Figure 26. The percentages of plants sampled as unbrowsed (NB), lightly (L), moderately (M), or heavily browsed (H), across plots (distance classes) for the control area and treatment study areas (SIA and SIB) throughout 2009-2010. Small sample sizes for many browse intensity categories within plots for each site hindered thorough statistical evaluation. One plot was established within each distance class of 0-33 ft (0-10 m; plot 1), 36-328 ft (11-100 m; plot 2), 331-656 ft (101-200 m; plot 3), and 659-984 ft (201-300 m; plot 4).

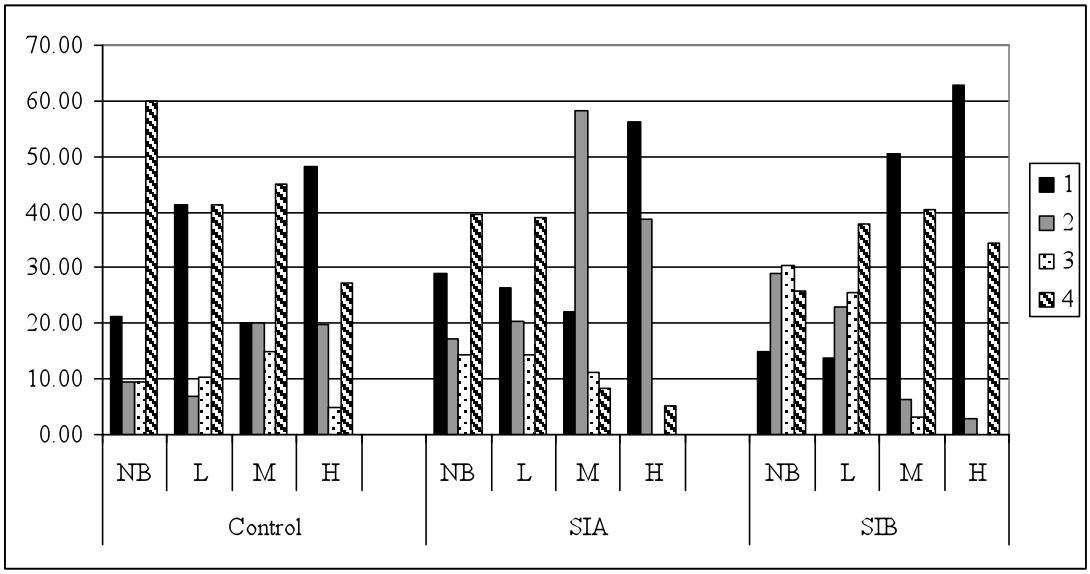


Figure 27a. The percentages of ornamental plants sampled under the browse intensity categories unbrowsed (NB), lightly (L), moderately (M), heavily (H), or severely (S) during 2009 within the ornamental vegetation survey sites on the control area (NH) and the treatment study areas (SIA and SIB).

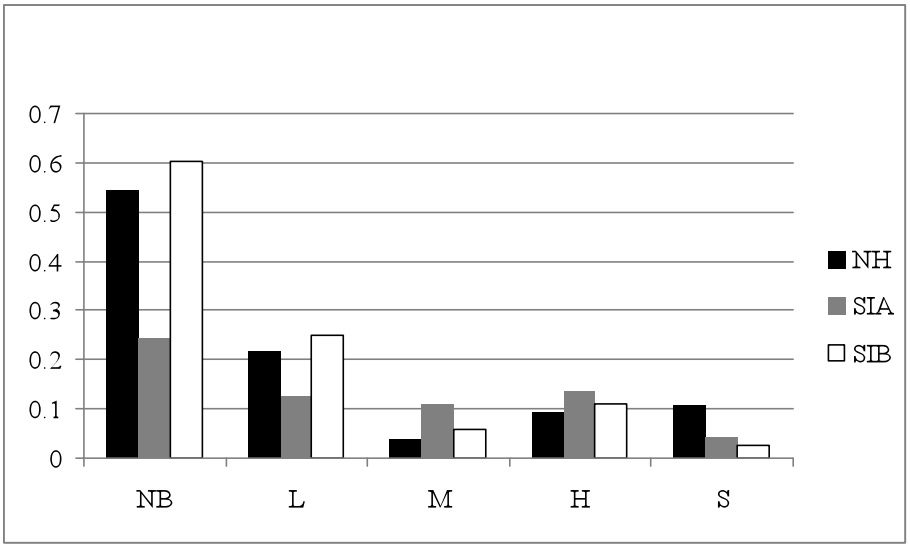


Figure 27b. The percentages of ornamental plants sampled under the browse intensity categories unbrowsed (NB), lightly (L), moderately (M), heavily (H), or severely (S) during 2010 within the ornamental vegetation survey sites on the control area (NH) and the treatment study areas (SIA and SIB).

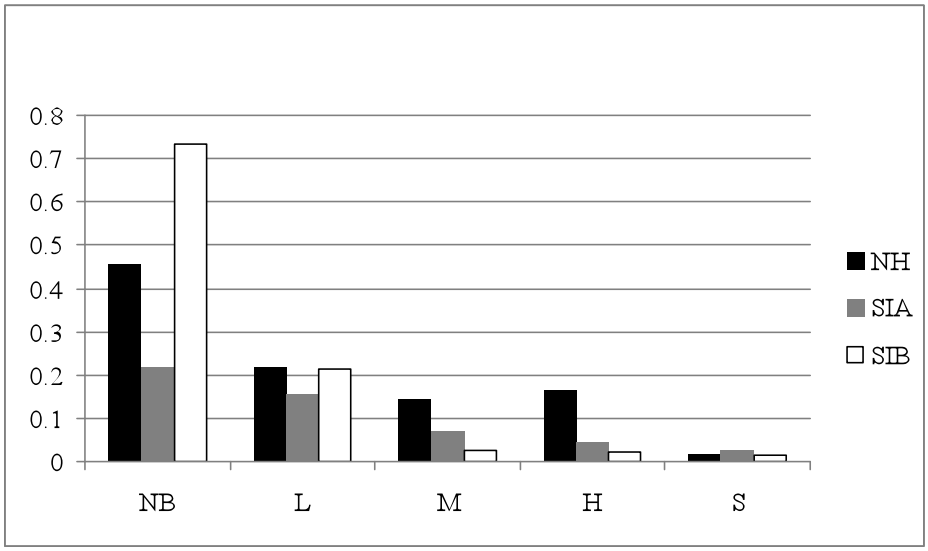


Figure 28a. The numbers of ornamental indicator plants sampled under the browse intensity categories unbrowsed (NB), lightly (L), moderately (M), heavily (H), or severely (S) during 2009 within the ornamental vegetation survey sites on the control area (NH) and the treatment study areas (SIA and SIB). For ornamental indicator species classification, rhododendrons and azaleas were considered high preference indicator species, viburnum spp. were medium preference, and boxwood spp. were low preference.

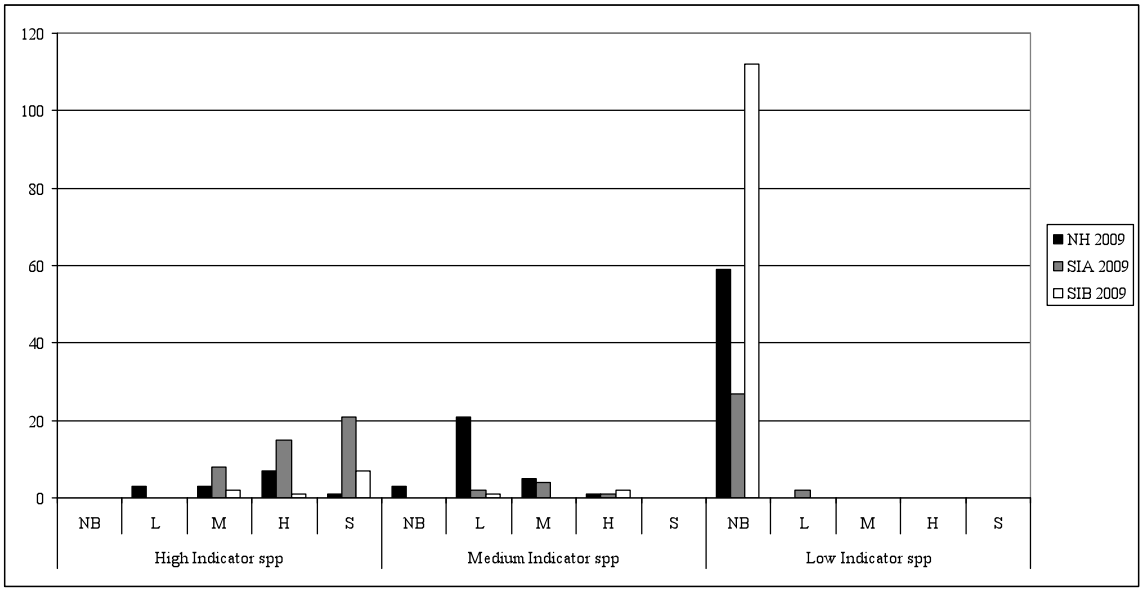


Figure 28b. The number of ornamental indicator plants sampled under the browse intensity categories unbrowsed (NB), lightly (L), moderately (M), heavily (H), or severely (S) during 2010 within the ornamental vegetation survey sites on the control area (NH) and the treatment study areas (SIA and SIB). For ornamental indicator species classification, rhododendrons and azaleas were considered high preference indicator species, viburnum spp. were medium preference, and boxwood spp. were low preference.

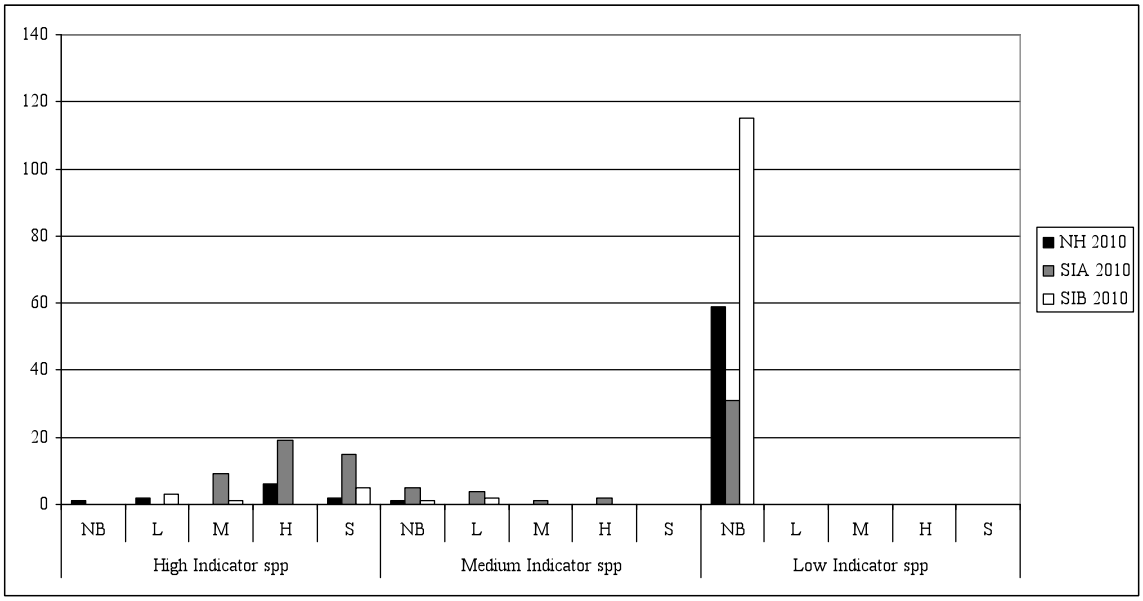


Figure 29. Many natural plots within the control area had nothing growing or plants that were not preferred or unpalatable due to over-browsing by deer. This image depicts the lack of understory commonly observed within sampling sites.

Figure 30. The total amount of corn consumed (lbs) from 4-Poster devices on Shelter Island, New York (treatment area) during the fall season each study year, 2008-2010.

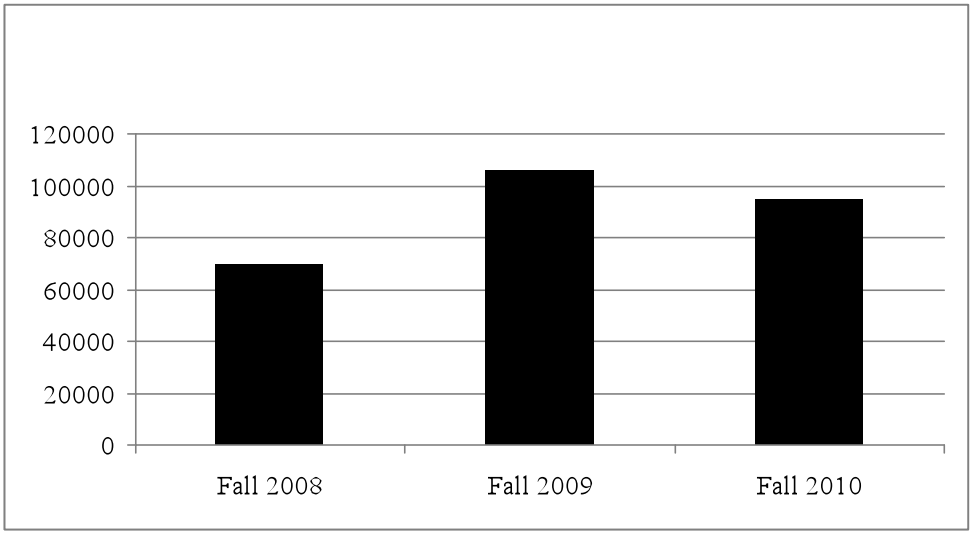


Figure 31. A comparison between the amount of permethrin detected on coat swabs (µg) for each deer with the corresponding average amount of time (minutes) each deer spent visiting a device during 2008-2010.

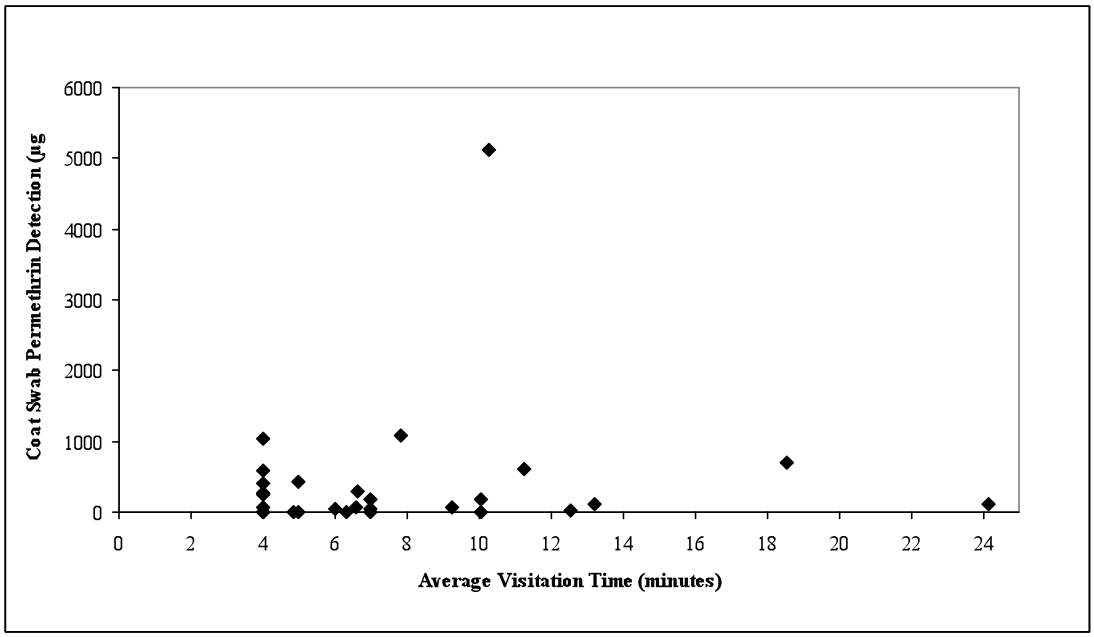


Figure 32. A comparison between the amount of permethrin detected on coat swabs (µg) for each deer with the corresponding number of device visitations each deer made each day throughout all 3 study years, 2008-2010.

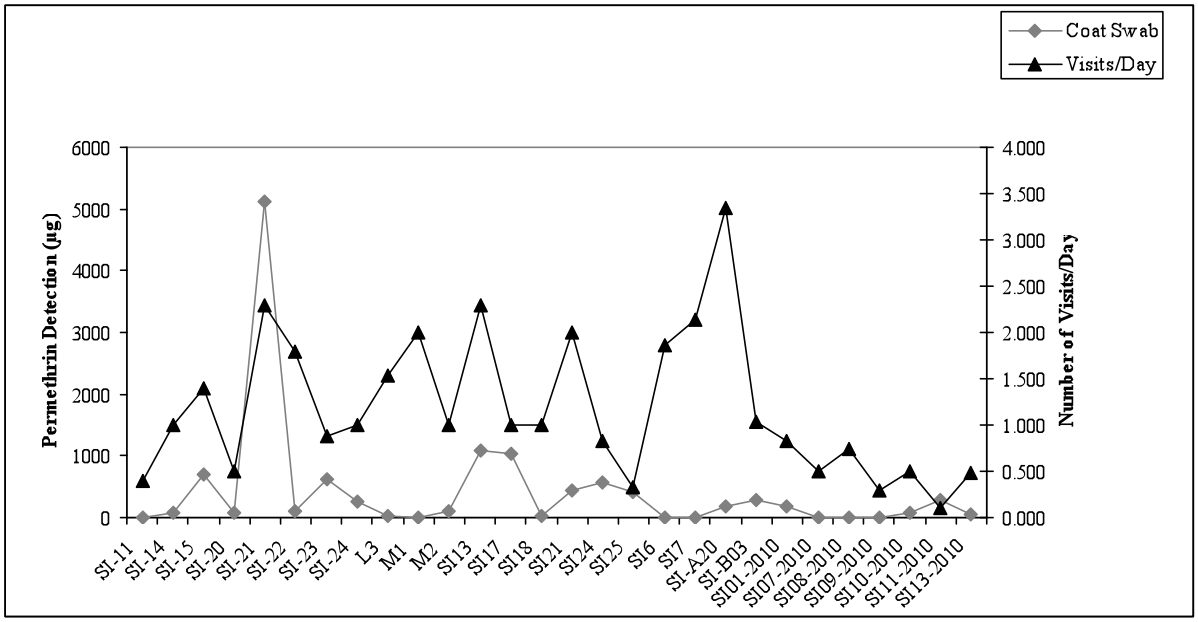


Figure 33. The amount of permethrin detected on coat swabs (µg) from each deer compared with the number of days between the date of the last known observation of the deer using a device on a trail camera photo and the date the deer was harvested and sampled. Data are included from all study years (2008-2010).

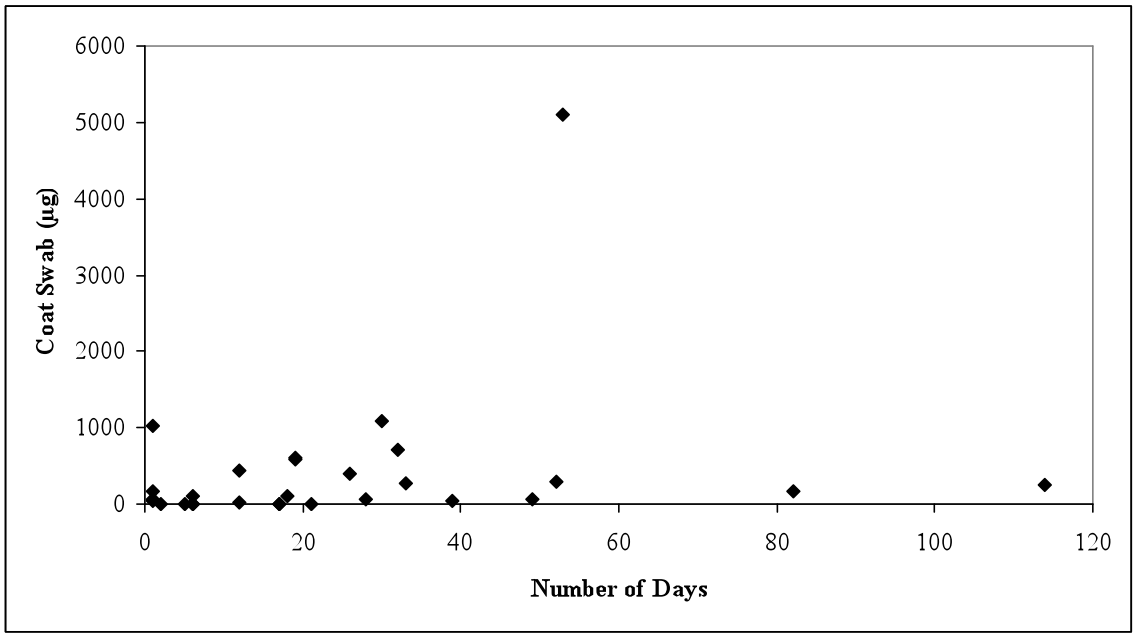


Figure 34. A comparison of both the amounts of permethrin detected on coat swabs (µg) and within neck muscles (ppb) for each deer sampled on Shelter Island, New York (treatment area) during 2008-2010.

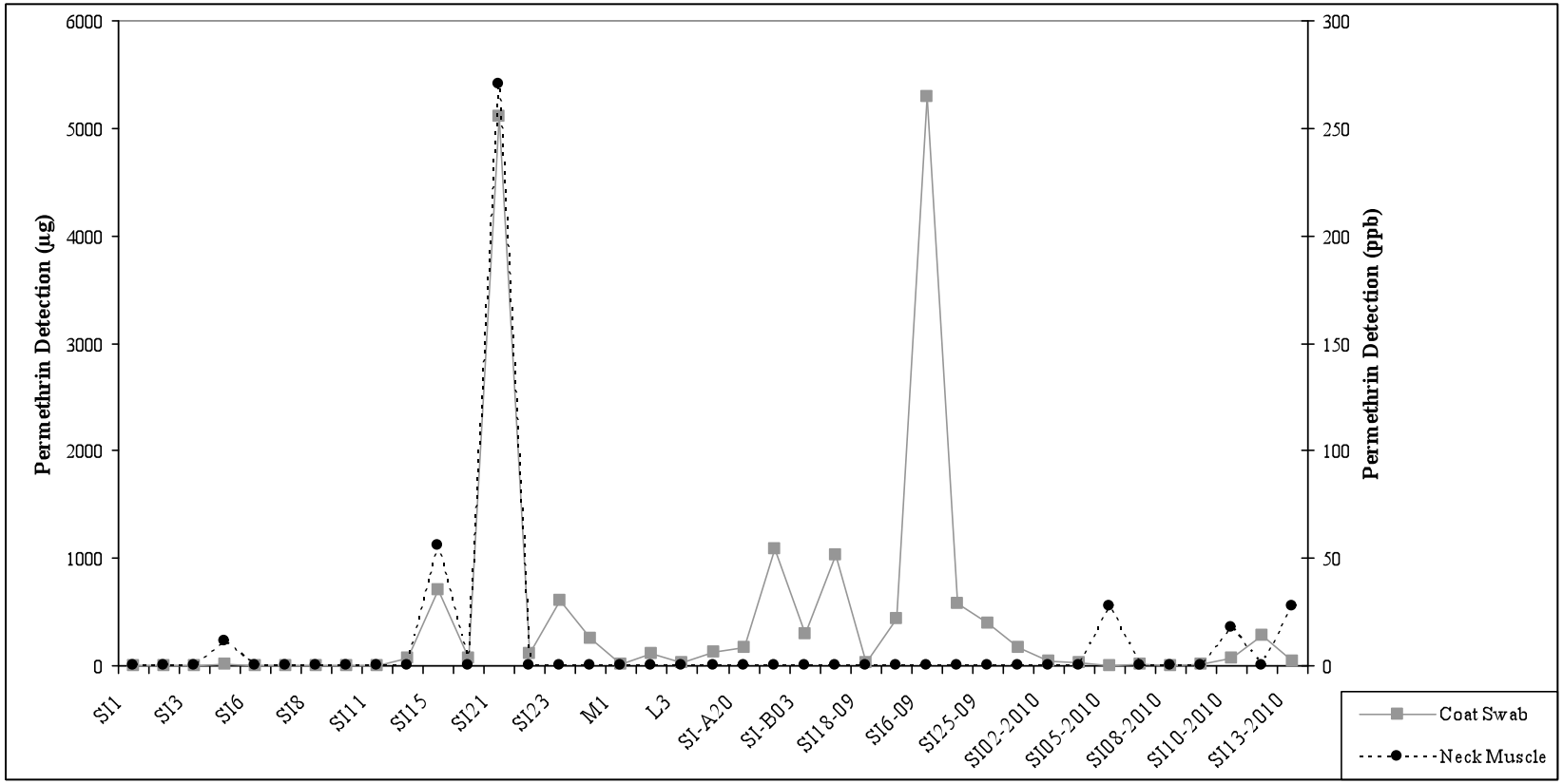


Figure 35. A comparison between the amounts of permethrin detected in neck muscle samples (ppb) for each deer and the number of days between the last date a deer was observed in trail camera photos using a device and the date that deer was harvested as well as the number of days between the last date of permethrin application to the device used and the date that deer was harvested. Data are included from all study years (2008-2010).

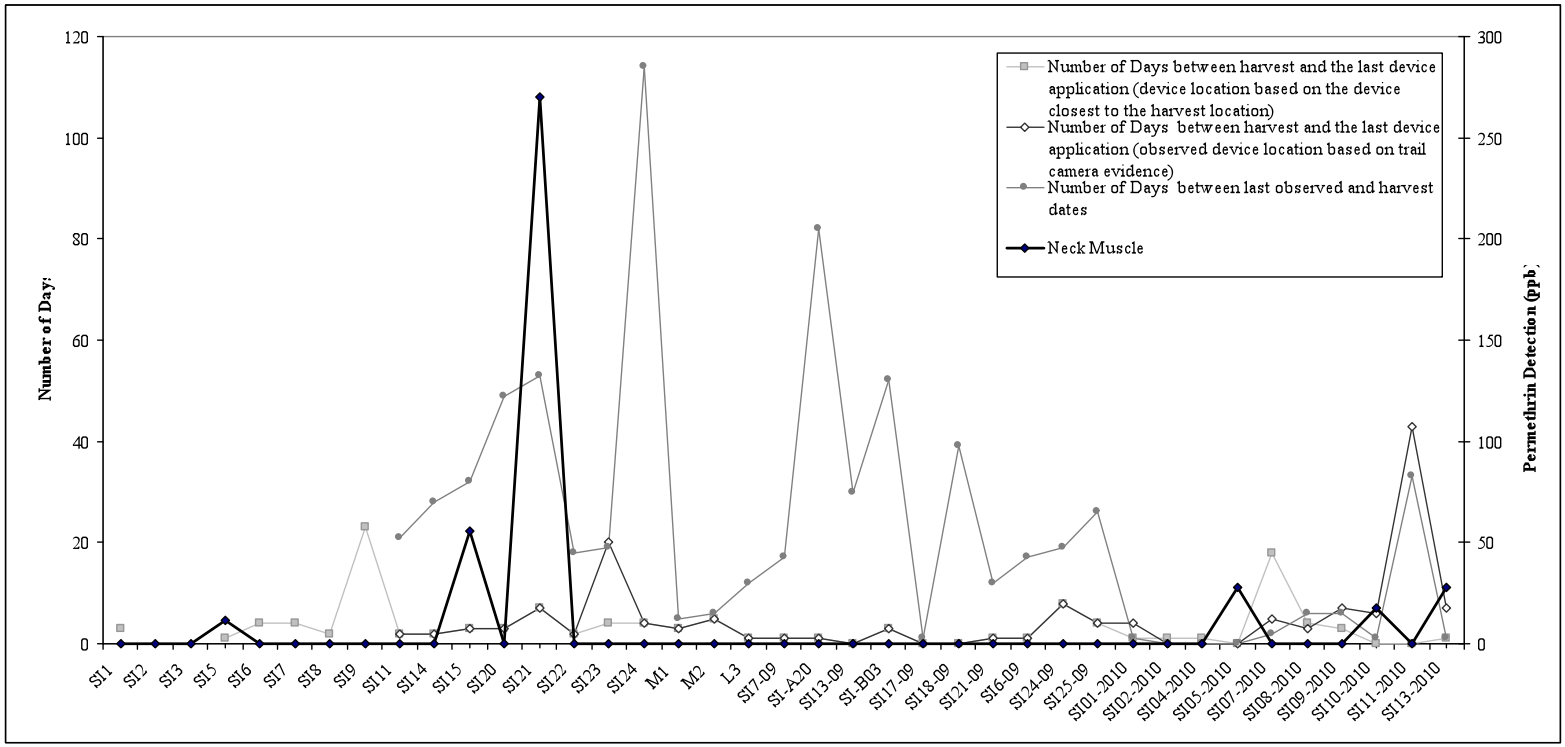
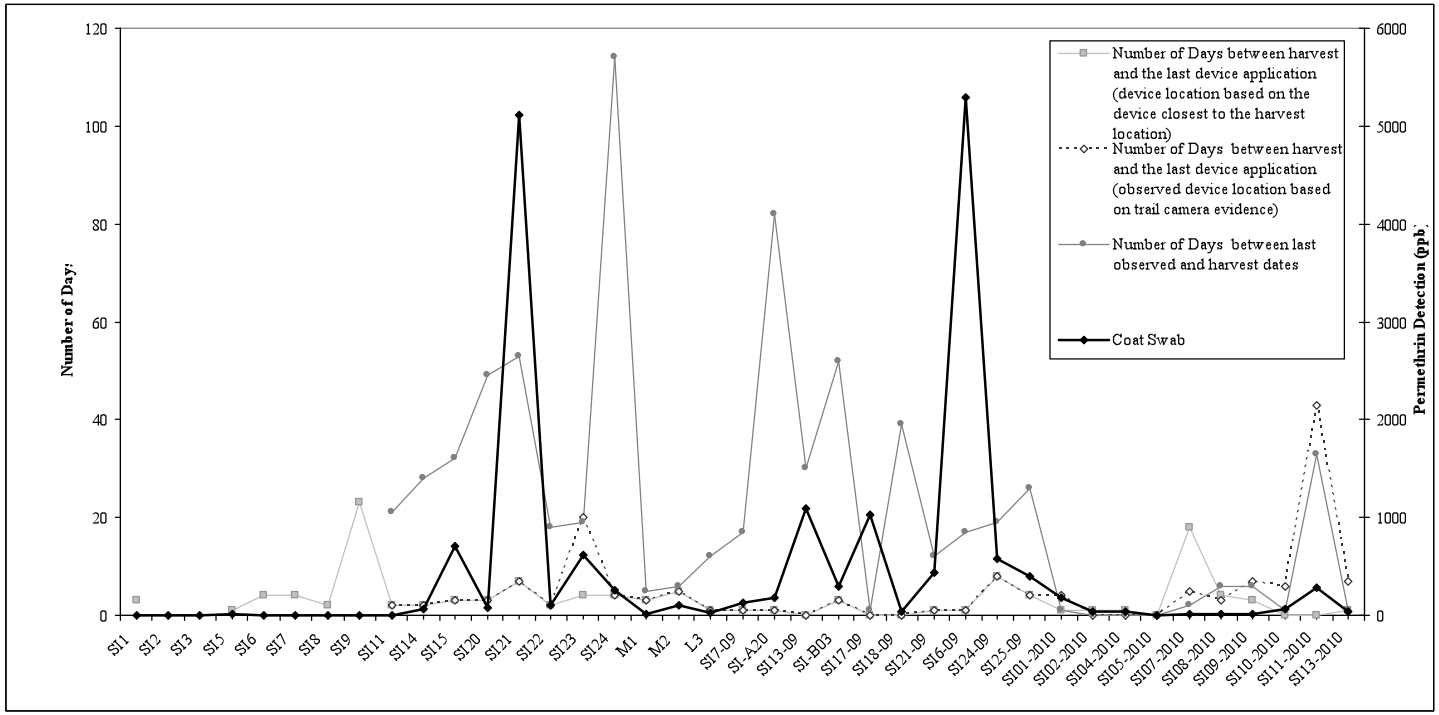


Figure 36. A comparison between the amounts of permethrin detected on coat swabs (µg) for each deer and the number of days between the last date a deer was observed in trail camera photos using a device and the date that deer was harvested as well as the number of days between the last date of permethrin application to the device used and the date that deer was harvested. Data are included from all study years (2008-2010).



Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

Scope of Study for 4-Poster SLN Permit: 3rd Amendment Request for Objective II

Long Island 4-Poster Deer & Tick Study
Department of Natural Resources, Cornell University
June 18, 2010

Objective & Introduction: The Scope of Study outlines the experimental portions of the Special Local Need (SLN) permit for the 4-Poster acaricide delivery system on Fire Island and Shelter Island (Long Island, NY). The 4-Poster study addresses technical concerns held by the New York State Department of Environmental Conservation (DEC) and Department of Health (DOH) regarding 4-Poster registration and use in New York State. Objective II from the Scope of Study was designed to investigate permethrin residues in and on white-tailed deer from 4-Poster treatment areas. This original objective was devised and approved in 2007, then revised and approved in 2008. Laboratory analytical detection of permethrin residues within the muscle of 3 of 16 sampled deer on Shelter Island during 2008 prompted the second amendment of Objective II, which was submitted and approved during July 2009. The third amendment to Objective II, revised and submitted in May 2010, was prompted by potential funding limitations and strong interest in obtaining results that more closely reflect actual hunter exposure.

Overview of Technical Concerns: The concerns of NYSDEC and DOH broadly fall into three general categories:

I. Human and wildlife-associated risks due to change in deer movement and behavior. Voiced concerns include:
- potential impact on vegetation near the deployed stations in both natural and residential settings
- possible increase in deer road crossing leading to more vehicle collisions
- increased contact and potential disease transmission between deer
- changes in deer mortality due to feeding or reduced tick pressure
- use of feeding stations by non-target wildlife.

II. Possible increased human exposure to permethrin via handling and consuming treated deer. Concerns expressed are dermal exposure via the deer hide during handling as well as the possibility of permethrin accumulation in deer tissues that would be orally ingested by consumers of venison.

III. Efficacy of the 4-Poster system in controlling tick densities in human inhabited and visited areas. The 4-Poster label dictates that stations must not be deployed within 100 yards of anywhere a child may be present without adult supervision. It has been agreed that a reduction in tick densities can serve as the best proxy for a reduction in the likelihood of human disease transmission.

Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

**** The original Objective II was devised and approved in the original Scope of Study during 2007.***

Objective II. Investigation of Permethrin Residues in and on Deer from Treated Areas.

There are no public deer check stations on Shelter Island, so we will work with Town staff to collect tissue samples and swabs from deer harvested under Bonus Deer Permits issued by DEC. If the entire developed area on Shelter Island is treated with 4-Poster stations, these deer can be sampled outside of the 2,400-acre study sites. The heart, liver, and a sample of muscle of harvested deer will be stored in glass containers, frozen, and tested for permethrin residues at the Animal Health Diagnostic Laboratory at Cornell using a mass spectroscopy technique. Deer from 4-Poster treatment areas will be collected in collaboration with the Town of Shelter Island Deer Management Program during November and December. Deer hides will be wiped with cotton swabs along both sides of the head and neck in areas likely to contact 4-Poster rollers. We will focus on tagged deer that we know have contacted 4-Poster stations based on the IR-camera photos. These samples will be tested for permethrin by a chromatography technique (Miller et al. 1983). The sample size will be approximately 45 animals for the entire duration of the study (about 15 deer per year). This number includes a sample of 5-10 deer from the control site in North Haven so that we can evaluate background permethrin levels (potential contact from lawn spraying).

**** The first amendment to Objective II was completed and approved during 2008.***

Objective II. Proposed Revisions for Permethrin Residue Investigations

To evaluate potential human exposure to permethrin through contact with deer hides and consumption of deer meat, tissues and pelage will be sampled from 30 deer (10 per study year) on Shelter Island. Check stations will be established during October – December to obtain samples from hunter harvested deer during the regular and nuisance hunting seasons. Although deer harvested from any location on Shelter Island (7,000 acres) will be sampled, tagged deer observed using 4-Poster devices in IR-camera photos will be primarily targeted for sampling.

To evaluate base line permethrin levels or potential permethrin accumulation in deer from broadcast lawn spraying, tissues and pelage from 15 deer (5 per study year) will be sampled in the control site of North Haven. These control samples will provide information that is representative of potential human exposure to permethrin preceding 4-Poster use. Individual hunters will be contacted or check stations will be established during October – December to obtain samples from harvested deer on North Haven.

From each deer, 1 liver and 1 muscle sample will be collected for analysis. These samples will be stored in glass containers, frozen, and tested for permethrin residues at the Animal Health Diagnostic Laboratory at Cornell using a mass spectroscopy technique. Deer pelage in areas likely to contact 4-Poster rollers (both sides of the head and neck) will be wiped with 1 cotton

swab. Swab samples will be analyzed for permethrin by a chromatography technique (Miller et al. 1983).

**** The second amendment to Objective II was completed and approved in July 2009.***

Objective II. Investigation of Permethrin Residues in and on Deer from Treated Areas.

Sampling Objective

Objective II is designed to address concerns of potential human exposure to permethrin via handling and consuming deer from treatment areas. Residue sampling is conducted to detect permethrin residues on deer coats and within deer tissues as well as identify potential risks associated with hunting and consuming venison from areas where 4-Poster technology is used. Similar to sampling conducted during 2008, the sampling conducted during 2009 and 2010 will continue to address the aforementioned sampling objectives related to potential human exposure. Residue sampling will be reassessed upon completion of the 2009 fall sampling season. The Cornell Animal Health Diagnostic Center will continue to conduct all permethrin residue analyses for the 4-Poster Deer and Tick Control Study.

Sampling Plan

Thirteen deer on Shelter Island and 6 deer on North Haven will be collected for permethrin residue sampling during 2009. Permethrin residue sampling will continue during 2010 and sample collection is anticipated from 10 deer on Shelter Island and 5 on North Haven. The deer sampled during the regular fall deer harvest seasons of 2009 and 2010 will be prioritized based on verified 4-Poster device use. Verified device use will be determined for each deer through positive permethrin detections on coat swab samples or infrared-triggered camera detection methods. Sample analysis based on positive coat swab detections will require submission and analysis of swab samples prior to further analysis of muscle and organ samples.

Sampling will include collection of coat swab, muscle tissue, and organ samples from deer on Shelter Island and North Haven. Two muscles (1 neck and 1 hind quarter), 1 liver, and 1 coat swab (4 samples total/deer) will be sampled from each deer submitted for analysis. Sample collection methods will be consistent between Shelter Island and North Haven. Information about each deer sampled will be collected including date and location of harvest/mortality, sex, approximate age, and any sample-related comments or observations.

Permethrin residue sample collection from deer on Shelter Island and North Haven allows for comparisons between residues within the 4-Poster treatment area and the North Haven control area. Samples collected from Shelter Island will be representative of the residues hunters may potentially be exposed to during deer harvest, meat processing, and meat consumption for those deer that use the 4-Poster devices. Deer samples obtained from North Haven, the control area, will provide base-line permethrin levels or potential permethrin accumulation in deer from broadcast lawn spraying. Similar to the 4-Poster tick control technology, lawn spraying often

uses the common insecticide, permethrin. Deer samples from the control site are representative of potential human exposure to permethrin as a result of handling and consuming deer prior to 4-Poster use on Shelter Island.

Three deer of the 13 deer to be sampled on Shelter Island during 2009 will be sampled prior to the fall deer harvest season and regular fall study sampling. These deer will be positively identified using 4-Poster devices based on infrared-triggered camera detections. The samples will be collected prior to August 10, 2009 and submitted to Cornell Animal Health Diagnostic Center (AHDC) upon completion. A minimum 30-day time frame is required by the laboratory for analysis and report completion; the time may be substantially longer depending on laboratory work load. Analysis results are expected prior to the 2009 fall deer harvest season. Pre-season (summer) tissue and coat sampling should be considered ancillary to the fall season sampling. Seasonal differences in deer pelage and feeding habits affect exposure to 4-Poster Tickicide and use of 4-Poster devices. Consequently, residue data from samples collected during summer may not be entirely representative of those collected during the regular fall harvest season.

Regular fall study sampling will begin October 1, 2009. Ten deer from Shelter Island and 6 deer from North Haven will be sampled during the regular fall permethrin residue sampling during 2009. Individual hunters will be contacted during October – December 2009 to obtain samples from harvested deer on Shelter Island and North Haven during the regular fall deer harvest season. The Town of Shelter Island has been asked to assist with sampling through the submission of the first deer harvested each month (October – December) from 5 designated nuisance hunting properties. All samples will be collected by mid-December, prior to the seasonal removal of 4-Poster devices on Shelter Island. Samples will be submitted to Cornell AHDC at the same time and only upon completion of all 2009 permethrin residue sampling. The exact submission date will depend on the AHDC receiving department's holiday schedule but is expected to be no later than December 31, 2009.

Sampling Procedures

Harvest and Field Dressing

Hunters will be asked to contact Cornell as soon as possible post-harvest to provide an ungutted and unskinned deer for sampling purposes. Samples collected from hunter-harvested deer will be collected within less than 12-24 hours post-harvest by Cornell staff. If sampling is not possible directly upon harvest, the hunter will be asked to contact Cornell staff immediately for further direction. The hunter will then be asked to carefully gut but not to skin his/her deer. The hunter will be directed to store the deer in a cool location and store the liver refrigerated, in a non-plastic container. A non-plastic container is requested for storage because plastic could contribute to permethrin leaching from the samples prior to analysis. Cornell staff will skin and collect all remaining samples from deer that are gutted by the hunter. New nitrile gloves will be worn by Cornell staff when collecting samples and hunters will be asked to wear protective gloves when they are responsible for gutting their deer. Deer samples will be prioritized for analysis based on known conditions of sampling (handling and collection solely by Cornell will

be priorities for analysis) as well as availability of verified 4-Poster use indicators (positive coat swabs and/or photo documentation). Detailed records will be kept for each deer sampled and all applicable information will be summarized and available for review.

Liver Collection

Liver samples (100-grams) will be obtained by Cornell staff using a new disposable, sterile scalpel and new nitrile gloves. The liver samples will be wrapped in aluminum foil, sealed in 8 oz. glass jars, and frozen. Gloves will be worn during the liver sample collection to prevent cross-contamination.

The Cornell AHDC analysts will dissect a section of liver from the inner portion of the 100-gram sample. To minimize sample contamination, precautions will be taken by the analysts to ensure no contact occurs between the inner section and the outside of the samples. Analysis will be performed by GC/MS-MS using a minimum detection limit (MDL) of 10 parts per billion.

Hide Swab Collection

Deer coat swabs will be obtained using wipes and a protocol provided by the NYSDEC Division of Solid and Hazardous Materials Laboratory (P. Furdyna, September 2008). Wipes are prepared by exhaustive soxhlet extraction with isopropanol. Each cleaned wipe is saturated with isopropanol and packaged into an I-Chem Certified 300 series four-ounce amber, Teflon-lined screw-topped sealed glass jar. Using a disposable paper template, a 200 cm^2 (4”x8”) area of fur on both lateral side of each deer’s neck (behind the ear) will be swabbed with 1 swab in a movement with and against the grain of the hair. Swab samples will be immediately placed in sealed glass jars and stored frozen until laboratory analysis. Cornell staff will be collecting these samples wearing new, nitrile gloves during swab sample collection and gloves will be changed between each collection.

The permethrin residue analysis of coat swabs will be performed by the Cornell AHDC by gas chromatography/mass spectrometry (GC/MS-MS) using a certified reference standard of permethrin to establish retention time and response (MDL 0.010 mcg/swab). A control swab (unopened wipe) will be tested by the AHDC as an interference control check.

Skinning and Muscle Collection

Prior to muscle sample collection, the entire animal will be skinned, posterior to anterior by Cornell staff. One disposable, sterile scalpel will be used to make the initial incisions in the skin. A new, disposable, sterile scalpel will be used to assist the process of peeling the skin away from the body of the animal. As the skin is peeled from posterior toward anterior, the underlying muscle is exposed for further sample collection. Caution will be taken to avoid contact between the muscle and the scalpel that was used to assist the final stages of the skinning process.

Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

Muscle samples (100-grams) will be obtained by Cornell staff from the neck and hind quarter of each sampled deer. A new, disposable, sterile scalpel will be used to remove a 100-gram section of neck muscle from both lateral sides of a deer being sampled. The 2, 100-gram lateral neck muscle samples will be stored separate until being processed by the AHDC. One 100-gram hind quarter muscle will be removed from either 1 of the lateral sides of a sampled deer. The muscle samples will be wrapped in aluminum foil, sealed in 8 oz. glass jars, and frozen. Gloves will be changed between skin removal and muscle collection to prevent cross-contamination.

The Cornell AHDC analysts will dissect a section of muscle from the inner portion (core) for each muscle sample. To minimize sample contamination, precautions will be taken by the laboratory to ensure no contact occurs between the core and the outside of the sample. For each set of neck muscle samples per deer, the 2, 100-gram lateral neck muscle samples will be cored; the 2 core sections will be combined and homogenized into 1 sample by AHDC analysts. Analysis will be performed by GC/MS-MS using a minimum detection limit (MDL) of 10 parts per billion. A core section from each hind quarter muscle sample will be collected by the AHDC analysts and used for further analysis. No homogenization will occur and analysis will be performed by GC/MS-MS using a minimum detection limit (MDL) of 10 parts per billion.

Sample Storage, Shipment, and Laboratory Analysis

All sample containers will be labeled for proper identification. Muscle, liver, and swab samples will be stored in a freezer immediately upon sampling and kept frozen until shipment to the laboratory. Samples will potentially be stored frozen up to 2 months prior to shipment. Thick-walled Styrofoam coolers and dry ice will be used to ship samples overnight to the Cornell Animal Health Diagnostic Center (AHDC).

**** The <u>third</u> amendment to Objective II was completed and submitted for approval in May 2010.***

Objective II. Investigation of Permethrin Residues in and on Deer from Treated Areas.

Sampling Objective

Objective II is designed to address concerns of potential human exposure to permethrin via handling and consuming deer from treatment areas. Residue sampling is conducted to detect permethrin residues on deer coats and within deer tissues as well as identify potential risks associated with hunting and consuming venison from areas where 4-Poster technology is used. Similar to sampling conducted during 2008 and 2009, the sampling during 2010 will continue to address the aforementioned sampling objectives related to potential human exposure. The Cornell Animal Health Diagnostic Center will continue to conduct the permethrin residue analysis for the 4-Poster Deer and Tick Control Study.

Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

Optimal Sampling Plan

Ten deer on Shelter Island and 5 deer on North Haven will be collected for permethrin residue sampling during 2010. The deer sampled from Shelter Island will be prioritized based on 4-Poster device use verified through infrared-triggered camera detection methods. We will obtain two muscles (1 neck and 1 hindquarter) and 1 coat swab (3 samples total/deer) from each North Haven and each Shelter Island deer. Liver sampling was eliminated from analysis in response to the following: no permethrin residues were detected in liver samples collected during the 2008 and 2009 study years, limited knowledge of regular consumption of liver and other organs by hunters, and funding constraints. Sample collection methods will be consistent between Shelter Island and North Haven. Information about each deer sampled will be collected including date and location of harvest/mortality, sex, approximate age, and any sample-related comments or observations.

Permethrin residue samples collected from deer will be compared between the 4-Poster treatment area (Shelter Island) and the control area (North Haven). Samples collected from Shelter Island will be representative of the residues hunters may potentially be exposed to during deer harvest, meat processing, and meat consumption for those deer that use the 4-Poster devices. Deer samples obtained from North Haven, the control area, will provide base-line permethrin levels or potential permethrin accumulation in deer from broadcast lawn spraying. Similar to the 4-Poster tick control technology, lawn spraying often uses the common insecticide, permethrin. Deer samples from the control site are representative of potential human exposure to permethrin as a result of handling and consuming deer prior to 4-Poster use on Shelter Island.

Sampling is anticipated to occur during October 1- November 30, but not before September 1st. We will work with the Shelter Island Venison Donation Program meat processor to obtain samples from both Shelter Island and North Haven deer. Samples will be submitted to Cornell AHDC upon completion of all 2010 permethrin residue sampling. We anticipate submission to the lab during mid-November 2010 to ensure analysis results are available for review by early to mid-winter 2011.

Contingency Sampling Plan

A minimum of 7 deer on Shelter Island and 3 deer on North Haven will be collected for permethrin residue sampling during 2010. The number of deer may be reduced in response to funding constraints that could limit the duration of the 4-Poster Deer & Tick Study and our ability to cover analysis costs.

The deer sampled from Shelter Island will be prioritized based on 4-Poster device use verified through infrared-triggered camera detection methods. Sampling from Shelter Island deer will include collection of two muscles (1 neck and 1 hindquarter) and 1 coat swab (3 samples total/deer) and sampling from North Haven deer will include collection of 1 hindquarter muscle and 1 coat swab (2 samples total/deer). The elimination of organ (liver) sampling from analysis is proposed in response to the following: no permethrin residues were detected in liver samples

collected during the 2008 and 2009 study years, limited knowledge of regular consumption of liver and other organs by hunters, and funding constraints. Neck muscle samples will not be obtained from deer collected on North Haven as these deer should not have contact with 4-Poster devices thus no permethrin residues are expected. Hindquarter muscles are representative of any potential residues found within muscle tissues resulting from permethrin contact, absorption, and systemic distribution. Sample collection methods will be consistent between Shelter Island and North Haven. Information about each deer sampled will be collected including date and location of harvest/mortality, sex, approximate age, and any sample-related comments or observations. We will work with the Shelter Island Venison Donation Program meat processor to obtain samples from both Shelter Island and North Haven deer. Samples will be submitted to Cornell AHDC upon completion of all 2010 permethrin residue sampling.

Funding constraints necessitate identifying and following a contingency plan to ensure adequate completion of the permethrin residue investigations and Deer and Tick Study. Current funding will allow device deployment and maintenance until roughly September 30, 2010. Sampling will occur September 1 – September 30, 2010 (or possibly later, depending upon the date of device removal) to ensure samples are collected while 4-Poster devices are deployed and actively used by deer. Although sampling will occur prior to the regular fall harvest season, the pelage and feeding habits of deer will be similar and there will be minimal differences in deer exposure to 4-Poster Tickicide and use of 4-Poster devices. Thus, the residue samples collected during September will be closely representative of those collected during the regular fall harvest season (October -December).

Sampling Procedures

Harvest and Field Dressing

We will seek the cooperation of the Shelter Island Venison Donation meat processor to obtain deer for sampling. The meat processor will be asked to follow the White-tailed Deer Harvest & Safe Handling recommendations provided by Cornell (Figure 1) to properly gut and skin each deer for sampling. Samples will be obtained within 12-24 hours post-harvest. If sampling is not possible directly upon harvest, the hunter will be asked to contact Cornell staff immediately for further direction. The meat processor will obtain the deer and using the White-tailed Deer Harvest & Safe Handling recommendations, he will gut but not skin the deer following Cornell recommendations outlined in Figure 1 and store the deer in a cool location. Cornell staff will collect a coat swab and the meat processor will then skin, quarter, and remove the muscle samples from the deer following Cornell recommendations (Figure 1). Detailed records will be kept for each deer sampled and all applicable information will be summarized and available for review.

Hide Swab Collection

Prior to skinning, deer coat swabs will be obtained by Cornell staff using wipes provided by the NYSDEC Division of Solid and Hazardous Materials Laboratory (P. Furdyna, September 2008). Wipes are prepared by exhaustive soxhlet extraction with isopropanol. Each cleaned wipe is saturated with isopropanol and packaged into an I-Chem Certified 300 series four-ounce amber,

Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

Teflon-lined screw-topped sealed glass jar. Using a disposable paper template, a 200 cm^2 (4"x8") area of fur on both lateral side of each deer's neck (behind the ear) will be swabbed with 1 swab in a movement with and against the grain of the hair. Swab samples will be immediately placed in sealed glass jars and stored frozen until laboratory analysis. Cornell staff will collect these samples wearing new, nitrile gloves during swab sample collection.

The permethrin residue analysis of coat swabs will be performed by the Cornell AHDC by gas chromatography/mass spectrometry (GC/MS-MS) using a certified reference standard of permethrin to establish retention time and response (MDL 0.010 mcg/swab). A control swab (unopened wipe) will be tested by the AHDC as an interference control check.

Skinning and Muscle Collection
After the coat swab sample has been collected, the meat processor will follow the Cornell Safe Handling recommendations (Figure 1) to skin the deer. Muscle samples (100-grams) from the neck and hindquarter of each sampled deer will be obtained by the meat processor. The meat processor, following the Cornell Safe Handling recommendations (Figure 1), will quarter the deer for meat processing and then use his knife to remove a 100-gram section of neck muscle from both lateral sides. Using the same knife used for neck muscle removal, the meat processor will remove one 100-gram hindquarter muscle from either of the lateral sides of a sampled deer. Cornell staff will wrap the samples in aluminum foil, seal in 8 oz. glass jars, and freeze until submission to the laboratory for analysis.

The Cornell AHDC analysts will not dissect a section of muscle from the inner portion (core) of each sample for analysis; the entire sample will be homogenized, and the homogenate will be analyzed. For each set of neck muscle samples per deer, the two 100-gram lateral neck muscle samples will be combined and homogenized into 1 sample by the AHDC analysts. Analysis will be performed by GC/MS-MS using a minimum detection limit of 10 parts per billion (ppb).

Sample Storage, Shipment, and Laboratory Analysis
All sample containers will be labeled for proper identification. Muscle and swab samples will be stored in a freezer immediately upon sampling and kept frozen until shipment to the laboratory. Samples will potentially be stored frozen up to 2 months prior to shipment. Thick-walled Styrofoam coolers and dry ice will be used to ship samples overnight to the Cornell Animal Health Diagnostic Center (AHDC).

References

Miller, J. A. et al. 1983. Release of pyrethroids from insecticidal ear tags. Journal of Economic Entomology 76:1335-1340.

Appendix 1. The sampling protocols used for permethrin residue investigations and amendments to Objective II throughout the 4-Poster Deer & Tick Study, 2008-2010.

Figure 1. White-tailed deer harvest and safe handling recommendations provided by Cornell University Department of Natural Resources and Cornell Cooperative Extension of Suffolk County during the 4-Poster Deer & Tick Control Study.

Cornell University

White-tailed Deer: Harvest & Safe Handling

Cornell University Department of Natural Resources &
Cornell Cooperative Extension of Suffolk County

White-tailed deer on Shelter Island may have contacted permethrin on 4-Poster devices being used as a method for tick control. Any permethrin present will likely be on the deer hide, specifically on the head and neck. Based on permethrin residue sampling from hunter harvested deer during the 4-Poster Deer & Tick Control Study, Cornell is providing the following recommendations for handling and processing deer harvested from Shelter Island. As an informed sportsman, you will find that many of these handling suggestions are standard protective measures recommended each time you handle and process a deer. Please visit the NYSDEC's deer and bear hunting webpage to review more information regarding deer harvest throughout NYS as well as information from the NYSDOH about lead in venison (http://www.dec.ny.gov/outdoor/7857.html).

*** ALWAYS WEAR PROTECTIVE RUBBER OR PLASTIC GLOVES WHEN HANDLING, FIELD DRESSING, AND PROCESSING YOUR DEER. CHANGE GLOVES BETWEEN EACH OF THESE STEPS.**

*** SKIN YOUR DEER STARTING FROM THE TAIL END AND MOVING TOWARD THE HEAD TO MINIMIZE CONTACT WITH THE FUR ON THE NECK.**

*** AVOID CONTACT BETWEEN THE HIDE AND THE MEAT YOU INTEND TO PROCESS FOR CONSUMPTION.**

*** DURING THE SKINNING PROCESS, REPLACE OR CLEAN YOUR KNIFE BETWEEN INITIAL INCISIONS THROUGH THE SKIN AND WHEN YOU USE THE KNIFE TO ASSIST PULLING THE SKIN DOWN.**

*** WASH YOUR HANDS THOROUHGLY AFTER FIELD DRESSING AND PROCESSING YOUR DEER.**

Continue Following Standard Recommendations Including:

- Field dress your deer ASAP to speed the loss of body heat, especially in warm weather. This will slow bacterial growth and improve the quality of the meat.
- Clean out the body cavity with a damp cloth or paper towel to remove dirt, feces, hair, and bloodshot areas.
- Prop the body cavity open with sticks to allow for adequate air circulation.
- Minimize meat contact with the brain, spinal cord, spleen, and lymph nodes.
- You may be able to age your deer in a temperature-controlled room, set between 35 and 40°F, for up to a week.
- Wrap your venison tightly with heavily waxed paper, freezer wrap, heavy-duty aluminum foil, or plastic freezer bags before freezing or refrigerating. Take care to remove all excess air from the package. Deer venison will keep 9-12 months in a freezer when properly wrapped.
- Thoroughly clean and sanitize equipment and work areas with a 10% bleach solution (one part bleach in nine parts water) after processing.

For more information please contact Susan Walker or Dan Gilrein
Phone: (631) 727-3595
Web: http://wildlifecontrol.info/TickStudy/Pages/default.aspx

Appendix 2. Safe handling guidelines recommended for all hunters and meat processors handling deer collected from 4-Poster treatment areas.

Cornell University

White-tailed Deer: Harvest & Safe Handling

Cornell University Department of Natural Resources &
Cornell Cooperative Extension of Suffolk County

White-tailed deer on Shelter Island may have contacted permethrin on 4-Poster devices being used as a method for tick control. Any permethrin present will likely be on the deer hide, specifically on the head and neck. Based on permethrin residue sampling from hunter harvested deer during the 4-Poster Deer & Tick Control Study, Cornell is providing the following recommendations for handling and processing deer harvested from Shelter Island. As an informed sportsman, you will find that many of these handling suggestions are standard protective measures recommended each time you handle and process a deer. Please visit the NYSDEC's deer and bear hunting webpage to review more information regarding deer harvest throughout NYS as well as information from the NYSDOH about lead in venison (http://www.dec.ny.gov/outdoor/7857.html).

*** ALWAYS WEAR PROTECTIVE RUBBER OR PLASTIC GLOVES WHEN HANDLING, FIELD DRESSING, AND PROCESSING YOUR DEER. CHANGE GLOVES BETWEEN EACH OF THESE STEPS.**

*** SKIN YOUR DEER STARTING FROM THE TAIL END AND MOVING TOWARD THE HEAD TO MINIMIZE CONTACT WITH THE FUR ON THE NECK.**

*** AVOID CONTACT BETWEEN THE HIDE AND THE MEAT YOU INTEND TO PROCESS FOR CONSUMPTION.**

*** DURING THE SKINNING PROCESS, REPLACE OR CLEAN YOUR KNIFE BETWEEN INITIAL INCISIONS THROUGH THE SKIN AND WHEN YOU USE THE KNIFE TO ASSIST PULLING THE SKIN DOWN.**

*** WASH YOUR HANDS THOROUHGLY AFTER FIELD DRESSING AND PROCESSING YOUR DEER.**

Continue Following Standard Recommendations Including:

- Field dress your deer ASAP to speed the loss of body heat, especially in warm weather. This will slow bacterial growth and improve the quality of the meat.
- Clean out the body cavity with a damp cloth or paper towel to remove dirt, feces, hair, and bloodshot areas.
- Prop the body cavity open with sticks to allow for adequate air circulation.
- Minimize meat contact with the brain, spinal cord, spleen, and lymph nodes.
- You may be able to age your deer in a temperature-controlled room, set between 35 and 40°F, for up to a week.
- Wrap your venison tightly with heavily waxed paper, freezer wrap, heavy-duty aluminum foil, or plastic freezer bags before freezing or refrigerating. Take care to remove all excess air from the package. Deer venison will keep 9-12 months in a freezer when properly wrapped.
- Thoroughly clean and sanitize equipment and work areas with a 10% bleach solution (one part bleach in nine parts water) after processing.

For more information please contact Susan Walker or Dan Gilrein
Phone: (631) 727-3595
Web: http://wildlifecontrol.info/TickStudy/Pages/default.aspx

Appendix 3. Preliminary statements for review of permethrin residue investigations by New York State Department of Health.

STATE OF NEW YORK
DEPARTMENT OF HEALTH
Flanigan Square 547 River Street Troy, New York 12180-2216

Richard F. Daines, M.D.
Commissioner

James W. Clyne, Jr.
Executive Deputy Commissioner

Shelter Island and Fire Island 4-Poster Deer and Tick Study

October 21, 2009

The 4-Poster device is a bait station that applies the pesticide permethrin to deer when they feed, with the intent of killing ticks on the deer. As part of a multi-year study to determine whether 4-Poster devices can reduce tick populations on Shelter and Fire Islands, deer are being sampled for residues of permethrin in meat, liver and on hide. Results of preliminary sampling for permethrin indicate that the health risks of handling and of consuming venison or liver from deer that have visited a 4-Poster device on Shelter Island are very low. The sampling results currently available represent samples collected in 2008 and the summer of 2009. More deer are planned to be tested during the fall of 2009 and in 2010.

Background

A multi-year study is being conducted on Shelter Island and Fire Island, New York to determine whether a device known as 4-Poster can reduce the population of ticks. The 4-Poster device is a passive feeding station designed to control ticks that use deer as a host, such as adult black-legged ticks (*Ixodes scapularis*) and immature and adult lone star ticks (*Amblyomma americanum*). These species of ticks can transmit diseases to humans including Lyme disease, babesiosis and ehrlichiosis. As a deer feeds on the bait (corn kernels) at a 4-Poster station, the animal's neck, head and ears brush against the rollers of the device which are coated with an oily liquid containing the insecticide permethrin. The permethrin then kills ticks on the deer, which should reduce the number of adult ticks that will lay eggs. Studies have shown reductions in tick populations in the years following use of 4-Poster devices, which may reduce the risks of disease transmission to humans.

Aside from its use on the 4-Poster device, permethrin is widely used as an insecticide on numerous food/feed crops, livestock and livestock housing, buildings, indoor and outdoor residential spaces, pets and for community-based mosquito control. In addition, certain products containing permethrin can be sprayed onto clothing, but not directly on skin. Permethrin-impregnated clothing is also available to hunters and hikers, and typically contains 0.5 percent permethrin. Permethrin kills ticks and insects that come in contact with it.

Appendix 3. Preliminary statements for review of permethrin residue investigations by New York State Department of Health.

The New York State Department of Health and some hunters expressed concern during the 4-Poster evaluation process about the potential health risks from exposure to permethrin. Due to the use of the 4-Poster on Shelter Island (where deer hunting is permitted), hunters and others who eat the deer could be exposed to permethrin that is in or on the meat, or from contact with a deer's hide while handling and dressing the deer. To determine the levels of permethrin in and on deer, about ten deer from Shelter Island and about five deer from a comparison area (North Haven), are being harvested and sampled each year during the hunting season from 2008 to 2010.

In September 2008 prior to the hunting season, New York State Department of Environmental Conservation (DEC) and Cornell University staff harvested three deer on Shelter Island as a preliminary effort to measure permethrin levels. These deer were taken from an area where 4-Poster devices were deployed and used by deer since spring 2008. These initial samples were obtained from adult does, and included hide swabs and meat from the neck region, as well as liver. Swab samples from hides were analyzed by DEC chemists, and no permethrin residues were detected. No permethrin residues were detected (at a detection limit of 10 micrograms per kilogram) in the liver and meat samples analyzed by Cornell's Animal Health Diagnostic Center (AHDC) either. While these deer were harvested in areas near 4-Poster devices, it is not known if and when they actually fed at a device.

During October and November 2008, thirteen deer were harvested from Shelter Island, and four deer from North Haven where no 4-Poster devices are used. Eight of the deer from Shelter Island were verified as using 4-Poster devices through photo documentation during Cornell camera surveys. Verification of 4-Poster use was suggested by the presence of corn in the stomach of an additional two deer and no evidence of 4-Poster use was available for the three other deer. Meat and swab samples of hide from the neck region, as well as liver samples, were collected from each of these deer and sent to laboratories for measurement of permethrin residues. All samples from the seventeen Shelter Island and North Haven deer were analyzed by Cornell AHDC. Samples from two Shelter Island deer were also analyzed by Eurofins Central Analytical Laboratories (Metairie, LA).

Permethrin Residue Results for October and November 2008 Samples

Permethrin residues were detected in meat samples of three deer from the treatment area at levels ranging from 11.2 to 270.3 micrograms per kilogram. Permethrin residues were not detected (at a detection limit of 10 micrograms per kilogram) in meat of the other ten deer from the treatment area or in the four deer from the comparison area. Permethrin residues were not detected in liver samples from any of these seventeen deer from the treatment or comparison areas. The hide wipe samples from the thirteen deer in the treatment area contained levels of permethrin ranging from 0.02 micrograms per swab to 5110.3 micrograms per swab. Levels of 0.02 to 0.05 micrograms per swab were found on three of the four deer from the comparison area, while no permethrin residues were detected on the one other deer.

The meat samples were taken from the neck area of the deer directly below the area where the hide swabs indicated the presence of permethrin. Because the hide was cut open in this area to take the meat sample, there is the possibility that the permethrin residues measured in meat may have resulted from residues accidentally transferred from the hide to the meat during sampling. Because of this possibility, the sampling protocol was modified for deer harvested in 2009 to minimize the chances for such cross-contamination, while being more representative of handling and processing practices a hunter would typically use. The modified sampling protocol includes the addition of a second meat sample from the hindquarters of the deer to supplement the samples taken from the liver and the meat from the neck region.

Pre-Hunting Season Sampling for 2009

To determine permethrin residues on and in deer prior to the 2009 hunting season, three deer from Shelter Island that were known from photo documentation to have repeatedly visited 4-Poster stations were harvested and sampled using the revised sampling protocol. These deer were harvested in late July and early August when the coat of deer is much thinner than during the hunting season. This should increase the potential for absorption of permethrin residues from contact with the 4-Poster. The extent to which seasonal differences in 4-Poster visitation by deer would affect permethrin residues in meat and liver is not known. Additional sampling, using the same methods as those in the 2009 pre-season sampling, will be conducted on deer of both Shelter Island and North Haven during the hunting season as required by this multi-year study.

The 2009 pre-hunting season sampling of the three deer known to have repeatedly visited 4-Poster stations on Shelter Island did not detect (at a detection limit of 10 micrograms per kilogram) any permethrin residues in the liver, meat from the hindquarters or meat from the neck area. The hide wipe samples of the neck area from these three deer contained levels of permethrin ranging from 7.5 micrograms per swab to 108.1 micrograms per swab.

Health Risks from Permethrin Residues

Risks to people from eating venison from deer harvested on Shelter Island can be conservatively estimated. The U.S. Environmental Protection Agency's (EPA) Exposure Factor Handbook reports that an adult hunter consumes about 0.3 pounds of venison in a meal. If this meat contains the highest permethrin residue found thus far in the study (270.3 micrograms per kilogram in 2008) and such a meal is consumed every day of the year (approximately 110 pounds of venison per year), the hunter's permethrin exposure would be about 0.6 micrograms per kilogram body weight per day (assuming a body weight of 70 kilograms). This exposure level is about 450-fold lower than the chronic population adjusted dose (cPAD) established by the EPA. The cPAD is the amount of a chemical that a person (adults or children) could consume every day for a lifetime (70 years) and not be expected to have adverse non-cancer effects. While no information on children's consumption of venison is available, it is highly unlikely that a child would consume enough permethrin residues from venison to exceed the cPAD.

Permethrin caused some tumors in laboratory animals exposed to this chemical for their lifetime and is classified by EPA as a "likely human carcinogen." Using the number that EPA established to quantify the potency of permethrin's cancer causing ability, the highest permethrin residues measured in the study thus far, the daily venison consumption rate indicated above and a lifetime of exposure, the estimated increased lifetime cancer risk would be low (about five in a million).

The EPA sets limits on the amount of pesticide residues that may be present in food marketed in the U.S.; these limits are called tolerances. Tolerances have not been established for permethrin in deer meat, but the tolerance for cattle, goat and sheep meat is 100 micrograms per kilogram. The permethrin residues detected in meat of deer on Shelter Island are below these tolerances in all cases but one, the sample containing 270.3 micrograms per kilogram.

The swab samples from deer hide indicate that hunters could be exposed to permethrin residues from skin contact with the hide, particularly in the deer's neck region. The amount of permethrin a hunter might be exposed to by this route is difficult to determine, but if direct skin contact does occur, some skin absorption of permethrin is possible (when conducting risk assessments, EPA has assumed that 5.7 percent of the permethrin present on a person's skin will be absorbed into the body). Skin exposure to permethrin residues can be minimized by wearing rubber, vinyl or latex gloves when handling deer. To further minimize exposure to themselves and also reduce potential contamination of meat, hunters should skin deer starting from the hindquarters going to the neck, and otherwise avoid letting the outer hide contact venison, during handling of the deer.

Summary

The permethrin residue data currently available result from the sampling of nineteen deer from Shelter Island and four from North Haven. These sampling results indicate that permethrin residues can be present on the hide of deer. Thus, measures to reduce exposure, as indicated above, should be taken by hunters. The sampling results also indicate that most deer from Shelter Island do not contain detectable permethrin residues in their meat. Only three of the sixteen deer sampled in 2008 had detectable levels of permethrin in their meat and none of the three deer sampled in 2009 (by a revised methodology designed to reduce the risk of cross-contamination) had detectable permethrin residues. Thus, the health risks from permethrin residues when consuming venison from deer harvested on Shelter Island would be very low, and it is unlikely that anyone will experience any permethrin-related health effects from this source. Nevertheless, the choice of whether to consume venison from deer harvested in the treatment area is a personal one. The additional deer sampling that will take place over the next two years as part of the multi-year study will help further assess potential exposures and health risks.

Additional Information for Hunters

Deer and other game can carry infectious organisms. To minimize the transmission of these organisms when handling game, hunters should take appropriate precautions. For more information visit:

Appendix 3. Preliminary statements for review of permethrin residue investigations by New York State Department of Health.

http://www.nyhealth.gov/environmental/outdoors/fish/fish.htm#other

Also, recent research indicates that small lead fragments can be present in deer harvested with lead bullets. Measures to reduce lead exposure from deer meat should be taken. For more information visit:

http://www.dec.ny.gov/outdoor/48420.html

For information on Cornell's permethrin residue investigation and results for the 4-Poster study, including "Cornell's White-tailed Deer Harvest & Safe Handling"fact sheet, visit:

http://wildlifecontrol.info/TickStudy/Pages/PermethrinResidueInvestigations.aspx

If you have questions on the subject of this fact sheet, call the New York State Department of Health, Center for Environmental Health hotline at 1-800-458-1158, extension 27820.

P:\Guidance\ShelterIslandDeerFS.doc

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI14:

Spike buck (1.5 years old)

Unique Identification: Antler development had 2-points. The left main beam (deer's left side of antlers) flattens at the tip and notice the right main beam (deer's right side) was broken, likely after the last camera survey in September.

Harvest Date: October 17, 2008

Device Visitation: 37 instances of photo documentation were available at 2 different 4-poster devices during camera survey periods in August and September 2008. Photo documentation indicates 23 temporally distinct visits during the camera survey periods. Based on camera survey data, SI14 spent roughly 6 minutes feeding per device visit. The last date of photo documentation was September 19, 2008.

Device Tickicide Application History: The two devices used by SI14 were treated with tickicide on October 15, 2008, prior to harvest.

Camera Survey Photo: SI14

Harvest Photo: SI14

SI15:

9-point buck (2.5 years old)

Unique Identification: Antler development had 9-points. Off the right main beam, the brow tine (T1 or tine 1) curls in at the tip. Near the tip of the right main beam, note where the antler flattens as new growth of an additional tine (T4 or tine 4) would have begun the next fall. Examining the left main beam, the T4 (tine 4) branches off close to the main beam and resembles a 'crab claw.'

Unique physical feature. A distinctive muscle abnormality (degeneration) is visible on the pelvic girdle/hindquarters possibly resulting from a previous deer-vehicle collision.

Harvest Date: October 18, 2008

Device Visitation: 44 instances of photo documentation at 2 different 4-poster devices during camera survey periods in August and September 2008. Photo documentation indicates 16 temporally distinct visits documented during the camera survey periods. Based on camera data,

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI15 spent roughly 10 minutes feeding per device visit. The last date of photo documentation was September 19, 2008.

Device Tickicide Application History: The 2 devices used by SI15 were treated with tickicide on October 15, 2008, prior to harvest.

Camera Survey Photo: SI15

Harvest Photo: SI15

SI11:

6-point buck (1.5 years old)

Unique Identification: Antler development had 6-points. The left main beam (deer's left side of antlers) blunted (broken during antler development in velvet) at the tip.

Harvest Date: October 10, 2008

Device Visitation: 3 instances of photo documentation were available at 1, 4-poster device during the camera survey period in September 2008. Photo documentation indicates 3 temporally distinct visits during the camera survey periods. Based on camera data, SI11 spent roughly 4 minutes feeding per device visit.

Device Tickicide Application History: The device SI11 used during September was treated with tickicide on September 17, 2008, prior to the device being moved to avoid hindering hunting within the area.

Camera Survey Photo: SI11

Harvest Photo: SI11

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI20:

Tagged & GPS-collared Female (2.5 years old): B012

Unique Identification: Unique tag number (B012) and GPS collar.

Harvest Date: November 1, 2008

Device Visitation: 17 instances of photo documentation were available at 1, 4-poster device during August-October camera surveys. Photo documentation indicates 9 temporally distinct visits during the camera survey periods in August-October and an average of 7 minutes feeding at a device per visit. The last date of photo documentation was October 23, 2008.

Device Tickicide Application History: The device used by SI20 was treated on September 17th with 7.5 ml per post. The device was visited on September 25th again but no Tickicide application was made. On October 29th the device was treated with 22.5 ml per post. The next visit was post-harvest of SI20.

Camera Survey Photos: SI20 (B012)

Harvest Photos SI20: No harvest photos were taken for tagged deer. The presence of a tag was suitable for unique identification.

SI21:

7-point Buck (1.7 years old)

Unique Identification: Antler development. Seven points total with 4 points on his right side and 3 points on his left side. Between September 15, 2008 at 1829 hrs and September 16, 2008 at 0423 hrs, SI21 broke his right main beam leaving him with only 6 points. The break can easily be seen in both the camera photos and the post harvest photos.

Harvest Date: 11/5/2008

Device Visitation: 50 instances of photo documentation at 1, 4-poster device during August and September camera surveys. Photo documentation indicates 21 temporally distinct visits during the camera survey periods in August and September and an average of 12 minutes feeding at a device per visit. The last date of photo documentation was September 19, 2008.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Device Tickicide Application History: The device used by SI21 was treated on September 17th with 15 ml Tickicide per post. The device was removed about 1 week after application and not replaced for the remainder of the season thus no further Tickicide applications were made.

Camera Survey Photo: SI21

Harvest Photo: SI21

SI22:

8-point Buck, Tagged (2.5 years old): B052

Unique Identification: Unique tag number (B052). Antler development had 8 points total with 4 points on his right side and 4 points on his left side. This buck had a symmetrical rack but the right brow tine is slightly longer than the left.

Harvest Date: November 8, 2008

Device Visitation: 61 instances of photo documentation at 1, 4-poster device during September and October camera surveys. Photo documentation indicates 13 temporally distinct visits during the camera survey periods in September and October and an average of 20 minutes feeding at a device per visit. The last date of photo documentation was October 21, 2008.

Device Tickicide Application History: The device frequented by SI22 was treated on October 15th with 20 ml per post and again on October 21st with 10 ml per post. It was treated on November 6th with 22.5 ml per post, and the next application was post-harvest.

Camera Survey Photo: SI22 (B052)

Harvest Photos SI22: No harvest photos were taken for tagged deer. The presence of a tag was suitable for unique identification.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI23:

5-point Buck, Tagged (2.5 years old): A055

Unique Identification: Unique tag number (A055). Antler development has 5 points total with 3 points on his right side and 2 points on his left side. This buck had only one brow tine and it is present on the deer's right side.

Harvest Date: November 11, 2008

Device Visitation: 19 instances of photo documentation at 2, 4-poster devices during August-October camera surveys. Photo documentation indicates 7 temporally distinct visits during the camera survey periods in August – October and an average of 14 minutes feeding at a device per visit. Corn was visible in the rumen contents when harvested. The last date of photo documentation was October 21, 2008.

Device Tickicide Application History: The device frequented by SI23 was treated on October 22nd with 25 ml per post and on November 7th with 27.5 ml per post. The next application was post-harvest. Nearby devices were treated on the same days.

Camera Survey Photos: SI23 (A055)

Harvest Photos SI23: No harvest photos were taken for tagged deer. The presence of a tag was suitable for unique identification.

SI24:

Spike Buck, Tagged (1.5 years old): A057

Unique Identification: Unique tag number (A057). Antler development has 2 points total. The buck broke its right spike off prior to harvest on November 11, 2008 and after our last picture of him in August.

Harvest Date: November 11, 2008

Device Visitation: 3 instances of photo documentation at 2, 4-poster devices were obtained. Two photos were obtained during the June, 2008 3-4 day camera survey and 1 photo was

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

obtained during the August, 2008 3-4 day camera survey. A057 (SI24) was present within Shelter Island Study A during June and was located again in the August camera survey on Mashomack Nature Preserve on Shelter Island. Based on the limited photo documentation available, SI24 had 3 temporally distinct visits to a 4-Poster device, spending an average of 4 minutes feeding per visit. The last date of photo documentation was August 18, 2008.

Device Tickicide Application History: The device SI24 was believed to be visiting (based on known movement) around the time of harvest was treated by the applicator on October 21st with 10 ml, October 30th with 25 ml, and November 7th with 10 ml. The next application was post-harvest.

Camera Survey Photos: SI24 (A057)

Harvest Photos SI24: No harvest photos were taken for tagged deer. The presence of a tag was suitable for unique identification.

***SI5:** No Photo Documentation (male, fawn). Corn was visible in the rumen contents.

Harvest Date: October 3, 2008

***SI6:** No Photo Documentation (female, fawn).

Harvest Date: October 6, 2008

***SI7:** No Photo Documentation (female, fawn). Corn was visible in the rumen contents.

Harvest Date: October 6, 2008

***SI8:** No Photo Documentation (female, fawn).

Harvest Date: October 10, 2008

***SI9:** No Photo Documentation (female, 3.5 yrs).

Harvest Date: October 10, 2008

**Please note: There are no photos documenting device use by these deer due to the lack of distinguishing features or characteristics for each deer.*

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

M1:

6-point Buck (1.2 year old)

Unique Identification: This 6-point buck was identified based on unique antler development including a brow tine and a small fork on both the right and left side of his rack. The rack was still in velvet at the time of harvest. Photos provided below provide a means of comparison between antler development observed in trail camera photos and deer harvest photos. These photos allow adequate verification of sampled deer identity.

Harvest Date: July 28, 2009

Device Visitation: M1 was observed using 1 4-Poster device (12 instances of photo documentation) during a camera survey period from July 20th-24th. Photo documentation indicates 6 temporally distinct visits during this time period. On average, M1 was present at the device for 6 minutes per visit. M1 visited the device 3 of 5 days during the July camera survey. During the survey period, M1 was last observed visiting the device on July 23rd. Based on known device use by M1, the animal likely visited the device again prior to harvest (7/28) and after device tickicide application (7/25) although no camera survey data is available to document this.

Device Tickicide Application History: Device #38 was treated on July 25th with 28 ml of tickicide per post. This device has received an average application of 29 ml of tickicide per post each week.

Camera Survey Photos: M1

Harvest Photos: M1

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

M2:

7-point buck (2.2 year old)

Unique Identification: This 7-point buck was identified based on unique antler development including 4 points on his left side and 3 points on his right side including his brow tine. The rack was still in velvet at the time of harvest. Photos are provided below to facilitate identification.

Harvest Date: July 30, 2009

Device Visitation: M2 was observed using 1, 4-Poster device (15 instances of photo documentation) during a camera survey period from July 20th-24th. Photo documentation indicates 5 temporally distinct visits during this time period. On average, M2 was present at the device for 13 minutes per visit. During the survey period, M2 was last observed visiting the device on July 24th. Based on known device use by M2, the animal likely visited the device again prior to harvest (7/30) and after device tickicide application (7/25) although no camera survey data is available to document this.

Device Tickicide Application History: Device #35 was treated on July 25th with 28 ml of tickicide per post. This device has received an average application of 22 ml of tickicide per post each week.

Camera Survey Photos: M2


Harvest Photos: M2


Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

L3:

3-point buck (Unknown Age)

Unique Identification: This 3-point buck was identified based on unique antler development such as 2 points on his right side including a brow tine and a deformed spike on his left side. The rack was still in velvet at the time of harvest. Photos are provided below to facilitate identification.

Harvest Date: August 4, 2009

Device Visitation: L3 was observed using 1, 4-Poster device (66 instances of photo documentation) during the April (20-27), June (17-22), and July (20-24) 2009 camera survey periods. Photo documentation indicates L3 visited the device 3 of the 5 July survey days and made 6 temporally distinct visits. On average during July, L3 was present at the device for 10 minutes per visit. L3 was last observed visiting the device on July 23rd. During April, June, and July, L3 was present at the device for an average of 14.5 minutes per visit and observed visiting the device roughly 60-65% of each monthly camera survey period. Based on this known device use, it is likely that L3 visited the device a minimum of 7 of the 12 days between the last day observed on camera (7/23) and date of harvest (8/4). The device was treated with tickicide one day prior to harvest of L3 thus due to variable use, it is difficult to know if L3 came in contact with a newly treated device.

Device Tickicide Application History: Device #22 was treated on August 3rd with 40 ml of tickicide per post. This device has received an average application of 9 ml of tickicide per post twice each week.

Camera Survey Photos: L3


Harvest Photos: L3


Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI6-09:

5-point buck (1.5 year old)

Unique Identification: This 5-point buck was identified based on unique antler development as well as a tag (A75) in his left ear. Photos are provided below to facilitate identification.

Harvest Date: October 2, 2009

Device Visitation: SI6-09 was observed using the 4-Poster device 7 days (58 instances of photo documentation) during a camera survey period from September 8th-15th. Photo documentation indicates 28 temporally distinct visits during this time period. On average, SI6-09 was present at the device for 7 minutes per visit. During the survey period, SI6-09 was last observed visiting the device on September 15th.

Device Tickicide Application History: Device #2 was treated prior to harvest on October 1st with 13 ml of tickicide per post. This device has received an average application of 14.39 ml of tickicide per post each week.

Camera Survey Photos: SI6-09

Harvest Photos: SI6-09

No harvest photos were taken for SI6-09 tagged deer. The presence of a tag was suitable for unique identification.

SI7-09:

4-point buck (1.5 year old)

Unique Identification: This 4-point buck was identified based on unique antler development including that the left fork of his rack was slightly larger than the right. Photos are provided below to facilitate identification.

Harvest Date: October 2, 2009

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Device Visitation: SI7-09 was observed using the 4-Poster device 7 days (41 instances of photo documentation) during a camera survey period from September 8th-15th. Photo documentation indicates 16 temporally distinct visits during this time period. On average, SI7-09 was present at the device for 10 minutes per visit. During the survey period, SI7-09 was last observed visiting the device on September 15th.

Device Tickicide Application History: Device #13 was treated prior to harvest on October 1st with 14 ml of tickicide per post. This device has received an average application of 23.1 ml of tickicide per post each week.

Camera Survey Photos: SI7-09

Harvest Photos: SI7-09

SI13-09:

Spike buck (1.5 year old)

Unique Identification: This spike buck was identified based on unique antler development including a scar/growth over the right eye. Photos are provided below to facilitate identification.

Harvest Date: October 15, 2009

Device Visitation: SI13-09 was observed using the 4-Poster device 7 days (39 instances of photo documentation) during a camera survey period from September 8th-15th. Photo documentation

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

indicates 22 temporally distinct visits during this time period. On average, SI13-09 was present at the device for 8 minutes per visit. During the survey period, SI13-09 was last observed visiting the device on September 15th.

Device Tickicide Application History: Device #7 was treated prior to harvest on October 8th with 2 ml of tickicide per post. This device has received an average application of 13.13 ml of tickicide per post each week.

Camera Survey Photos: SI13-09


Harvest Photos: SI13-09


SI17-09:

4-point buck (1.5 year old)

Unique Identification: This 4-point buck was identified based on unique antler development including a deformed left antler tip. Photos are provided below to facilitate identification.

Harvest Date: November 19, 2009

Device Visitation: SI17-09 was observed using the 4-Poster device 1 day (1 instance of photo documentation) during a camera survey period from November 16th-20th. Photo documentation indicates 1 temporally distinct visit during this time period. On average, SI17-09 was present at the device for 4 minutes per visit. During the survey period, SI17-09 was last observed visiting the device on November 18th.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Device Tickicide Application History: Device #12 was treated prior to harvest on November 19th with 3 ml of tickicide per post. This device has received an average application of 8.43 ml of tickicide per post each week.

Camera Survey Photos: SI17-09 Harvest Photos: SI17-09

SI18-09:

8-point buck (3.5 year old)

Unique Identification: This 8-point buck was identified based on unique antler development including two small points of the right tine. Photos are provided below to facilitate identification.

Harvest Date: November 23, 2009

Device Visitation: SI18-09 was observed using the 4-Poster device 3 days (4 instances of photo documentation) during a camera survey period from October 12th-16th. Photo documentation indicates 3 temporally distinct visits during this time period. On average, SI18-09 was present at the device for 4 minutes per visit. During the survey period, SI18-09 was last observed visiting the device on October 14th.

Device Tickicide Application History: Device #51 was treated prior to harvest on November 19th with 15 ml of tickicide per post. This device has received an average application of 23.13 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photos: SI18-09

Harvest Photos: SI18-09

SI21-09:

4-point buck (1.5 year old)

Unique Identification: This 4-point buck was identified based on unique antler development including two small brow tines. Photos are provided below to facilitate identification.

Harvest Date: December 1, 2009

Device Visitation: SI21-09 was observed using the 4-Poster device 4 days (8 instances of photo documentation) during a camera survey period from November 16th-20th. Photo documentation indicates 6 temporally distinct visits during this time period. On average, SI21-09 was present at the device for 5 minutes per visit. During the survey period, SI21-09 was last observed visiting the device on November 19th.

Device Tickicide Application History: Device #14 was treated prior to harvest on November 30th with 16 ml of tickicide per post. This device has received an average application of 15.71 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photos: SI21-09

Harvest Photos: SI21-09

SI24-09:

4-point buck (1.5 year old)

Unique Identification: This 4-point buck was identified based on unique antler development including a unique shaped right main beam. Photos are provided below to facilitate identification.

Harvest Date: December 8, 2009

Device Visitation: SI24-09 was observed using the 4-Poster device 4 days (6 instances of photo documentation) during a camera survey period from November 16th-20th. Photo documentation indicates 5 temporally distinct visits during this time period. On average, SI24-09 was present at the device for 4 minutes per visit. During the survey period, SI24-09 was last observed visiting the device on November 19th.

Device Tickicide Application History: Device #13 was treated prior to harvest on December 6th with 18 ml of tickicide per post. This device has received an average application of 20.2 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photos: SI24-09

Harvest Photos: SI24-09

SI25-09:

Spike buck (1.5 year old)

Unique Identification: This spike buck was identified based on unique antler development including a couple small broken points on each main beam. Photos are provided below to facilitate identification.

Harvest Date: December 13, 2009

Device Visitation: SI25-09 was observed using the 4-Poster device 2 days (3 instances of photo documentation) during a camera survey period from November 16th-20th. Photo documentation indicates 2 temporally distinct visits during this time period. On average, SI25-09 was present at the device for 4 minutes per visit. During the survey period, SI25-09 was last observed visiting the device on November 17th.

Device Tickicide Application History: Device #5 was treated prior to harvest on December 9th with 13 ml of tickicide per post. This device has received an average application of 18.53 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photos: SI25-09 Harvest Photos: SI25-09

SI-B03:

Female (2.5+ year old)

Unique Identification: Tagged Female (B03). Photos are provided below to facilitate identification.

Harvest Date: October 11, 2009

Device Visitation: SI-B03 was observed using the 4-Poster device 4 days (15 instances of photo documentation) during a camera survey period from August 17th-21st. Photo documentation indicates 10 temporally distinct visits during this time period. On average, SI-B03 was present at the device for 6 minutes per visit. During the survey period, SI-B03 was last observed visiting the device on August 20th.

Device Tickicide Application History: Device #25 was treated prior to harvest on October 8th with 18 ml of tickicide per post. This device has received an average application of 23.75 ml of tickicide per post each week.

Camera Survey Photos: SI-B03

Harvest Photos SI-B03: No harvest photos were taken for SI-B03 tagged deer. The presence of a tag was suitable for unique identification

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI-A20:

Female (1.7 year old)

Unique Identification: Tagged Female (A20). Photos are provided below to facilitate identification.

Harvest Date: December 7, 2009

Device Visitation: SI-A20 was observed using the 4-Poster device 7 days (53 instances of photo documentation) during a camera survey period from September 8th-16th. Photo documentation indicates 24 temporally distinct visits during this time period. On average, SI-A20 was present at the device for 9 minutes per visit. During the survey period, SI-A20 was last observed visiting the device on September 15th.

Device Tickicide Application History: Device #17 was treated prior to harvest on December 6th with 25 ml of tickicide per post. This device has received an average application of 23.7 ml of tickicide per post each week.

Camera Survey Photos: SI-A20

Harvest Photos SI-A20: No harvest photos were taken for SI-A20 tagged deer. The presence of a tag was suitable for unique identification.

SI01-2010:

Male (1.7 year old)

Unique Identification: This 3-point buck was identified based on 1 brow tine on the right antler and a shorter, twisted left antler with one small spur near the point. Photos are provided below to facilitate identification.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Harvest Date: October 22, 2010

Device Visitation: SI01-2010 was observed using the 4-Poster device 3 days (11 photos documenting device use) during October 17th-23rd. Photo documentation indicates 5 temporally distinct visits and an average of 6.8 minutes at a device per visit. SI01-2010 was last observed visiting the device the morning of Sept 21, 2010.

Corn was visible in the rumen contents.

Device Tickicide Application History: Device #13 was treated prior to harvest on October 21st with 2 ml of tickicide per post. This device has received an average application of 18.4 ml of tickicide per post each week.

Camera Survey Photo: SI01-2010

Harvest Photo: SI01-2010

SI07-2010:

Male (2.5 year old)

Unique Identification: This 4-point forked buck has 2 broken tines, 1 on the left and 1 on the right antler. Photos are provided below to facilitate identification.

Harvest Date: November 2, 2010

Device Visitation: SI07-2010 was observed using 1, 4-Poster device 1 day (1 photo documenting device use) during a camera survey period from September 30th to November 2nd. Photo documentation indicates 1 temporally distinct visit with approximately 4 minutes of feeding time. SI07-2010 was last observed at a 4-Poster device on October 31, 2010.

Some corn was visible in the rumen contents.

Device Tickicide Application History: Device #22 was treated prior to harvest on November 1st with 18 ml of tickicide per post. This device has received an average application of 11.5 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photo: SI07-2010 Harvest Photos: SI07-2010

SI08-2010:

Female (4.5 year old)

Unique Identification: Tagged female A22. Photos are provided below to facilitate identification.

Harvest Date: November 3, 2010

Device Visitation: SI08-2010 was observed using 1, 4-Poster device 3 days (5 photos documenting device use) during a camera survey period from October 29th to November 2nd. Photo documentation indicates 3 temporally distinct visits with an average of 7 minutes of feeding time per visit. SI08-2010 was last observed at a 4-Poster device on October 28, 2010.

Mostly acorns and small amounts of corn were visible in the rumen contents.

Device Tickicide Application History: Device #37 was treated prior to harvest on October 28th with 4 ml of tickicide per post. This device has received an average application of 20.4 ml of tickicide per post each week.

Camera Survey Photo: SI08-2010

Harvest Photos: No harvest photos were taken for tagged deer. The presence of ear tags was suitable for unique identification.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

SI09-2010:

Male (1.5 year old)

Unique Identification: This 6-point buck was identified by 1 broken tine on the right antler and relatively long brow tines. Photos are provided below to facilitate identification.

Harvest Date: November 4, 2010

Device Visitation: SI09-2010 was observed using 1, 4-Poster device 4 days (6 photos documenting device use) during September 7th-16th and October 26th – 31st. Photo documentation indicates 4 temporally distinct visits with an average of 5 minutes of feeding time per visit. SI09-2010 was last observed at a 4-Poster device on October 29, 2010.

Corn was visible in the rumen contents.

Device Tickicide Application History: Device #7 was treated prior to harvest on November 1st with 4 ml of tickicide per post. This device has received an average application of 12.0 ml of tickicide per post each week.

Camera Survey Photos: SI09-2010

Harvest Photo: SI09-2010

SI10-2010:

Male (1.5 year old)

Unique Identification: This 4-point buck had 2 tines on the left antler and none on the right. Photos are provided below to facilitate identification.

Harvest Date: November 10, 2010

Device Visitation: SI10-2010 was observed using 1, 4-Poster device 2 days (2 photos documenting device use) during November 8th-12th. Photo documentation indicates 2 temporally distinct visits with an average of 4 minutes of feeding time per visit. SI10-2010 was last observed at a 4-Poster device on November 9, 2010.

Corn was visible in the rumen contents.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Device Tickicide Application History: Device #5 was treated prior to harvest on November 10th with 18 ml of tickicide per post. This device has received an average application of 17.8 ml of tickicide per post each week.

Camera Survey Photo: SI10-2010 Harvest Photo: SI10-2010

SI11-2010:

Male (1.5 year old)

Unique Identification: This spike buck was identified by 2 short antlers, with the right antler the longer of the 2 and the left barely visible. Photos are provided below to facilitate identification.

Harvest Date: November 10, 2010

Device Visitation: SI11-2010 was observed using 1, 4-Poster device 2 days (2 photos documenting device use) during October 1st – 17th and October 26th – 31st. Photo documentation indicates 2 temporally distinct visits with an average of 4 minutes of feeding time per visit. SI11-2010 was last observed at a 4-Poster device on November 8, 2010.

Corn was visible in the rumen contents.

Device Tickicide Application History: Device #7 was treated prior to harvest on November 10th with 6 ml of tickicide per post. This device has received an average application of 11.9 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photo: SI11-2010

Harvest Photo: SI11-2010

SI13-2010:

Male (1.5 year old)

Unique Identification: This 3-point buck was identified by a forked left antler and a damaged right antler. The right antler was turned down, growing towards the animal's mouth. Photos are provided below to facilitate identification.

Harvest Date: November 11, 2010

Device Visitation: SI13-2010 was observed using 3, 4-Poster devices 9 days (21 photos documenting device use) during October 18th to November 12th. Photo documentation indicates 12 temporally distinct visits with an average of 7 minutes of feeding time per visit. SI13-2010 was last observed at a 4-Poster device on November 10, 2010.

Corn was visible in the rumen contents.

Device Tickicide Application History: Device #7 was treated prior to harvest on November 10th with 6 ml of tickicide per post. This device has received an average application of 11.9 ml of tickicide per post each week. Device #31 was treated prior to harvest on November 10th with 15 ml of tickicide per post. This device has received an average application of 23.8 ml of tickicide per post each week. Device #55 was treated prior to harvest on November 11th with 14 ml of tickicide per post. This device received an average application of 13.7 ml of tickicide per post each week.

Appendix 4. Detailed information for deer harvested from Shelter Island, New York and sampled for permethrin residue investigations during 2008-2010.

Camera Survey Photo: SI13-2010 Harvest Photo: SI13-2010

*__SI02-2010:__ No Photo Documentation (female, fawn). Corn was visible in the rumen contents.

Harvest Date: October 26, 2010

*__SI04-2010:__ No Photo Documentation (female, adult 2.5 years). Corn was visible in rumen contents.

Harvest Date: October 26, 2010

*__SI05-2010:__ No Photo Documentation (female, adult 3.5 years). Corn was visible in the rumen contents.

Harvest Date: November 1, 2010

**Please note: There are no photos documenting device use by these deer due to the lack of distinguishing features or characteristics for each deer.*

Appendix 5. New York State-Certified Pesticide Applicators providing services to the study

Shelter Island – (2008 – 2010, excluding Mashomack 2009 – 2010)
John Bennett NY Commercial Pesticide Applicator ID# C1800309
Ryan Anderson, NY Commercial Pesticide Apprentice
Premier Pest Control, NY Business/Agency Registration # 10723
1736 County Rd 39, Southampton NY 11968
Phone 631-287-5551

Shelter Island –Mashomack (2009 – 2010)
Ilia Rochlin NY Commercial Pesticide Applicator ID# C1831788
Gerald Franklin NY Commercial Pesticide Applicator ID# C1831068
Chris Kampfer NY Commercial Pesticide Applicator ID# C1831171
Brian Viggiano NY Commercial Pesticide Applicator ID# C1831075
Danny Lopez NY Commercial Pesticide Applicator ID# C1800278
Glenn Springman NY Commercial Pesticide Applicator ID# C1659413
Steven Impellizzeri NY Commercial Pesticide Applicator ID# C1671627
Mike Masterson, NY Commercial Pesticide Applicator ID# 1831797

Suffolk County Dept. of Public Works – Division of Vector Control
NY Business/Agency Registration # 02189
335 Yaphank Ave., Yaphank, NY 11980
Phone 631-852-4010

Fire Island (2008-2010)
Lynn Frank NY Commercial Pesticide Applicator ID# C1269607
Kenny Munch NY Commercial Pesticide Applicator ID# C1806759
Suburban Pest Management LLC, NY Business/Agency Registration #14395
879 Jericho Turnpike Smithtown NY 11787
Phone 631-864-6900

Joe Brodtman NY Commercial Pesticide Applicator ID# C1839248 (2008)
Chris Thompson NY Commercial Pesticide Applicator ID# C1831746 (2008 – 2010)
John Cabral NY Commercial Pesticide Applicator ID# C1869557 (2008 – 2009)
Joseph Leissle, NY Commercial Pesticide Technician ID# T1874860 (2010)
Robert Moses State Park, NY Business/Agency Registration #06505
PO Box 247, Babylon, NY 11702