female deer. Also, a single untagged doe may appear at more than one camera location. If our estimate of 6 untagged adult female deer is correct, then approximately 95% of the breeding female deer in the Village were tagged, and 93% were surgically sterilized.

There were several tagged deer (Tables 8 and 9) that did not appear in any of the photos obtained from the infra-red triggered camera survey conducted during the January 4-12, 2013. Some of these deer were captured near the Village boundary (Table 9), and these deer may spend little time in the community. Other deer may have been reluctant to visit bait sites, as many were captured less than one month earlier at baited drop-net sites. Given the large number of pictures taken ($n = 3,764$ photos), these unobserved deer should not influence the population estimate.

Family groups of deer do occasionally enter or leave the Village. For example, a group of 4 deer (C105, C106, C107, and C108) tagged and sterilized after drop-net capture near Triphammer and Sheldon Roads, were observed on April 30, 2013, in a yard at 49 Turkey Hill Road. This was about 2.8 miles from their original capture site. It will be interesting to see if these deer return to the Village during peak fawning season in late May and early June.

Discussion

It is clear that deer are overabundant in the Village of Cayuga Heights based on homeowner complaints, vehicle collisions, and plant damage. More tagged deer were killed in vehicle collisions (46.7%, $n= 7$; Table 7) than for any other mortality factor. A few marked deer (13.3%, $n= 2$) wandered into areas open to hunting on Cornell lands. As long as mortality exceeds immigration and births, the deer population in Cayuga Heights will slowly decline. However, it is clear that a very low immigration and birth rate (e.g., 15-20 immigrants and new-born fawns) may keep the population stable for many years. Consequently, it will be extremely important to capture and sterilize any new or untagged female deer to maintain sterilization rates around 95% or higher over time. Population reduction will be very slow, and it may take 5 years or more to see a significant reduction in deer numbers.

If lethal removal of adult female deer can be implemented, the population will decline much more rapidly. The Village Board should consider alternatives and potential modification of their SEQR documents to include other methods for reducing the deer population more quickly. Currently, the primary form of deer removal in the community is via deer-vehicle

collisions. This has high cost and safety risks for motorists, and is an inhumane way to manage a deer herd. Professional, lethal control would be much more humane for the deer involved, and there is greater likelihood the deer would be fit for human consumption.

Continued monitoring of the deer herd via a survey with infra-red triggered cameras will be critical to document the impacts of the program. It will be important to clearly show whether the deer herd actually declines, and over what time frame significant differences are observed. It is clear from past deer-modeling studies (Merrill et. al. 2003, Merrill et. al. 2006) that immigration of female deer, and difficulty with capturing some adult females, may significantly reduce the success of a deer sterilization program.

Recommendations

Based on the current population analysis and knowledge of deer behavior, we make the following recommendations:

1. During summer, the DPW crew should watch for spotted fawns, and note their locations. That should help us focus follow-up trapping efforts in areas where reproducing female deer have established home ranges.
2. Continue to record locations of dead, tagged deer. The Village Police and DPW staff have been very helpful in providing us with information concerning known deer mortalities. This will help us with future population estimation.
3. Plan for follow-up deer trapping in fall and/or early winter. Trapping and sterilization efforts should focus on immigrant, untagged does, and female fawns. Discussions should occur with A. DeNicola, P. Curtis, and DEC staff (S. Joule, DEC Region 7, Cortland) to plan for follow-up deer capture efforts and LCP renewal.
4. Conduct a camera survey of deer in winter 2014. It will be important to monitor for any untagged female deer, and estimate deer abundance to determine the success of these research and management efforts. The deer camera survey should occur in the same time frame (January 2014), using the same camera locations, as much as possible.
5. Continue to pursue socially-acceptable options for deer removal. Additional deer mortality will be needed to lower deer abundance in a reasonable time frame. The Village Board should discuss and pursue additional management options to supplement the ongoing deer sterilization program.

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Table 1. Female deer captured, ear-tagged, and sterilized during December 2012 in Cayuga Heights, NY.

| Tag# | Capture Date | Age 12' | Radio Freq. | Previous Treatment | Treat 2012 | Capture Method | Comments |
|------|--------------|---------|-------------|--------------------|------------|----------------|----------------------|
| C01 | 12/1/2012 | A | | | OV | DN | Back Tag reads C101 |
| C02 | 12/1/2012 | F | | | OV | DN | Back Tag reads C102 |
| C03 | 12/1/2012 | 3.5 | | | OV | Dart | |
| C04 | 12/2/2012 | A | | | OV | DN | w/C08 and H18 |
| C05 | 12/2/2012 | A | | | OV | DN | |
| C06 | 12/2/2012 | F | | | OV | DN | |
| C07 | 12/2/2012 | F | | | OV | DN | |
| C08 | 12/2/2012 | 5.5 | | | OV | DN | w/C04 and H18 |
| C09 | 12/2/2012 | 3.5 | | | OV | DN | |
| C10 | 12/2/2012 | F | | | OV | DN | |
| C11 | 12/2/2012 | 4.5 | | | OV | DN | |
| C12 | 12/2/2012 | F | | | OV | DN | |
| C13 | 12/2/2012 | F | | | OV | DN | |
| C14 | 12/2/2012 | 5.5 | | | OV | DN | |
| C15 | 12/2/2012 | A | 151.523 | | OV | DN | w/C123, H06, H07 |
| C16 | 12/2/2012 | 4.5 | | | OV | Dart | |
| C17 | 12/2/2012 | 3.5 | | | OV | Dart | w/C19 |
| C18 | 12/2/2012 | F | | | OV | Dart | |
| C19 | 12/2/2012 | 1.5 | | | OV | Dart | w/C17 |
| C20 | 12/3/2012 | 6.5 | | | OV | Dart | |
| C21 | 12/3/2012 | 10+ | | | OV | Dart | w/H06 |
| C22 | 12/3/2012 | 2.5 | | | OV | Dart | |
| C23 | 12/3/2012 | A | | | OV | DN | w/C24, 25, 103 |
| C24 | 12/3/2012 | 2.5 | | | OV | DN | w/C23, 25, 103 |
| C25 | 12/3/2012 | 0.5 | | | OV | DN | w/C23, 24, 103 |
| C26 | 12/3/2012 | A | | | OV | DN | w/C72 |
| C27 | 12/3/2012 | 6.5 | | | OV | Dart | w/C53 |
| C28 | 12/3/2012 | 3.5 | 151.503 | | OV | Dart | w/C118 2bb C114 |
| C29 | 12/4/2012 | 3.5 | | | OV | Dart | w/C30-C33 and bb |
| C30 | 12/4/2012 | 3.5 | | | OV | Dart | w/C29, C31-C33, bb |
| C31 | 12/4/2012 | 1.5 | | | OV | Dart | w/C29, 30, 32, 33 bb |
| C32 | 12/4/2012 | F | | | OV | Dart | w/C29-C31, C33, bb |
| C33 | 12/4/2012 | F | | | OV | Dart | w/C29-C32 and bb |
| C34 | 12/4/2012 | A | | | OV | DN | w/H10 |
| C35 | 12/4/2012 | F | | | OV | DN | w/H10 |
| C36 | 12/4/2012 | A | | | OV | DN | |
| C37 | 12/4/2012 | A | | | OV | DN | w/bb |
| C38 | 12/4/2012 | 2.5 | | | OV | DN | |
| C39 | 12/4/2012 | 1.5 | | | OV | DN | |
| C40 | 12/4/2012 | F | | | OV | DN | |
| C41 | 12/4/2012 | 2.5 | | | OV | DN | |
| C42 | 12/4/2012 | 6.5 | | | OV | DN | |

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|-----|-----------|-----|---------|----|------|--------------------|
| C43 | 12/5/2012 | 4.5 | | OV | DN | |
| C44 | 12/5/2012 | 6.5 | | OV | DN | w/H16 |
| C45 | 12/5/2012 | 4.5 | 151.643 | OV | DN | w/C46, C47 H12 H01 |
| C46 | 12/5/2012 | 3.5 | | OV | DN | w/C45, C46 H12 H01 |
| C47 | 12/5/2012 | F | | OV | DN | w/C45, C47, H12 |
| C48 | 12/5/2012 | 2.5 | | OV | Dart | |
| C49 | 12/5/2012 | 1.5 | | OV | Dart | |
| C50 | 12/6/2012 | 2.5 | 151.302 | OV | Dart | w/C54 and C128 |
| C51 | 12/6/2012 | 1.5 | 151.623 | OV | Dart | w/C88 and C87 |
| C52 | 12/6/2012 | 4.5 | | OV | Dart | |
| C53 | 12/6/2012 | 2.5 | | OV | Dart | w/C27 |
| C54 | 12/6/2012 | 6.5 | | OV | Dart | 3 legs w/50W C128 |
| C55 | 12/6/2012 | 3.5 | 151.323 | OV | Dart | w/92 94 95 122 H26 |
| C56 | 12/6/2012 | 4.5 | | OV | DN | w/bb |
| C57 | 12/6/2012 | 8.5 | | OV | Dart | w/ 2 F |
| C58 | 12/7/2012 | 5.5 | 151.422 | OV | Dart | w/H19 and bb |
| C59 | 12/7/2012 | 4.5 | | OV | Dart | w/C83 and C109 |
| C60 | 12/7/2012 | 1.5 | 151.403 | OV | Dart | w/C84 |
| C61 | 12/7/2012 | 3.5 | | OV | Dart | w/C62, C127 |
| C62 | 12/7/2012 | 8.5 | 151.603 | OV | Dart | w/C61, C127 |
| C63 | 12/7/2012 | 1.5 | | OV | DN | w/C64 and H20 |
| C64 | 12/7/2012 | 3.5 | | OV | DN | w/C63 and H20 |
| C65 | 12/7/2012 | 6.5 | 151.363 | OV | DN | w/C66, C98 and H14 |
| C66 | 12/7/2012 | 6.5 | | OV | DN | w/C65, C98 and H14 |
| C67 | 12/7/2012 | 3.5 | | OV | Dart | w/H?? |
| C68 | 12/7/2012 | 5.5 | | OV | Dart | w/H15 and C78 |
| C69 | 12/7/2012 | F | | OV | Dart | w/C70 and bb |
| C70 | 12/7/2012 | 6.5 | | OV | Dart | w/C69 and bb |
| C71 | 12/7/2012 | 3.5 | | OV | Dart | w/unmarked bb |
| C72 | 12/8/2012 | F | | OV | Dart | w/C26 |
| C73 | 12/8/2012 | 3.5 | | OV | DN | w/C74 H24 C111, bb |
| C74 | 12/8/2012 | 4.5 | 151.443 | OV | DN | w/C73, H24 C111 bb |
| C75 | 12/8/2012 | 5.5 | | OV | Dart | Solo |
| C76 | 12/8/2012 | 2.5 | | OV | Dart | w/bb |
| C77 | 12/8/2012 | 4.5 | | OV | Dart | w/C79 |
| C78 | 12/8/2012 | F | | OV | Dart | w/C68 and H15 |
| C79 | 12/9/2012 | 3.5 | 151.382 | OV | Dart | w/C96 and C77 |
| C80 | 12/9/2012 | F | | OV | Dart | w/C81 and H21 |
| C81 | 12/9/2012 | 8.5 | | OV | Dart | w/C80 and H21 |
| C82 | 12/9/2012 | 3.5 | | OV | Dart | w/C60, C62, 2 bb |
| C83 | 12/9/2012 | F | | OV | Dart | w/C59, C109 |
| C84 | 12/9/2012 | 2.5 | | OV | Dart | w/C60 and C62 |
| C85 | 12/9/2012 | F | | OV | Dart | w/C20 and bb |
| C86 | 12/9/2012 | F | | OV | DN | w/H23, H30, H31 |
| C87 | 12/9/2012 | A | | OV | DN | w/C88 |

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|------|------------|-----|---------|----|------|------------------------|
| C88 | 12/9/2012 | F | | OV | DN | w/C87and C51 |
| C89 | 12/9/2012 | A | | OV | DN | w/C90 and C91 |
| C90 | 12/9/2012 | A | | OV | DN | w/C89 and C91 |
| C91 | 12/9/2012 | 2.5 | | OV | DN | w/C89 and C90 |
| C92 | 12/11/2012 | 1.5 | | OV | Dart | w/C55, C94, C95 122 |
| C93 | 12/11/2012 | 1.5 | 151.584 | OV | Dart | w/antlerless? |
| C94 | 12/11/2012 | 1.5 | | OV | Dart | w/C55, C92, C95 122 |
| C95 | 12/11/2012 | 1.5 | | OV | Dart | w/C55, C92, C94 122 |
| C96 | 12/11/2012 | 1.5 | | OV | Dart | w/C79 |
| C97 | 12/11/2012 | 1.5 | | OV | Dart | |
| C98 | 12/11/2012 | F | | OV | Dart | w/C65, C66 and H14 |
| C99 | 12/11/2012 | 2.5 | | OV | Dart | w/C100 |
| C100 | 12/11/2012 | F | | OV | Dart | w/C99 |
| C103 | 12/12/2012 | 3.5 | | OV | Dart | w/C23 |
| C105 | 12/12/2012 | 1.5 | | OV | DN | w/C106-108 |
| C106 | 12/12/2012 | F | | OV | DN | w/105,107, 108, 126 |
| C107 | 12/12/2012 | F | | OV | DN | w/105,106, 108, 124 |
| C108 | 12/12/2012 | 2.5 | 151.464 | OV | DN | w/C105 – 107 |
| C109 | 12/12/2012 | 3.5 | | OV | Dart | w/C59 |
| C111 | 12/12/2012 | F | | OV | Dart | w/C73, C74, H24, bb |
| C112 | 12/12/2012 | 5.5 | 151.483 | OV | Dart | w/H27, unmarked YF, bb |
| C113 | 12/13/2012 | F | | OV | Dart | w/C115, 116, 117 bb |
| C115 | 12/13/2012 | 3.5 | | OV | Dart | w/C113, 116, 117 bb |
| C116 | 12/13/2012 | 5.5 | | OV | Dart | w/C113, 115, 117 bb |
| C117 | 12/13/2012 | F | | OV | Dart | w/C113, 115, 116 bb |
| C118 | 12/13/2012 | F | | OV | Dart | w/C28 and 2bb |
| C119 | 12/13/2012 | 1.5 | | OV | Dart | |
| C120 | 12/13/2012 | 3.5 | | OV | Dart | w/C121 |
| C121 | 12/13/2012 | F | | OV | Dart | w/C120 |
| C122 | 12/13/2012 | F | | OV | Dart | w/C55, 92 94 95 H26 |
| C123 | 12/13/2012 | 2.5 | | OV | Dart | w/C15, H06, H07 |
| C124 | 12/14/2012 | 2.5 | | OV | Dart | w/C107 |
| C125 | 12/14/2012 | 3.5 | | OV | Dart | w/3 fawns |
| C126 | 12/14/2012 | 2.5 | | OV | Dart | w/C106 |
| C127 | 12/14/2012 | F | | OV | Dart | w/C62 and C61 |
| C128 | 12/14/2012 | 4.5 | | OV | Dart | w/C50 and C54 |
| C129 | 12/14/2012 | 3.5 | | OV | Dart | w/Cornell 310 |
| C130 | 12/14/2012 | F | | OV | Dart | |
| C131 | 12/14/2012 | 2.5 | | OV | Dart | w/fawn |
| C132 | 12/14/2012 | 2.5 | | OV | Dart | w/Cornell 316 |
| C133 | 12/14/2012 | 4.5 | | OV | Dart | w/AD and DF |
| C134 | 12/15/2012 | 4.5 | | OV | Dart | |
| C135 | 12/15/2012 | 4.5 | | OV | Dart | w/fawn |
| C136 | 12/15/2012 | F | | OV | Dart | |

Total

131

Table 2. Tagged female white-tailed deer from previous studies that were recaptured and sterilized during December 2012 in Cayuga Heights, NY.

| Tag# | Capture Date | Age in 2012 | Radio Freq. | Previous Treatment | Treat 2012 | Capture Method | Capture Location | Comments |
|--------------|--------------|-------------|-------------|--------------------|------------|----------------|------------------|------------------------------|
| C110 | 12/10/2012 | 8+ | | tubal ligation | OV | Dart | Comstock | Failed tubal ligation w/C118 |
| C114 | 12/12/2012 | 8+ | | tubal ligation | OV | DN | Highland | Failed tubal ligation w/C28 |
| 127 | 12/4/2012 | 10+ | | SpayVac™ | OV | Dart | Texas | |
| 128 | 12/5/2012 | 8.5 | | SpayVac™ | OV | Dart | Winthrop | |
| 131 | 12/12/2012 | 8+ | | SpayVac™ | OV | Dart | Iroquois/Parkway | |
| 133 | 12/3/2012 | 7.5 | | SpayVac™ | OV | Dart | Winthrop | |
| Total | | 6 | | | | | | |

Table 3. Previously-marked female deer not captured and surgically treated in Cayuga Heights, NY, during December 2012 because of old age and anticipated short life expectancy.

| Tag# | Capture Date | Age in 2012 | Radio Freq. | Previous Treatment | Treat 2012 | Capture Method | Capture Location | Comments |
|--------------|--------------|-------------|-------------|--------------------|------------|----------------|------------------|--|
| 35 | 02/24/04 | 13+ | 151.059 | tubal ligation | None | Clover trap | North Sunset | Originally captured 02/17/2000 |
| 59 | 02/19/04 | 13+ | 151.512 | hysterec-tomy | None | Clover trap | North Sunset | Originally captured 03/12/2002, complications with usual surgery |
| 73 | 12/17/02 | 13+ | 150.448 | ovarectomy | None | Rocket Net | Hanshaw Road | |
| 103 | 12/14/02 | 11+ | 151.551 | ovarectomy | None | Clover trap | Lowell Place | |
| 118 | 03/11/04 | 10+ | 150.526 | tubal ligation | None | Clover trap | Comstock Rd. | |
| Total | | 5 | | | | | | |

Table 4. Newly-marked male deer captured in Cayuga Heights, NY, during December 2012.

| Tag# | Capture Date | Age 12' | Radio Freq. | Previous Treatment | Treat 2012 | Capture Method | Comments |
|--------------|--------------|---------|-------------|--------------------|------------|----------------|---------------------|
| H01 | 12/3/2012 | F | | | Male | DN | w/C45, C46, C47 |
| H02 | 12/4/2012 | 2.5 | | | Male | DN | |
| H03 | 12/4/2012 | F | | | Male | DN | |
| H04 | 12/4/2012 | F | | | Male | DN | |
| H05 | 12/5/2012 | F | | | Male | DN | |
| H06 | 12/2/2012 | F | | | Male | DN | |
| H07 | 12/2/2012 | F | | | Male | DN | |
| H08 | 12/2/2012 | 2.5 | | | Male | DN | |
| H09 | 12/4/2012 | F | | | Male | DN | |
| H10 | 12/4/2012 | F | | | Male | DN | w/C34 and C35 |
| H12 | 12/5/2012 | F | | | Male | DN | |
| H13 | 12/5/2012 | F | | | Male | DN | |
| H14 | 12/7/2012 | F | | | Male | DN | w/C65 and C66 |
| H15 | 12/7/2012 | F | | | Male | Dart | w/C68 and C78 |
| H16 | 12/5/2012 | F | | | Male | DN | w/C44 |
| H17 | 12/5/2012 | F | | | Male | DN | |
| H18 | 12/7/2012 | F | | | Male | Dart | w/C04 and C08 |
| H19 | 12/7/2012 | F | | | Male | Dart | w/C58 |
| H20 | 12/7/2012 | F | | | Male | DN | w/C63 and C64 |
| H21 | 12/9/2012 | F | | | Male | Dart | w/C80 and C81 |
| H22 | 12/9/2012 | F | | | Male | Dart | w/133 |
| H23 | 12/9/2012 | F | | | Male | DN | w/C86 |
| H24 | 12/8/2012 | F | | | Male | DN | w/C73 and C74 |
| H25 | 12/9/2012 | F | | | Male | DN | w/C89, C90, C91 |
| H26 | 12/13/2012 | F | | | Male | Dart | w/C55, 92 94 95 122 |
| H27 | 12/15/2012 | F | | | Male | Dart | w/C112 and bb |
| H28 | 12/15/2012 | F | | | Male | Dart | Solo |
| H30 | 12/9/2012 | F | | | Male | DN | w/C86 |
| H31 | 12/9/2012 | F | | | Male | DN | w/C86 |
| Total | | | | | 29 | | |

Table 5. Total marked deer in the Village of Cayuga Heights at the time of the photo survey during January 4 through January 12, 2013.

| | |
|--|------------|
| Female deer tagged and sterilized | 137 |
| Previously-marked females not recaptured | 5 |
| Male deer captured and marked | 29 |
| Total marked deer | 171 |

Table 6. Known mortality of tagged deer in Cayuga Heights during December, 2012 through May 1, 2013.

| Tag# | Capture Date | Age | Treatment | Capture Location | Alive? | Recovery Codes* | Recovery Date | Recovery Site |
|------|--------------|------|------------------------|------------------------|--------|-----------------|---------------|---|
| C13 | 12/2/2012 | F | OV | 223 Highgate | N | HH | 1/30/2013 | Cornell Hunting Zone M1 |
| C21 | 12/3/2012 | 10+ | OV | Winthrop | N | DVC | 4/25/2013 | 2213 N Triphammer Rd. |
| C58 | 12/7/2012 | 5.5 | OV | Berkshire/Highgate | N | DVC | 2/4/2013 | 608 Cayuga Heights Rd. right along the edge |
| C82 | 12/9/2012 | 3.5 | OV | Upland/Triphammer | N | DVC | 2/26/2013 | Route 13 hill |
| C94 | 12/11/2012 | 1.5 | OV | Winthrop | N | ND | 4/16/2013 | Sandra Place Walkway west of NE School |
| C95 | 12/11/2012 | 1.5 | OV | Winthrop | N | ND | 3/24/2013 | 201 Christopher Lane |
| C116 | 12/13/2012 | 5.5 | OV | Wychoff/Cayuga Heights | N | CM | 12/18/2012 | Lakeview Cemetery |
| C119 | 12/13/2012 | 1.5 | OV | Triphammer | N | HH | 3/20/2013 | Bluegrass Lane, north of Moakley House |
| C124 | 12/14/2012 | 2.5 | OV | DPW | N | DVC | 3/26/2013 | Palmer Woods Creek near Triphammer Rd. |
| 35 | 02/24/04 | >3.5 | 2004 tubal ligation | 336 N. Sunset | N | OC | 01/22/13 | 508 Cayuga Heights Rd. |
| 59 | 02/19/04 | >4.5 | 2004 hysterectomy | 109 N. Sunset | N | OC | 02/27/13 | Definitive location not provided |
| 73 | 12/17/02 | >3.5 | 2002 ovarectomy | 1008 Hanshaw Road | N | DVC | 4/12/2013 | 820 Hanshaw Rd. |
| H01 | 12/3/2012 | F | Male | The Parkway | N | DVC | 12/21/2012 | The Parkway near Upland |
| H08 | 12/2/2012 | 2.5 | Male | Lexington | N | DVC | 2/17/2013 | Along Route 13 north between Triphammer and Warren Roads. |
| H14 | 12/7/2012 | F | Male | 711 Triphammer | N | ND | 4/2/2013 | 107 Sheldon Rd. |

*HH= hunter harvest; DVC= deer-vehicle collision; ND= not possible to determine; CM= capture-related mortality; OC= other causes.

Table 7. Causes of deer mortality in Cayuga Heights during December, 2012, through May 1, 2013.

| Cause of Death | Total | Percent |
|--------------------------------|-----------|---------|
| Deer-vehicle collision (DVC) | 7 | 46.7% |
| Hunter harvest (HH) | 2 | 13.3% |
| Other causes (OC) | 2 | 13.3% |
| Capture-related mortality (CM) | 1 | 6.7% |
| ND (unable to determine) | 3 | 20.0% |
| Total Deer Mortality | 15 | |

Table 8. Deer captured and tagged in Cayuga Heights but not photographed during the camera survey during January 4 through 12, 2013.

| Tag# | Treatment 2012 | Capture Location | Total pictures | Observed during Telemetry |
|-------------|---------------------------|---------------------------|---------------------------|--|
| C18 | OV | Winthrop | 0 | N |
| C33 | OV | Parkway/Comstock | 0 | N |
| C48 | OV | Texas Lane | 0 | N |
| C52 | OV | Highland | 0 | N |
| C70 | OV | Comstock | 0 | N |
| C81 | OV | Texas Lane | 0 | N |
| C85 | OV | Winthrop | 0 | N |
| C87 | OV | Highland | 0 | N |
| C88 | OV | Highland | 0 | N |
| C96 | OV | Cayuga Heights Rd. | 0 | N |
| C97 | OV | Comstock | 0 | N |
| C117 | OV | Wychoff/Cayuga Heights | 0 | N |
| C123 | OV | Lexington | 0 | N |
| C125 | OV | DPW | 0 | N |
| C133 | OV | Lexington | 0 | N |
| C135 | OV | Triphammer | 0 | N |
| H07 | Male | Lexington | 0 | N |
| H13 | Male | Highland | 0 | N |
| H21 | Male | Texas Lane | 0 | N |
| H26 | Male | Lexington | 0 | N |
| H28 | Male | Triphammer | 0 | N |
| C15 | OV | Lexington | 0 | Y |
| C51 | OV | Highland | 0 | Y |
| C55 | OV | Lexington | 0 | Y |
| C69 | OV | Comstock | 0 | Y |
| C92 | OV | Winthrop | 0 | Y |
| C93 | OV | Lexington | 0 | Y |
| C94 | OV | Winthrop | 0 | Y |
| C95 | OV | Winthrop | 0 | Y |
| C122 | OV | Lexington | 0 | Y |
| 128 | OV | Winthrop | 0 | Y |
| H22 | Male | Warrick | 0 | Y |

Table 9. Deer darted near the borders of Cayuga Heights that were not observed in pictures, and not seen during telemetry tracking of collared deer in January 2013. It is questionable if these deer spend much time in the Village.

| Tag# | Treatment 2012 | Capture Location | Total pictures | Observed during Telemetry |
|-------------|-----------------------|----------------------------|-----------------------|----------------------------------|
| C18 | OV | Winthrop | 0 | N |
| C48 | OV | Texas Lane | 0 | N |
| C81 | OV | Texas Lane | 0 | N |
| C85 | OV | Winthrop | 0 | N |
| C117 | OV | Wychoff/Cayuga Heights Rd. | 0 | N |
| C123 | OV | Lexington | 0 | N |
| C133 | OV | Lexington | 0 | N |
| H07 | Male | Lexington | 0 | N |
| H21 | Male | Texas Lane | 0 | N |
| H26 | Male | Lexington | 0 | N |