The efficiency of 4-poster tick management stations on three tick species populations within Brookhaven National Laboratory.

Tayelor Gosselin, Department of Wildlife, Fisheries, and Conservation Biology, University of Maine, Orono, ME 04469
Tim Green, Environmental Protection Division, Brookhaven National Laboratory, Upton, New York 11973

Abstract

Increased risk of contracting Lyme Disease and other tick related illnesses has led to many research and management projects being conducted throughout the United States. In 2013, Brookhaven National Laboratory (BNL) set up fourteen 4-poster tick management systems in an effort to control populations of three tick species: blacklegged (deer) tick (Ixodes scapularis), American dog tick (Dermacentor variabilis), and lone star tick (Amblyomma americanum). An increase in the deer population in 2014 resulted in four additional systems being added. In 2015, when the deer population decreased, three systems were removed. Each station, filled with corn to bait deer, has four rollers coated in 10% permethrin which kills ticks attempting to feed on treated deer. Camera traps are present at all stations to determine usage and assist in determining the BNL deer population. Tick populations are determined by flagging, where a 0.46 by 0.76 meter flag is dragged across vegetation 30 times for 1 minute each at every site. Captured ticks were then identified and recorded. Other 4-poster studies show an overall decrease in tick populations, with significant results showing after the third year of treatment. One such study has been carried out on Shelter Island and Fire Island, with results supporting the use of 4-poster devices as a means to control the tick populations. Although this was the third year of the study at BNL, percent control was less than expected, with the highest control at 59% for A. americanum males.

Introduction

- Ticks can be infected with vector-borne diseases during the larval and nymphal stages. The most notable is Lyme disease.

- Other diseases include Powassan disease, Anaplasmosis, Babeosis, Rocky Mountain spotted fever (RMSF), Tularemia, Ehrlichiosis, and Southern tick-associated rash illness (STARI).

- Tick species present on Long island are deer tick (*I. scapularis*), lone star tick (*A. americanum*), and dog tick (*D. variabilis*).

- Ticks use deer not only as a food source, but also as a means of transportation into other areas, increasing human exposure to illness.

- 4-poster devices apply acaricide to the head, neck, and ears of deer as they feed.

- Permethrin (acaricide used in this study) kills ticks attempting to feed on deer.

- This study focused on the effectiveness of the 4-posters in controlling the free-living tick population after 3 years of treatment.
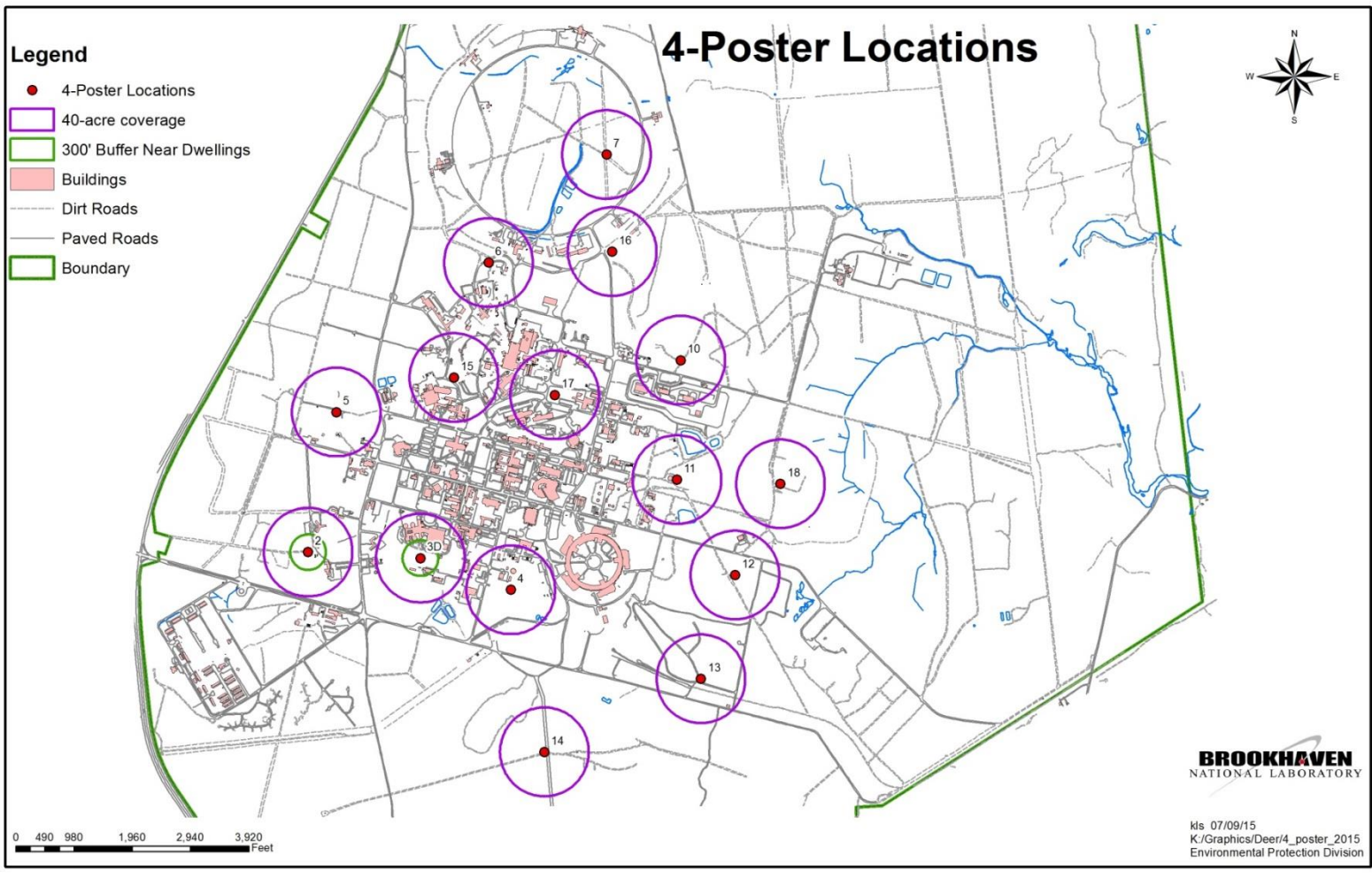

Figure 1 & 2: Deer with ears relatively free of ticks at 4-poster station 5 (left). Deer with ears covered in ticks with no 4-poster (right).

Methods and Materials

- 15 4-poster devices were deployed around the BNL site.

- Devices were serviced weekly, and for every 1.5 lbs of corn missing, 1.25 mL of permethrin was applied to the rollers.

- Each device had a trail camera (either Wildgame Innovations or Moultrie) set up adjacent to it.

- Memory cards were collected bi-weekly, and pictures sorted by species presence into folders.

- A 0.46 x 0.76 meter flag was dragged across vegetation and leaf litter to sample the tick population.

- Each device was flagged 30 times – 30 seconds each.

- Ticks were identified as either adult male, adult female, nymph or larva of *A. americanum*, *I. scapularis*, or *D. variabilis*.

Figure 3: Deer feeding and being treated at the 4-poster station.

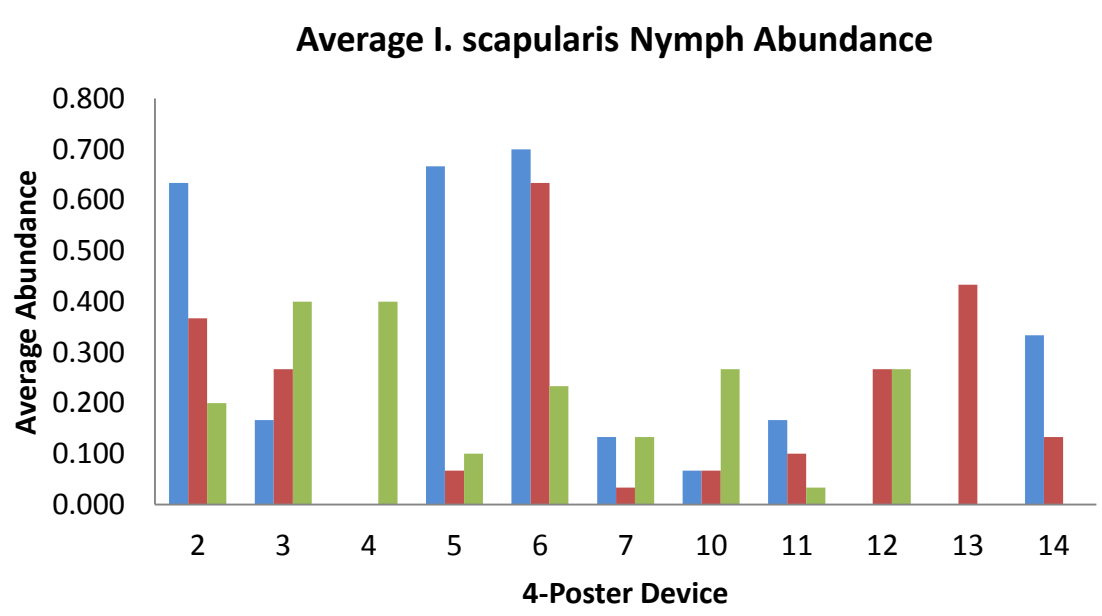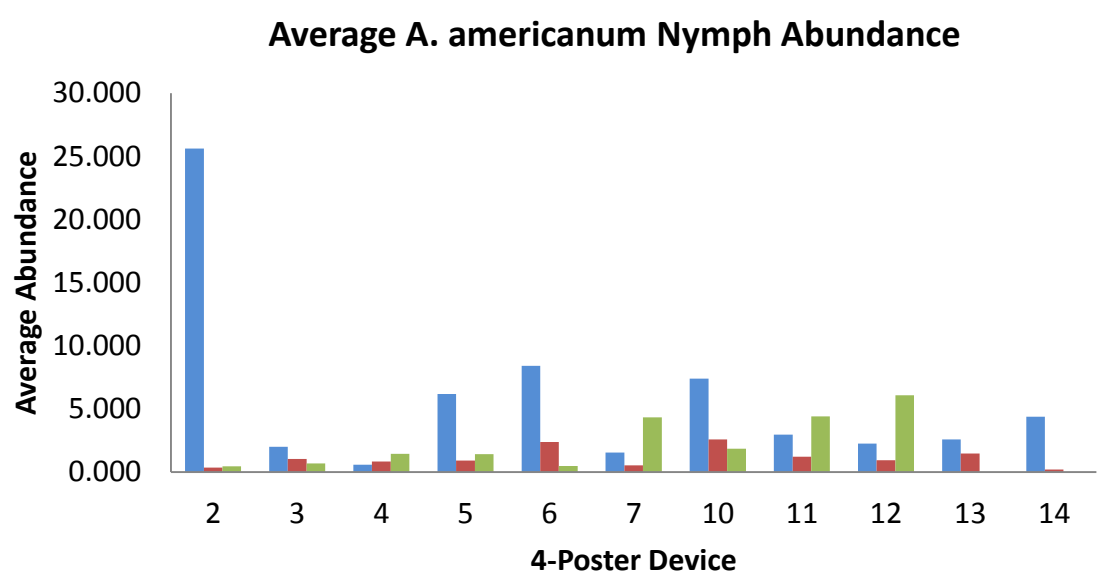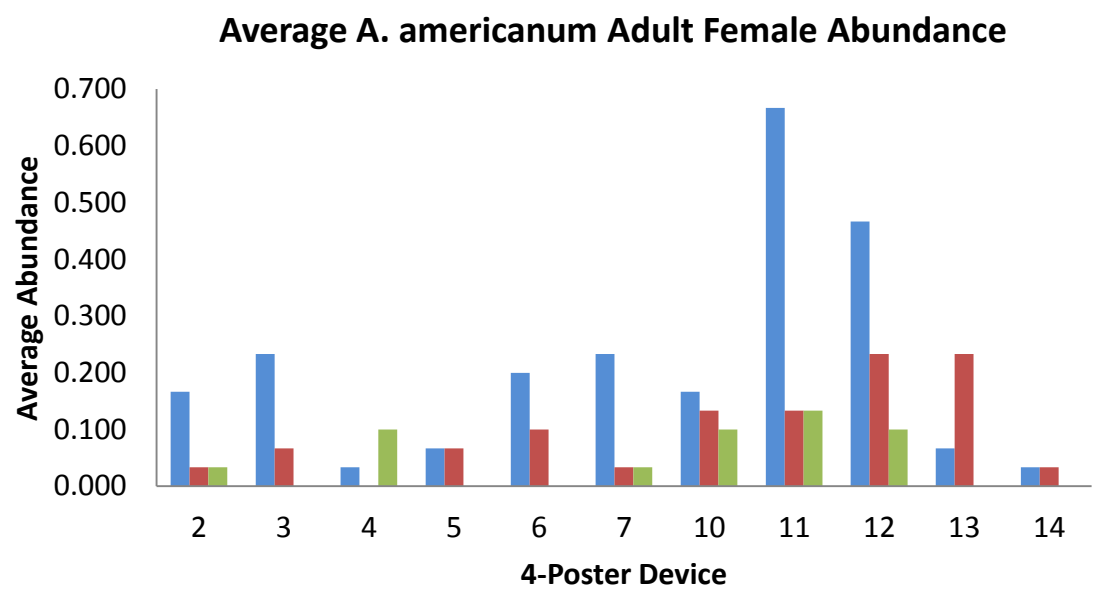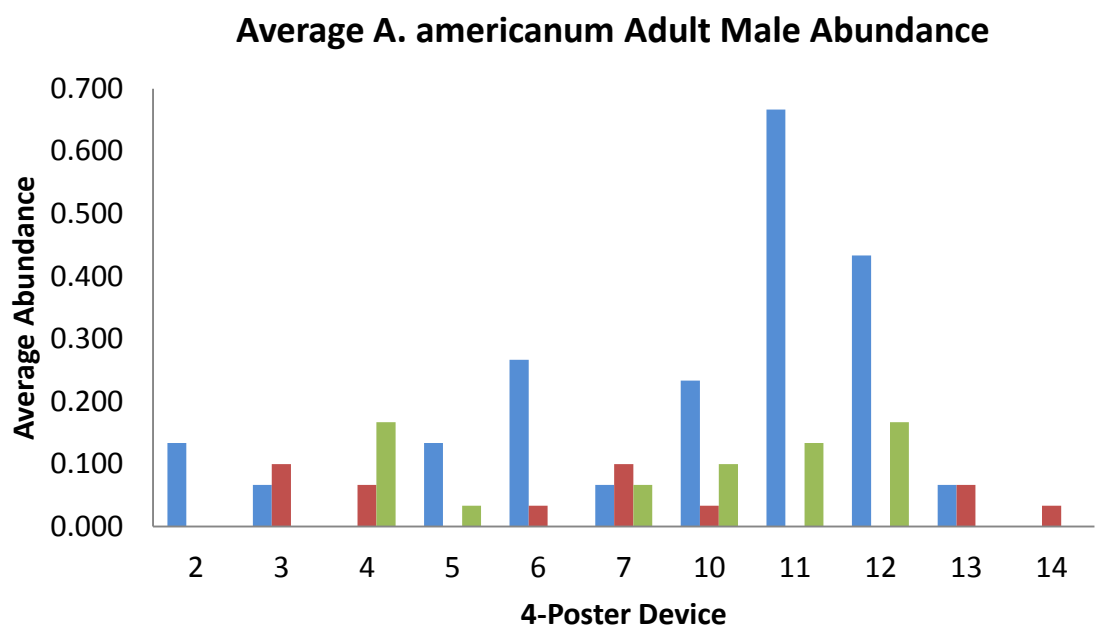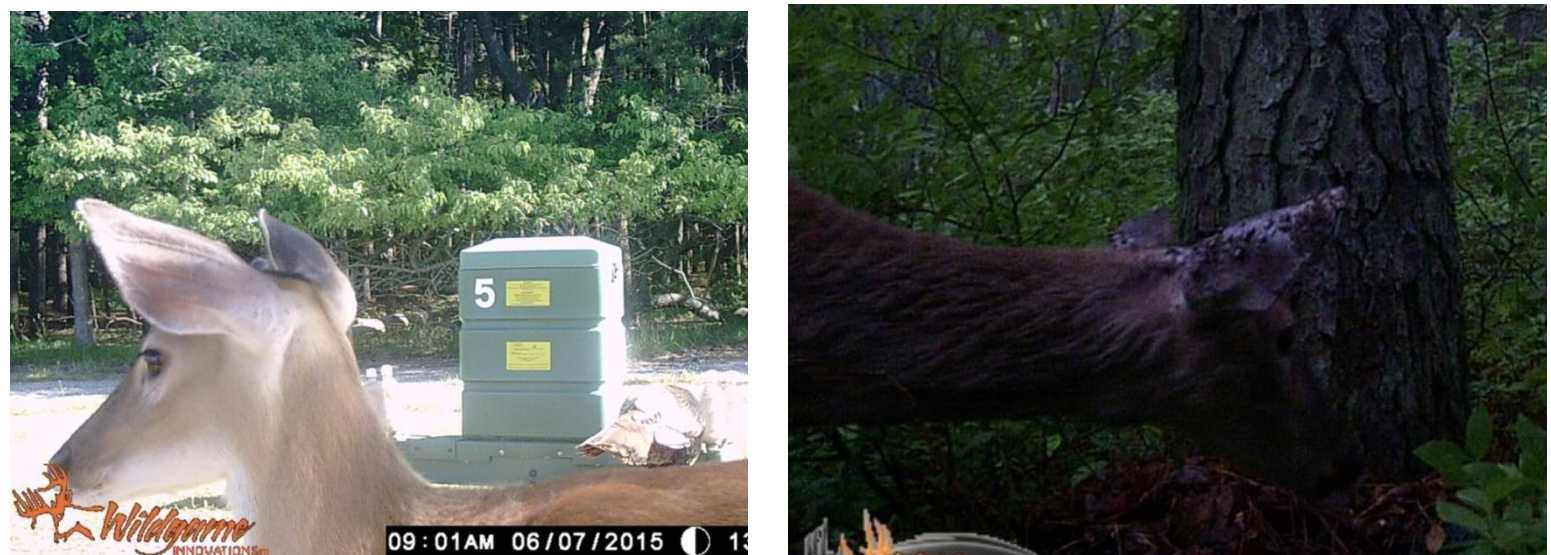**Figure 4**: Map of BNL site with 4-poster device locations.
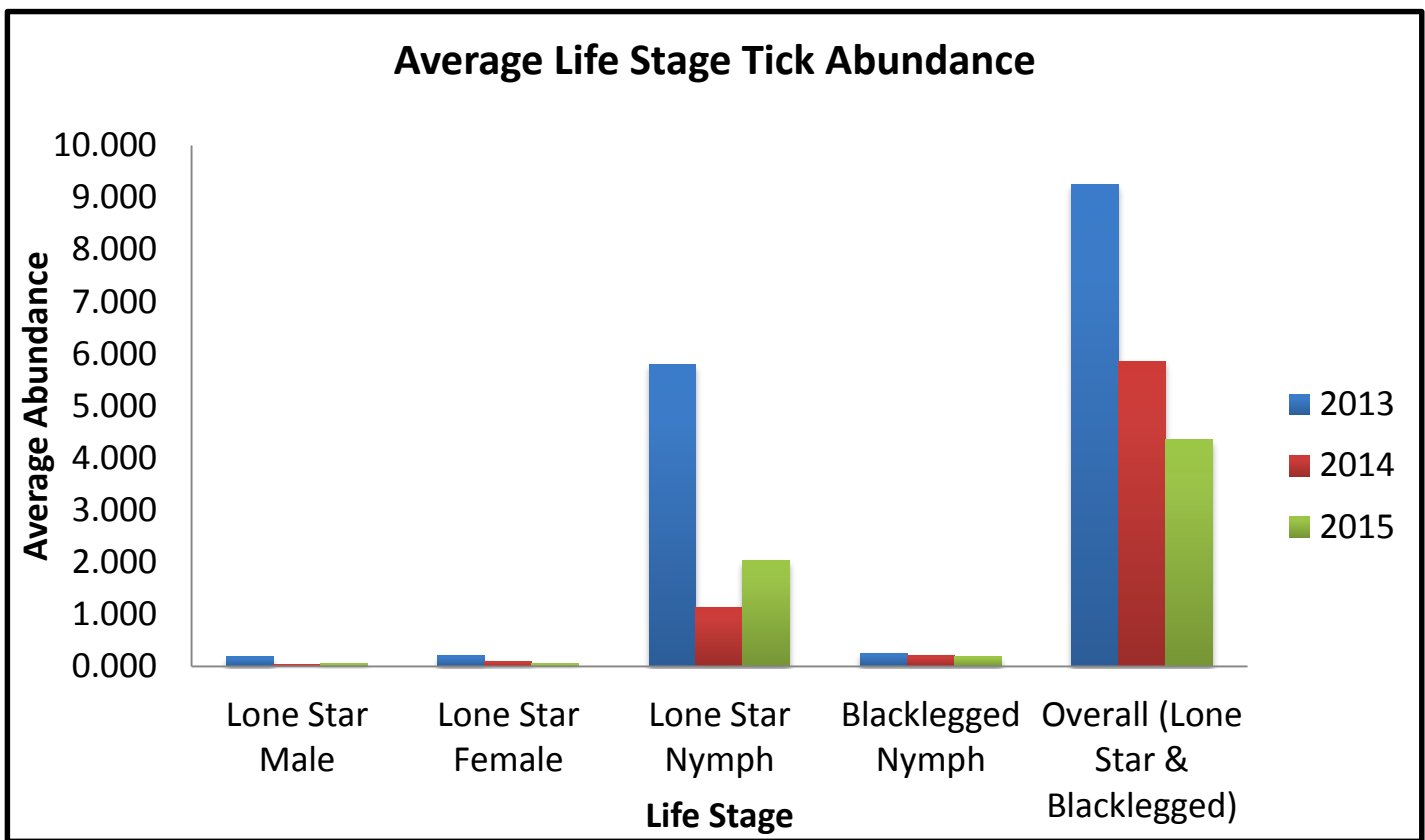
Figure 5: Overall average tick abundance in each category per year.

Figures 6, 7, 8 & 9: Average tick abundance for each species/life stage at each 4-poster device per year.

Results

- Percent control between 2013-2015 had an average of 59% (P=0.0392) for *A. americanum* males, 55.8% (P=0.0202) for females, and 0.5% (P<0.0001) for nymphs. *I. scapularis* nymphs had -7.3% (P=0.995) control.

- Percent control between 2014-2015 had an average of 7.6% for *A. americanum* males, 51.6% for females, and -137% for nymphs. *I. scapularis* nymphs had -38.6% control.

- Over the course of the study, no *I. scapularis* adults and larvae or *D. variabilis* nymph and larvae were found.

	2013-2015					2014-2015			
	A. americanum			I. scapularis		A. americanum			I. scapularis
	Male	Female	Nymph	Nymph		Male	Female	Nymph	Nymph
4P-2	75.0%	80.0%	98.3%	68.4%	4P-2	0.0%	0.0%	-30.0%	45.5%
4P-3	100.0%	100.0%	66.7%	-140.0%	4P-3	100.0%	100.0%	35.5%	-50.0%
4P-4	-	-200.0%	-152.9%	-	4P-4	-150.0%	-	-72.0%	-
4P-5	75.0%	100.0%	77.3%	85.0%	4P-5	-	100.0%	-55.6%	-50.0%
4P-6	100.0%	100.0%	94.4%	66.7%	4P-6	100.0%	100.0%	80.3%	63.2%
4P-7	0.0%	85.7%	-182.6%	0.0%	4P-7	33.3%	0.0%	-712.0%	-300.0%
4P-10	57.1%	40.0%	75.2%	-300.0%	4P-10	-200.0%	25.0%	28.6%	-300.0%
4P-11	80.0%	80.0%	-48.3%	80.0%	4P-11	-	0.0%	-266.7%	66.7%
4P-12	61.5%	78.6%	-171.6%	-	4P-12	-	57.1%	-550.0%	0.0%
4P-13	100.0%	50.0%	53.2%	0.0%	4P-13	100.0%	85.7%	18.2%	100.0%
4P-14	0.0%	100.0%	96.2%	60.0%	4P-14	100.0%	100.0%	16.7%	0.0%
Average	59.0%	55.8%	0.5%	-7.3%	Average	7.6%	51.6%	-137.0%	-38.6%

-% : Indicates an increase in tick abundance
- : Indicates unquantifiable increase in tick abundance

Table 1 & 2: Comparison of 2013-2015 and 2014-2015 percent controls at each 4-poster device for each category.

Discussion

- 4-Poster devices were effective, but not to the extent we were expecting. This may be due to several factors:
    - **Amount of snowfall during winter months** – high amounts insulate ticks and decrease mortality.
    - **Temperature/Humidity** – can influence tick behavior and activity, resulting in an increase/decrease in mortality.

- Variation in tick abundance by site may be the result of several important habitat characteristics such as:
    - **Vegetation composition** – *A. americanum* prefer woody edges and grassy habitats. *I. scapularis* preference is unknown.
    - **Host abundance** – *A. americanum* feeds on a variety of hosts, while *I. scapularis* are very specified. Sites differ in species richness which may affect tick abundance.

- Although little to no data was found previously, there was an increase in adult male & female *D. variabilis* at several sites during July.

Acknowledgements

Figure 10: Researcher with flag and sticky tape lint roller looking for ticks at 4-poster site 5.