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UMaine Tick Surveillance Program Annual Report - 2019

INTRODUCTION

The University of Maine Cooperative Extension Tick Lab conducts surveillance of ticks and tick-borne pathogens to track their distribution, detect trends or changes in tick activity, and to identify areas of risk for tick-borne disease in Maine. In 2019, the UMaine Extension Tick Lab began accepting tick samples from the public for tick-borne pathogen testing. For $15, Maine residents can have ticks tested for the causative agents of Lyme disease, anaplasmosis, and babesiosis; the three most common tick-borne diseases. A free tick identification program also continues to be offered.

This report summarizes the information gathered through the passive surveillance associated with the UMaine Extension Tick Surveillance Program. Passive surveillance refers to tick specimens found and submitted by members of the public and can potentially result in a bias toward certain geographic locations or uncertainty about where a specific sample was collected. All samples were submitted to the Tick Lab within the UMaine Cooperative Extension Diagnostic & Research Laboratory. For more information on ticks in Maine or on submitting a tick to the Tick Lab, please visit us online at:

ticks.umaine.edu

BACKGROUND

Ticks and tick-borne diseases have become a significant public health issue in Maine and throughout the eastern United States. Lyme disease is the most commonly reported vector-borne disease in the US, and reported cases have been steadily increasing throughout much of the state. In addition to Lyme disease, cases of anaplasmosis and babesiosis are also on the rise. Other tick-borne diseases known to occur in Maine include *Borrelia miyamotoi* disease and the serious but relatively rare Powassan virus. The primary vector of these diseases, the deer tick or black-legged tick, has greatly increased in both population size and geographic range within the state. Furthermore, Maine faces significant threats related to invasive tick species including the lone star tick and Asian long-horned tick, both of which can have serious impacts on the health of humans, wildlife, and domestic animals.

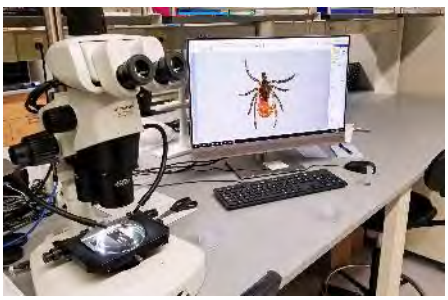
There are fifteen different tick species that have been found in Maine, though not all are permanent residents. Some may arrive in the state on wildlife hosts and do not establish viable populations. Other species have thrived in Maine and are now widespread throughout much of the state. The most commonly encountered tick species in Maine are the deer tick (*Ixodes scapularis*), the American dog tick (*Dermacentor variabilis*), and, to a lesser extent, the woodchuck tick (*Ixodes cookei*).

PURPOSE

Combatting the threats associated with ticks is an immense challenge that relies heavily on an integrated approach that includes monitoring tick populations, reducing tick and host habitat, managing ticks and their wildlife hosts, and widespread educational outreach on personal protection. The tick surveillance associated with the UMaine Extension Tick Lab is an attempt to gain information on the geographic spread of ticks and tick-borne disease in Maine and to provide information on the risk of encountering ticks.

The Tick Lab is not a medical lab and does not provide medical information. The testing of tick samples is intended to provide information on ticks and their associated pathogens in Maine and is not intended to be used in human health assessment or to be interpreted as a medical diagnosis. If you have been bitten by a tick, do not wait until tick testing results are available to consult with your doctor.

This report was prepared by Griffin Dill and Tom Rounsville, University of Maine Cooperative Extension. Questions regarding the report can be directed to tickID@maine.edu.



TICK SPECIES IDENTIFICATION

A total of 2,697 ticks were submitted to the UMaine Extension Tick Surveillance Program in 2019, with samples submitted from each of the state's 16 counties and from 358 towns. The first sample arrived to the lab for testing on April 1st and the final sample of 2019 arrived on December 30th. The majority of the ticks submitted were identified as deer ticks (*Ixodes scapularis*), while American dog ticks (*Dermacentor variabilis*) also made up a significant portion of the submissions. Lone star ticks (*Amblyomma americanum*), a species of significant medical importance, were also submitted. Lone star ticks are not known to have established permanent populations in Maine, but are established in other New England states. They are sporadically found in Maine, most likely the result of being transported on migratory wildlife. Of the 10 lone star ticks that were submitted to the program, five were related to Maine residents travelling to other states, while the other five samples were acquired in Maine, originating from Cumberland, Knox, Kennebec, and Penobscot Counties.

Tick Species Submitted to the UMaine Extension Tick Lab in 2019 (Table 1)

Tick Species	Common Name	Total
Ixodes scapularis	Deer tick or blacklegged tick	2056
Dermacentor variabilis	American dog tick	585
Ixodes cookei	Woodchuck tick	37
Amblyomma americanum	Lone star tick	10
Ixodes marxi	Squirrel tick	1
Ixodes muris	Mouse tick	1
Unknown	Specimens damaged during removal/delivery	7

Deer Tick (*Ixodes scapularis*) Submissions by Life Stage and Feeding Status (Table 2)

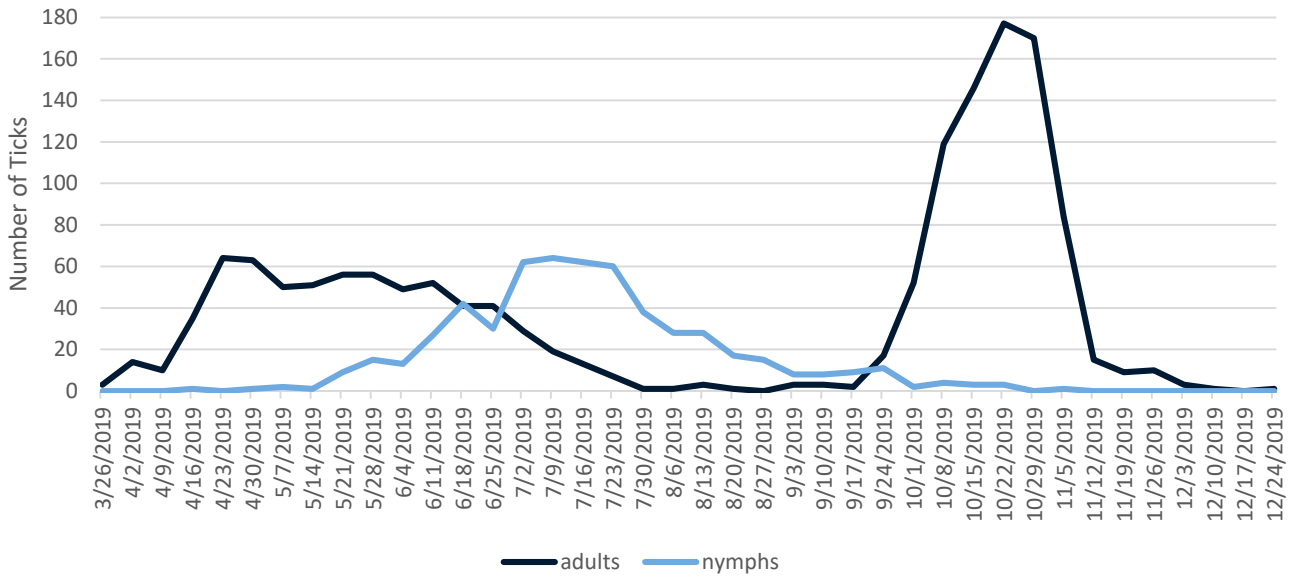
Life Stage	Unfed	Partially Engorged	Fully Engorged	Engorgement Unknown*	Total
Adult Females	624	760	25	32	1441
Adult Males	-	-	-	-	30
Nymphs	118	427	15	5	565
Larvae	7	13	0	0	20

* Some specimens arrived to the lab too damaged to determine feeding status. Though male ticks may feed for brief periods, they do not become engorged.

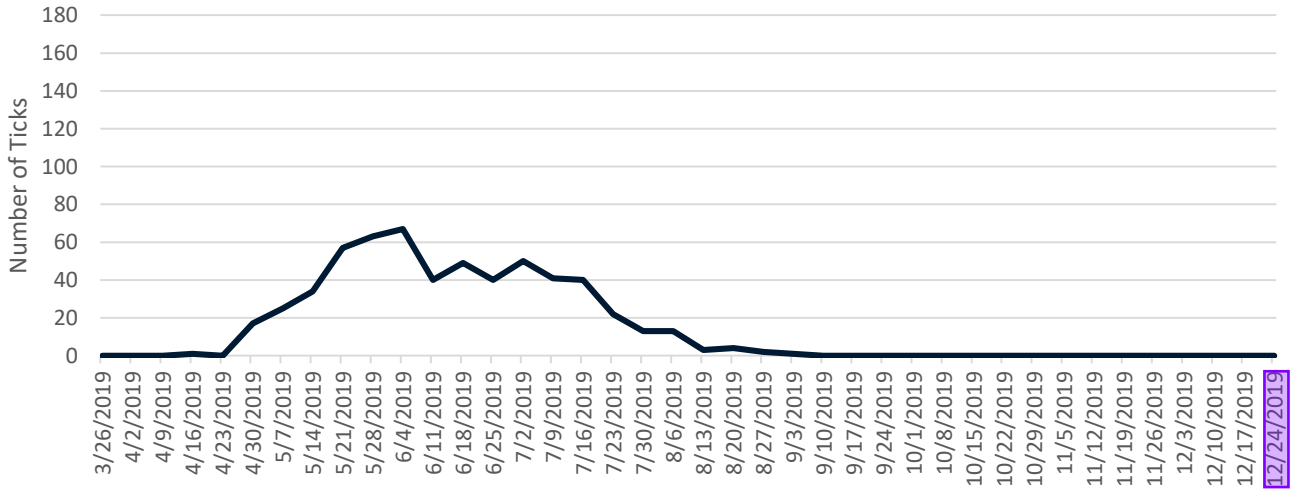
SEASONALITY OF TICK SUBMISSIONS

The risks associated with ticks and tick-borne disease varies by season, based upon multiple factors including the tick's life cycle, weather conditions, and host availability. Adult deer ticks are generally most active from early spring to late fall with two peaks, one in April or May and another in late October or early November. Nymph numbers usually peak in June and early July. Deer ticks can remain active as long as the temperature is above freezing, thus it is also possible to encounter them during the winter months. American dog tick activity tends to peak in early summer with populations becoming inactive by early fall.

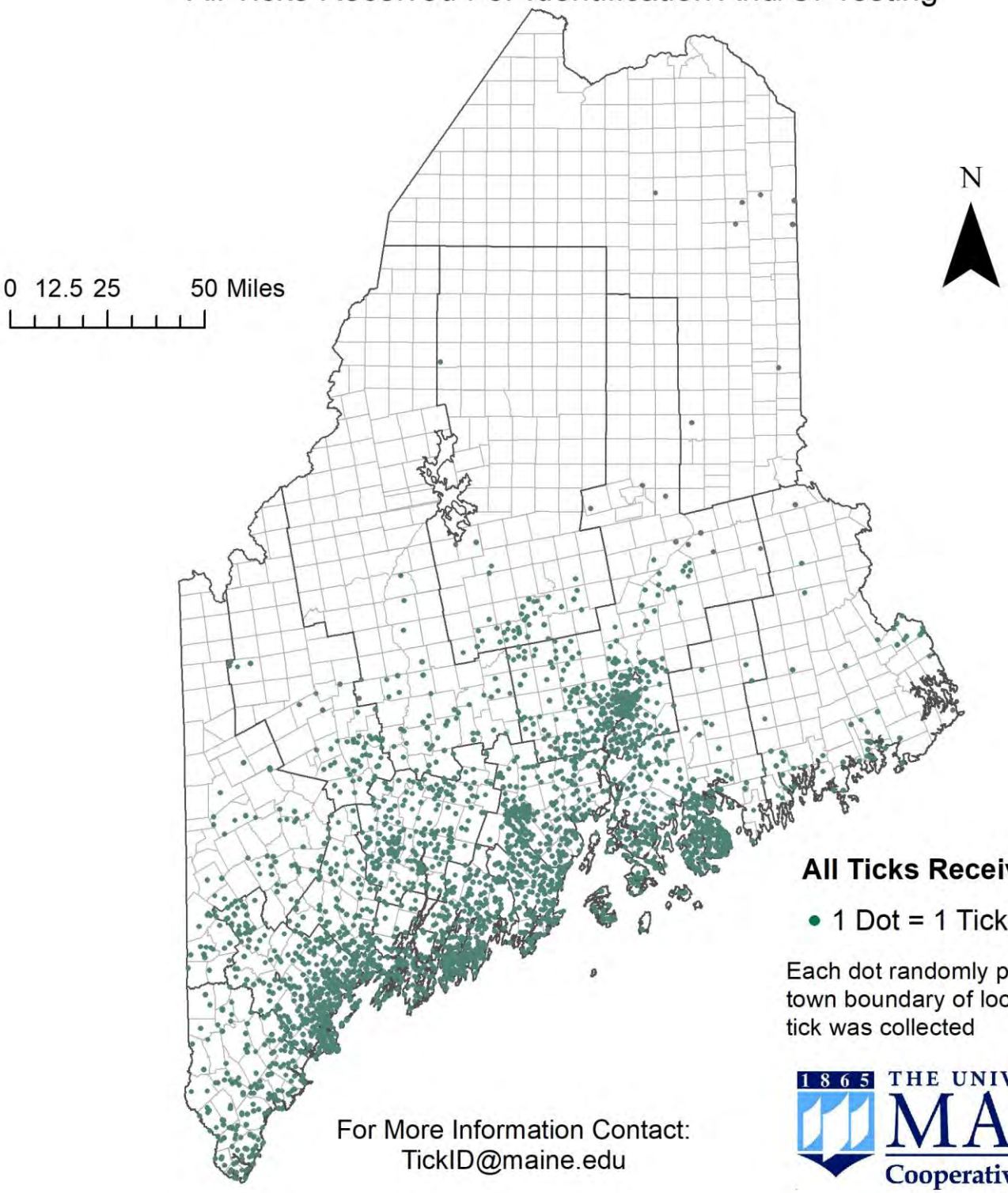
Deer Ticks (*Ixodes scapularis*) Collected by Week (Fig. 1)

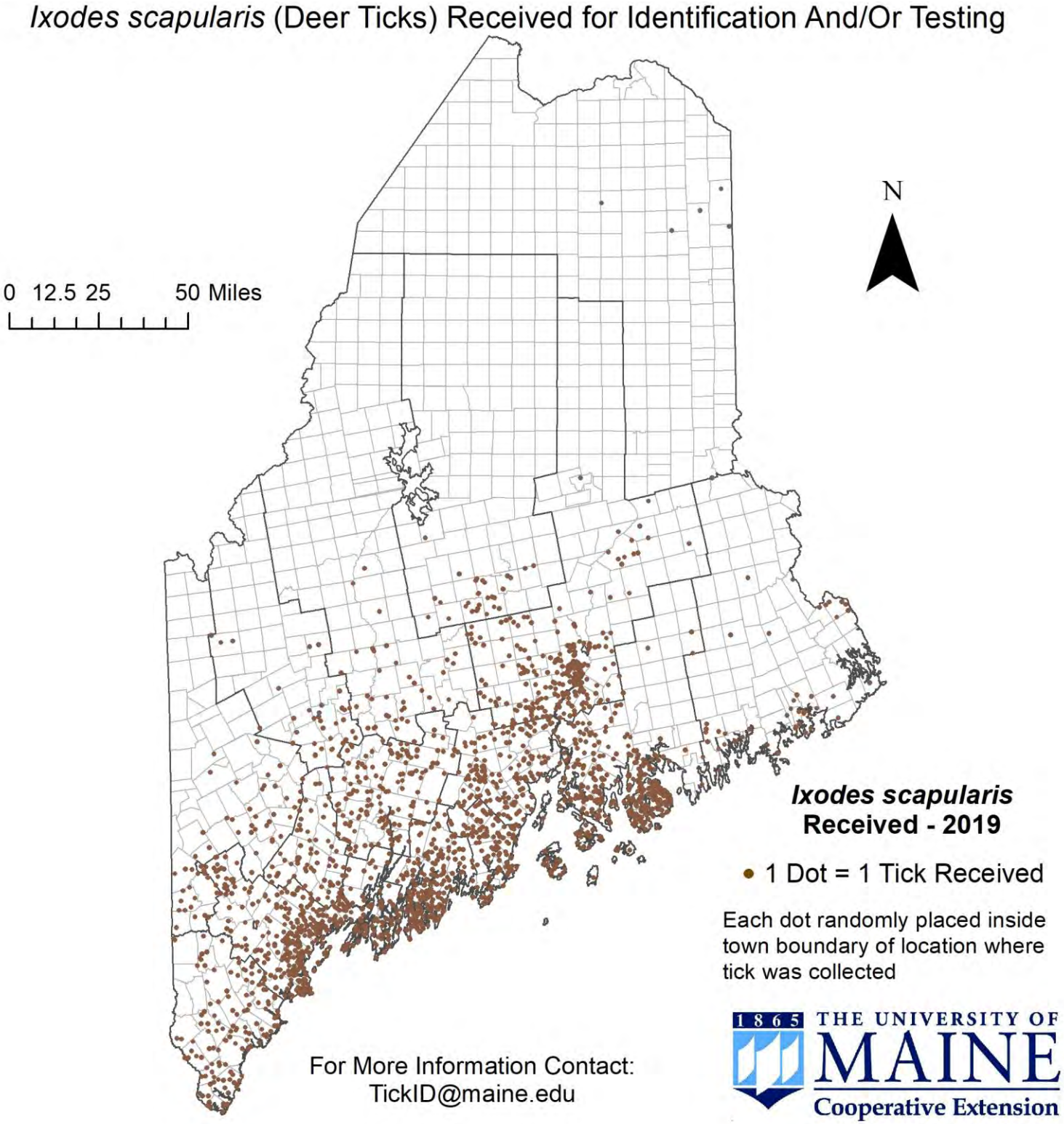


American Dog Ticks (*Dermacentor variabilis*) Collected by Week (Fig. 2)



All Ticks Received For Identification And/Or Testing




Ixodes scapularis (Deer Ticks) Received for Identification And/Or Testing
0 12.5 25 50 Miles
N
Ixodes scapularis
Received - 2019
• 1 Dot = 1 Tick Received
Each dot randomly placed inside town boundary of location where tick was collected
For More Information Contact:
TickID@maine.edu
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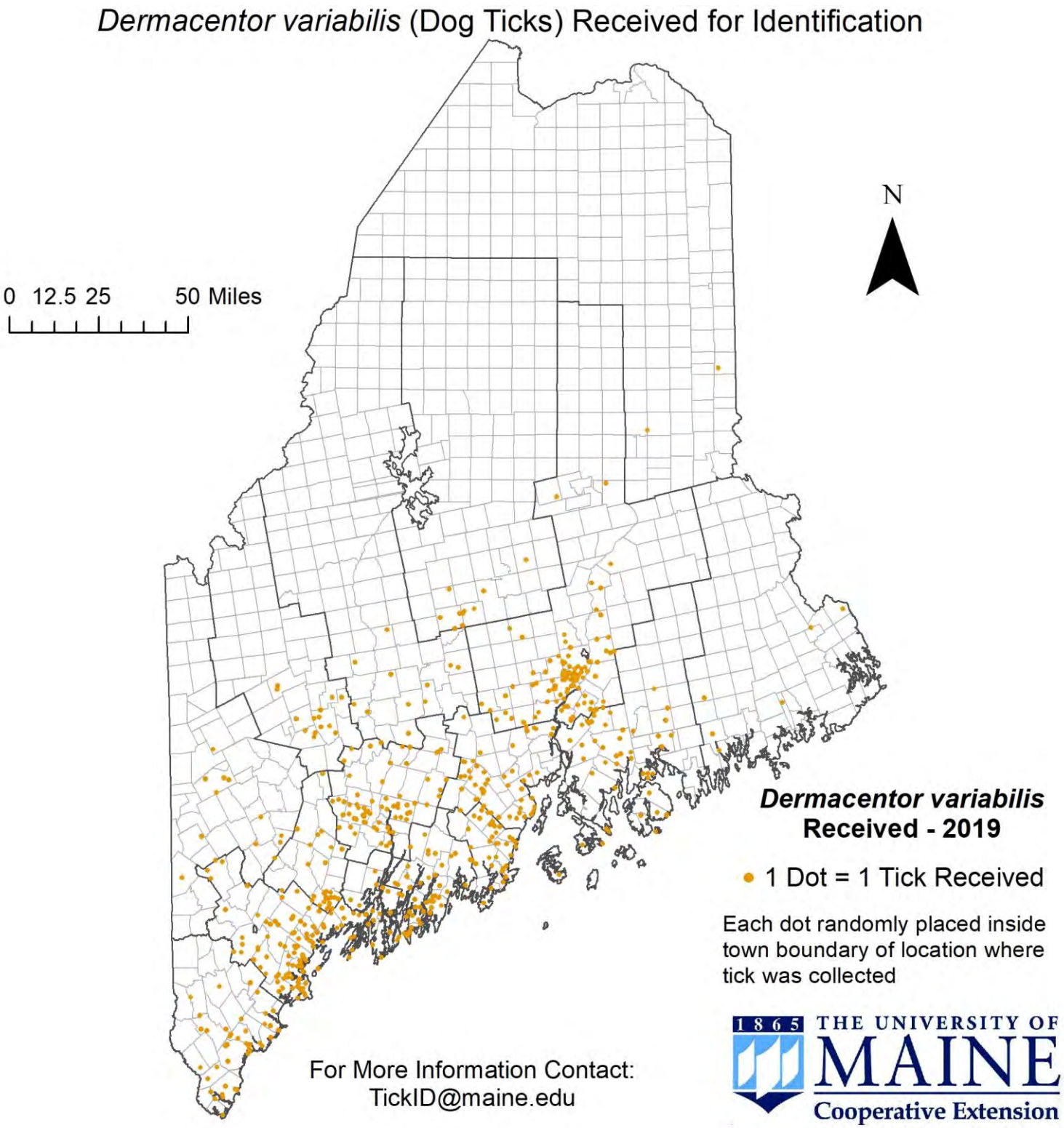
Dermacentor variabilis (Dog Ticks) Received for Identification
0 12.5 25 50 Miles
N
Dermacentor variabilis
Received - 2019
1 Dot = 1 Tick Received
Each dot randomly placed inside town boundary of location where tick was collected
For More Information Contact:
TickID@maine.edu
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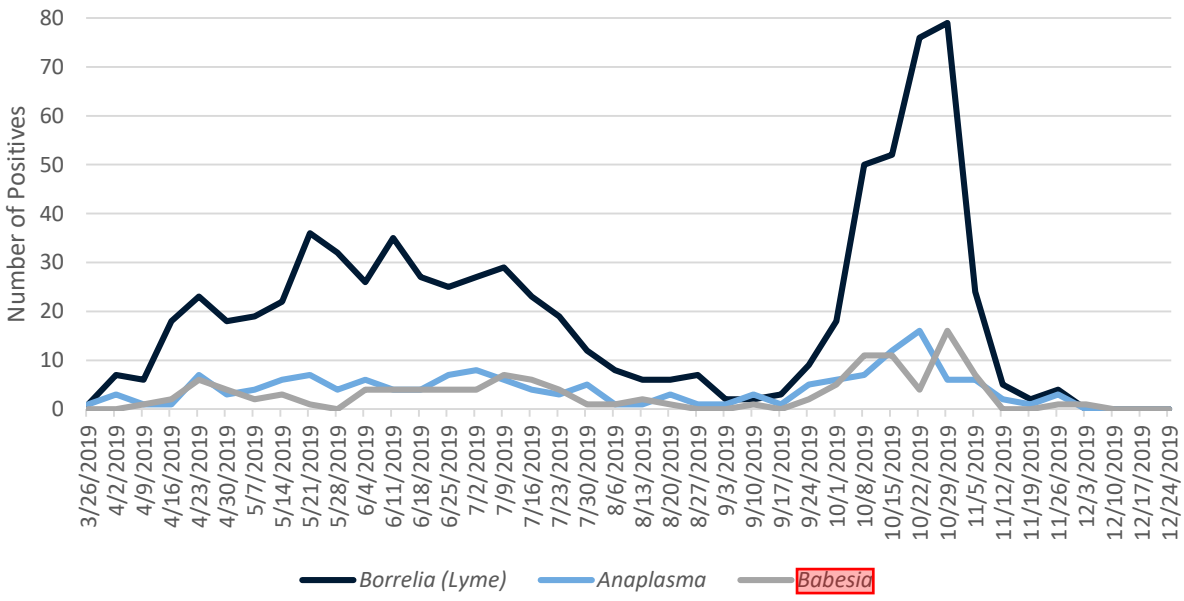
TICK PATHOGEN TESTING

Pathogen testing was conducted for the causative agents of Lyme disease (*Borrelia burgdorferi*), anaplasmosis (*Anaplasma phagocytophilum*), and babesiosis (*Babesia microti*), using a multiplex real-time polymerase chain reaction (PCR) assay. As the deer tick (*Ixodes scapularis*) is the known vector of these pathogens, testing was conducted primarily on this species. The figures below display the percentage of deer ticks infected with each pathogen and ticks co-infected with multiple pathogens, as well as a weekly record of infected tick submissions.

Infection Prevalence in Submitted Deer Ticks - 2019 (Table 3)

Pathogen	% of infected nymphs	% of infected adults	% of infected ticks
Positive for at least 1 pathogen	33.9%	49.8%	44.9%
Borrelia burgdorferi	29.3%	43.0%	38.8%
Anaplasma phagocytophilum	6.7%	8.7%	8.1%
Babesia microti	5.3%	6.5%	6.1%
Borrelia + Anaplasma	3.1%	3.5%	3.3%
Borrelia + Babesia	2.7%	3.2%	3.0%
Anaplasma + Babesia	0.2%	0.4%	0.3%
Borrelia + Anaplasma + Babesia	0.7%	0.7%	0.7%

Infection Prevalence in Submitted Deer Ticks by Week - 2019 (Fig. 3)

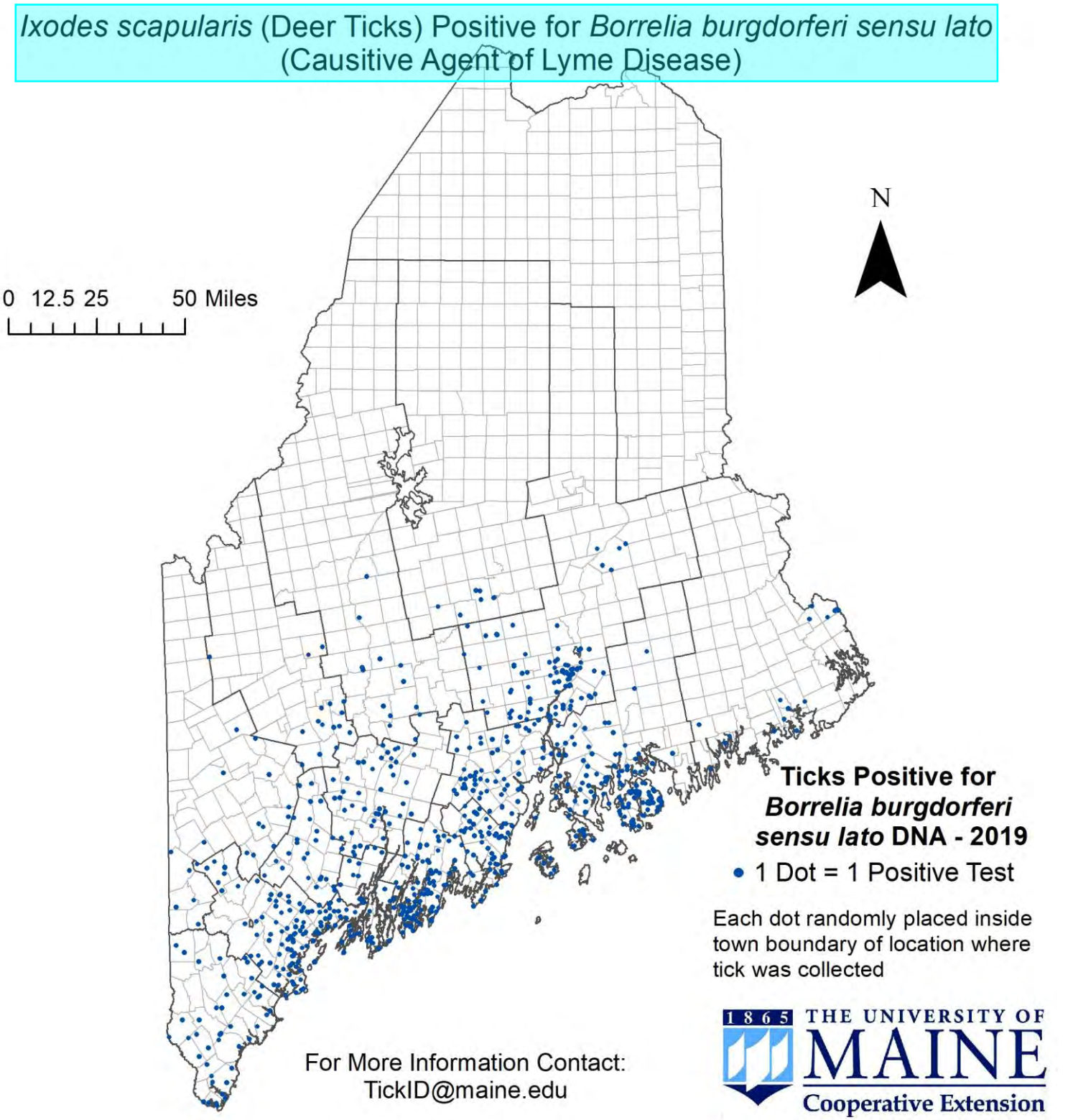


TICK PATHOGEN TESTING

Tick populations and infection rates can vary greatly over both large and small geographic distances. The numbers in the following table represent the amount of deer ticks that tested positive from each county. The percentage indicates the number of ticks that tested positive divided by the total number of deer ticks that were tested from that county. Submissions testing positive for each pathogen are mapped on the following three pages.

Infection Prevalence in Submitted Deer Ticks - 2019 (Table 4)

County	Deer Ticks Submitted	Deer Ticks Tested	*Borrelia* (Lyme)	*Anaplasma*	*Babesia*
Androscoggin	70	66	26 (39.4%)	5 (7.6%)	7 (10.6%)
Aroostook	5	5	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cumberland	347	328	116 (35.4%)	36 (11.0%)	26 (7.9%)
Franklin	33	30	15 (50.0%)	1 (3.3%)	0 (0.0%)
Hancock	332	325	121 (37.2%)	23 (7.1%)	11 (3.4%)
Kennebec	136	128	43 (33.6%)	13 (10.2%)	5 (3.9%)
Knox	140	135	62 (45.9%)	11 (8.1%)	15 (11.1%)
Lincoln	218	206	91 (44.2%)	10 (4.9%)	13 (6.3%)
Oxford	52	49	18 (36.7%)	8 (16.3%)	3 (6.1%)
Penobscot	251	229	90 (39.3%)	11 (4.8%)	4 (1.7%)
Piscataquis	25	24	6 (25.0%)	0 (0.0%)	0 (0.0%)
Sagadahoc	49	48	19 (39.6%)	4 (8.3%)	4 (8.3%)
Somerset	39	36	14 (38.9%)	2 (5.6%)	0 (0.0%)
Waldo	145	141	59 (41.8%)	10 (7.1%)	10 (7.1%)
Washington	45	43	16 (37.2%)	5 (11.6%)	2 (4.7%)
York	128	125	42 (33.6%)	14 (11.2%)	16 (12.8%)
Outside of Maine	41	39	21 (53.8%)	6 (15.4%)	4 (10.3%)
TOTAL	**2056**	**1957**	**759 (38.8%)**	**159 (8.1%)**	**120 (6.1%)**


Ixodes scapularis (Deer Ticks) Positive for *Borrelia burgdorferi sensu lato*
(Causitive Agent of Lyme Disease)
N
0 12.5 25 50 Miles
Ticks Positive for
Borrelia burgdorferi
sensu lato DNA - 2019
1 Dot = 1 Positive Test
Each dot randomly placed inside town boundary of location where tick was collected
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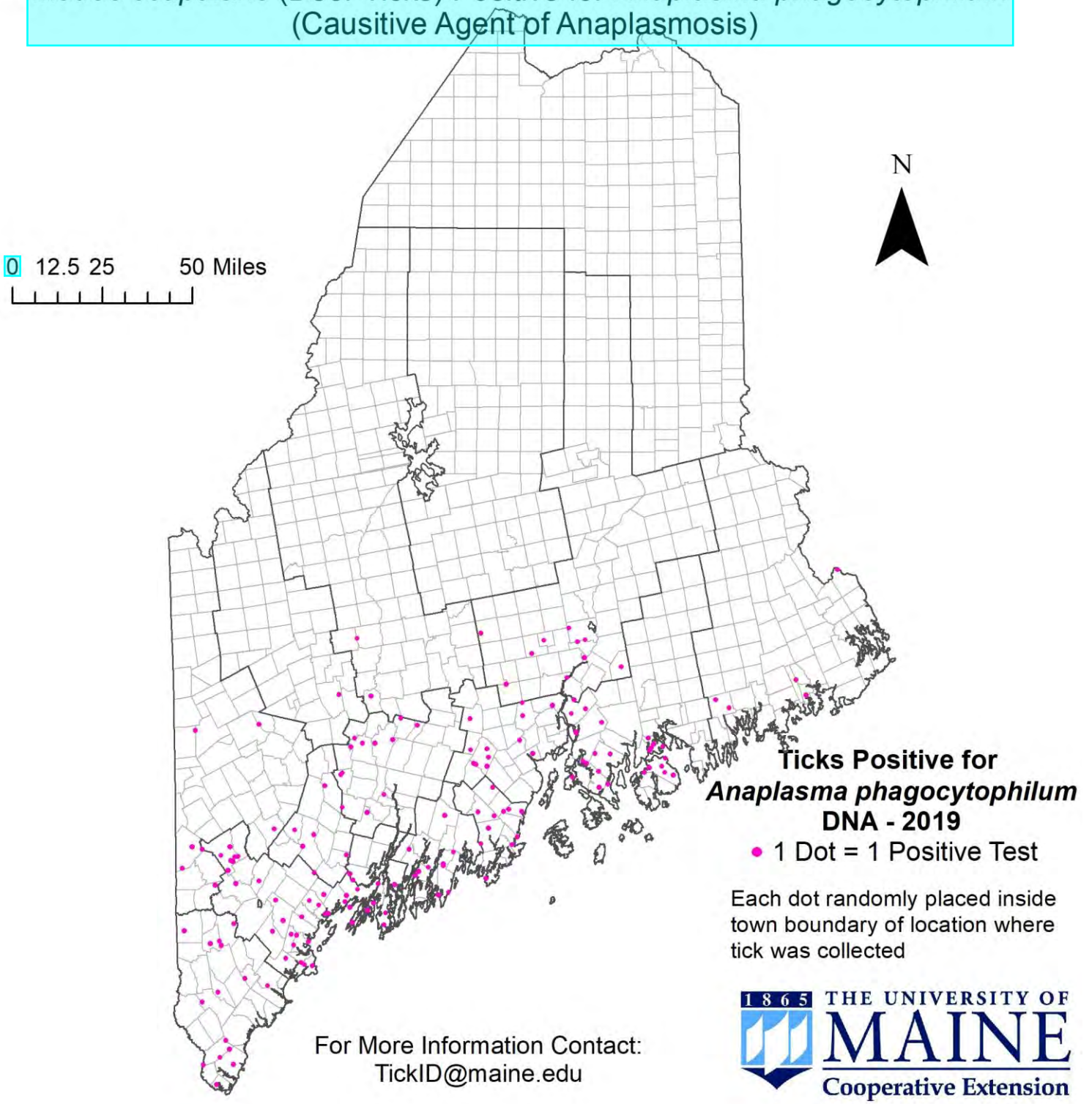
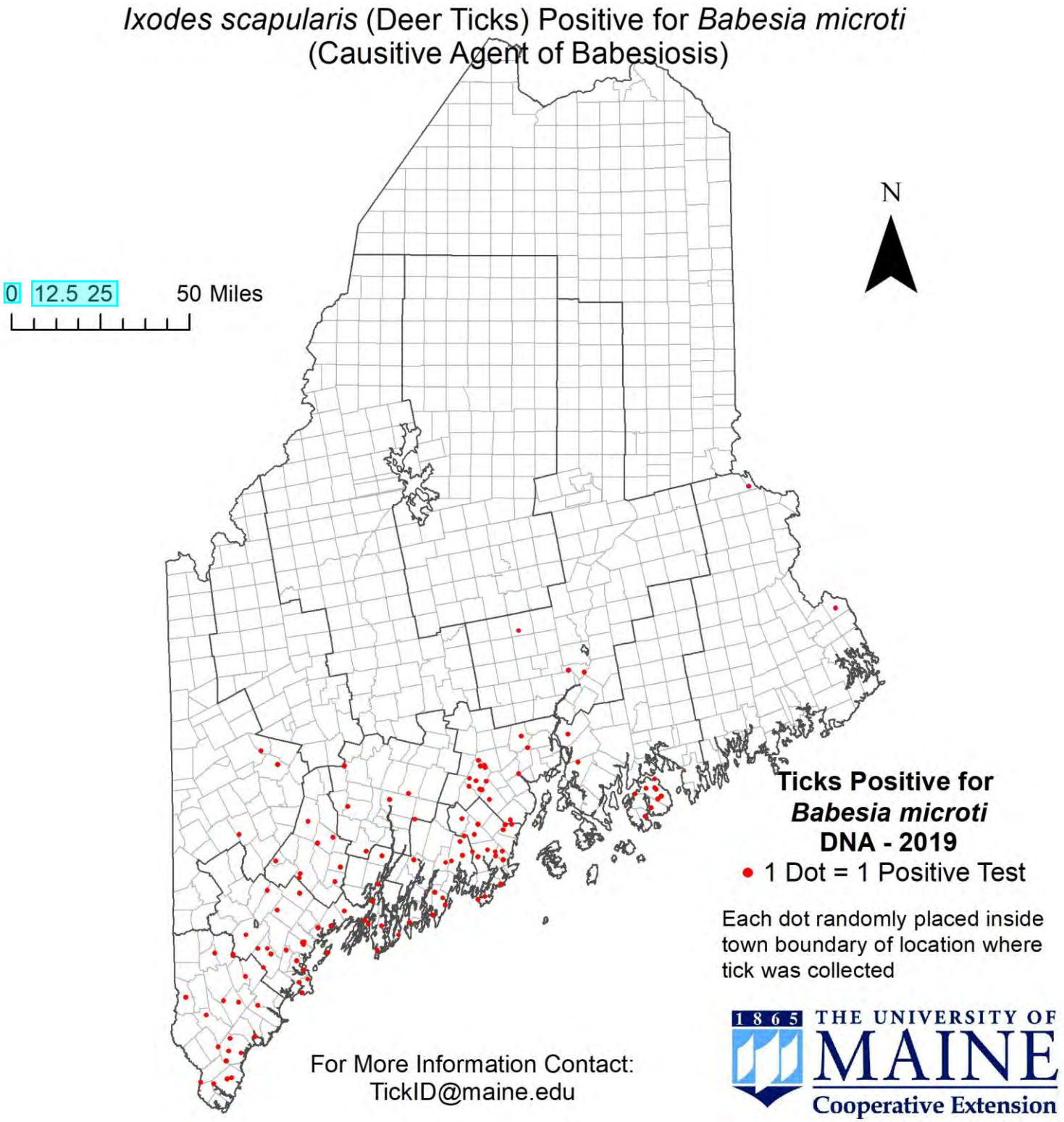
Ixodes scapularis (Deer Ticks) Positive for *Anaplasma phagocytophilum* (Causitive Agent of Anaplasmosis)




Ixodes scapularis (Deer Ticks) Positive for *Babesia microti*
(Causitive Agent of Babesiosis)
N
0 12.5 25 50 Miles
Ticks Positive for
Babesia microti
DNA - 2019
1 Dot = 1 Positive Test
Each dot randomly placed inside town boundary of location where tick was collected
For More Information Contact:
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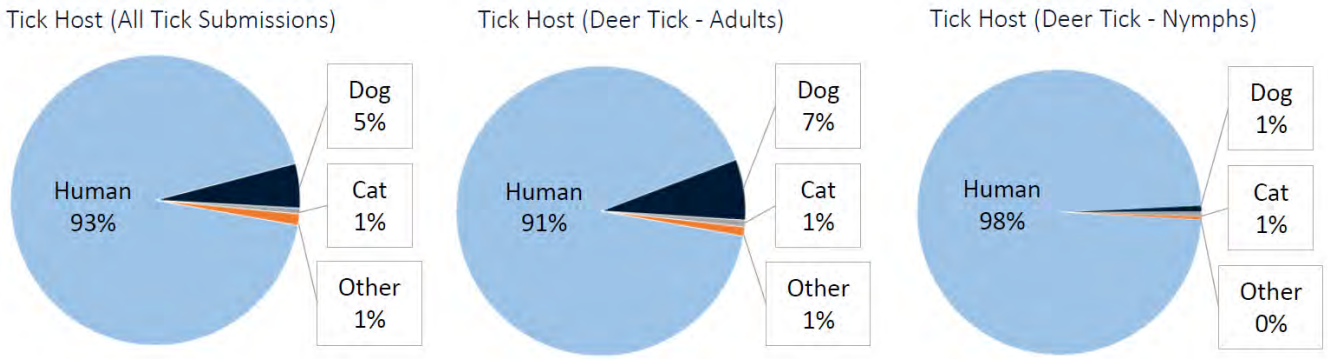
HOST ASSOCIATIONS

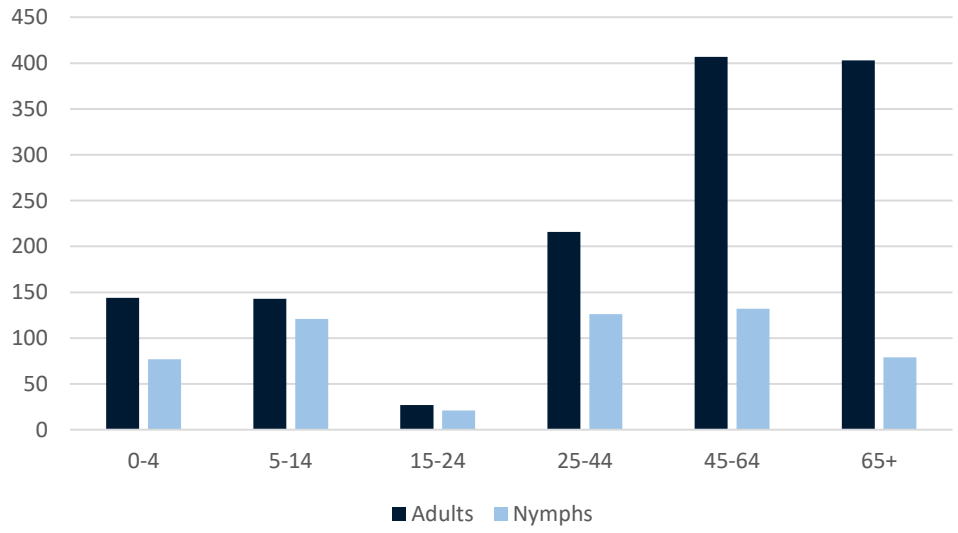
Many of the tick species in Maine are host specific, in that they feed on a limited range of wildlife species and are not commonly found on humans. The tick species most commonly encountered by humans, the deer tick and American dog tick, are generalist feeders that will attach and feed upon humans as well as a wide variety of different animal species. The ticks submitted to the UMaine Tick Lab were overwhelmingly found on human hosts (93%), with pets and other hosts making up the remaining small percentage of submissions.

Tick Submissions by Host - 2019 (Fig. 4)



The risk of encountering ticks can vary depending upon age, with the young and very old often considered to be most at risk. During 2019, deer tick nymphs were commonly submitted from children under the age of 15, while adult deer ticks were most commonly submitted by those over the age of 45.

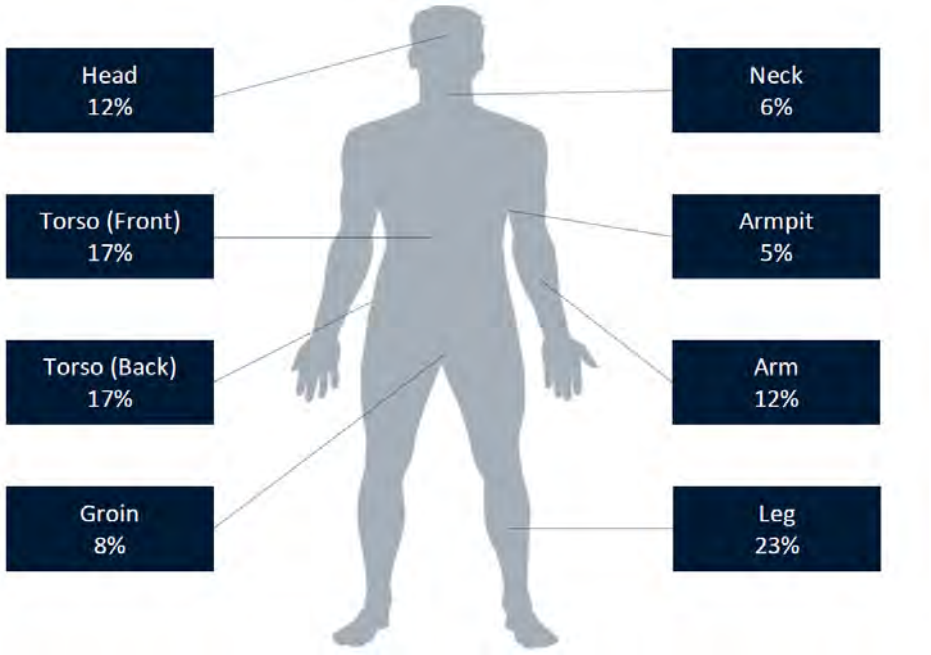
Deer Tick (*Ixodes scapularis*) Submissions by Age Group - 2019 (Fig. 5)



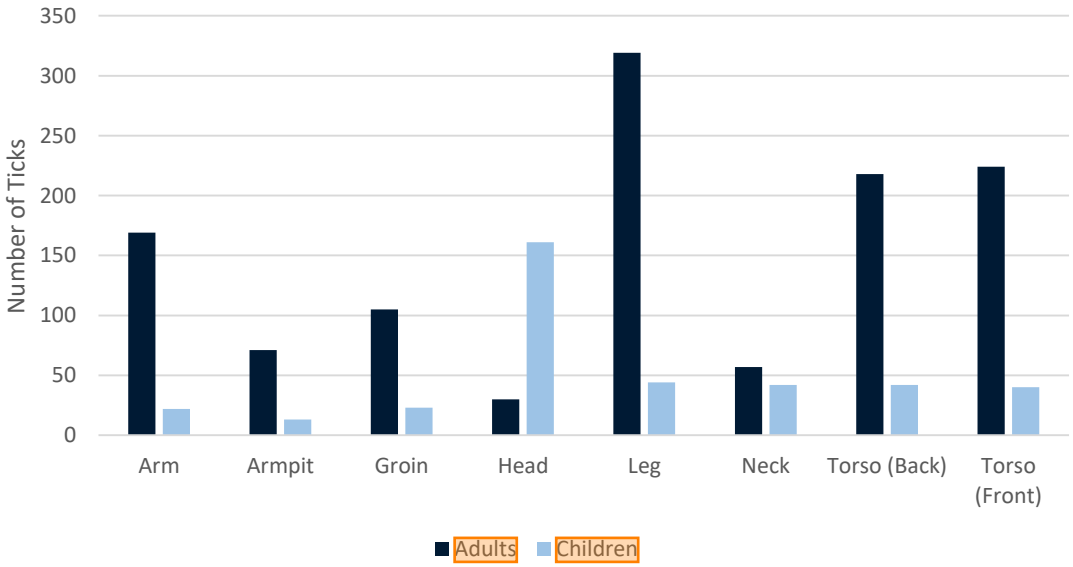
TICK FEEDING SITES

Once the tick is on a host it may immediately attach and start feeding or it may wander around before settling on a spot. Feeding may last several days or more than a week depending on the species and life stage. Females utilize these extended feedings, while adult males only take small occasional blood meals, if they feed at all. The vast majority of ticks submitted from human hosts (95%) were discovered while attached and feeding, while the remaining 5% were found crawling on the body. Feeding sites were fairly evenly distributed across the body on average (Fig. 6), however, there were some differences based upon age (Fig. 7). Deer ticks were most commonly found on the head of children under the age of 15, however, they were more often attached to the legs of adults. The tick's life stage also made a difference, with deer tick nymphs more often attached to the legs than other parts of the body.

Deer Tick Attachment Sites – All Ages (Fig. 6)



Deer Tick Attachment Sites by Age – 2019 (Fig. 7)



HUMAN ACTIVITY

One of the goals of UMaine Extension's Tick Surveillance Program is to identify potential risk factors for contacting ticks. Certain human activities may increase this potential for contact and subsequently lead to increased risk of contracting a tick-borne illness. The following table summarizes the human activities associated with the deer ticks (*Ixodes scapularis*) that were submitted to the UMaine Tick Lab in 2019. The listed activities represent just some of the potential ways in which contact with ticks can be made.

Human Activity at the Time of Deer Tick (*Ixodes scapularis*) Acquisition (Table 5)

Activity	Adults	Nymphs	Total
ATV Riding	5	3	8 (0.4%)
Bicycling	10	6	16 (0.8%)
Camping	15	41	56 (2.9%)
Fishing	5	2	7 (0.4%)
Gardening/Yardwork	529	198	727 (38.2%)
Hiking	129	55	184 (9.7%)
Hunting / Trapping	29	1	30 (1.6%)
Occupational - Agriculture	16	3	19 (1.0%)
Occupational – Forestry/Logging	18	4	22 (1.2%)
Occupational - Other	13	5	18 (0.9%)
Other	178	56	234 (12.3%)
Playing Outside	96	49	145 (7.6%)
Playing Sports	29	20	49 (2.6%)
Running	6	5	11 (0.6%)
Walking	267	108	375 (19.7%)

LIMITATIONS OF THE DATA

The information in this report is preliminary as of December 31, 2019. Tick samples collected in 2019 that are submitted after this date will be added to the data set and included in future reports. As this is the first annual report, it represents only a snapshot in time and cannot be used to examine long-term trends. This report provides a general summary of the data collected and does not attempt to draw specific conclusions. Each tick is counted individually, but multiple ticks may be submitted from a single host or person, which can thus impact the interpretation of geographic data. Towns without tick submissions or positive test results should not be interpreted as not having tick populations or tick-borne disease. The data in this report is generated from passive surveillance (tick specimens found and submitted by members of the public) and can potentially result in a bias toward certain geographic locations or uncertainty about where a specific sample was collected.

LOOKING AHEAD

The University of Maine Cooperative Extension Tick Lab plans to expand upon its Tick Surveillance Program through the addition of tests for other emerging tick-borne pathogens. Currently, the Tick Lab tests for the three most common tick-borne illnesses, Lyme disease, anaplasmosis, and babesiosis. In April of 2020, *Borrelia miyamotoi* will be added to the deer tick testing panel and a new testing panel will be added for non-deer tick samples. American dog ticks, lone star ticks, and other non-deer tick samples will be screened for the causative agents of Rocky Mountain spotted fever, Ehrlichiosis, and Tularemia. In addition to the enhanced passive surveillance, the Tick Lab also plans to increase field monitoring for disease-carrying ticks throughout Maine.

ACKNOWLEDGEMENTS

Special thanks to all those who submitted ticks to the program, the Maine state government, and the people of Maine for supporting this program.

The Tick Lab is part of the Pest Management Unit within the University of Maine Cooperative Extension Diagnostic and Research Laboratory. The Diagnostic and Research Lab is coordinated by Jim Dill and combines veterinary diagnostics, pest management, and aquatic animal health research under one roof.

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