

TickBot efficacy in residential and wildlife habitats in Portsmouth, Virginia



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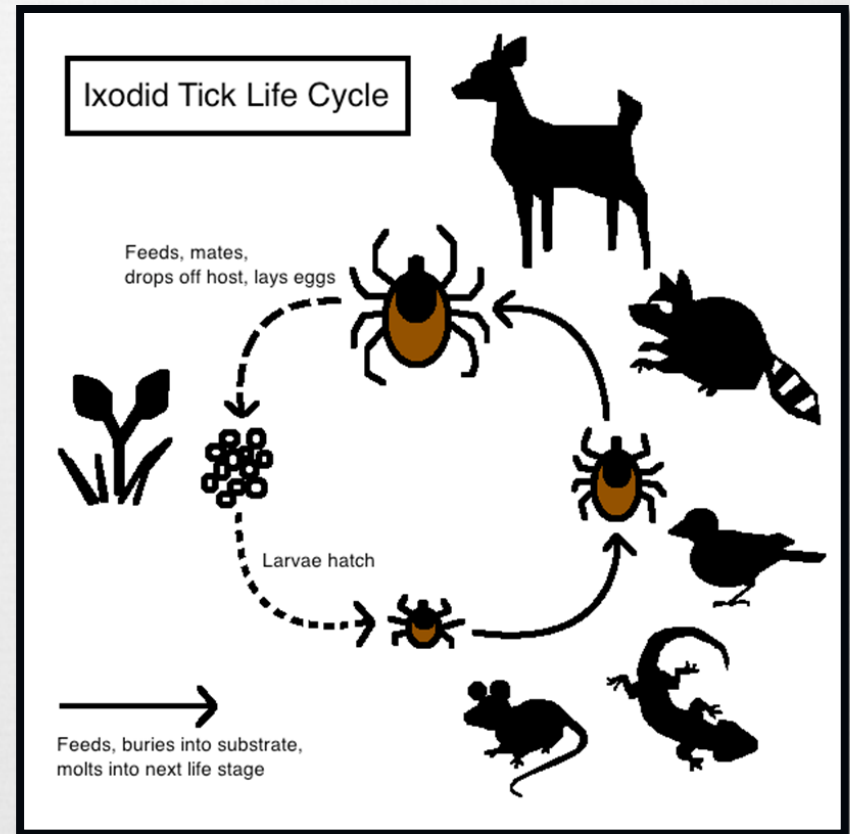
Old Dominion University, Norfolk, Virginia

Virginia Mosquito Control Annual Meeting 2017

Tick 101



- Acarids
- Punctuated life history
 - Egg, larva, nymph, adult
 - One bloodmeal per life stage
- Hardy and widespread
- Host-specific at each life stage
- Will feed on most vertebrates
- Can survive off host for months to years between meals



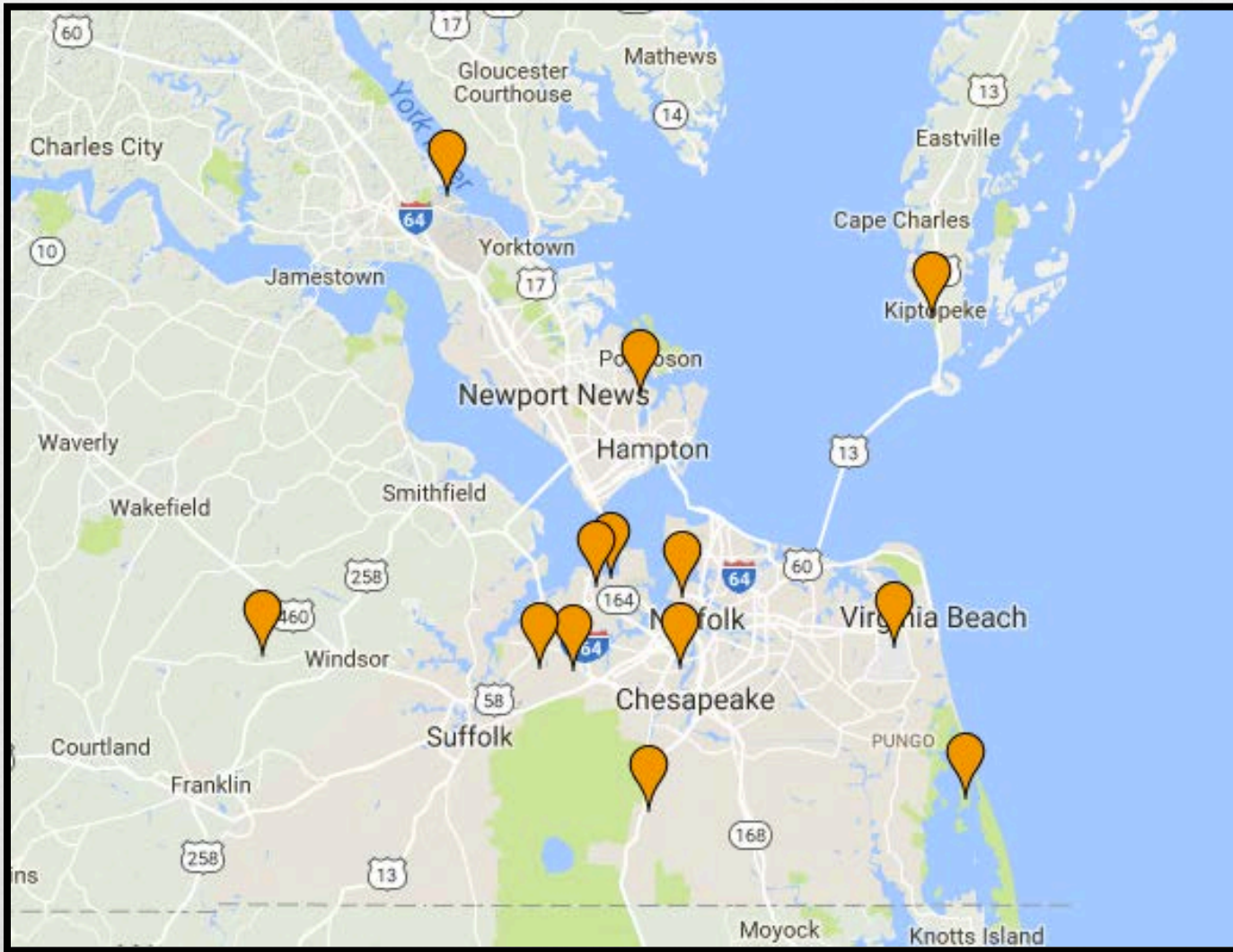
ODU Surveillance Study



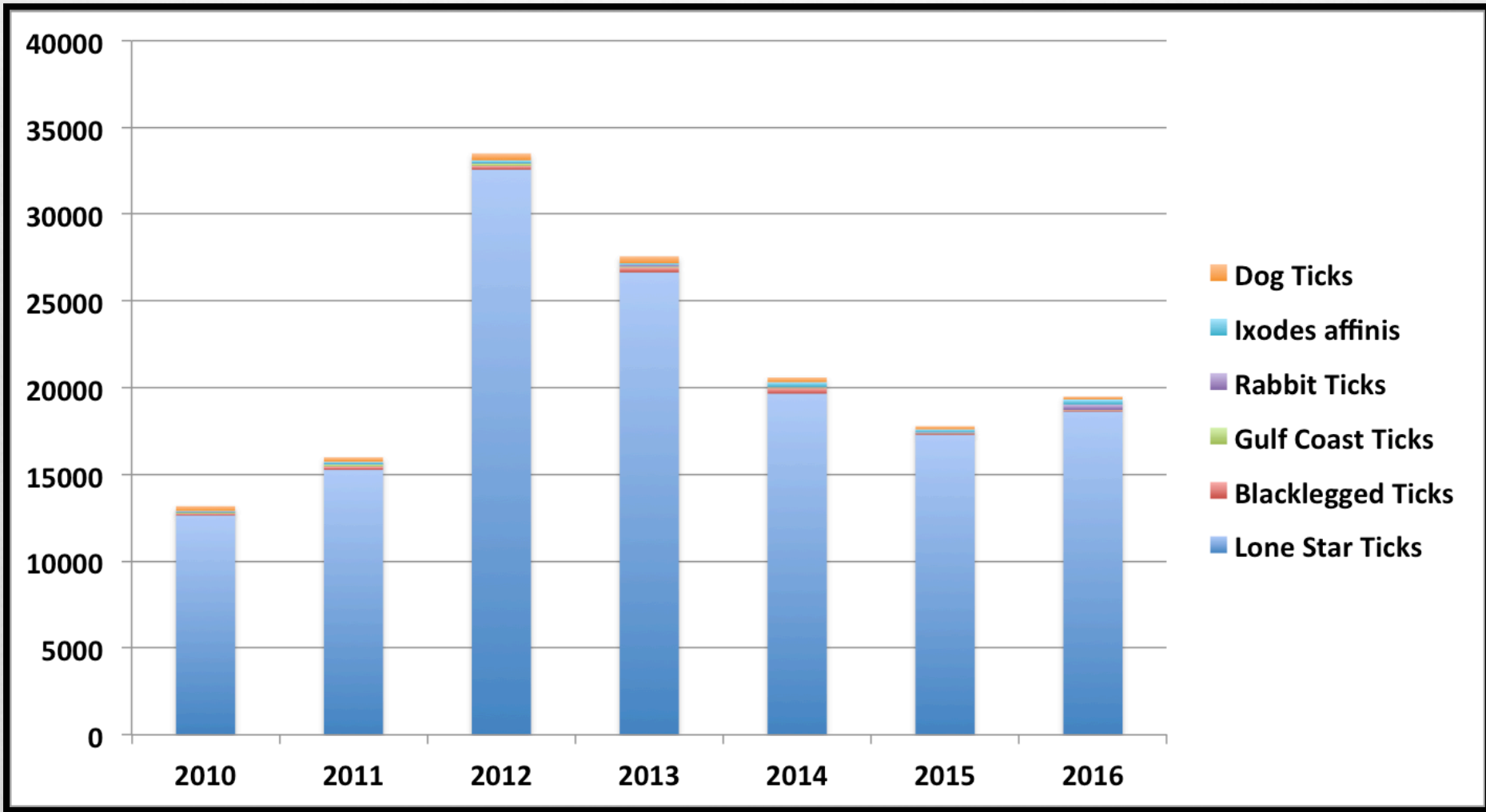
- Long-term study of tick population ecology in Hampton Roads area
 - Collect ticks from the field
 - Determine populations of ticks in Hampton Roads that carry pathogens
 - Mathematical modeling and simulation to determine high-risk areas and best control methods



2016 Flagging Sites



Total Ticks



Tick Management



- Ticks transmit a larger variety of disease-causing pathogens than any other blood-sucking arthropod
- Tick-borne pathogens affect both human and wildlife populations
- Finding effective methods for managing tick populations is a complex problem
- Ticks are attracted to CO₂ and movement



TickBot

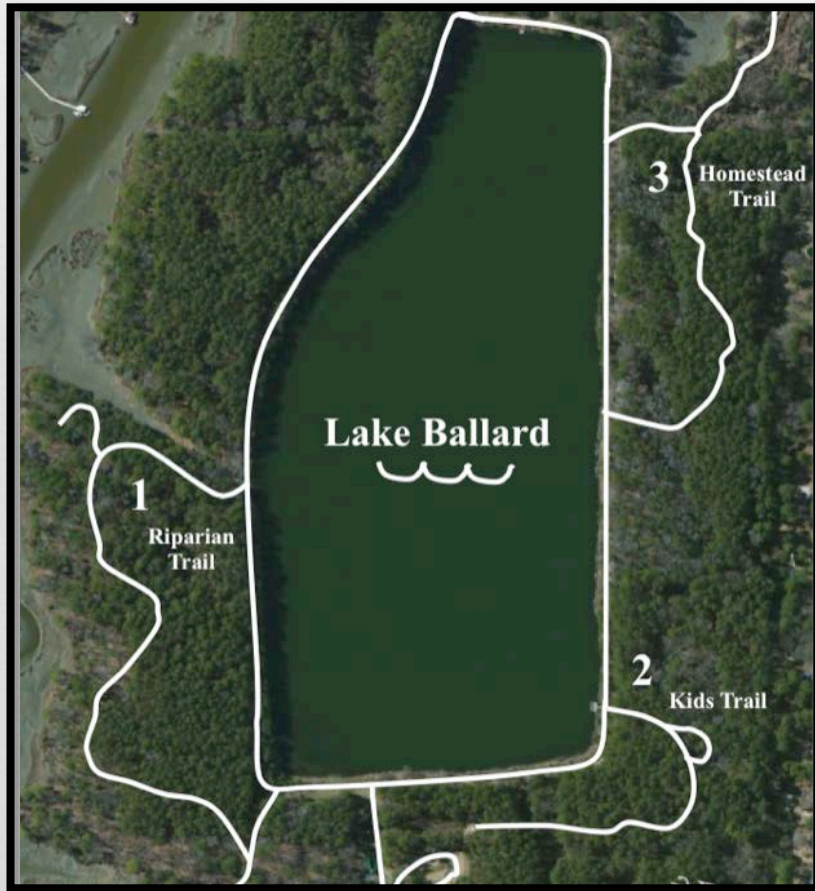


Goals:

- Attract ticks through carbon dioxide and movement of robot
- Kill ticks that come in contact with cloth
- Protect area for finite period of time
- Long-term market goal of residential pest control use



TickBot Testing in 2013



- Tested at Hoffer Creek Wildlife Preserve
 - With and without CO₂
 - With and without treated cloth
- Tick populations reduced to essentially zero for 24 hours
- Reintroduction from untreated areas and emergence from within treated areas

Gaff HD, White A, Leas K, Kelman P, Squire JC, Livingston DL, Sullivan GA, Baker EW, Sonenshine DE. TickBot: A novel robotic device for controlling tick populations in the natural environment. *Ticks and tick-borne diseases*. 2015 Mar 31;6(2):146-51.

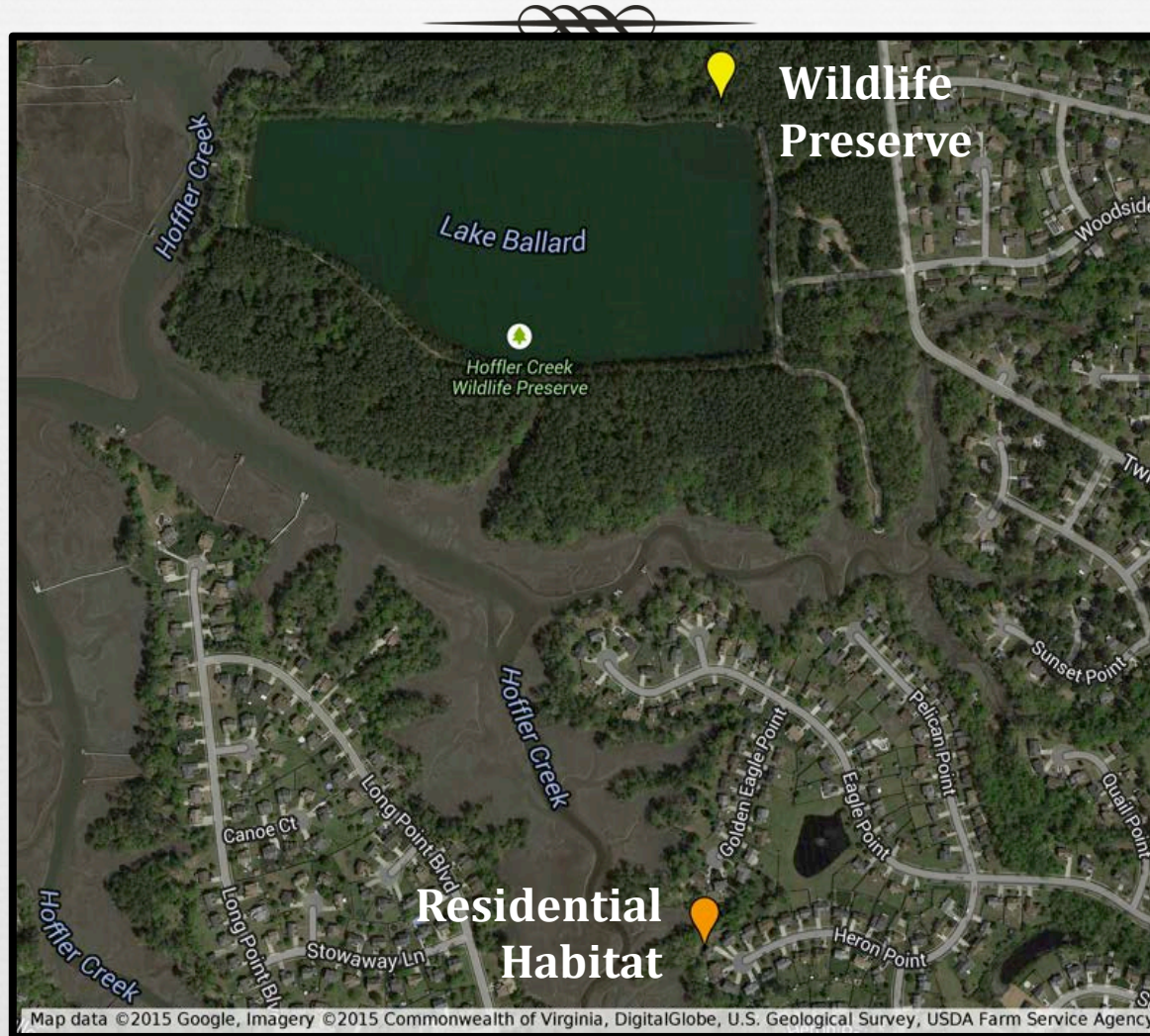
TickBot 2016 Hypotheses



- TickBot will reduce potential tick encounters in a residential setting.
- Solid carbon dioxide will lure ticks as well as gaseous carbon dioxide.



TickBot Sites Portsmouth, VA



Eight trials were completed from May-August 2016
at two sites in Portsmouth, Virginia

Methods



- To measure TickBot efficacy, ticks were captured, marked with nail polish, then returned to the habitat the day before treatment



Methods

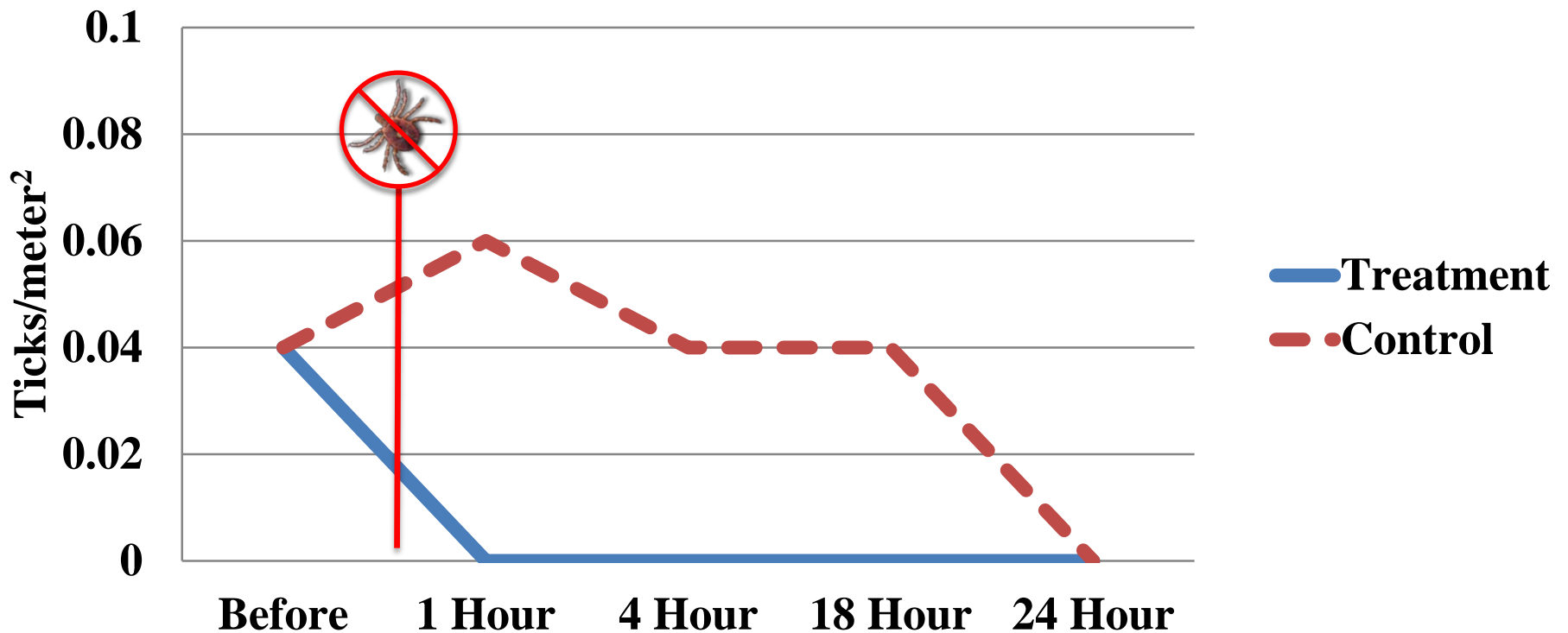


- Solid or gaseous CO₂ was released along the transects for 15 minutes before trials
- Trials were either 30 min or 1 hr in length
- Each treated area had an adjacent control area which
 - sampled at 1 hr, 4 hrs, 18 hrs, 24 hrs after each trial
- Ticks were marked and released at each interval
 - At both transects

Results: Residential Habitat



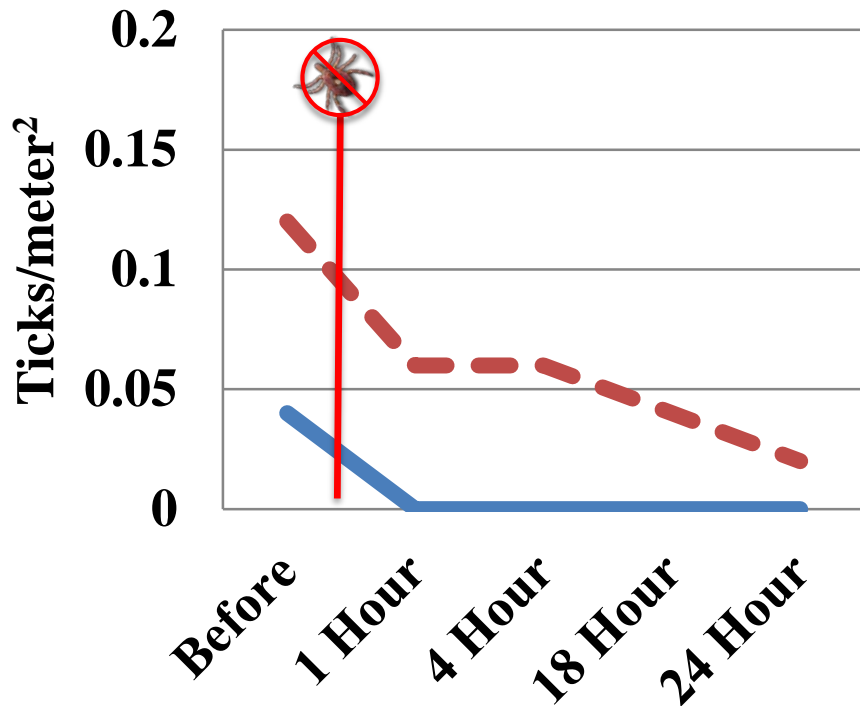
**Residential Habitat: Solid CO₂ 1 hour
(6/6/2016 - 6/10/2016)**



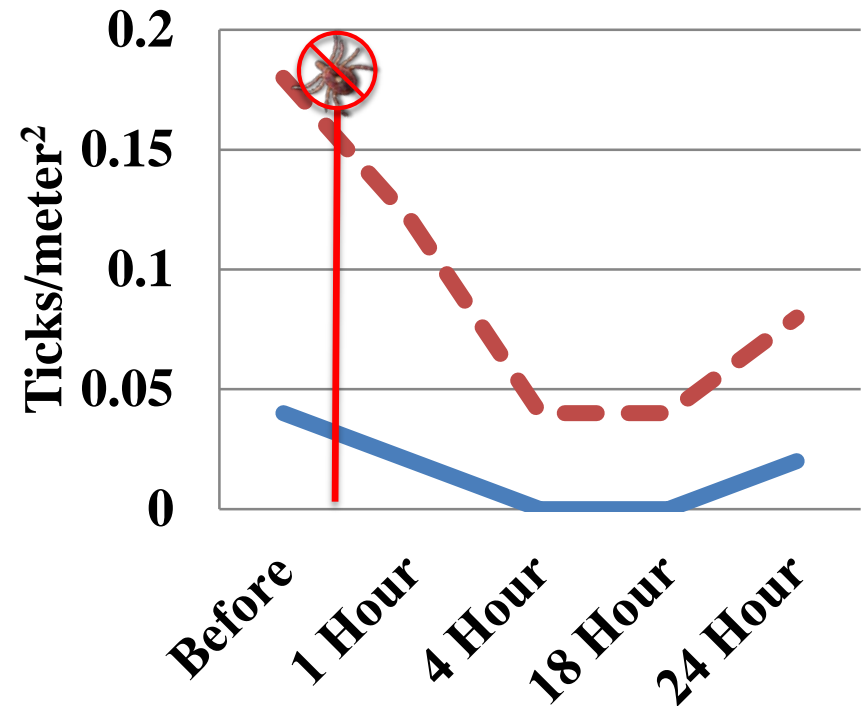
Results: Solid vs. Gaseous CO₂



**Wildlife Preserve:
Solid CO₂ 30 minutes
(6/14/16 - 6/16/16)**



**Wildlife Preserve:
Gaseous CO₂ 30 minutes
(6/14/16 - 6/16/16)**



Conclusions



- TickBot reduced potential tick encounters in both residential and wildlife habitats for 24 hours
- Solid CO₂ was shown to be as effective as gaseous CO₂ in attracting ticks to TickBot

Future studies

- TickBot efficacy in *Ixodes scapularis* habitat
 - Vector of the causative agent of Lyme Disease
 - Differs behaviorally to *Amblyomma americanum*



Acknowledgements



- TickBot Team: Armin Bahrani, Sean Campbell, Alex Suarez, Laura Bitzer
- Collaborative effort with Virginia Military Institute
- Grad students: Lindsey Bidder, Allyn Bryan, Alexandra Cumbie
- Faculty: Wayne Hynes, David Gauthier, Eric Walters, Daniel Sonenshine
- Hoffler Creek Wildlife Preserve & Dr. Eric Walters for use of field sites
- And the tireless effort of more than 40 undergrad lab assistants





Thank you!



Questions?

Like us on Facebook!!! "Tick Lab at ODU"

