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**Metropolitan Mosquito Control District**  
***Ixodes scapularis* Distribution Study Report**

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**Tick Vector Services**

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## 1996 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 (MMCD). Small mammal sampling was used to collect ticks from 100 woodlots that have all been sampled since 1990 or 1991. At least one *I. scapularis* was collected from 30 of these sites during 1996. A total of 102 *I. scapularis* were removed from 791 mammals for an overall season mean of .129 *I. scapularis* per mammal. Most of the *I. scapularis* collections continue to occur north of the Mississippi River in Washington, Anoka, and Ramsey counties, with the majority of collections (40% (41/102) of the total (34 larvae; 7 nymphs)), occurring for the first time in Anoka county. The highest average number of *I. scapularis* per mammal was again calculated for Washington county, which had a season mean of .183, compared with Anoka county's season mean of .178 overall. Townships maintaining the highest 1990-1996 *I. scapularis* per mammal averages (all > .500) include Hugo, New Scandia, May, and Grant townships of Washington county, as well as East Bethel and Linwood townships of Anoka county. Two additional sites were re-sampled during 1996; section 7 of New Market township in Scott county and section 19 of West Saint Paul township in Dakota county (Dodge Nature Center). *I. scapularis* was not collected from either sampling location in 1996. District restructuring may have temporarily impacted the data integrity of the study. The number of rodents collected is lower than that found in previous years and is probably a result of natural variation in the rodent population along with sampler error. 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 MMCD initiated a Lyme Disease Tick Surveillance Program to determine the distribution and prevalence of *I. scapularis* and *Borrelia burgdorferi* within the Minneapolis-Saint Paul metropolitan area. The 1990 and 1991 studies provided baseline *I. scapularis* distribution data for our area. Most of the ticks were found in Anoka, Washington, and northern Ramsey counties, located north of the Mississippi River. 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 that have been sampled since 1990 or 1991. We began re-sampling seventy-five of these sites in 1991 to detect any changes in *I. scapularis* distribution over a many year period. These repeat sites 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 for repeat sampling 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 were sampled during 1996 for a total of 102 sites inspected for the season. Section 7 of New Market township in Scott county was re-sampled but the location was moved closer to where a single adult *I. scapularis* tick had been collected in 1995. Dodge Nature Center, section 19 of West Saint Paul township in Dakota county, was re-sampled in an attempt to foster improved relations between the Nature Center and the District 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 site selected for sampling in section 7 of Scott county was moved to a locale nearer the original 1995 adult *I. scapularis* collection area while the same Dakota county site was sampled in 1996 .

Sampling was initiated on April 23, 1996 and ended on October 25, 1996. 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

### *1996 Study (Repeat Sites):*

We found at least one *I. scapularis* at 30 of 100 sampling sites, with 26 of these positive sites located north of the Mississippi River in Washington (10 sites positive/25 sites sampled), Anoka (15 sites positive/28 sites sampled), and Ramsey (1 site positive/3 sites sampled) counties. Four positive sites were detected south of the river in Dakota county as well.

Overall, 791 mammals (Figure 1) were inspected: 406 from north of the Mississippi River and 385 from south of the river, and a total of 102 *I. scapularis* (Figure 2) were collected from them. The Anoka county sampling locations accounted for 40% (41/102) of the total (34 larvae; 7 nymphs), with the highest *I. scapularis* collections obtained from Linwood (7 larvae; 4 nymphs), Andover (6 larvae), Burns, and Oak Grove (5 larvae each) townships. Collections from Washington county accounted for an additional 29% (30 (17 larvae; 13 nymphs) /102) of the total with another 25% (25 larvae) collected from Dakota county.

The overall season mean number of *I. scapularis* collected per mammal in 1996 was .129 (larvae: .104, nymphs: .025). The mean increases to .432 (larvae: .347, nymphs: .085) 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 .183, compared with Anoka county's season mean of .178 overall (see 1996 results in Figure 3).

### *Compiled 1990-1996 Results (Repeat Sites):*

The 1990-1996 season mean number of *I. scapularis* collected per mammal was .212, 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 1990-1996 township averages for Hugo, New Scandia, May (Washington county), and East Bethel (Anoka county) townships were found to be > 0.9 *I. scapularis* per

mammal, while the averages for Linwood (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 47 of the sites since 1990 or 1991. In particular, we determined that:

- I. scapularis* was found all years (+) at 11 sites
- I. scapularis* was found most years at 19 sites
- I. scapularis* was found least (but + at least 1 year) at 28 sites
- I. scapularis* was not found any year (-) at 42 sites

(Note: 1996 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 9 small mammals examined overall. A total of 4 small mammals (2 *Peromyscus leucopus*, 2 *Clethrionomys gapperi*) were inspected from New Market township in Scott county with an additional 5 (4 *P. leucopus*, 1 *Tamias striatus*) 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 low or nonexistent south of the Mississippi River. Given the consistency of our results over the last seven 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 at this time. 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.

District re-structuring may have temporarily impacted the data integrity of the study, however. The number of rodents collected is lower than that found in previous years and is probably a result of natural variation in the rodent population along with sampler error:

The average number of mammals trapped per site by year and sampling period:

Year	number of sites	Round A	Round B	Round C
1996	100	1.21	3.62	3.09
1995	100	3.03	5.80	5.29
1994	100	4.00	6.92	5.80
1993	100	2.57	5.28	7.58
1992	200	5.65	4.57	5.33
1991	270	4.71	7.30	8.60
1990	250	3.04	5.42	6.18

The objective for the 1996 re-structuring was to integrate the former tick focus program activities into the District's overall field processes, which led to more staff involvement in sampling (approximately twelve people) than in past years when only one person had responsibility for sampling. This low exposure level to field activities led to inconsistent sampling success, and

although the greatest number of ticks were collected in Anoka county for the first time, it is difficult to draw any conclusions based on these 1996 results.

### Continuing Studies:

#### *Distribution study:*

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

#### *In question- Cooperative study with the University of Minnesota:*

As of February, 1997 our cooperative study with the University of Minnesota regarding the distribution and prevalence of *B. burgdorferi* in the metropolitan area is planned to continue using the same six sampling sites that have been sampled since 1994. However, the study sites could be altered or the study discontinued altogether due to some unresolved issues. The landowner of a portion of North Oaks undeveloped properties has requested that the District discontinue all activities on her properties, and District staff are currently in negotiations with the landowner. Some of the study sites are located on the properties in question.

### METROPOLITAN MOSQUITO CONTROL DISTRICT: ADDITIONAL UPDATES

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

This table has been excluded because only 9 ticks were turned in during 1996, with nothing unusual to report.

#### ***EHRlichia* STUDIES:**

Presence/absence of antibodies to *Ehrlichia* species in metropolitan area mammals: a cooperative study with Dr. Barb Greig, DVM U of MN, Saint Paul campus

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#### Overview:

Human ehrlichiosis is a newly discovered bacterial disease thought to be caused by several different species of *Ehrlichia*, with various regional tick vectors suspected in the United States, including *Ixodes scapularis*, the tick vector of Lyme disease. As the Metropolitan Mosquito Control District's distribution study results have previously determined, *I. scapularis* populations appear to be established within portions of the seven-county metropolitan area. Cases of human ehrlichiosis have occurred in Minnesota residents as well. For these reasons, the District was interested in this collaborative effort to assess the potential risk of exposure to ehrlichiosis for metropolitan area residents.

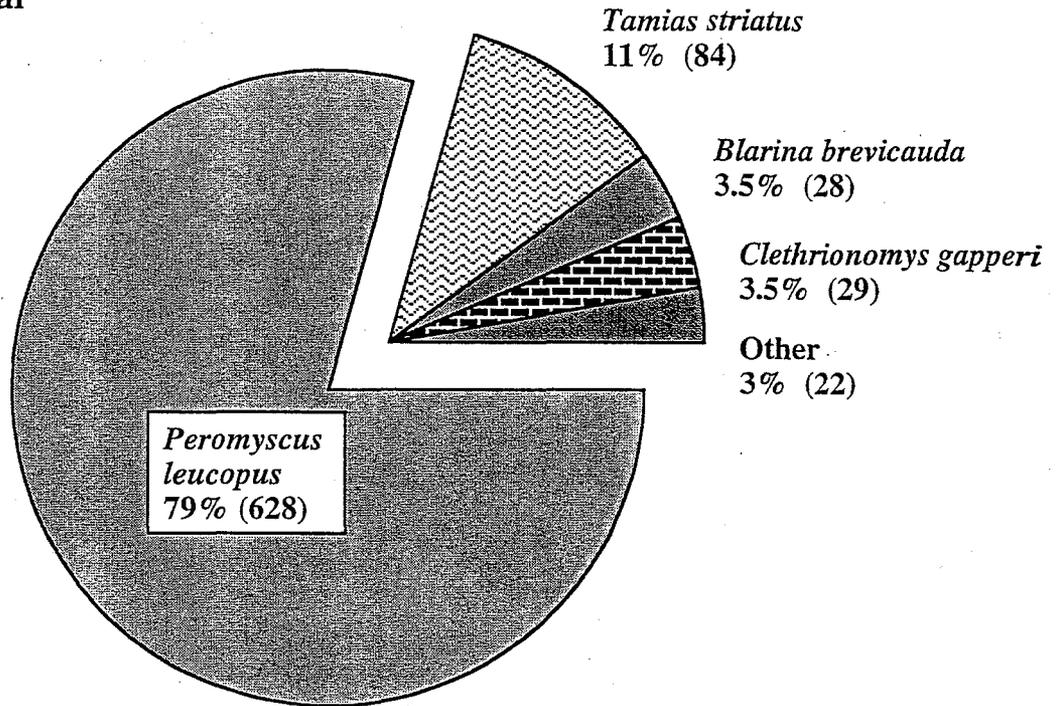
#### In brief:

During 1995, the small mammals that had been collected for the distribution study were used to obtain blood samples that were to be analyzed for the presence/absence of antibodies to *Ehrlichia* species. District staff drew blood samples from the majority of 1406 small mammals that had been collected in 1995 (an attempt was made to draw a sample from all) and provided the collection locations and mammal identification records as well. Dr. Greig provided the equipment necessary to perform the study and planned to perform the laboratory analysis of the samples.

Dr. Greig sent a subset (190 total) of samples to J. Stephen Dumler of Johns Hopkins for testing. All blood samples tested by Johns Hopkins had been drawn from small mammals collected between May 31 and June 30, 1995 (see enclosed map titled *Metropolitan Mosquito Control District Ehrlichiosis Monitoring, 1995* for presence / absence results). The abstract of the resulting paper follows.

**Small Mammals Collected  
1996: 791 total**

**Figure 1**



**Ticks, by Species and Stage,  
Removed from Small Mammals  
1996:  
724 total**

**Figure 2**

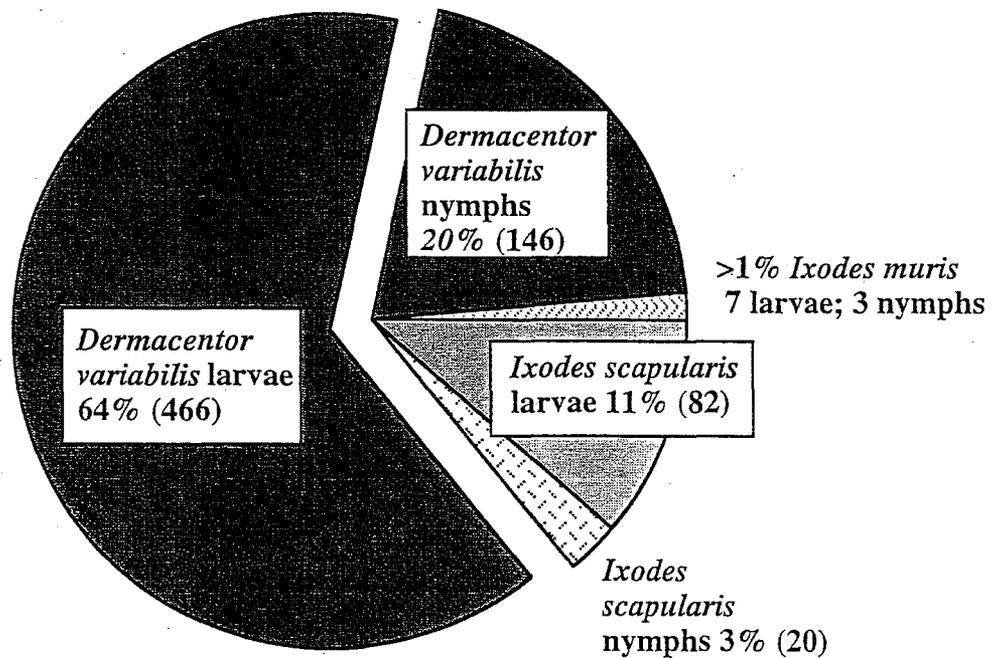
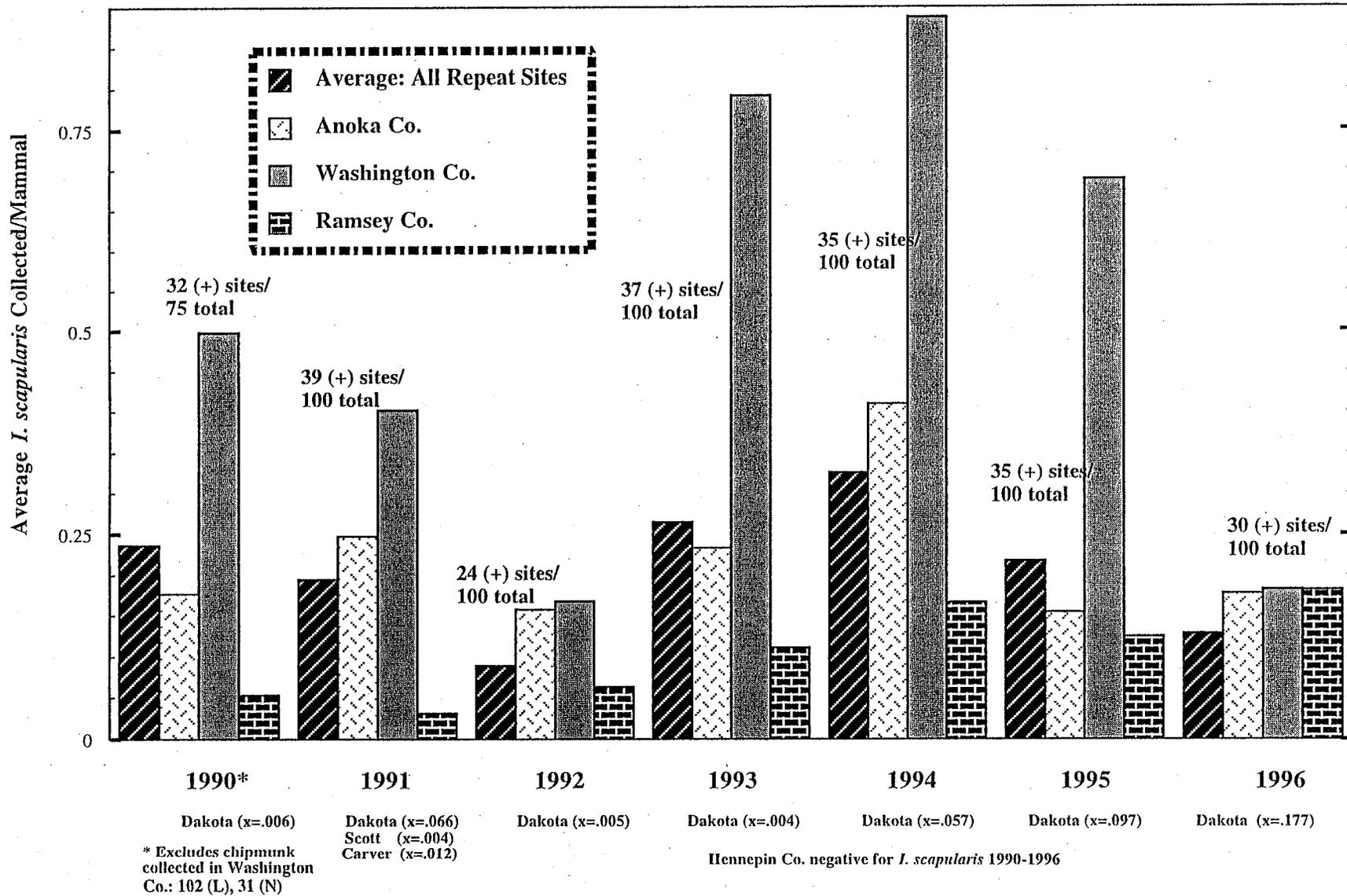


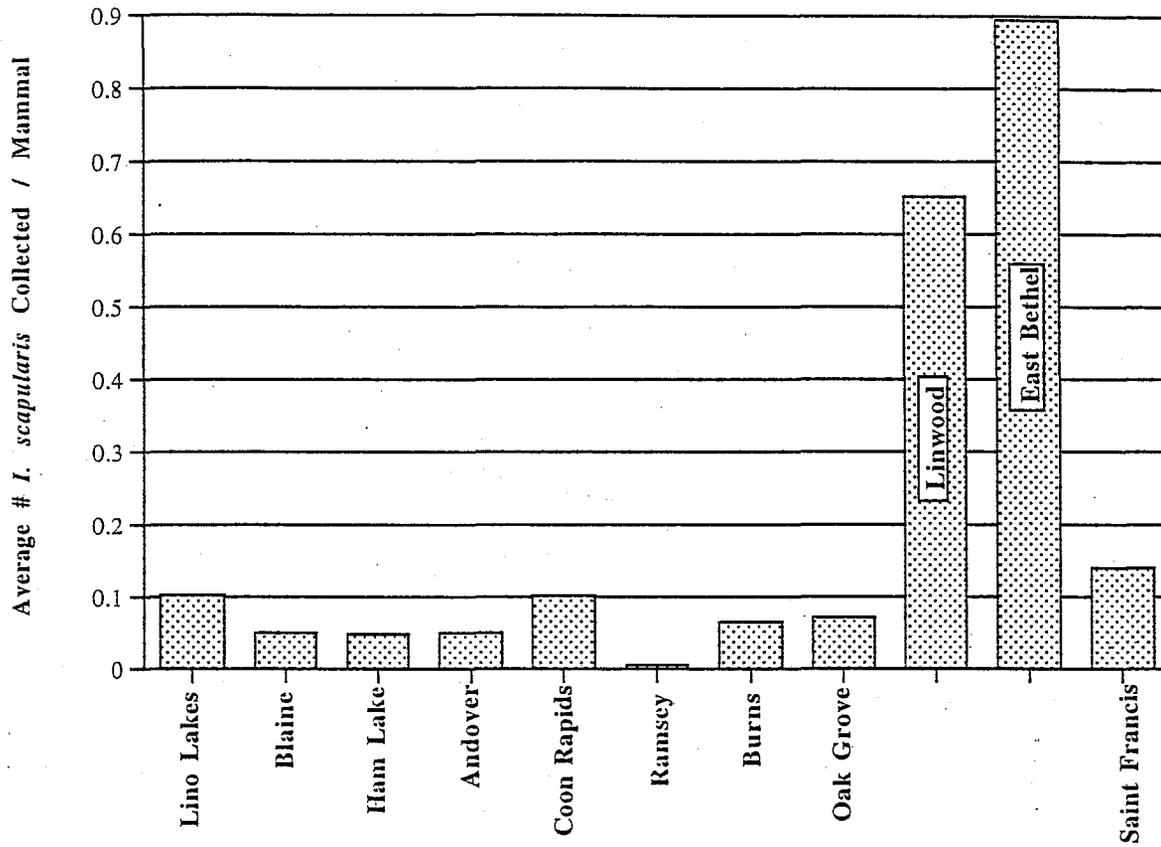
Figure  
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### Average Number of *I. scapularis* Collected Per Mammal in Anoka, Washington, and Ramsey Counties: 1990-1996

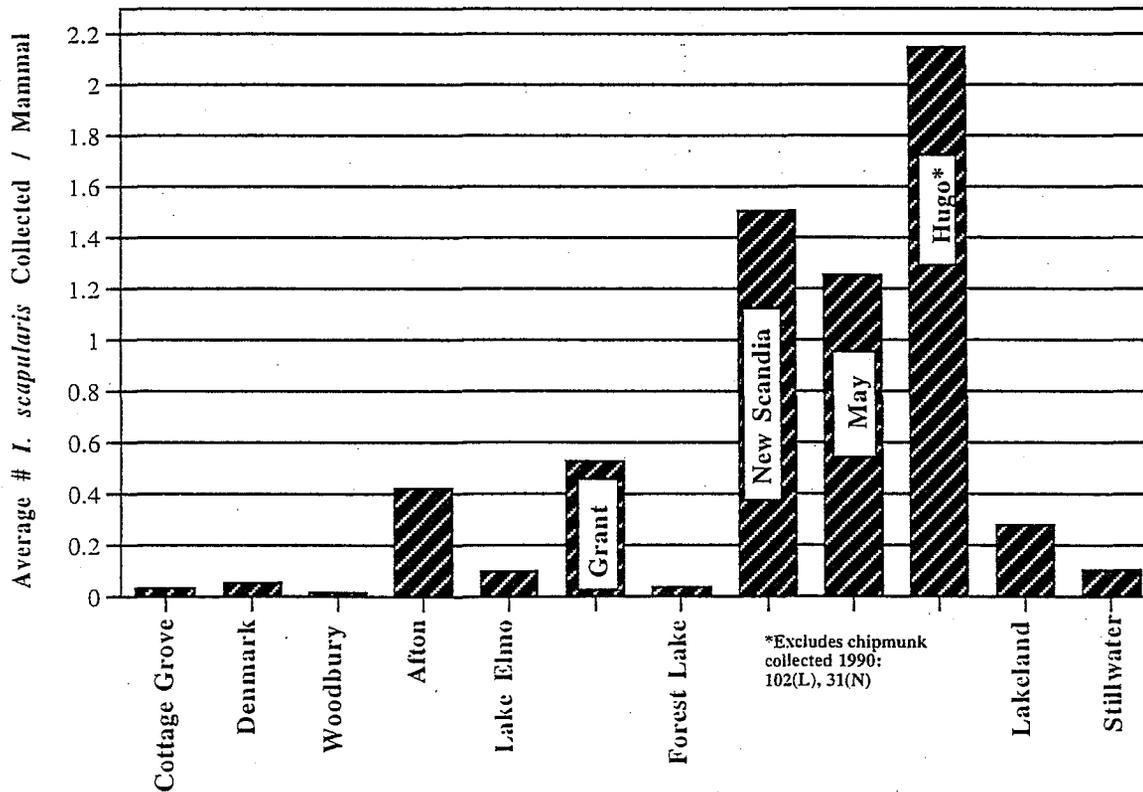


Average Number of *I. scapularis* Collected Per Mammal in Anoka County (by Twp): 1990-1996

Figure 4

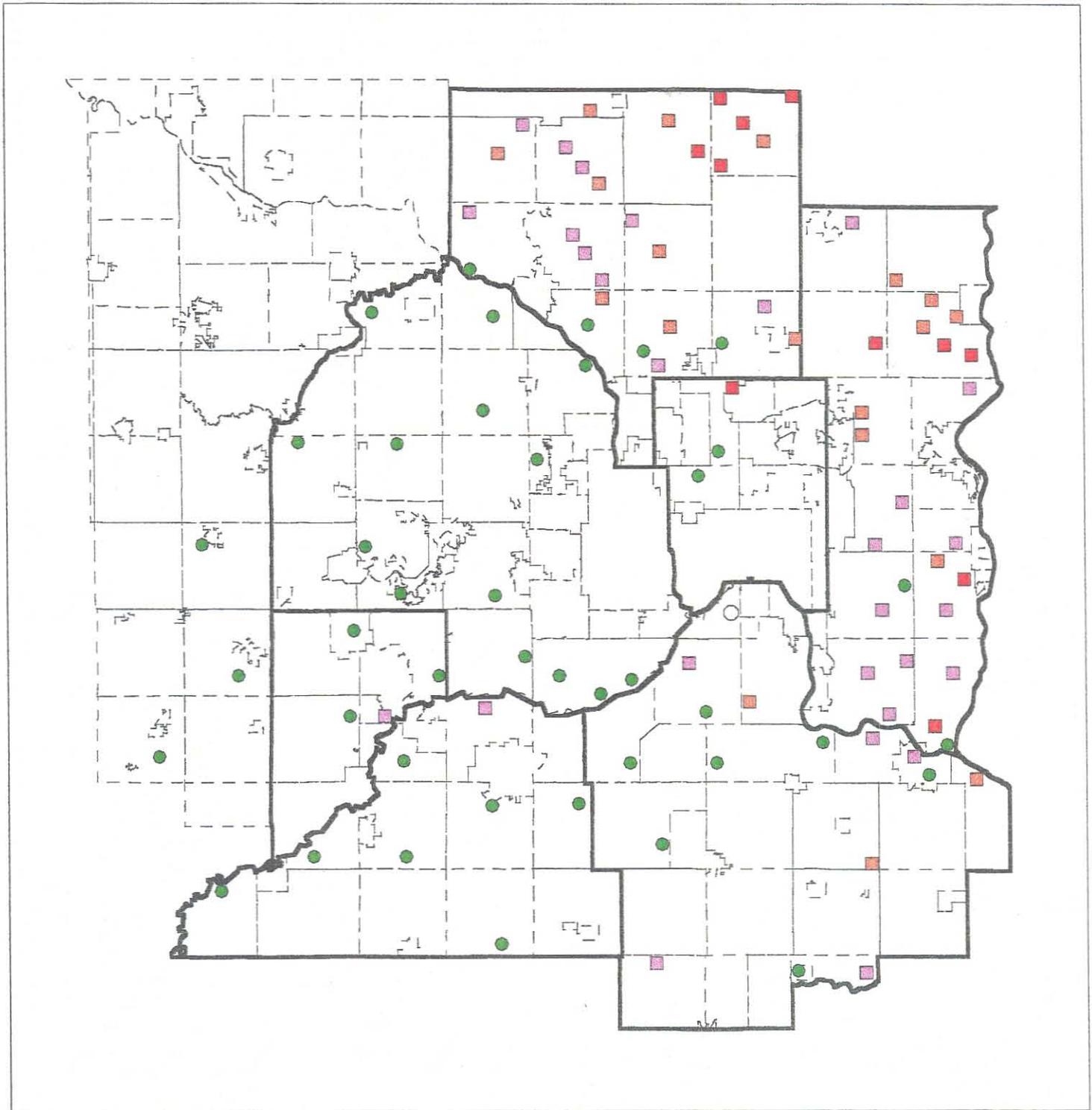


Average Number of *I. scapularis* Collected Per Mammal in Washington County (by Twp): 1990-1996



REPEAT SAMPLING LOCATIONS: 1990-1996

Figure 5



Key:

- *I. scapularis* was found all years (+)
- *I. scapularis* was found most years
- *I. scapularis* found least (but + at least 1 year)
- *I. scapularis* was not found