



Deer Ticks ...*One bite can  
change your life...*



## Massachusetts Association of Public Health Nurses

April 14, 2016

**Larry Dapsis**

Deer Tick Project Coordinator - Entomologist

[www.capecodextension.org](http://www.capecodextension.org)

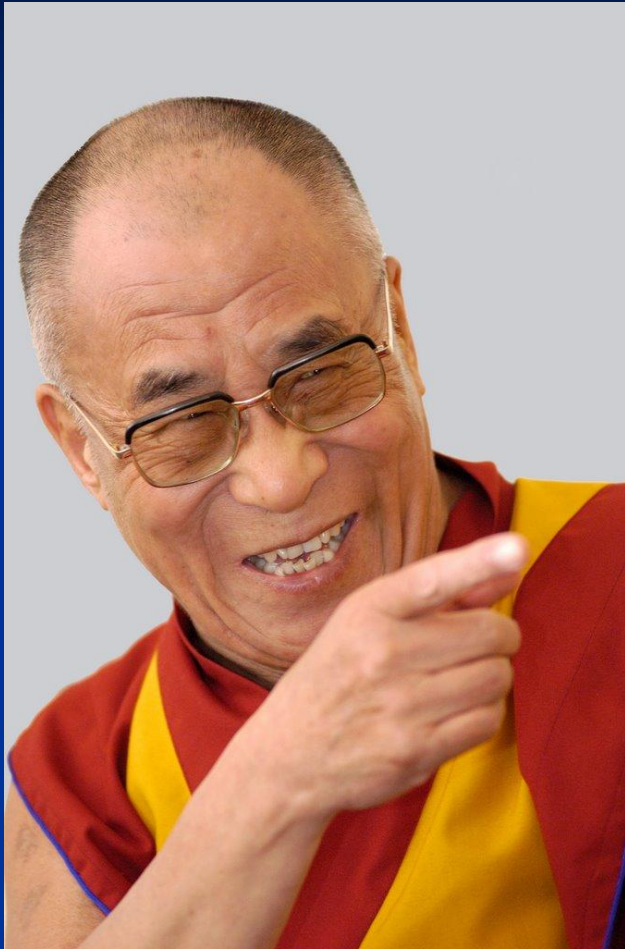
508-375-6642



# Ticks have NO friends...

- The Dalai Lama
- *"I love everything in the world...except for ticks..."*





“Actually, NFL Commissioner Roger Goodell is TIED with ticks on my list of the unworthy...”

# Incidence Rate Lyme: 2014

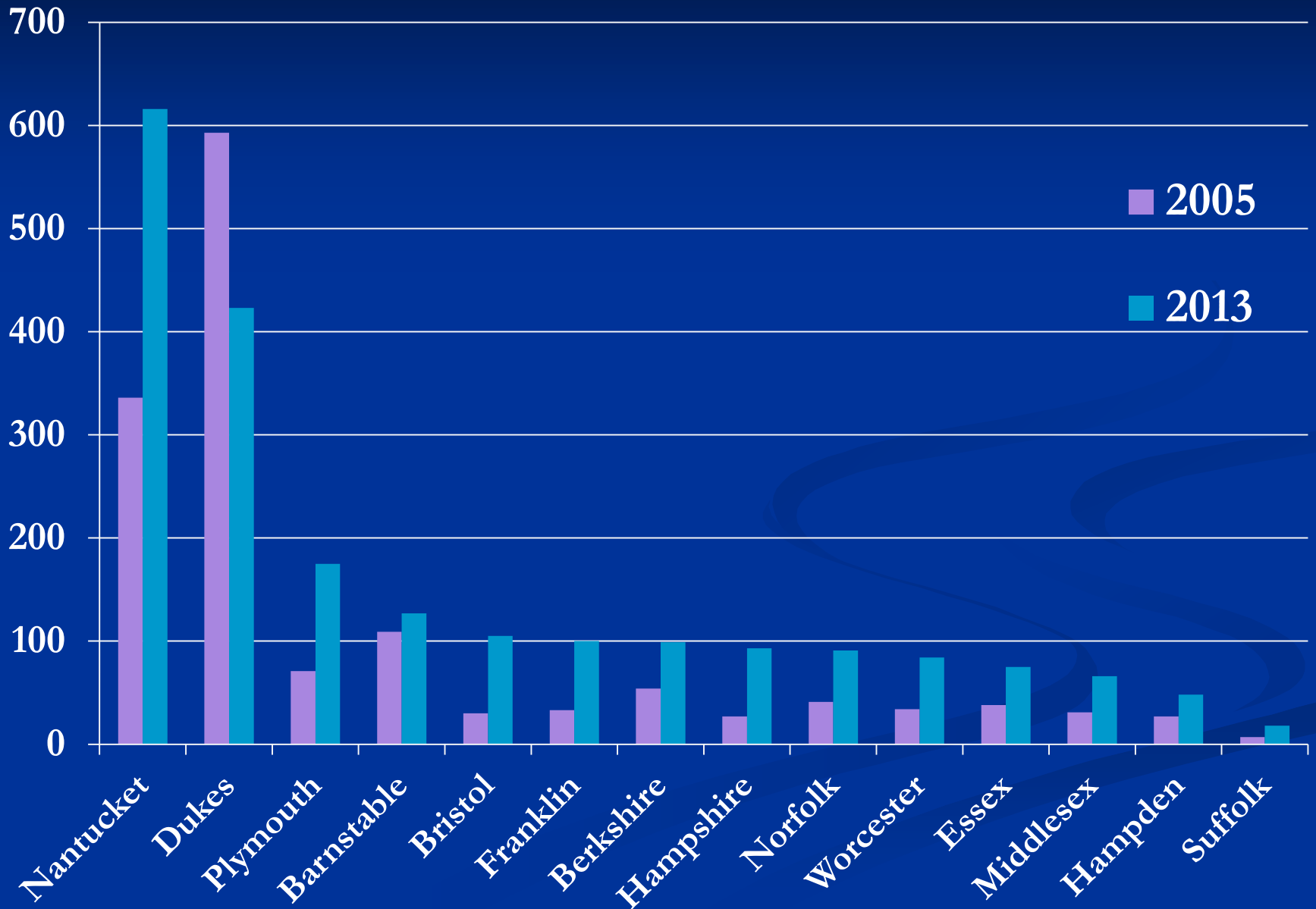
## *State Ranking*



<b>1 – Maine</b>	<b>88*</b>
<b>2 – Vermont</b>	<b>71</b>
<b>3 – Massachusetts</b>	<b>54</b>
<b>4 – Rhode Island</b>	<b>54</b>
<b>5 – Pennsylvania</b>	<b>51</b>
<b>6 – Connecticut</b>	<b>48</b>
<b>7 – New Hampshire</b>	<b>47</b>
<b>U.S.</b>	<b>8</b>

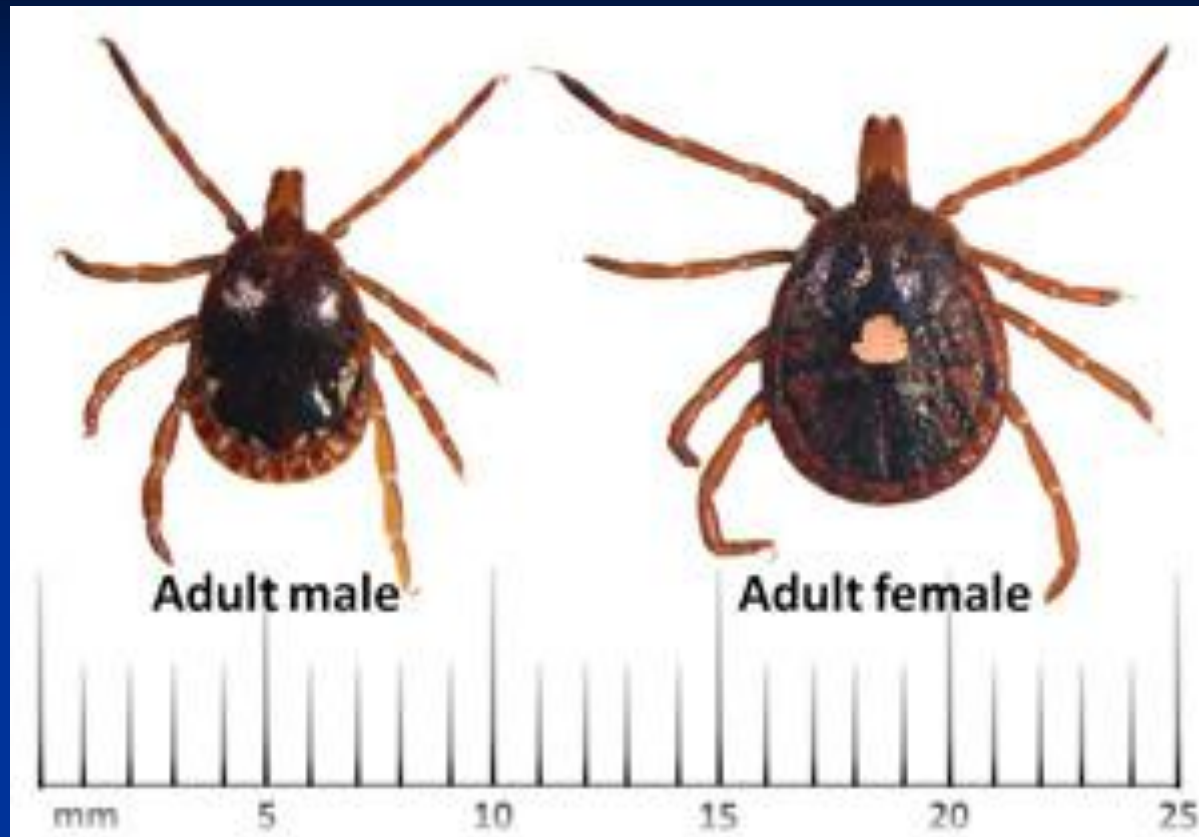
**\* Confirmed cases  
Per 100,000**

# 2005/2013 - MA Lyme Incidence per 100,000





**American Dog Tick**  
***Dermacentor variabilis***



**Lone Star Tick**  
***Amblyomma americanum***



- **Cuttyhunk & Naushon Islands**
- **Sandy Neck, West Barnstable**



# Lone Star Tick

- ***Aggressive*** biter

- Erlichiosis
- STARI\*
- *Falmouth*
- Tularemia



**Bite can trigger allergy to red meat consumption**

**Beef, Pork, Lamb and by-products...gelatin**

# Deer Tick, or Blacklegged Tick





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# Journal of Medical Entomology



2016 Smith, R. & F. Wesson

*New tick species discovered on Cape Cod,  
Massachusetts: Risk Assessment*

*Dierdris  
carnivororous*



# Massachusetts Winters: *Kill Ticks???*



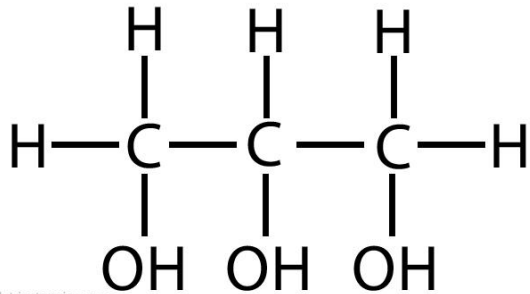
*A Wisconsin*  
❄️❄️❄️❄️❄️❄️  
**Winter**



OCTOBER 1, 2011

*The Lyme disease spirochete feasts on tick  
antifreeze*

Glycerol (Glycerin)



Glycerol prevents ice crystal formation in cells

Lyme bacteria use glycerol as a carbon (= energy)  
source

# BE INFORMED

TICK-BORNE DISEASES ARE PREVENTABLE

# HOW TO SUBMIT A TICK FOR TESTING

TICK-BORNE DISEASES ARE PREVENTABLE

# DON'T LET ONE BITE CHANGE YOUR LIFE

TICK-BORNE DISEASES ARE PREVENTABLE

## An Ounce of Prevention

There are ways to protect yourself and your family. Tick checks are important, and consider repellents: Deet-based for exposed skin and Permethrin-based for clothing including footwear. Visit [www.tickcounter.org/exposure](http://www.tickcounter.org/exposure) to learn more.

## Once Bitten, Don't Be Shy

Prompt removal of an attached tick is highly recommended. The longer the tick is attached the higher the risk of disease transmission. Check yourself, your family, and pets often.

## Lyme Isn't the Only Concern

Lyme disease is the most prevalent vector-borne infectious disease in the U.S., but ticks carry other pathogens as well. Anaplasmosis, Babesiosis, and Relapsing Fever are also important and increasing. Visit our website [www.capecodextension.org](http://www.capecodextension.org) to learn more.



[www.TickReport.com](http://www.TickReport.com)

The Laboratory of Medical Zoology (LMZ) tests thousands of ticks from all over the country. Having your tick tested couldn't be easier. Just follow five simple steps:

1. Place the tick in a sealable plastic bag.
2. Complete the online submission form at [www.TickReport.com](http://www.TickReport.com). Pay the \$15 fee online with a credit card or enclose a check.
3. Label the bag with the order number assigned by TickReport.
4. Send the labeled tick in an envelope to:  
*Laboratory of Medical Zoology  
Fernald Hall, University of Massachusetts  
270 Stockbridge Rd.  
Amherst, MA 01003*
5. Results of the tick test will be sent to you in 5 business days or less.

**Cape Cod Tick Testing Program**

**2016**

**\$15**

[www.TickReport.com](http://www.TickReport.com)

Tests for these agents carried by deer ticks:

**Lyme  
Babesiosis  
Anaplasmosis  
Relapsing Fever**



Submit Online Form



Mail Tick



Receive Results

Cape Cod Cooperative Extension  
Larry Dapsis, Entomologist  
[ldapsis@barnstablecounty.org](mailto:ldapsis@barnstablecounty.org)

Funding provided by  
Cape Cod Healthcare



CAPE COD HEALTHCARE

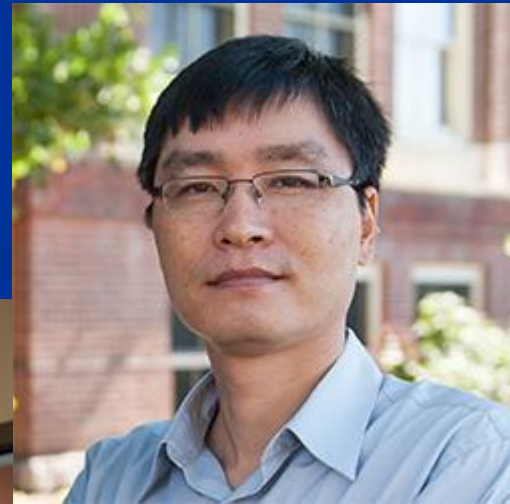


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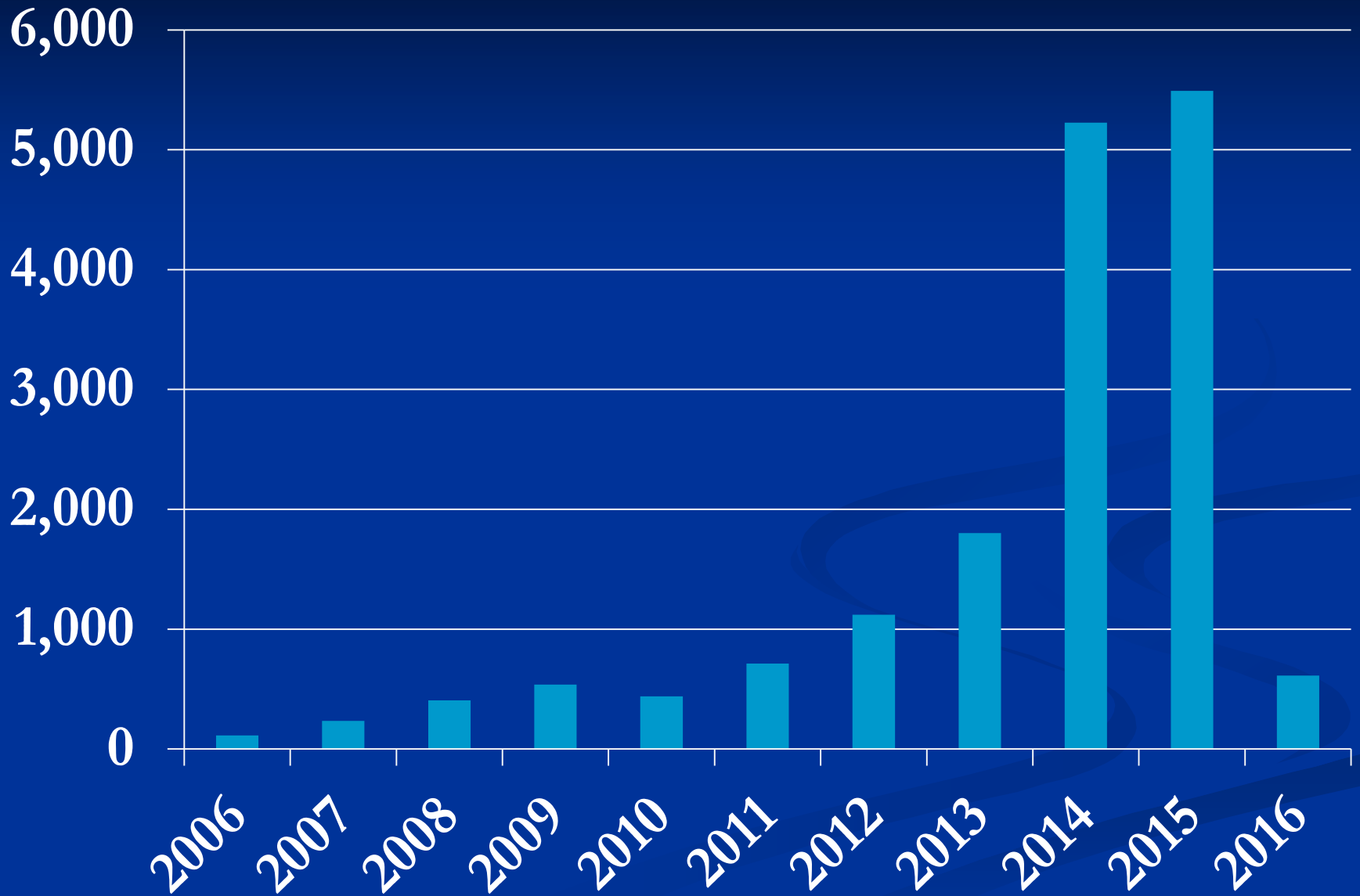


LABORATORY OF MEDICAL ZOOLOGY





# LMZ Tick Testing



# Massachusetts 2015 – 2016

# 2,324 Tests

<u>Pathogen</u>	<u>Total Tested</u>	<u>Total Positive</u>	<b>% Positive</b>
Borrelia burgdorferi	4,673	1,378	<b>29.49%</b>
Anaplasma	4,673	335	<b>7.17%</b>
Babesia microti	4,673	217	<b>4.64%</b>
Bartonella	44	0	<b>0%</b>
Borrelia miyamotoi	4,673	76	<b>1.63%</b>
Borrelia mayonii	212	0	<b>0%</b>

Tests Ordered			
Pathogen	Date Ordered		Result
Borrelia mayonii	4/6/2016		<b>NEGATIVE</b>
Borrelia burgdorferi	3/30/2016		<b>POSITIVE</b>
Anaplasma	3/30/2016		<b>NEGATIVE</b>
Babesia	3/30/2016		<b>POSITIVE</b>
Borrelia miyamotoi	3/30/2016		<b>NEGATIVE</b>

**Patient Information:**  
**Host Source:** human  
**Gender:** male  
**Age:** 3  
**City:** Norwell  
**State:** MA  
**Zip:** 02061  
**Attached:** Yes  
**Site of Attachment:** Head  
**Rash Present:** No

### Tick Information

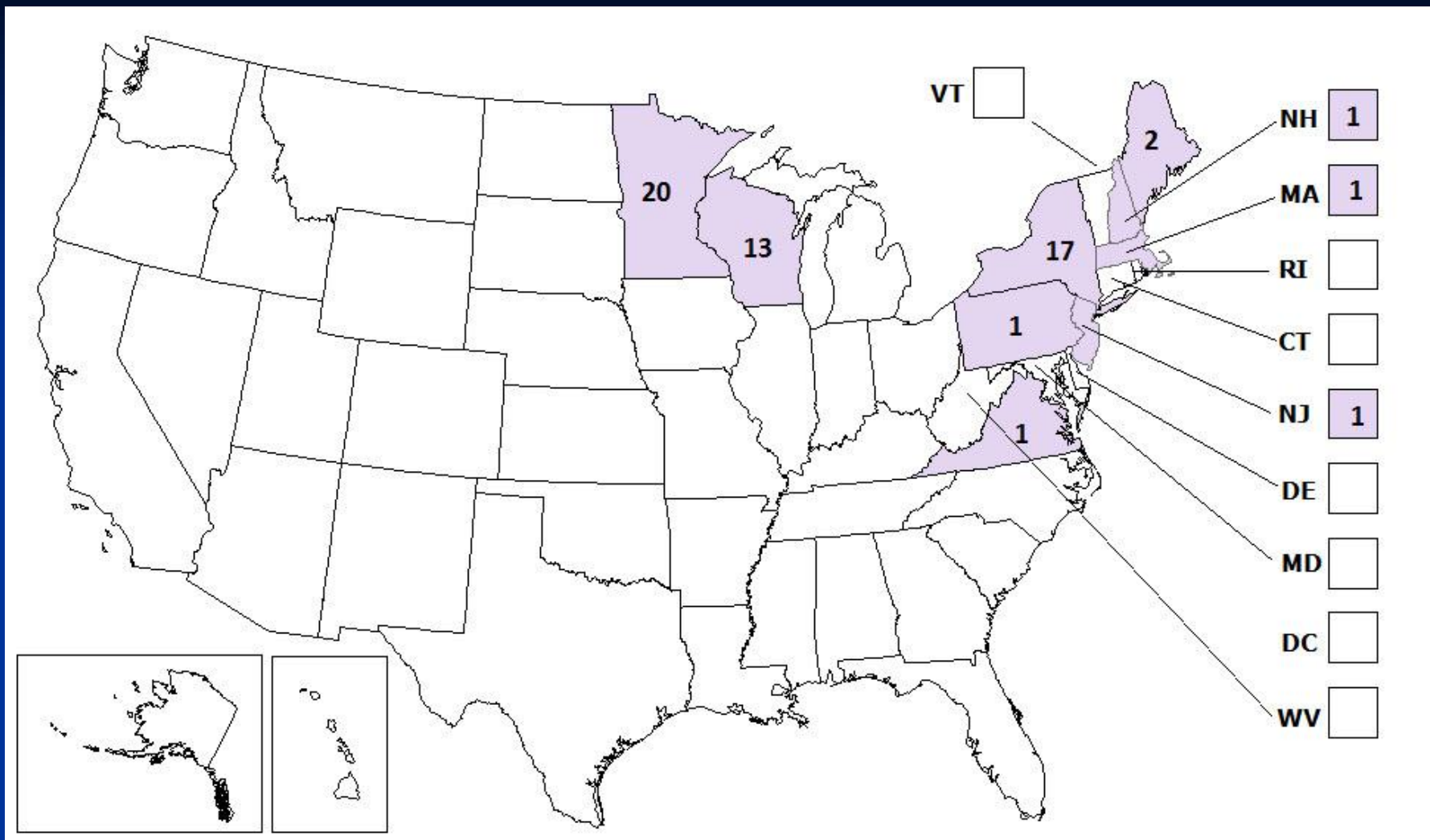
**Species:** *Ixodes scapularis*

**Sex:** female

**Stage:** adult

**Feeding State:** engorged





# Powassan Virus – 2004 to 2013 CDC

# Powassan Massachusetts, 2013- September, 2015

- 7 cases (5 confirmed, 2 probable)
- Residents of:
  - Barnstable*, Essex, Middlesex and Norfolk counties
- Exposure occurred in Massachusetts
- Month of onset
  - May, June, September and October
- Encephalitis requiring hospitalization
  - No fatalities

# Powassan Surveillance LMZ - 2016



© 2016 Google  
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Image Landsat

Google earth

# Phase 1 Game Plan- Protect Yourself





# Protect Yourself

- Long pants - tucked into socks
- Light colors...easier to see ticks
- Tumble-dry clothes for 20 minutes



- Shoes



- Deet, Picaridan, IR3535, Oil of Lemon Eucalyptus to treat exposed skin



- “All Natural”?



- FIFRA Section 25(c) Minimum Risk Pesticides
  - Active Ingredient List
  - Claims Linking Pest to Specific Diseases – NO
  - False or Misleading Statements – i.e. “Chemical Free”
  
- EPA Registration Exemption
  - Performance Data NOT Required
  
  - Note: Some actives ID'd as known human allergens  
Negative interaction observed with  
sunscreens

# Tick Repellent Clothing – Permethrin



Fabric only...Active thru 6 washings

## Brands

- *Ben's*
- *Coleman*
- *Sawyer*



**Note, Permethrin is an insecticide that repels and kills ticks. Read the Label...**

# Pre-treated Tick Repellent Clothing



- Proprietary process to bond permethrin to fabric...
- Many brands...one supplier
- 70 Washings EPA Claim

Or, send clothing to Insect Shield for treatment



Climate  
change.

## **In Hot Pursuit:**

# What We are Learning About Mosquito and Tick Abundance on Cape Cod



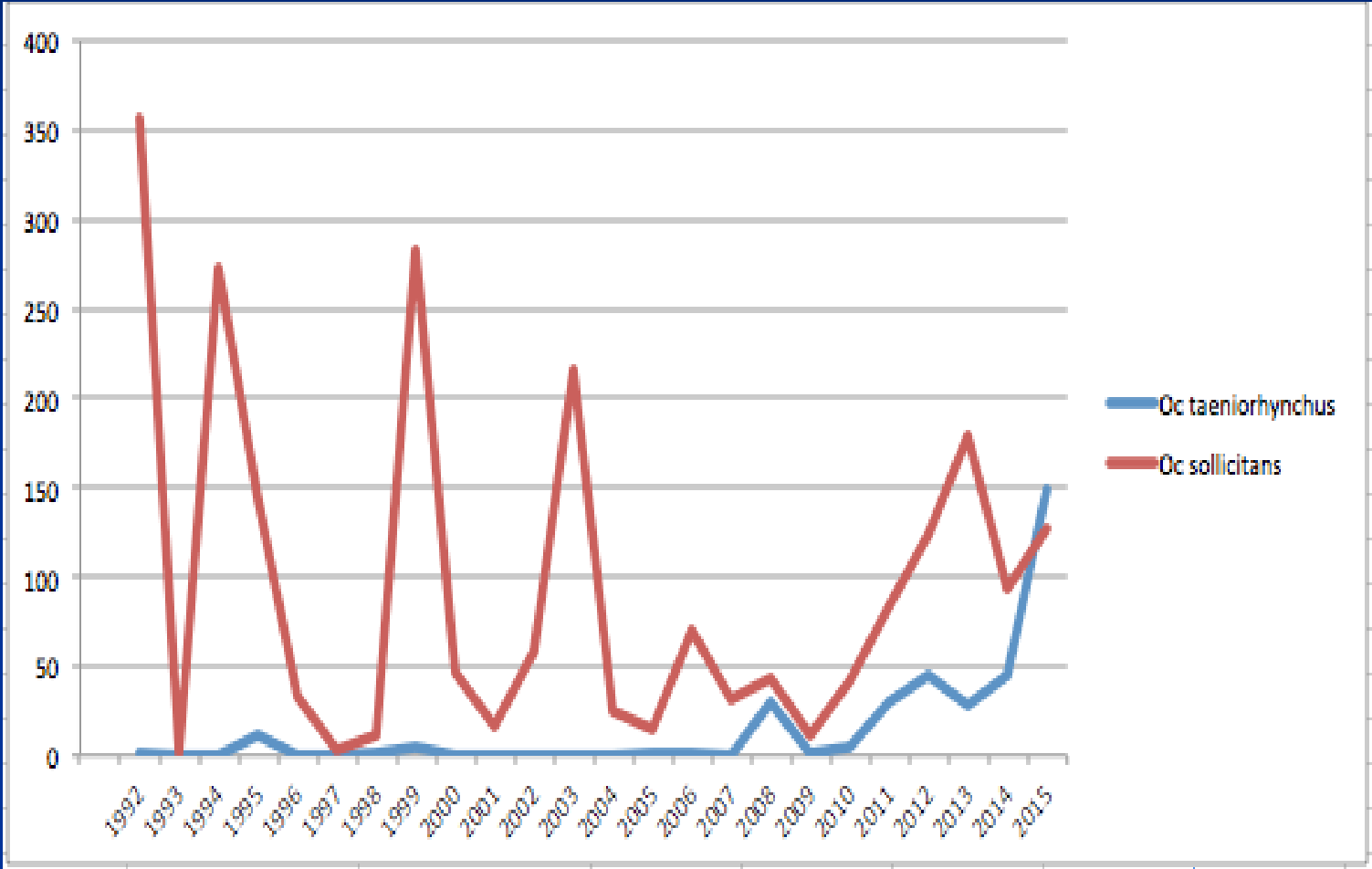
**Larry Dapsis**

**Cape Cod Cooperative Extension**

**Gabrielle Sakolsky**

**Cape Cod Mosquito Control**

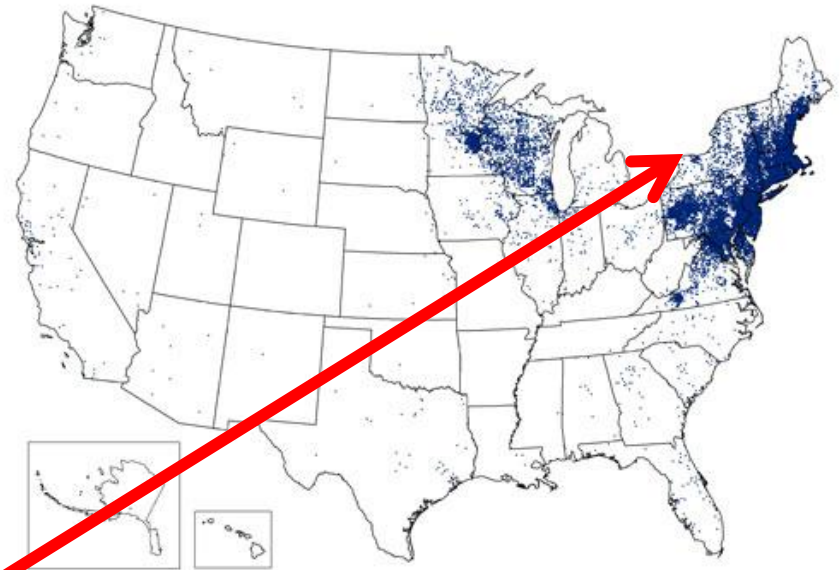
# Number of Mosquitoes - Trapping



Year



Reported Cases of Lyme Disease -- United States, 2012



1 dot placed randomly within county of residence for each confirmed case

Reported Cases of Lyme Disease -- United States, 2001

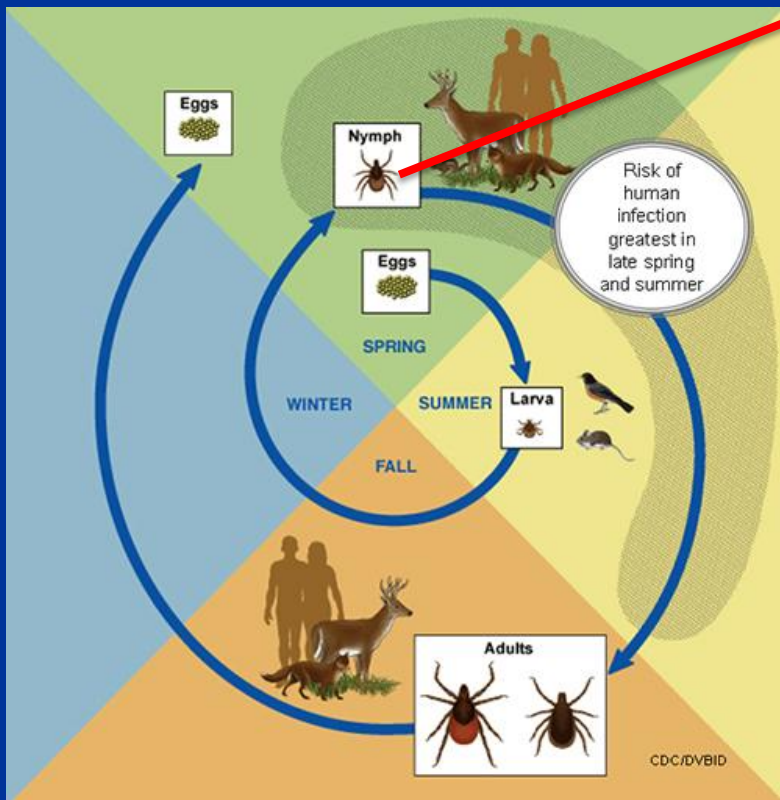
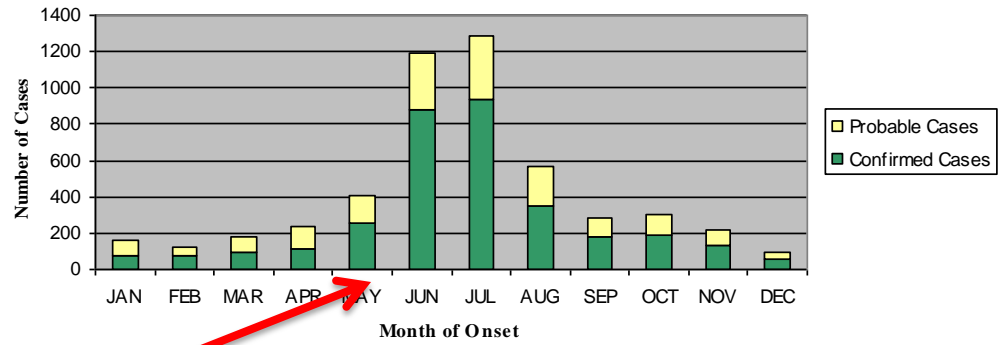


1 dot placed randomly within county of residence for each reported case

## Range Expansion

- Host Animal Dispersal
- Degree Days above base 0 C

Number of Confirmed and Probable Lyme Disease Cases Reported in Massachusetts by Month of Onset, 2012



# Climate Change and Tick Abundance/Survival

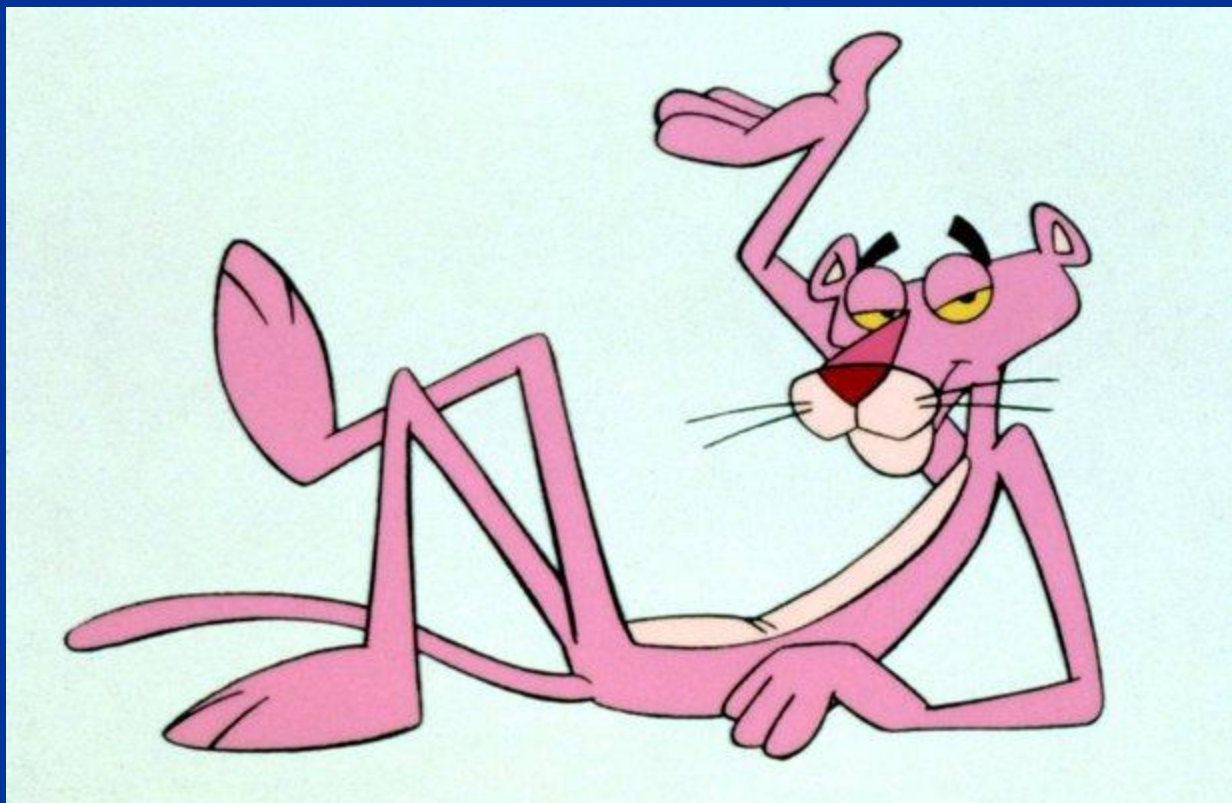
## ■ Macroclimate

- Overall precipitation/drought measurements inconsistently related to tick populations

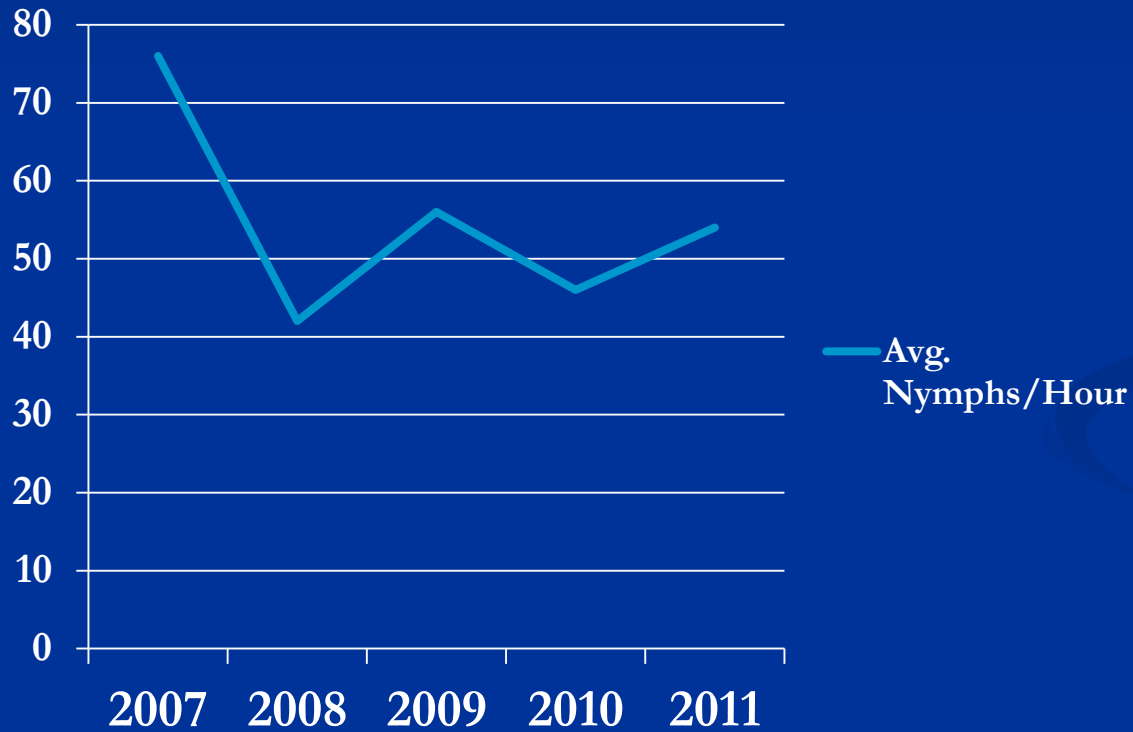
## ■ Microclimate

- RH measurements within leaf litter habitat provided a more accurate prediction of nymph stage tick abundance (Berger et al. 2014)

Questions?



# Deer Tick Sampling – Cape & Islands



<b>Pathogen</b>	<b>Total Tested</b>	<b>Total Positive</b>	<b>% Positive</b>
<b>Borrelia burgdorferi</b>	<b>8,305</b>	<b>2,655</b>	<b>31.97%</b>
<b>Anaplasma</b>	<b>7,636</b>	<b>402</b>	<b>5.26%</b>
<b>Babesia</b>	<b>7,644</b>	<b>359</b>	<b>4.70%</b>
<b>Bartonella</b>	<b>76</b>	<b>0</b>	<b>0%</b>
<b>Borrelia miyamotoi</b>	<b>2,856</b>	<b>85</b>	<b>2.98%</b>
<b>Borrelia mayonii</b>	<b>97</b>	<b>0</b>	<b>0%</b>

**Massachusetts Deer Tick Database, 2006 - 2016**



February 15, 2016

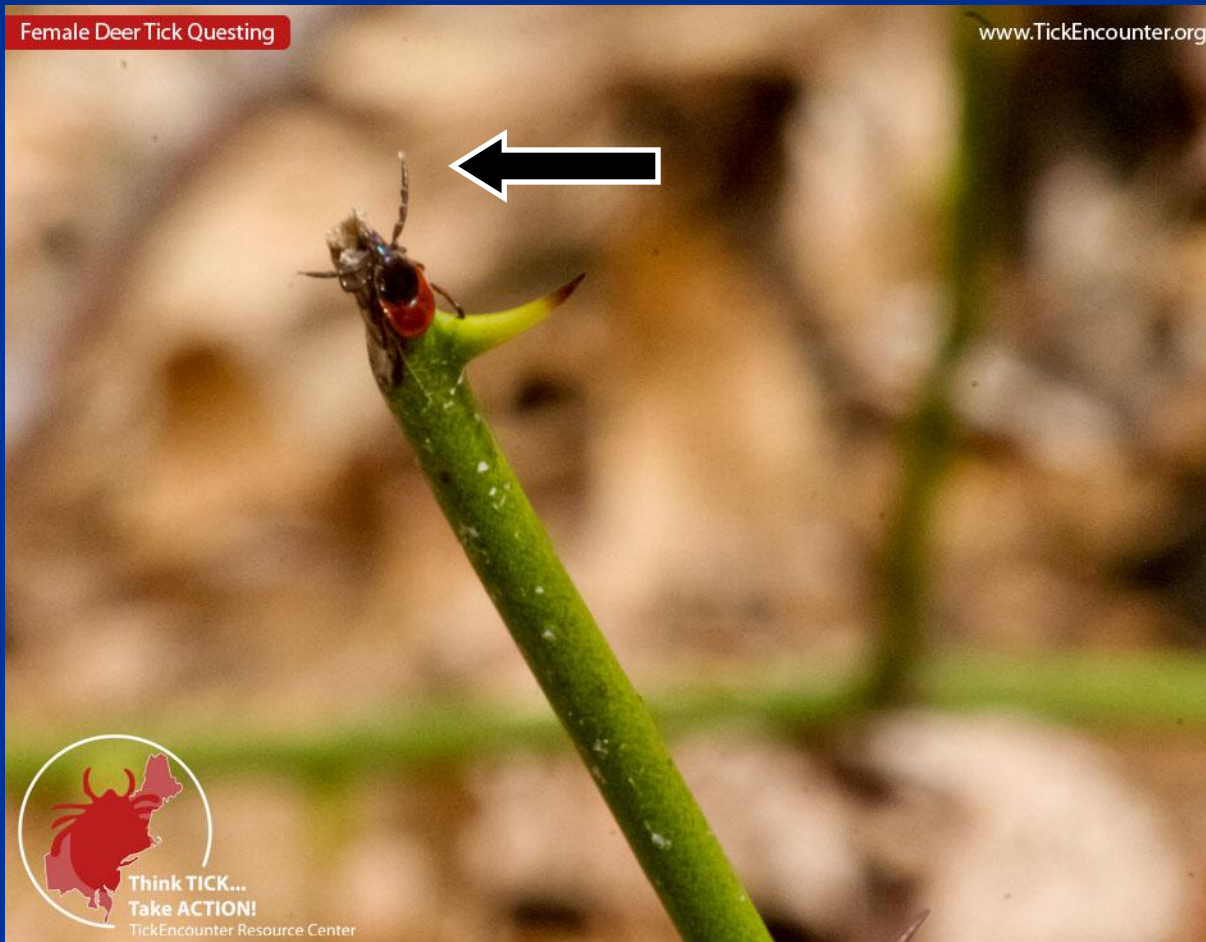
## A New Culprit in Lyme Disease



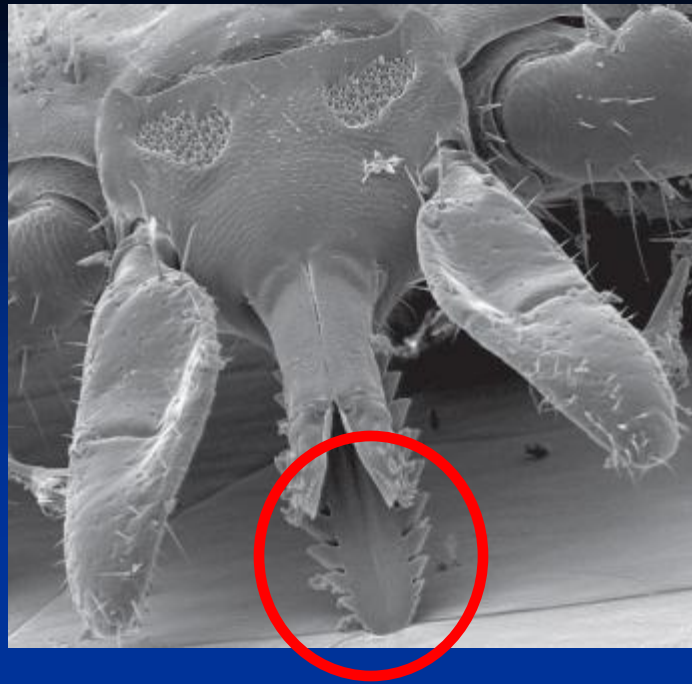
*Borrelia mayoinii*

# Tick Ambush Behavior – Questing

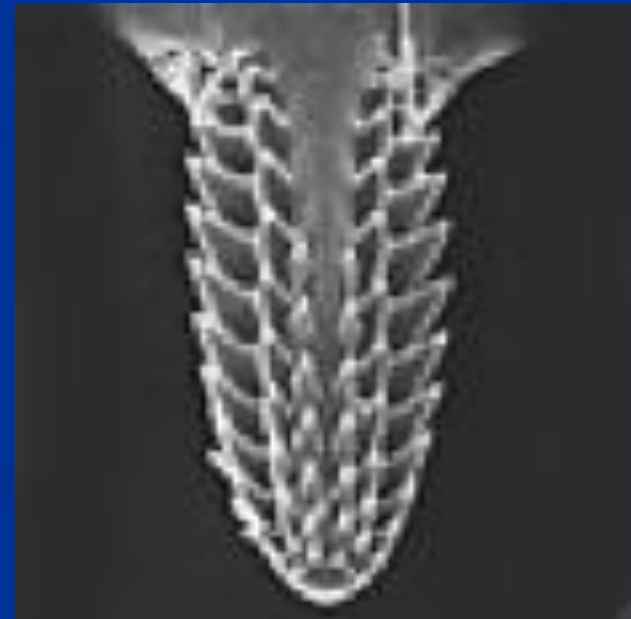
...Designed to latch onto any creature that brushes up against it







***Ticks are designed to stay a while...***



# About hosts...

125 vertebrate species play in the tick-disease ecosystem...

Rodents are important infective hosts – Mice are extremely “competent”, as are chipmunks

Birds play a role

Hosts that are “incompetent”  
are important for supporting tick numbers

# Risk of infection is year round, but the greatest risk...

is **NOT** the tick adults

Fall thru Spring, 50% infected

Bite more likely to be detected

...it's from the nymph stage

Late May into August, 25%  
infected

Bite is *difficult to detect*



# Tick SIZE WISE ? check your bagels

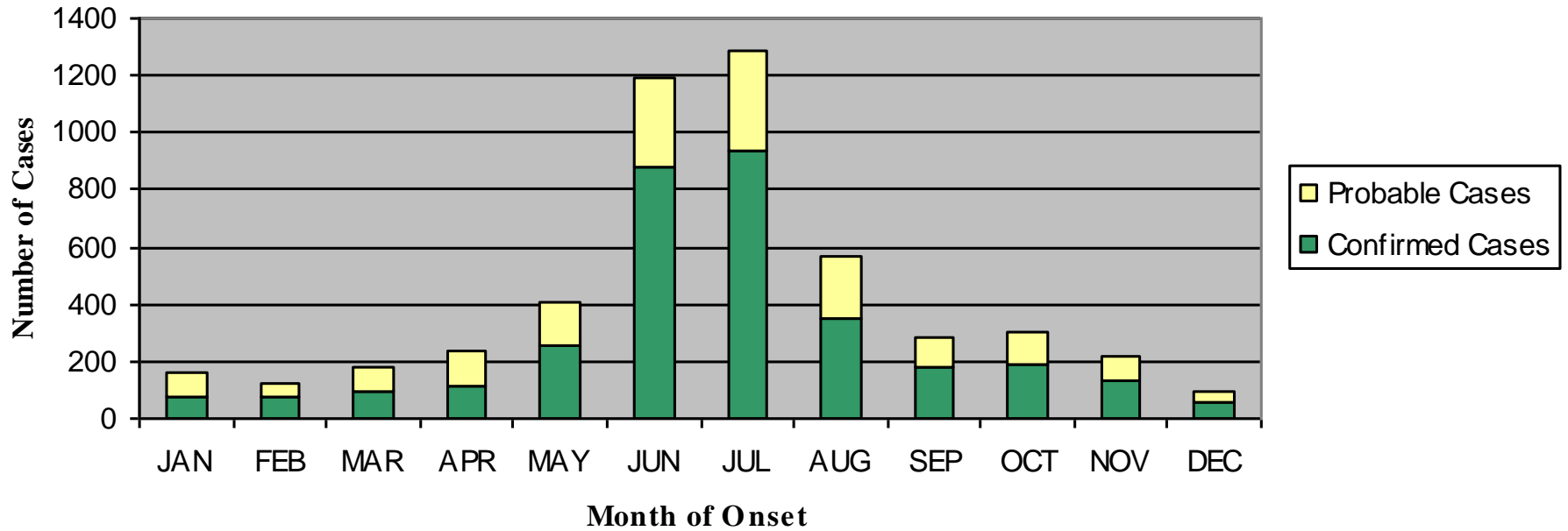
**Adult – Sesame Seed  
Sized**



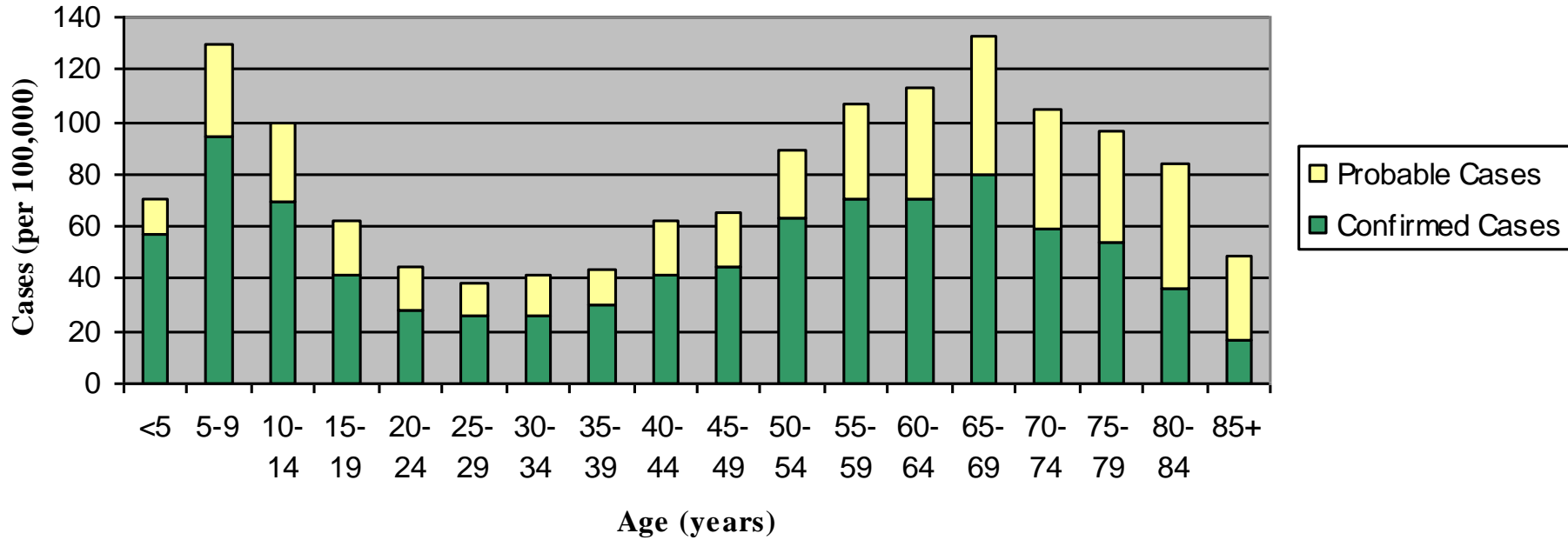
**Nymph - Poppy  
Seed Sized**



## Number of Confirmed and Probable Lyme Disease Cases Reported in Massachusetts by Month of Onset, 2012



## Incidence Rates of Confirmed and Probable Lyme Disease Cases in Massachusetts, by Age Group, 2012



“Upon further examination the complexity of this problem continues to grow....”



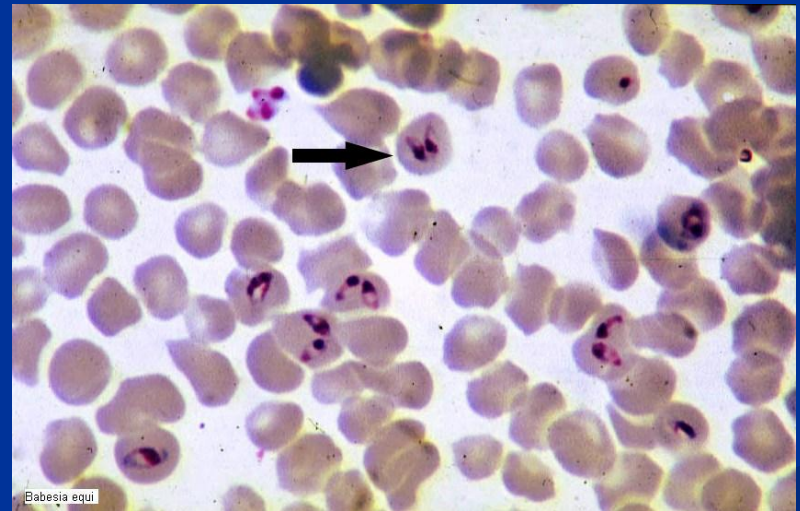
# Other Diseases Transmitted by Deer Ticks

## ○ Babesiosis

- Invades Red Blood Cells (malaria-like)

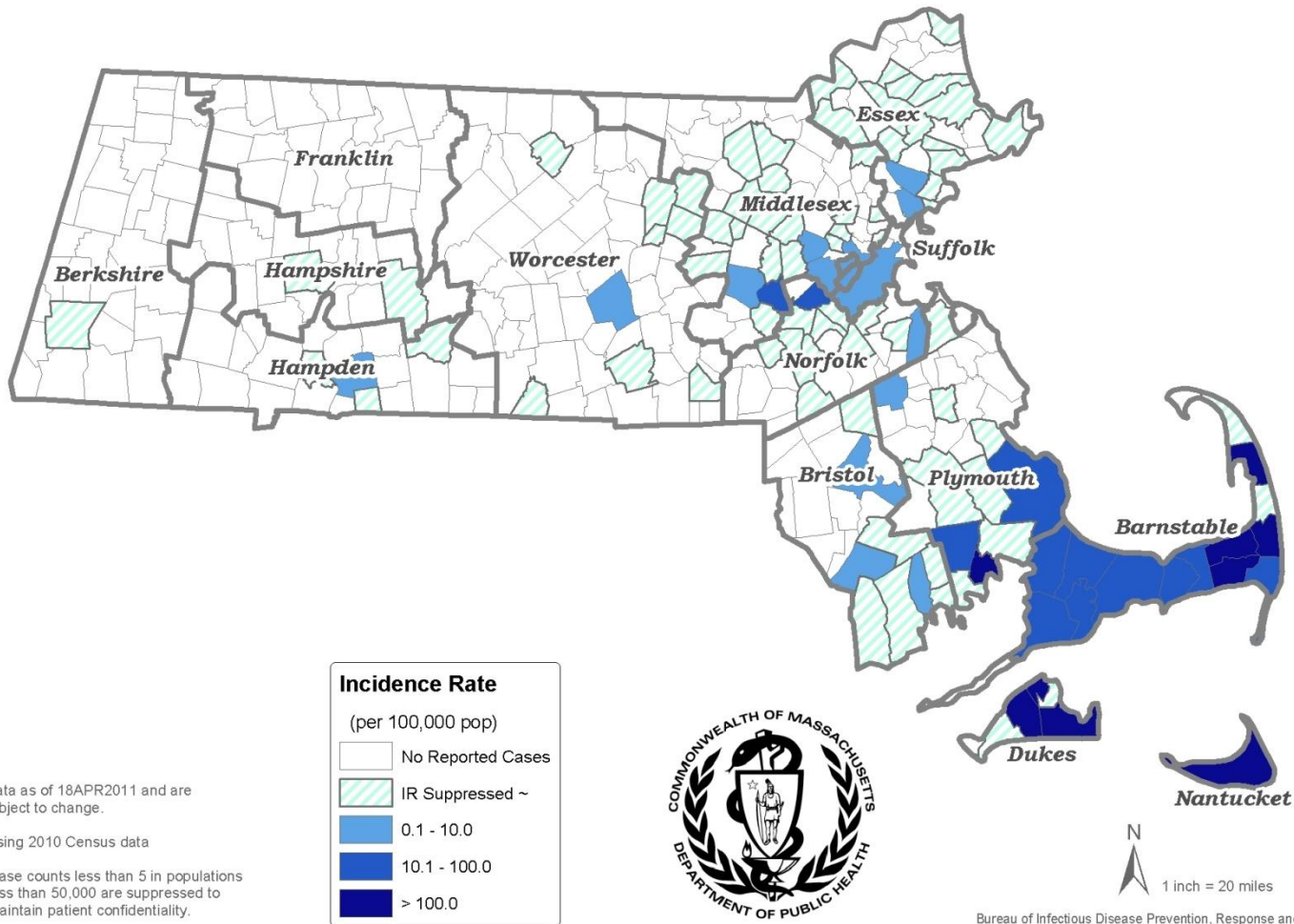
- Symptoms include fever/chills, severe anemia

- Blood Transfusion





Incidence Rates (per 100,000 population<sup>^</sup>) for Confirmed Babesiosis in Massachusetts: 2007-2011\*



\* Data as of 18APR2011 and are subject to change.

<sup>^</sup> Using 2010 Census data

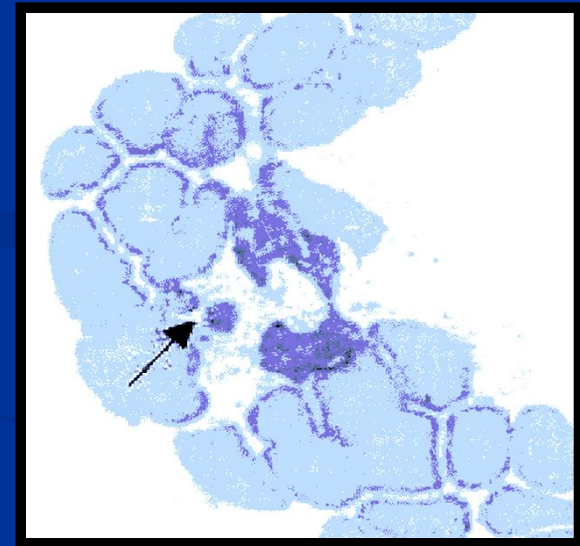
~ Case counts less than 5 in populations less than 50,000 are suppressed to maintain patient confidentiality.



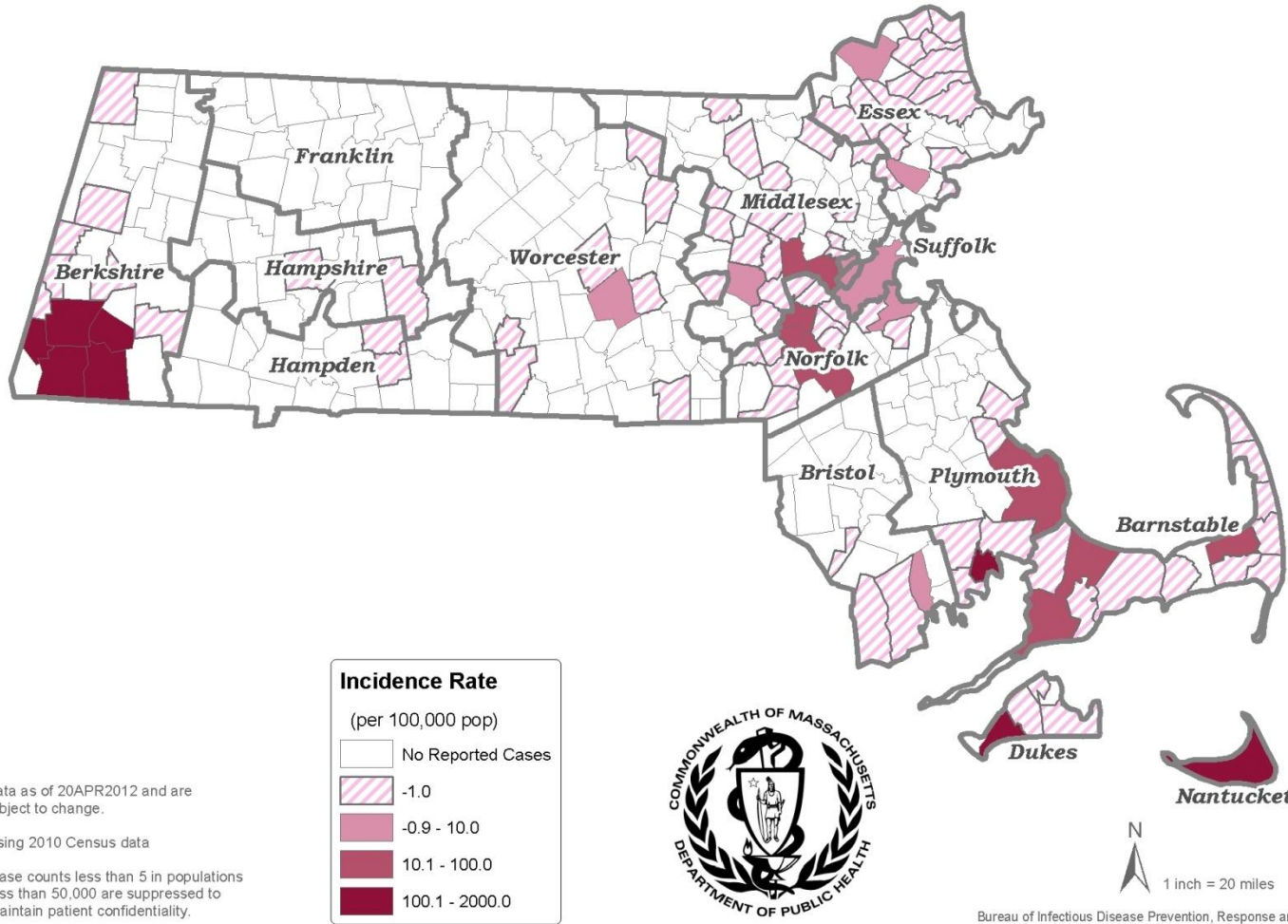
Bureau of Infectious Disease Prevention, Response and Services  
Office of Integrated Surveillance & Informatics Services

# Other Diseases Transmitted by Deer Ticks

- **Anaplasmosis (HGA)**
  - Invades White Blood Cells
  - Symptoms include fever, nausea, headache, muscle pain, abdominal pain, confusion...



# Incidence Rates (per 100,000 population<sup>^</sup>) for Confirmed Anaplasmosis in Massachusetts: 2007-2011\*



\* Data as of 20APR2012 and are subject to change.

<sup>^</sup> Using 2010 Census data

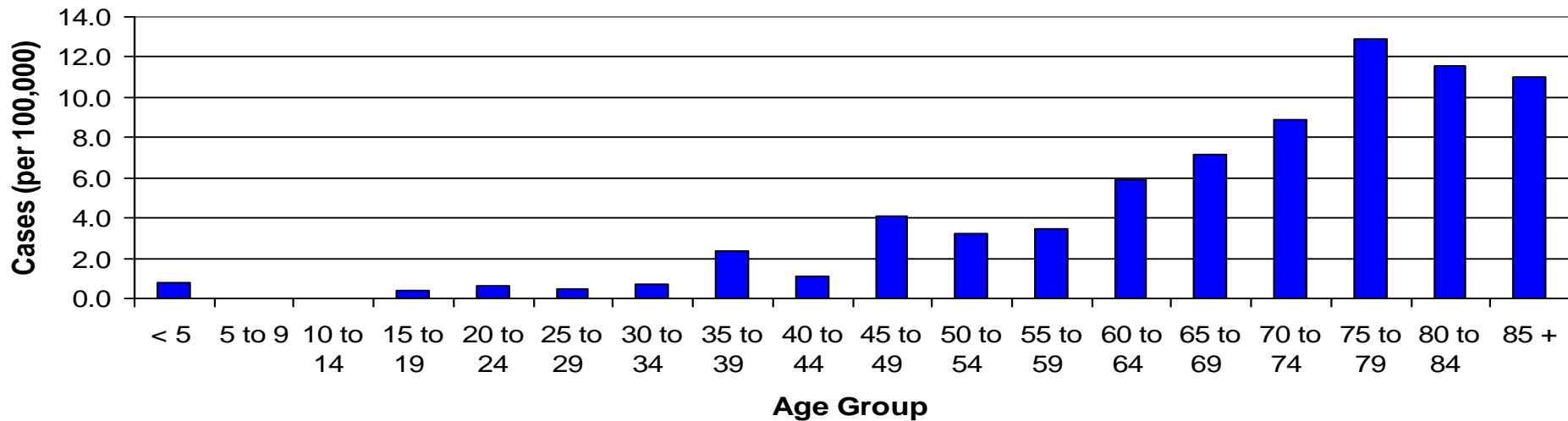
~ Case counts less than 5 in populations less than 50,000 are suppressed to maintain patient confidentiality.



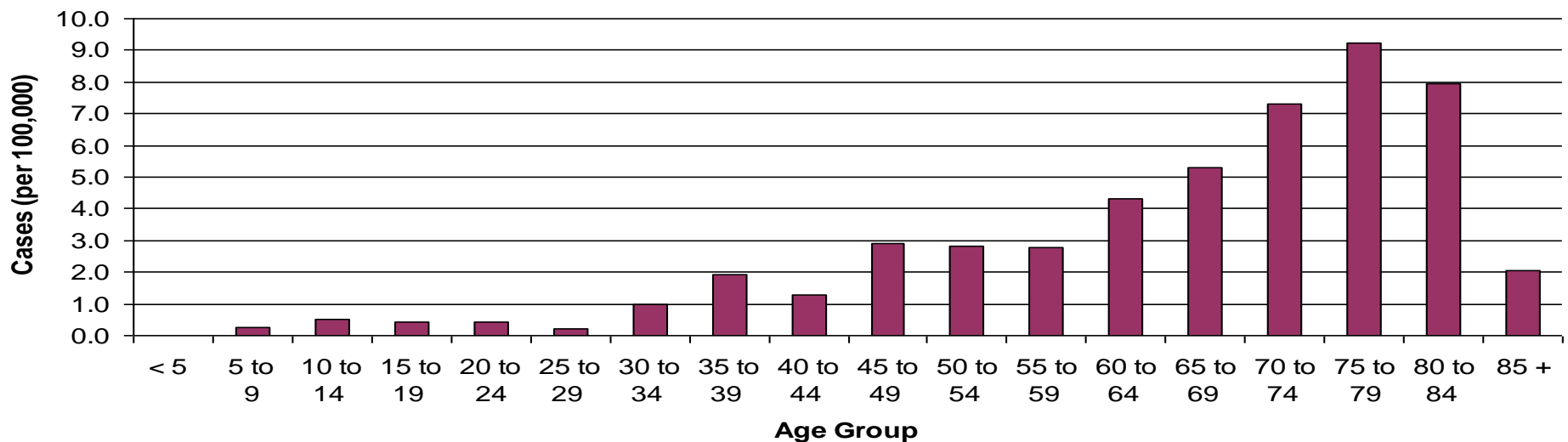
1 inch = 20 miles

Bureau of Infectious Disease Prevention, Response and Services  
Office of Integrated Surveillance & Informatics Services

### Incidence Rate of Confirmed Babesiosis Cases in Massachusetts, by Age Group, 2011

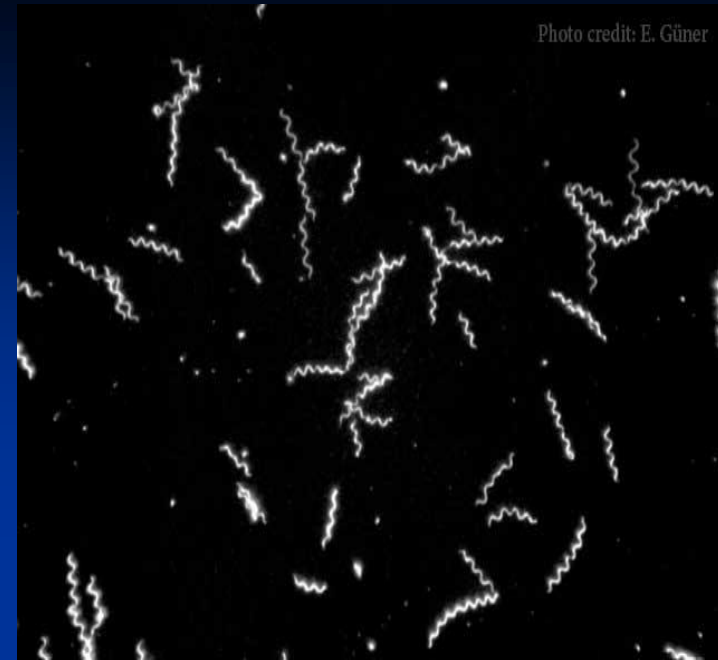


### Incidence Rate of Confirmed HGA Cases Reported in Massachusetts, by Age Range, 2011



# *Borrelia miyamotoi*

- **Known for 10 years**
- **First linkage to human disease in 2012 – Russia**
- **U.S. cases followed...Relapsing Fever**
  - **Misdiagnosed as Anaplasmosis**
- **Found in 1% of ticks collected on Cape & Islands - 2014**

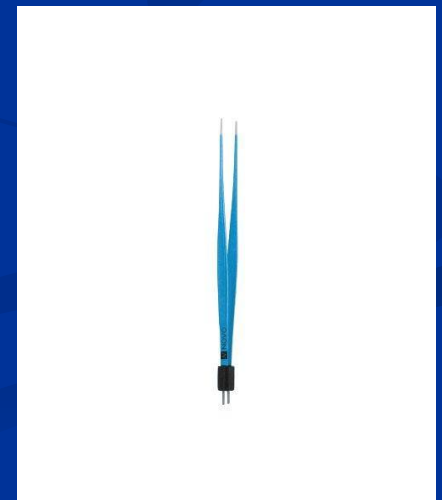


# Phase 1 Game Plan- Protect Yourself



# Phase 1 Game Plan- Protect Yourself

- Proper Tweezers
- Proper Removal
- Record Date...Save Tick
  
- Infection Test Available
  - Laboratory of Medical Zoology...UMass-Amherst
  - [www.TickReport.com](http://www.TickReport.com)



# Permethrin Facts

- 2,250 times more toxic to ticks than humans
- EPA: Reasonable certainty that permethrin-treated clothing poses no harm to infants, children or pregnant women
- Low skin absorption...metabolized quickly
- Exposure data also studied by National Academy of Sciences
- Also used for scabies and head lice control



# Phase 2 Game Plan - Protect Your Yard

- Wildlife and habitat management ????
- Perimeter sprays effective  
...NOT the entire yard  
Consider all “edges”



# Phase 3 Game Plan - Protect Your Pets

- Tick check
- Products such as K9 Advantix II, Frontline
- Seresto collars
- Vaccine available for dogs



# Don't Let...*one bite can change your life...*

## Simplified Game Plan Summary

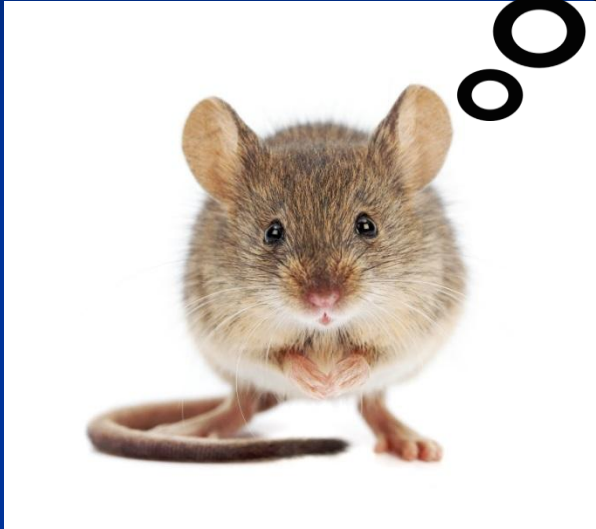
- Tick Checks and Use of Permethrin-Treated Clothing
- Perimeter Yard Spray
- Pet Protection





Acorns!...Wicked  
Cool !!!

**US** **BIOLOGIC**



Mice become  
vaccinated against  
Lyme bacteria



Tick infection rate  
reduced by 76%  
after five-years...



# Damminix Tubes – Eco-Health, Inc.



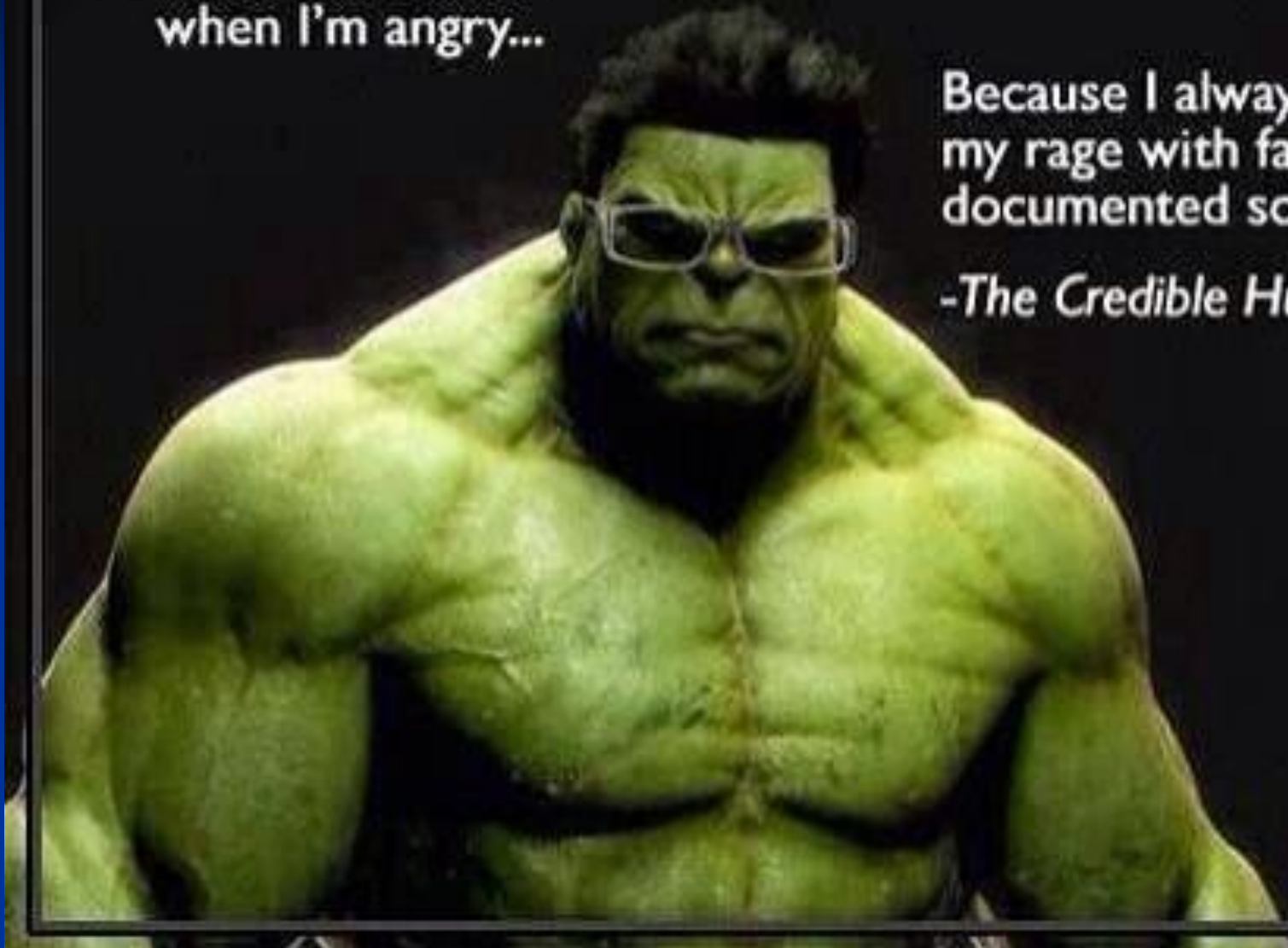
# Damminix Tubes

- Several initial university studies looked promising
  - Fewer ticks on mice
- Follow-up studies, NY & CT
  - Replicated, multi-year
  - No significant effect on nymph tick populations
    - ...not all tick-carrying animals take cotton
- Company website – testimonial driven, no baseline data in company trial

You wouldn't like me  
when I'm angry...

Because I always back up  
my rage with facts and  
documented sources.

*-The Credible Hulk*









**TCS – Tick Box Technology Corporation**

**- Mice, chipmunks, meadow voles**

**CDC**

**– 500 Households 2012 – 2015**

**- Final Report Pending**



# CAUTION!

## DEER TICK HABITAT

### APPROXIMATE ACTUAL SIZES



Nymph

Female

Male

Deer ticks can carry the pathogens that cause Lyme Disease, Babesiosis, and Anaplasmosis.  
Nymphs are active May-August.  
Adults are active September-May.



### PREVENTION TIPS

- Stay on the trail.
- Wear shoes, not sandals.
- Repellents recommended:
  - DEET on exposed skin
  - Permethrin on clothing and footwear
- After outdoor activities, check yourself, your children, and your pets for ticks. Place clothes in the dryer for 20 minutes.

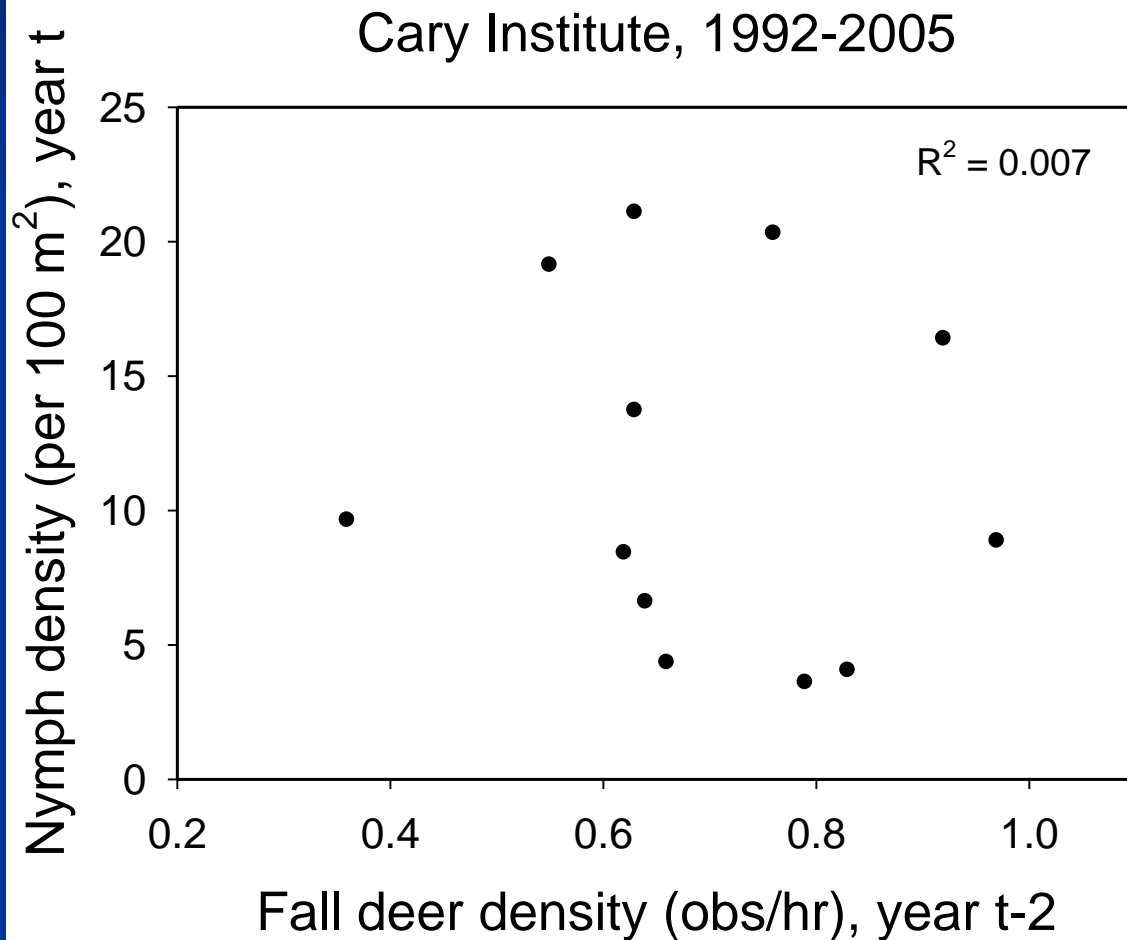
**DON'T LET**  **ONE BITE** *CHANGE YOUR LIFE*

**TICK-BORNE DISEASES ARE PREVENTABLE**

CAPE COD COOPERATIVE EXTENSION  
[www.capecodextension.org](http://www.capecodextension.org)

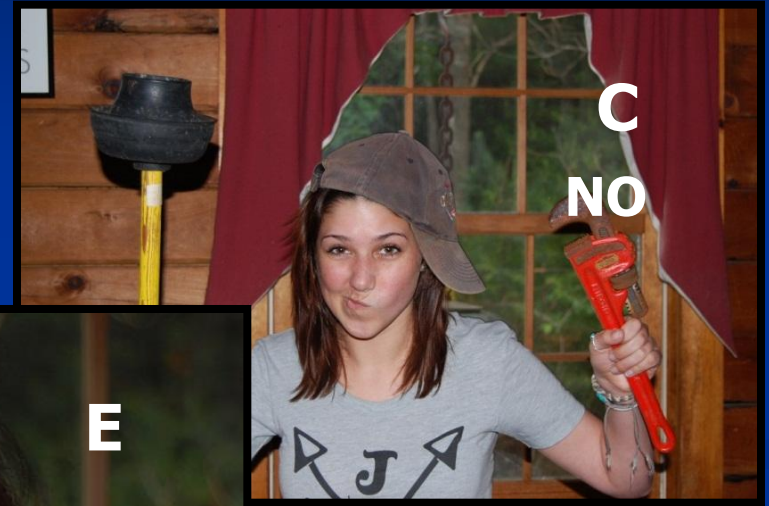


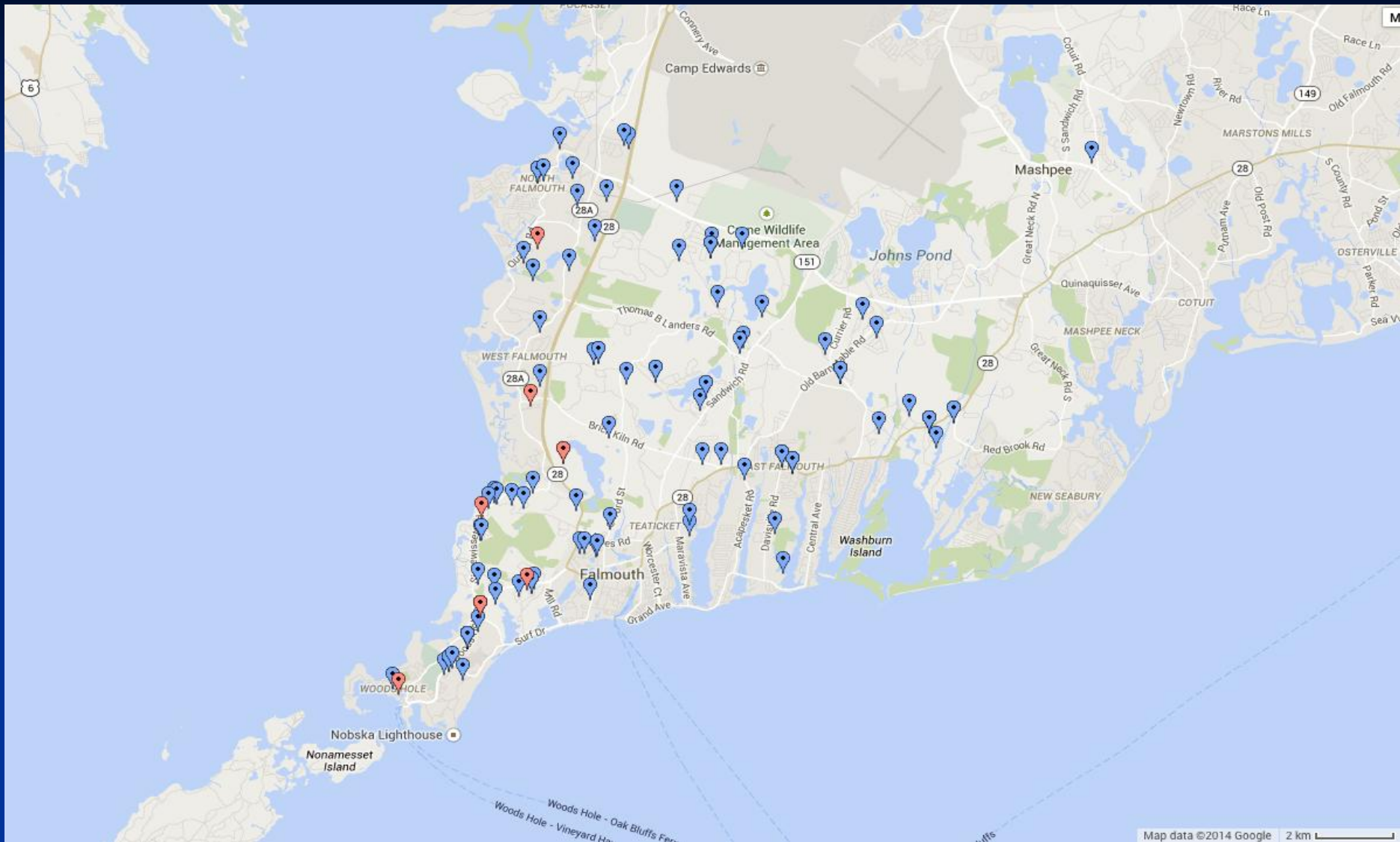
Funding support provided by  CAPE COD HEALTHCARE



# Protect Yourself

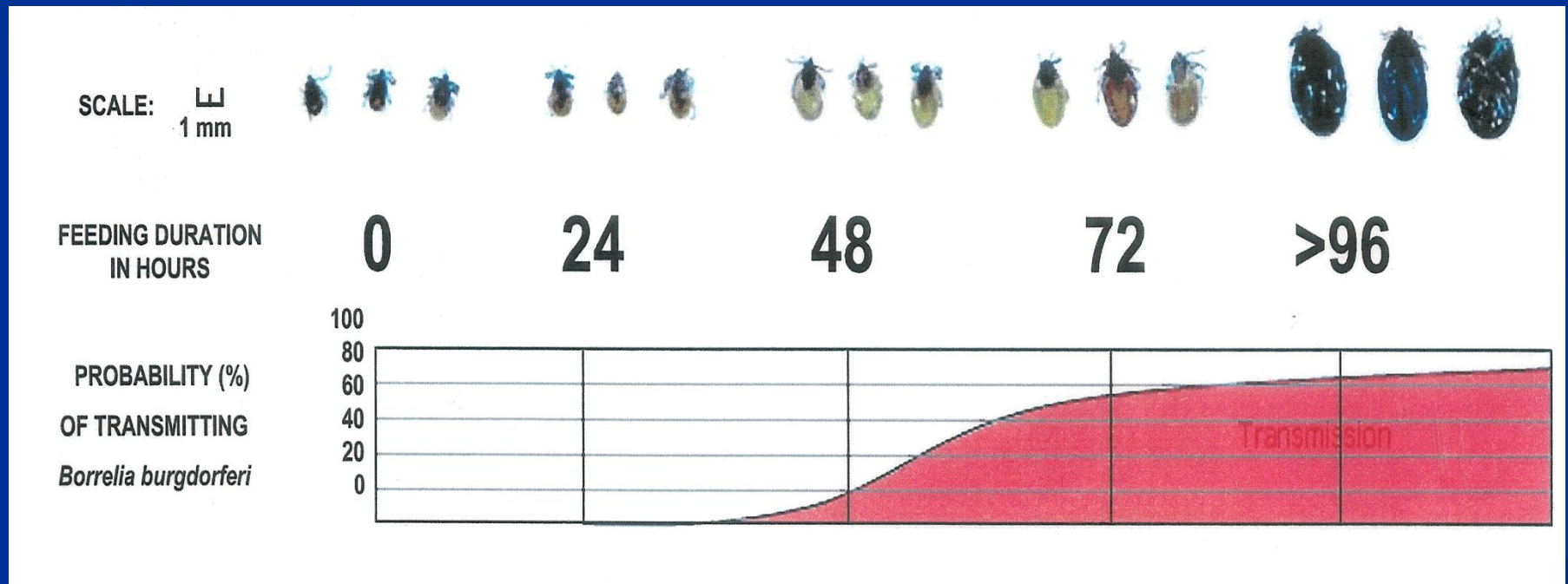
- Tick Checks...Choose Proper tool for removing an attached tick





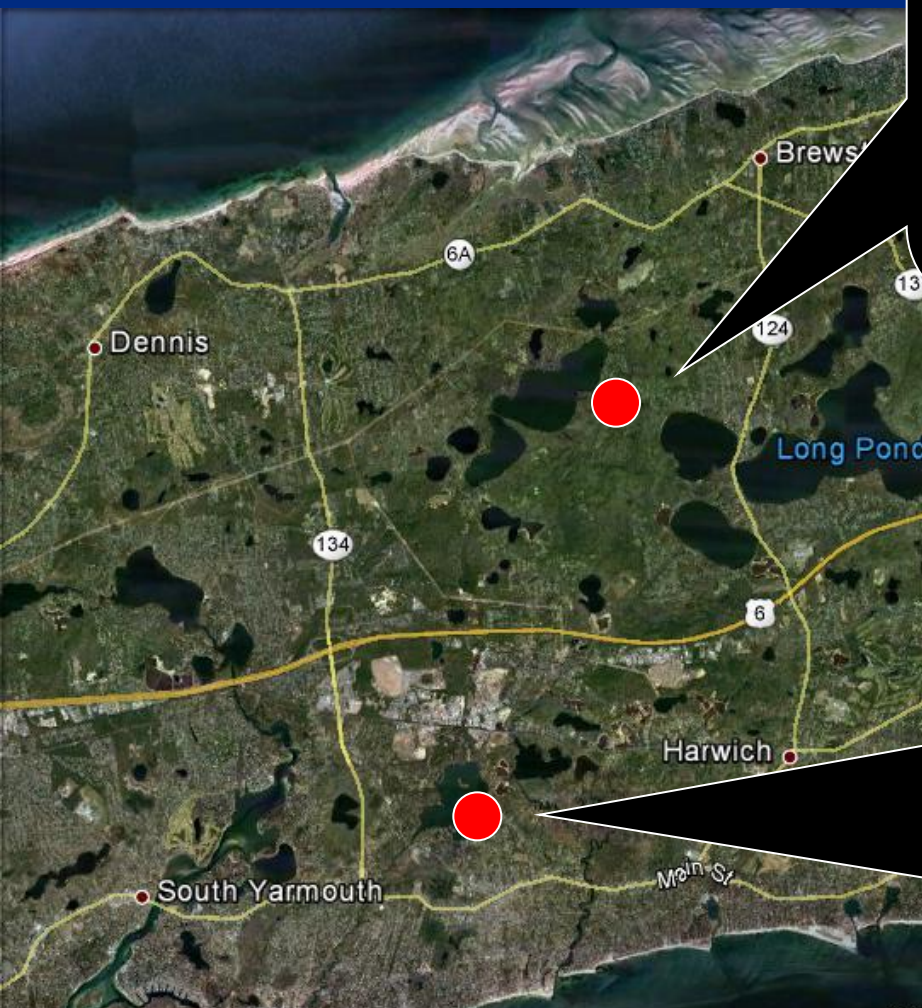
**2014 – Falmouth *Babesia* infected ticks**

# Lyme Disease Transmission is Not Immediate



**24 Hour "Rule" ...for Lyme**

# Nymph Stage Tick Infection



## Punkhorn Conservation % Bor-Bab-Ana

<b>2013</b>	<b>28</b>	<b>12</b>	<b>0</b>
<b>2012</b>	<b>20</b>	<b>20</b>	<b>2</b>
<b>2011</b>	<b>22</b>	<b>20</b>	<b>0</b>
<b>2010</b>	<b>47</b>	<b>13</b>	<b>8</b>

## Bells Neck Conservation % Bor-Bab-Ana

<b>2013</b>	<b>20</b>	<b>12</b>	<b>4</b>
<b>2012</b>	<b>32</b>	<b>22</b>	<b>9</b>
<b>2011</b>	<b>23</b>	<b>20</b>	<b>0</b>
<b>2010</b>	<b>27</b>	<b>0</b>	<b>5</b>



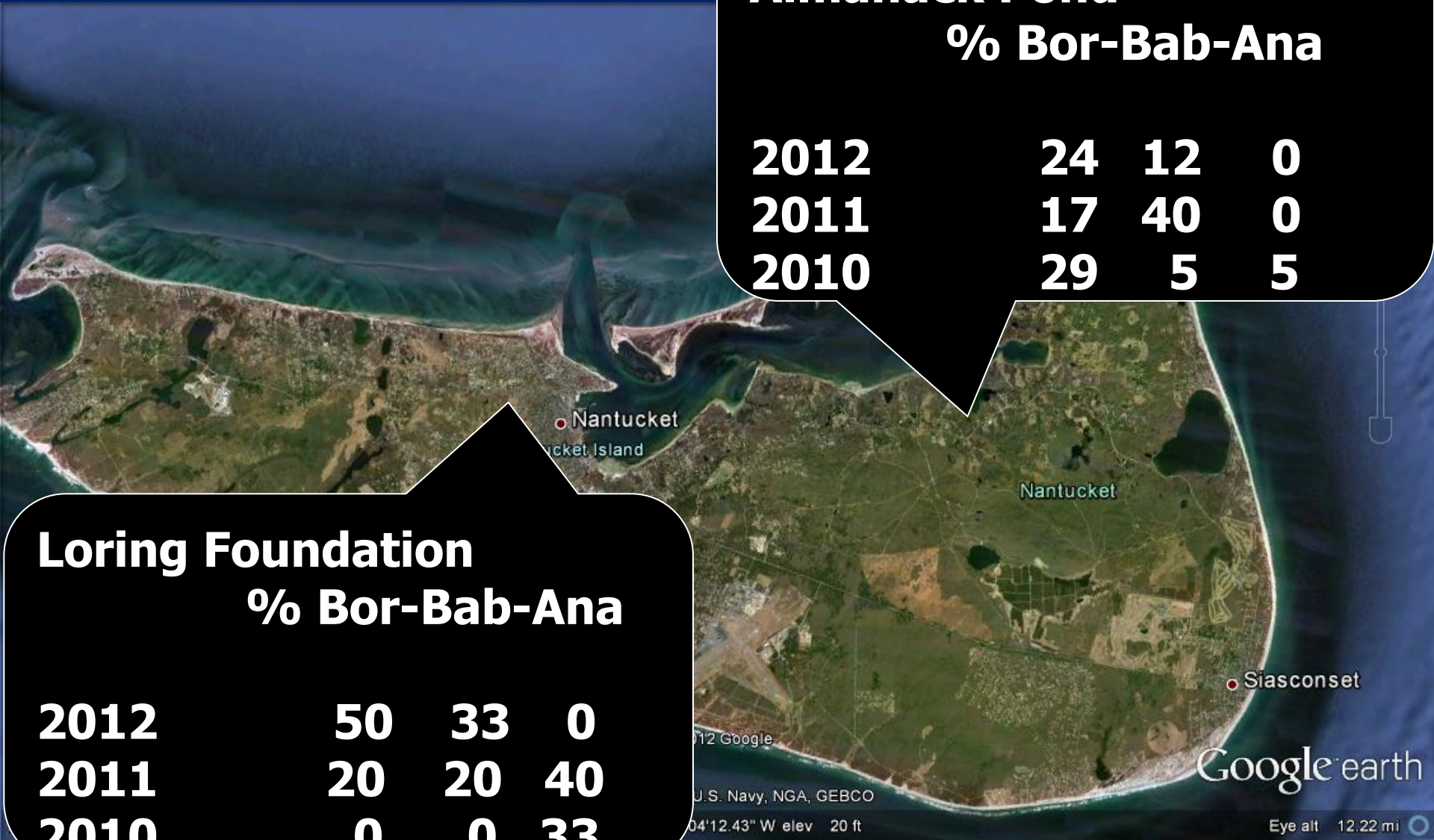
# Nymph Stage Tick Infection

## Almanack Pond % Bor-Bab-Ana

<b>2012</b>	<b>24</b>	<b>12</b>	<b>0</b>
<b>2011</b>	<b>17</b>	<b>40</b>	<b>0</b>
<b>2010</b>	<b>29</b>	<b>5</b>	<b>5</b>

## Loring Foundation % Bor-Bab-Ana

<b>2012</b>	<b>50</b>	<b>33</b>	<b>0</b>
<b>2011</b>	<b>20</b>	<b>20</b>	<b>40</b>
<b>2010</b>	<b>0</b>	<b>0</b>	<b>33</b>



# Nymph Stage Tick Infection

## Jehu Pond Conservation

### % Bor-Bab-Ana

<b>2013</b>	<b>21</b>	<b>21</b>	<b>4</b>
<b>2012</b>	<b>19</b>	<b>4</b>	<b>8</b>
<b>2011</b>	<b>11</b>	<b>20</b>	<b>30</b>
<b>2010</b>	<b>13</b>	<b>0</b>	<b>7</b>



**Average Co-infection all sites/years: 8%**

# Nymph Stage Tick Infection

## Burgess Conservation

### % Bor-Bab-Ana

**2013**

**2012**

**2011**

**2010**

**4**

**0**

**0**

**0**

**0**

**0**

**9**

**0**

**18**



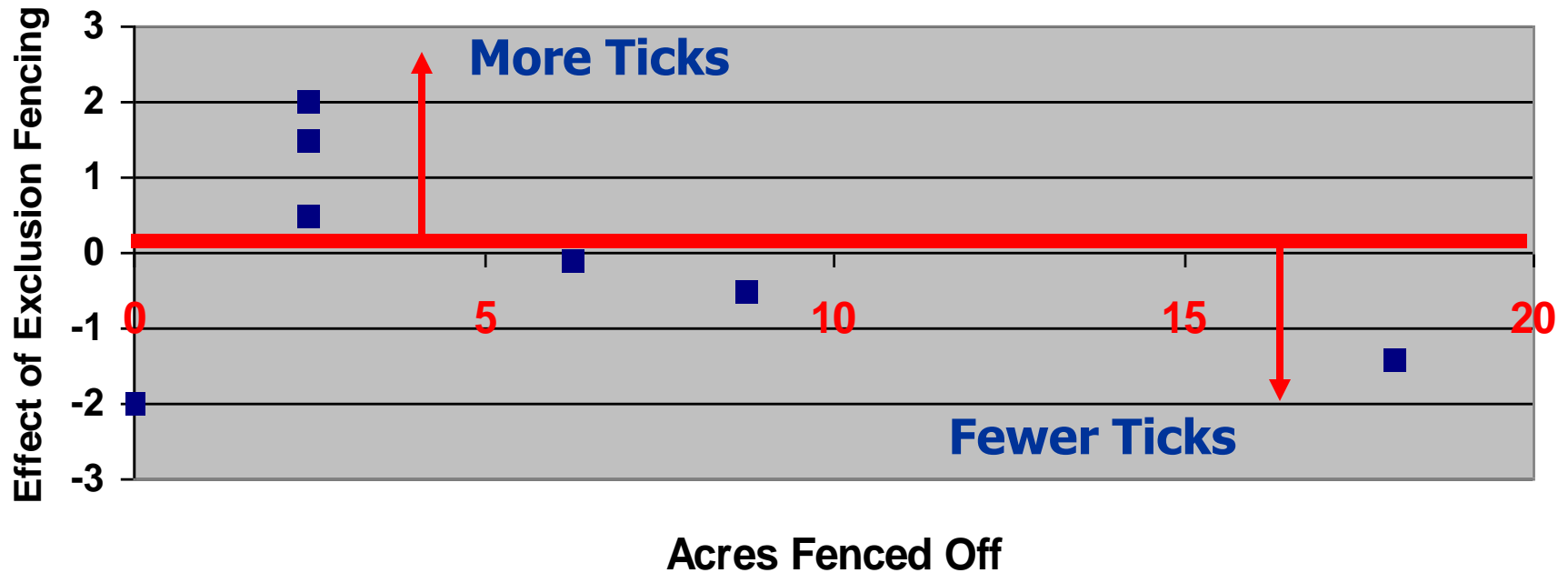


**Can Deer  
Exclusion  
Fencing reduce  
tick populations  
on a  
homeowners  
property???**



**Fact or Myth**

# Effect of Deer Exclusion Fencing on Tick Numbers





CAPE COD  
HEALTHCARE

“Hard Data” for patients to review with medical providers

Develop baseline data for Relapsing Fever

Evaluate potential to reduce medication scripts

???.Should tick testing be a CC Healthcare benefit...