

## **2018 Report to the New York State Department of Environmental Conservation**

### **License to Collect or Possess: Scientific #1356 White-tailed Deer Contraception and Impact Study Village of Hastings-on-Hudson, New York**

Allen T. Rutberg, Ph.D.  
Center for Animals and Public Policy  
Cummings School of Veterinary Medicine at Tufts University  
200 Westborough Road, North Grafton, MA 01536

Kali Pereira, M.S.  
The Humane Society of the United States  
700 Professional Drive, Gaithersburg, MD 20879

November 7, 2018

## **INTRODUCTION**

After an extended community discussion of how to manage its conflicts with deer, the Village of Hastings on Hudson (HoH) joined with The Humane Society of the United States (HSUS) and Cummings School of Veterinary Medicine at Tufts University to undertake a comprehensive approach to deer population management and impact measurement. This collaboration features an experimental effort to apply and evaluate the PZP (porcine zona pellucida) immunocontraceptive vaccine to stabilize and reduce deer numbers in HOH.

The scientific objectives of the HoH immunocontraception project are to:

1. Confirm that a single, hand-delivered, timed-release PZP preparation first tested on Fripp Island, South Carolina, is effective for more than one year;
2. Evaluate whether the same timed-release PZP vaccine can be effective and long-lasting when delivered by dart as a booster, when compared to an emulsion-only PZP booster;
3. Test whether contraception can be used to manage a deer population in a suburban/urban environment in which deer movements are not tightly restricted by geographic boundaries (as distinct from islands and other isolated areas).
  - To help us achieve objective 3, we are providing camera-trapping data for research exploring sight-resight techniques of population estimation being carried out under the supervision of Dr. Mark Weckel at the American Museum of Natural History.

Through the first four field seasons, winters 2014-2017, 69 individual females were captured and treated with PZP- 22. In addition, three males were captured incidentally, and three previously tagged females who had lost their tag were recaptured and retagged. Blood sampling for pregnancy testing was conducted on captured females, and tagged

females were observed for fawn associations through direct visual contact and camera trap records.

Scientific objectives aside, a cornerstone of the HoH deer project is community engagement in assisting the research team with locating deer and measuring impacts of the deer population in terms of deer-vehicle collisions, damage to backyard vegetation, and ecological impact on open space. Residents of HoH have contributed substantially to the study through flagging of properties to indicate permission for access by the research team, online and telephone reports of deer observations, participation in the Host-a-Hosta impact measurement effort, and other means.

## **2018 METHODS**

### **Deer Observations and Remote Booster Treatment**

**Summer Fawning Session.** Observations were made during 21 August 2018 through 25 August 2018. During this period, observations were made from a labeled field vehicle, as well as on foot, during sessions with approximate hours of 5:00 – 11:00am and 4:30 – 10:00 pm. Spotlights were utilized in times of low light or reduced visibility. All deer observed were recorded, regardless of tag, sex, or age.

**Fall Darting Session.** Booster darting was carried out from 24 September 2018 through 29 September 2018, between the hours of 5:30 am and 10:00 pm. PZP emulsion and pellet sets were administered via 1cc self-injecting dart from a DanInject® JM Standard projector at a distance of 10-24 yards. Field team members carried out all tasks in a labeled vehicle. Spotlights were utilized in times of low light or reduced visibility.

**Community Participation.** For the third year, the Village set up a “deer hotline” by which residents could report deer sightings in real time, either by speaking directly to the field team leader or leaving a recorded message. The purpose of the hotline was to provide the research team with immediate darting opportunities as well as information about deer movements. This year, the hotline was active throughout the fall darting session. Village residents participated in the fifth year of the Host-a-Hosta program, accepting planters of hostas into their yards in late spring and monitoring deer browse impacts through the summer.

### **Deer Impact Studies**

**Population Surveys.** A grid of 12 motion-sensitive cameras was placed by Chris Johnson and Kali Pereira at pre-determined locations throughout HoH on September 27, 2018. The cameras will be removed later in the fall so that they are in place approximately 45 days to match previous years’ timelines.

Demographic descriptions of photographs from the 2015 and 2016 surveys have been entered in Excel spreadsheets by Maria Gavrutenko, a graduate student in biology at City University of New York, working under the supervision of Dr. Mark Weckel. Currently a graduate student at the Tufts Center for Animals and Public Policy is performing the analysis for population estimation for 2015-2016. We expect to use both the modified Jacobson's method (Weckel et al. 2011) and a mark-resight approach using ear-tagged females to allow corroboration of density estimates.

***Host-a-Hosta.*** Potted hostas were placed with 42 households in 2018, of which 41 provided data on plant survival.

## **RESULTS**

### **Community Outreach**

During 2018, the research team supplied updated and current materials to HoH. Now posted on the Village website (<http://www.hastingsgov.org/deer-issues>) are a 2017 report to the Village, links to a workshop organized by the Botstiber Institute for Wildlife Fertility Control in Tarrytown in May 2018 which includes presentations by Dr. Rutberg, Ms. Pereira, and village officials Peter Swiderski and Dan Lemons, and earlier documents.

The deer hotline received approximately 10 calls from residents reporting tagged doe sightings to assist the field team in locating targets for 2018 darting efforts.

### **Remote Booster Treatments**

A total of 8 deer from the 2016 capture cohort were identified and re-treated with PZP via remote darting in 5 field days. Four of these does were treated with PZP emulsion + pellets, and four were treated with PZP emulsion per project design. An additional doe, Tag #26 was also treated with PZP emulsion remotely, as she was not treated on schedule the year prior. Seven of the eight darts fired were recovered; after a prolonged unsuccessful search for the unrecovered dart, its approximate was reported to municipal leadership and police department in the unlikely event a resident comes across it.

### **Vaccine Effectiveness**

None of the 30 ear-tagged does observed during August and September 2018 was accompanied by fawns or showed signs of an active or recent pregnancy (i.e., no abdominal distension, no udder present at time of observations). The 30 does included

- Five (5) does captured and treated with PZP emulsion + pellets in winter 2014 and remotely boosted in September 2016;
- Eight (8) does captured and treated with PZP emulsion + pellets in winter 2015 of which 6 were remotely boosted in September 2017 and two had not previously been boosted;

- Nine (9) does captured and treated with PZP emulsion + pellets in winter 2016; and
- Eight (8) does captured and treated with PZP emulsion + pellets in winter 2017

Over the course of the study, fawning rates among females receiving a single hand-injection of PZP emulsion plus controlled release pellets have averaged approximately 13% over three years (although because of the experimental design Year 3 data are very limited; Table 1). Fawning rates among females also receiving boosters 2.5 years after initial treatment have averaged approximately 6% over two years, although sample sizes are still small (Table 2). So far, no difference in fawning rates has emerged between females boosted with PZP emulsion only and PZP emulsion plus controlled-release pellets.

***Table 1. 2014-2018 fawning among untreated (Year 0) and treated does receiving a single hand-injection of PZP emulsion + controlled release pellets, all cohorts.***

<b>Years After Initial Vaccination</b>	<b># Females Fawning/Total (%)</b>
<b>Year 0 (based on pregnancy testing, 2014-17)</b>	46/51 (90.2%)
<b>Year 1 (2014-2017 cohorts)</b>	5/38 (13.2%)
<b>Year 2 (2014-2016 cohorts)</b>	3/22 (13.6%)
<b>Year 3 (2015 cohort)</b>	0/2 (0%)
<b>Total Treated</b>	<b>8/62 (12.9%)</b>

***Table 2. 2017-2018 fawning among does treated with a hand injection of PZP emulsion + controlled release pellets followed 2.5 years later by dart-delivered boosters, all cohorts.***

<b>Years After Booster</b>	<b>Native PZP Booster</b>	<b>Native PZP + Pellet booster</b>	<b>Total</b>
<b>Year 1</b>	1/6 (16.7%)	0/5	1/11 (9.1%)
<b>Year 2</b>	0/3 (0%)	0/2	0/5 (0%)
<b>Total</b>	<b>1/9 (11.1%)</b>	<b>0/7 (0.0%)</b>	<b>1/16 (6.3%)</b>

## Population Dynamics

***Reproduction, Mortality and Disappearances.*** Fewer than 10 fawns were observed within HoH during late August observations. As noted above, none accompanied ear-tagged females. Most fawns were sighted at the northern and southern boundaries of HoH, where females regularly accessed Dobbs Ferry and the Andrus School, respectively, where we had no access for darting.

Of the 69 females captured and ear-tagged since 2014, we are aware of 9 documented mortalities (Appendix B). Of the six for which we have a known cause, two were taken by hunters, two were reported hit by cars (one two weeks after capture in 2017), one was euthanized after becoming impaled on a fence, and one died as a result of injuries sustained during capture in 2017.

As of September 2018, 30 of the 69 does captured during 2014-17 had been sighted in HoH in the previous three months, representing a minimum number of tagged does still in the community. Of the females that were still alive at the end of 2017, we sighted all 5 females tagged in 2014; 8 of 10 females tagged in 2015; 9 of 14 females tagged in 2016; and only 8 of 18 females tagged in 2017 (Appendix B).

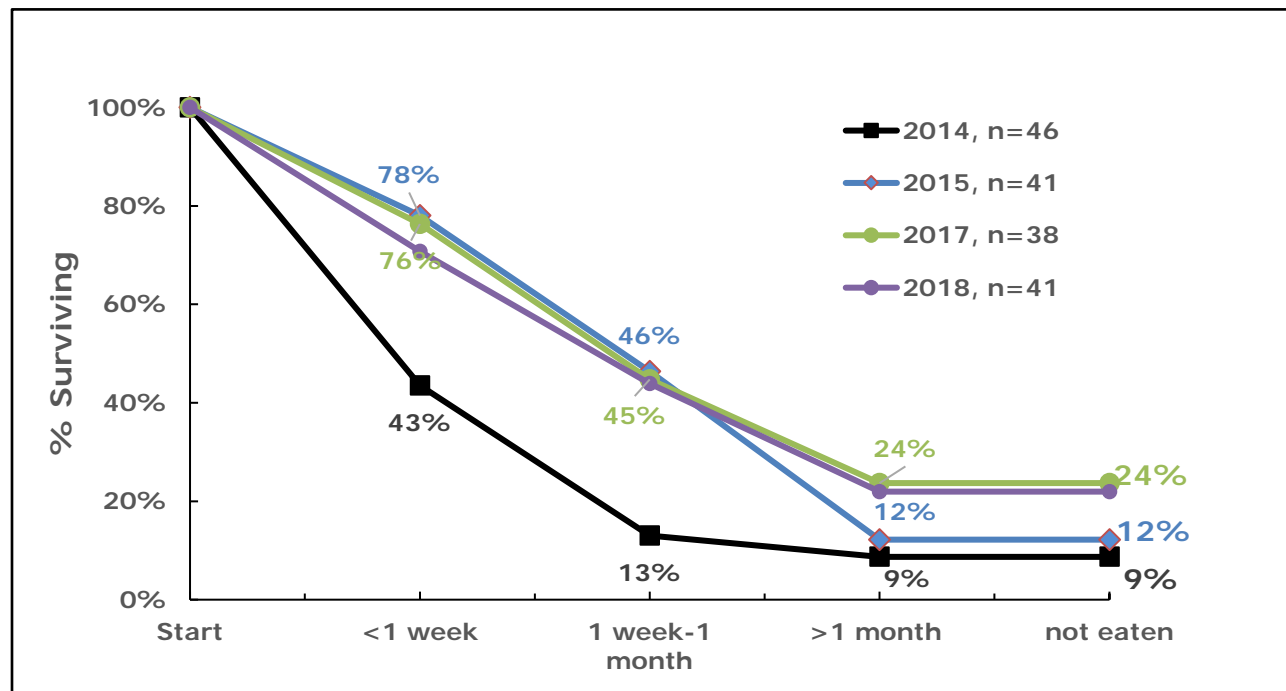
***Deer Density and Herd Composition.*** Formal analysis of deer densities and herd composition for 2015-2018 using the camera trap grid is in progress. However, some rough estimates of population density and composition can be made using an informal mark-resight analysis based on observations of tagged and untagged females observed during August observations (Appendix A).

During observations carried out 21-25 August 2018 and 24-29 September 2018, we re-sighted 30 ear-tagged does as well as an estimated 16 untagged adult does, identified distinctively through their associations with tagged females as well as their consistent location within the Village. On that basis we can estimate that approximately 65% of adult females present were tagged. Alternatively, summing raw observations of tagged and untagged females (Appendix A) yields 60 observations of tagged females and 42 observations of untagged females, or 59% tagged females. Based on the same observations, there were 0.24 fawns/doe and a doe:buck ratio of 4.4. If we assume that we have seen all tagged does present onsite (30) and that 62% (the average of the two estimates) of the females are tagged, we can infer that there are approximately 48 does, 12 fawns, and 11 bucks, for a total of 71 deer onsite. (This total surely is an underestimate; see Discussion.)

## Vegetation Impacts:

***Host-a-Hosta.*** On May 29, 2018, 41 Hastings households received potted hostas in the Host-a-hosta program. As in 2017, approximately 24% of the plants survived the summer. Overall, survivorship of hostas through the summer of 2018 closely tracked survival of hostas in 2017, which showed consistent improvements over survival recorded in 2014 and 2015 (Fig. 1).

**Figure 1. Reported survival of backyard hostas placed during the Host-a-Hosta program, Village of Hastings-on-Hudson 2014-2018. (2016 data were too imprecise to include.)**



## DISCUSSION

Several factors may reduce frequency of sightings. The robust vegetation growth of the summer makes it difficult to see deer compared to the late fall and winter months, thus providing additional places for them to tuck out of sight during times of observation. The Village continues to set limits on times of day when the field team can work which, though understandable, reduce nighttime opportunities for sighting animals. Rough terrain, fencing, sheds, and houses on private property also reduce observation and access to animals. Darting opportunities are sometimes interrupted by dog walkers and others passing by with questions and comments. Access to larger fenced lots where many deer are observed (e.g., the Andrus School and the Graham School) remains restricted.

## Vaccine Effectiveness

The total absence of fawns associated with tagged females in 2018 was striking, although we hesitate to interpret this as an indication of improved efficacy or anything other than a statistical anomaly. We commonly saw fawns associated with untagged females, especially at the northern and southern edges of the village where does often crossed into areas to which we did not have access for darting. Thus, we have no reason to think there was any broader environmental factor affecting fawning rates in ear-tagged females.

Our first scientific objective for the HoH study has been achieved. Fawning data collected in 2018 affirm that hand injections of PZP emulsion plus controlled release pellets delivered in March are effective for at least two years, approximately replicating the efficacy and longevity results from Fripp Island, SC (Rutberg et al. 2013). Combining the fawning results for the 2014-2017 cohorts yields fawning rates of 13-14% for both year one and year two.

With respect to our second scientific objective, testing efficacy and longevity of two different kinds of dart-delivered PZP boosters, sample sizes are still small (N=16 fawning opportunities), especially for Year Two after boosting. The data we do have suggest that both kinds of boosters may be effective for at least two years.

### **Population Dynamics**

A total of 69 adult females were tagged and treated since the beginning of the study in 2014. Observations suggest that tagged females continue to comprise significantly more than half of the adult females present onsite. This is especially true for more central areas of the Village as opposed to groups whose home ranges spill over into Dobbs Ferry, the east side of Saw Mill River Parkway, and the Andrus School in Yonkers.

An unusually high number of females captured and tagged in 2017 were not observed in summer or fall 2018 and for now are presumed dead or dispersed. This may be because a higher proportion of females tagged in 2017 occupied the margins of HoH and may spend more time outside the study area. We expect that some may be re-sighted either in the October-November camera trapping survey; it may also be worthwhile to conduct more observations in March 2019 in case seasonal movements account for their absence in late summer and early fall.

It seems fair to say that there is no obvious trend over time as of yet. We will continue to track these numbers, but because the number of DVC's is small, and subject to random fluctuation as well as causal variables unrelated to this project, we remain uncertain as to whether DVC's will be an effective metric of success for the project.

Although we await corroboration from camera-trapping-based estimates, there are clear indications of population impacts since the study began in 2014. Most notable is a sharp reduction in the number of fawns present. While the estimate of 12 fawns now present in the study area is tentative, the number is a very small fraction of the number (61) estimated to have been present in the camera-trapping study conducted in autumn 2014 (see 2016 Report to the NYSDEC).

The informal mark-resight estimate of 71 deer in HoH, including 12 fawns, 48 does, and 11 bucks, is undoubtedly low, although it may be close to correct for the more accessible core areas of the Village. As was the case last year, searches focused on finding adult females, especially those wearing ear-tags, so the estimated doe:buck ratio is certainly biased high. Relatively little search time was spent in the forested areas west of the Graham School, in part because of property access issues and in part because the accessible portion of the forest along the aqueduct trail was regularly disturbed by dog walkers, who drive deer away from the trail. There are probably more ear-tagged does in the village than we were

able to observe; as we correct that number upward through future observations the population estimates will rise in parallel. If there are, for example, 35 ear-tagged females onsite (rather than the 30 we observed), the population estimates would rise to 56 does, 14 fawns, and 13 bucks, or 83 deer.

Nevertheless, it seems likely that the current deer population of HoH is lower than the initial 2014 camera trapping estimates of 79 does and 207 deer total. Using methods of estimation comparable to those used in 2017, our observations also suggest that there has been a decrease in the number of does present since last year of about 15-20%.

## **Vegetation Impacts**

The Host-a-Hosta program provided a 4<sup>th</sup> year of useful data. Although there was no further improvement over 2017, a clear distinction in hosta browse impacts has emerged between the first two years of the study and the last two years. For the community's sake, we hope there will be further reduction in browsing. We note that this improvement has occurred in spite of the continued fencing of property in the community to exclude deer, which concentrates deer impact on unfenced properties.

## **Community Involvement**

As noted above, community engagement through the Deer Hotline remains a productive tool for the research team and helped keep open the lines of communication between the community and the research team and facilitated booster-darting and observations in late summer and early fall. HoH continued to communicate with its residents through the village website through the Sustainability & Environment portal (<http://www.hastingsgov.org/deer-issues>), posting reports, fact sheets, and other relevant documents. The Host-a-Hosta program continues to be an important citizen science program that has both engaged the community and provided instructive data on deer impacts.

## **Work Planned for the Remainder of 2018 and Beyond**

Camera traps that were placed this October will be collected in November. Photographs will be entered in the Excel database for 2018, and the methodology used to estimate populations that was developed in 2014 will be applied to 2015, 2016, and 2018 data, supplemented by mark-resight methodology associated with the presence of eartags. This process will be repeated the following year, during September-November 2019.

During summer 2019, the team will return to HoH for approximately 4 days to observe and locate previously tagged animals, match tagged and untagged females with fawns, and estimate the proportion of females in the population that are tagged. If feasible, we will also carry out a few days of observation in March 2019 to look for ear-tagged females that were not sighted in late summer/early fall 2018.

In autumn 2019, we will locate and remotely booster-dart all surviving females captured and treated in 2017 (Year Four). At least 8 were known to be alive and present on site at the end of 2018. Following the experimental protocol, emulsified PZP and emulsified PZP



plus timed- release pellets will alternately be administered remotely via a barbless, self-injecting dart. Each dart will then be recovered following inoculation. Chemical immobilization will not be necessary as these animals are already identified with numbered yellow ear tags. Deer location information will be sought from HoH residents via the DeerLog website and the Deer Hotline. Residents will be encouraged to note tag numbers and fawning status of does both to corroborate research team observations and facilitate relocation for darting. The host-a-hosta program will also be continued for a 5<sup>th</sup> year.

After the autumn 2019 re-treat session, no additional darting is planned for the project, and the field work for 2020 and beyond will consist of observational data collection only.

## **References**

Rutberg, A.T., R.E. Naugle, J.W. Turner, Jr., M.A. Fraker, and D.R. Flanagan. 2013. Field testing of single-administration porcine zona pellucida contraceptive vaccines in white-tailed deer (*Odocoileus virginianus*). *Wildlife Research* 40:281-288.

Weckel, M., R.F. Rockwell, and F. Secret. 2011. A modification of Jacobson et al.'s (1997) individual branch-antlered male method for censusing white-tailed deer. *Wildlife Society Bulletin* 35:445-451.

# APPENDIX A. TABLE AND TRANSCRIPTION OF SUMMER OBSERVATIONS

	# Tagged Does seen	# Untagged Does seen	# fawns seen	# Bucks seen	Total Deer Seen	Tag Numbers	NOTES
DAY 1 8/21/18	7	6	3	2	18	6, 30/7, 36, 12, 24, 73, 29	½ day – PM session only
DAY 2 AM 8/22/18	8	8	2	5	23	67, 39, 74, 29, 24, 42, 9, 65,	
DAY 2 PM 8/22/18	10	6	6	2	26	31, 15, 11, 36, 75/21, 6, 51, 42, 8, 73,	
DAY 3 8/23/18	9	9	5	7	30	4, 5, 12, 24, 55, 29, 47, 36, 6,	
DAY 4 8/24/18	13	6	4	5	28	39, 63, 11, 15, 31, 65, 9, 24, 73, 12, 42, 6, 30/7	
DAY 5 8/25/18	11	7	4	2	24	31, 15, 11, 29, 47, 24, 73, 55, 51, 26, 64,	½ day- AM session only