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

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1992 DEER TICK DISTRIBUTION STUDY

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Abstract

As a continuation of efforts initiated in 1990, a deer tick (*Ixodes scapularis*) distribution study was conducted in the seven county metropolitan area by the Metropolitan Mosquito Control District (MMCD). Small mammal trapping was used to collect ticks from 200 woodlots chosen for study (100 woodlots sampled previously, 100 new woodlots). We found at least one *I. scapularis* at 30 of these sites (24 repeat sites, and 6 new sites positive). As in the 1990 and 1991 studies, most of the deer ticks were found on the northeast side of the metropolitan area (Anoka, Washington, and northern Ramsey counties).

Introduction

I. scapularis (formerly *Ixodes dammini*) and human cases of Lyme disease have been reported from several counties in Minnesota. Drew et al. (1988) obtained location records for *I. scapularis* from grouse hunters in several parts of Minnesota. The Minnesota Department of Health has recorded human cases of Lyme disease from across the state (Osterholm et al. 1984, Minnesota Department of Health 1987 and 1990). Most of the *I. scapularis* and Lyme disease cases appear to be occurring in east-central Minnesota, north and east of the Twin Cities metropolitan area. However, many confirmed cases of Lyme disease have been reported from within the metropolitan area as well (Minnesota Department of Health 1987 and 1990).

In 1990, the MMCD initiated a Lyme Disease Tick Surveillance Program. The main goals of the program are to determine the distribution and prevalence of *I. scapularis* and *Borrelia burgdorferi*, within the Minneapolis- St. Paul metropolitan area. The 1990 and 1991 studies provided baseline *I. scapularis* distribution data for the area. Most of the ticks were found in counties north and east of the Mississippi River (Anoka, Washington, and Ramsey). The current study was conducted to fill in information gaps in the *I. scapularis* distribution map, and to help detect any long-term changes in *I. scapularis* distribution.

Materials and Methods

Of 200 sites selected for sampling in 1992, 100 sites were previously unstudied areas chosen to fill information gaps in the *I. scapularis* distribution map. Eighty-six of these sites were located south and west of the Mississippi River (Dakota, Hennepin, Scott, and Carver counties) where *I. scapularis* has been rare or absent in the past studies. Unlike the previous studies, we arbitrarily chose the square mile sections to be sampled to ensure that the unstudied areas were sampled. The actual location sampled within each section was also chosen nonrandomly by searching for the thickest woodlot (heaviest canopy, shrub, and herb coverage).

Our repeat sampling effort was increased from 75 sites in 1991, to 100 sites in 1992. The additional 25 sites were selected in Dakota, Hennepin, Scott, and Carver counties to better enable us to detect any changes in *I. scapularis* distribution over a many year

period. Repeat sites were selected from the previous studies based on three criteria: representative habitat of an area, locations that were unlikely to be developed, and good small mammal numbers.

As in past years, one 300 foot transect was established at each sampling location. Sherman live traps (H.B. Sherman Traps, Inc., Tallahassee, Fla.) baited with peanut butter and oats were placed along these transects at 50 foot intervals. Any small mammals caught in the traps were euthanized and searched for ticks. All ticks found were removed with forceps and stored in alcohol for later identification.

Sampling was initiated on 4/20/92 and ended on 10/22/92. The 27 week study was divided into three sampling periods. Every site was sampled for one week (randomly selected) during each nine-week period. Each week consisted of 21 trap nights (7 traps x 3 nights).

Results

During the 1992 study 2544 mammals (Fig. 1) were inspected and a total of 4130 ticks, of which 148 were *I. scapularis* (Fig. 2), were collected from them. We found at least one *I. scapularis* at 30 of 200 sampling sites (Fig. 3). Most of these positive sites were in Anoka, Ramsey, and Washington counties. The most prevalent tick species and stage collected were larval *Dermacentor variabilis* at a season mean of 1.28/mammal. The overall season mean number of *I. scapularis*/mammal was .058 (larvae: .045/mammal, nymphs: .013/mammal). If all sites with 0 *I. scapularis* are excluded, the means increase to .27 larval and .08 nymphal *I. scapularis*/mammal. As in past years, very low numbers of *I. scapularis* were collected at most sites. At 9 of 30 positive sites only one *I. scapularis* was collected during the entire season.

As in 1990 and 1991, the number of ticks collected each week showed definite seasonal trends. The average number of of *I. scapularis* larvae and nymphs collected/week peaked at the same time in mid-June. These data correspond well with information collected during the first two years of study (Fig. 4 and 5).

I. scapularis status at the 100 repeat sampling locations is shown on Figure six. *I. scapularis* presence/absence status has changed at 26 of the sites since 1990 or 1991. In particular, we determined that:

- I. scapularis* was found all years at 21 sites
- I. scapularis* was not found any year at 53 sites
- I. scapularis* was found most years at 5 sites
- I. scapularis* was not found most years (but positive at least one year) at 21 sites

At the 25 of these repeat sampling locations only resampled in 1992, we used the 1992 results to determine whether each site was predominately positive or negative for *I. scapularis*.

Quality assurance measures were conducted on random small mammal and tick

samples. We rechecked 227/2544 mammals (8.9%) for any ticks missed on the first inspection. We found additional ticks on 8/227 mammals (3.5%). Of the 621 total ticks on these mammals, only 8 (1.3%) were found on the quality assurance inspection. None of these ticks were *I. scapularis*. Tick identification accuracy was checked by re-identifying 211/4130 (5.1%) randomly selected ticks. All ticks were identified correctly.

Discussion

During the 1992 study we found *I. scapularis* in the same general areas as in the 1990 and 1991 studies. The emphasis that we put into sampling new areas south and west of the Mississippi River produced only one positive site out of 86 monitored (Marshan township, Dakota county). Conversely, we found *I. scapularis* at 5 of 14 new sampling areas north of the Mississippi river. Since 1990 we have monitored a total of 545 different locations across the seven county metropolitan area for deer ticks. We now feel that we have good baseline *I. scapularis* distribution data for the area.

Our repeat sampling of 100 sites is beginning to give us good information on where *I. scapularis* presence/absence status is changing. Most of the sites that are changing status appear to be located along a line from southern Anoka county, across northern Ramsey county, down through southern and western Washington county, and through northern and eastern Dakota county (Fig. 6). Sites in the northeastern part of the metropolitan area were more likely to remain positive for deer ticks during the three years of study. Similarly, sites in the southern and western parts of the area tended to be negative for deer ticks all three years of the study. It will be interesting to see if the line of changing site status shifts to the south and west in upcoming years.

In 1992 we again found *Ixodes muris* at some sampling locations. Nineteen of twenty miscellaneous ticks (not *I. scapularis* or *D. variabilis*) collected were this species. The importance of this tick in the epidemiology of Lyme disease is still poorly understood. However since *Peromyscus leucopus* are a major host for all stages of *I. muris*, these ticks may be locally important in spirochete maintenance.

In 1993 we will continue sampling the 100 repeat locations to look for changes in *I. scapularis* distribution. We will also continue cooperative studies with the University of Minnesota to determine the distribution and prevalence of *B. burgdorferi* in the metropolitan area.

Small Mammals Collected 1992

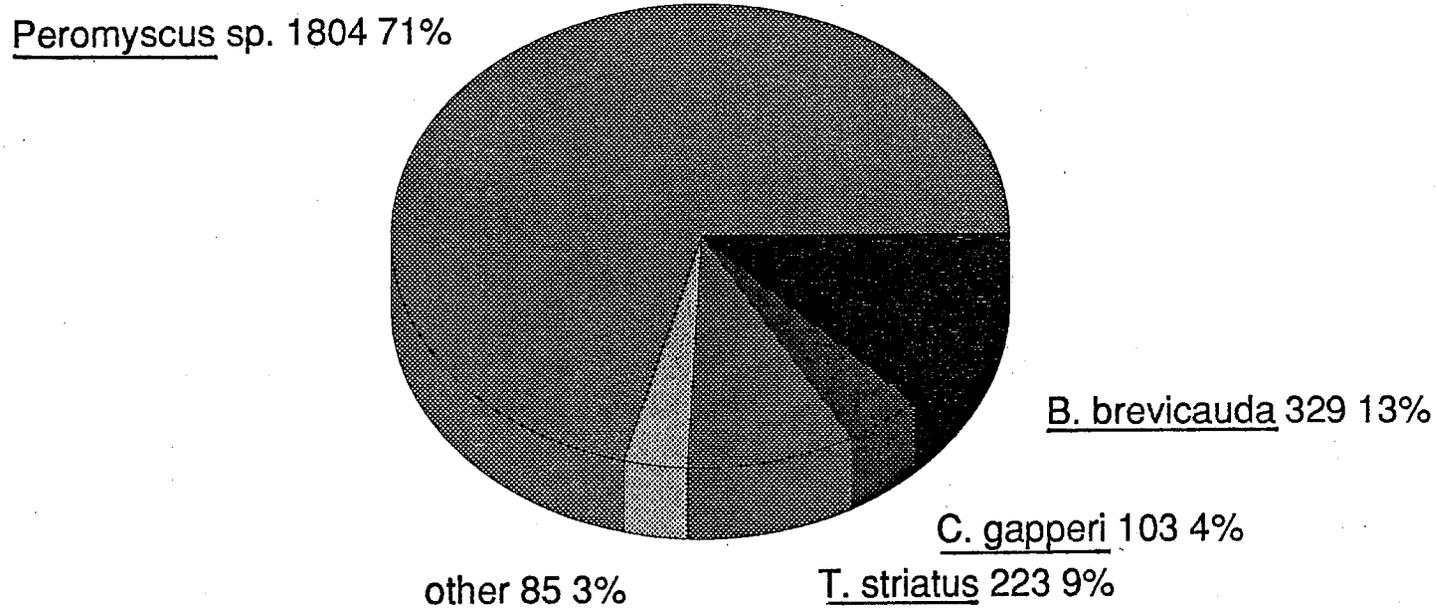
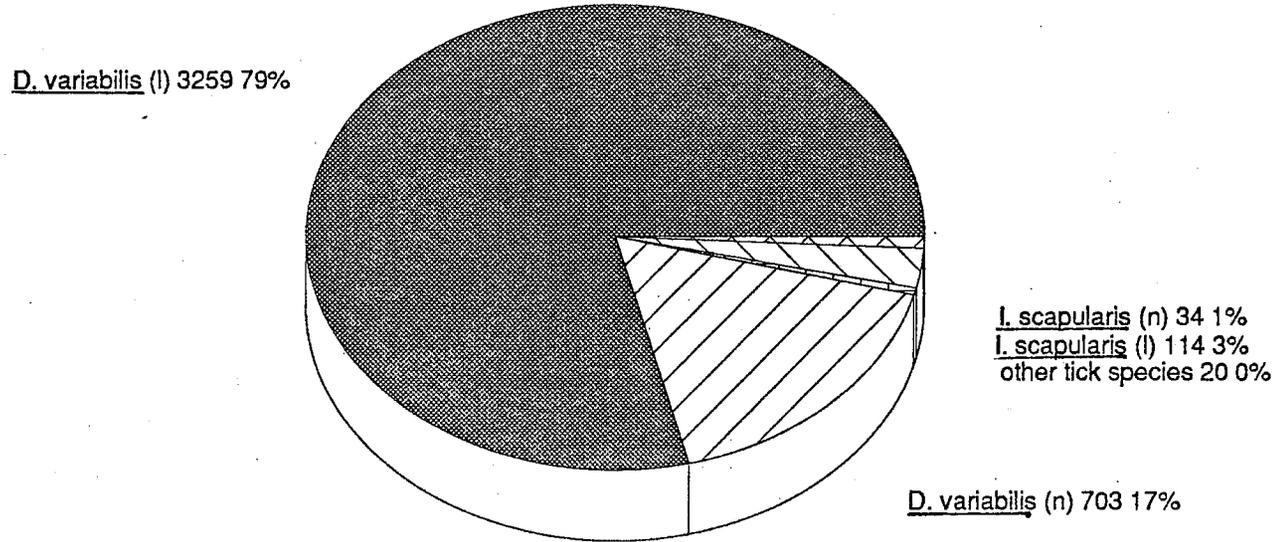


Figure 1

n=2544 mammals

Total Ticks Collected From Small Mammals By Tick Species and Stage: 1992

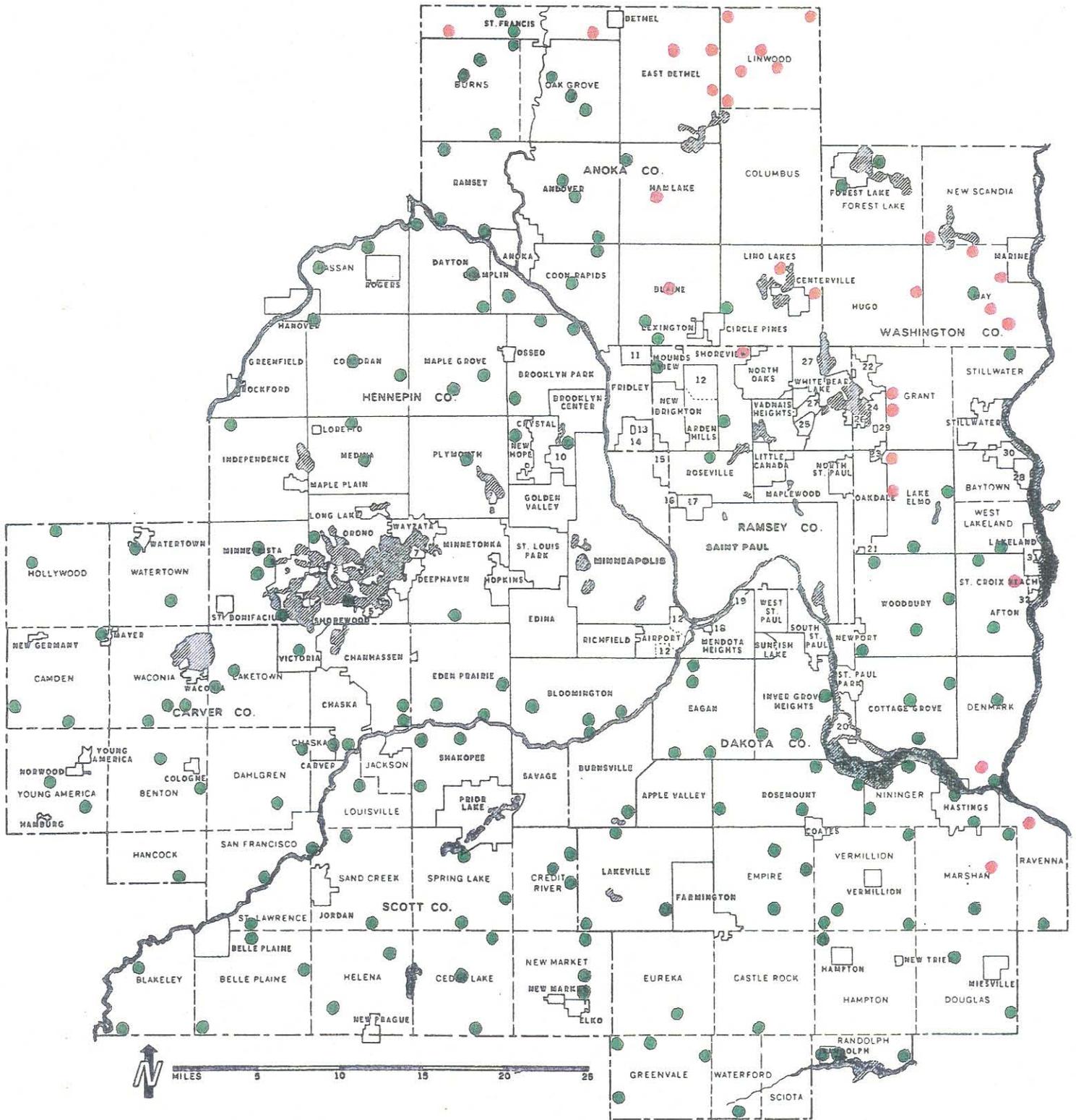


n=4130 ticks

Figure 2

1992 IXODES SCAPULARIS PRESENCE / ABSENCE STUDY

MAP OF SAMPLING LOCATIONS (N = 200)



Key:

- I. scapularis found at site
- I. scapularis not found at site

Ixodes scapularis Larvae 1990-1992 Average Ticks/Mammal By Month

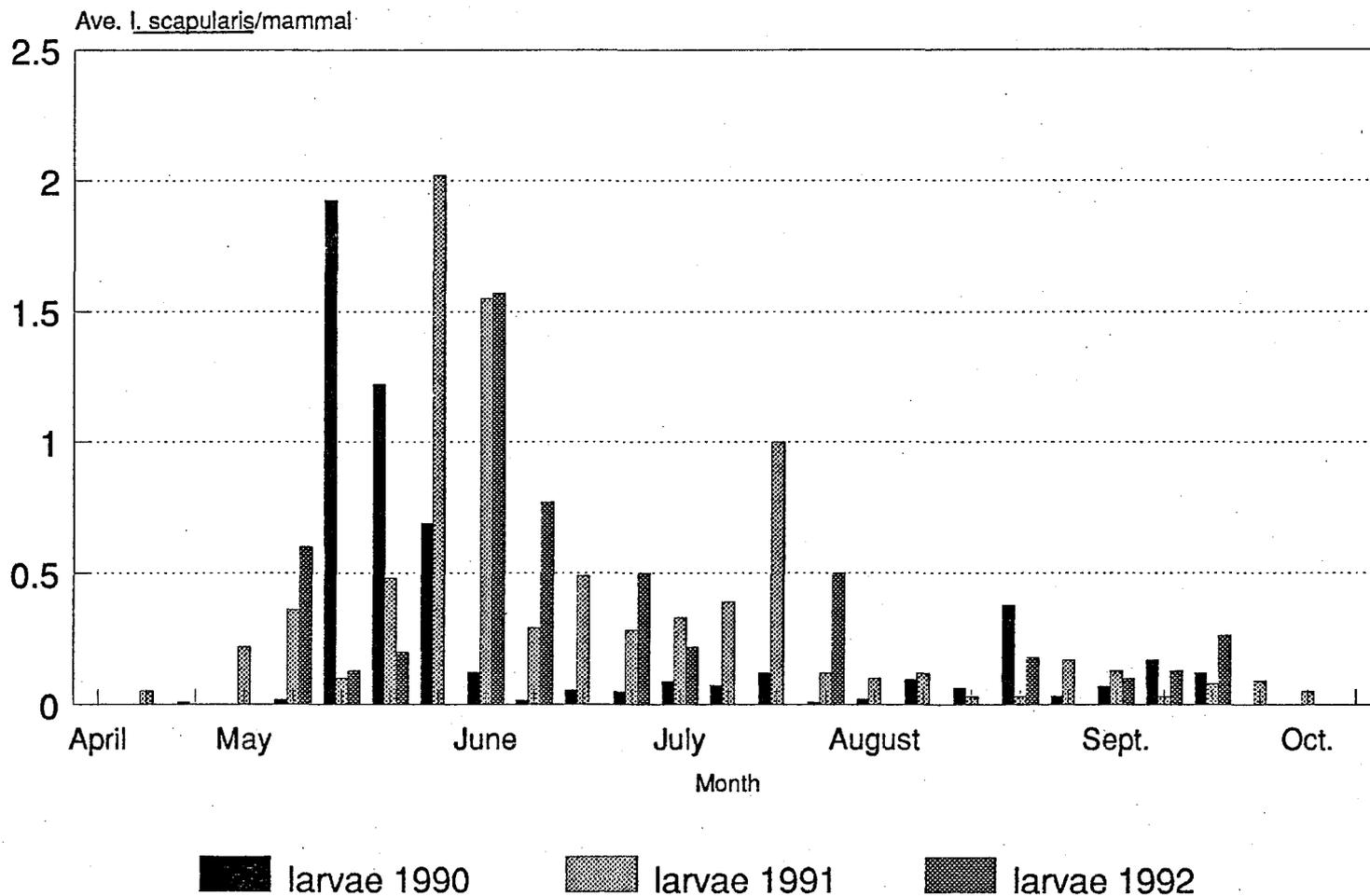


Figure 4

computed from positive sites only

Ixodes scapularis Nymphs 1990-1992 Average Ticks/Mammal By Month

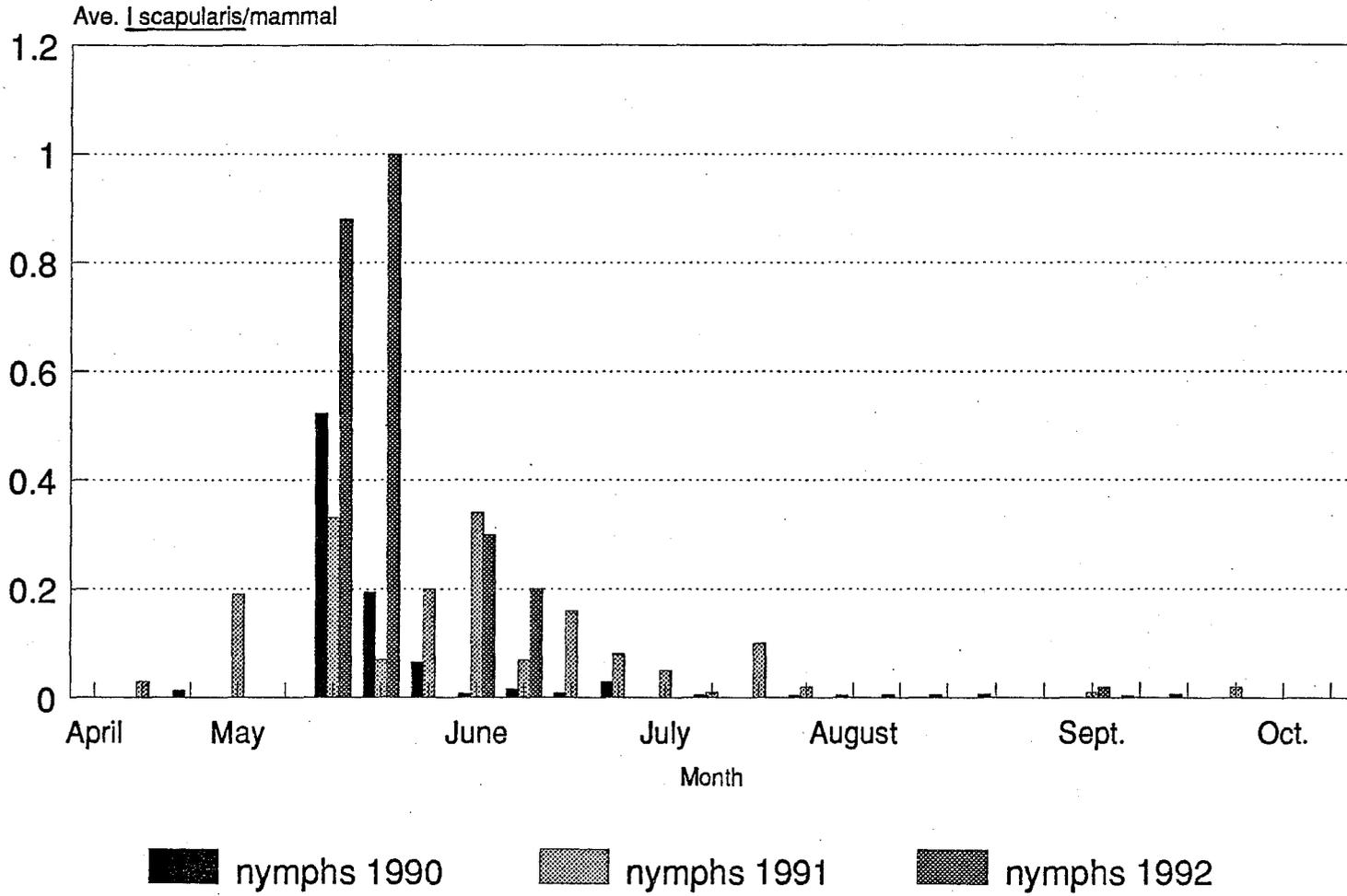


Figure 5

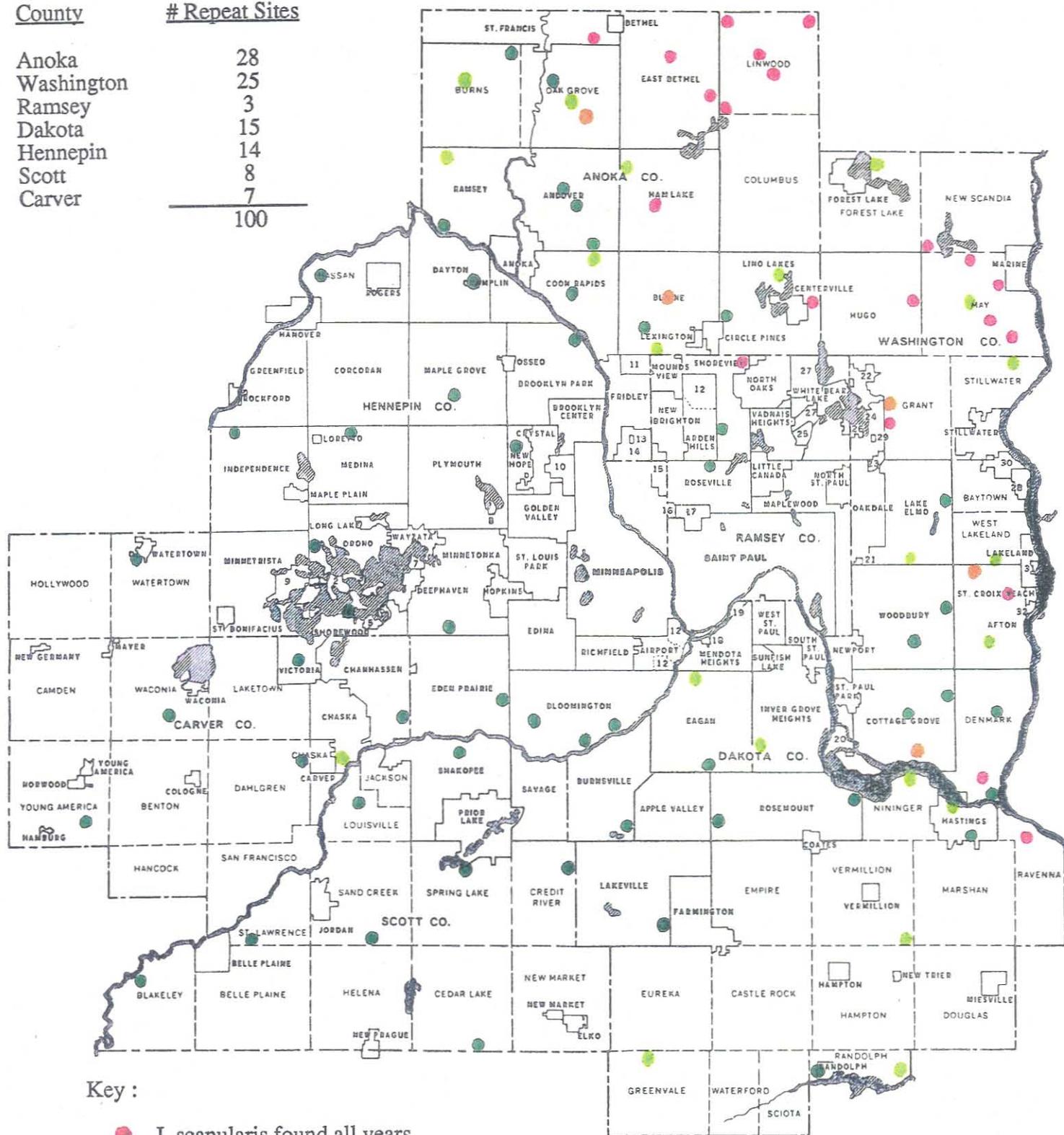
computed from positive sites only

REPEAT SAMPLING LOCATIONS

1990-1992

County # Repeat Sites

Anoka	28
Washington	25
Ramsey	3
Dakota	15
Hennepin	14
Scott	8
Carver	7
	<hr/>
	100



Key :

- I. scapularis found all years
- I. scapularis not found
- I. scapularis found most years
- I. scapularis not found most years
(but have been positive some years)

References Cited

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DEER TICK DISTRIBUTION STUDY ROADKILLED MAMMAL SAMPLING & TICKS TURNED IN BY STAFF 1992

Abstract:

As a part of our Deer Tick Distribution Study, roadkilled mammals were examined for *Ixodes scapularis* (formerly *I. dammini*). In addition, MMCD employees were requested to turn in any ticks found on themselves while conducting field operations. We found 63 *I. scapularis* on the 152 mammals examined during 1992 in the seven county metropolitan area. All *I. scapularis* were found on white-tailed deer. A total of 254 ticks were collected on the mammals representing 6 tick species. Field staff turned in 35 *I. scapularis* during the year.

Introduction:

In 1990 the Metropolitan Mosquito Control District initiated a study to determine the distribution of deer ticks (*I. scapularis*) within the seven county metropolitan area. The majority of the sampling effort has been directed towards collecting the ticks from their small mammal hosts at several hundred area woodlots.

As a supplement to this work, we decided to collect ticks from medium to large sized roadkilled mammals. These mammals have larger home ranges than most small mammals, thus increasing their opportunities to come into contact with deer ticks. Roadkill sampling has been used successfully in New York to collect deer ticks (MDNR Jay McAninch pers. commun.).

In an attempt to understand the exposure potential to deer ticks that MMCD staff experience, field staff were requested to turn in any ticks that they found on themselves. The MMCD has 100-200 people in the field during most of the tick season.

Materials and Methods:

Roadkilled mammals were collected during the process of traveling to conduct other job functions. When a roadkilled mammal was found, it was checked to make sure it was relatively fresh, placed in a plastic bag, and brought back to the laboratory for tick removal. Many of the mammals (including all white-tailed deer) were checked for ticks in the field where they were found.

MMCD employees collected any ticks found on themselves during field operations. They were instructed to turn in all ticks unless they knew the ticks were wood ticks (*Dermacentor variabilis*). Wood ticks are often so abundant, that to request the staff to turn them all in would not be feasible.

Results:

A total of 152 mammals, representing 15 species, were inspected for ticks in 1992 (Fig. 1). Of the 254 total ticks collected, 63 were *I. scapularis*. All of the *I. scapularis* collected came from 16 white-tailed deer. These deer were from Anoka and Washington counties. Mammals were sampled from all seven metropolitan counties.

MMCD employees turned in a total of 35 *I. scapularis* in 1992. All deer ticks were found in the same counties where they were found in the small mammal studies (Anoka, Washington, and Ramsey) (Fig. 2). Two adult *Amblyomma americanum* were also submitted for identification. One was reported from Hastings (Dakota county), and the other from an unspecified location in Wright county.

Discussion:

This was the first year of the roadkilled mammal study where we found *I. scapularis* (unsuccessful in 1990-1991). No *I. scapularis* were found on mammals other than white-tailed deer. Many of the deer we sampled this year were at the Wildlife Science Center in Carlos Avery WMA (Anoka county). This private organization had an agreement with county highway crews and a private hauler to bring roadkilled deer to the site to be fed to their research wolves. We were able to inspect many of these roadkills before they were eaten. Deer brought to the site were supposed to be labeled with the location where they were found. Unfortunately, some of the deer were left unlabeled, or only partial data were provided. Of the deer properly marked, all *I. scapularis* positive ones came from Anoka and Washington counties. Three of the deer we sampled at the Center came from southern Isanti county. We did not include their data in this study, however 20 *I. scapularis* were found on these animals.

We were disappointed that we did not receive more *I. scapularis* from our field staff. A few of the ticks submitted actually came from the employee's pets (eg. Most of the Lake Elmo ticks came from an employee's dog with no travel history). The impression we got from our staff was that deer ticks were infrequently encountered except in a few localized areas. However, the areas where our employees found ticks seemed to correspond well with where we have found *I. scapularis* on small mammals.

Figure 1: Roadkilled Mammal Data Summary 1992

SPECIES:	# SAMPLED:	# POSITIVE FOR TICKS	# TICKS FOUND AND SPECIES:
White-tailed deer	70	16	63 Ixodes scapularis 1 A. americanum
Raccoon	44	16	157 D. variabilis 15 Ixodes cookei
Gray squirrel	15	1	15 Ixodes marxi
Woodchuck	6	1	2 D. variabilis
Cottontail rabbit	4	1	1 H. leporispalustris
Short-tailed shrew	3	0	
Red squirrel	2	0	
Opposum	2	0	
Chipmunk	1	0	
Thirteen-lined ground squirrel	1	0	
Eastern mole	1	0	
Striped skunk	1	0	
Red fox	1	0	
Muskrat	1	0	

Figure 2: Ixodes scapularis Turned in by Field Staff 1992

COUNTY:	TOWNSHIP:	# <u>I. scapularis</u>
Washington (28 Total)	Lake Elmo	12
	Hugo	6
	New Scandia	4
	Baytown	1
	Ham Lake	3
	Afton	1
	Cottage Grove	1
Anoka (5 Total)	Coon Rapids	1
	Lino Lakes	2
	Ramsey	1
	Burns	1
Ramsey (2 Total)	Maplewood	2

1993 LYME PROGRAM PROPOSAL

Introduction:

In 1990 the Metropolitan Mosquito Control District initiated a Lyme Disease Tick Surveillance Program. In 1990-1991, a study was conducted to determine the current distribution of *Ixodes scapularis* (formerly *I. dammini*) within the seven county metropolitan area. *I. scapularis* were found primarily in the northeastern counties of the area (Anoka, Washington, and northern Ramsey). The study was continued in 1992 to look for changes in *I. scapularis* distribution. We also initiated cooperative studies with Dr. Russell Johnson (University of Minnesota) to determine the distribution and prevalence of *Borrelia burgdorferi* within the metropolitan area.

In 1993 we will continue the repeat sampling portion (100 sampling locations) of the Deer Tick Distribution Study, and the cooperative studies with Dr. Johnson.

Outline of 1993 Program Elements

1. *I. scapularis* Distribution Study

We will sample the 100 repeat sampling locations chosen in 1990 and 1991. This work is part of a multi-year effort to look for changes in *I. scapularis* distribution. In particular, want to determine when *I. scapularis* becomes established in new areas south and west of the Mississippi River. Small mammal populations will be sampled at each site using the same methods as in the previous years of the study. The work will begin in mid-April, and end in mid-October. Each site will be sampled for three one-week periods during the year.

2. *B. burgdorferi* Distribution and Prevalence Study

The cooperative study with Dr. Johnson will be continued at four new locations within the City of North Oaks. We hope to obtain a better understanding of the apparent focal nature of *B. burgdorferi* distribution within this relatively small residential area. Small mammals will be collected weekly from each site and brought to Dr. Johnson's laboratory to be cultured (heart, spleen, bladder, and blood samples) for the spirochete.

3. Roadkilled Mammal Study

As in 1990-1992, freshly roadkilled mammals found while conducting other parts of our studies, will be examined for ticks. This effort will focus on medium to large sized mammals (eg. squirrels, raccoons, deer, etc.).

4. Deer Blood Sampling

As in the past few years, we will collect deer blood samples from deer taken in local hunts or shoots. The samples will then be tested for exposure to *B. burgdorferi*.

5. Ticks Submitted By Employees

Employees will again be encouraged to turn in any ticks they find on themselves that cannot be readily identified as wood ticks. We hope to get a better understanding of the potential exposure to deer ticks by our field staff.