

## **2017 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**

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May 31, 2017

## **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 three field seasons, winters 2014-2016, 48 individual females were captured and treated with PZP- 22. In addition, one male was captured incidentally, and one previously tagged female who had lost her tag was 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.

## 2017 METHODS

### Deer Capture and Treatment

**Bait Stations.** Six fixed feeders were placed during the week of February 20, 2017. These feeders were set to release whole corn in 5-7 second durations twice daily. One bait station was stolen and replaced during the capture season. This feeder was replaced on another property in early March. The remaining stations remained in place until their removal in the week following the completion of darting operations on March 21, 2017. Each bait station was monitored with one or two trail cameras to provide the research team with information about when deer were visiting feeders. In addition to automatic feeders, bait (corn and/or apples) was regularly placed by hand at six other locations on public and private property (with permission).

**Community Participation.** Under the oversight of HoH trustee Dan Lemons, students from HoH High School sought from property owners written permission for research team members to access their properties for darting and work-up of immobilized animals. Properties for which owners had given access permission were marked by small flags placed near front steps, mailboxes, and other prominent positions. Permission-seeking efforts were focused around feeders and other high priority sites for darting.

For the second 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 field season.

**Capture.** Two or three teams of two were available to conduct captures. This year’s darting season ran from March 10-21, for a total of eleven field days (vs. eight weeks in 2015 and six weeks in 2016). All animals were chemically immobilized via 2 cc self-injecting PneuDart® transmitter dart with a 1” needle tip with double wire barbs, using a Dan-Inject Model JM Standard CO2 rifle. Darts were filled with 2.0 mL of BAM (Butorphanol/Azaperone/Medetomidine), pre-mixed formulation from Wildlife Pharmaceuticals, Inc. (Windsor, CO; <http://wildpharm.com/bam-kit/item/2-wildlife/61-bamiikit.html>), dosed approximately at 55 mg Butorphanol, 18 mg Azaperone, and 22 mg

Medetomidine per dart. Supplemental injections of 1 to 2 mL were administered on an as-needed basis if animals were not fully sedated at time of approach for work-up.

Animals were captured both over bait at fixed feeder stations and in yards of cooperating homeowners. All darts and sharps were recovered following each work-up. One darted deer was not recovered after the dart bounced out at impact. The dart was recovered.

Use of chemical immobilizing drugs was carried out under the supervision and authority of Dr. Richard Joseph, DVM, VCA Animal Medical Center, Yonkers, NY.

**Work-up Process.** Upon tracking the anesthetized animal via radio-telemetry, each doe was quietly approached and stabilized via placing in sternal or lateral recumbent (right side up) body position, covering eyes to reduce stimulation, and opening the airway and administering supplemental oxygen via nasal cannula or muzzle-encompassing mask at a rate of 2 to 4 liters per minute. Animals that were not at an acceptable level of sedation for safe handling were administered a supplemental injection of BAM in 1 to 2 mL doses. Ophthalmic lubricant was instilled in eyes to reduce corneal desiccation. Rectal temperature, cardiac & respiratory auscultation, pulse oximetry and mucous membrane color assessments were performed and recorded approximately every 5 minutes throughout the workup. Yellow, numbered ear tags were placed in both ears, with the larger of the two tags in the right ear pinna, and the smaller button tag in the left ear pinna. Darts were carefully removed and wounds were cleansed/flushed with dilute betadine and packed with topical antibiotic ointment. Emulsified PZP vaccine and timed-release pellets were injected intramuscularly in the quadriceps muscles of the left or right hind limb in each animal. Eight to ten mL of blood was collected for pregnancy testing. Each animal received approximately 600mg of Liquamycin (Oxytetracycline), an antibiotic injection administered subcutaneously. Body condition scores and measurements including weight, body length, girth, and distal hind limb were obtained and recorded when possible. Age estimates were made upon evaluation of body size and characteristics and dental assessment. Due to field team difficulty with heavy lifting, location safety, level of anesthetic depth, or missing equipment, some animals were not weighed. Reversal agents Atipamezole and Naltrexone were administered intramuscularly upon completion of animal handling procedures and recipients were monitored closely for any complications. In most cases the animals were alert and fully ambulatory within 5 to 15 minutes of antagonist administration.

Following protocols established in 2014, blood samples were spun down and serum was sent, frozen, to BioTracking, Inc. (Moscow, ID), for pregnancy testing using an assay for Pregnancy-Specific Protein B.

## **Deer Impact Studies**

**Population Surveys.** A grid of 15 motion-sensitive cameras was placed by Chris Johnson at pre-determined locations throughout HoH on September 9, 2016, and removed on October 25, so that cameras were in place approximately 45 days.

Photographs from the 2015 survey were 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. Ms. Gavrutenko has also been hired to enter the 2016 photographs, a task that she will be completing over the next few months. Another graduate student – possibly a Ph.D. student – is being recruited to perform the analysis for population estimation for 2015-2017. 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.** Hostas were placed with 43 households in 2016, of whom 41 provided data on plant survival.

## RESULTS

### Community Outreach:

At the beginning of the field season, the research team supplied updated and current materials to HoH, which the Village posted on its website (<http://www.hastingsgov.org/deer-issues>). A total of 191 properties were flagged, indicating signed permission to access the property for darting and handling deer. Flagging efforts focused principally in eight core areas where we anticipated darting efforts would be concentrated.

The deer hotline received approximately 25 calls from residents. As in 2016, on at least three occasions residents provided information that led directly to the capture and treatment of new deer.

### Captures:

A total of 25 deer were captured in 11 field days, including 21 new does, 2 recaptures, and 2 incidental males (Table 1). One of the 21 newly captured does (#54) suffered a broken right hind leg at some time during the capture and recovery process, and was recaptured the next day and euthanized. This was the first capture-related mortality during the four years of the study. One deer was darted but the dart fell out and she was not recovered after a 2-hour search of Hillside Woods by all six team members. One doe (#75, originally # 21) darted on the first day of darting (10 March) was not recovered initially, but was redarted and tagged on 21 March and the original dart recovered. All other animals that were darted were processed and recovered well. All darts fired were recovered.

Average time from darting to release using the BAM protocol was  $55.8 \pm 11.6$  minutes ( $\pm$ sd) (Table 2). Time from administration of reversal to release averaged  $9.2 \pm 4.5$  minutes.

**Table 1. Description of deer captured in the Village of Hastings-on-Hudson, New York, March 2017. All deer captured were females. (Body weights were not obtained in 2017.)**

Tag #	Date Captured	Estimated Age	Physical Condition	Hind-Foot Length (cm)	Girth (cm)	Body Length (cm)
48	3/10/2017	Adult	1	48.2	109.5	162
52	3/12/2017	Adult	1	not recorded	not recorded	149
53	3/15/2017	1.5	1.5	43	87.5	132.2
54	3/11/2017	Adult	2	not recorded	not recorded	not recorded
55	3/10/2017	3+	1	not obtained	not obtained	not obtained
56	3/10/2017	Adult	1	40.9	83.8	138
57	3/11/2017	Adult	1	46.5	107	143.5
58	3/12/2017	Adult	1.5	47.5	91	141
59	3/11/2017	Adult	2	not recorded	not recorded	not recorded
60	3/12/2017	Not recorded		46	107	162
61	3/16/2017	Adult	1	not obtained	not obtained	not obtained
62	3/15/2017	Not recorded	2	46	102	144
63	3/13/2017	2+	2	not obtained	not obtained	not obtained
64	3/15/2017	2	2	45	84	132
65	3/15/2017	Adult	2	not obtained	not obtained	not obtained
66	3/16/2017	Young Adult	1	43	79	131
67	3/19/2017	3	1	44.8	93.2	147
68	3/15/2017	Adult	2	45	87	131
69	3/18/2017	Adult	2	not obtained	not obtained	not obtained
70	3/22/2017	1.5	2	43	88	127
71	3/20/2017	2.5	1	47	104	135
72 / (prev 34)	3/20/2017	3+	1	-	-	-
73	3/21/2017	2+	1	46.2	99	138
74	3/21/2017	2.5	1	49.6	102	146.5
75/ (prev 21)	3/21/2017	3+	1.5	47.5	93.5	147

**Table 2. Darting, reversal, and recovery times of deer captured using the BAM immobilization protocol in Hastings-on-Hudson, NY, March 2017.**

Tag #	Time at Darting	Time at Reversal	Time at Release	Time, Reversal to Release (min.)	Total Time, Darting to Release (min.)
48	11:27	12:35	12:47	12	87
52	17:53	18:50	18:55	5	62
53	11:08	11:49	12:03	14	55
54	09:59	10:45	10:51	6	52
55	17:50	18:23	18:30	7	40
56	19:31	20:13	20:19	6	48
57	18:07	18:40	18:47	7	40
58	07:57	08:50	09:01	11	64
59	18:31	19:25	19:25	0	54
60	19:01	19:54	20:07	13	66
61	12:02	12:46	13:01	15	59
62	18:37	19:31	19:42	11	65
63	08:07	08:58	9:02	4	55
64	13:36	14:26	14:33	7	57
65	18:32	19:02	19:10	8	38
66	18:45	19:33	19:42	9	57
67	17:46	18:24	18:42	18	56
68	18:46	19:28	19:43	15	57
69	15:35	16:16	16:26	10	51
70	08:16	08:48	09:00	12	44
71	18:32	19:38	19:48	10	76
72 / (prev 34)	21:27	22:04	22:07	3	40
73	19:54	20:48	20:55	7	61
74	07:56	08:45	9:01	16	65
75/ (prev 21)	17:52	18:34	18:38	4	46

## **Vaccine Effectiveness and Population Dynamics:**

**Reproduction.** Pregnancy diagnoses based on assays for Pregnancy-Specific Protein B (BioTracking, Inc., Moscow, ID) were obtained from blood samples taken at the time of capture in 2016 in 19 of the 23 captured females. Thirteen of the 17 females captured for the first time (76.5%) were diagnosed as pregnant, while neither of the 2 retags (21/75 and 34/72, tagged in 2015 and 2016, respectively) was pregnant.

Of the eight adult does hand-injected in winter 2014 with PZP emulsion + pellets, five were observed during summer and autumn 2016. One of the five was observed with fawns in 2016, the second year of treatment effects.

Of the 20 does captured and treated in 2015, we resighted 12 during summer and fall observations in 2016. Of the 12, two were accompanied by fawns (16.7%) in 2016, the first year of treatment effects for the 2015 cohort.

Of the 20 does captured and treated in 2016, we resighted 10; 9 of the 10 were accompanied by fawns, consistent with the pre-treatment pregnancy rates indicated by blood sampling.

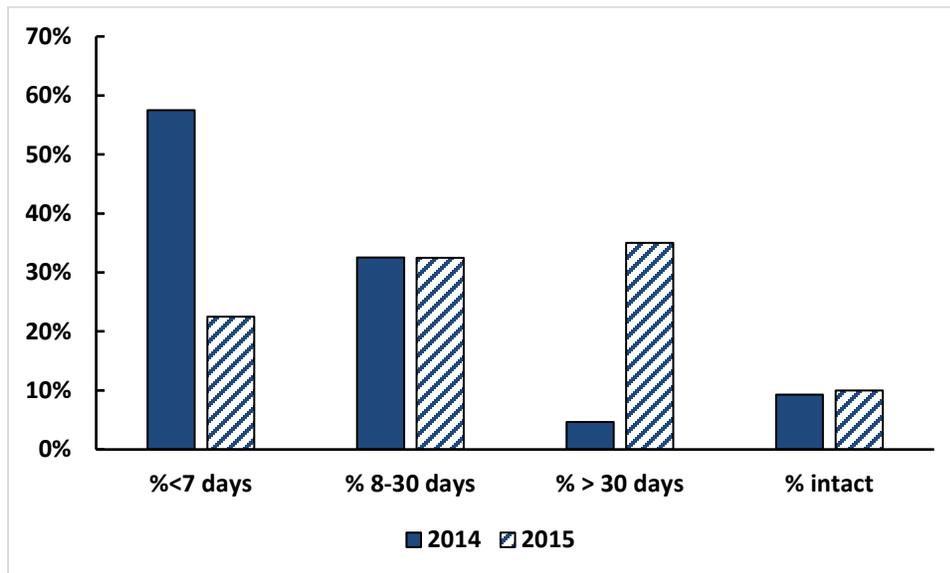
**Mortality and Disappearances.** Of the 69 females captured and ear-tagged since 2014, we are aware of seven mortalities. Of the six for which we have a known cause, two were taken by hunters, two were reported hit by cars (one two weeks after capture in 2017), one was euthanized after becoming impaled on a fence, and one died as a result of injuries sustained during capture in 2017. As of August 2016, 29 of the 48 does captured during 2014-16 had been sighted in HoH in the previous three months, representing a minimum number of tagged does still in the community. A total of eight deer-vehicle collisions were reported to police in 2016.

**Deer Density and Herd Composition.** Analysis of deer densities and herd composition for 2015-2017 is still pending. During observations carried out 1-4 August 2016, we resighted 25 eartagged does (and the tagged male) as well as an estimated 19 untagged adult does (identified distinctively through their associations with tagged females as well as their location within the Village). Thus approximately 57% of adult females observed were tagged.

## **Vegetation Impacts:**

**Host-a-Hosta.** Proportion of hostas placed in the backyard Host-a-Hosta program consumed by deer was unchanged from 2014-2015 (Fig. 1). It did, however, take deer longer to find and consume the backyard hostas in 2015, with the median time-to-consumption shifting from  $\leq 7$  days to 8-30 days. Three of 41 hostas (7%) placed in 2016 remained uneaten throughout the sample period. This is slightly lower than in the previous two years.

**Figure 1. Reported survival of backyard hostas placed during the Host-a-Hosta program, Village of Hastings-on-Hudson 2014-2015.**



## DISCUSSION

### Capture and Treatment:

The field team was far more efficient this year than in previous years. Working in two or three teams of two, it required only 11 field days to capture 25 deer. The greater capture efficiency may be related to the shortened amount of time spent handling and watching recovering deer with the BAM immobilization combination; better knowledge of the deer accumulated through experience and the presence of multiple tagged does whose movements could be followed; information obtained from HoH residents through the Deer Hotline, which was responsible for at least three captures; good weather, which permitted consecutive long field days; and improved team cohesion and leadership.

### Vaccine Effectiveness and Population Dynamics:

Based on current sample sizes, we now have some confidence that the hand injections of PZP emulsion plus controlled release pellets at HoH approximately replicates the efficacy and longevity results from Fripp Island, SC (Rutberg et al. 2013). Combining the fawning results for the 2014 and 2015 cohorts yields fawning rates of 11.8% (2/17) for year one and 1/5 (20%) for year two. The small number of pregnancy tests from blood samples of retagged deer (0/3 pregnant) further supports vaccine effectiveness. Data from the 2017 fawning season will increase the precision of our estimates for years one and two and provide the first effectiveness data for the five does boosted in 2016.

Pregnancy rates from does captured in 2017 were down from previous years (13/17 vs. 33/34). We attribute this to the capture of three 1.5-2.5 year old females, none of which was pregnant. More consistently with past years, 13 of the 14 full-grown adult females

captured (93%) were pregnant. Overall, for the four years of the study, 46/51 females (90.2%) were pregnant at time of first capture.

Depending on whether we calculate survival rates based on known mortalities and dispersals (5/49 through the end of 2016) or by confirmed resightings (25/34 animal-years through the end of 2016), the annual survival rate ranges from ~74-93%. Higher mortality and disappearance rates will speed population decline unless compensated for by movement of females onto the site, for which we have little evidence.

A total of 69 adult females have now been tagged and treated since the beginning of the study in 2014. Observations suggest that tagged females now comprise significantly more than half of the adult females present onsite (pending population analyses and summer 2017 observations). 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. With data through autumn 2016 suggesting that the PZP vaccine treatments are highly effective through two years, and PZP treatments having been administered to 48 females from 2014-2016, there should be a measurable decline in number of fawns present in the population in summer 2017. Whether the decline in fawn numbers translates into an effect on population density in 2017 remains to be seen.

The number of deer-vehicle collisions (8) reported to police in 2015 was lower than that reported in 2013 (12) and 2014 ( $\geq 7$ ) but up from 2016 (5). 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.

### **Community Involvement**

As noted above, community engagement through the Deer Hotline was highly productive for the research team, and helped keep open the lines of communication between the community and the research team. 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. Dr. Rutberg also made a presentation in the Village library on May 17, 2017, a video recording of which has also been posted on the Village website (<http://hastingsonhudsonny.swagit.com/play/05182017-1198>).

### **Work Planned for the Remainder of 2017 and Beyond**

During summer 2017, the team will return to HoH for approximately 3 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.

In autumn 2017, we will also locate and re-treat all surviving females captured and treated in 2015 (year two). At least 11 were known to be alive and present on site at the end of 2016. 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.

No further recruitment of new deer through chemical immobilizations is planned for the project.

In September and October, camera traps will be placed for a fourth year of data collection for estimation of population size and age-sex composition. In summer 2017, photographs will be entered in the Excel database for 2016, and methodology used to estimate populations that was developed in 2014 will be applied to 2015 and 2016 data, supplemented by mark-resight methodology associated with the presence of eartags.

The host-a-hosta program will be continued for a 4<sup>th</sup> year, with the intention of restoring some of the precision of reporting that would permit use of survival analysis for comparing between years.

## References

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