



06 - 0381

# Metropolitan Mosquito Control District

## *Ixodes scapularis* Distribution Study Report

Janet Jarnefeld  
Tick Vector Services

QL  
458 . 2  
. I9  
M48  
1997

RECEIVED

JUN 22 2006

LEGISLATIVE REFERENCE LIBRARY  
STATE OFFICE BUILDING  
ST. PAUL, MN 55155

## 1997 BLACK LEGGED TICK DISTRIBUTION STUDY

### Abstract

A black legged tick (*Ixodes scapularis*) distribution study, designed to detect any changes in *I. scapularis* distribution over a many year period, was conducted in the seven county metropolitan area by the Metropolitan Mosquito Control District. Small mammal sampling was used to collect ticks from 100 wooded areas that have all been sampled since 1990 or 1991. At least one *I. scapularis* was collected from 24 of these sites during 1997. A total of 118 *I. scapularis* were removed from 728 mammals for an overall season mean of .162 *I. scapularis* per mammal. Most of the *I. scapularis* collections continue to occur north of the Mississippi River with the majority of collections occurring in Washington county (60% (67 larvae; 4 nymphs) of the total). For the first time, *I. scapularis* were not collected from Ramsey county. The highest average number of *I. scapularis* per mammal was calculated for Washington county, which had a season mean of .444 compared with Anoka county's season mean of .190 overall. Townships maintaining the highest 1990-1997 *I. scapularis* per mammal averages (all > .500) include New Scandia, May, Hugo, Grant (all Washington county), Linwood, and East Bethel (both Anoka county) townships. Two additional sites were re-sampled during 1997 with zero *I. scapularis* collected from either sampling location; section 7 of New Market township in Scott county and section 19 of West Saint Paul township in Dakota county (Dodge Nature Center). District re-structuring may have continued to impact the data integrity of the study. The number of rodents collected is comparable to the 1996 total but lower than that found in previous years and is probably a result of natural variation in the rodent population along with sampler error. We plan to continue to examine ways to make improvements to the mammal collection process. Still, we conclude that *I. scapularis* is not noticeably expanding its range at this time because we have seen no significant change in where our tick collections are occurring.

### Introduction

In 1990 the Metropolitan Mosquito Control District initiated a Lyme Disease Tick Surveillance Program to determine the distribution and prevalence of *Ixodes scapularis* and *Borrelia burgdorferi* within the Minneapolis- Saint Paul metropolitan area. District re-structuring in 1996 integrated the former tick surveillance program activities into the District's overall field processes. Small mammal trapping has been the primary sampling method used, with examination of road-killed mammals and dragging flannel cloth along vegetation both used in the past as secondary collection methods.

A total of 545 sites were sampled from 1990 through 1992, including 100 sites that had been selected for repetitive sampling prior to the 1991 or 1992 field season. Baseline *I. scapularis* distribution data for our area was determined from the 1990 and 1991 studies with most of the ticks collected north of the Mississippi River in Anoka, Washington, and northern Ramsey counties. The 1992 study was designed to inspect areas that had not been sampled as intensely in the past, with emphasis on locations south and west of the Mississippi River, but the majority of *I. scapularis* continued to be collected in the northeastern counties.

Since 1993, our distribution study has focused on the re-sampling of 100 sites to detect any potential changes in *I. scapularis* distribution over time. Seventy-five of these sites were re-sampled beginning in 1991 and were selected from the previous study based on three criteria: representative habitat of an area, locations that were unlikely to be developed, and areas where small mammal collections had been sufficient in the past. An additional twenty-five sites were selected from Dakota, Hennepin, Scott, and Carver counties in 1992 to increase our data collections south of the Mississippi River. We plan to monitor these sites indefinitely and will intensify our sampling effort in areas that have shown potential *I. scapularis* range expansion.

Two additional sites have been sampled since 1995 for a total of 102 sites inspected for the 1997 season; section 7 of New Market township in Scott county and section 19 of West Saint Paul township in Dakota county (Dodge Nature Center). The District has made a continuing effort to detect additional *I. scapularis* ticks from Scott county's New Market township where a single adult *I. scapularis* tick had been collected in 1995, and the District is attempting to foster improved relations with Dodge Nature Center through providing a general risk assessment of this high public use area.

### Materials and Methods

Of the 100 repeat sites, 56 are located north of the Mississippi River in Anoka (28 sites), Washington (25 sites), and Ramsey (3 sites) counties. The 44 repeat sites located south of the Mississippi River are distributed throughout the counties of Dakota (15 sites), Hennepin (14 sites), Scott (8 sites), and Carver (7 sites).

#### *Site Selection for Section 7 in Scott County and Section 19 of Dakota County:*

Site selection for both the Scott and Dakota county sampling locations occurred non-randomly with the main criterion being the best available wooded and/or brushy habitat deemed to be easily accessible to the sampler. The Scott county site was moved in 1996 to a locale nearer the original 1995 adult *I. scapularis* collection area and the same site has been sampled since, while the same Dakota county site has been sampled since 1995.

Sampling was initiated on April 29, 1997 and ended on October 31, 1997 with small mammal trapping used as the primary sampling method. As in past years, the twenty-seven week study was divided into three nine-week sampling periods, and all sites were sampled for twenty-one trap nights (7 traps x 3 consecutive nights) per period. Weeks of site visitation were randomly selected within each sampling period.

One three-hundred foot transect was established at each sampling location, and Sherman live traps (H. B. Sherman Traps, Inc., Tallahassee, Fla.), baited with peanut butter and oats, were placed along these transects at fifty foot intervals. We euthanized all small mammals caught in the traps, removed any ticks found, and stored the ticks in alcohol for later identification.

### Results

#### *1997 Study (Repeat Sites):*

We found at least one *I. scapularis* at 24 of 100 sampling sites, with 21 of these positive sites located north of the Mississippi River in Washington (14 sites positive/25 sites sampled) and Anoka (7 sites positive/28 sites sampled) counties. Three positive sites were detected south of the river in Dakota county as well. For the first time, *I. scapularis* were not collected from Ramsey county.

Overall, 728 mammals (Figure 1) were inspected: 363 from north of the Mississippi River and 365 from south of the river, and a total of 118 *I. scapularis* (Figure 2) were collected from them. The Washington county sampling locations accounted for 60% (71/118) of the total (67 larvae; 4 nymphs), with the greatest number of *I. scapularis* obtained from May (27 larvae; 1 nymph), Denmark (15 larvae), New Scandia (10 larvae; 1 nymph), and Afton (8 larvae; 1 nymph) townships. Collections from Anoka county accounted for an additional 29% (19 larvae; 15 nymphs) of the total with another 11% (10 larvae; 3 nymphs) collected from Dakota county.

The overall season mean number of *I. scapularis* collected per mammal in 1997 was .162 (larvae: .132, nymphs: .030). The mean increases to .618 (larvae: .503, nymphs: .115) when all sites that were negative for *I. scapularis* are excluded. The highest average number of *I. scapularis* per mammal was calculated for Washington county, which had a season mean of .444, compared with Anoka county's season mean of .190 overall (see 1997 results in Figure 3).

*Compiled 1990-1997 Results (Repeat Sites):*

The 1990-1997 season mean number of *I. scapularis* collected per mammal was .209, with the highest averages continuing to occur north of the Mississippi River. Yearly season means for Washington county have consistently been the highest, followed by Anoka county. Averages for Ramsey county have been consistently low, yet greater overall than those occurring south of the river (Figure 3). The 1990-1997 township averages for Hugo, New Scandia, and May townships of Washington county were > 1.0 *I. scapularis* per mammal, while the averages for East Bethel, Linwood (both Anoka county) and Grant (Washington county) townships were > .500 *I. scapularis* per mammal (Figure 4).

*I. scapularis* status at the 100 repeat sampling locations is shown on Figure 5.

*I. scapularis* status has changed at 53 of the sites since 1990 or 1991. In particular, we determined that:

- I. scapularis* was found all years (+) at 6 sites
- I. scapularis* was found most years at 27 sites
- I. scapularis* was found least (but + at least 1 year) at 26 sites
- I. scapularis* was not found any year (-) at 41 sites

(Note: 1997 results were used to categorize between "most" and "least" as needed.)

*Scott and Dakota County Sampling Sites:*

Zero *I. scapularis* were collected from a total of 10 small mammals examined overall. A total of 7 small mammals (6 *Peromyscus leucopus*, 1 *Sorex cinereus*) were inspected from New Market township in Scott county with an additional 3 (2 *Tamias striatus*, 1 *P. leucopus*) small mammals inspected from Dodge Nature Center in Dakota county.

**Discussion**

Our results seem to indicate that *I. scapularis* populations are established within northeastern Anoka and northern Washington counties, while remaining localized or nonexistent south of the Mississippi River. While our study was not designed to specifically answer the question of tick establishment, we feel that our relative *I. scapularis* density estimates are accurate enough for a general risk assessment. Given the consistency of our results over the last eight years, with greater numbers of *I. scapularis* collected in the northeastern metropolitan area each year, we believe that the greatest Lyme disease risk occurs in the northeastern metropolitan area.

District re-structuring may have continued to impact the data integrity of the study, however. The number of rodents collected is comparable to the 1996 totals but lower than that found in previous years and is probably a result of natural variation in the rodent population along with sampler error. Small mammal collection averages during both 1996 and 1997 have been approximately half the average number of mammals collected per site during previous years. While the actual impact on the number of *I. scapularis* collected is unknown, we assume that the low numbers of mammals collected has an overall negative impact on our success in collecting *I. scapularis* ticks, and we plan to continue to examine ways to make improvements to the mammal collection process.

**Continuing Studies:**

*Distribution study:*

Our multi-year distribution study will continue (sites unchanged from 1993).

*in question- Cooperative studies with the University of Minnesota:*

As of February, 1997 our cooperative study with Dr. Russ Johnson of the U of MN regarding the distribution and prevalence of *B. burgdorferi* in the metropolitan area is planned to discontinue due to lack of funding. The status of further study into ehrlichiosis in the metropolitan area (see below) is unknown.

## METROPOLITAN MOSQUITO CONTROL DISTRICT: ADDITIONAL UPDATES

### A. MISCELLANEOUS TICKS TURNED IN BY MMCD FIELD STAFF:

This table has been excluded because only 11 ticks were turned in during 1997. Of mild interest is the inclusion of 2 adult *Amblyomma americanum* (lone star tick) that were collected separately (one each from Dakota and Scott counties). Only one additional *A. americanum* (a nymph from Washington county in 1995) had been collected from staff to date.

### B. NEW COLLABORATIVE EHRLICHIA STUDY:

A cooperative study with Dr. Russ Johnson, University of Minnesota, Minneapolis campus.

Ehrlichiosis is a newly discovered bacterial disease caused by several species of *Ehrlichia*, with various regional tick vectors suspected in the United States, including *I. scapularis*, the tick vector of Lyme disease in Minnesota. Cases of human ehrlichiosis have occurred in Minnesota residents, and *I. scapularis* populations are established within portions of the metropolitan area as well. Human granulocytic ehrlichiosis (HGE) agent DNA was found in rodent blood samples drawn from small mammals collected for our distribution study in a 1995 collaboration with Dr. Barb Greig DVM, formerly of the University of Minnesota, Saint Paul campus, although results of *Ehrlichia* testing by Dr. Russ Johnson of the U of MN, Mpls. campus, were negative for mammals collected in 1996 during our cooperative Lyme disease studies in North Oaks. Therefore, the District was interested in further collaborative effort to aid us in assessing the potential of ehrlichiosis risk for metropolitan area residents.

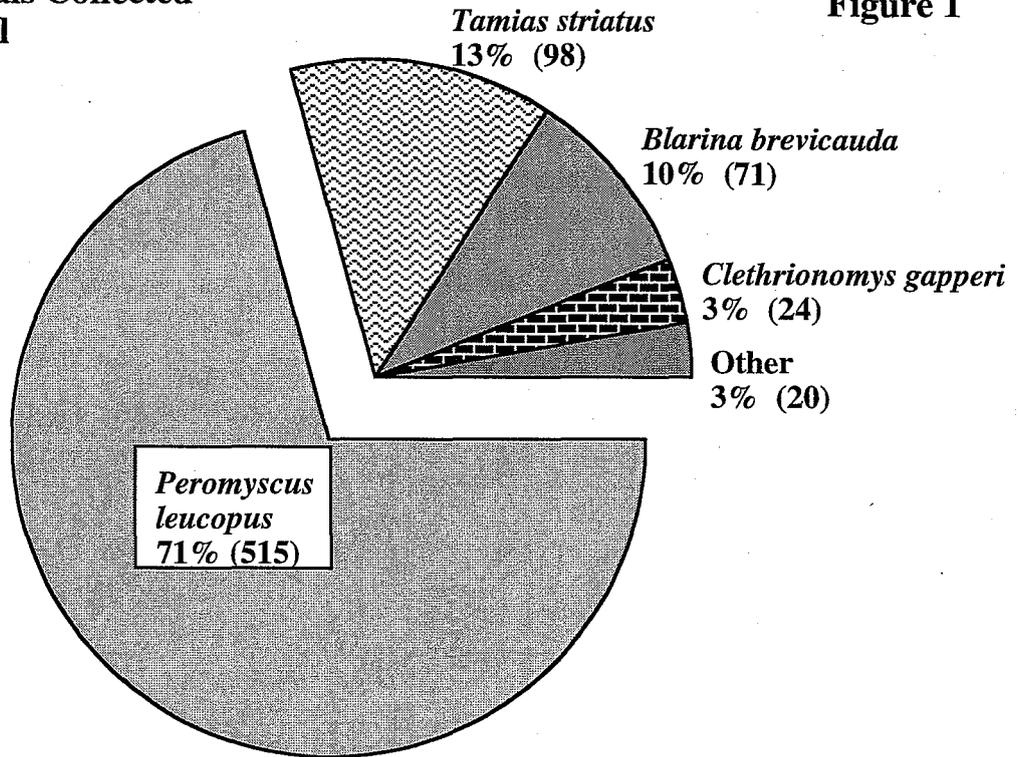
In the 1997 cooperative ehrlichiosis study with Dr. Johnson, *Peromyscus leucopus* collected for our *I. scapularis* distribution study were used to obtain blood samples that were to be analyzed for the presence/absence of antibodies to *Ehrlichia* species. District staff performed the majority of the blood sample collections, while the University performed the laboratory analysis. Preliminary results yielded eleven samples that reacted positively to immunofluorescent antibody (IFA) testing, but the identification of these samples are being verified by polymerase chain reaction (PCR) testing. These preliminary positive results appear to be human granulocytic ehrlichiosis. Final results should be available by spring of 1998.

**C. ROCKY MOUNTAIN SPOTTED FEVER (RMSF)- a note of interest:** Two confirmed cases of RMSF occurred in Minnesota in 1997 and are of interest due to the extremely low incidence of this disease in Minnesota. One case occurred in Todd county in central Minnesota with the other contracted in Lakeville of Dakota county. Positive serology test results from a sample collected from the Lakeville family dog provided added confidence in the initial human test result.

The District did not respond in either of these instances although past *Dermacentor variabilis* data from our distribution study was compiled to determine whether a significant increase in the average number of *D. variabilis* collected per mammal could be detected. Although the 1997 average of 4.0 *D. variabilis* collected per mammal through the end of June was higher than has been found in recent years, the averages for both 1991 and 1992 were greater than 5.0. The District has offered to provide the MDH with *D. variabilis* specimens dating back to 1990 for testing purposes. No final decision on this issue has been made to date.

**Small Mammals Collected  
1997: 728 total**

**Figure 1**



**Ticks, by Species and Stage,  
Removed from Small Mammals  
1997:  
693 total**

**Figure 2**

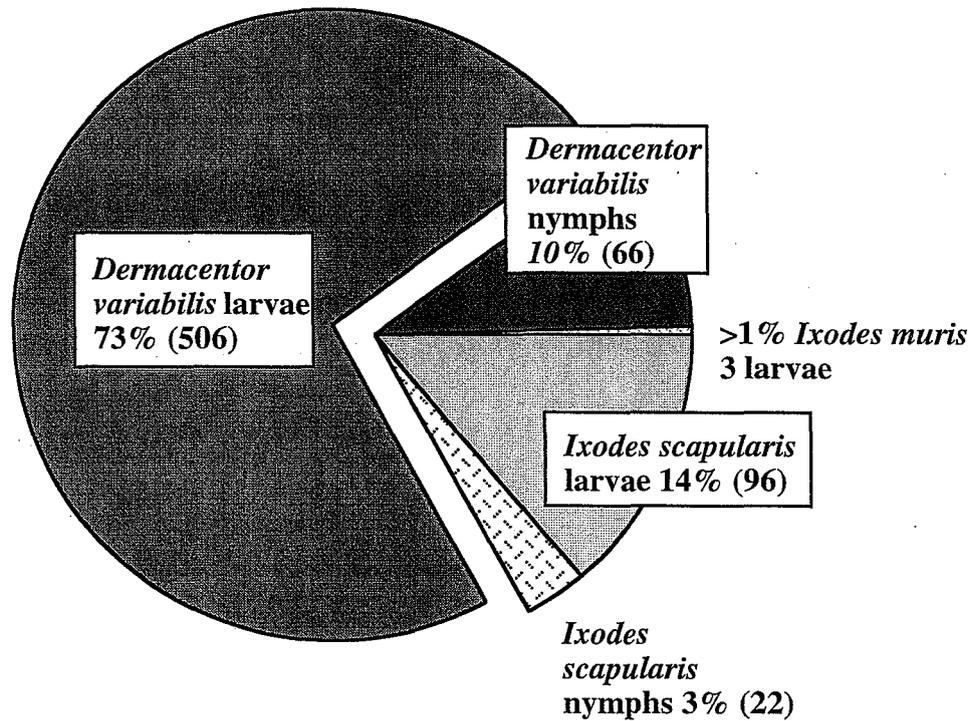
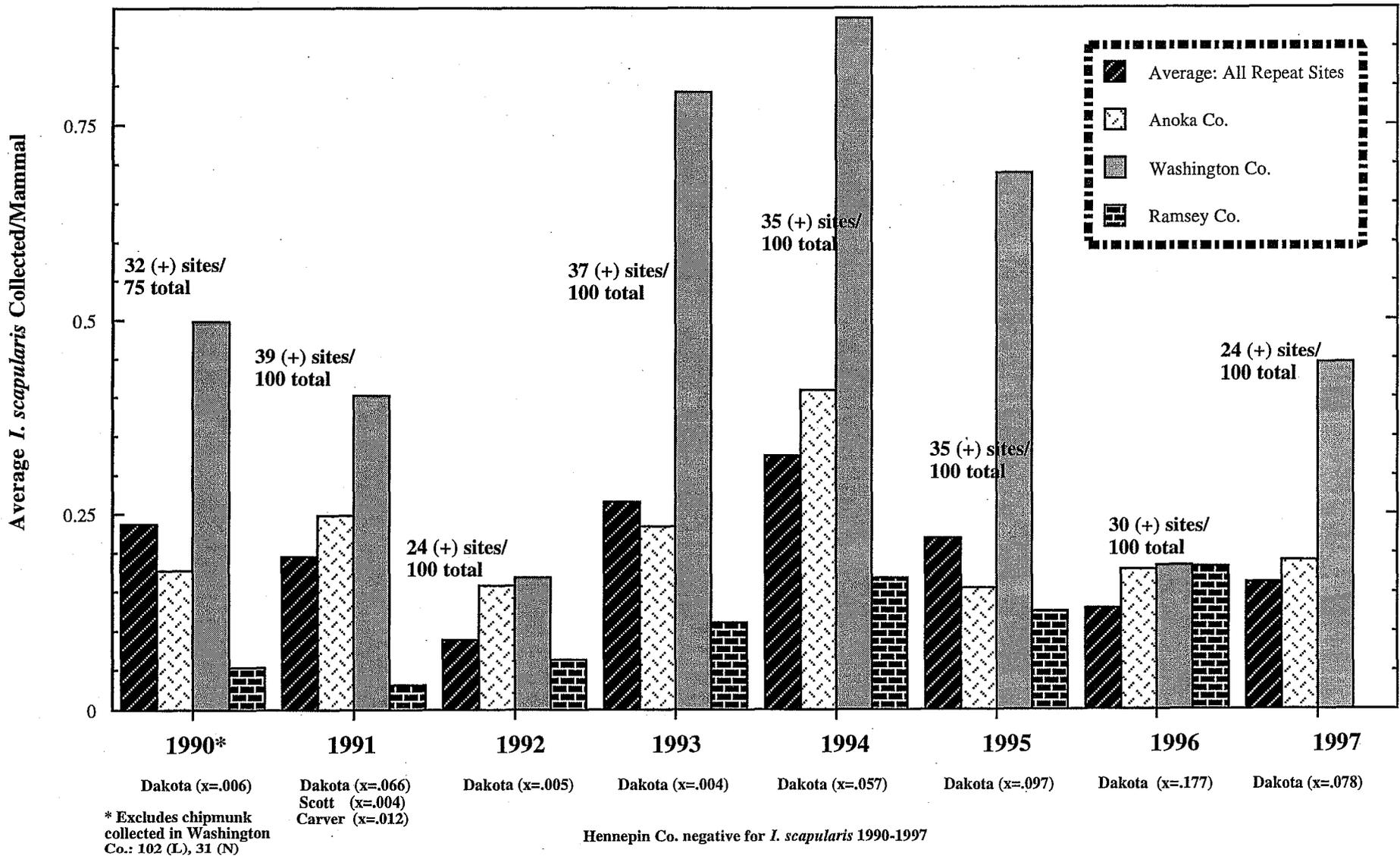
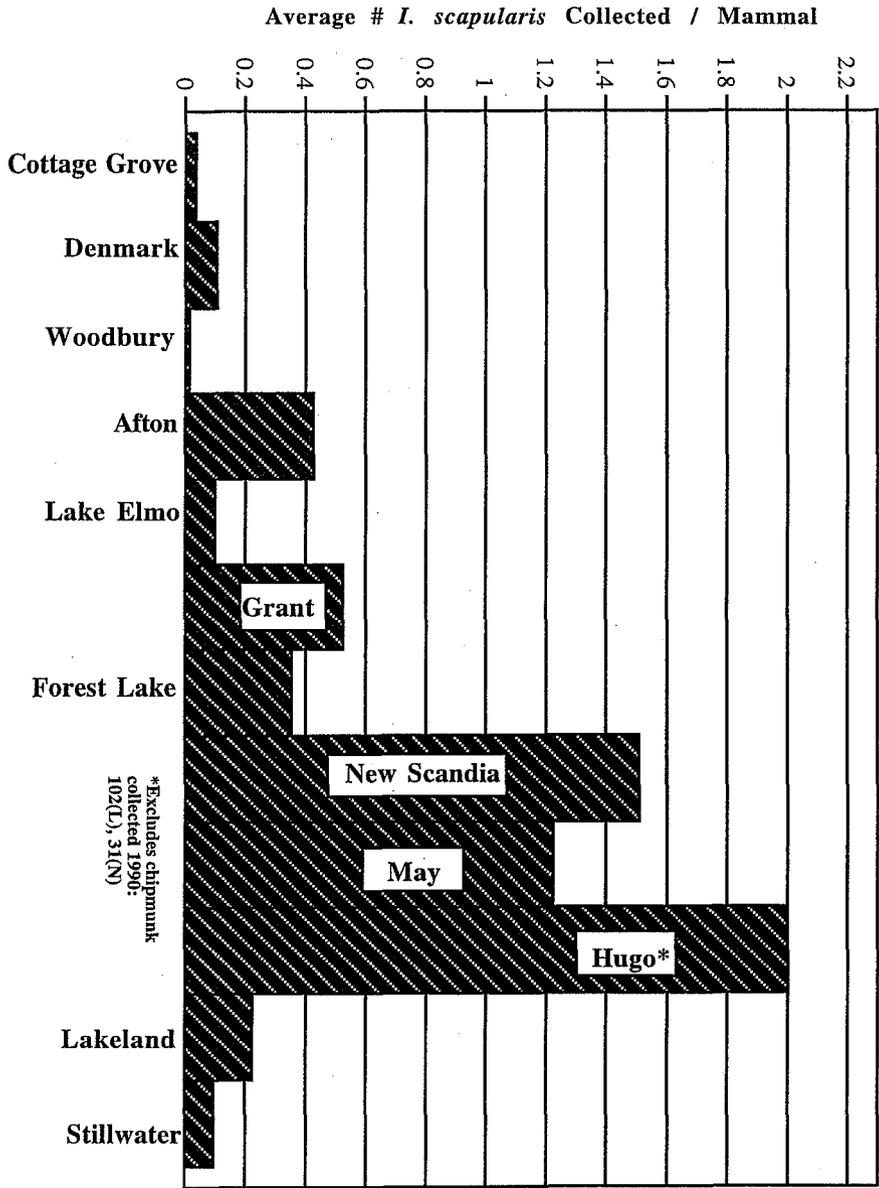


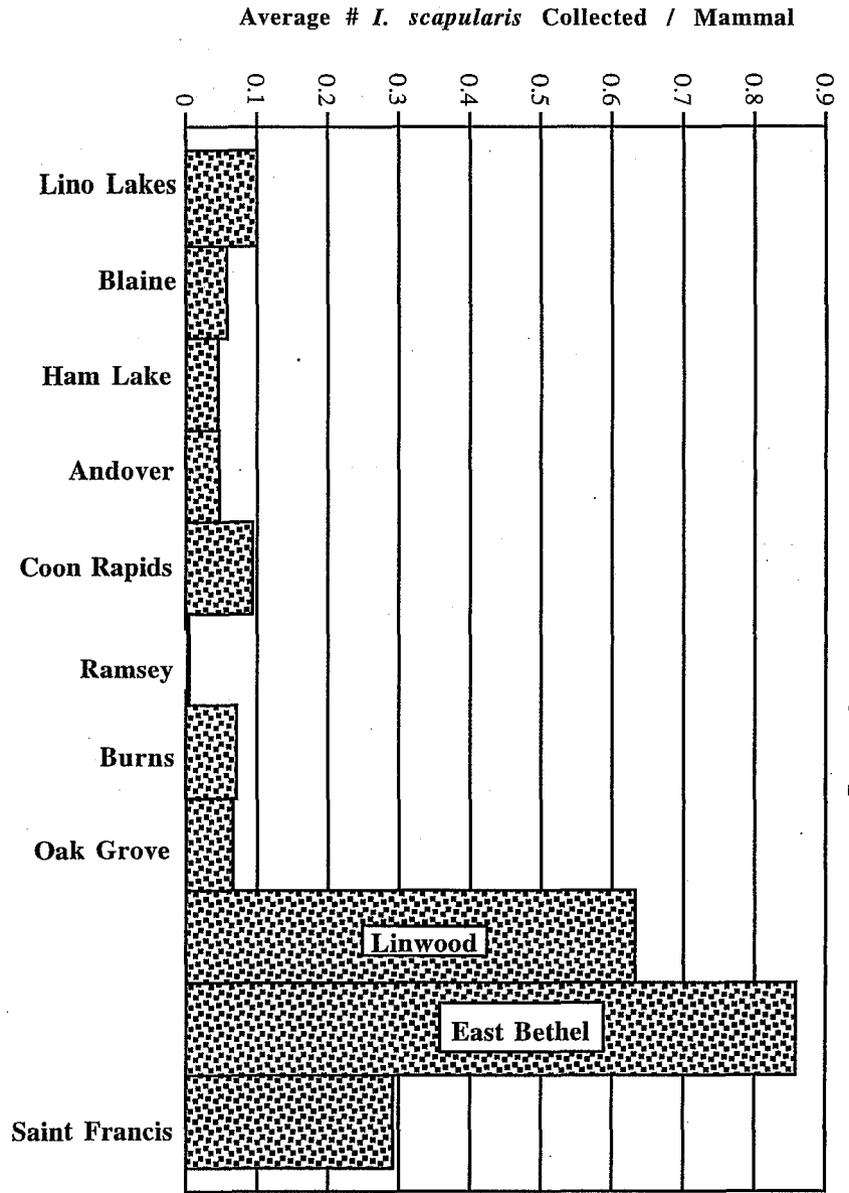
Figure  
3

### Average Number of *I. scapularis* Collected Per Mammal in Anoka, Washington, and Ramsey Counties: 1990-1997





Average Number of *I. scapularis* Collected Per Mammal in Washington County (by Twp): 1990-1997



Average Number of *I. scapularis* Collected Per Mammal in Anoka County (by Twp): 1990-1997

Figure 4

No Figure 5 available

1997 *Ixodes scapularis*  
distribution study report