

Tick Surveillance Program

ANNUAL REPORT

2023



PURPOSE

Ticks and tick-borne diseases pose a significant public health concern in Maine and the United States, with Lyme disease being the most commonly reported vector-borne illness. Anaplasmosis, babesiosis, hard-tick relapsing fever, and Powassan virus are also increasing in reported cases. The blacklegged tick (commonly known as the deer tick) is the primary vector for these diseases and has expanded in both population and geographic range in Maine. The state hosts 15 tick species, with the blacklegged, American dog, and woodchuck ticks being the most common. Invasive species like the lone star tick and Asian longhorned tick (not yet found in Maine) also threaten human, wildlife, and domestic animal health. Combatting these threats requires an integrated approach involving monitoring, habitat reduction, wildlife management, and public education.

This report summarizes the information gathered through the passive surveillance associated with the 2023 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.

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 Rounselle, Ann Bryant, and John Nugent. Questions regarding the report can be directed to tickID@maine.edu. Additional data are available online at ticks.umaine.edu.



TICK SPECIES IDENTIFICATION

A total of **6,114** ticks were submitted to the UMaine Extension Tick Surveillance Program in 2023, with samples submitted from each of the state's 16 counties and from 407 towns. The majority of the ticks submitted were identified as blacklegged ticks (*Ixodes scapularis*), while American dog ticks (*Dermacentor variabilis*) also made up a significant portion of the submissions. Blacklegged tick life stage can be important in the disease transmission cycle, as adults are more likely to be infected with a pathogen, but the smaller immature nymphs can easily go unnoticed for long periods of time while feeding. Most pathogens, with the exception of *Borrelia miyamotoi* and possibly Powassan virus, are not passed from the adult female blacklegged tick through the egg to the larvae.

Tick Species Submitted to the UMaine Extension Tick Lab in 2023

Tick Species	Common Name	Total
<i>Ixodes scapularis</i>	Blacklegged tick (also known as deer tick)	3342
<i>Dermacentor variabilis</i>	American dog tick	2706
<i>Amblyomma americanum</i>	Lone star tick	17
<i>Ixodes cookei</i>	Woodchuck tick	40
<i>Dermacentor albipictus</i>	Winter Tick	1
<i>Ixodes marxi</i>	Squirrel tick	1
Unknown	Specimens damaged during removal/delivery	7

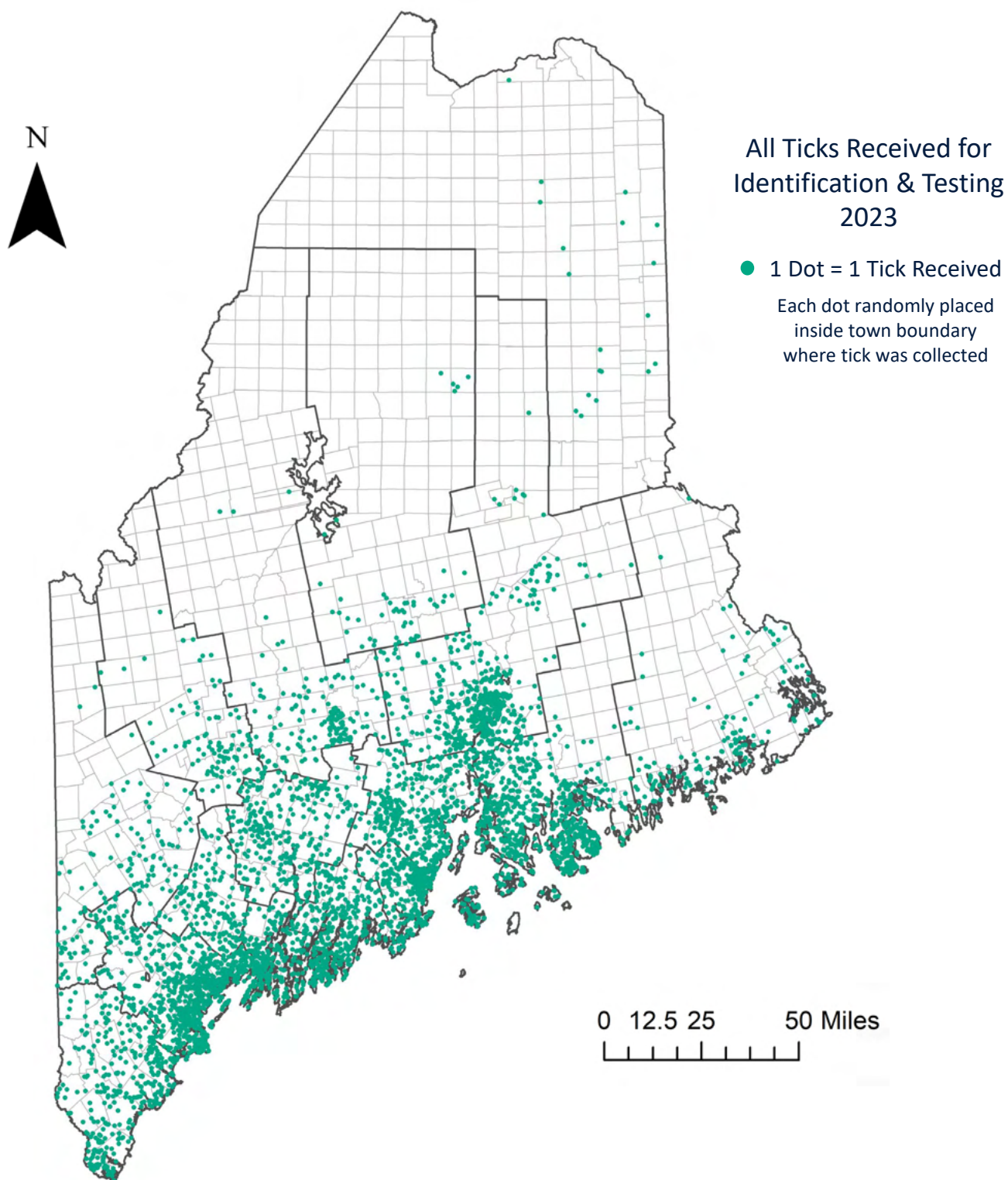
Blacklegged Tick (*Ixodes scapularis*) Submissions by Life Stage and Feeding Status – 2023

Life Stage	Not Engorged	Partially Engorged	Fully Engorged	Engorgement Undetermined*	Total
Adult Females	207	1834	27	132	2200
Adult Males	-	-	-	-	63
Nymphs	17	952	14	19	1002
Larvae	13	63	0	1	77

* 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.

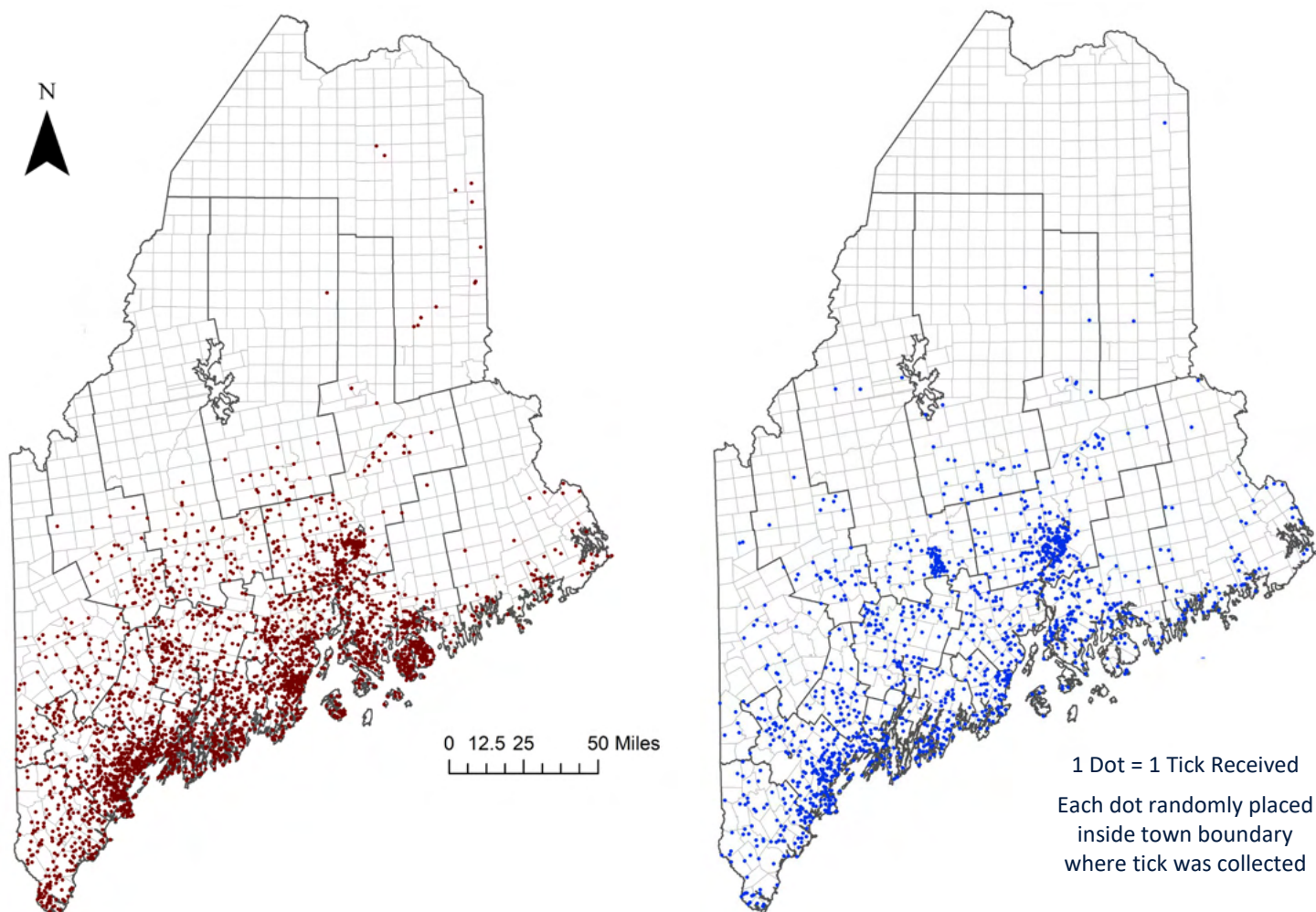


TICK SPECIES IDENTIFICATION

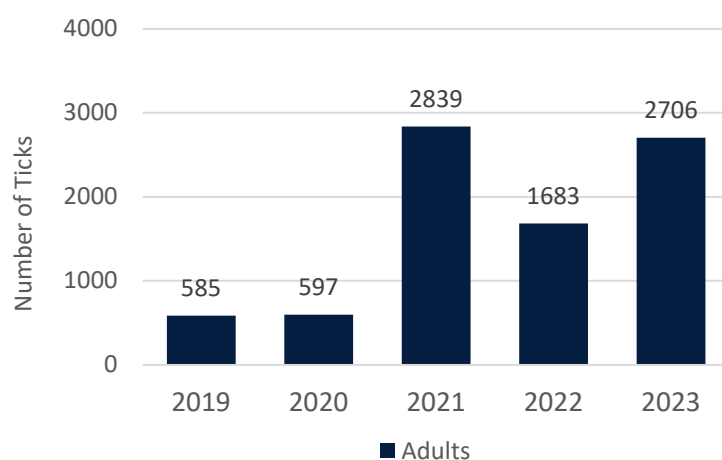
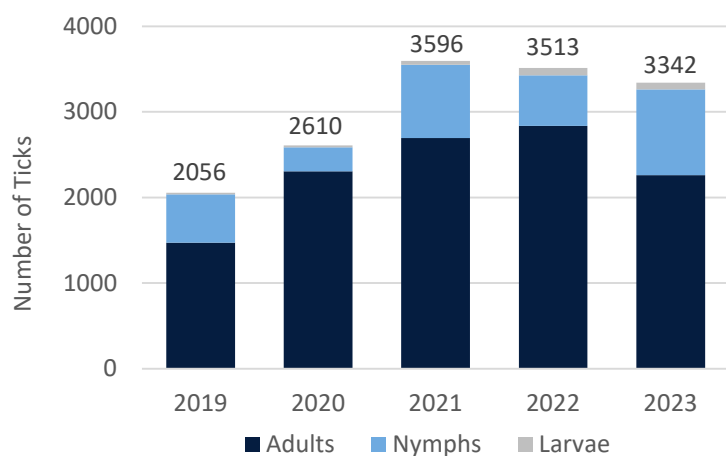


TICK SPECIES IDENTIFICATION

Blacklegged Tick (Left) and American Dog Tick (Right) Submissions – 2023



Blacklegged Tick (Left) and American Dog Tick (Right) Submissions – 2019-2023



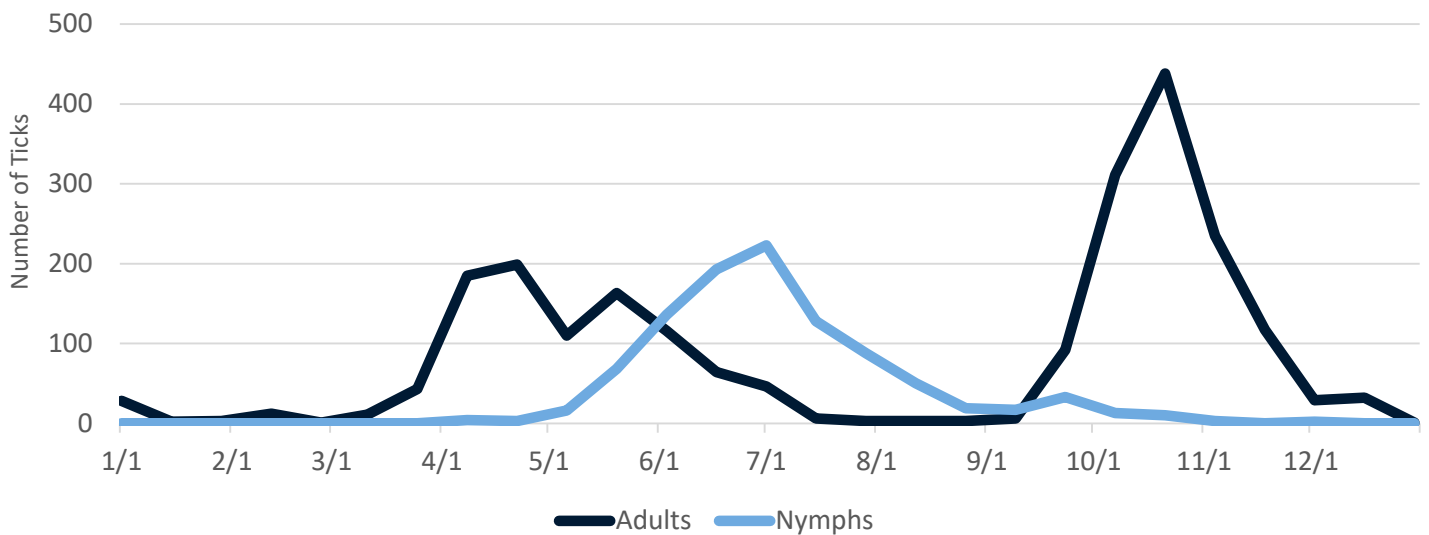
Map of Maine showing towns from which Lone Star Ticks were submitted without recent out-of-state travel from 2019 to 2023. The map includes a north arrow, a scale bar (0 to 50 miles), and a legend box. Red squares indicate the locations of these towns.

Maine Towns from which Lone Star Ticks were Submitted without Recent Out-of-State Travel – 2019-2023

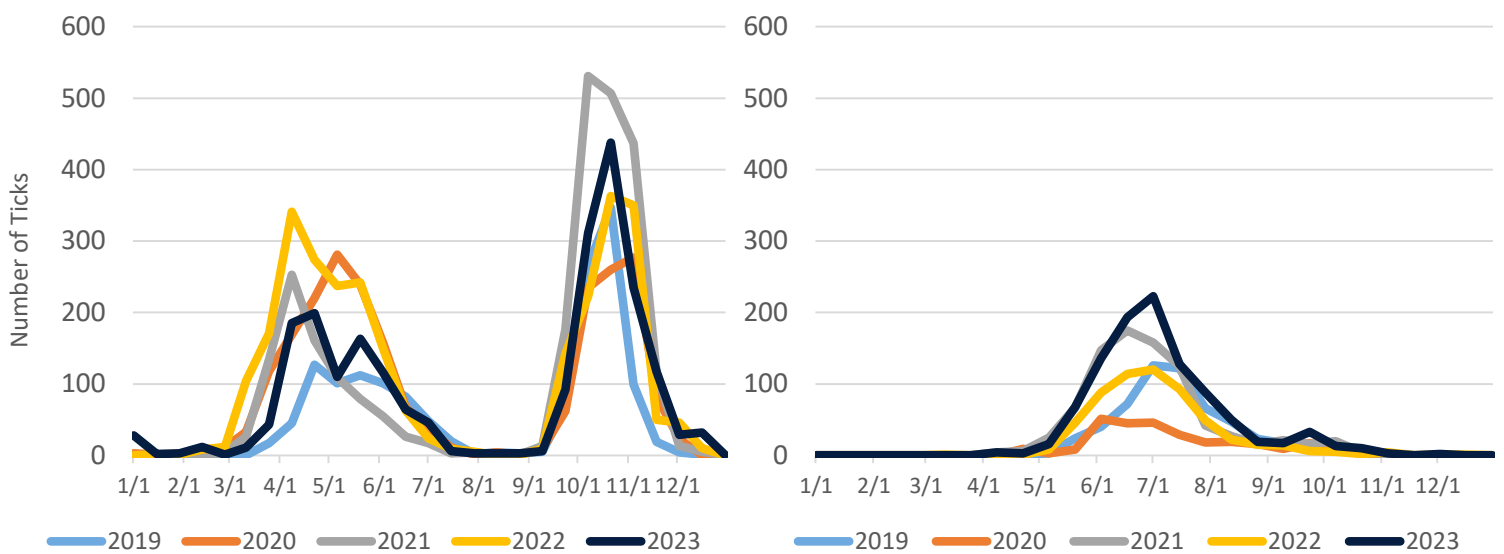
SEASONALITY OF TICK SUBMISSIONS

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, one in April or May and another peak in late October or early November. Nymph numbers usually peak in June and early July. When temperatures permit, blacklegged ticks can be active year round.

Blacklegged Tick (*Ixodes scapularis*) Submissions By Date they were Found – 2023



Blacklegged Tick Submissions (Left: Adults, Right: Nymphs) by Date they were Found – 2019-2023



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*), babesiosis (*Babesia microti*), hard tick relapsing fever (*Borrelia miyamotoi*), and Powassan virus. We tested 1,977 adult blacklegged ticks and 962 nymphs. All Powassan virus detections (26) were lineage II (deer tick virus). We also tested 60 larval blacklegged ticks, one of which tested positive for *Borrelia miyamotoi*.

Infection Prevalence in Submitted Blacklegged Ticks (*Ixodes scapularis*) (Adults & Nymphs) – 2023

Pathogen	% of nymphs infected	% of adults infected	% of ticks infected
<i>Borrelia burgdorferi</i>	21.5%	42.9%	35.9%
<i>Anaplasma phagocytophilum</i>	8.7%	11.5%	10.6%
<i>Babesia microti</i>	3.5%	8.3%	6.8%
<i>Borrelia miyamotoi</i>	0.5%	0.7%	0.6%
Powassan Virus	0.2%	1.2%	0.9%
<i>Borrelia</i> + <i>Anaplasma</i>	3.0%	6.1%	5.1%
<i>Borrelia</i> + <i>Babesia</i>	1.7%	5.7%	4.4%
<i>Anaplasma</i> + <i>Babesia</i>	0.2%	1.2%	0.9%
<i>Borrelia</i> + <i>Anaplasma</i> + <i>Babesia</i>	0.1%	0.9%	0.6%

Non-*Ixodes* tick species, including the American dog tick and lone star tick were tested for the causative agents of Rocky Mountain spotted fever (*Rickettsia rickettsii*), ehrlichiosis (*Ehrlichia* spp.), tularemia (*Francisella tularensis*), and Heartland virus. One *Francisella tularensis* positive American dog tick was detected, though the tick was removed from a dog that had recently arrived in Maine from the western United States.

Infection Prevalence in American Dog Ticks and Lone Star Ticks – 2023

Pathogen	American Dog Ticks (<i>Dermacentor variabilis</i>)	Lone Star Ticks (<i>Amblyomma americanum</i>)
<i>Rickettsia rickettsii</i>	0/1054 (0%)	0/6 (0%)
<i>Ehrlichia</i> spp.	1/1054 (<1%)	0/6 (0%)
<i>Francisella tularensis</i>	1/1054 (<1%)	0/6 (0%)
Heartland Virus	0/1054 (0%)	0/6 (0%)



TICK PATHOGEN TESTING

Tick populations and infection rates can vary over both large and small geographic distances. The numbers in the following table represent the number of blacklegged ticks that tested positive from each county. The percentage indicates the number of ticks that tested positive divided by the total number of blacklegged 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 57 samples were submitted from locations outside of Maine.

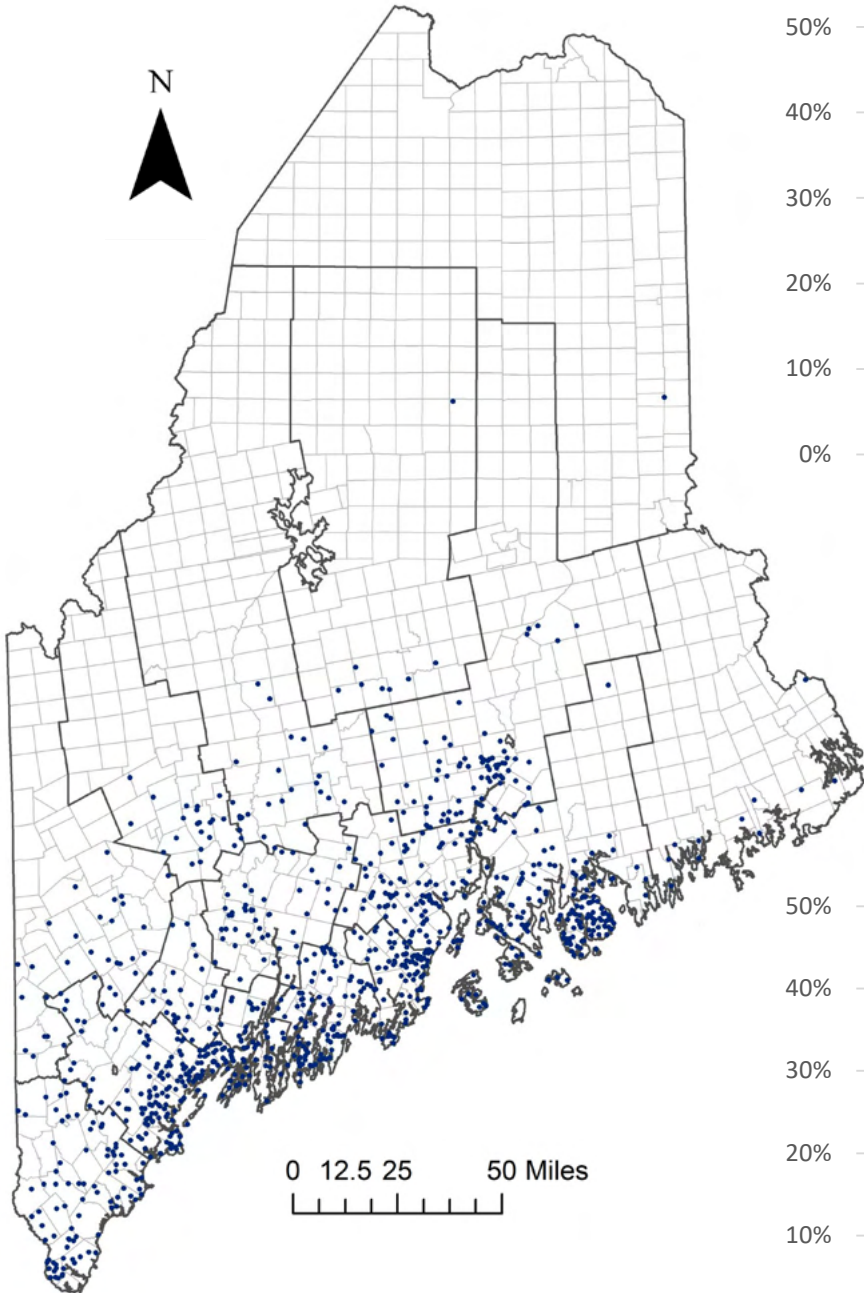
Infection Prevalence in Submitted Blacklegged Ticks (*Ixodes scapularis*) (Adults & Nymphs) by County – 2023

County	Ticks Submitted	Ticks Tested	<i>Borrelia burgdorferi</i>	<i>Anaplasma phagocytophilum</i>	<i>Babesia microti</i>	Powassan Virus
Androscoggin	102	91	35 (38.5%)	11 (12.1%)	5 (5.5%)	0 (0.0%)
Aroostook	12	9	1 (11.1%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cumberland	614	580	192 (33.1%)	56 (9.7%)	49 (8.4%)	7 (1.2%)
Franklin	63	58	22 (37.9%)	1 (1.7%)	1 (1.7%)	1 (1.7%)
Hancock	610	444	163 (36.7%)	51 (11.5%)	29 (6.5%)	1 (0.2%)
Kennebec	190	183	54 (29.5%)	15 (8.2%)	11 (6.0%)	2 (1.1%)
Knox	273	256	95 (37.1%)	37 (14.5%)	26 (10.2%)	3 (1.2%)
Lincoln	265	249	103 (41.4%)	29 (11.6%)	19 (7.6%)	3 (1.2%)
Oxford	97	91	31 (34.1%)	7 (7.7%)	4 (4.4%)	1 (1.1%)
Penobscot	281	252	86 (34.1%)	27 (10.7%)	7 (2.8%)	0 (0.0%)
Piscataquis	23	23	8 (34.8%)	0 (0.0%)	1 (4.3%)	0 (0.0%)
Sagadahoc	117	108	36 (33.3%)	18 (16.7%)	9 (8.3%)	3 (2.8%)
Somerset	73	68	25 (36.8%)	3 (4.4%)	5 (7.4%)	0 (0.0%)
Waldo	260	242	99 (40.9%)	22 (9.1%)	18 (7.4%)	1 (0.4%)
Washington	72	67	13 (19.4%)	7 (10.4%)	0 (0.0%)	0 (0.0%)
York	233	218	92 (42.2%)	28 (12.8%)	15 (6.9%)	4 (1.8%)
TOTAL	3285	2939	1055 (35.9%)	312 (10.6%)	199 (6.8%)	26 (0.9%)

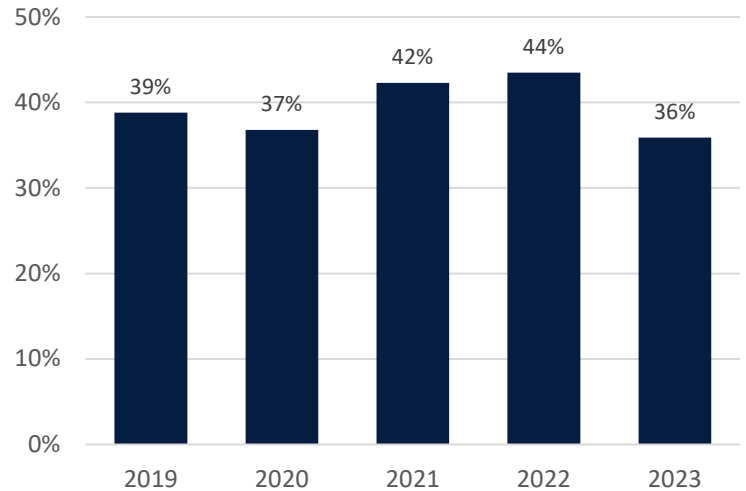


BORRELIA BURGDORFERI (CAUSATIVE AGENT OF LYME DISEASE)

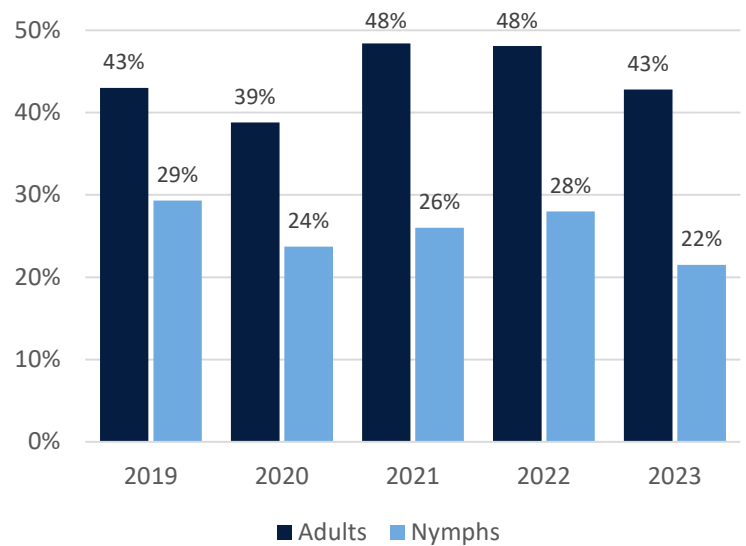
Blacklegged Ticks (*Ixodes scapularis*) Positive for *Borrelia burgdorferi* – 2023



Borrelia burgdorferi Infection Prevalence in Submitted Blacklegged Ticks – 2019-2023

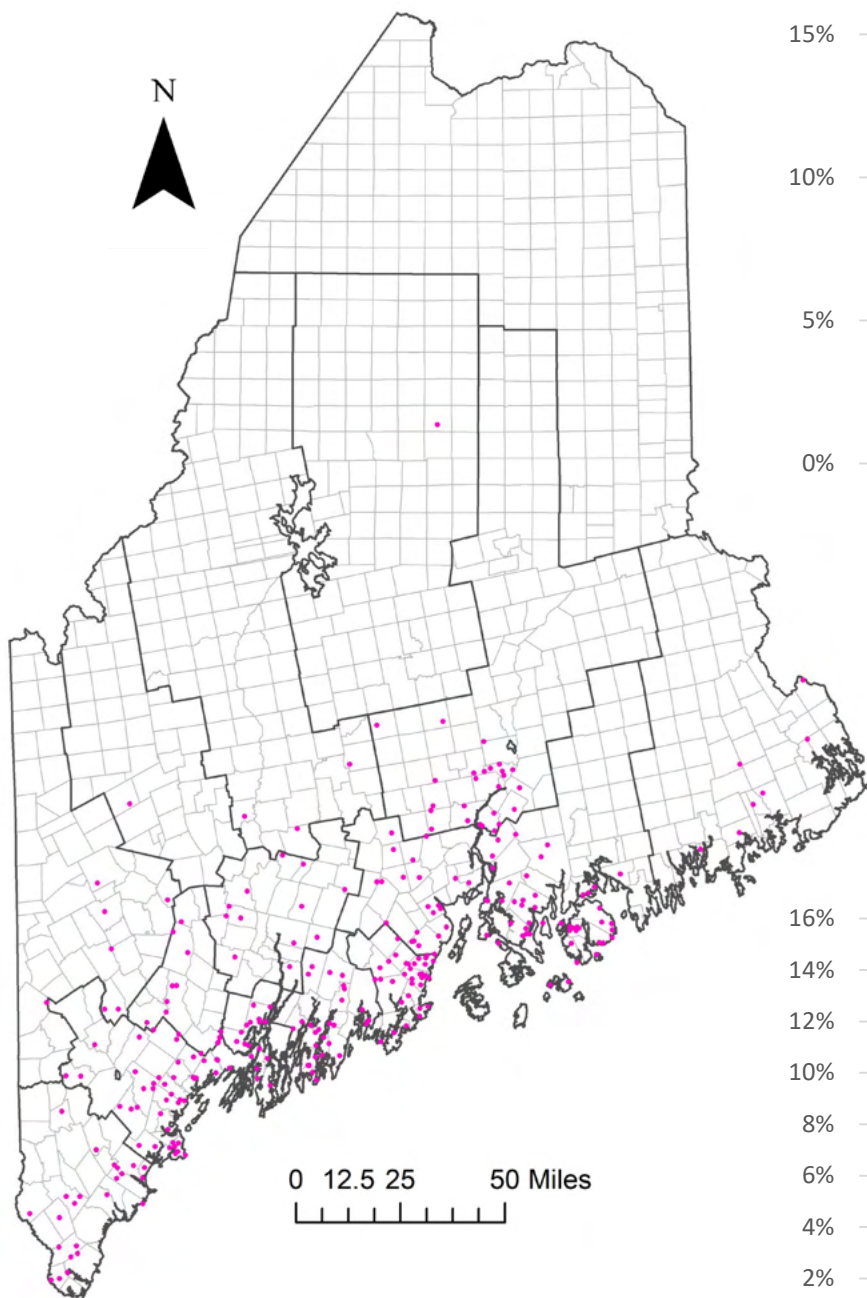


Borrelia burgdorferi Infection Prevalence by Life Stage in Submitted Blacklegged Ticks – 2019-2023

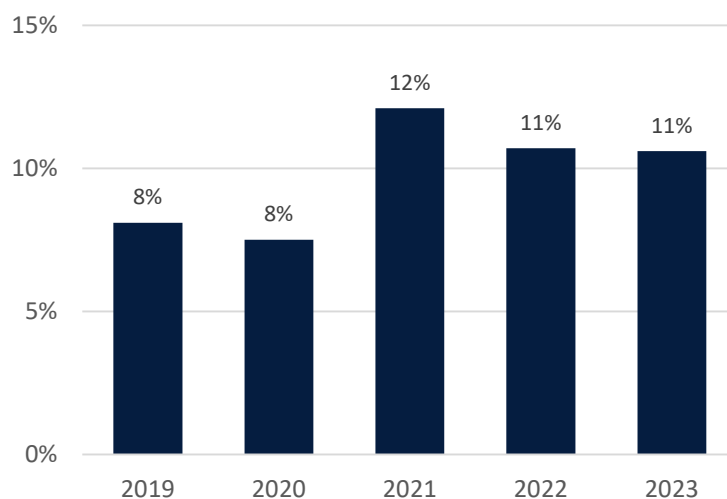


ANAPLASMA PHAGOCYTOPHILUM (CAUSATIVE AGENT OF ANAPLASMOSIS)

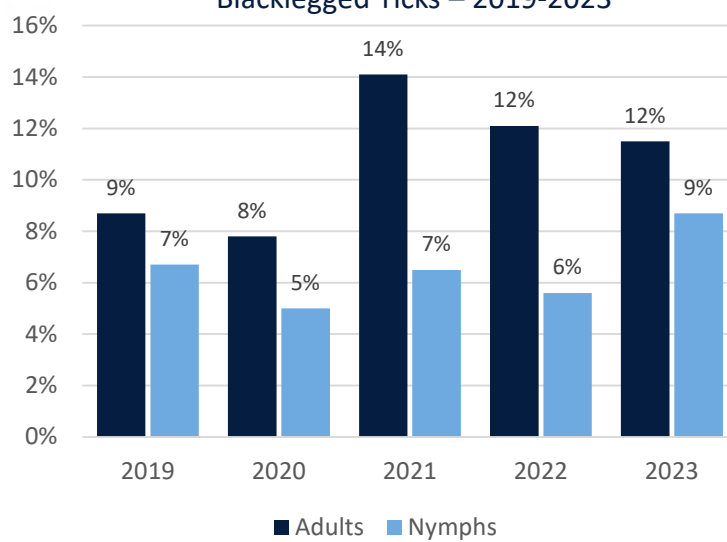
Blacklegged Ticks (*Ixodes scapularis*) Positive for *Anaplasma phagocytophilum* – 2023



Anaplasma phagocytophilum Infection Prevalence in Submitted Blacklegged Ticks – 2019-2023

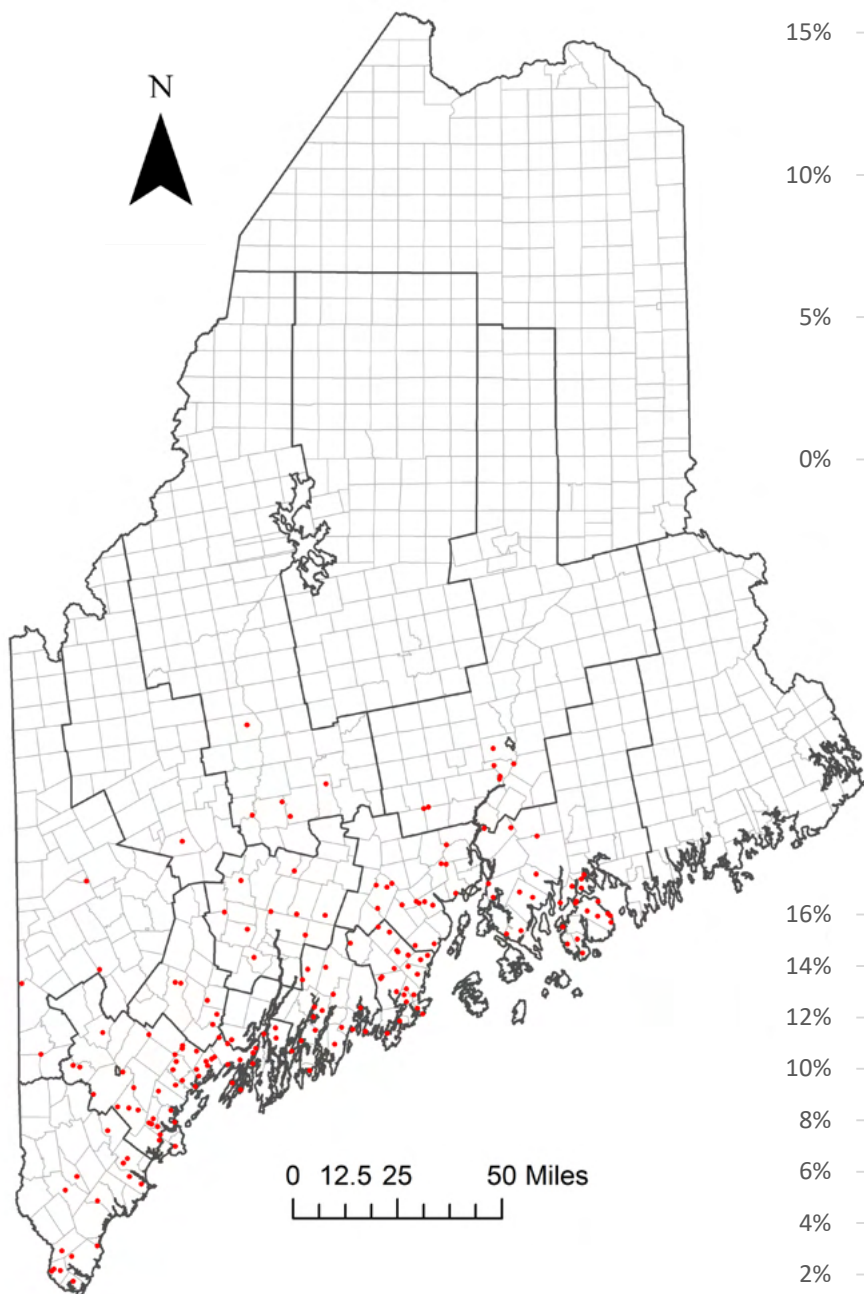


Anaplasma phagocytophilum Infection Prevalence by Life Stage in Submitted Blacklegged Ticks – 2019-2023

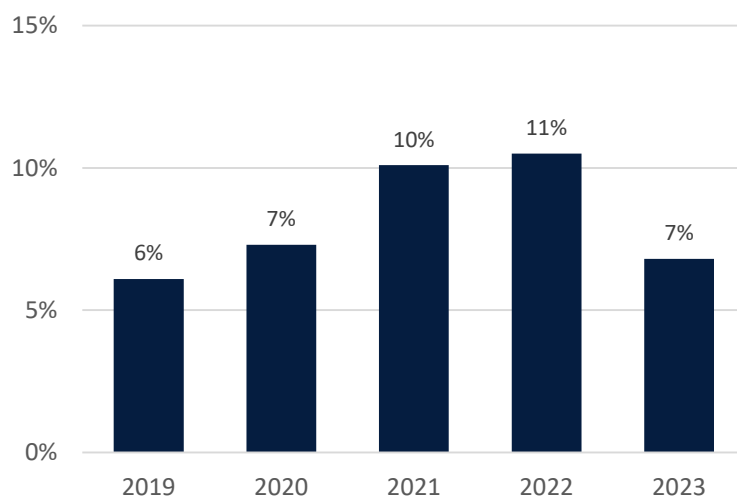


BABESIA MICROTI (CAUSATIVE AGENT OF BABESIOSIS)

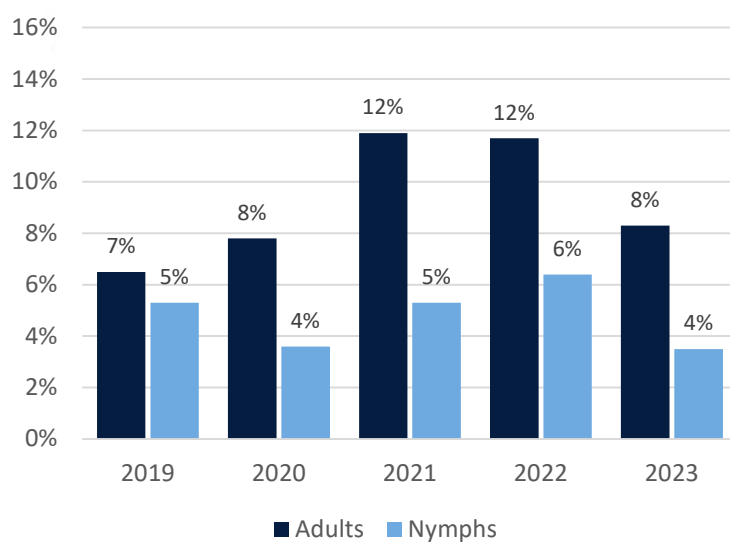
Blacklegged Ticks (*Ixodes scapularis*) Positive for *Babesia microti* – 2023



Babesia microti Infection Prevalence in Submitted Blacklegged Ticks – 2019-2023



Babesia microti Infection Prevalence by Life Stage in Submitted Blacklegged Ticks – 2019-2023

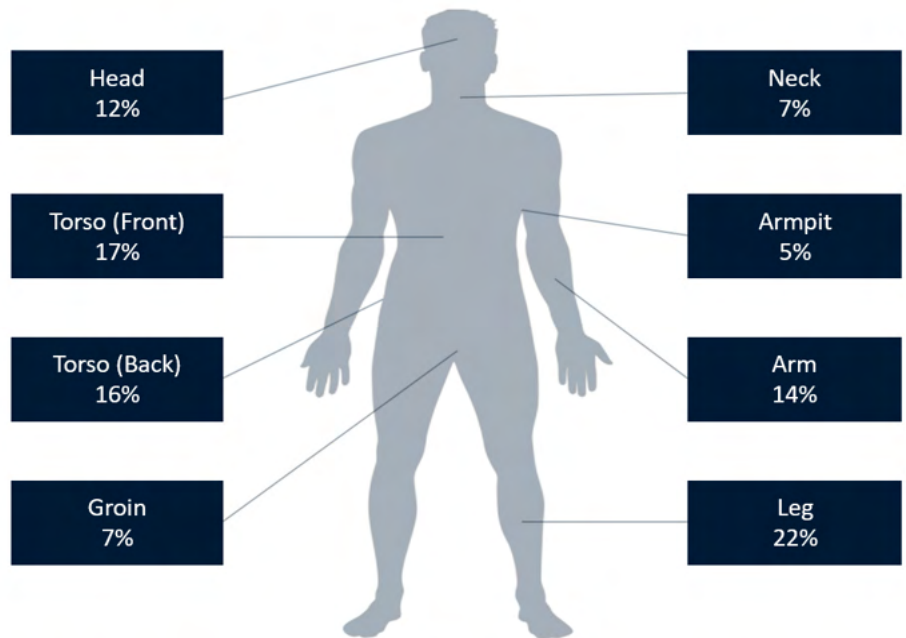


HOST ASSOCIATIONS

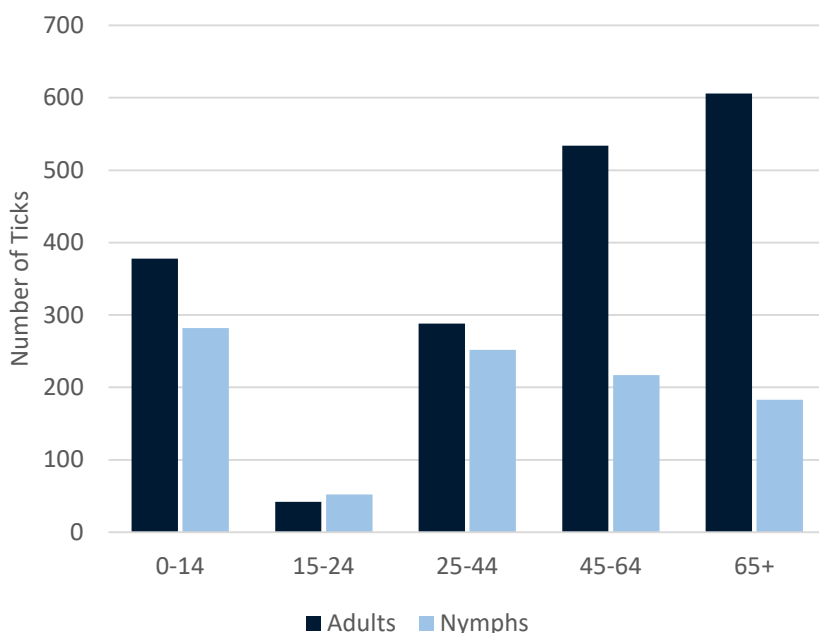
The ticks submitted to the UMaine Tick Lab were overwhelmingly found on humans (76%) and dogs (20%), with cats and other hosts making up the remaining submissions. There were some tick species-related differences in

host association with 87% of blacklegged ticks found on humans and 11% found on dogs. In comparison, 61% of American dog ticks were found on humans and 32% were found on dogs. 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 (95%) were discovered while attached and feeding. Feeding sites were fairly evenly distributed across the body, with the legs and torso representing the most common attachment sites.

Ixodes scapularis Attachment Sites – All Ages



Blacklegged Tick (*Ixodes scapularis*) Submissions
By Human Age Group – 2023

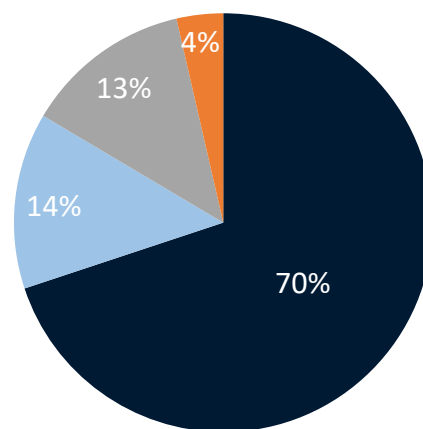


Tick submissions can vary based upon human age, with ticks frequently found attached to those over the age of 45 and under the age of 15. During 2023, blacklegged tick nymph submissions were highest from children under the age of 15 and were relatively evenly distributed across adult age groups. Submissions of adult blacklegged ticks were most commonly submitted by those over the age of 45. Adolescents between the ages of 15 and 24 are consistently the age group with the fewest submissions.

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, 70% of those who submitted blacklegged ticks encountered them on their own property, with yardwork/gardening being the most commonly reported activity at the time of encounter. The table below summarizes the human activities associated with the blacklegged ticks that were submitted to the UMaine Tick Lab in 2023.

Property Type Where Blacklegged Ticks Were Encountered – 2023



■ Own Residence ■ Other Private Property ■ Public Land ■ Other

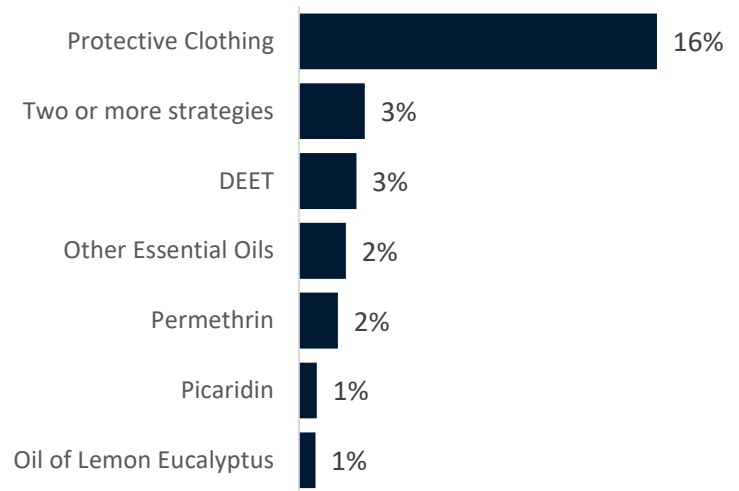
Human Activity at the Time of Blacklegged Tick (*Ixodes scapularis*) Encounter – 2023

Activity	Adults	Nymphs	Total
Yardwork/Gardening	616	368	984 (35.1%)
Playing Outside	276	214	490 (17.5%)
Walking	262	121	383 (13.7%)
Pet Related	226	46	272 (9.7%)
Hiking	198	73	271 (9.7%)
Other	115	50	165 (5.9%)
Occupational - Other	41	20	61 (2.2%)
Camping	7	34	41 (1.5%)
Hunting / Trapping	37	2	39 (1.4%)
Occupational - Agriculture	19	12	31 (1.1%)
Occupational - Forestry/Logging	16	7	23 (0.8%)
Playing Sports	11	5	16 (0.6%)
Running	9	2	11 (0.4%)
Bicycling	6	3	9 (0.3%)
Fishing	2	2	4 (0.1%)

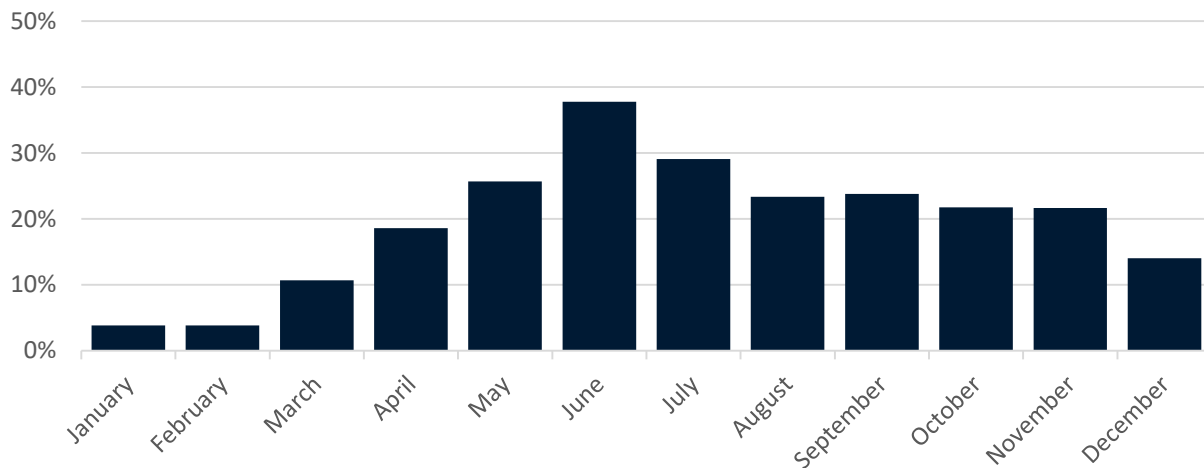
PERSONAL PROTECTION

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 2023, approximately 27% reported using some type of personal protection measure at the time of their tick encounter, with protective clothing being the most commonly used (16%). The use of personal protection peaked at 38% in June and remained low (10 - 25%) during the spring and fall peaks in adult blacklegged tick activity.

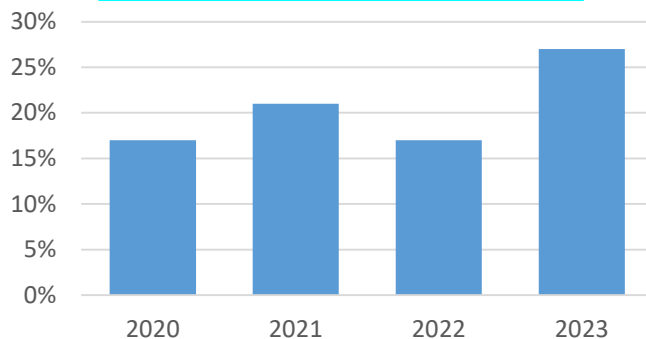
Percentage of Tick Submitters Using Different Tick Protection Measures – 2023



Percentage of Tick Submitters Using Personal Protection Measures (Calculated Monthly) – 2023



Percentage of Tick Submitters Using Tick Protection Measures – 2020-2023



The proportion of tick submitters using different tick protection measures has been relatively stable since 2020, with individuals reporting the use of DEET ranging from 2.3 - 2.9% and permethrin ranging from 1.8 - 2.2%. The use of protective clothing has fluctuated more widely with 6.7% of submitters reporting its use in 2020 and 16.1% in 2023.

LIMITATIONS OF THE DATA

The information in this report is preliminary as of December 31, 2023. Tick samples collected in 2023 that are submitted after this date will be added to the data set and included in future reports. 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 research assistants Alyssa Marini, Alaina Woods, Olivia Choi, Maggie McAuliffe, Oyku Gotug, Dev Scott, Olivia Getchell, Mazie Gordon, and Nicole Kilhullen, 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.

SUBMIT A TICK

If you would like to submit a tick for identification and/or testing, complete the online submission form at our website ticks.umaine.edu and mail your sample to the Tick Lab at 17 Godfrey Drive, Orono, ME 04473.



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