2019 Report to the New York State Department of Environmental Conservation

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Developing techniques to reduce animal-handling in deer immunocontraception programs

Village of Head of the Harbor, New York

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INTRODUCTION

After an extended community discussion of how to manage its conflicts with deer, the Village of Head of the Harbor (HotH), NY, joined with Avalon Park and Preserve, The Humane Society of the United States (HSUS), and Cummings School of Veterinary Medicine at Tufts University to undertake a comprehensive approach to addressing deer population growth. This collaboration features an experimental effort to test technologies that will improve cost-effectiveness and practicality of PZP contraceptives for management of suburban deer. Specifically, we propose to:

1. Test remote delivery of priming doses of controlled-release PZP vaccines ("PZP-22"). Although there is evidence for effectiveness of remotely delivered PZP-22 primers in wild horses, for deer PZP-22 primers have only been administered by hand.

2. Test individual identification systems, including implantable microchips and Artificial Intelligence (AI) systems, that could ultimately reduce the need to capture all deer prior to treatment. Capturing deer for ear-tagging is more time-consuming, costlier, and riskier to animals and field personnel than direct administration of vaccine by dart. Capture also requires higher levels of personnel training, expertise, permitting, and personal commitment. In addition, capturing deer with immobilizing drugs poses higher risks to secondary consumers (including predators, scavengers, and hunters) than direct PZP administration.

3. Test and cross-check a variety of population estimation techniques, including drone surveillance, distance sampling, mark-resight, and AI-based identification of deer in camera trap grids.
4. Contingent on successful outcomes in accomplishing goals 1 and 2, develop and test tools to deliver PZP-22 and PIT tags remotely in a single package.

2019 METHODS

Deer Capture and Treatment

Bait Stations. Four fixed feeders were placed during March 2019. These feeders were set to release whole corn in 5-7 second durations two to four times daily. Each bait station was placed at a distance greater than 300 feet from a road and monitored with one or two trail cameras to provide the research team with information about when deer were visiting feeders. Feeders were taken down at the end of April 2019.

Capture. Two teams of two or three were available to conduct captures. This years' darting season ran from April 18 – April 28, for a total of ten field days (where poor weather prevented the team from darting during 4 of those days). 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 BAM were administered on an as-needed basis if animals were not fully sedated at time of approach for work-up.

Animals were captured over bait at fixed feeder stations. All darts and sharps were recovered following each work-up. Two darted deer were not recovered after the dart bounced out at impact. Both darts were recovered.

Use of chemical immobilizing drugs was carried out under the supervision and authority of Dr. Christopher Miller, DVM, Miller & Associates, Hampton Bays, 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 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. Pink or Yellow numbered ear tags were placed in both ears. A single HDX PIT tag (OregonRFID) was injected intramuscularly in the hip/rump via hand injection with a trocar syringe. Darts were carefully removed and wounds

were cleansed/flushed with dilute saline or betadine and packed with topical antibiotic ointment. Per project design, seven of the fourteen captured does were given emulsified PZP vaccine and timed- release pellets (PZP-22)- 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.

Remote Primer Delivery. During the first week of October 2019, three does initially captured and tagged in April 2019 were given their first dose of PZP-22 via remote delivery in a 1 cc self-injecting prototype implant dart with a 14g x 1" needle (Pneudart®, Williamsport, PA). Darts were delivered with a Dan-Inject® Model CO2 PI pistol, or Model JM Standard CO2 rifle or equivalent. All does receiving priming doses of PZP-22 were darted opportunistically from a marked field vehicle at a range of 10-22 yards. All darts were recovered and discarded into medical sharps container.

Deer Identification Studies

Population Surveys. A grid of 11 un-baited motion-sensitive IR trail camera stations was placed by Avalon Park and Preserve Staff at pre-determined locations throughout the village for six-week periods from March 2019 to May 2019, and again from October 2019 through November 2019. Analysis is underway.

Drone Surveillance. After obtaining appropriate clearances through the FAA, the team began mapping and testing potential flight patterns throughout the village to set the stage for counting deer via drone surveillance throughout the study. This year, we were able to successfully fly the Inspire 1 v2.0 drone with a standard Zenmuse x3 camera both manually and autonomously. For autonomous flights, the application Litchi was used to plot grid patterns for each specific property. Altitude above ground level (AGL) ranged from 131 ft-200 ft. at a cruising speed of 13.0 mph to ensure a proper speed relative to the ground for spotting deer.

Artificial Intelligence. Photographs and videos of deer from both Head of the Harbor and Hastings-on-Hudson are being incorporated into machine learning models to initially recognize deer out of photographs, and then to use spatial measurements to try to distinguish individuals. This effort was aided in 2019 by placing fixed objects of known height and distance from the camera at one site at Head-of-the-Harbor.

Individual Identification with PIT Tags. Preliminary schematic models of multi-antenna array and single antenna array units were built out and continue to undergo refining in order to

maintain positive ID capture and battery life at each reader station. Fully functional models will be erected in early 2020 and monitored with motion-triggered IR trail cameras to cross-check reader function on tagged deer.

Community Outreach

At the beginning of the field season, the research team supplied updated and current materials to village residents in the form of a mailed letter, as well as posting project information on the Avalon Park and Preserve's website (https://avalonparkandpreserve.org/deer/).

2019 RESULTS

Vaccine Effectiveness and Population Dynamics:

Capture and Treatment. A total of fourteen (14) adult female white-tailed deer (*Odocoileus virginianus*) were captured in the Village of Head of the Harbor in an abbreviated field session during April 2019 (Table 1; Appendix 1).

Table 1. Description of deer captured in the Village of Head of the Harbor, New York, April 2019. All deer captured were females.

Ear Tag # / PIT #	Date Captured	Estimated Age	Weight (Kg) *Approximated*	Physical Condition	Hind-Foot Length (cm)	Girth (cm)	Body Length (cm)
Pink 1 / 881	4/18/19	Mature Adult	58	Excellent	45	113	144
Pink 2 / 879	4/18/19	Young Adult	54	Excellent	47	96	143
Pink 3 / 877	4/19/19	Young Adult	Not obtained	Good	45	91	130
Pink 4 / 882	4/19/19	Young Adult	50	Good	44	96	145
Pink 5 / 878	4/21/19	Mature Adult	60*	Excellent	Not recorded	103	143
Pink 6 / 883	4/25/19	Mature Adult	Not obtained	Not recorded	47	110	154
Pink 7 / 891	4/27/19	Young Adult	Not obtained	Good	42	96	131
Yellow 26 / 175	4/22/19	Mature Adult	54*	Good	42	100	140

Yellow 27 / 199	4/23/19	Mature Adult	60*	Excellent	Not recorded	Not recorded	Not recorded
Yellow 28 / 116	4/22/19	Young Adult	50*	Good	Not recorded	Not recorded	Not recorded
Yellow 29 / 172	4/23/19	Mature Adult	52*	Excellent	42	98	136
Yellow 30 / 184	4/24/19	Mature Adult	60*	Not recorded	45	105	150
Yellow 31 / 100	4/25/19	Mature Adult	55*	Good	46	99	139
Yellow 32 / 127	4/28/19	Young Adult	Not obtained	Good	42	87	130

During capture efforts, seven (7) does tagged with PINK ear tags were also given PZP-22 via hand injection, while seven (7) does tagged with YELLOW ear tags were not vaccinated at that time.

During remote delivery efforts in October, three of the six remaining yellow-tagged does were administered PZP-22 remotely via dart (Appendix 2).

Individual Identification. All animals treated in 2019 received a PIT tag via hand injection at time of capture. Tag number and location were verified after insertion with a handheld PIT tag reader prior to reversing anesthetized does. Further confirmation of successful PIT tag readability will be evaluated in 2020 via free standing reader stations.

The AI algorithm was trained to reliably pick deer out of photographs and label them. Current efforts focus on establishing morphological landmarks that can be picked out of visual images of deer and which vary consistently between deer in distance and spacing relative to other such landmarks.

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 April 2019 in 11 of the 14 captured females. All samples submitted resulted in a positive pregnancy status.

Of the 14 does captured and treated in 2019, we resighted 12; all of which were accompanied by fawns, consistent with the pre-treatment pregnancy rates indicated by blood sampling.

Mortality and Disappearances. As of October 2019, 12 of the 14 does captured during 2019 were sighted in the village, in close proximity to capture locations. Of the 14 females captured and ear-tagged since April 2019, we are aware of two deaths. Yellow Tag # 32 was found deceased and entangled in downed electrical wires and debris after a severe storm in July 2019.

Her remains were collected and incinerated. Pink Tag #3 had not been re-sighted in the village, and was harvested by a hunter in Hauppauge, NY, approximately eight miles from the study site, in early November 2019. Her remains were submitted directly to NYSDEC at that time.

Deer Density and Herd Composition. Analysis of deer densities and herd composition for winter and autumn 2019 is still pending.

WORK PLANNED FOR 2020

During winter 2020, the team will return to Head of the Harbor to capture, tag, and treat up to 50 additional does. Following the experimental protocol HDX PIT Tags, numbered ear tags, and, for half the does, PZP-22 will be administered at time of capture with the use of chemical immobilization methods previously described. For does not treated with PZP-22 at time of initial capture, the PZP-22 vaccine will be delivered remotely via a barbless, self-injecting dart. Bait stations will be utilized during capture efforts and for luring deer to PIT Tag Readers through April 2020. Camera traps will be installed for approximately 6 weeks in winter to assist with population modelling and individual AI algorithm work.

In summer and autumn 2020, we will also 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. Camera traps will be installed for approximately 6 weeks in autumn to assist with population modelling and individual machine learning algorithm work.

Stationary PIT Tag reading and village-wide drone surveillance efforts will continue to be tested, refined and modified throughout the year. During times of ideal field conditions, the drone pilot will continue to perform test flights with the Inspire 1 equipped with a Zenmuse XT FLIR camera and continue flight mapping to widen transects to improve visibility and flight time efficiency.

Official workplans that provide further detail of any animal capture, treatment, and observation efforts will be provided prior to each of those periods of fieldwork.