Biology Student Scholarship

Biology

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Lyme disease cases dependent on annual snowfall

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LYME DISEASE CASES DEPENDANT ON ANNUAL SNOWFALL

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Background

Ticks are parasitic arachnids that have been known to inhabit every region of the United States. Specifically, adult ticks are approximately 3 to 5 mm in length depending on age, sex and species (1). Ticks can spread diseases through feeding on the blood of mammals and birds. Lyme disease is a bacterial infection you can get from the bite of a Blacklegged tick (deer tick) (Fig 1). Lyme disease can lead to long term health effects and can ultimately lead to fatality. Depending on location, up to 50% of ticks in the given area can carry Lyme disease (2). Lyme disease is a problem and climate change could make it even worse. For whether a tick dies in the winter depends on how deep they burrow to go dormant or if they attach themselves to a host. There is little research to how recent climate changes have affected ticks that carry Lyme disease.

This study examines whether annual snowfall correlates with Lyme disease cases. It is possible that with increased snowfall, it can insulate the ground more and could increase tick survival. **I hypothesize that at higher snowfall rates annually there will be an increase in confirmed cases of Lyme disease.**
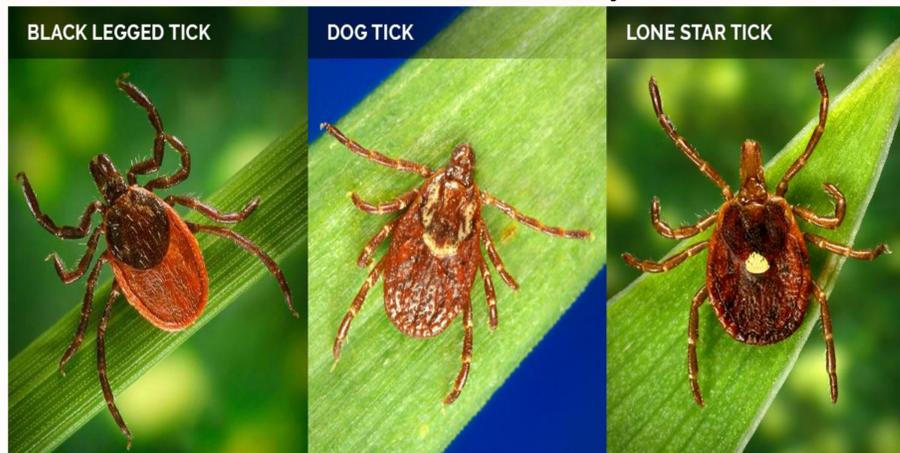
Fig 1. Three most common ticks in the New England region of the United States (New York Presbyterian).

Methodology

Reported Lyme disease cases were collected from five states: Connecticut, Maine, Vermont, New Hampshire and Rhode Island (Fig 2). Massachusetts was left out of this study due to lack of Lyme disease data. These cases were reported from 2016 through 2019. Annual snowfall in inches was taken from the city in each state that had the highest population density.
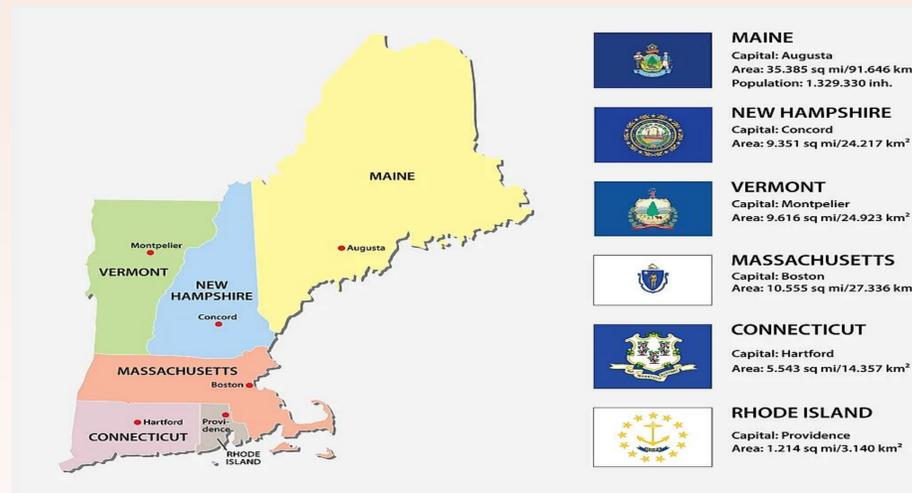
MAINE
Capital: Augusta
Area: 35.385 sq mi/91.646 km²
Population: 1.329.330 inh.

NEW HAMPSHIRE
Capital: Concord
Area: 9.351 sq mi/24.217 km²

VERMONT
Capital: Montpelier
Area: 9.616 sq mi/24.923 km²

MASSACHUSETTS
Capital: Boston
Area: 10.555 sq mi/27.336 km²

CONNECTICUT
Capital: Hartford
Area: 5.543 sq mi/14.357 km²

RHODE ISLAND
Capital: Providence
Area: 1.214 sq mi/3.140 km²

Fig 2. Map of the United States indicating New England regions states (worldatlas.com).

Results

Fig 3. Confirmed Lyme disease cases over annual snowfall (measured in inches).

Annual snowfall was a significant predictor in the amount of reported Lyme disease cases. (Poisson GLM, Chisq= 349.36, Df= 1, p< 0.001). As annual snowfall increased there was an increase in reported Lyme disease cases (Fig 3).
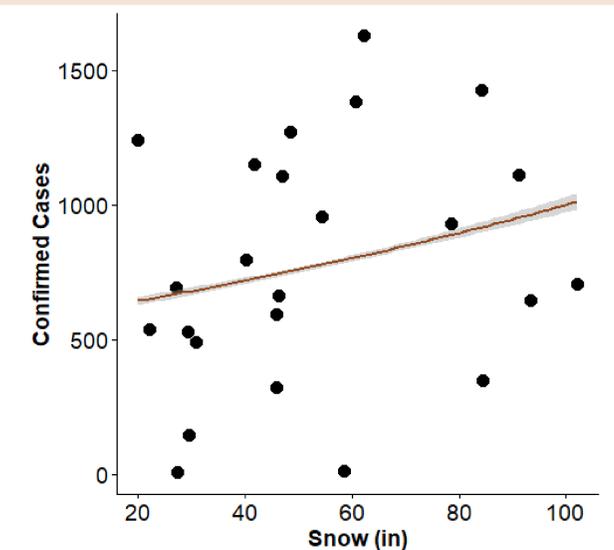
Conclusion(s)

As annual snowfall totals increased within the New England region, it was apparent that reported Lyme disease cases increased. Higher levels of snow could help tick populations insulate themselves while underground from the freezing temperatures above. Also, specific natural landscapes could aid in tick survival such as highly wooded areas. Lastly, fluctuations in temperature could possibly trick ticks into thinking warmer months are sooner than they are resulting in more die off. It is important to remember to take necessary precautions when outside with ticks.

References

(1) *About ticks*. Mass Audubon. (n.d.). Retrieved May 1, 2022, from https://www.massaudubon.org/learn/nature-wildlife/insects-arachnids/ticks/about#:~:text=There%20are%20two%20species%20of,the%20more%20common%20Dog%20Tick. (2) *Ticks and lyme disease*. Johns Hopkins Medicine. (2021, August 8). Retrieved May 1, 2022, from https://www.hopkinsmedicine.org/health/conditions-and-diseases/lyme-disease/ticks-and-lyme-disease

Acknowledgements