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UMaine Tick Surveillance Program Annual Report - 2021

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 testing tick samples for the causative agents of Lyme disease, anaplasmosis, and babesiosis; the three most common tick-borne diseases. In 2020, an additional testing panel was added to screen applicable tick species for the causative agents of Rocky Mountain spotted fever, ehrlichiosis, and tularemia. A free tick identification program also continues to be offered.

This report summarizes the information gathered through the passive surveillance associated with the 2021 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:

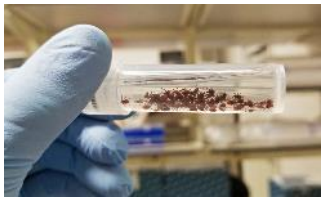
ticks.umaine.edu

BACKGROUND

Ticks and tick-borne diseases have become a significant public health issue in Maine and throughout the 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 blacklegged tick has greatly increased in both population size and geographic range within the state.

There are 15 different tick species that have been found in Maine, though not all are permanent residents. Some may arrive on wildlife hosts and do not establish viable populations. Other species have thrived and are now widespread throughout much of the state. The most commonly encountered tick species in Maine are the blacklegged tick (*Ixodes scapularis*), the American dog tick (*Dermacentor variabilis*), and, to a lesser extent, the woodchuck tick (*Ixodes cookei*). Maine also faces threats related to invasive tick species including the lone star tick and Asian longhorned tick, both of which can have impacts on the health of humans, wildlife, and domestic animals.

A note on common names: the blacklegged tick is commonly referred to as the deer tick, though blacklegged tick is the recognized common name. We will generally refer to this species as the blacklegged tick in this report.




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, Tom Rounsville, and Ann Bryant, University of Maine Cooperative Extension. Questions regarding the report can be directed to tickID@maine.edu. Additional data, including maps and tables updated daily, are available online at ticks.umaine.edu.

TICK SPECIES IDENTIFICATION

A total of 6,499 ticks were submitted to the UMaine Extension Tick Surveillance Program in 2021, with samples submitted from each of the state's 16 counties and from 349 towns. The majority of the ticks submitted were identified as blacklegged ticks (formerly known 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. Of the 29 lone star ticks that were submitted to the program, 17 were related to Maine residents travelling to other states, while the other 12 samples were acquired in Maine, originating from Androscoggin, Cumberland, Hancock, Lincoln, Penobscot, Waldo, and York Counties.

Tick Species Submitted to the UMaine Extension Tick Lab in 2021 (Table 1)

Tick Species	Common Name	Total
Ixodes scapularis	Blacklegged tick (formerly known as deer tick)	3598
Dermacentor variabilis	American dog tick	2839
Amblyomma americanum	Lone star tick	29
Ixodes cookei	Woodchuck tick	21
Ixodes marxi	Squirrel tick	5
Dermacentor albipictus	Winter tick	3
Amblyomma maculatum	Gulf Coast tick	1
Unknown	Specimens damaged during removal/delivery	3

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

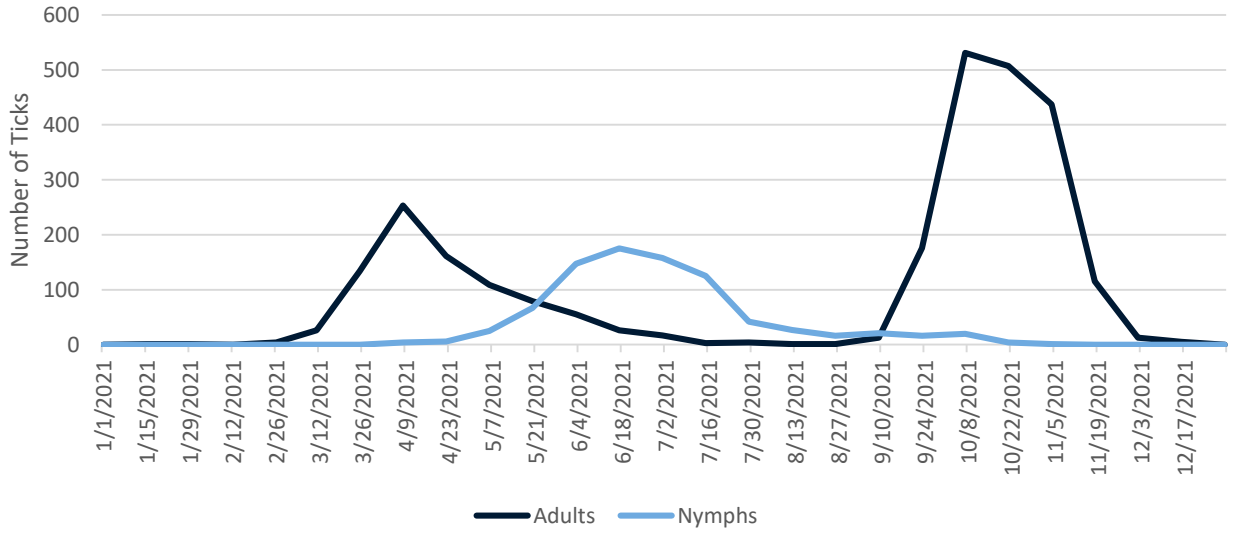
Life Stage	Not Engorged	Partially Engorged	Fully Engorged	Engorgement Undetermined*	Total
Adult Females	510	1928	42	102	2582
Adult Males	-	-	-	-	112
Nymphs	71	762	9	14	856
Larvae	10	35	0	1	46

* Some specimens arrived at the lab too damaged to determine feeding status, sex and/or life stage. Though male ticks may feed for brief periods, they do not become engorged.

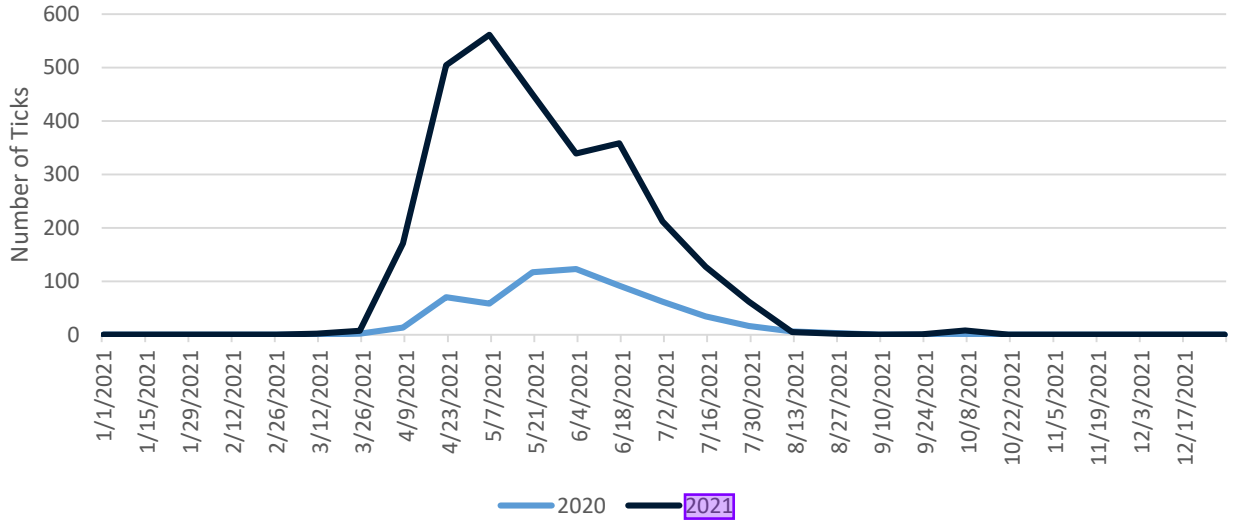
SEASONALITY OF TICK SUBMISSIONS

Tick activity can vary by season, based upon multiple factors including the tick's life cycle, weather, and host availability. While both blacklegged tick adults and nymphs can transmit pathogens, the nymphs play an important role in the disease transmission cycle due to their small size and ability to go unnoticed while feeding. Adult blacklegged ticks are most active from spring to late fall with two peaks, a smaller one in April or May and another larger peak in late October or early November. Nymph numbers usually peak in June and early July. The first sample arrived to the lab for testing on March 10th and the final sample of 2021 arrived on December 30th. Maine and other states throughout the region, experienced exceptionally high American dog tick (Dermacentor variabilis) abundance and activity throughout the spring and summer.

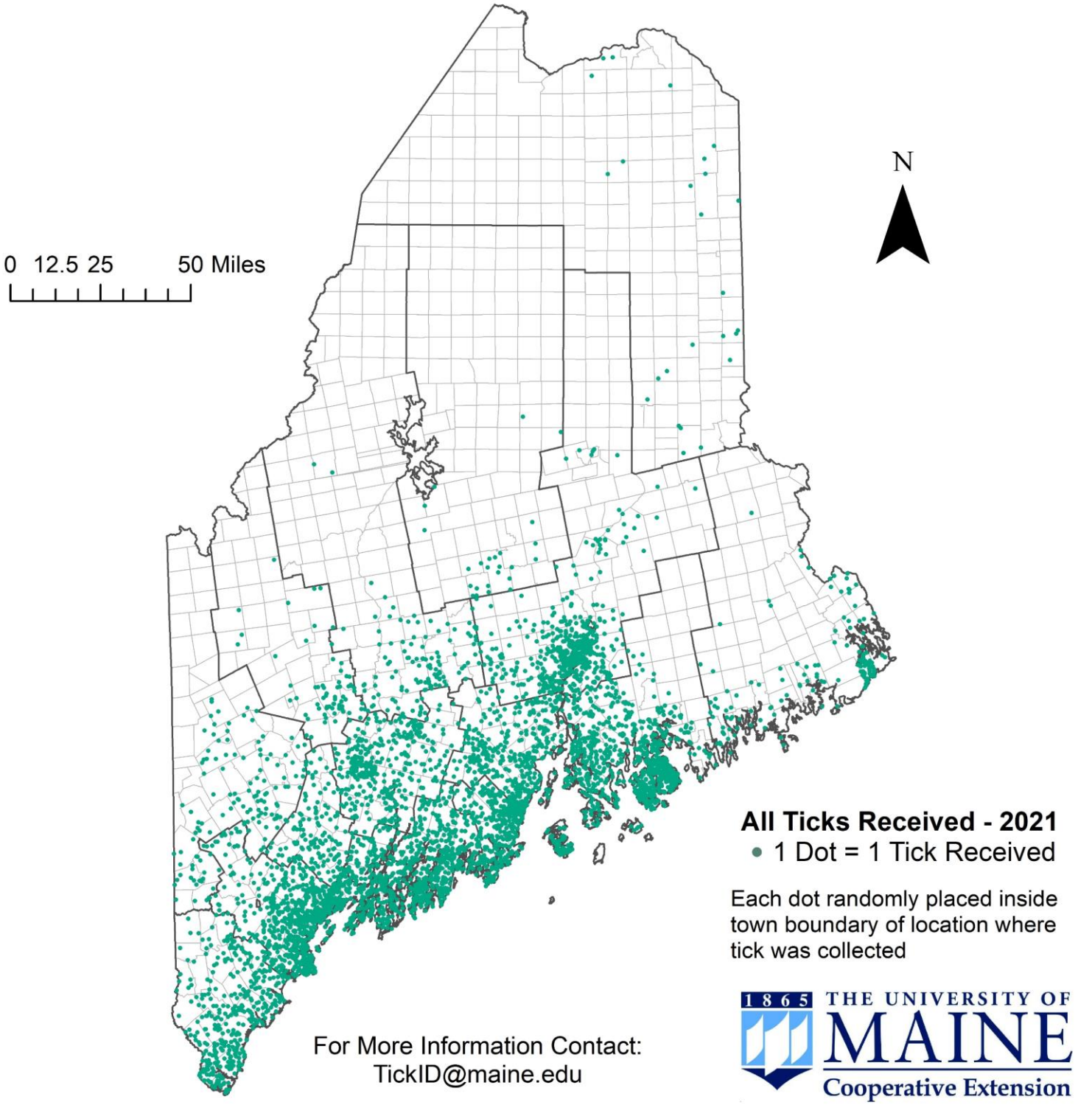
Blacklegged Ticks (*Ixodes scapularis*) Collected by Week - 2021 (Fig. 1)



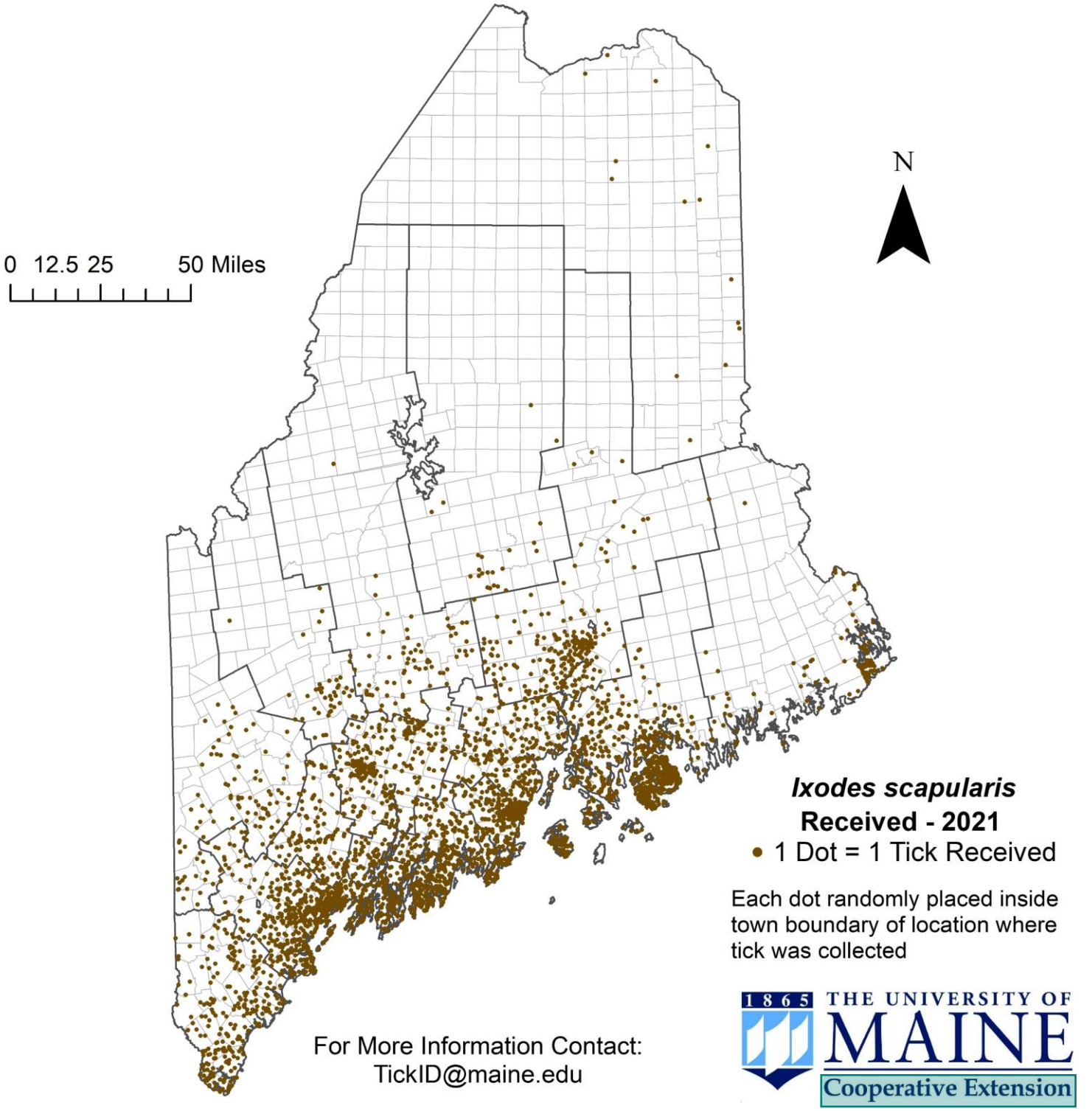
American Dog Ticks (*Dermacentor variabilis*) Collected by Week – 2020 & 2021 (Fig. 2)



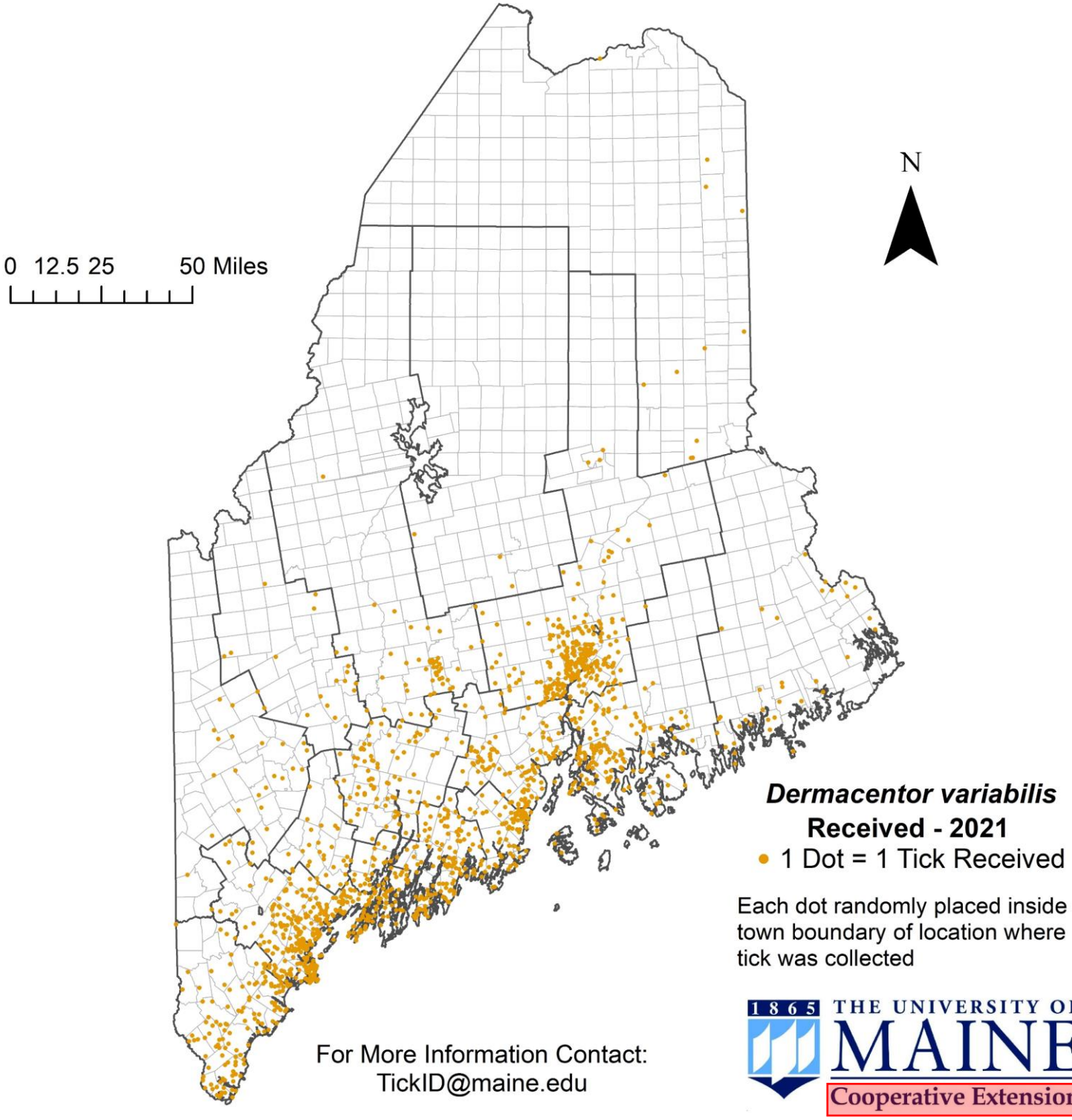
All Ticks Received for Identification and/or Testing (Map 1)



Ixodes scapularis (Blacklegged Ticks) Received for Identification and/or Testing (Map 2)



Dermacentor variabilis (Dog Ticks) Received for Identification and/or Testing (Map 3)



TICK PATHOGEN TESTING

Pathogen testing was conducted on blacklegged ticks and related species 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. The following tables include testing data from all samples, including those that may have been acquired outside of the state of Maine.

Infection Prevalence in Submitted Blacklegged Ticks (*Ixodes scapularis*) - 2021 (Table 3)

Pathogen	% of nymphs infected	% of adults infected	% of ticks infected
Positive for at least 1 pathogen	30.8%	56.7%	49.6%
Borrelia burgdorferi	26.0%	48.4%	42.3%
Anaplasma phagocytophilum	6.5%	14.1%	12.1%
Babesia microti	5.3%	11.9%	10.1%
Borrelia + Anaplasma	2.9%	5.9%	5.1%
Borrelia + Babesia	2.2%	6.8%	5.6%
Anaplasma + Babesia	0.1%	0.6%	0.5%
Borrelia + Anaplasma + Babesia	0.8%	2.1%	1.8%

An additional testing panel was used to screen non-*Ixodes* species, including the American dog tick and lone star tick for the causative agents of Rocky Mountain spotted fever (*Rickettsia ricketsii*), ehrlichiosis (*Ehrlichia spp.),* and tularemia (*Francisella tularensis*). Two lone star ticks, one from Waldo County and one acquired outside of Maine, tested positive for *Ehrlichia.* An American dog tick from Washington County also tested positive for *Ehrlichia,* with subsequent sequencing tentatively identifying the sample as *Ehrlichia muris*.

Infection Prevalence in American Dog Ticks and Lone Star Ticks – 2021 (Table 4)

Pathogen	American Dog Ticks (*Dermacentor variabilis*)	Lone Star Ticks (*Amblyomma americanum*)
Rickettsia rickettsii	0/1219 (0%)	0/29 (0%)
Ehrlichia spp.	1/1219 (0.1%)	2/29 (6.8%)
Francisella tularensis	0/1219 (0%)	0/29 (0%)

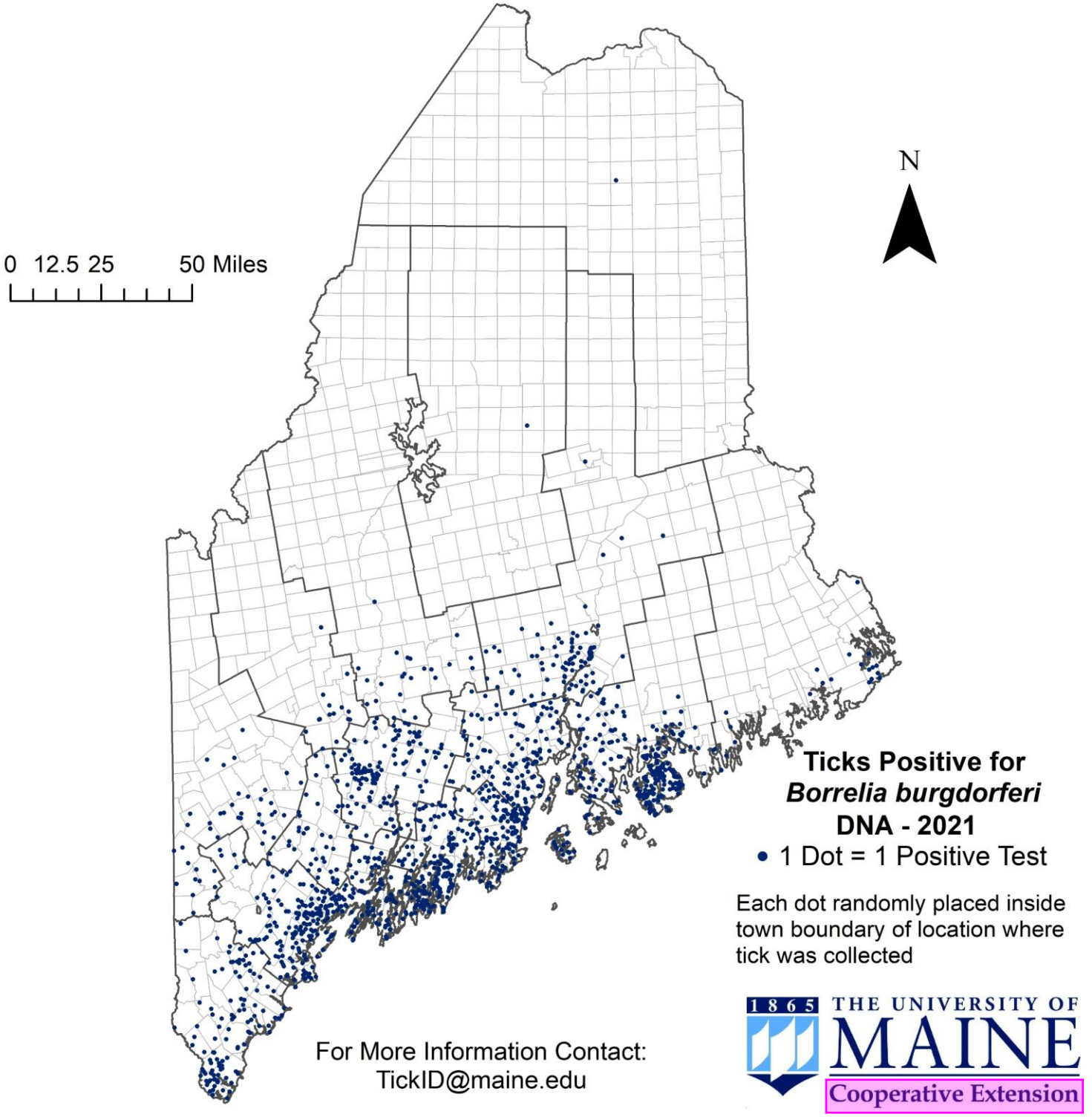
TICK PATHOGEN TESTING

Tick populations and infection rates can vary greatly over both large and small geographic distances. The numbers in the following table represent the number 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. In addition to the information listed below, another 65 samples were submitted from locations outside of Maine.

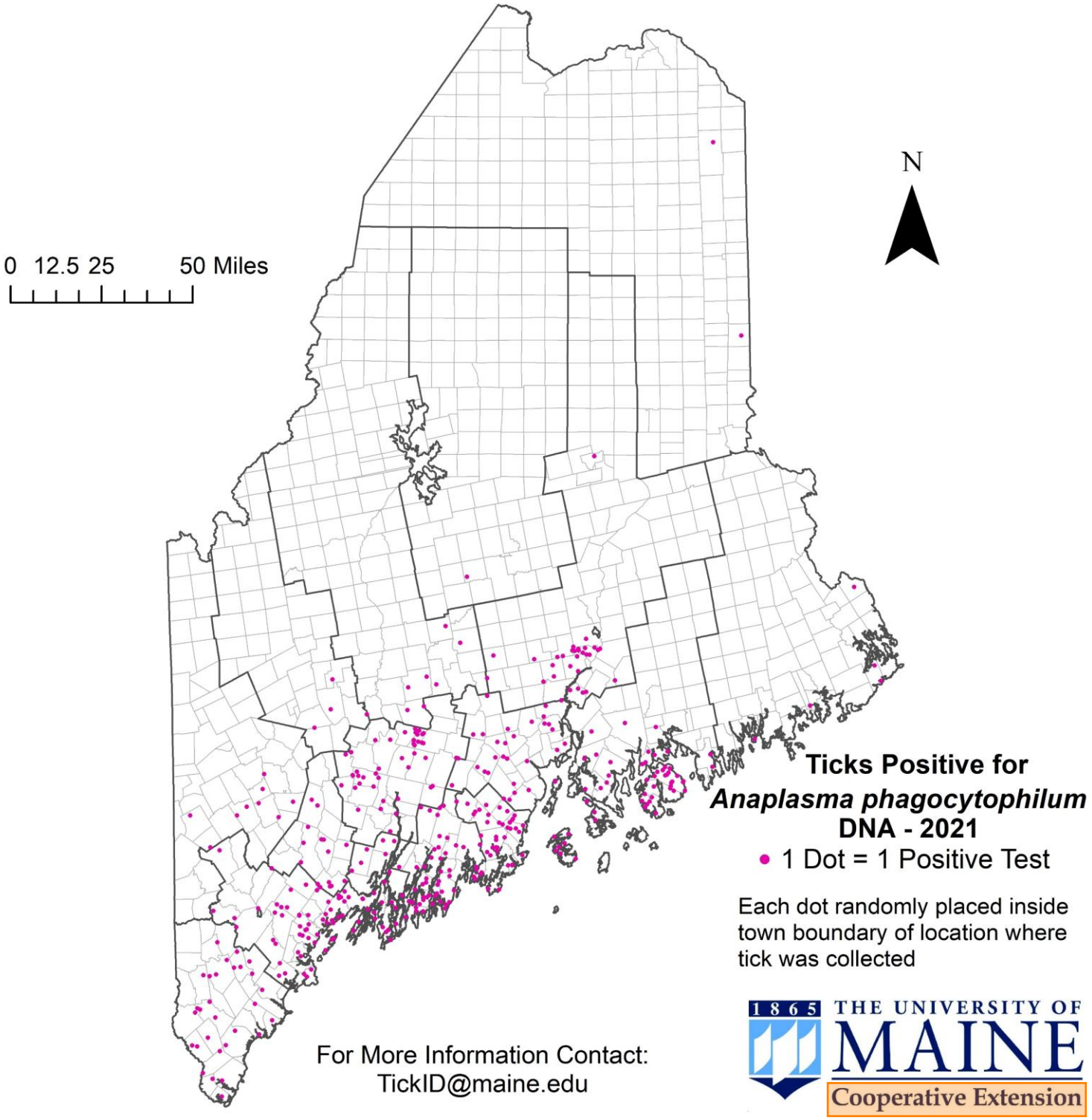
Infection Prevalence in Submitted Blacklegged Ticks (*Ixodes scapularis*) (All Life Stages) by County - 2021 (Table 5)

County	Ticks Submitted	Ticks Tested	*Borrelia* (Lyme)	*Anaplasma*	*Babesia*
Androscoggin	111	109	39 (35.8%)	16 (14.7%)	14 (12.8%)
Aroostook	14	12	1 (8.3%)	2 (16.7%)	0 (0.0%)
Cumberland	551	531	208 (39.2%)	62 (11.7%)	59 (11.1%)
Franklin	51	38	15 (39.5%)	4 (10.5%)	0 (0.0%)
Hancock	620	561	231 (41.2%)	46 (8.2%)	40 (7.1%)
Kennebec	266	257	125 (48.6%)	43 (16.7%)	30 (11.7%)
Knox	348	324	145 (44.8%)	45 (13.9%)	40 (12.3%)
Lincoln	346	345	172 (49.9%)	49 (14.2%)	50 (14.5%)
Oxford	105	98	45 (45.9%)	10 (10.2%)	10 (10.2%)
Penobscot	257	251	99 (39.4%)	31 (12.4%)	16 (6.4%)
Piscataquis	22	22	1 (4.5%)	1 (4.5%)	0 (0.0%)
Sagadahoc	154	150	57 (38.0%)	17 (11.3%)	14 (9.3%)
Somerset	71	66	23 (34.8%)	7 (10.6%)	3 (4.5%)
Waldo	248	243	118 (48.6%)	30 (12.3%)	33 (13.6%)
Washington	99	94	19 (20.2%)	5 (5.3%)	3 (3.2%)
York	243	240	107 (44.6%)	29 (12.1%)	25 (10.4%)
TOTAL	**3506**	**3341**	**1405 (42.1%)**	**397 (11.9%)**	**337 (10.1%)**

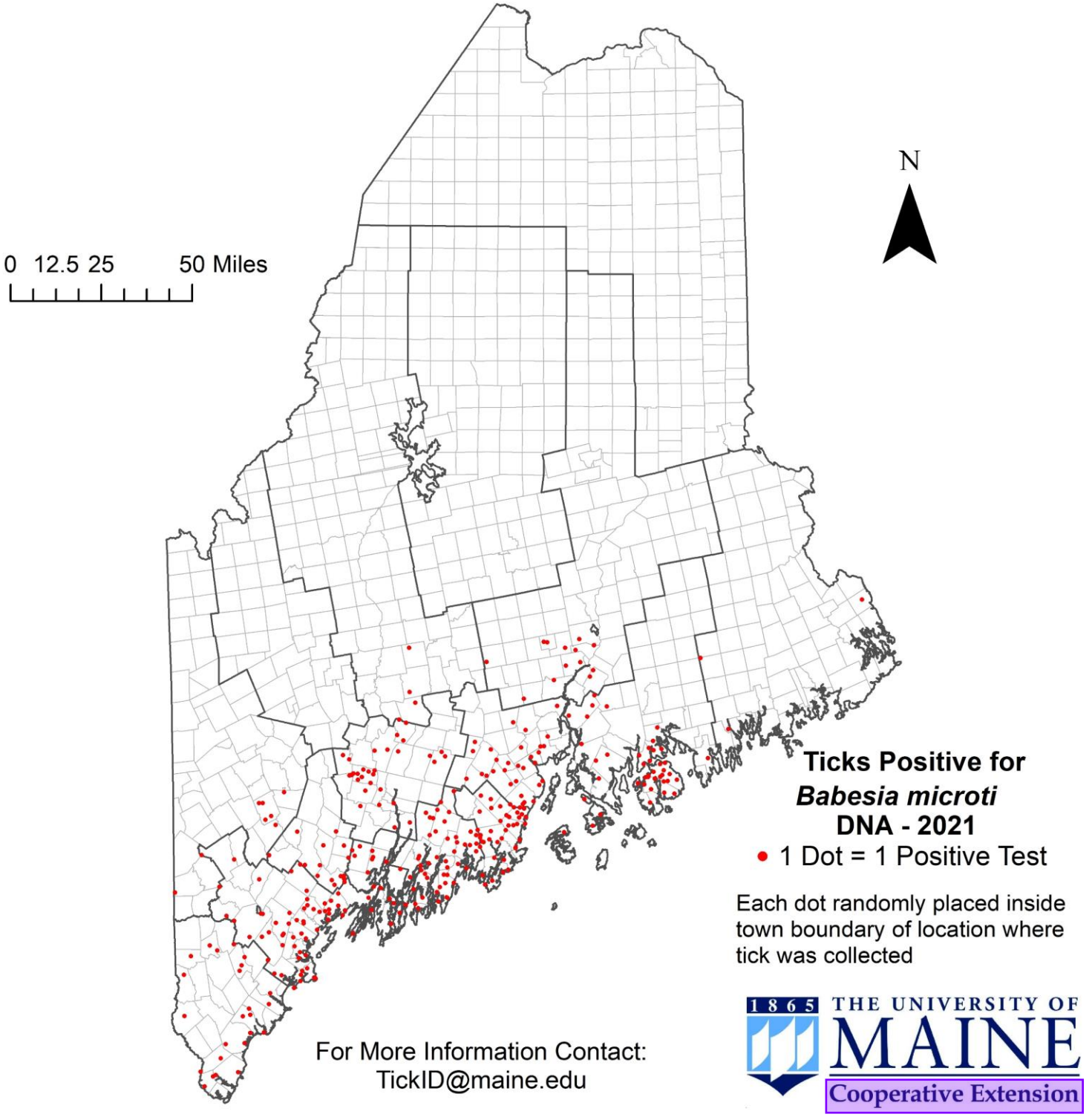
Ixodes scapularis (Blacklegged Ticks) Positive for *Borrelia burgdorferi* sensu lato (Causative Agent of Lyme Disease) (Map 4)



Ixodes scapularis (Blacklegged Ticks) Positive for *Anaplasma phagocytophilum* (Causative Agent of Anaplasmosis) (Map 5)



Ixodes scapularis (Blacklegged Ticks) Positive for *Babesia microti* (Causative Agent of Babesiosis) (Map 6)

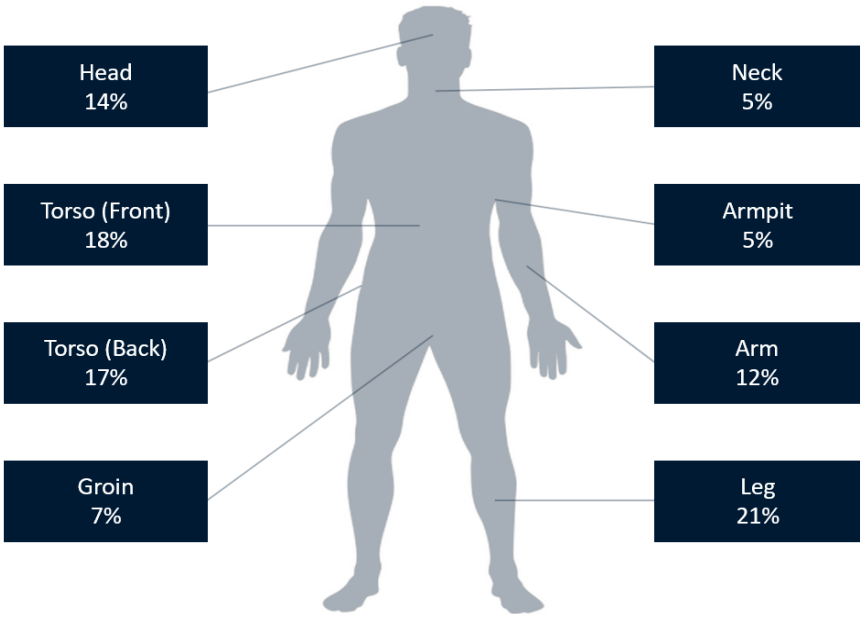


HUMAN TICK ENCOUNTERS

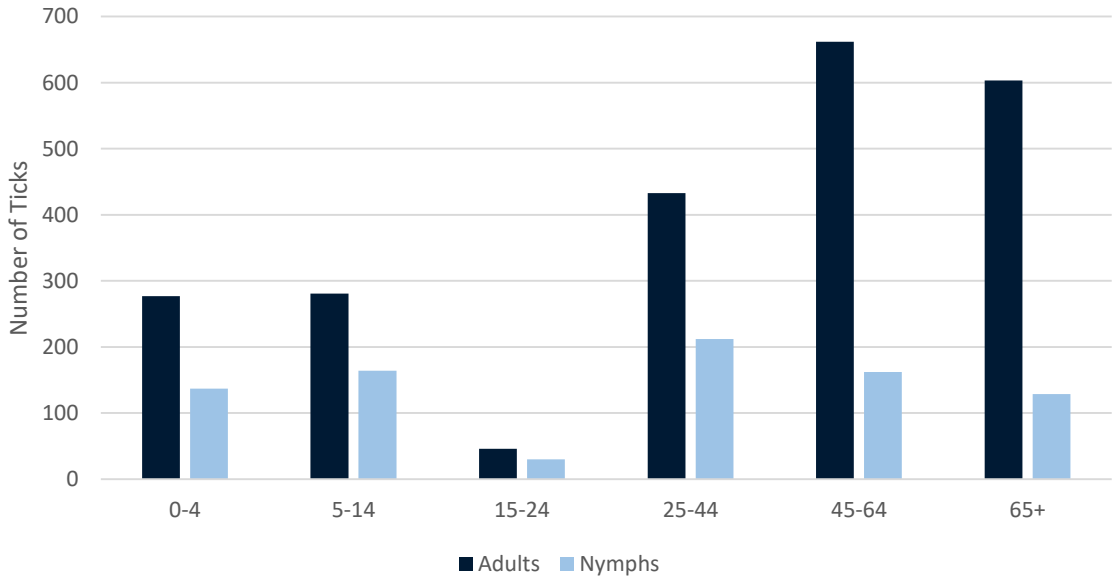
The tick species most commonly encountered by humans, the blacklegged tick and American dog tick, are generalist feeders that will attach and feed upon humans as well as a wide variety of different animal species.

The ticks submitted to the UMaine Tick Lab were overwhelmingly found on human hosts (76%), with pets and other hosts making up the remaining submissions. Once the tick is on a host it may immediately attach and start feeding or it may wander around before settling on a spot. The majority of ticks submitted from human hosts (86%) were discovered while attached and feeding, while the remaining 14% were found crawling on the body. Feeding sites were fairly evenly distributed across the body on average (Fig. 3). Tick submissions can vary widely based upon age, with ticks frequently submitted from those over the age of 45 and under the age of 15. During 2021, blacklegged tick nymph submissions were relatively evenly distributed by age group, while adult blacklegged ticks were most commonly submitted by those over the age of 45.

Ixodes scapularis Attachment Sites – All Ages (Fig. 3)



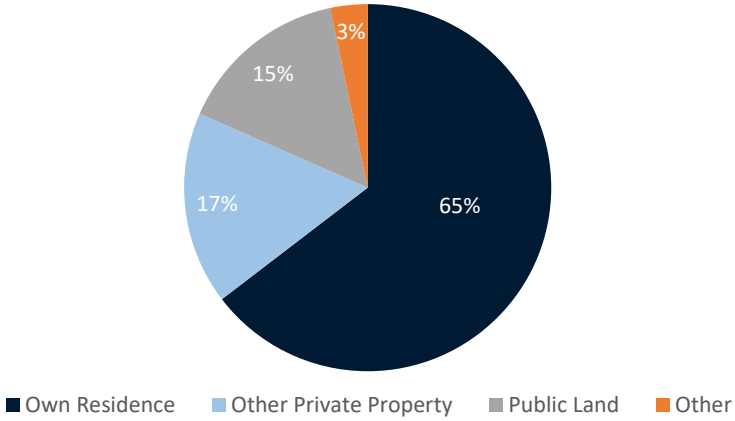
Blacklegged Tick (*Ixodes scapularis*) Submissions by Age Group - 2021 (Fig. 4)



HUMAN ACTIVITY

One of the goals of UMaine Extension's Tick Surveillance Program is to identify potential risk factors for contacting ticks. Certain habitats and human activities may increase this potential for contact and subsequently lead to increased risk of contracting a tick-borne illness. Approximately, 65% of those who submitted deer ticks encountered them on their own property. Table 6 summarizes the human activities associated with the deer ticks that were submitted to the UMaine Tick Lab in 2021. The listed activities represent just some of the potential ways in which contact with ticks can be made.

Property Type Where Ticks Were Encountered (Figure 5)



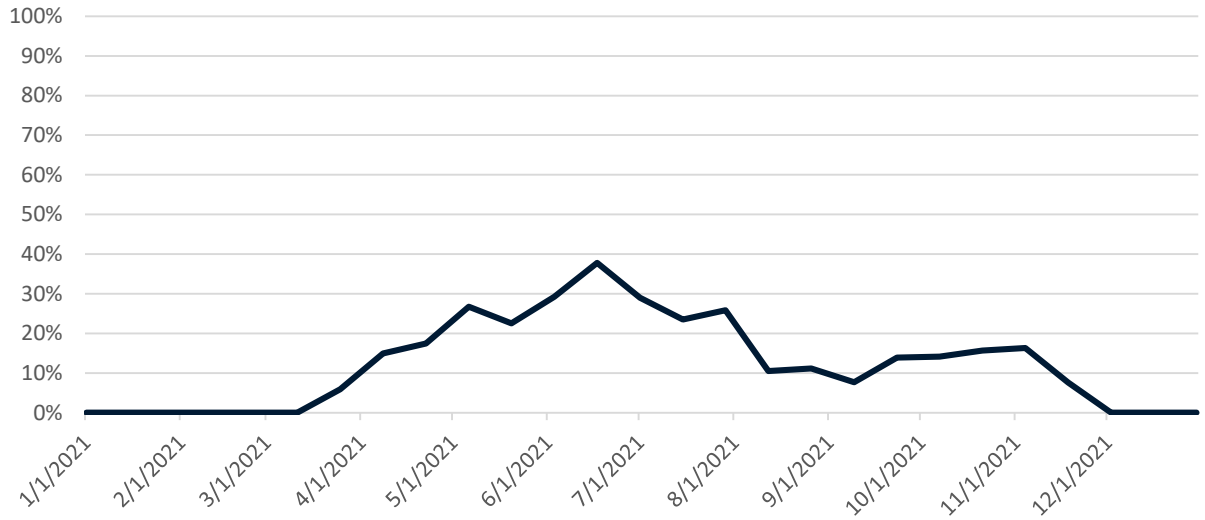
Human Activity at the Time of Blacklegged Tick (*Ixodes scapularis*) Encounter (Table 6)

Activity	Adults	Nymphs	Total
Yardwork / Gardening	685	248	933 (29.6%)
Playing Outside	510	275	785 (24.9%)
Walking	428	104	532 (16.9%)
Hiking	283	88	371 (11.8%)
Other	112	40	152 (4.8%)
Pet Related	89	12	101 (3.2%)
Occupational - Other	60	11	71 (2.3%)
Hunting / Trapping	64	3	67 (2.1%)
Camping	13	24	37 (1.2%)
Occupational - Agriculture	26	9	35 (1.1%)
Playing Sports	14	8	22 (0.7%)
Occupational - Forestry/Logging	11	4	15 (0.5%)
Bicycling	8	2	10 (0.3%)
Fishing	6	4	10 (0.3%)
Running	9	1	10 (0.3%)

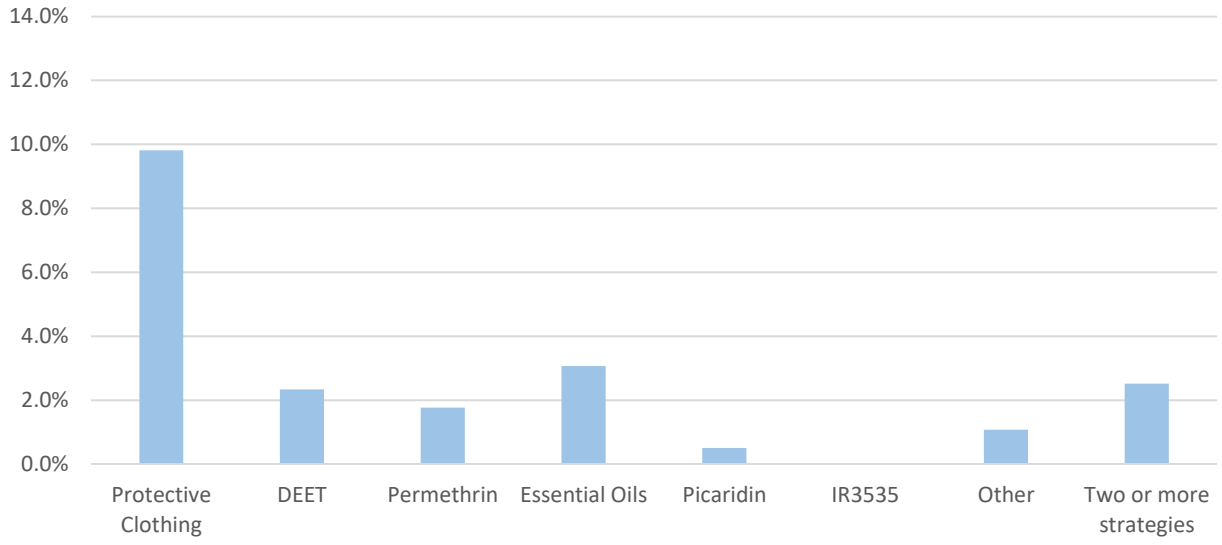
PERSONAL PROTECTION

Managing tick populations can be a challenge, thus the use of personal protection strategies is important in reducing tick encounters. Avoiding tick habitat, wearing appropriate clothing, and using tick repellents can significantly reduce exposure to ticks. Of those who submitted ticks to the Tick Lab in 2021, approximately 21% reported using some type of personal protection measure at the time of their tick encounter, with protective clothing being the most commonly used, followed by essential oils and a combination of two or more strategies. The use of personal protection peaked at 38% in early June and remained low (approximately 10%) during the spring and fall peaks in adult blacklegged tick activity.

Percentage of Tick Submitters Using Personal Protection Measures (Calculated Bi-Weekly) – 2021 (Figure 6)



Percentage of Tick Submitters Using Different Personal Protection Measures Against Ticks – 2021 (Figure 7)



LIMITATIONS OF THE DATA

The information in this report is preliminary as of December 31, 2021. Tick samples collected in 2021 that are submitted after this date will be added to the data set and included in future reports. As this is an 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.

ACKNOWLEDGEMENTS

Special thanks to the Tick Lab's student research assistants Brian Silva, Brendan Ward, Tegwin Taylor, Stephanie Shea, Joe Beale, Dev Scott, and John Nugent, as well as 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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