

Long term data required to establish trajectories of populations in Lyme disease transmitting deer ticks (*Ixodes scapularis*)

Introduction

Ixodes scapularis, the deer tick, is a primary vector of Lyme disease, a critical public health concern

Yet many biology studies are only a few years long, potentially resulting in misleading inferences when projected into the future

Objective: how do sampling method, geographic scope, life stage, and study length affect patterns inferred in long-term deer tick datasets?



Data Collection

We compiled 286 public datasets that recorded tick density or count for 9+ years Datasets varied in geographic scope, sampling techniques, study length, and life stage of tick sampled



Green areas are states and counties; and orange dots represent the state forests included in the study.

Bad Breakup Algorithm

This algorithm splits long-term datasets into different lengths to examine whether the truncated datasets would reach the same conclusions. (1)



Rowan Christie₁, Christine A. Bahlai₂, Julia Perrone₂, Kaitlin Stack Whitney₁₃







Figure 3B: Comparison of proportion significantly wrong before stability by life stage. Studies examining adults have a significantly greater proportion significantly wrong before stability compared to studies examining nymphs (t = 2.8993, p-value = 0.00449).

Legend for all figures:

Dots represent the data points between stability time or proportion significantly wrong before stability and x factor. Letters show which pair of factors are significantly different - if factors share the same letter, they are not significantly different, but if not, then the factors are significantly different.

Figure 4B: Comparison of proportion significantly wrong before stability by geographic scope. State forest level studies are have a significantly smaller proportion significantly wrong to stability than town and county level studies (state forest and county, t = 5.2409, p-value = 1.445e-06; state forest and town, t = 7.4221, p-value = 2.013e-09).

Figure 4A: Comparison of years to stability by geographic scope. County level studies reach stability significantly faster than town (t = -17.029, p-value < 2.2e-16), state forest (t = -5.5457, p-value = 0.002278), and grid level studies (t = -17.207, p-value < 2.2e-16).



time





Our main findings: Longer study length is important for reaching stability

Results from deer tick studies with less than 5 years of study should be interpreted cautiously

Dragging is more likely to yield stable trends than public surveys. Researchers should consider using standardized sampling techniques (dragging, flagging) as opposed to opportunistic surveys

Studies that collect data on adult ticks are more likely to reach stability than nymphs or larvae. Studies that focus on nymphs and larvae only should be interpreted more cautiously

County level studies are more likely to reach stability than town, state forest, and grid level studies Researchers should consider collecting data on county level scale rather than a smaller scale Analyzing the impact of study parameters help researchers conduct studies that reach stable trends and avoid misleading results

Author affiliations: 1 Thomas H Gosnell School of Life Sciences, Rochester Institute of Technology; 2 Department of Biological Sciences, Kent State University 3 Science, Technology & Society Department, College of Liberal Arts, Rochester Institute of Technology. RMC is supported by the National Institute of General Medical Sciences of the National Institutes of the Health under Award Number R25GM122672. CAB, JP, and KSW are supported by the Office of Advanced Cyberinfrastructure in the National Science Foundation under Award Number #1838807. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the National Science Foundation

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Discussion

Implications for future research:

Acknowledgments

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