

State of the World of Ticks and Tick-borne Pathogens



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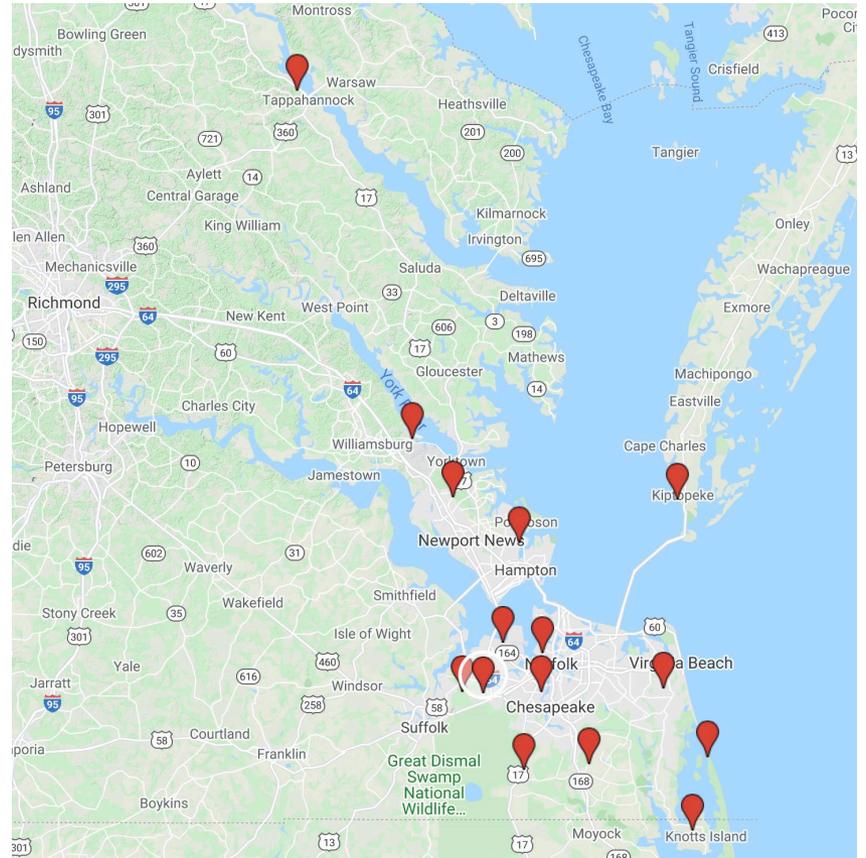
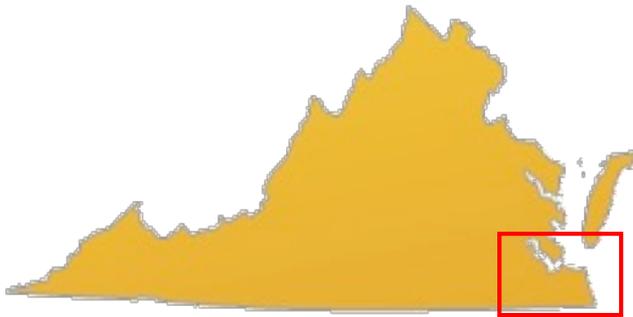
ODU Tick Study Objectives

Preliminary Data – Do Not Reprint

- Long-term study of tick ecology and tick-borne pathogens in Hampton Roads area
 - Collect ticks from the field
 - Determine populations of ticks in Hampton Roads and the pathogens they carry
 - Mathematical modeling and simulation to determine high-risk areas and best control methods

Collection Sites

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Flagging Effort

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- Flagging effort still modified for COVID
 - Reduced lab capacity
 - Sampling often done by individuals rather than pairs
- Sampling Frequency
 - Most sites were sampled monthly
 - Sites with Gulf Coast tick populations were sampled twice per month in summer
 - Quarterly sampling at a few for staffing shortages

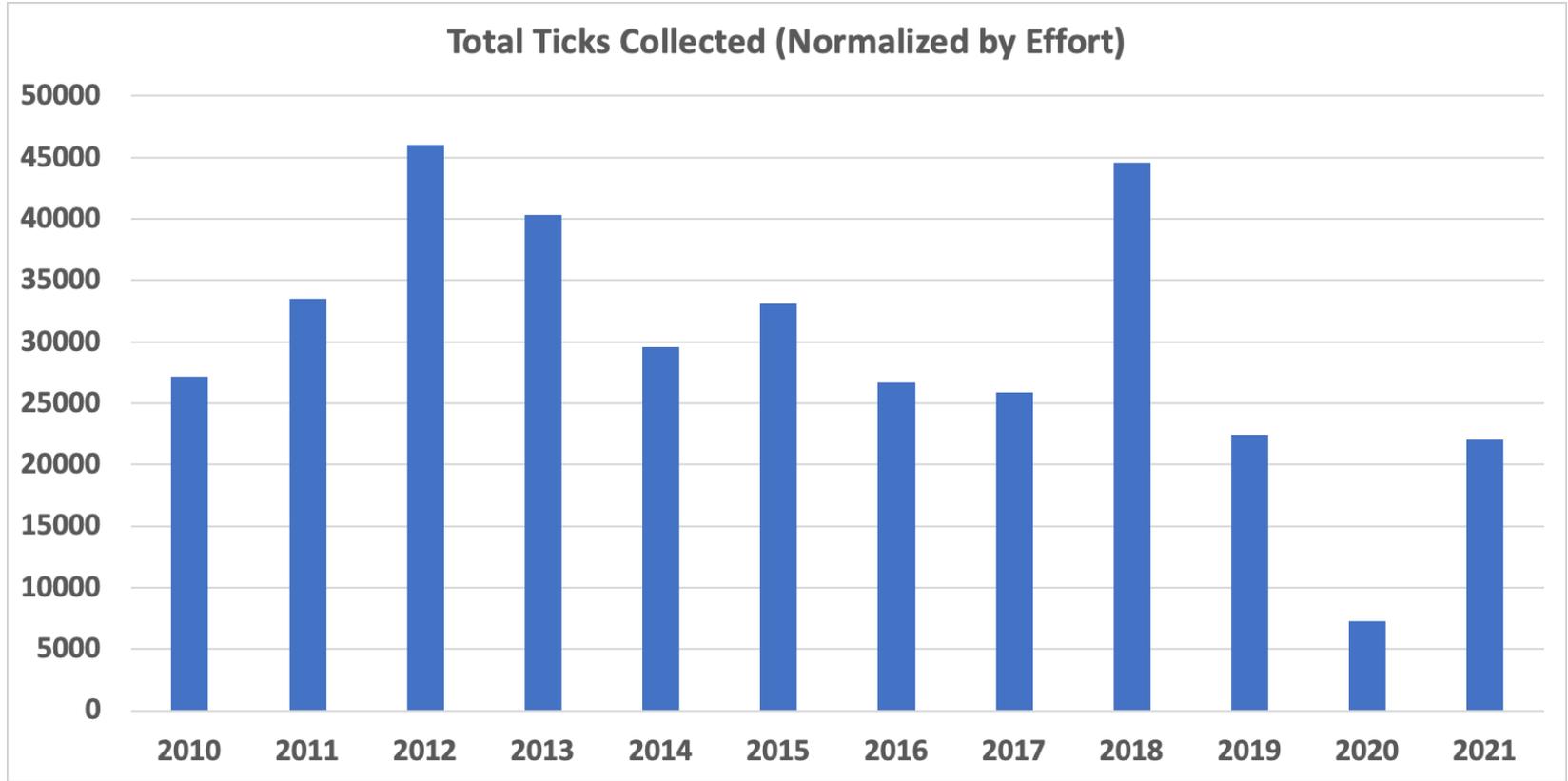
Ticks collected

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- The vast majority of ticks collected were, as always, lone star ticks
- Overall tick density was back to approximately normal.
- Large numbers of American dog ticks at many sites.
- Few blacklegged nymphs despite large adult population last winter.

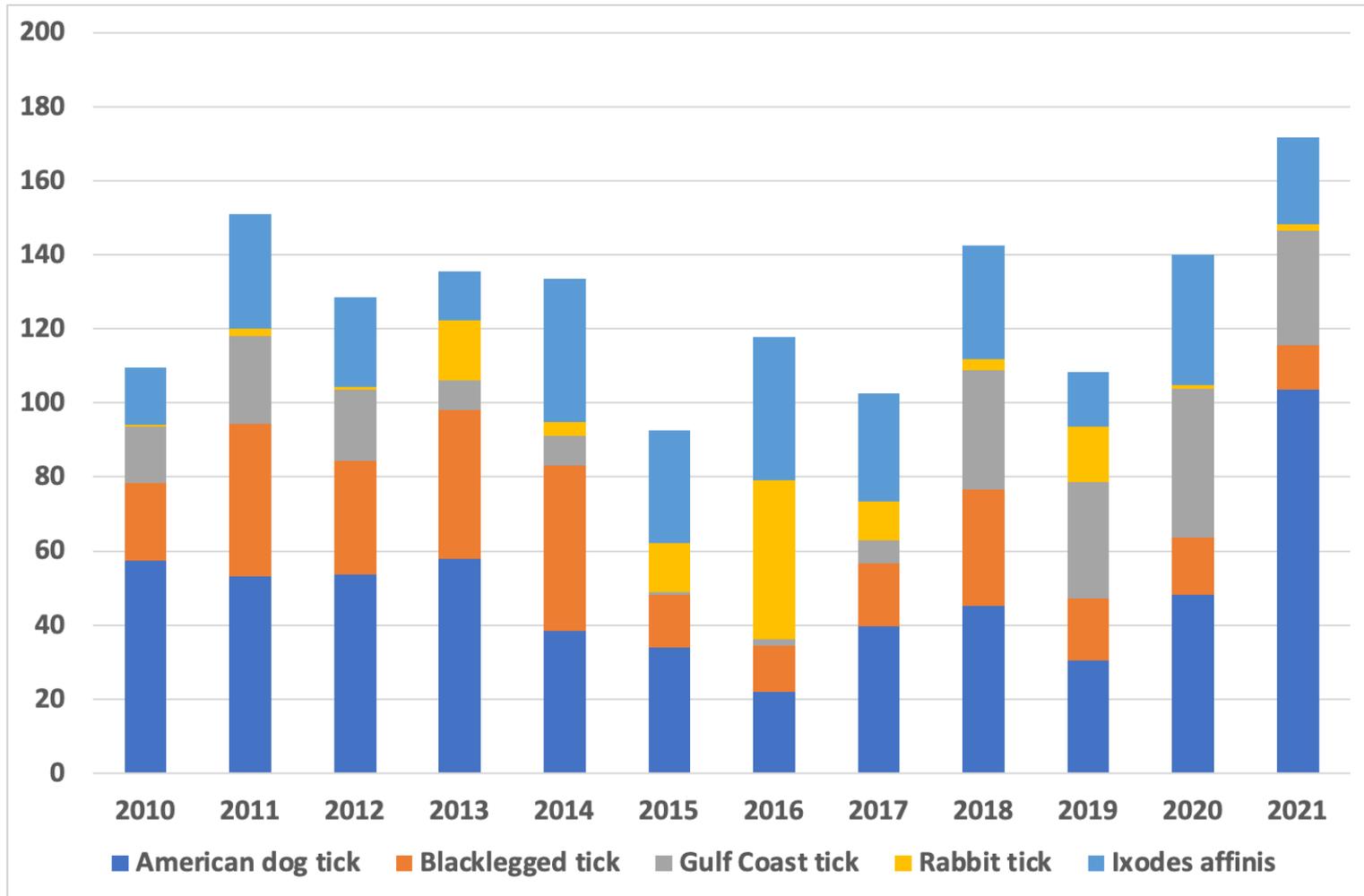
Total Ticks

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Total Ticks (without Lone Star)

Preliminary Data – Do Not Reprint



Flagged Ticks

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- The next slides show the data for the most common ticks collected.
- For each, the y-axis is average tick density (ticks per meter squared). The x-axis is the month averaged 2010-2021. Note that the maximum density changes from graph to graph.
- Orange bars with standard error bars are overall average, and the blue dots were the values for 2021.

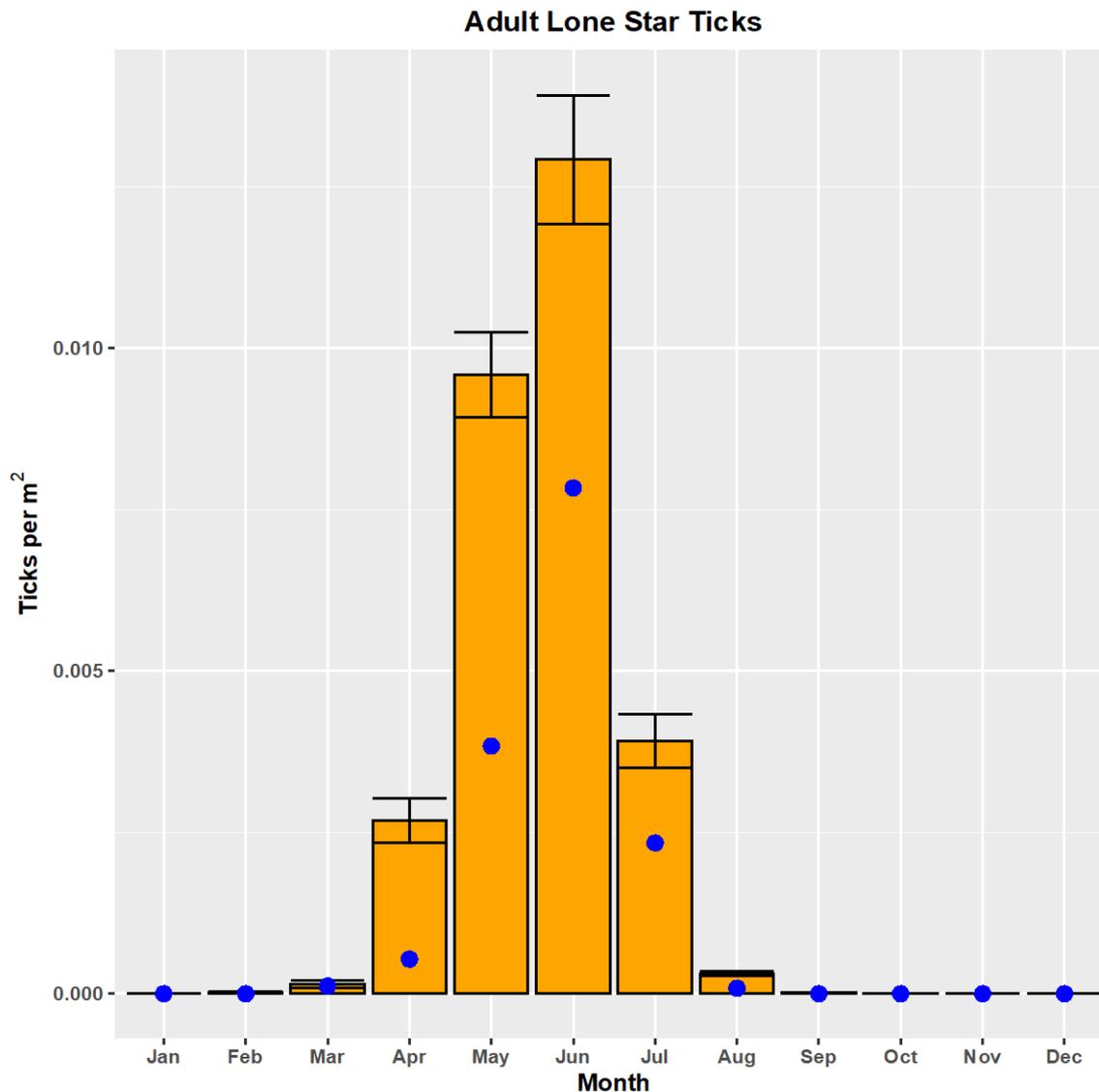
2021 Flagging Results

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- Overall, American dog tick numbers were high.
- Fewer lone star adults and nymphs, but higher than average numbers of larvae.
- Very few rabbit ticks were collected.
- The addition of sites for the Gulf Coast targeted collections pushed the collection numbers higher than average.

Lone star tick adults

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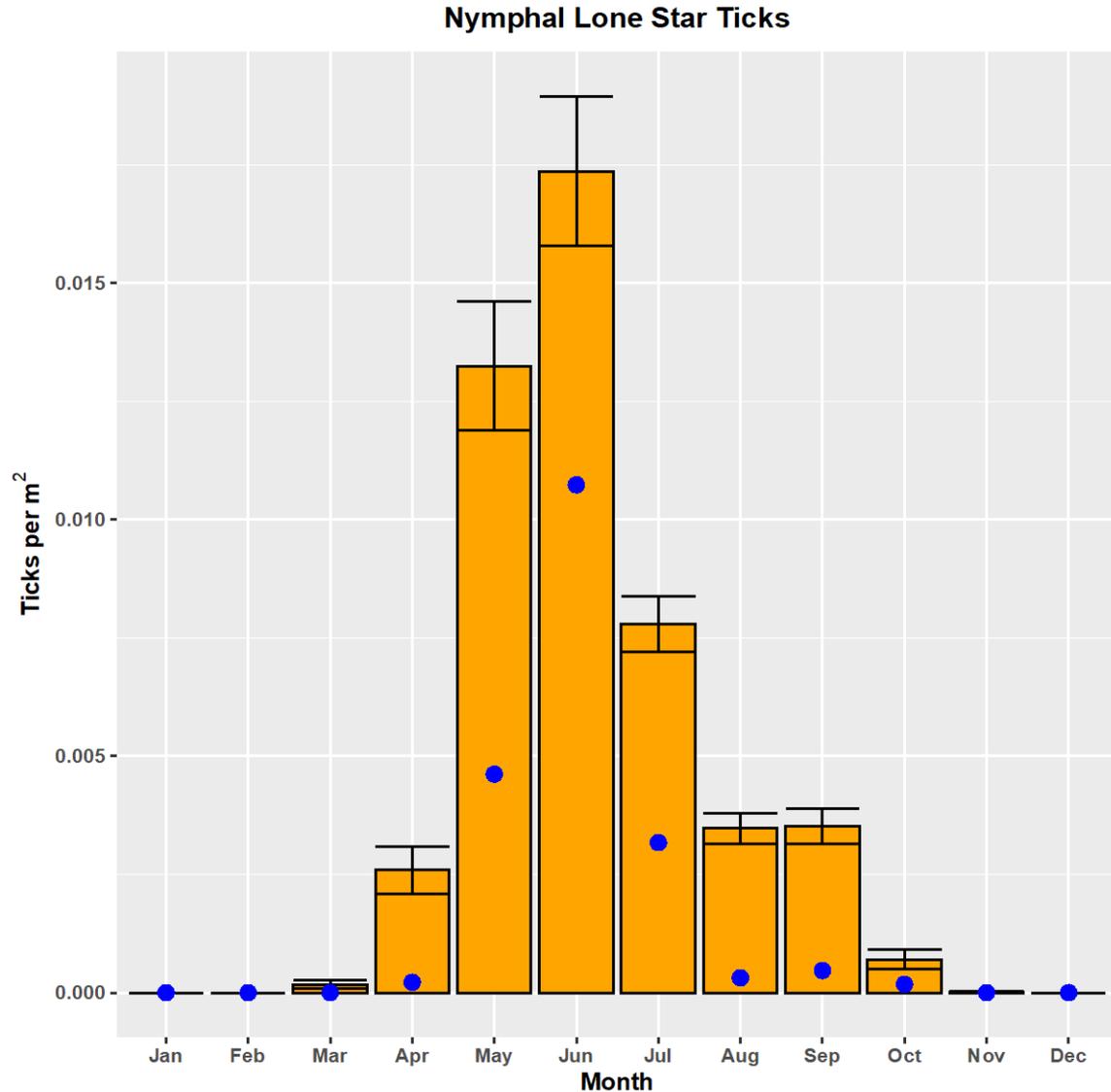


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Lone star tick nymphs

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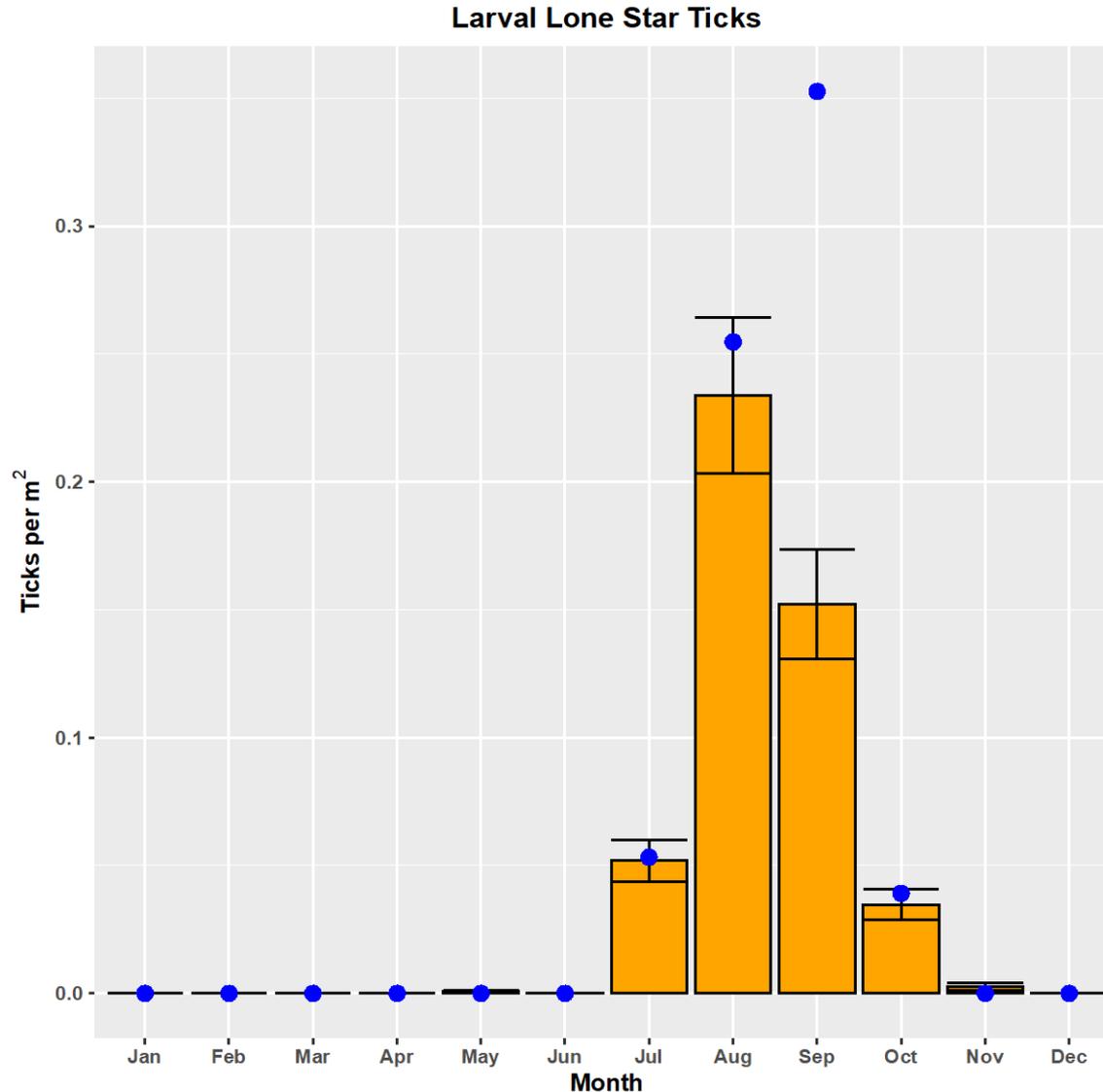


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Lone star tick larvae

Preliminary Data – Do Not Reprint

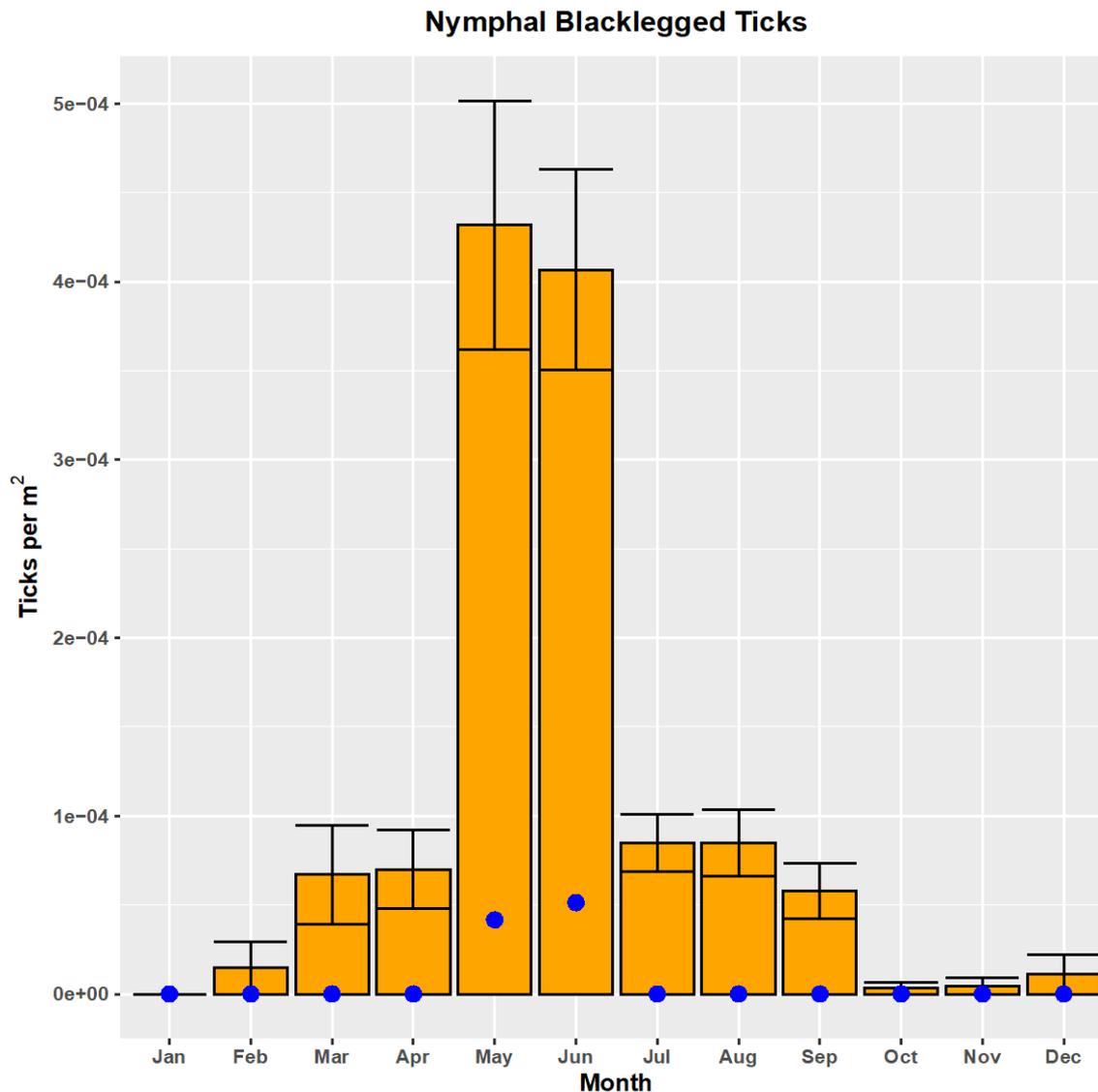


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Blacklegged tick nymphs

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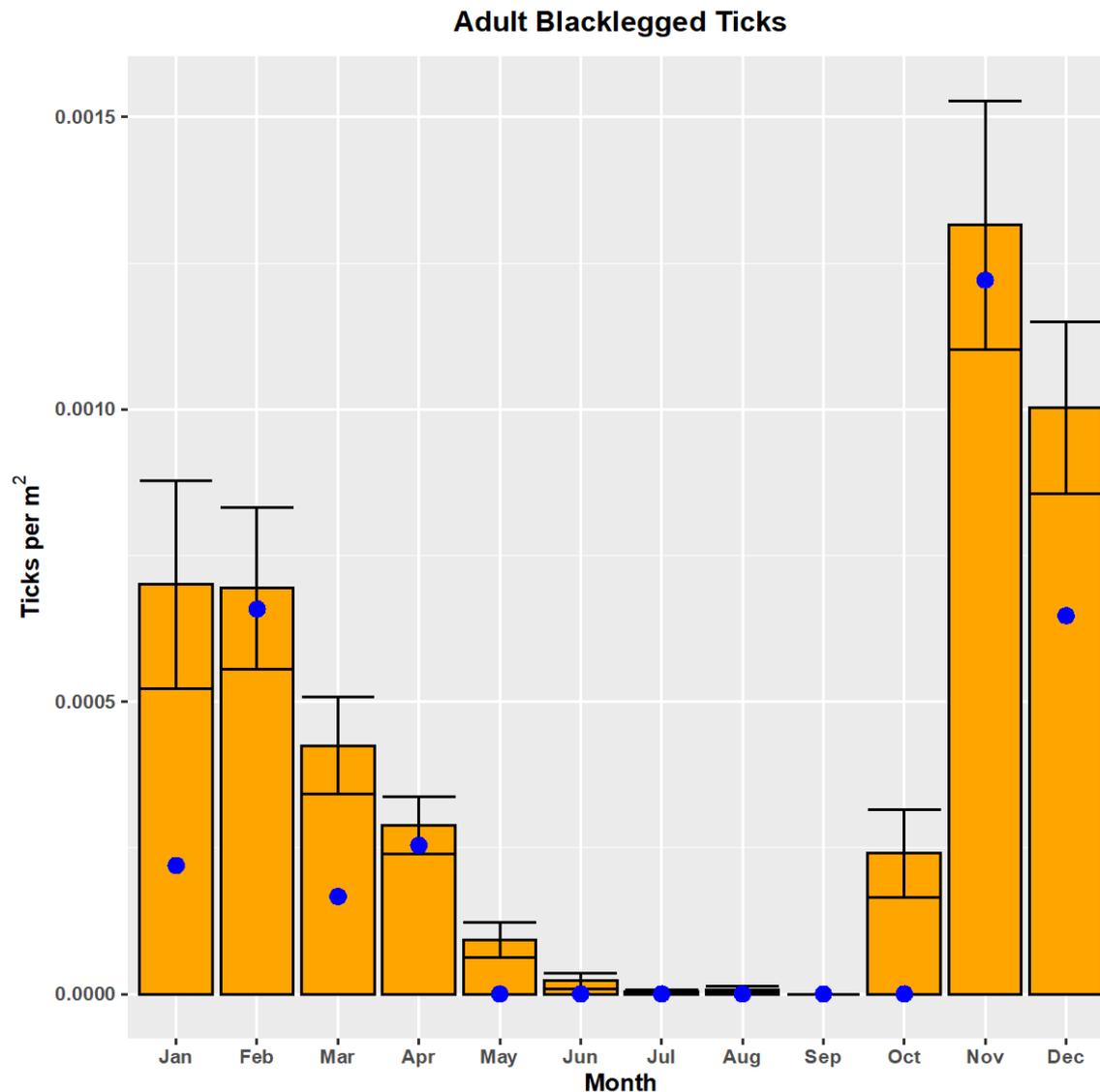


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Blacklegged tick adults

Preliminary Data – Do Not Reprint

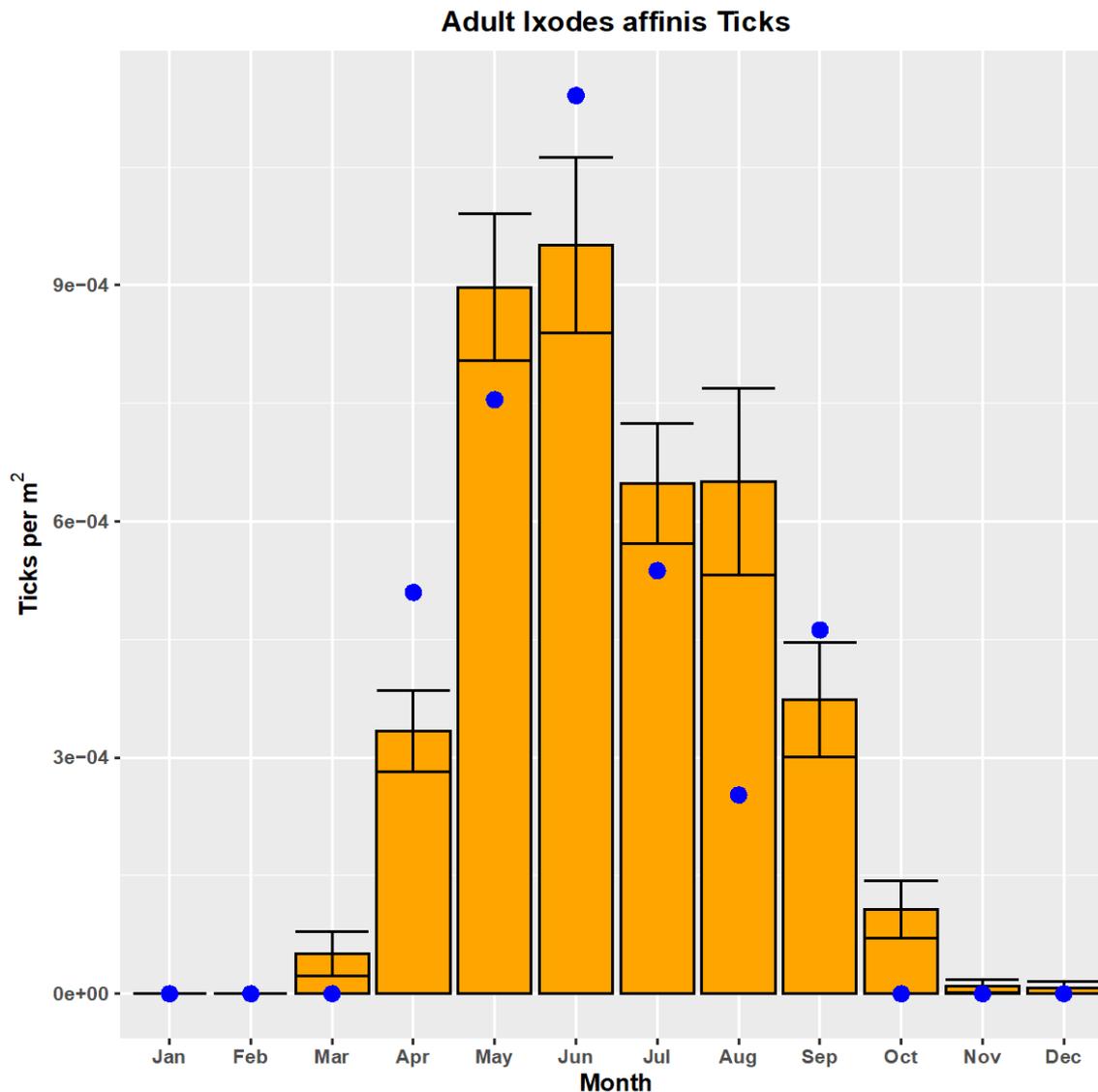


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Ixodes affinis adults

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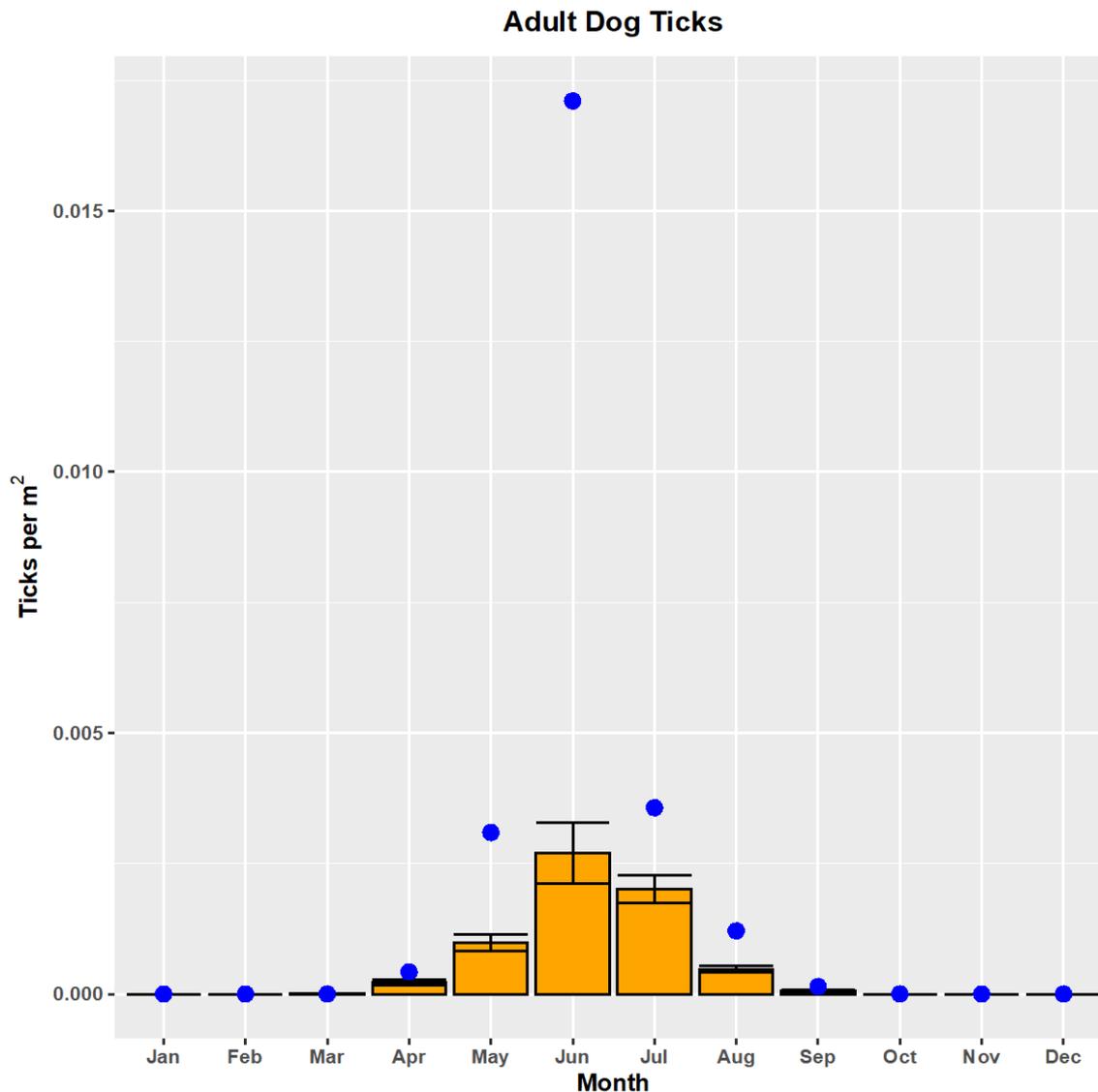


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

American dog tick adults

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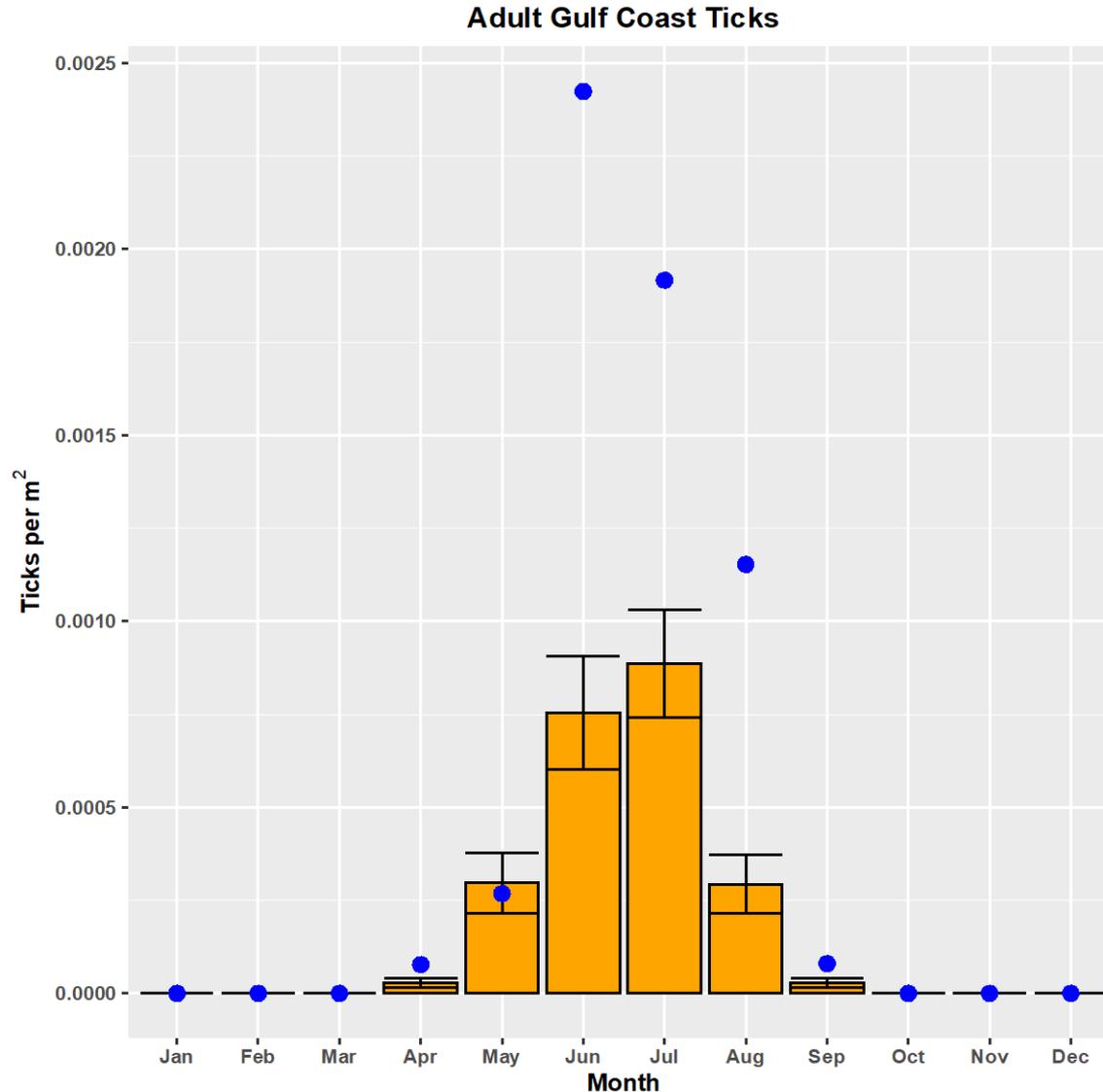


Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

Gulf Coast tick adults

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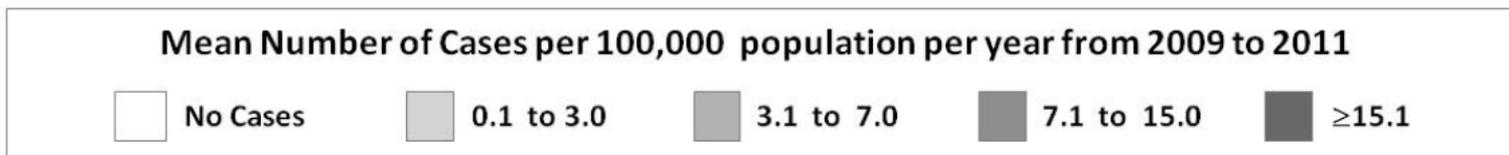
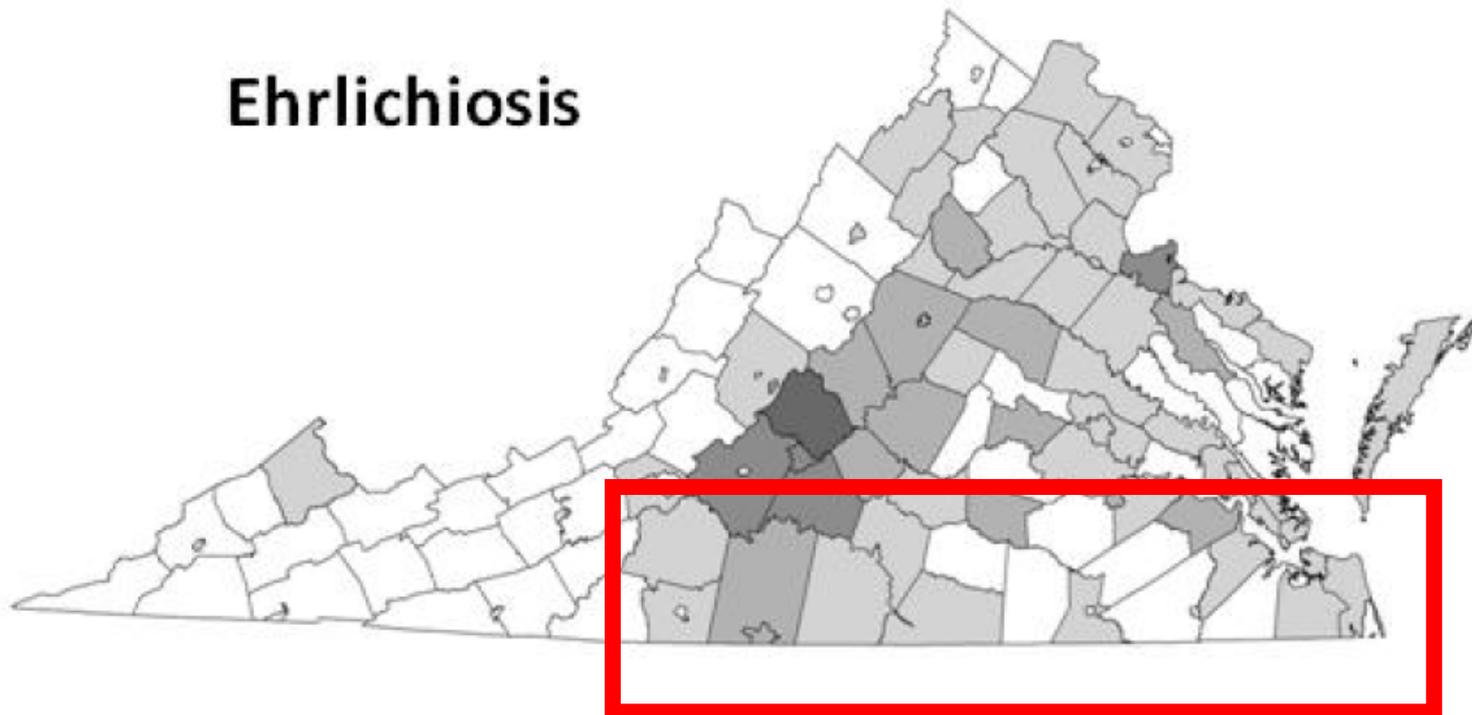
Orange bars – average ticks per m² for all sites, all years

Blue dots – average ticks per m² for all sites for 2021

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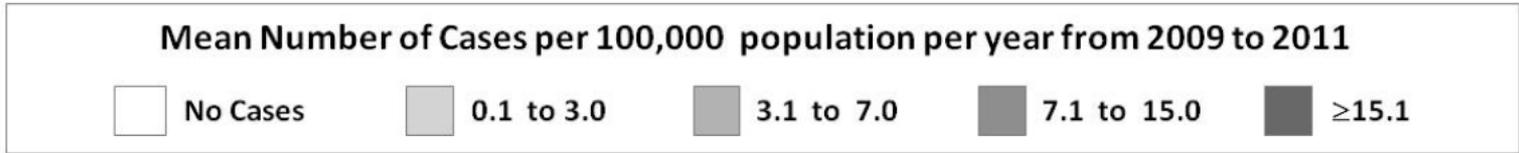
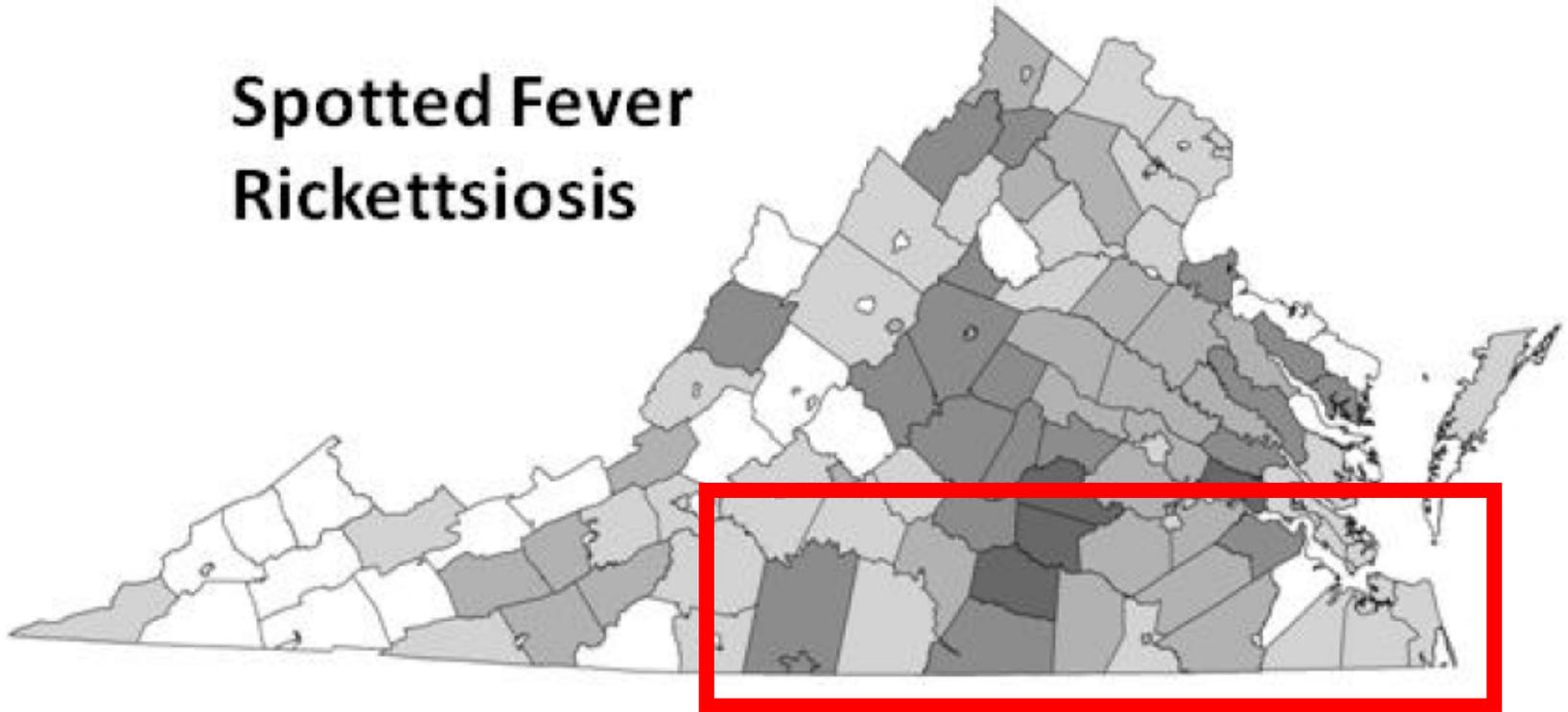
US-58 Collection Project

Ehrlichiosis



Gaines DN, Operario DJ, Stroup S, Stromdahl E, Wright C, Gaff H, Broyhill J, Smith J, Norris DE, Henning T, Lucas A. 2014. *Ehrlichia* and spotted fever group Rickettsiae surveillance in *Amblyomma americanum* in Virginia through use of a novel six-plex real-time PCR assay. *Vector-Borne and Zoonotic Diseases*. 14(5):307-16.

Spotted Fever Rickettsiosis



Gaines DN, Operario DJ, Stroup S, Stromdahl E, Wright C, Gaff H, Broyhill J, Smith J, Norris DE, Henning T, Lucas A. 2014. *Ehrlichia* and spotted fever group Rickettsiae surveillance in *Amblyomma americanum* in Virginia through use of a novel six-plex real-time PCR assay. *Vector-Borne and Zoonotic Diseases*. 14(5):307-16.

US-58 Corridor

Preliminary Data – Do Not Reprint



US-58 Project

Preliminary Data – Do Not Reprint

- Funded by the CDC Southeastern Center of Excellence
- Standard dragging protocol at two locations in every city/county from Virginia Beach to Martinsville
- Looked to assess variation in ticks, pathogens, and reported tick-borne human disease
- Ticks are currently waiting to be tested

Results

County/City	Anaplasma/Ehrlichiosis*	Lone Star Ticks**
Southampton County	1	466
Pittsylvania County	3	263
Halifax County	0	208
Brunswick County	0	193
Suffolk City	2	148
Henry County	2	68
Mecklenburg County	0	41
Greensville County	0	25
Chesapeake City	0	18
Virginia Beach City	0	12

*2018 data from VDH, **adults and nymphs only

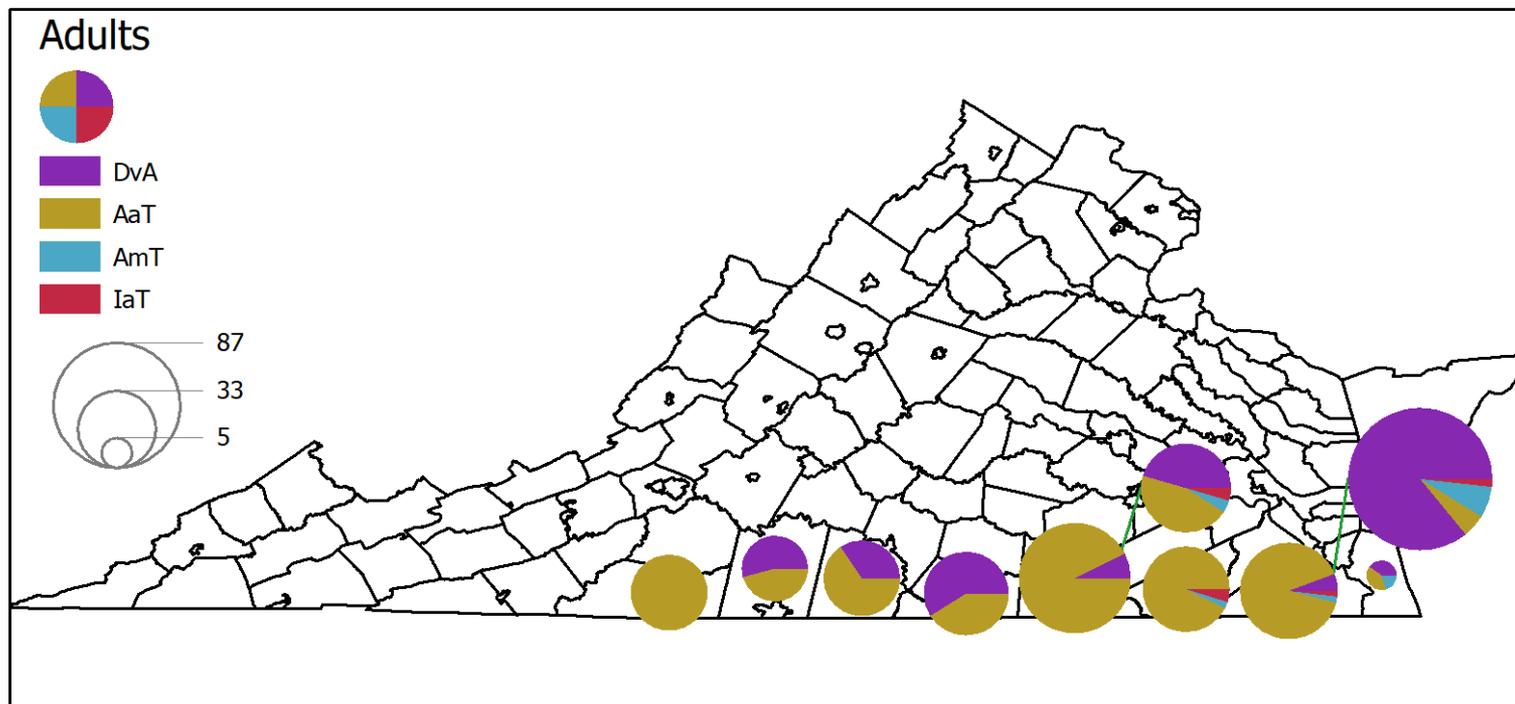
Results

Preliminary Data – Do Not Reprint

County/City	SFGR (RMSF)	American Dog Ticks	Gulf Coast Ticks
Chesapeake City	3	97	8
Mecklenburg County	0	23	0
Greensville County	1	20	2
Pittsylvania County	21	13	0
Halifax County	1	11	0
Brunswick County	0	5	0
Suffolk City	0	3	1
Virginia Beach City	5	2	1
Henry County	10	0	0
Southampton County	1	0	1

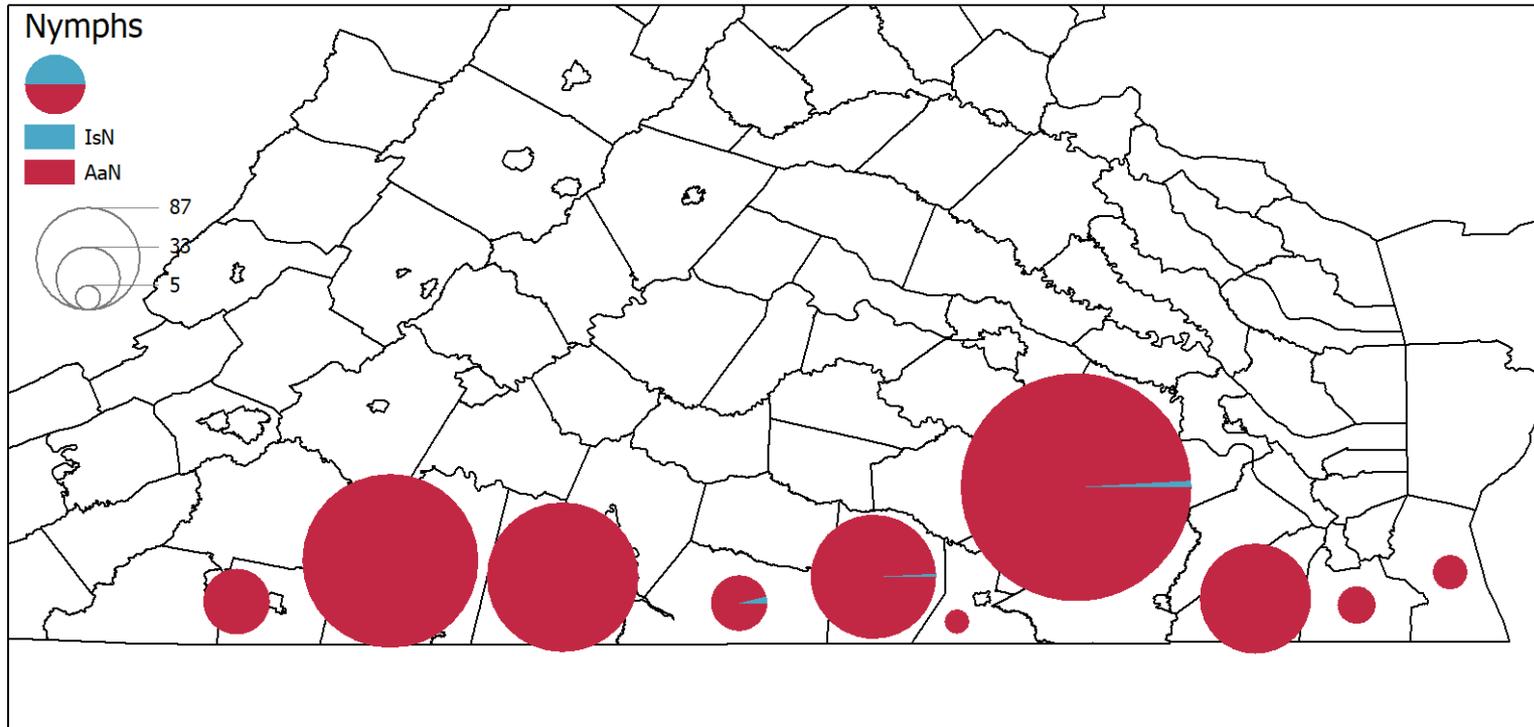
Adults

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Nymphs

Preliminary Data – Do Not Reprint



Preliminary Data – Do Not Reprint

2021 Publications

2021 Publications

Preliminary Data – Do Not Reprint

1. Nadolny RM, Toliver M, Gaff HD, Snodgrass JG, Robbins RG. Focus stacking images of morphological character states for differentiating the adults of *Ixodes affinis* and *Ixodes scapularis* (Acari: Ixodidae) in areas of sympatry. *Journal of Medical Entomology*. 2021.
2. Cumbie AN, Heller EL, Bement ZJ, Phan A, Walters EL, Hynes WL, Gaff HD. Passerine birds as hosts for *Ixodes* ticks infected with *Borrelia burgdorferi sensu stricto* in southeastern Virginia. *Ticks and Tick-borne Diseases*. 2021 May 1;12(3):101650.
3. Lippi CA, Gaff HD, White AL, Ryan SJ. Scoping review of distribution models for selected *Amblyomma* ticks and rickettsial group pathogens. *PeerJ*. 2021 Feb 17;9:e10596.
4. Lippi CA, Gaff HD, White AL, St. John HK, Richards AL, Ryan SJ. Exploring the Niche of *Rickettsia montanensis* (Rickettsiales: Rickettsiaceae) infection of the American dog tick (Acari: Ixodidae), using multiple species distribution model approaches. *Journal of Medical Entomology*. 2021 May;58(3):1083-92.
5. Espada C, Cummins H, Gonzales JA, Notto L, Gaff HD. A comparison of tick collection materials and methods in Southeastern Virginia. *Journal of Medical Entomology*. 2021 Mar;58(2):692-8.

Acknowledgements

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- Faculty: Wayne Hynes, David Gauthier, Eric Walters, Daniel Sonenshine
- And the tireless effort of more than 75 undergrad and grad lab assistants



City of Suffolk

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