

Infectious Disease Epidemiology Program, Maine Center for Disease Control and Prevention

Vectorborne Diseases in Maine

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Presentation Agenda

- Tick biology
- Tick ecology
- Lyme disease
- Prevention
- Other tick-borne diseases in Maine
- Mosquito ecology
- Mosquito-borne illnesses

Ticks in the Northeastern United States

- **Blacklegged (or deer) ticks** (*Ixodes scapularis*) can transmit several tick-borne diseases including anaplasmosis, babesiosis and Lyme disease
- Adult tick (at top)
- Nymphal ticks (at bottom) most commonly bite humans



Larger than actual size.

Deer Ticks vs. Dog Ticks

Deer Ticks



Dog Ticks

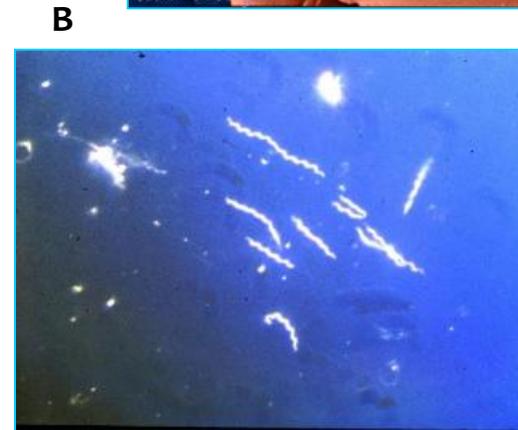
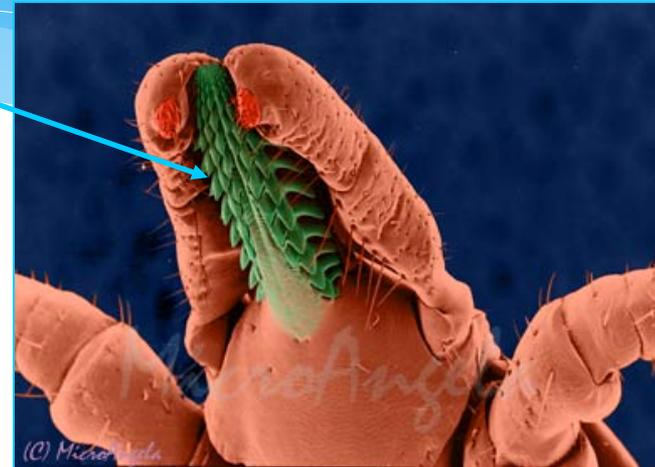


Deer Ticks Vs. Dog Ticks

- Dog ticks have either a white scutum (dot or shield behind the head) or white 'racing stripes' down the back
- *Generally*, deer ticks prefer woods while dog ticks prefer open habitats
- In the summer, large adult dog ticks (1/8"-3/16") are commonly found as well as the small deer tick nymphs (~1/16")
- If you find ticks in fall or spring, they are probably deer ticks

Bite is Worse Than the Bark

- Hypostome barbed
- Ticks secrete an anesthesia and anticoagulant when biting
- To transmit the Lyme bacterium (*Borrelia burgdorferi*), ticks must feed for at least 24 hours!

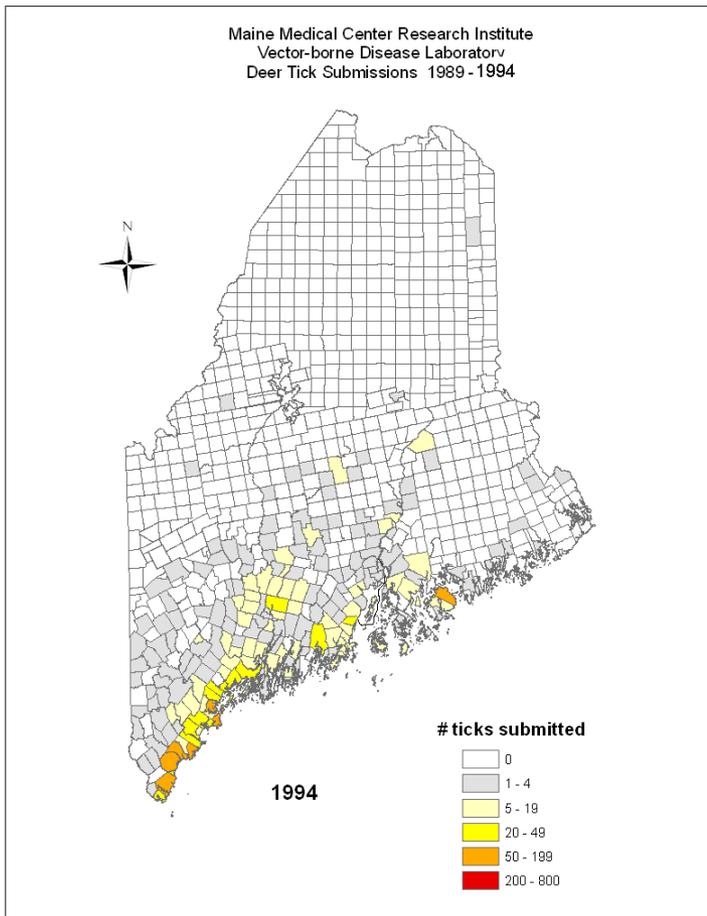


A) Scanning electron microscope (SEM) image of a deer tick. Courtesy of MicroAngela.

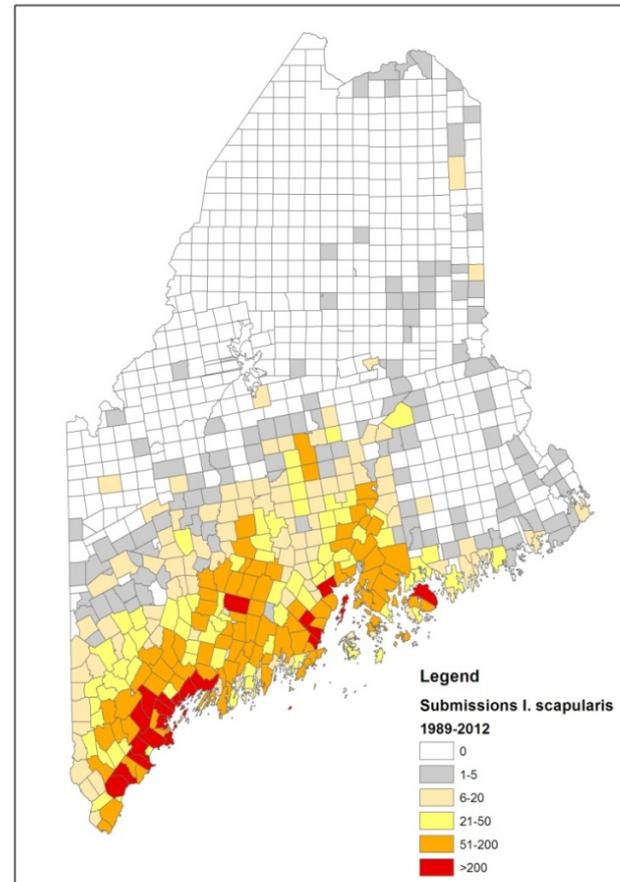
B. *Borrelia burgdorferi* spirochete. CDC.

Tick Distribution

1994



2012



Ticks & Habitat

- Favorable habitat
 - **Deciduous (broadleaf) forest such as oaks**
 - **Shrubby areas**



Photos: MMCRI

Ticks & Habitat

- Unfavorable habitat
 - **Open, dry habitats**



Photos: MMCRI

Symptoms of Lyme Disease

Early Manifestations of Lyme Disease

- Erythema migrans (bull's eye rash)
- Muscle and joint pain
- Fatigue
- Chills, fever, and headache
- Swollen lymph nodes



EM image: CDC

Late Manifestations of Lyme Disease

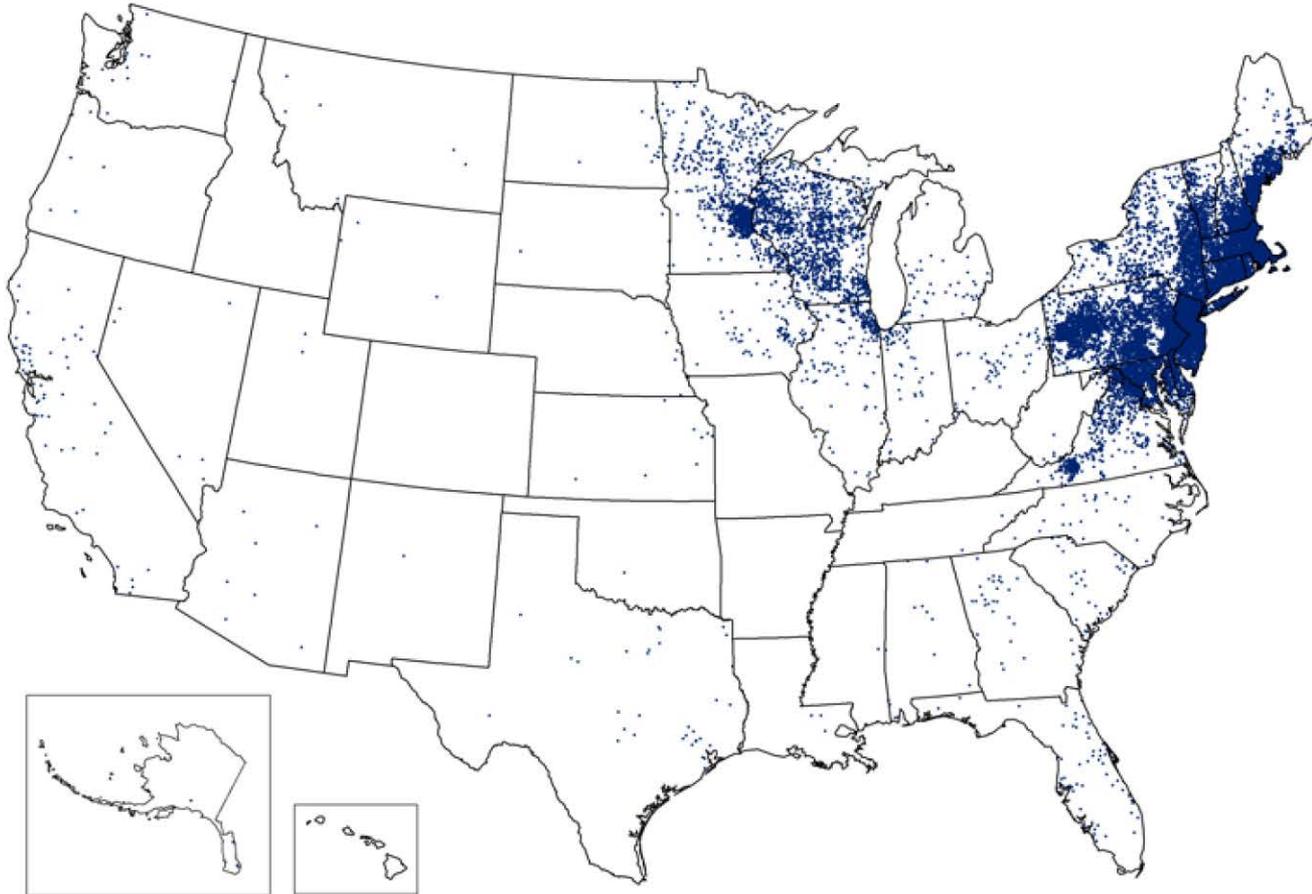
- Arthritis with recurrent, brief attacks of joint swelling
- Lymphocytic meningitis
- Cranial neuritis (such as Bell's palsy)
- Encephalitis
- 2nd or 3rd degree atrioventricular block

Treatment

- Identify symptoms early, as treatment is more effective the earlier it is started
- If bitten by a deer tick: monitor for signs and symptoms of Lyme disease for 3-30 days following bite
- If you have symptoms consistent with Lyme Disease, consult a healthcare provider for treatment
- Current treatment guidelines can be found on the Infectious Diseases Society of America website
<http://www.journals.uchicago.edu/doi/abs/10.1086/508667>

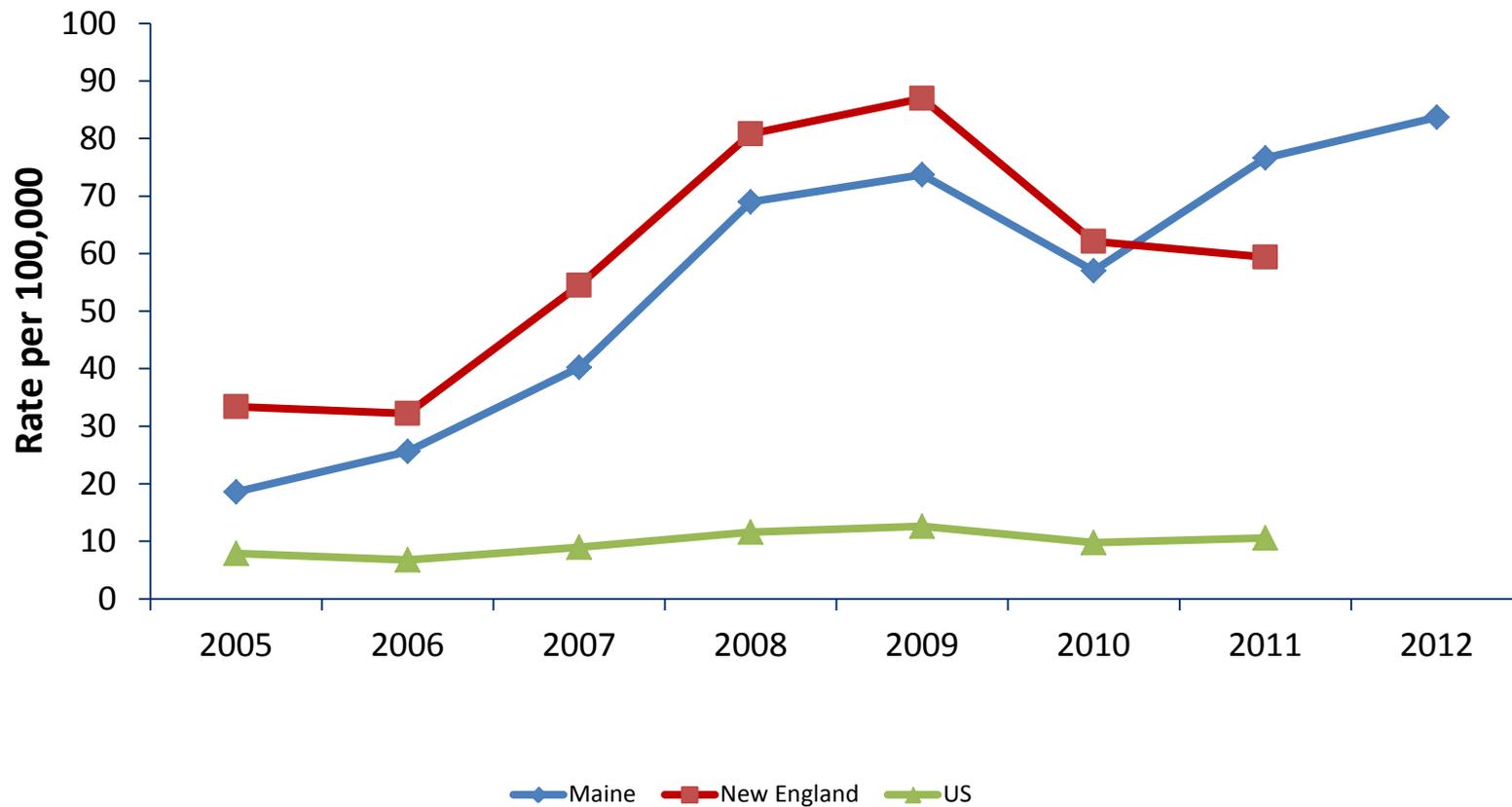
Reported Cases of Lyme Disease—United States, 2012

One dot is placed randomly within the county of residence for each confirmed case. Though Lyme disease cases have been reported in nearly every state, cases are reported based on the county of residence, not necessarily the county of infection.

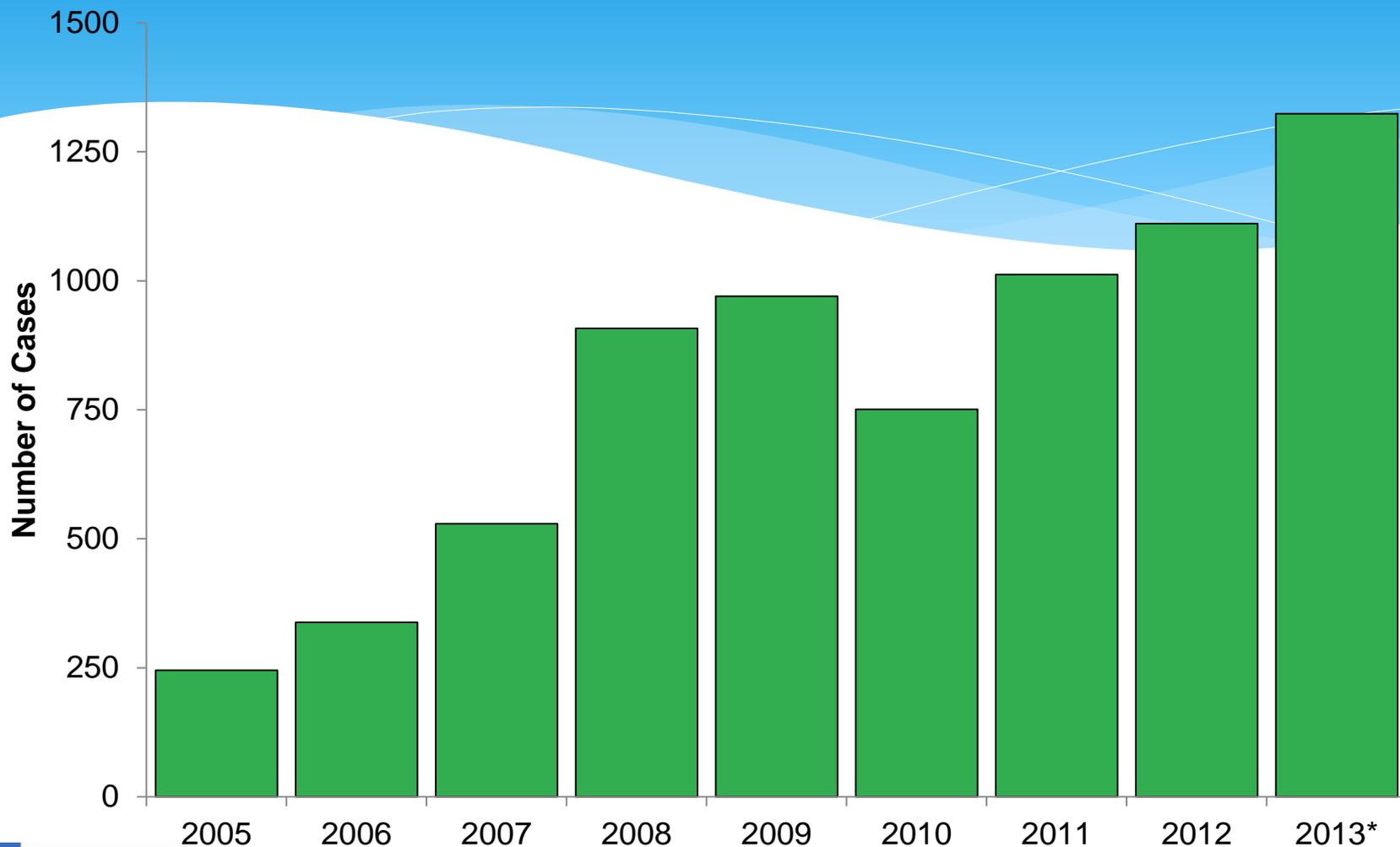


1 dot placed randomly within county of residence for each confirmed case

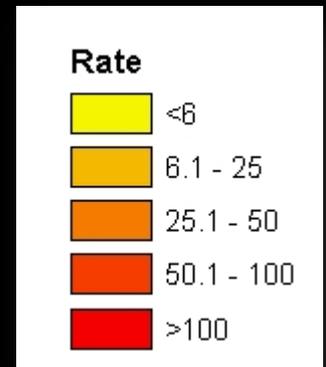
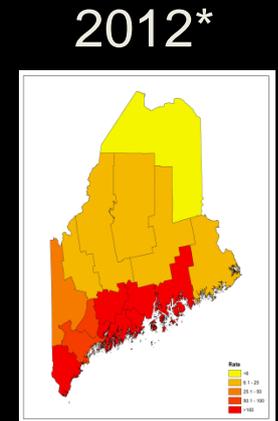
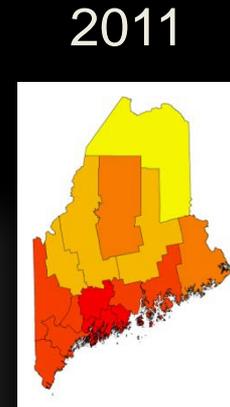
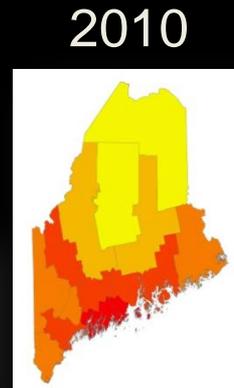
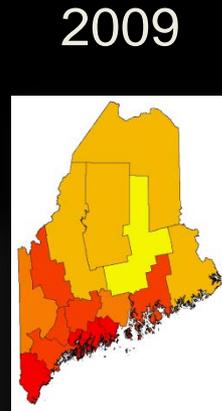
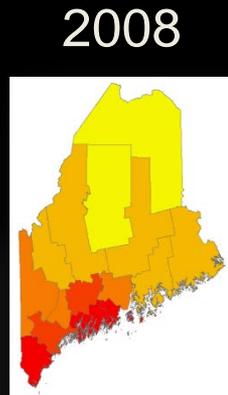
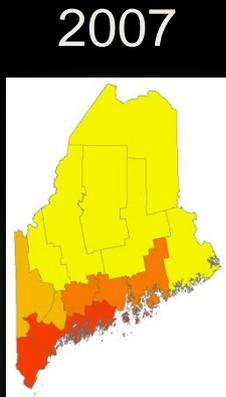
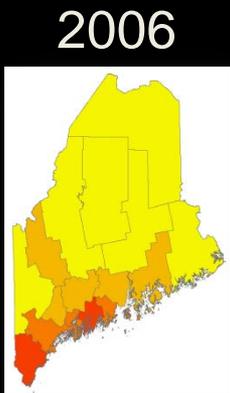
Lyme Disease Incidence in Maine and the United States: 2005 – 2012*



Lyme Disease Cases – Maine, 2005-2013*



Lyme Disease in Maine

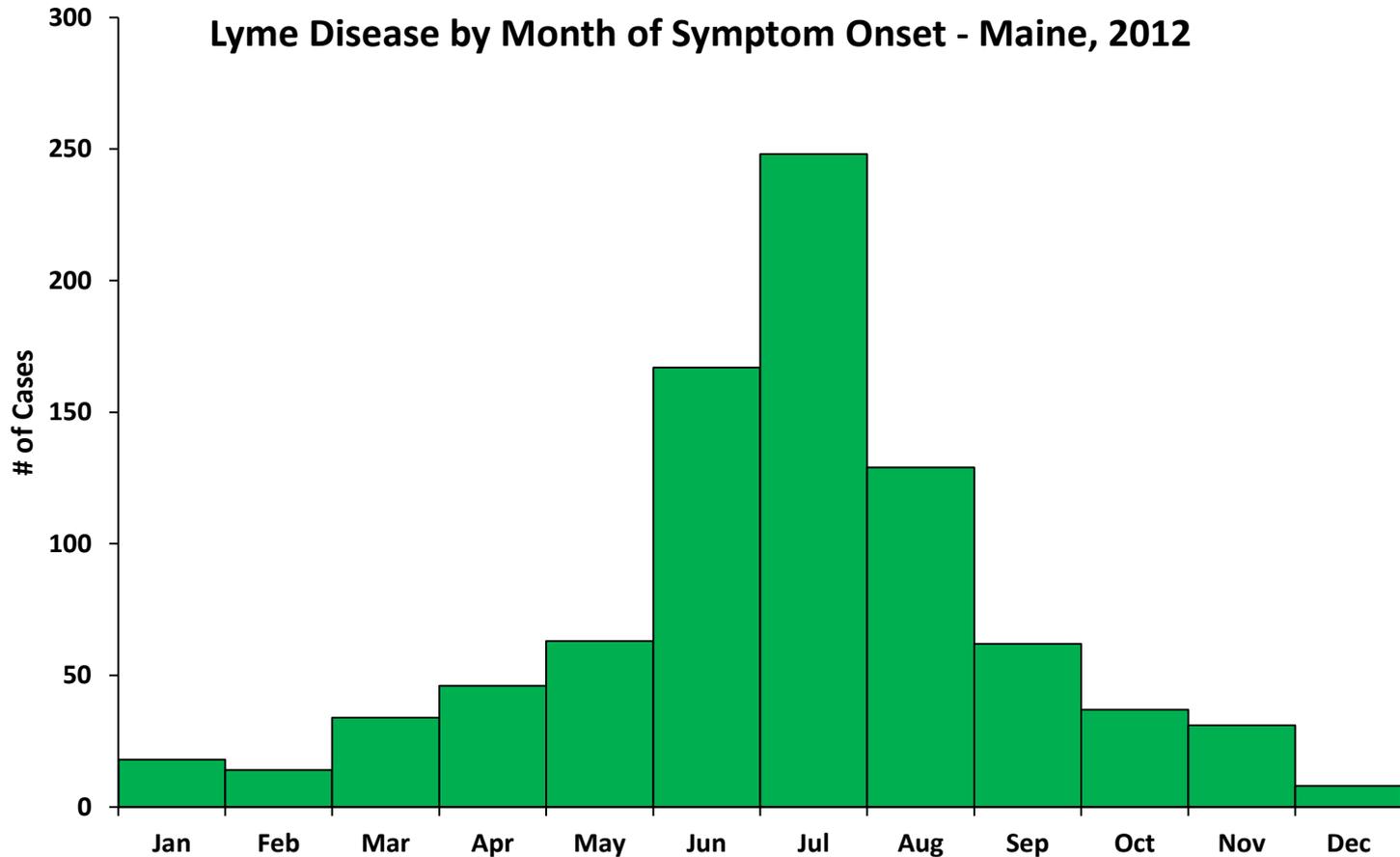


*Data as of 4/22/13

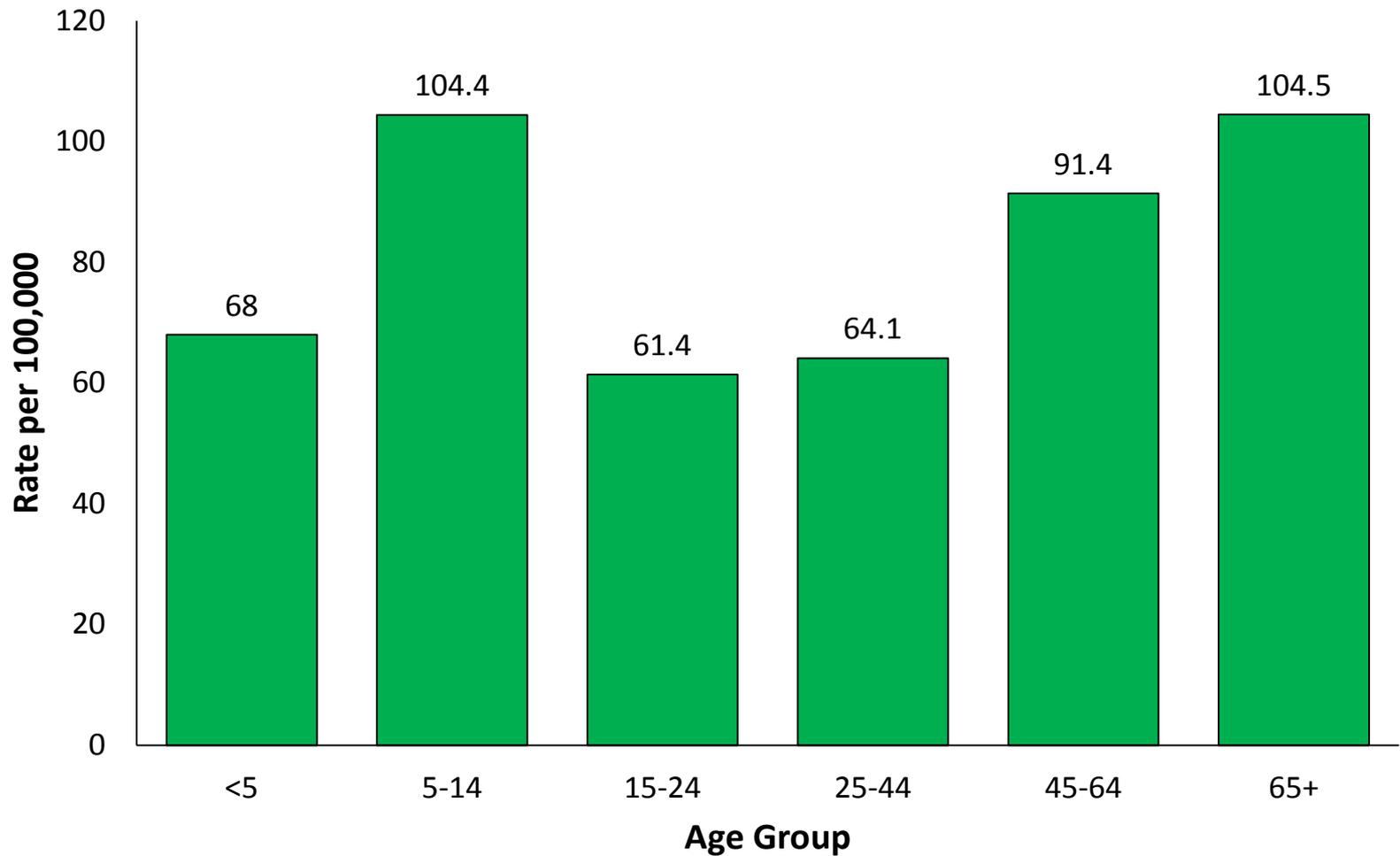
Case Rate by County, 2012

County	Cases	Rate	Percentage
Androscoggin	80	72.6	7.2
Aroostook	1	1.4	0.1
Cumberland	266	94.2	23.9
Franklin	6	19.5	0.5
Hancock	59	106.3	5.3
Kennebec	128	105.8	11.5
Knox	109	269.5	9.8
Lincoln	65	187	5.9
Oxford	25	39.9	2.3
Penobscot	21	13	1.9
Piscataquis	2	11.5	0.2
Sagadahoc	59	161.9	5.3
Somerset	11	21.1	1.0
Waldo	55	139.4	5.0
Washington	7	21.5	0.6
York	217	107	19.5
Maine	1111	82.4	100.0

Seasonality of Cases in Maine

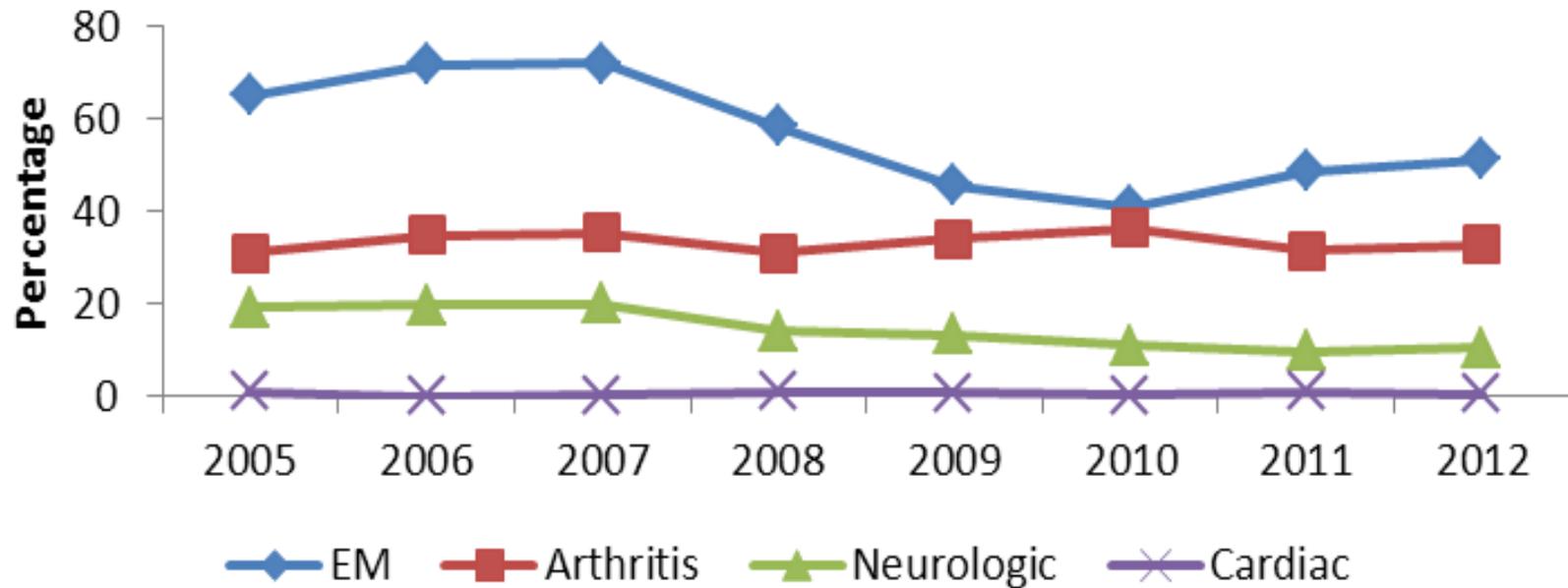


Lyme Disease Rates by Age Group – Maine, 2012



Lyme Disease Symptoms

Percentage of Symptoms Reported Among Lyme Disease Cases - Maine, 2005-2012*



No Ticks for ME

1. Wear protective clothing
2. Use an EPA approved repellent
3. Perform daily tick checks
4. Use caution in tick-infested areas



Personal Protection

- Dress appropriately when outdoors
- Use repellents containing DEET, oil of lemon eucalyptus, IR3535, picaridin, or permethrin
- Thoroughly wash and dry clothes



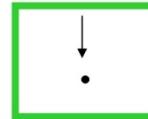
Personal Protection

Don't Forget to Check for Ticks!!

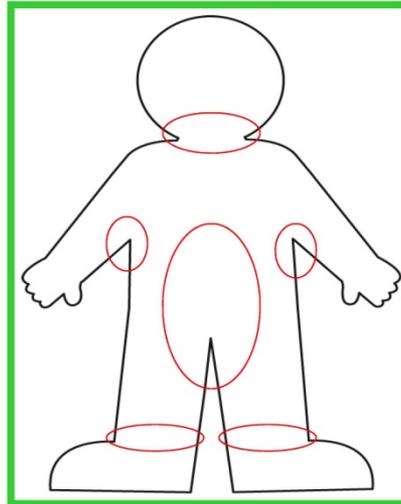
They look a little something like this:



But their actual size is more like this:



Places on your body where ticks commonly hide



WHAT TO DO IF YOU FIND ONE ON YOUR BODY:

- Grasp the tick with tweezers as close to the skin as possible.
- Pull gently but firmly until the tick lets go.
- Do not handle the tick with bare hands or squeeze the tick.
- Apply antiseptic to the bite.

Tick-Safe Landscaping

- Regularly remove brush, leaf litter and tall grass
- Create a dry border between the woods and the lawn
- Consider using a chemical control agent to reduce the number of ticks
- Remove plants that attract deer and construct physical barriers that may discourage deer from entering your yard

Tick Removal: Prompt Removal is Important!

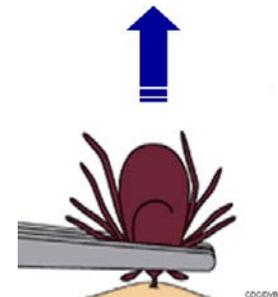
With a Tick Spoon

- Place the wide part of the notch on the skin near the tick (hold skin taut if necessary)
- Applying slight pressure downward on the skin, slide the spoon forward so the small part of the notch is framing the tick
- Continuous sliding motion of the remover detaches the tick



With Tweezers

- Grasp the tick close to the skin with tweezers
- Pull gently until the tick lets go



Killing / Preserving Ticks

- To kill a tick found in your home or removed from a person or pet, easiest is to put it in a container of rubbing alcohol
- Tick will soon die and be preserved in the event it is submitted to a laboratory

tick ID

KNOW THEM. PREVENT THEM.



Deer Tick (Black-Legged Tick)



nymph



adult male



adult female

- Deer ticks may transmit the agents that cause Lyme disease, anaplasmosis, and babesiosis
- **What bites:** nymphs and adult females
- **When:** anytime temperatures are above freezing, greatest risk is spring through fall

ACTUAL SIZE

nymph
(1/32"–1/16")

adult
(1/8")



engorged adult
(up to 1/2")

Dog Tick



adult male



adult female

- Dog ticks do not transmit the agent that causes Lyme disease
- **What bites:** adult females
- **When:** April–August through fall

(examples are not actual size, dog tick nymphs are rarely found on humans or their pets)

prevent the bite

- Wear light-colored protective clothing
- Use EPA-approved insect repellent on skin or clothing
- Use caution in tick infested areas
- Perform daily tick checks
- Protect your pets, use repellents, acaricides, and a Lyme disease vaccine for dogs



tick removal

Remove ticks immediately. They usually need to attach for 24 hours to transmit Lyme disease. Consult a physician if you remove an engorged deer tick.

Using a tick spoon:

- Place the wide part of the notch on the skin near the tick (hold skin taut if necessary)
- Applying slight pressure downward on the skin, slide the remover forward so the small part of the notch is framing the tick
- Continuous sliding motion of the remover detaches the tick

Using tweezers:

- Grasp the tick close to the skin with tweezers
- Pull gently until the tick lets go

Other Tick-borne Diseases

- Anaplasmosis
- Babesiosis
- Ehrlichiosis
- Powassan
- Rocky Mountain Spotted Tick Fever

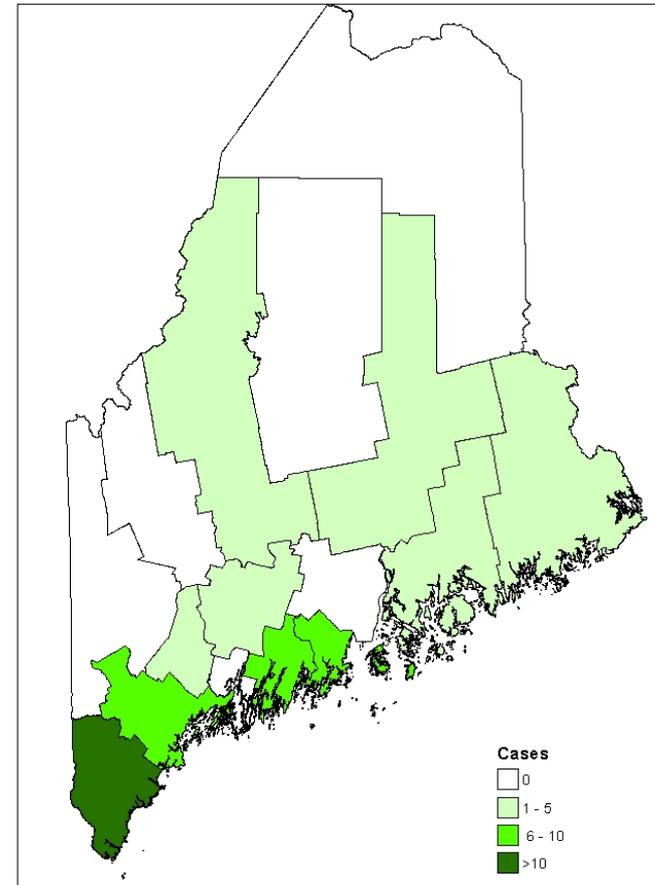
Anaplasmosis

- Caused by the bacteria *Anaplasma phagocytophilum*
- Symptoms include:
 - Fever, headache, malaise, myalgia, arthralgia, confusion, anemia, thrombocytopenia, leukopenia, elevated hepatic transaminases
- Testing:
 - PCR is preferred method of testing
- Treatment:
 - Appropriate antibiotic therapy as recommended by the IDSA Guidelines for Clinical Assessment, Treatment, and Prevention of Lyme Disease, HGA, and Babesiosis

Anaplasma Cases

2005: 4
2006: 10
2007: 9
2008: 17
2009: 15
2010: 17
2011: 26
2012: 52
2013: 92*

Anaplasma Cases, Maine 2012



*data as of 1/7/2014

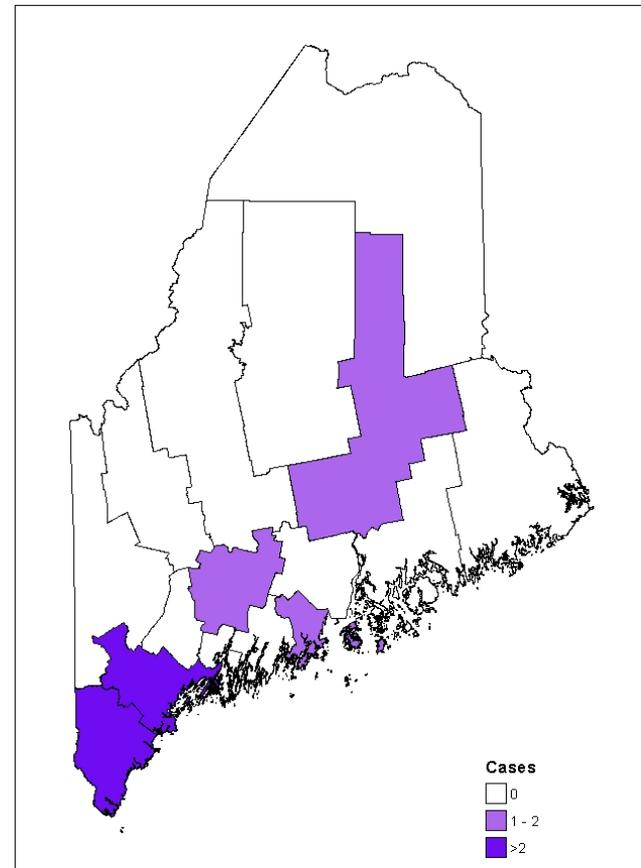
Babesiosis

- Caused by a parasite (*Babesia microti*)
- Symptoms include:
 - Fever, anemia, thrombocytopenia, chills, sweats, headache, myalgia, arthralgia
- Testing:
 - PCR or Microscopy (blood smear) is preferred
- Treatment:
 - Appropriate antibiotic therapy as recommended by the IDSA Guidelines for Clinical Assessment, Treatment, and Prevention of Lyme Disease, HGA, and Babesiosis

Babesia Cases

2005: 11
2006: 9
2007: 11
2008: 11
2009: 3
2010: 5
2011: 9
2012: 10
2013: 36*

Babesia Cases, Maine 2012



*data as of 1/7/2014

Powassan

- 1 case in 2013 (first case in 9 years)
- Caused by a virus (*Powassan*), carried by *Ixodes cookei* tick
- Symptoms include:
 - Fever, headache, vomiting, weakness, confusion, seizures, and memory loss
- Testing:
 - MIA and PRNT
- Treatment:
 - No specific treatment

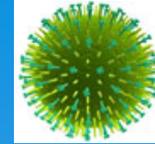
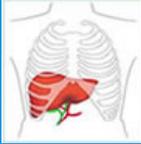
Non-endemic diseases

Ehrlichiosis

- Carried by the Lonestar tick
- Symptoms similar to Anaplasmosis
- Considered an emerging disease in Maine
- 3 cases in 2013

Rocky Mountain Spotted Fever

- Carried by the dog tick
- Hallmark symptom is a rash on palms and feet
- Not known to be acquired locally, but may be an emerging disease
- 3 probable cases in 2013



Infectious Disease Epidemiology Program, Maine Center for Disease Control and Prevention

Mosquito Borne Diseases

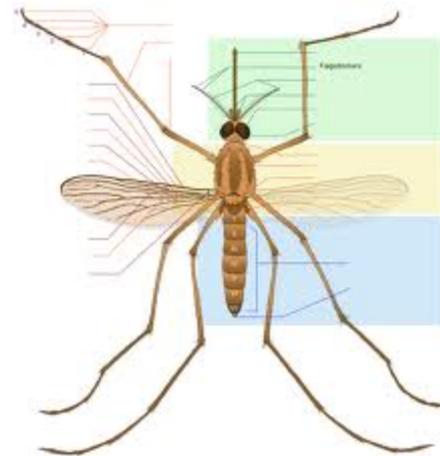
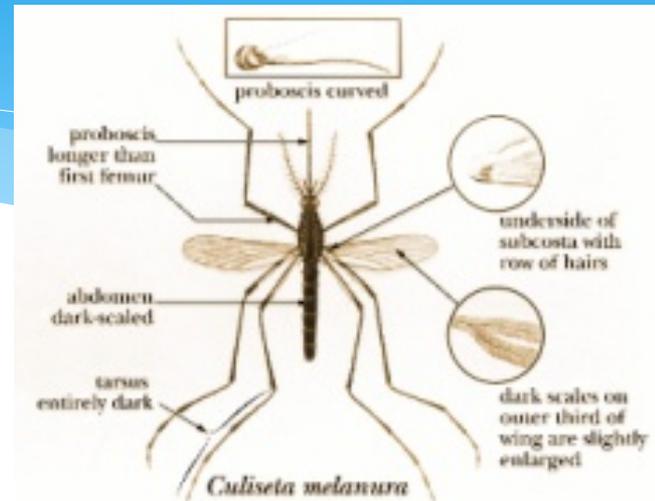
Mosquito-borne diseases



- Eastern Equine Encephalitis
 - One of the most serious mosquito-borne diseases in the United States
 - Many persons infected will have no obvious symptoms
- West Nile Virus
 - Occurs throughout the United States
 - Many persons infected will have no obvious symptoms

Mosquito Species

- 45 mosquito species in Maine, however less than half are considered to be likely vectors for EEEV and WNV



EEE vector habitat



- *Cs. melanura* primary vector of EEE
- Bogs and swamps
 - Mature hemlock, immature red maple, yellow birch, beech, winterberry, shrubs
 - Clear or tea colored water
 - Peat bottom
 - Acidic
- Early emergence in spring, overwinter as larvae, multiple generations
- Also WNV competent
- Primarily bird biters

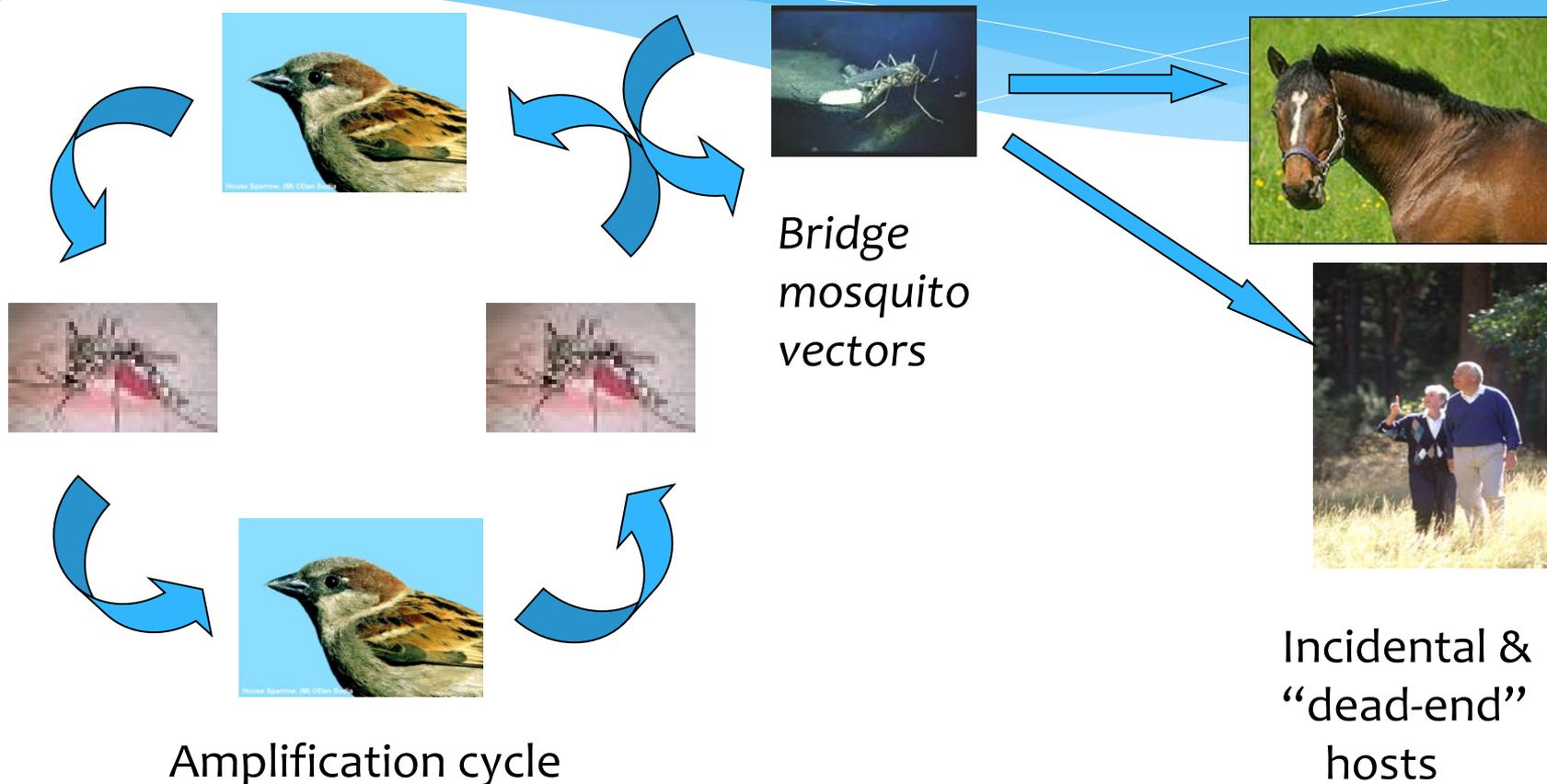
WNV vector habitat



- *Cx. pipiens/restuans* common WNV vector
 - Artificial containers
 - Catch basins
 - Flower pots
 - Discarded tires
 - Stagnant temporary pools
 - Holes in trees
 - Multiple generations
 - Can overwinter as adults
 - Generalist feeders



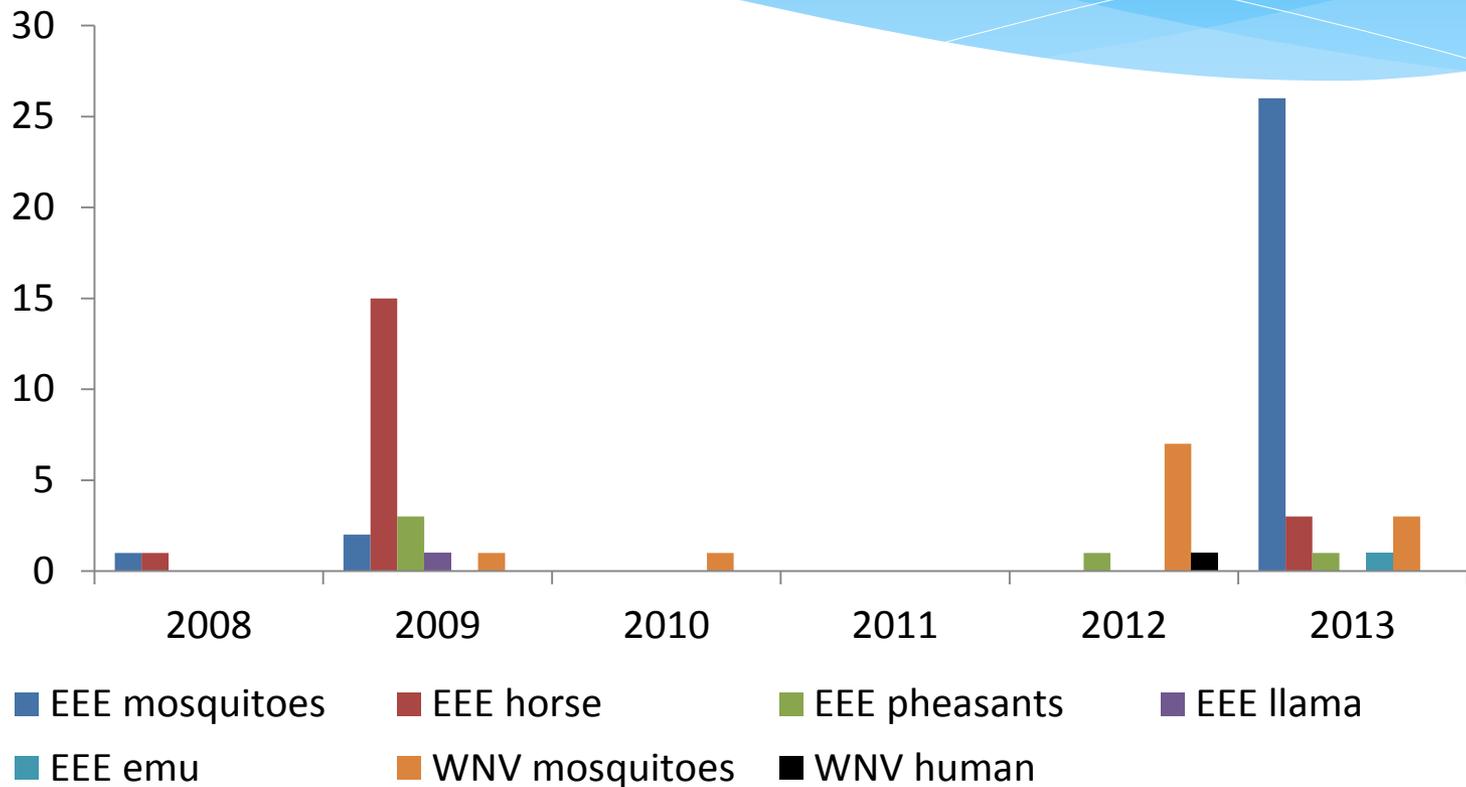
EEEV and WNV Transmission Cycle



Symptoms of Arboviral Illness

- MOST people infected with an arbovirus will not have symptoms
- Symptoms can be very mild to very severe and appear 3-18 days after infection
 - Mild
 - Fever
 - Head and body aches
 - Lack of energy
 - Neuroinvasive Disease
 - Central nervous system involvement
 - Stiff neck, altered mental status, inflammation of the brain, respiratory distress, paralysis, coma, death
- Symptoms usually last 1-2 weeks, no treatment, only support

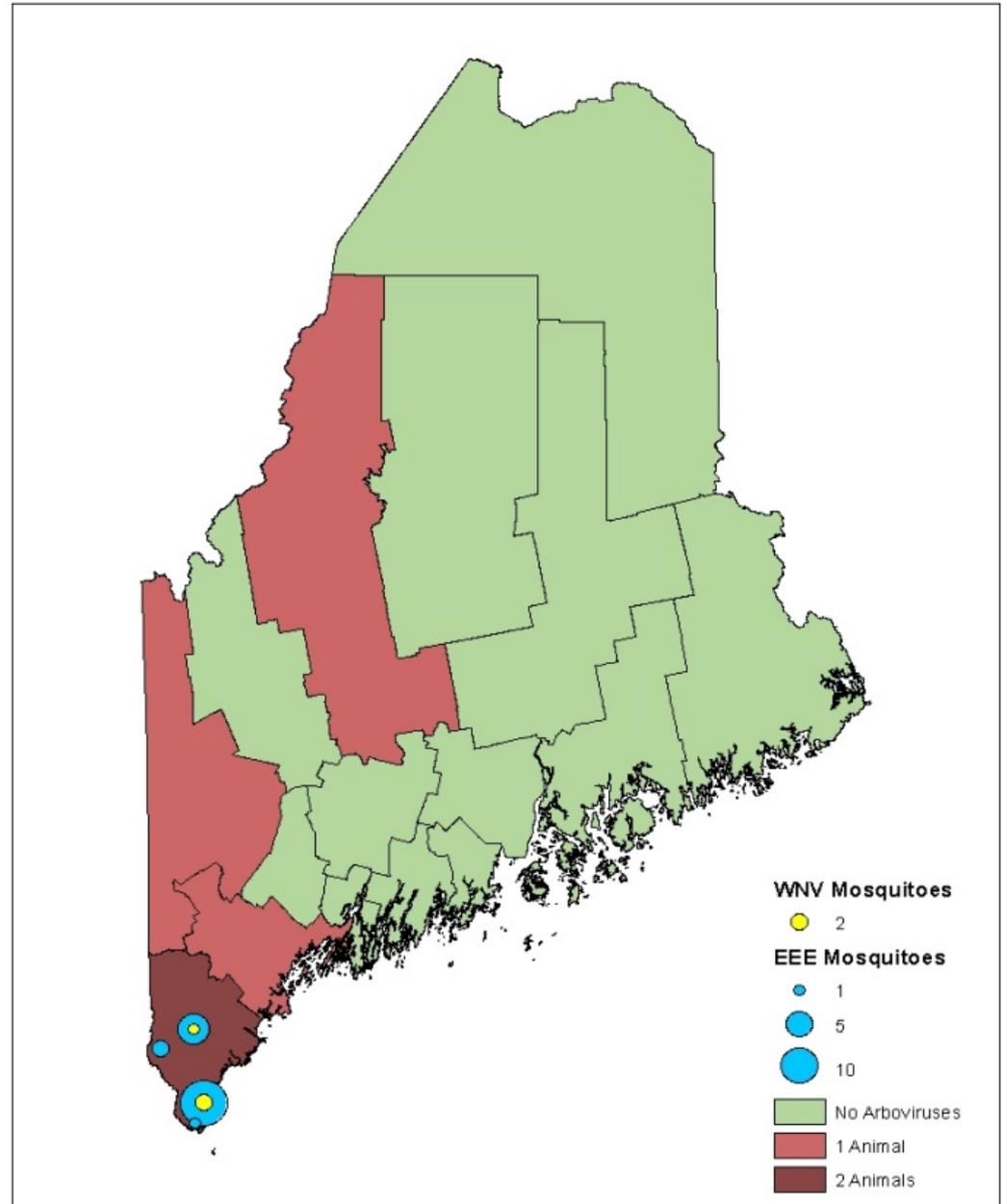
Arbovirus in Maine, 2008-13



Arboviral Activity, Maine 2013

Maine 2013

- 26 positive EEE pools
- 3 positive WNV pools
- 3 positive EEE horses
- 1 positive EEE emu
- 1 positive EEE pheasant flock





go ahead
**the fight
bite**

You can protect yourself against West Nile virus and Eastern equine encephalitis

- ▶ Wear long sleeves and long pants.
- ▶ Use repellent on skin and clothes.
- ▶ Take extra precautions at dusk and dawn.
- ▶ Use screens on your windows and doors
- ▶ Drain artificial sources of standing water where you live, work and play.

For more information about mosquito-borne diseases
visit www.mainepublichealth.gov

EEE - serosurvey

- Maine is interested in the geographical range of EEE – so in collaboration with federal CDC, MMCRI, and USDA we have done several serosurveys
 - Deer and moose serosurvey 2009, 2010, 2011, 2012, 2013
 - Turkey serosurvey 2011, 2012
- Positives found in 15 Maine counties (all but Lincoln)

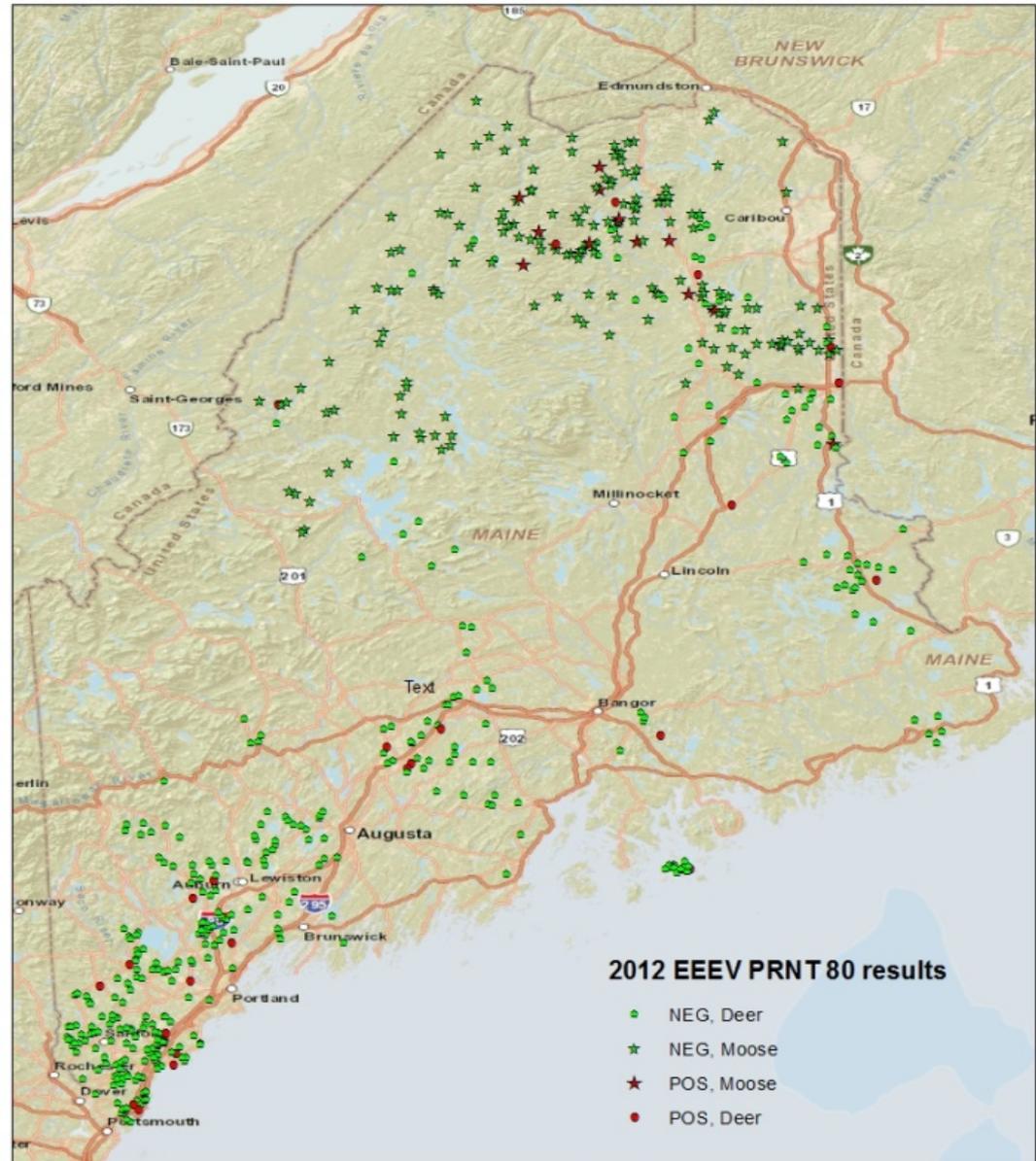
EEE serosurvey

2012 results

- 379 deer tested
 - 6.6% positive
- 187 moose tested
 - 6.3% positive
- Positives in 8 counties

2011 overall infection rates:

- 18.1% in deer
- 7.6 % in moose



For More Information

- Maine CDC disease reporting and consultation line: 1-800-821-5821
- Maine Medical Center Research Institute – Vector-borne Disease Lab: 207-396-8246
- Sara Robinson, Vectorborne Epidemiologist:
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