

Temporal Distribution and Lyme Disease Infection Rates in *Ixodes pacificus* from Contra Costa County

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ABSTRACT: Since 1993, Contra Costa Mosquito and Vector Control District (CCMVCD) has been conducting a long term, on-going study to evaluate spatial and temporal distribution and Lyme disease infection rates in *Ixodes pacificus*. Three surveillance sites were chosen based on an earlier county-wide survey for the presence of *Ix. pacificus* and *Borrelia burgdorferi*. Surveillance sites included mixed chaparral/oak woodland habitats at the Bear Creek Staging Area of Briones Regional Park, Springhill Road in Lafayette and Bollinger Canyon Road in San Ramon. Objectives included looking for long-term and seasonal trends in tick abundance and *Borrelia* infection rates by examining relationships, if any, between abundance, rainfall, tick density, tick identification, service requests and human case incidence, with the ultimate goal of optimizing tick and Lyme disease surveillance for human risk assessment.

Ticks were collected on a bi-weekly basis between the months of October-March each year from 1993-2008, using standard flagging procedures. All ticks were identified to species, and population densities were recorded as ticks per flag

hour. Individual specimens were tested for the presence *B. burgdorferi* by indirect fluorescent antibody test (IFA). Service requests included ticks submitted to the District for identification and/or testing by residents of Contra Costa County throughout the year. All ticks submitted were identified to species, and subsets of *Ixodes* were tested for *B. burgdorferi* by IFA at CCMVCD or by polymerase chain reaction (PCR) at IGeneX, Inc., (795 San Antonio Road, Palo Alto, CA 94303).

The seasonal pattern of tick abundance varied considerably from year to year. We saw no correlation between tick abundance data from our surveillance sites and the number of service requests per season or reported human Lyme disease case incidence, and no apparent relationship within years between monthly rainfall and tick abundance. Infection rates at surveillance sites also varied significantly over time and varied widely by location. We saw no apparent relationships between infection rates at different sites and reported human case incidence. Service request infection rates varied both by year and by test type, with PCR testing generally yielding higher

estimated infection rates than IFA testing. On average in any given year 0 - 3.5% of the adult *Ixodes pacificus* in Contra Costa County are infected with *B. burgdorferi*. Lyme disease activity appears to be concentrated in fairly discrete “hot spots” that vary from year to year. In some localized “hot spots” as many as 6 - 10% of the adult *Ixodes* may be infected. Surveillance of ticks and Lyme disease at our fixed ‘sentinel’ locations does not appear to be indicative of the overall disease risk to county residents, due to the spatial and temporal patchiness of both the ticks and *Borrelia*. We conclude that more random or widespread surveillance to locate additional Lyme disease “hot spots” may be a more effective approach than sampling from a small number of fixed surveillance locations for development of effective risk assessments.