

# Vectorborne Diseases and Prevention in NH

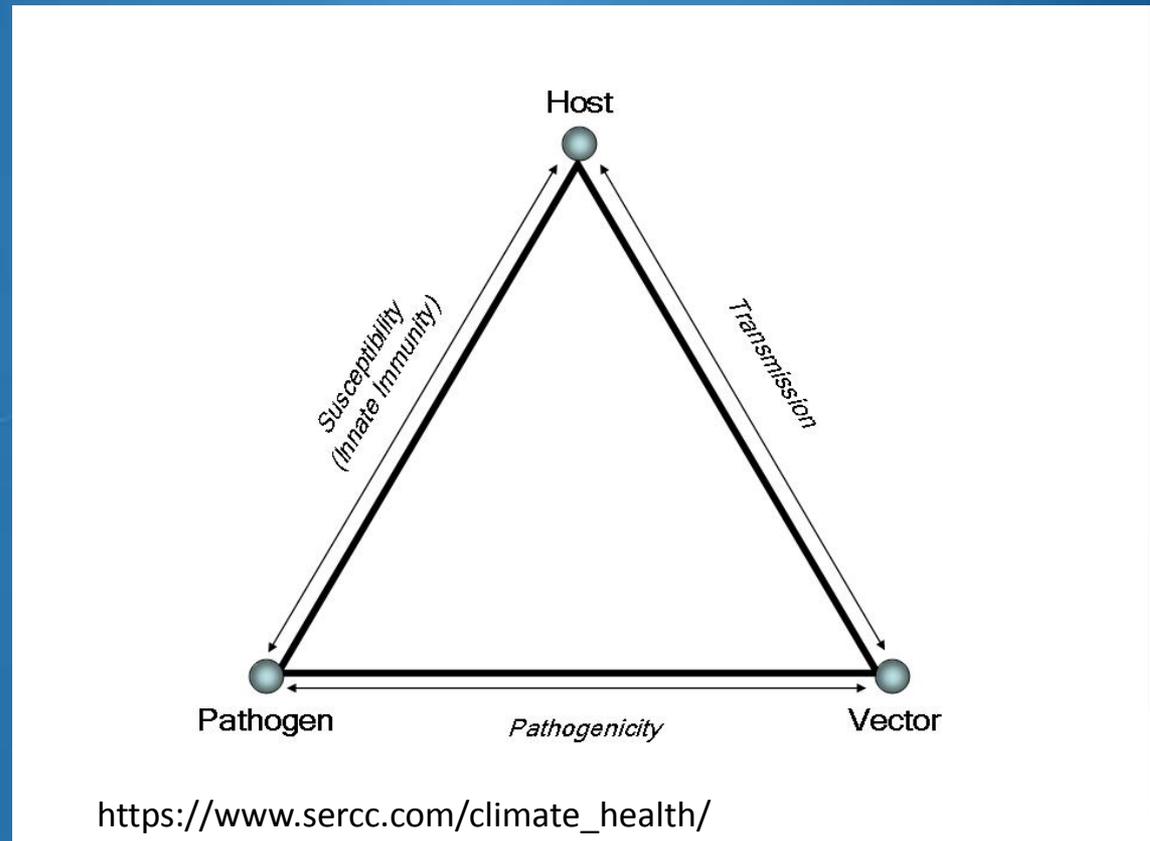
NH Health Officers Spring Workshop  
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Carolyn Fredette, MPH  
Vectorborne Disease Surveillance Coordinator  
Division of Public Health Services, DHHS  
Infectious Disease Surveillance Section

Carolyn.fredette@dhhs.nh.gov  
(603) 271-0273

# Vectorborne Disease

- Three components of vectorborne disease
  - Pathogen
  - Host
  - Vector



# Tickborne Disease Program

# NH DHHS Tickborne Disease Activities

- Human case surveillance
- Tick surveillance as funding allows
- Distribution of surveillance data
  - Maps, Data Reports, Incidence by County
- Healthcare provider clinical messaging
  - Annual health alert message with clinical, diagnosis, and treatment information
- Public education and prevention messaging
  - NH DHHS website
  - Annual Press Release
  - Availability of public health staff to respond to public inquiries by phone or email

# Ticks in NH

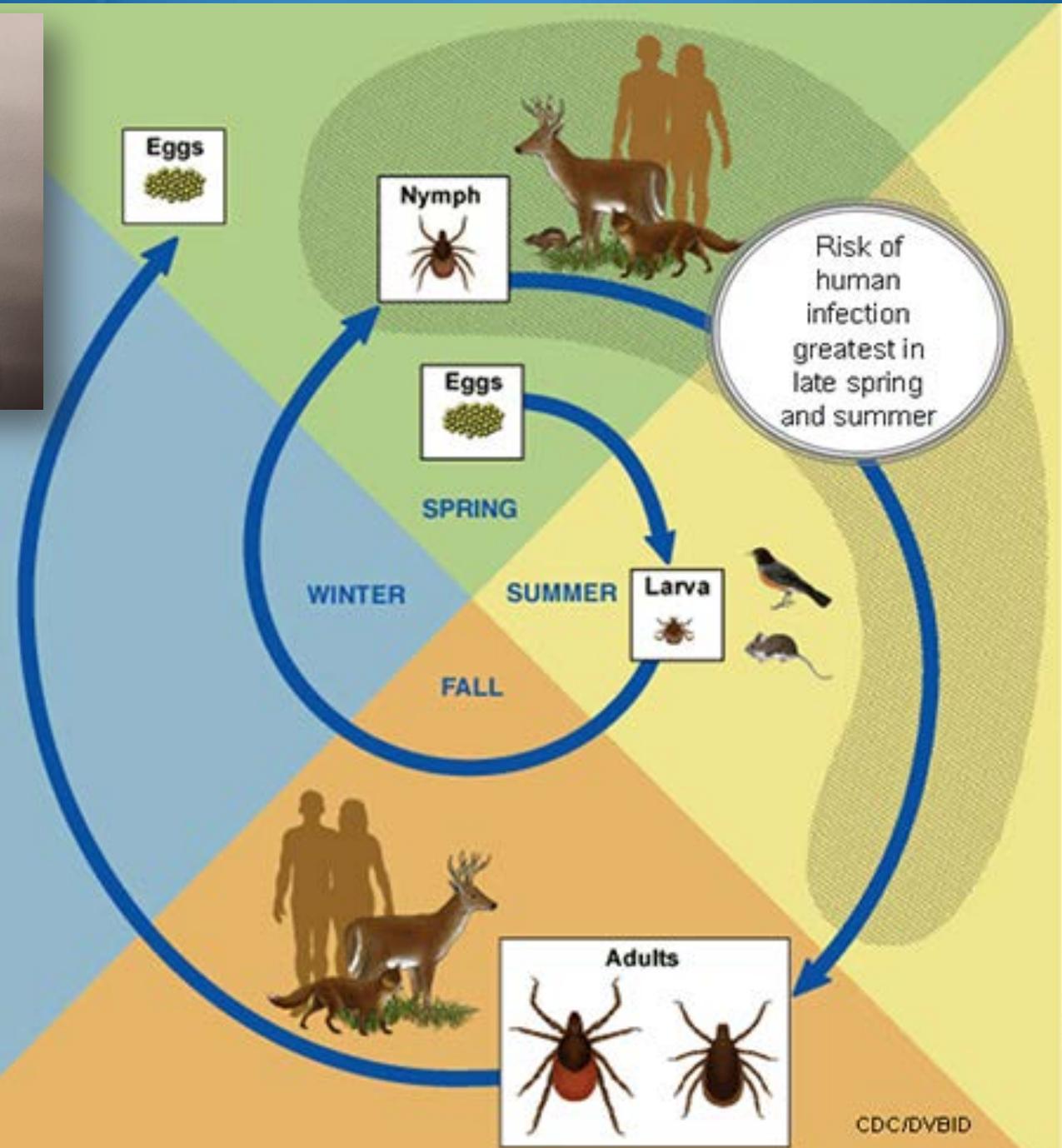
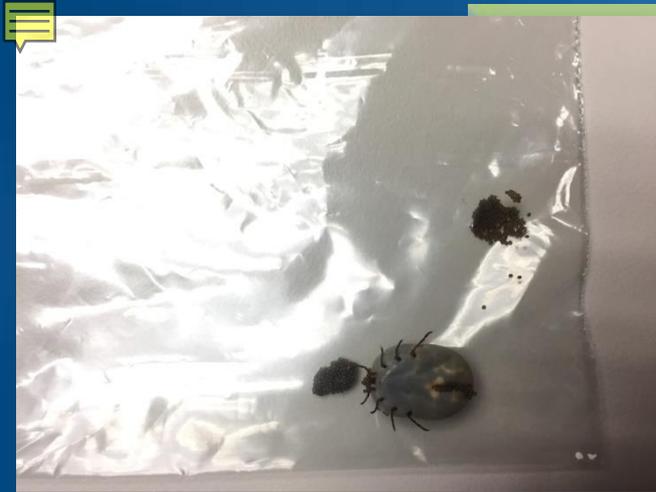
- Common human-biting species in NH
  - American dog tick: *Dermacentor variabilis*
  - **Blacklegged tick (deer tick): *Ixodes scapularis***



- Other ticks

- Winter tick: generally does not bite humans, looks similar to dog tick – moose impacted
- Lone star tick: may be moving north to NH eventually





CDC/DVBID

# Occupations and Activities at Risk

Some of the more common occupations that have a higher risk of tick bites and becoming infected with tickborne diseases include:

- Construction
- Landscaping
- Forestry
- Working with **brush**
- Working with **yard waste**
- Land surveying
- Farming
- Railroad work
- Oil field work
- Utility line work
- Park or wildlife management
- Hunting
- Hiking
- Other outdoor work

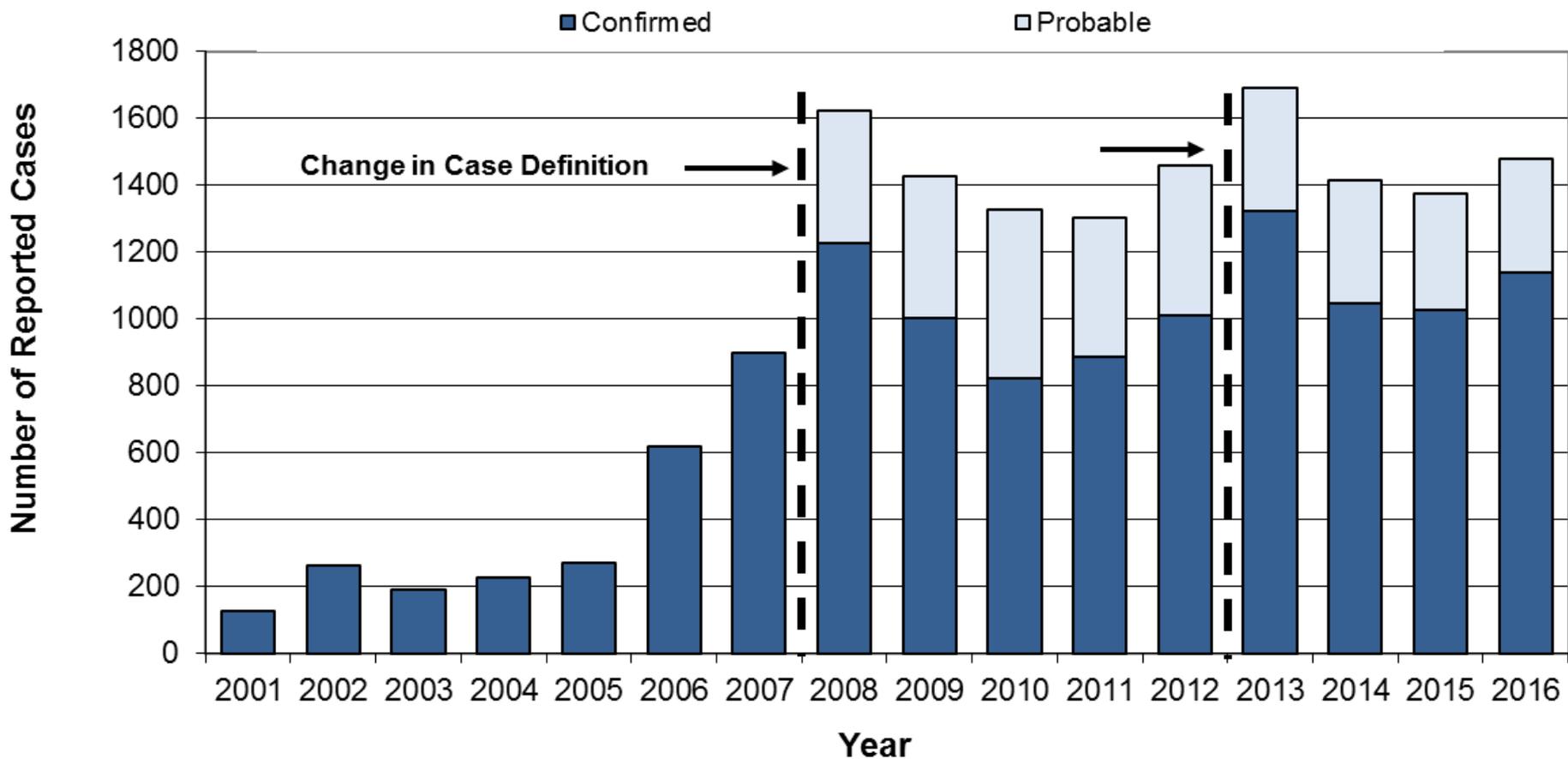
# Lyme Disease

# Symptoms of Lyme Disease

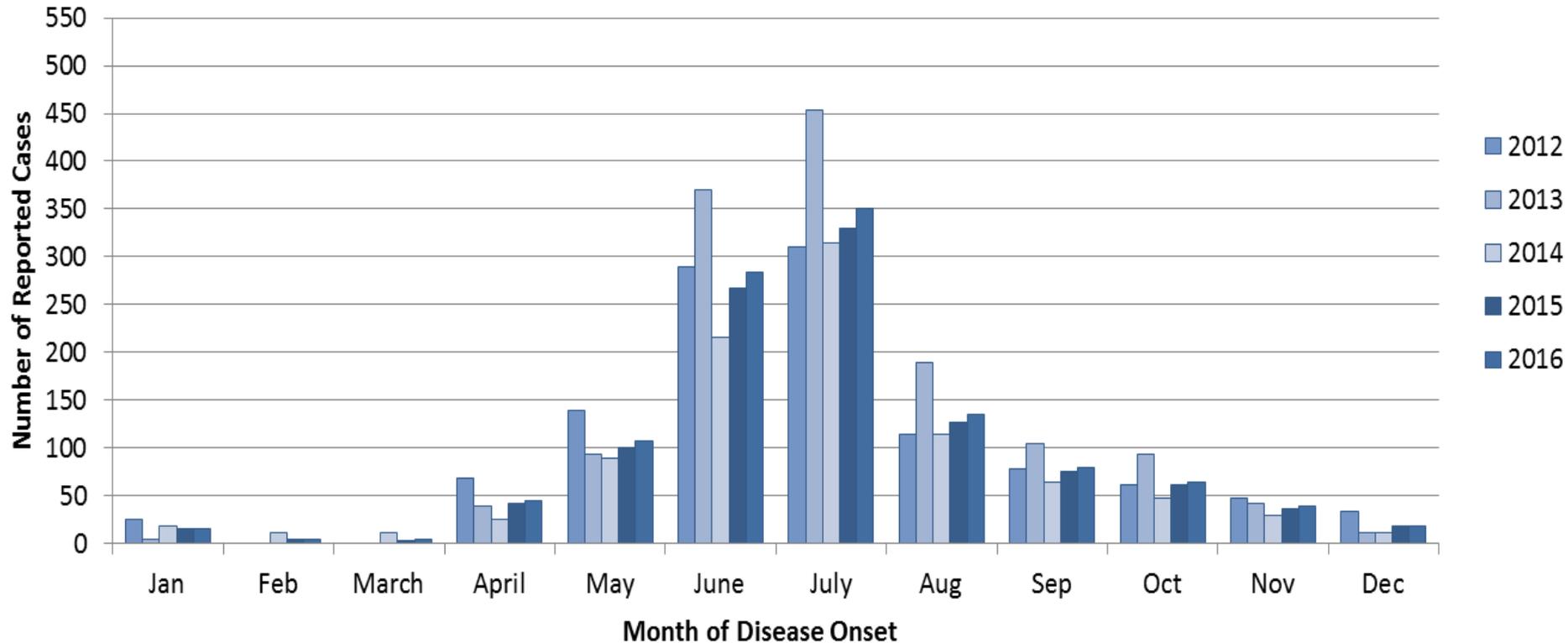


- Early localized disease
  - Incubation : 3 to 32 days
  - Early localized disease
    - within 1 month of infection
    - Slowly expanding skin lesion (**60-80%**): erythema migrans (bull's eye) rash
    - Usually accompanied by **influenza-like illness**: headache, arthralgias, myalgias, fever, lymphadenopathy.
- Early disseminated disease
  - Weeks to months after initial infection and can involve skin, joints, heart, CNS
  - Neurologic disease in 15% of untreated patients - Neuroborreliosis
  - Cardiac disease in 5% of untreated patients
    - Recent publication on Lyme carditis deaths
  - Musculoskeletal involvement in 60% of untreated patients
- Late disseminated disease
  - Months to years after initial infection
  - Lyme arthritis – 60% (untreated)
  - Neuroborreliosis – 5% (untreated)

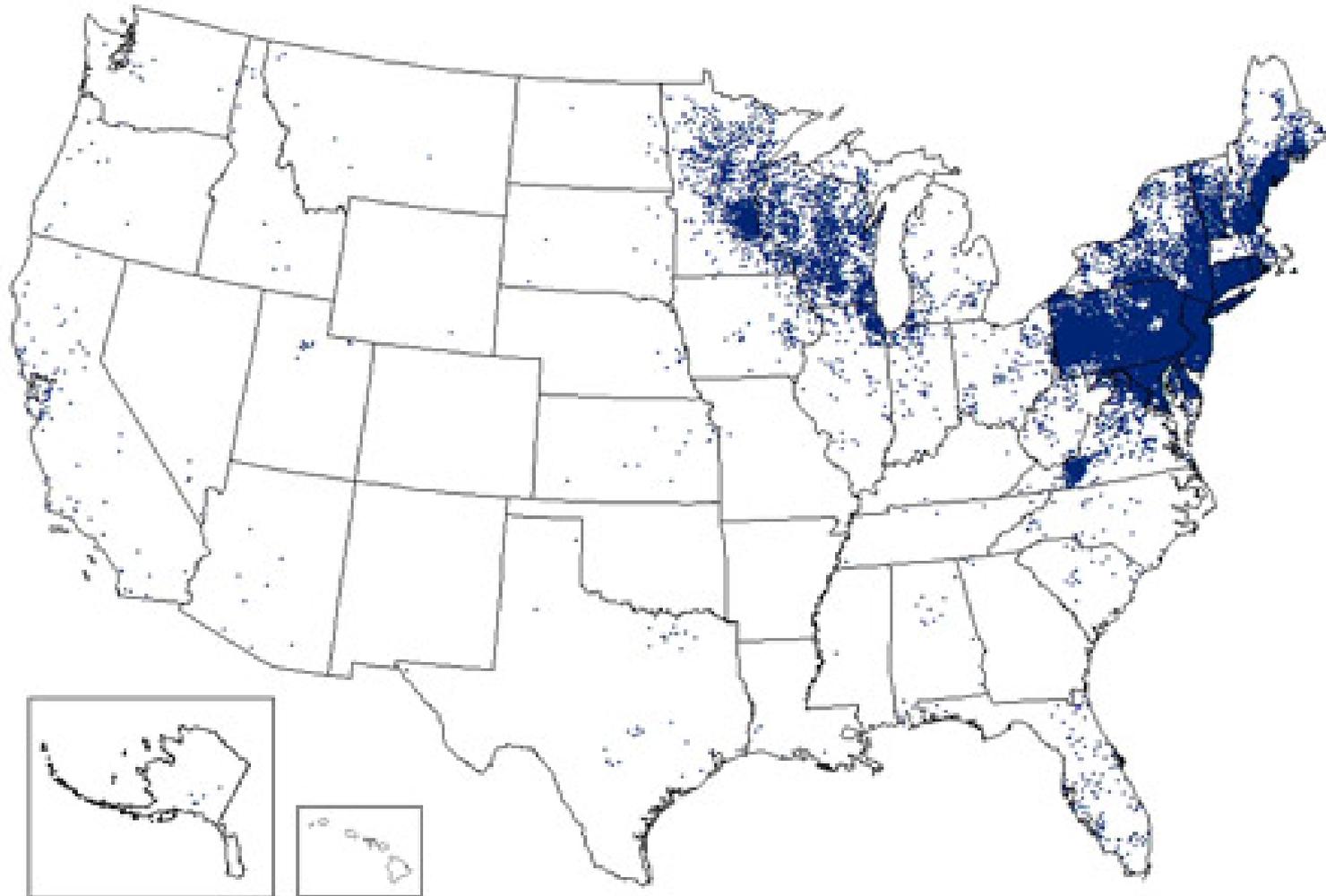
## Number of Reported Lyme Disease Cases by Year, New Hampshire, 2001-2016



# Number of Reported Lyme Cases by Month, New Hampshire, 2012-2016



# Distribution of Lyme Disease - 2016



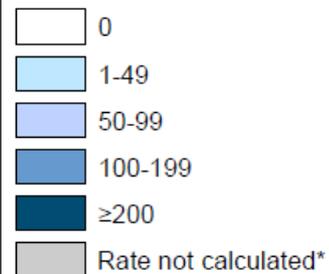
1 dot placed randomly within county of residence for each confirmed case



New Hampshire Department of Health and Human Services  
 Division of Public Health Services  
 Bureau of Infectious Disease Control

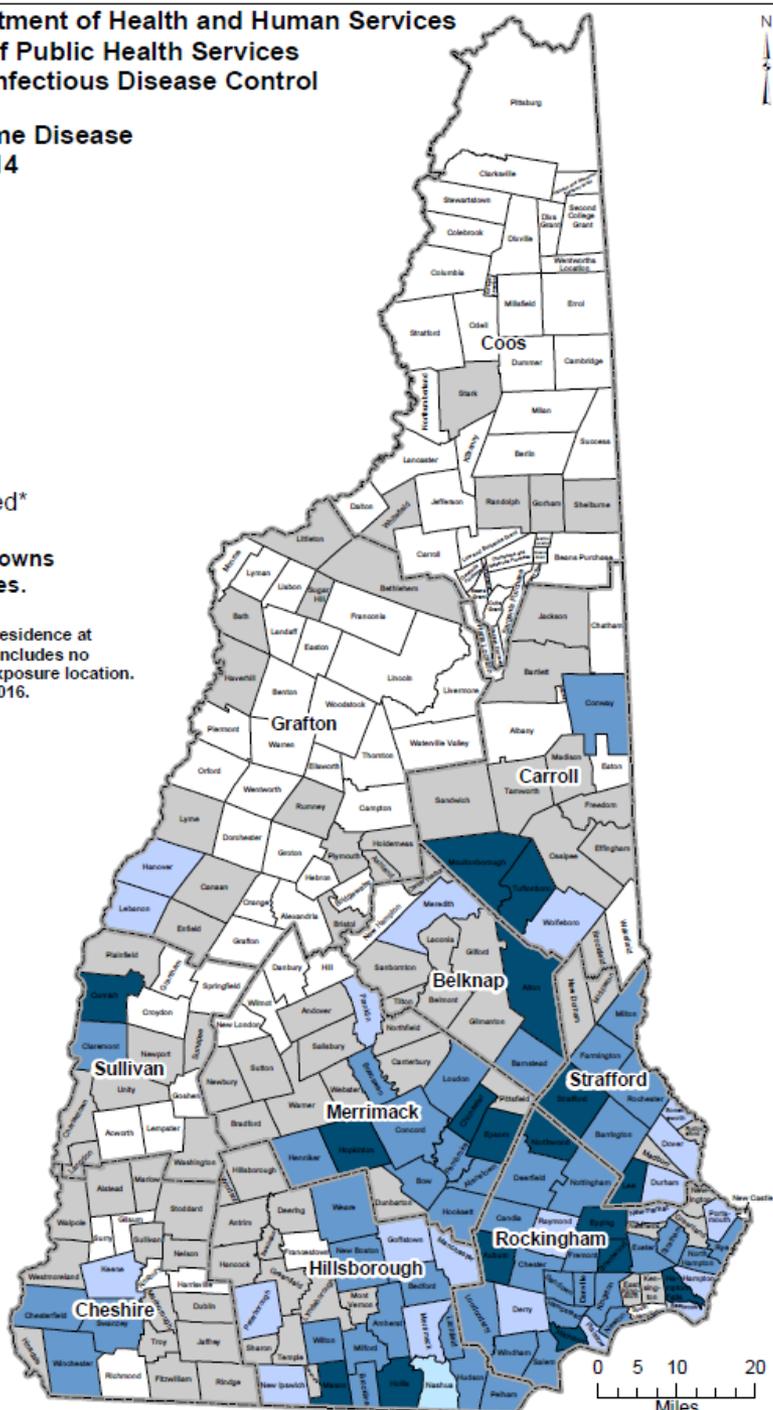
Reported Cases of Lyme Disease  
 in New Hampshire, 2014

Rates per 100,000

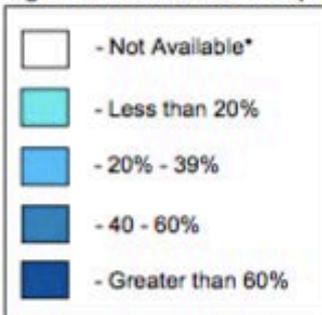


\*Rates not calculated for towns with between 1 and 4 cases.

Note: County/town is based upon residence at the time of disease diagnosis and includes no additional information regarding exposure location. Data are complete as of March 1, 2016.



Proportion of Adult Blacklegged Ticks Infected with *Borrelia burgdorferi* (Lyme disease) Spring and Fall 2013-2014 Samplings



\*Not available due to low number of ticks collected in the region

Tick numbers and percentage of ticks infected can change between years and locations, therefore estimates may change with additional surveillance.

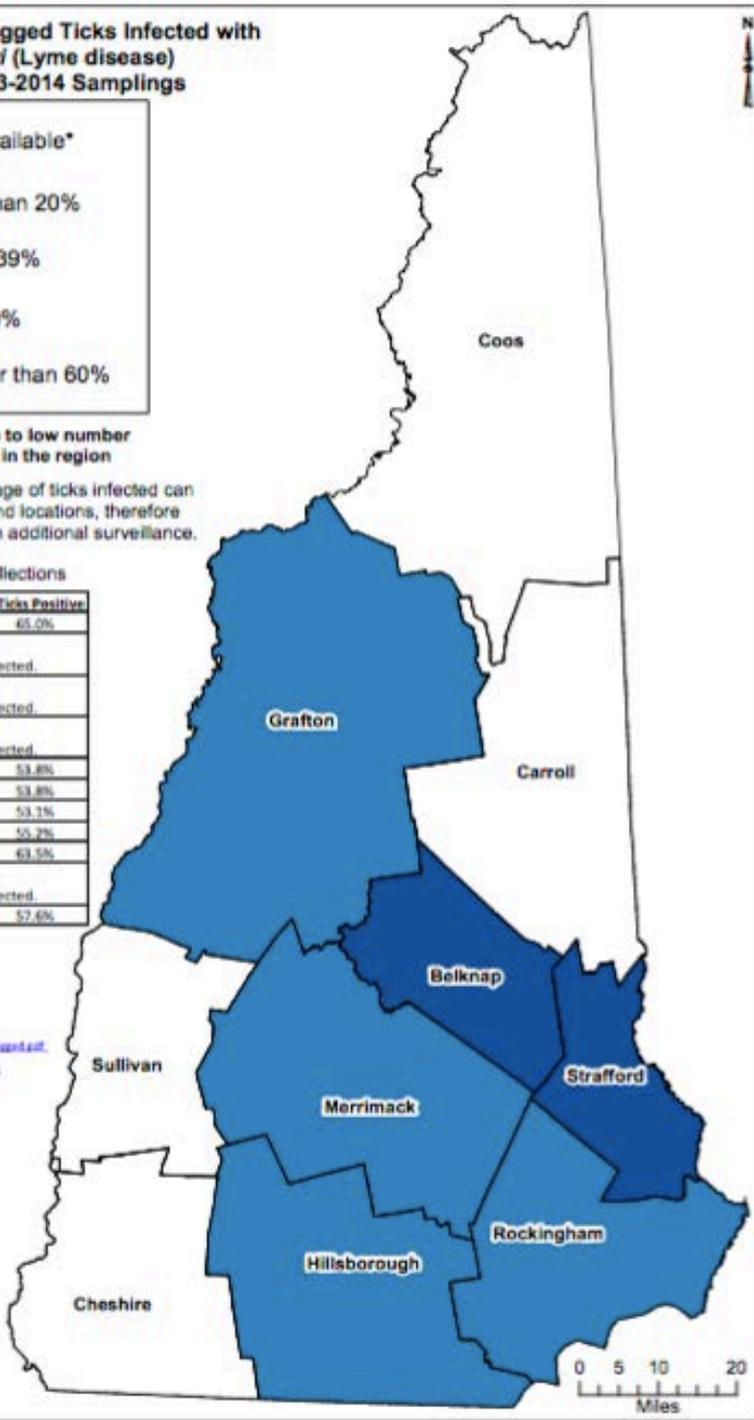
2013-2014 Spring and Fall Tick Collections

County	#Ticks Positive	#Ticks Total	%Ticks Positive
Belknap	13	20	65.0%
Carroll	Data not shown. Fewer than 20 ticks collected.		
Cheshire	Data not shown. Fewer than 20 ticks collected.		
Coos	Data not shown. Fewer than 20 ticks collected.		
Grafton	35	65	53.8%
Hillsborough	14	26	53.8%
Merrimack	17	32	53.1%
Rockingham	37	67	55.2%
Strafford	14	35	43.5%
Sullivan	Data not shown. Fewer than 20 ticks collected.		
State Total	170	295	57.6%

Notes:

1. The data and map from the 2007-2010 samplings can be found here: <http://www.dhhs.nh.gov/dohdiv/is/cid/tickreports/tickrpt4.pdf>.
2. These data show similar prevalence as was observed in the 2007-2010 samplings.
3. Ticks were collected by flagging and were provided by entomologist, Dr. Alan Eaton with University of New Hampshire Cooperative Extension.

Prepared by Tylor Young, GIS Analyst, New Hampshire Department of Health and Human Services, Bureau of Infectious Disease Control, August 14, 2015



# Presence of the *Borrelia* bacteria in the NH Blacklegged Ticks 2013- 2014



# Anaplasmosis and Babesiosis

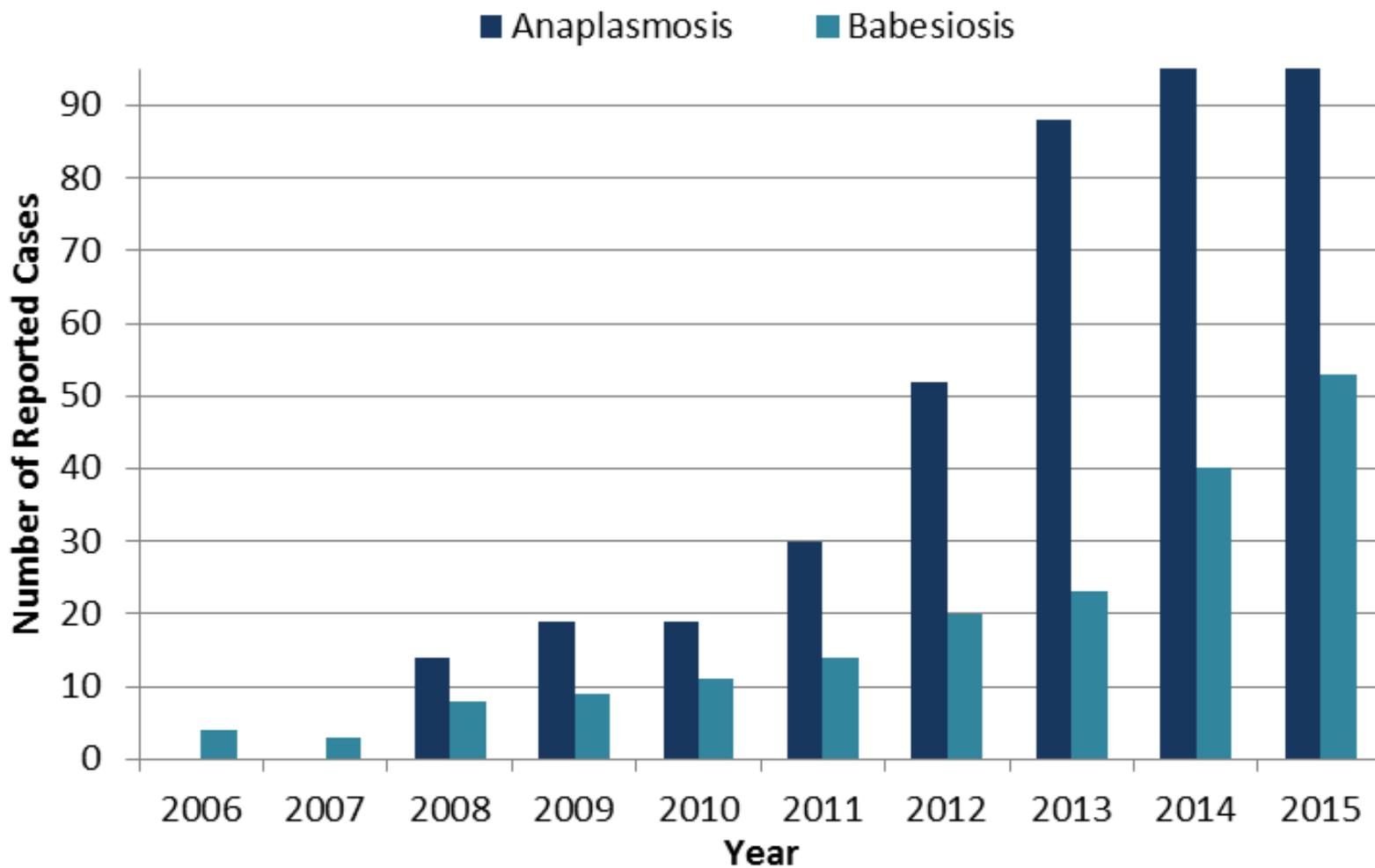
# Anaplasmosis and Babesiosis

- Transmitted by the blacklegged tick
- Main reservoir is the white footed mouse
- Flu-like symptoms (most common presentation)
  - Fever, headache, muscle pain, malaise, chills, nausea/abdominal pain, cough, confusion, sweats, headache, body aches, loss of appetite, nausea, fatigue



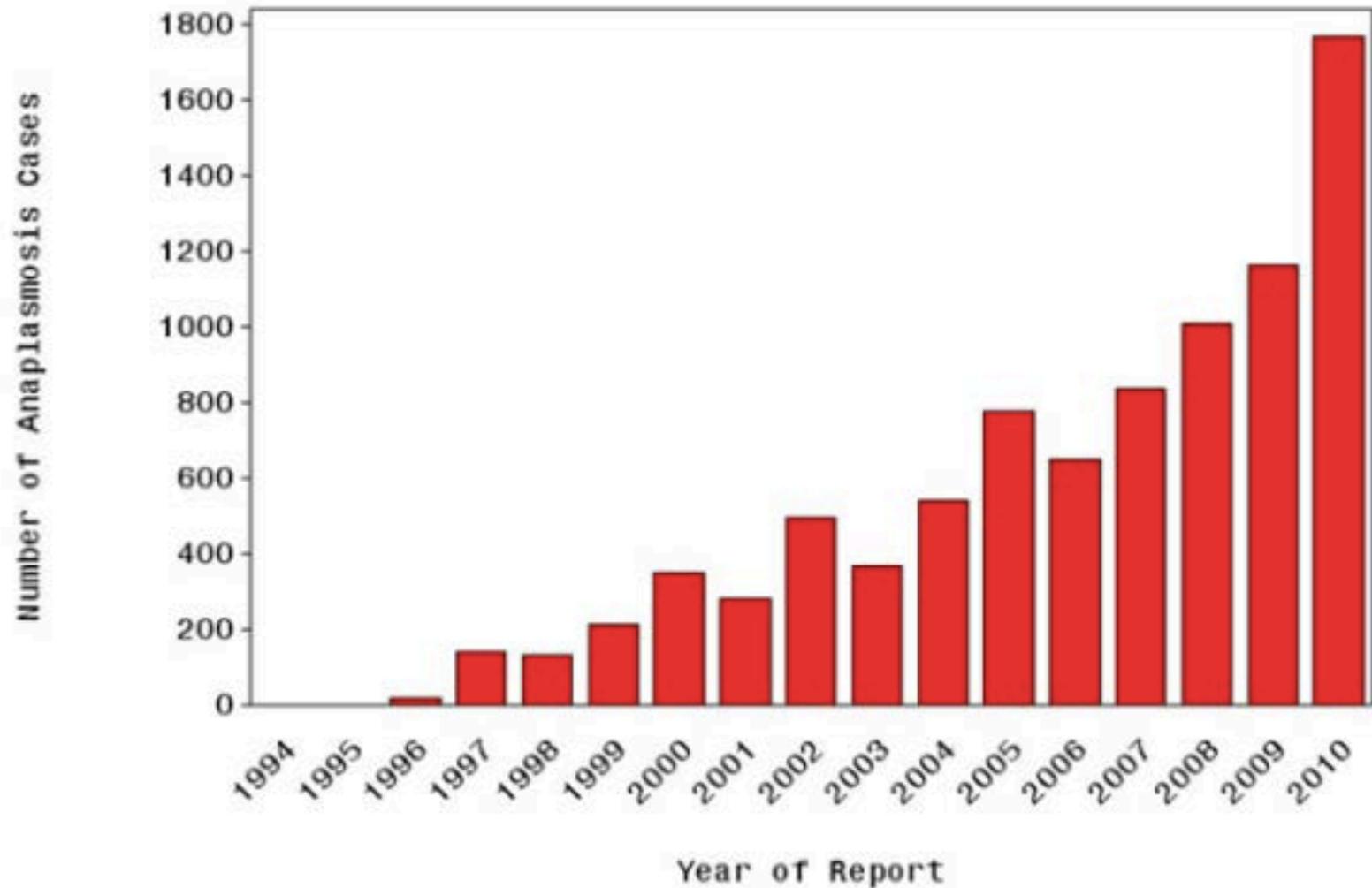
Image from  
[http://www.fcps.edu/islandcreekes/ecology/white-footed\\_mouse.htm](http://www.fcps.edu/islandcreekes/ecology/white-footed_mouse.htm)

# Reported Anaplasmosis and Babesiosis Cases by Year, New Hampshire

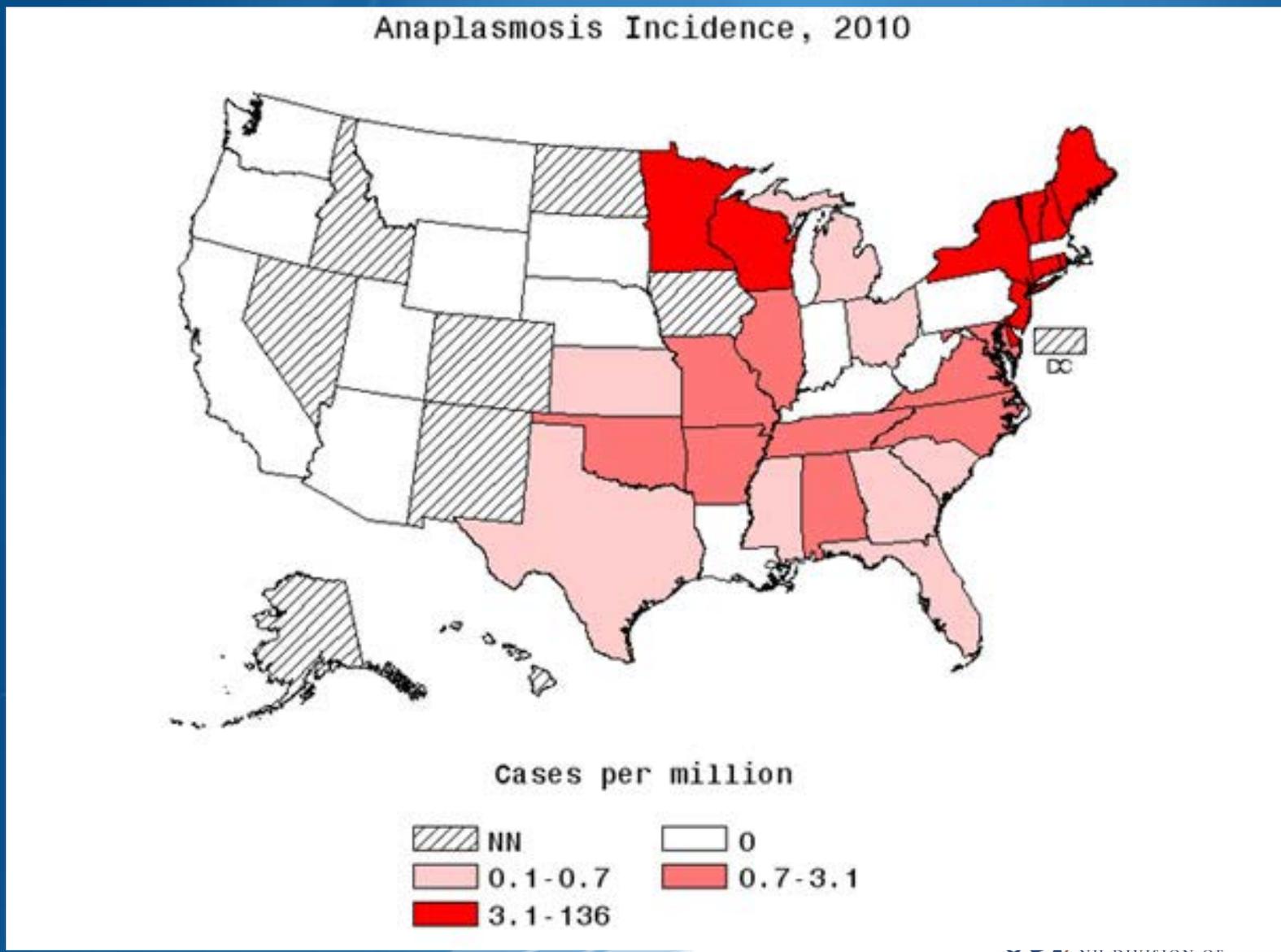


# Number of U.S. Anaplasmosis Cases

Number of Annual Anaplasmosis Cases, 1994-2010

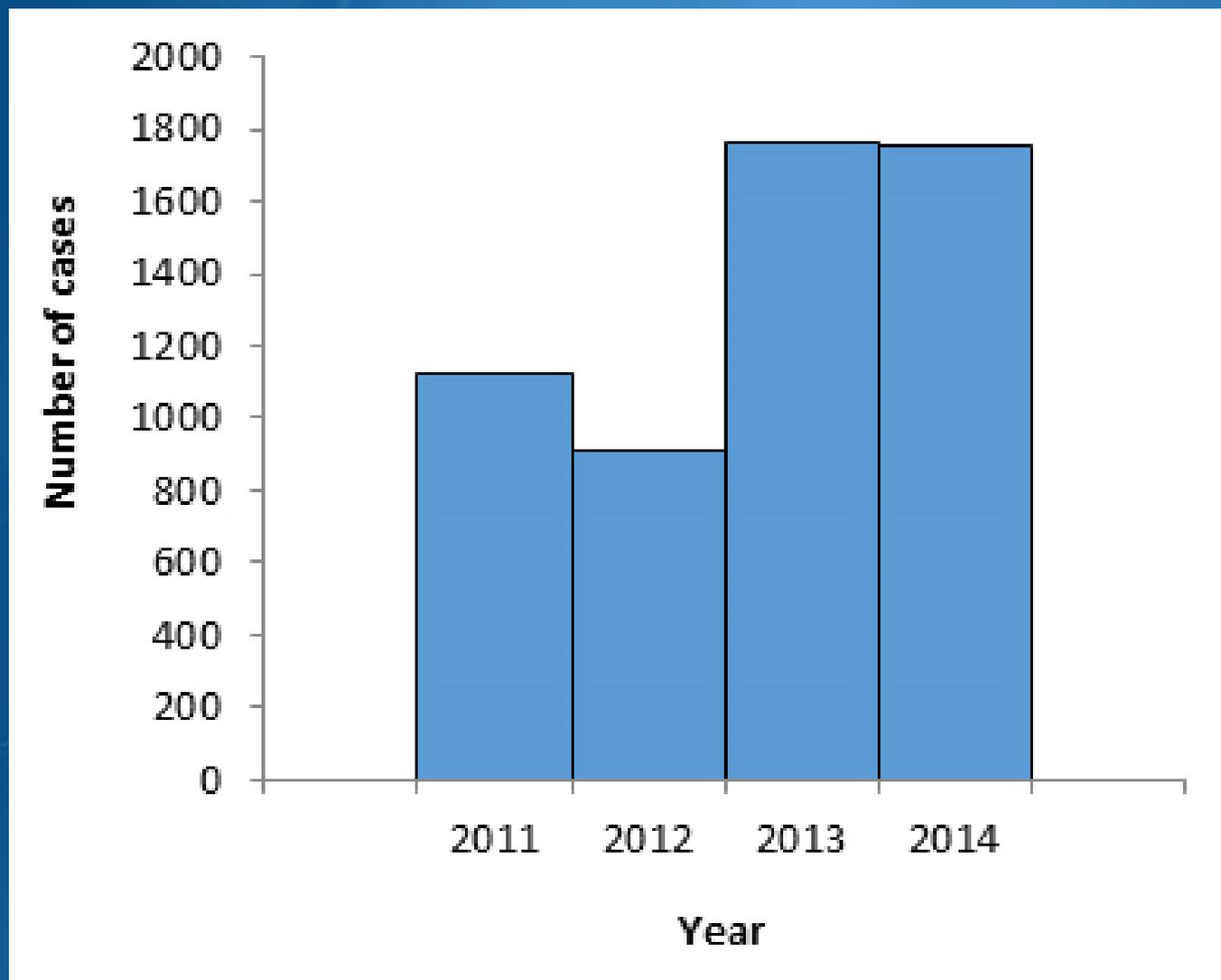


# Distribution of Anaplasmosis, 2010



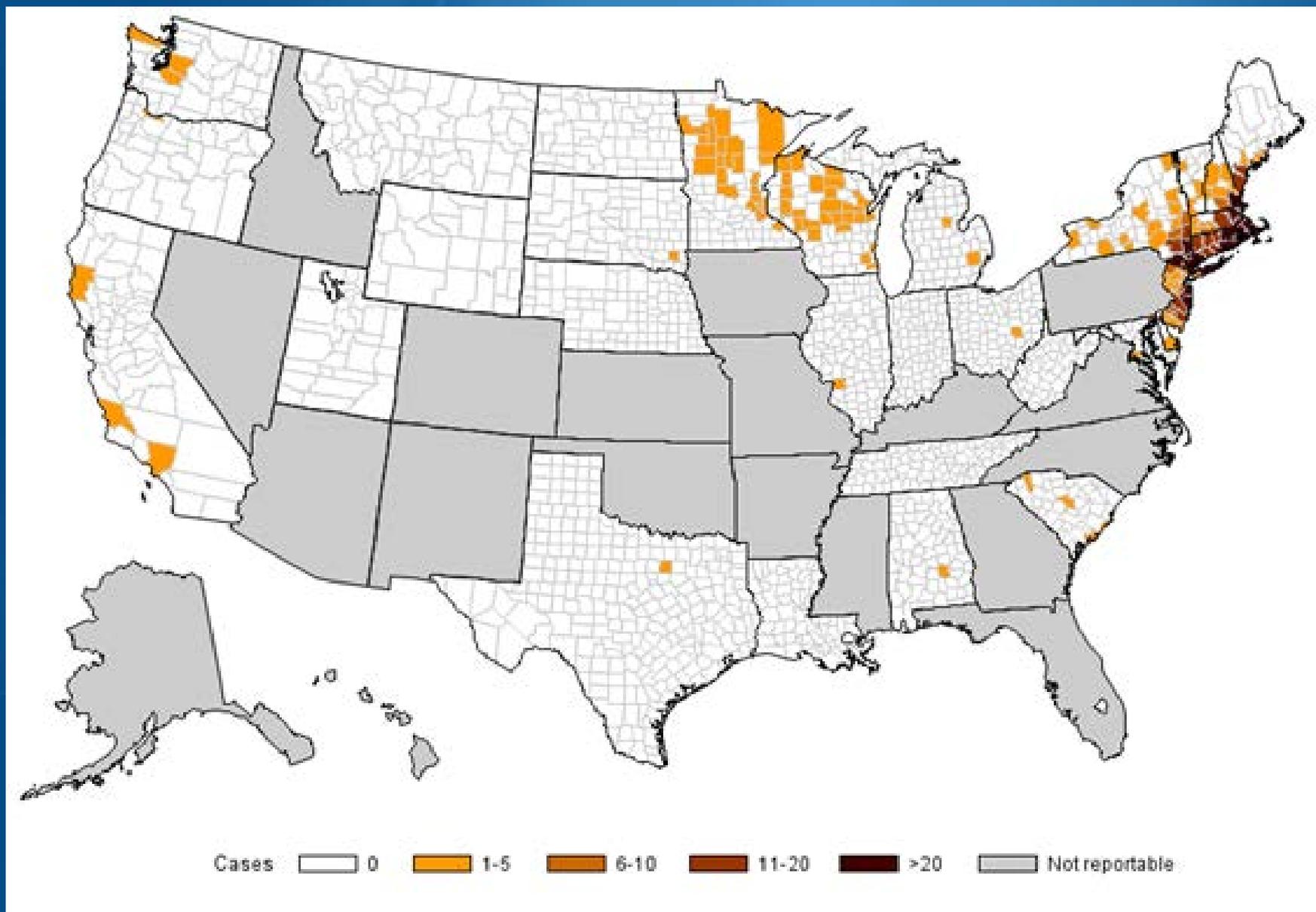
Source: CDC

# Number of U.S. Babesiosis Cases



Source: CDC

# Distribution of Babesia, 2013



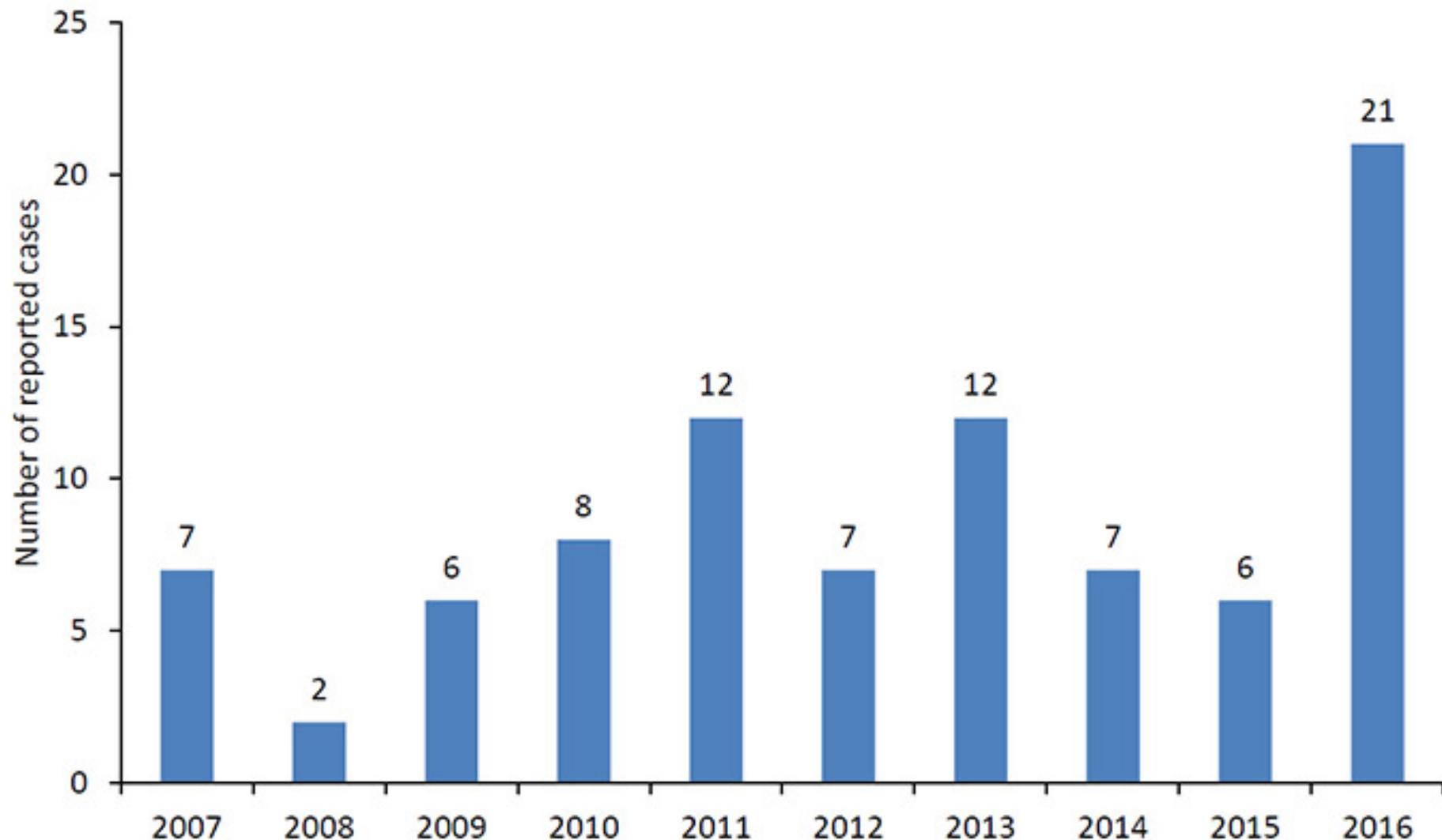
# Powassan Virus

# Powassan Virus



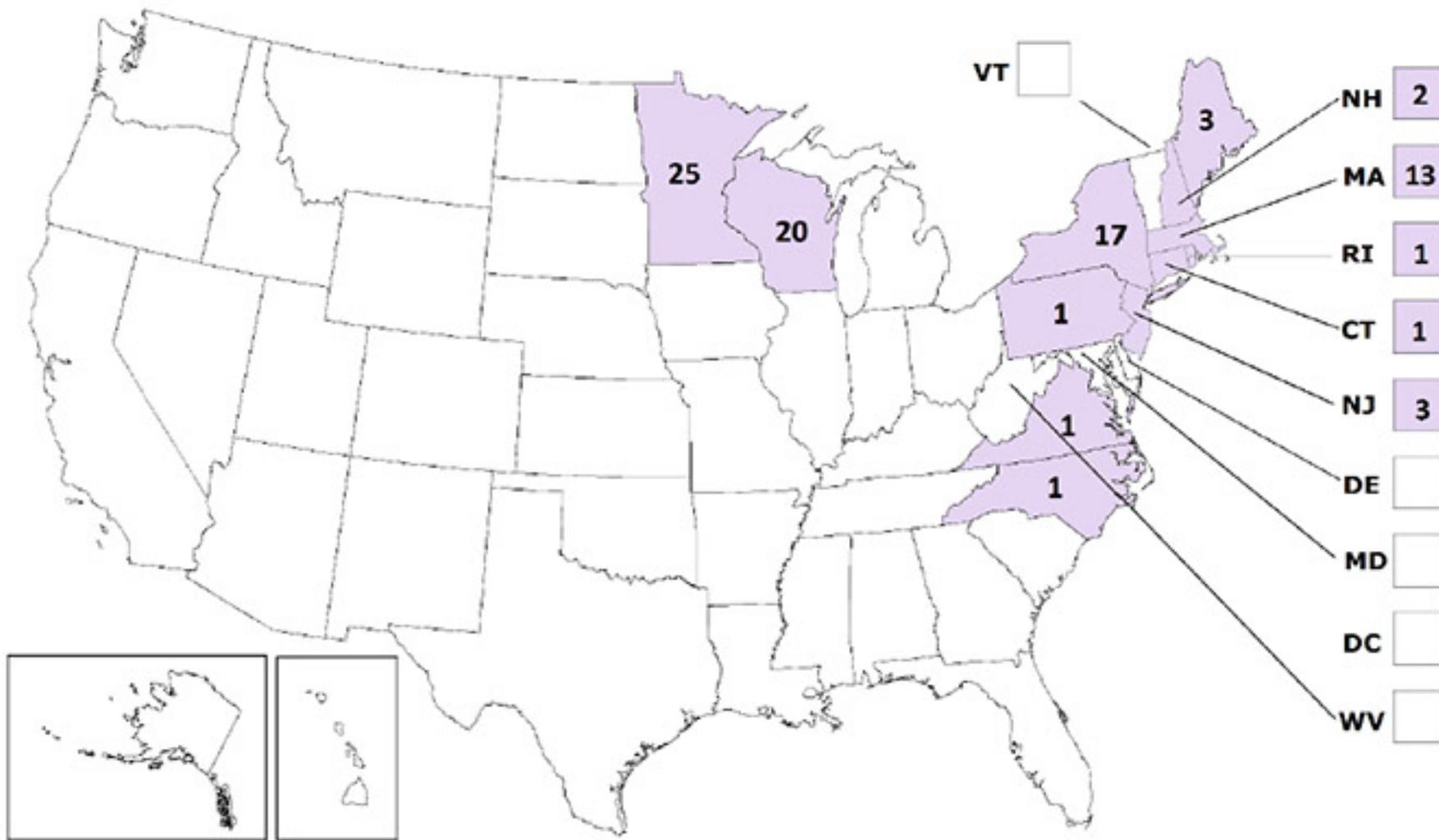
- Viral encephalitis
- Incubation from 1 week to 1 month
- Two strains associated with human disease
  - Powassan Virus (POW) – Lineage 1
  - Deer Tick Virus (DTV) – Lineage 2
    - Ixodes scapularis – white-footed mice (DTV)
- Possible symptoms: Drowsiness, headache, confusion, fever, vomiting, weakness, speech difficulties
- Illness could progress to encephalitis (brain), meningitis (membranes), or meningoencephalitis
- Severe, long lasting sequelae in  $\geq 50\%$
- Case fatality  $\sim 10\%$  (encephalitis)

# Powassan Virus – US 2007-2016



Source: [cdc.gov](http://cdc.gov) and *ArboNET*

# Distribution of Powassan Virus 2006-2016



Source: cdc.gov and ArboNET

# Mosquitoborne Diseases in NH

- West Nile Virus
- Eastern Equine Encephalitis
- Jamestown Canyon Virus

# NH DHHS Arboviral Surveillance Activities

- Surveillance and control
  - Mosquito
    - Town-based program decisions and financing
  - Human and veterinary
    - Outreach and coordination with healthcare providers (Health Alert Network messaging)
  - Public education and prevention messaging
    - Distribution of surveillance data
    - Test results and risk map updated weekly July-Sept
    - Press releases
- NH Public Health Laboratories testing
  - Mosquito, human, veterinary samples

# West Nile Virus



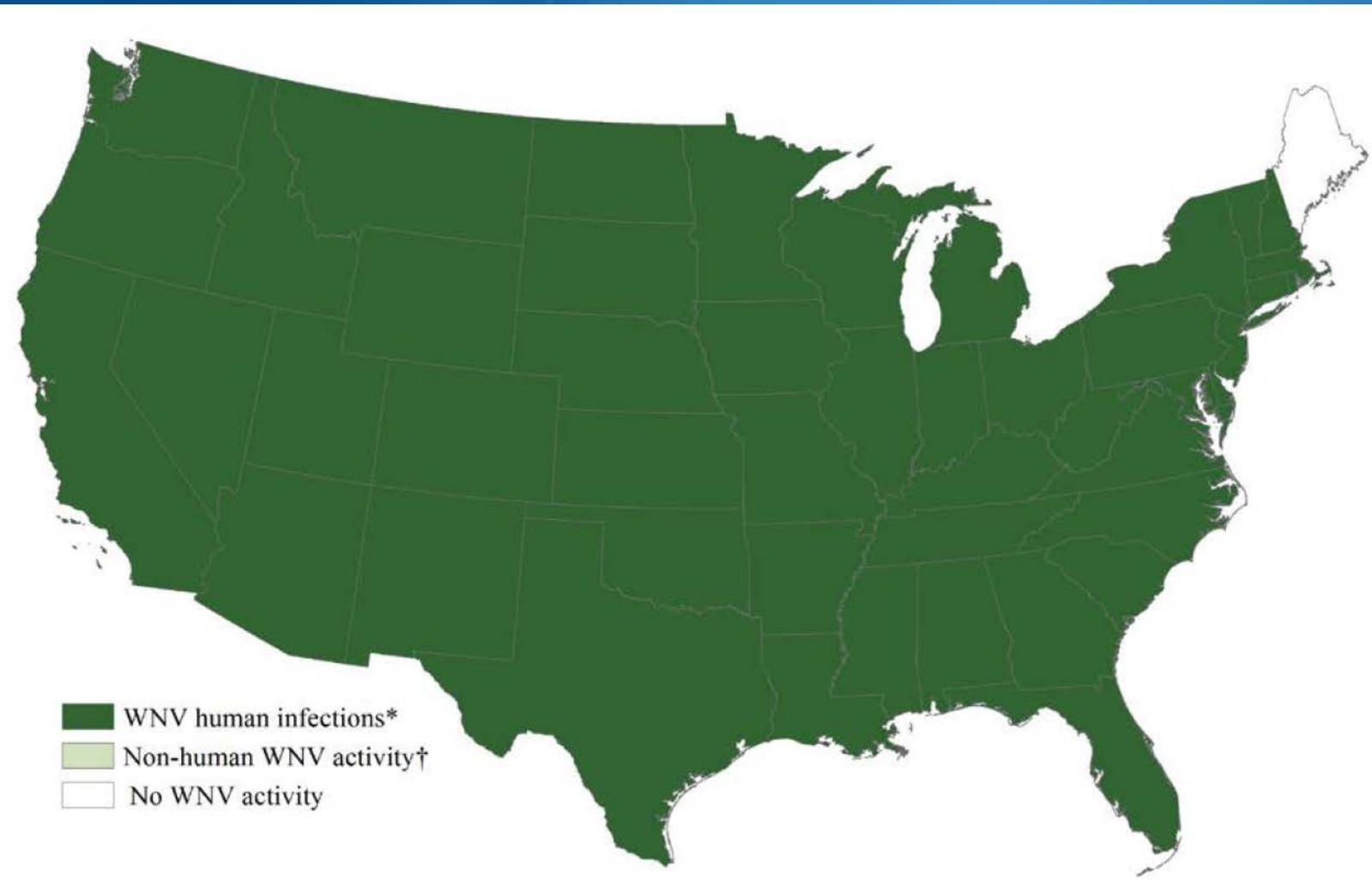
# West Nile Virus

- Most commonly transmitted through the bite of an infected mosquito
  - *Culex spp*
- Rarely transmitted by:
  - Blood transfusions
  - Organ transplants
  - Exposure in a lab
  - From mother to baby during pregnancy, delivery or nursing
- Birds are the main reservoir host

# Symptoms of West Nile Virus

- 3-14 days after bite from infected mosquito
- “West Nile Fever”
  - About 20% of those people infected will have mild illness
  - Fever, headache, body aches, swollen lymph nodes
- WNV Neuroinvasive Disease
  - About 1 in every 150 people infected
  - High fever, headache, neck stiffness, muscle weakness, disorientation, meningitis, encephalitis
- People over 50 years of age are at higher risk of developing serious symptoms

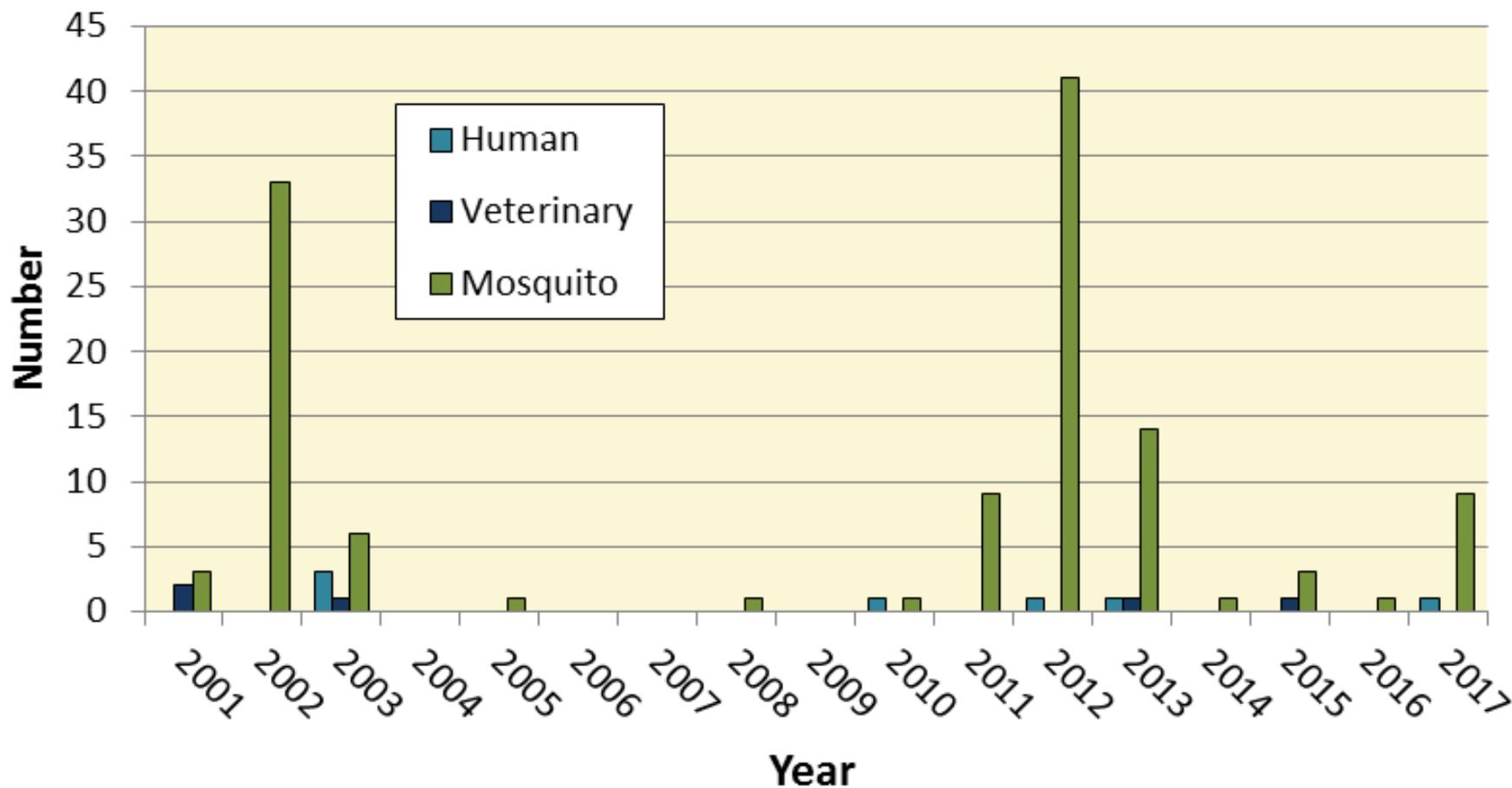
# 2017 WNV Activity - National



121 of 2,002 cases were fatal

Data: CDC ArboNET  
Current as of 1/09/2018

# NH WNV Activity: 2001-2017

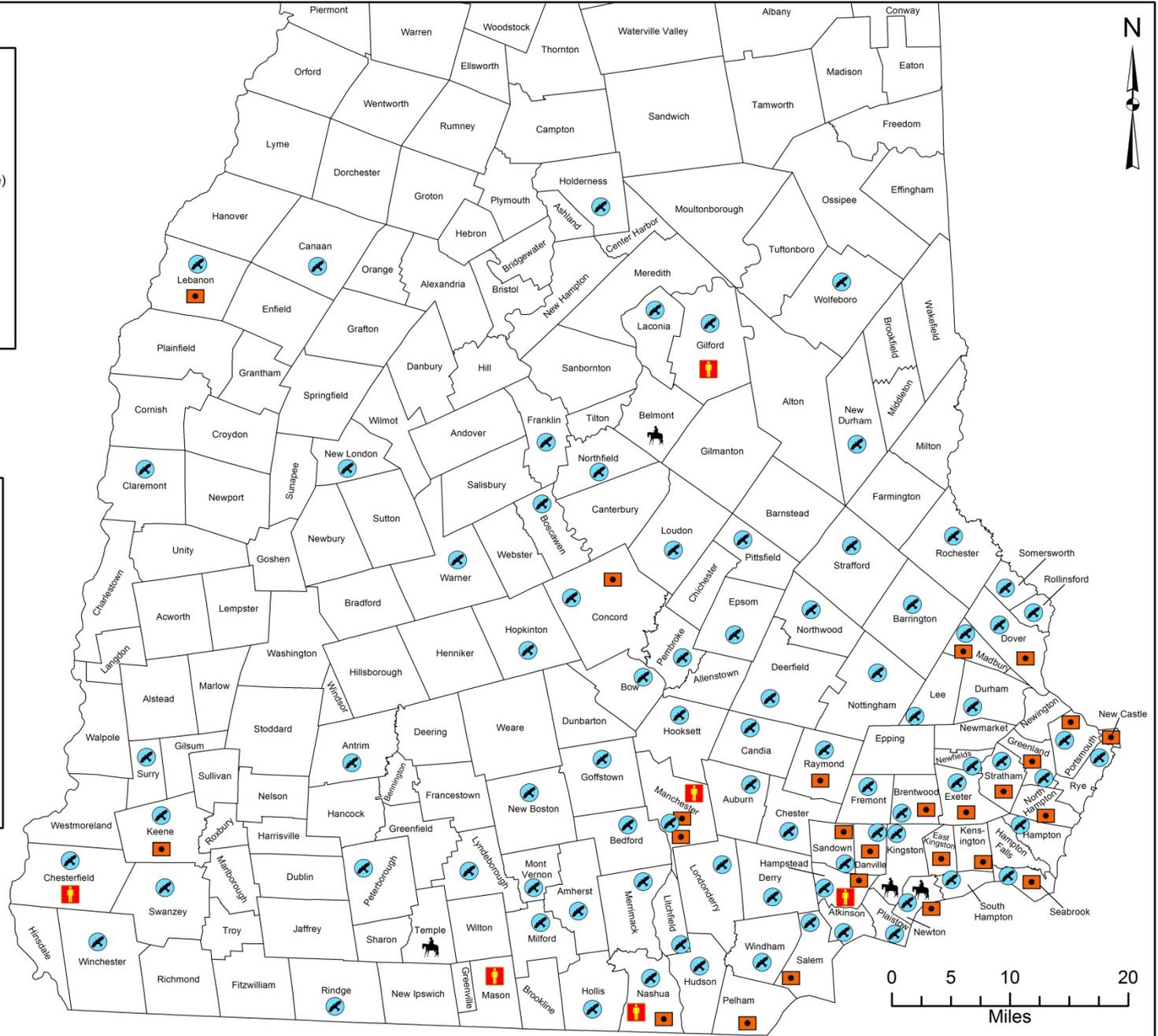
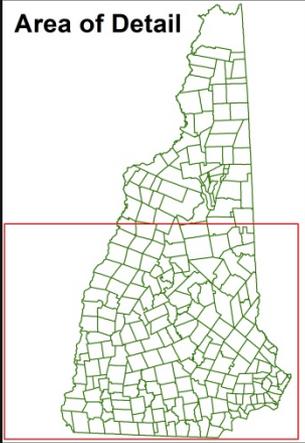


# West Nile Virus - Positive Test Results, 2001 - 2017

## Positive Results -

-  - Human (One or More)
-  - Wild Bird (One or More)
-  - Mosquito Pool (One or More)
-  - Horse (One or More)

## Area of Detail



# Eastern Equine Encephalitis

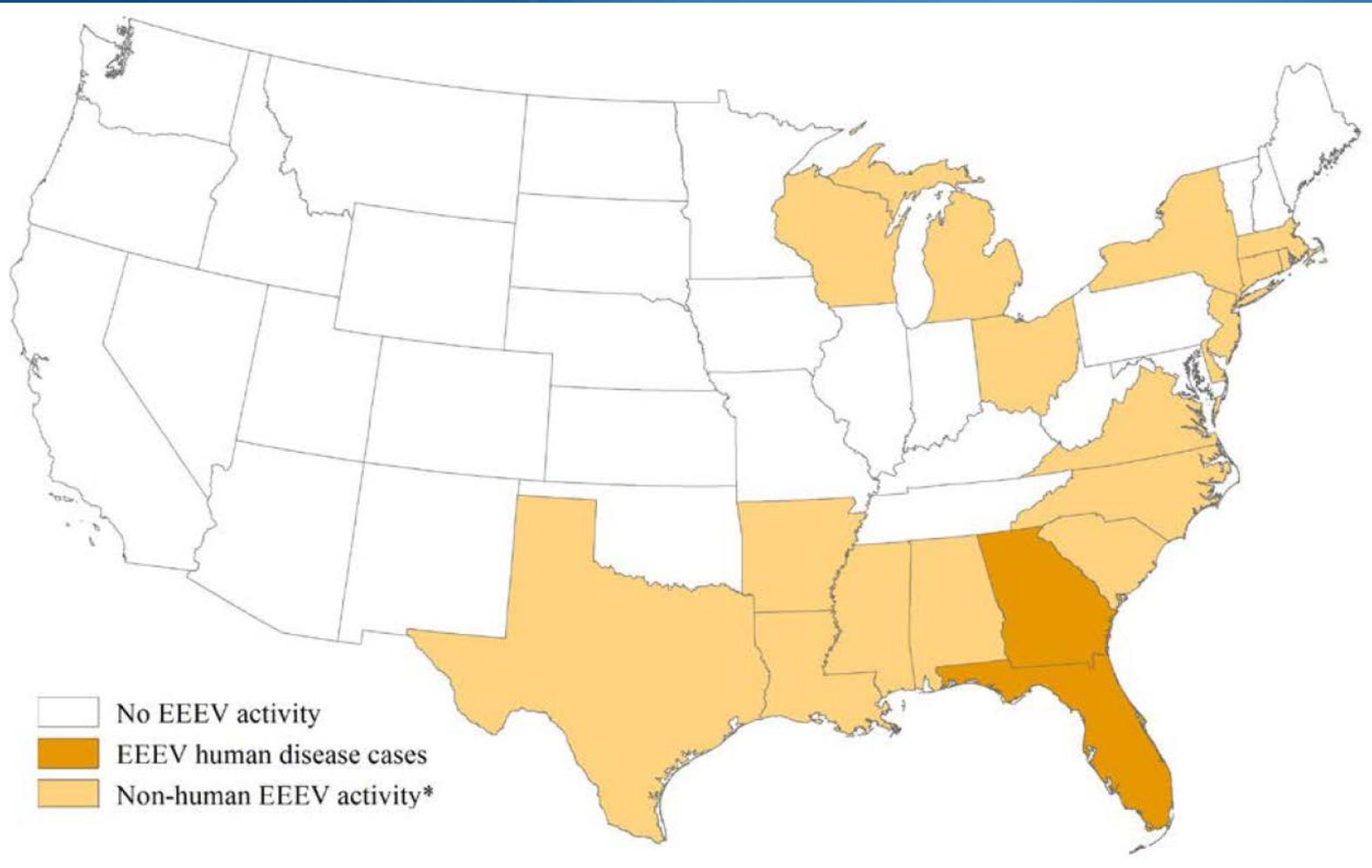
# Eastern Equine Encephalitis

- Most commonly transmitted through the bite of an infected mosquito
  - *Aedes, Coquillettidia, Culex spp, Culesita melanura*
- Rarely transmitted by:
  - Lab exposure
  - Bird to bird (emu, pheasants)
- Birds are the main reservoir host

# Symptoms of EEE

- Rare but serious disease
- 4-10 days after bite from infected mosquito
- Severe EEE: Encephalitis
  - Sudden high fever, severe headache, stiff neck, can be followed by seizures, coma
  - Approximately 33% mortality
  - Survivors often suffer long-term to permanent brain damage
- May also appear as milder, flu-like illness
- Persons < 15 and >50 are most at risk for severe disease

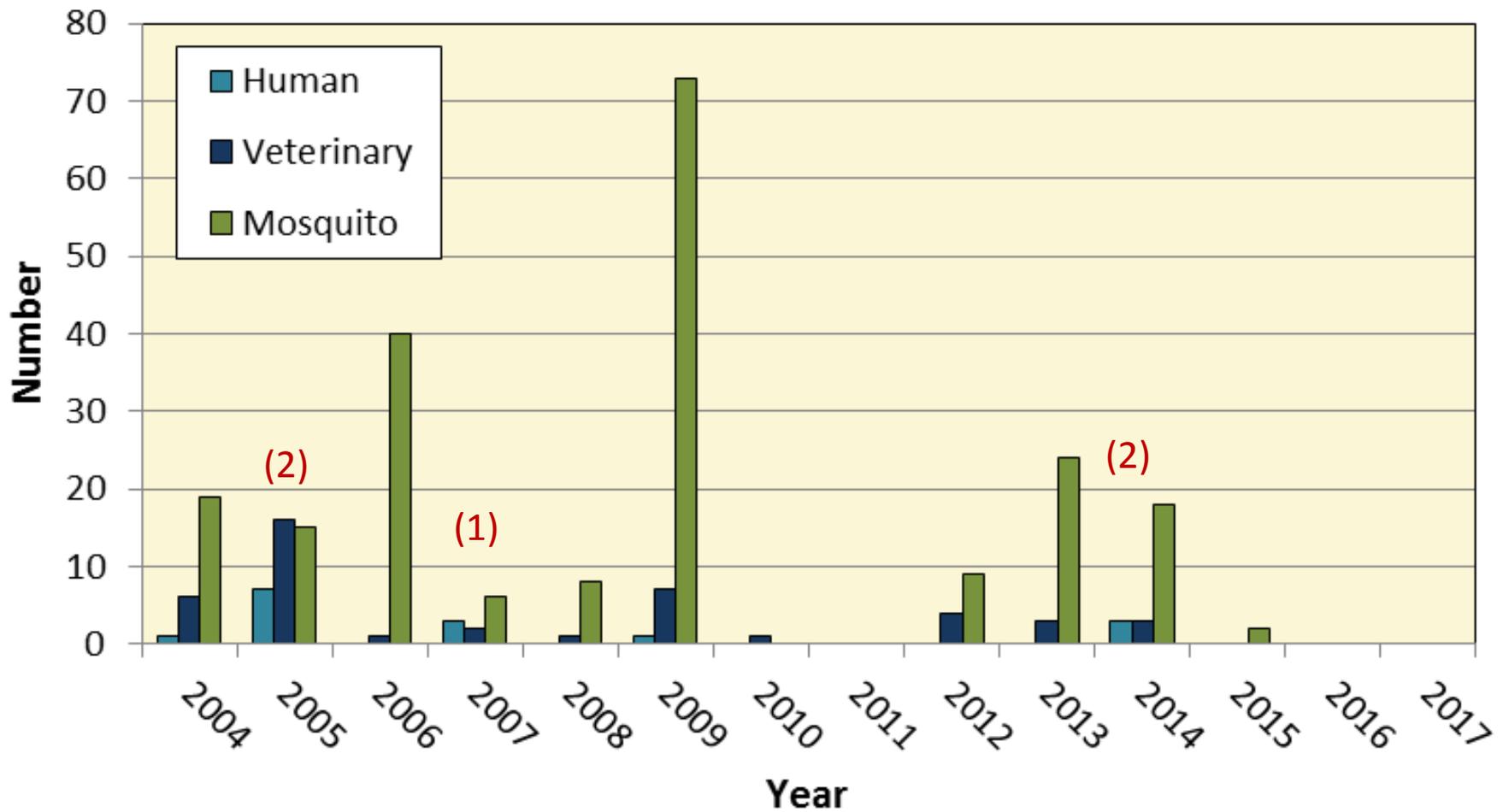
# 2017 EEE Activity - National



1 of 3 cases  
was fatal

Data: CDC ArboNET  
Current as of 1/09/2018

# NH EEE Activity 2004 - 2017



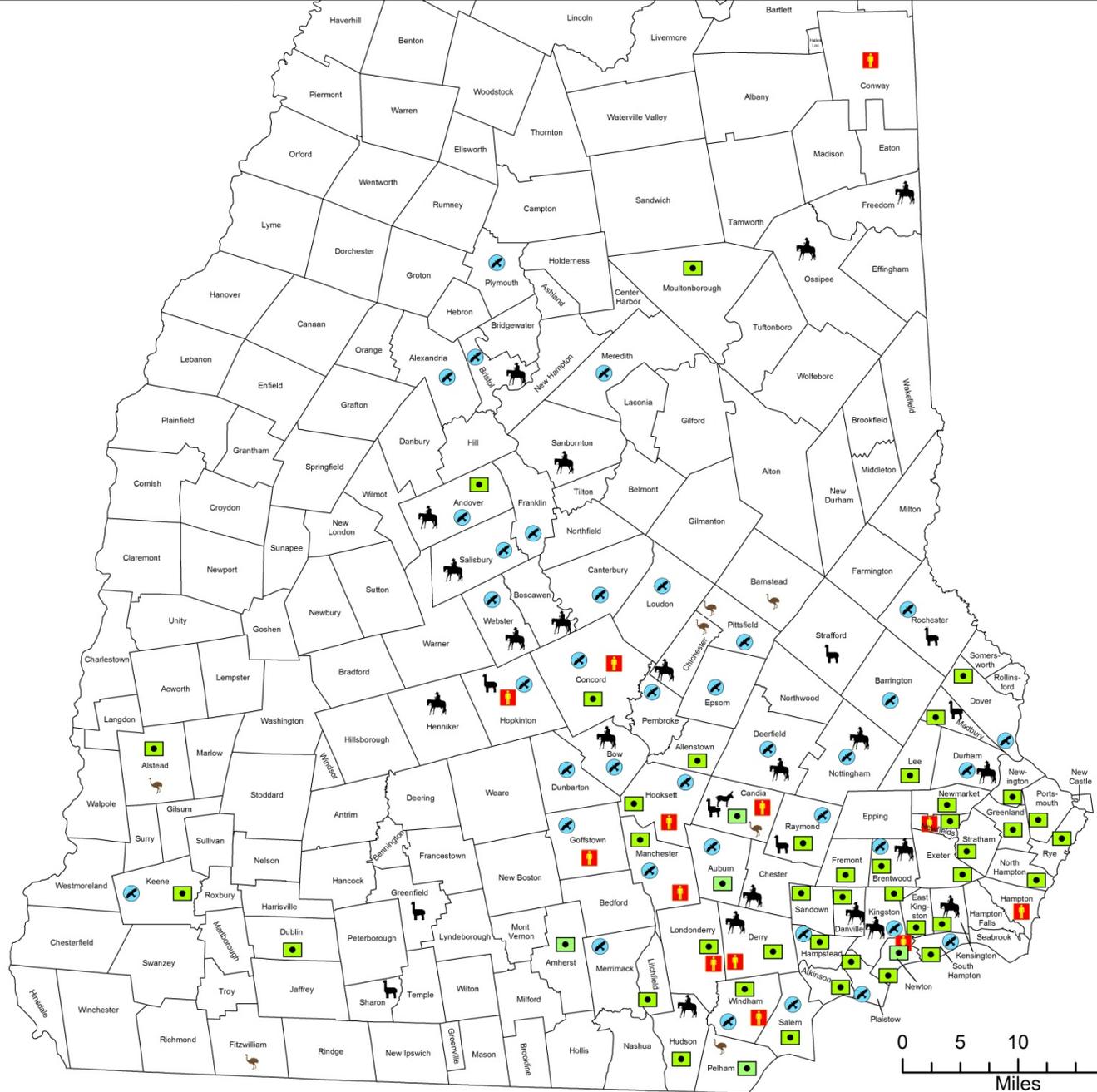
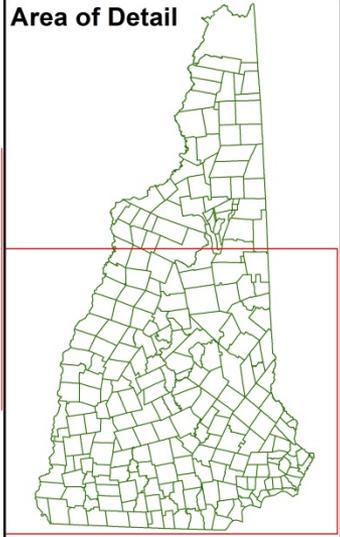
Mosquito Testing initiated in 2004

# Eastern Equine Encephalitis – Positive Test Results, 2004-2017

## Positive Results -

-  - Human (One or More)
-  - Wild Bird (One or More)
-  - Mosquito Pool (One or More)
-  - Horse (One or More)
-  - Alpaca/Llama (One or More)
-  - Emu (One or More)
-  - Mule (One or More)

## Area of Detail



# Jamestown Canyon Virus



# Jamestown Canyon Virus

- Most commonly transmitted through the bite of an infected mosquito
  - *Aedes*, *Coquillettidia*, *Culex*, and *Culiseta* mosquitoes
- Circulates primarily between deer and mosquitoes

# Symptoms of JCV

- Incubation period is unknown
- Symptoms may include: fever, muscle aches, fatigue, dizziness, and headache
- Severe JCV: Encephalitis and meningitis
  - Sudden high fever, severe headache, stiff neck, can be followed by seizures, coma

# NH JCV Activity 2013-2017

- 2013: 1 human case
  - Co-infected with Powassan Virus
- 2015: 1 human case
- 2017: 3 human cases

# Prevention and Control Measures

# Personal Protective Measures: EPA Registered Repellents

- DEET
  - Mosquitoes and Ticks
- Oil of Lemon Eucalyptus
  - Mosquitoes and Ticks
- Picaridin
  - Mosquitoes only!
- Permethrin
  - Mosquitoes and Ticks
  - Applied to clothing
  - Permethrin impregnated clothing



# Mosquito and Tick Repellent

- Always use according to the product label
- For information on EPA registered repellents and their active ingredients:

<https://www.epa.gov/insect-repellents/find-insect-repellent-right-you>





# Protect Yourself Against Tick Bites

- **EVERYONE** should be doing/advocating for these
- Use an EPA registered repellent
- Stay on cleared trails and out of tall grass when possible
- Wear long pants, long sleeves, hat, closed-toe shoes
  - Tuck shirts into pants and pants into socks
  - Light colors may make ticks on clothing easier to spot
- Daily tick checks for you and your pets, remove promptly
- Shower after returning indoors
- Dry clothes in hot dryer

# Tick Habitat



Ticks prefer sheltered, humid areas away from direct sunlight

Tall grass

Brush

Leaf litter

All make great tick habitat



# Create a “Tick-Safe Zone”



- 1 Tick zone** Avoid areas with forest and brush where deer, rodents, and ticks are common.
- 2 Wood chip barrier** Use a 3 ft. barrier of wood chips or rock to separate the “tick zone” and rock walls from the lawn.
- 3 Wood pile** Keep wood piles on the wood chip barrier, away from the home.
- 4 Tick migration zone** Maintain a 9 ft. barrier of lawn between the wood chips and areas such as patios, gardens, and play sets.
- 5 Tick safe zone** Enjoy daily living activities such as gardening and outdoor play inside this perimeter.
- 6 Gardens** Plant deer resistant crops. If desired, an 8-ft. fence can keep deer out of the yard.
- 7 Play sets** Keep play sets in the “tick safe zone” in sunny areas where ticks have difficulty surviving.

Based on a diagram by K. Stafford, Connecticut Agricultural Experiment Station



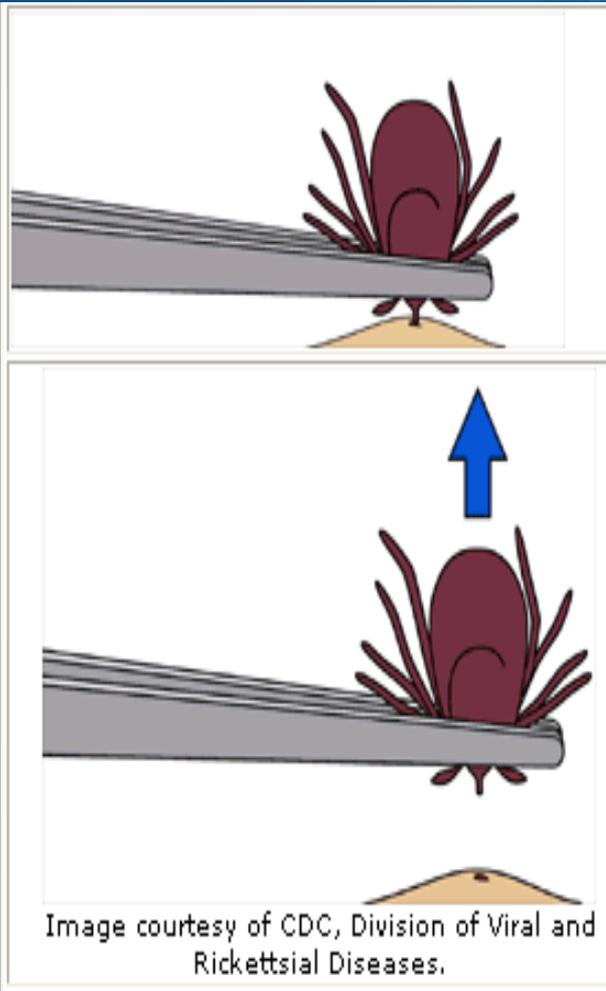
Connecticut  
Agricultural  
Experiment Station



# Prevention Methods and Priorities

- Management of landscaping for schools and communal use areas
- Treatment and/or exclusion of deer
  - An option, but requires extensive maintenance and other considerations
- Treatment and exclusion of mice
  - Owner based decisions
- What about host elimination?
- Area wide acaricide treatment

# Tick Removal



- Grasp tick's mouth parts close to the skin with tweezers
- Pull the tick slowly upwards using a gentle, straight-up motion
- Cleanse your hands and the area around the tick
- Apply an antiseptic to the site

# Tick Removal

- Do NOT:
  - Twist or jerk the tick
  - Squeeze the tick
  - Rub petroleum jelly on the tick
  - Pour kerosene or nail polish on the tick
  - Use a hot match or cigarette
  - Use dish soap
  - Use peanut butter

# Mosquito-proofing

*Don't give mosquitoes a place to breed!*

- No standing, stagnant containers of water
- Treat standing water
- Dump small containers and put away if possible
- Turn over wheelbarrows, kiddie pools, portable containers
- Clean gutters
- Change water in bird-baths/fountains weekly
- Fold and store tarps
- **Drill holes in tires**



# Additional Information

- The CDC has more national surveillance information and disease specific information
  - [www.cdc.gov](http://www.cdc.gov)
- The State of New Hampshire Arboviral Illness Surveillance, Prevention and Response Plan can be found here:
  - [www.dhhs.nh.gov/dphs/cdcs/arboviral/documents/arboviralresponse.pdf](http://www.dhhs.nh.gov/dphs/cdcs/arboviral/documents/arboviralresponse.pdf)
  - This document has additional information about arboviruses, vectors, and control
  - Updated annually
- The State of New Hampshire Tickborne Disease Prevention Plan
  - <https://www.dhhs.nh.gov/dphs/cdcs/lyme/documents/tbdpreventionplan.pdf>

# Acknowledgments

- NH DHHS Division of Public Health Services
  - Benjamin Chan, Elizabeth Talbot, Elizabeth Daly, Katrina Hansen, Abigail Mathewson, Tylor Young
- NH Public Health Laboratories
  - Christine Bean, Fengxiang Gao, Denise Bolton, Carol Loring, Rebecca Lovell, Trevor Lester

# Questions?

- Helpful resources

- <http://www.dhhs.nh.gov/dphs/cdcs/index.htm>
- <http://www.cdc.gov/ncezid/dvbd/>
- <http://www.ct.gov/caes/site/default.asp>

- Contact information:

carolyn.fredette@dhhs.nh.gov  
(603) 271-0273 or  
(603) 271-4496