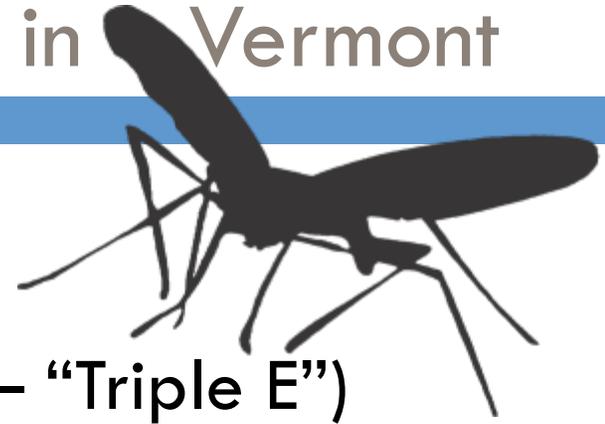




# Eastern Equine Encephalitis in Vermont • 2013

# Mosquito-borne Arboviruses in Vermont



- West Nile virus
- Eastern equine encephalitis (EEE – “Triple E”)

## Arboviruses: *Ar*thropod-*bo*rne viruses

Arthropod = invertebrate animals (insects, arachnids, crustaceans) that have a segmented body and jointed appendages, and a chitinous exoskeleton

Includes mosquitoes and ticks

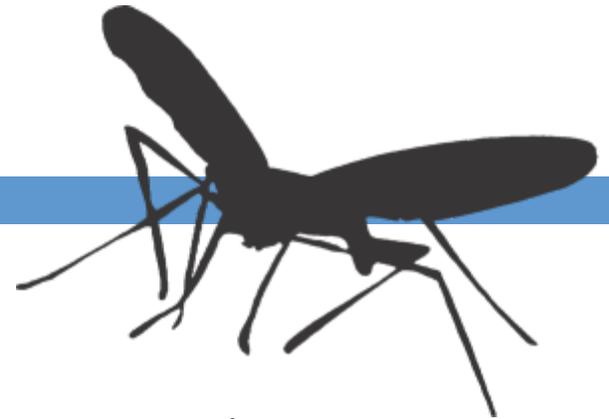
*West Nile virus and EEE virus are spread by the bite of an infected mosquito.*

*Culiseta melanura is the species of mosquito that keeps EEE virus circulating.*

# Eastern Equine Encephalitis Virus

- Virus Genus = *Alphavirus*
- Virus Family = *Togaviridae*
- Not new to the U.S. = Outbreaks in horses recorded in 1831
- Virus isolated in 1933
- First human case confirmed in 1938 in MA
- Virus mostly present along coastal areas, some inland swamps = mosquito habitat

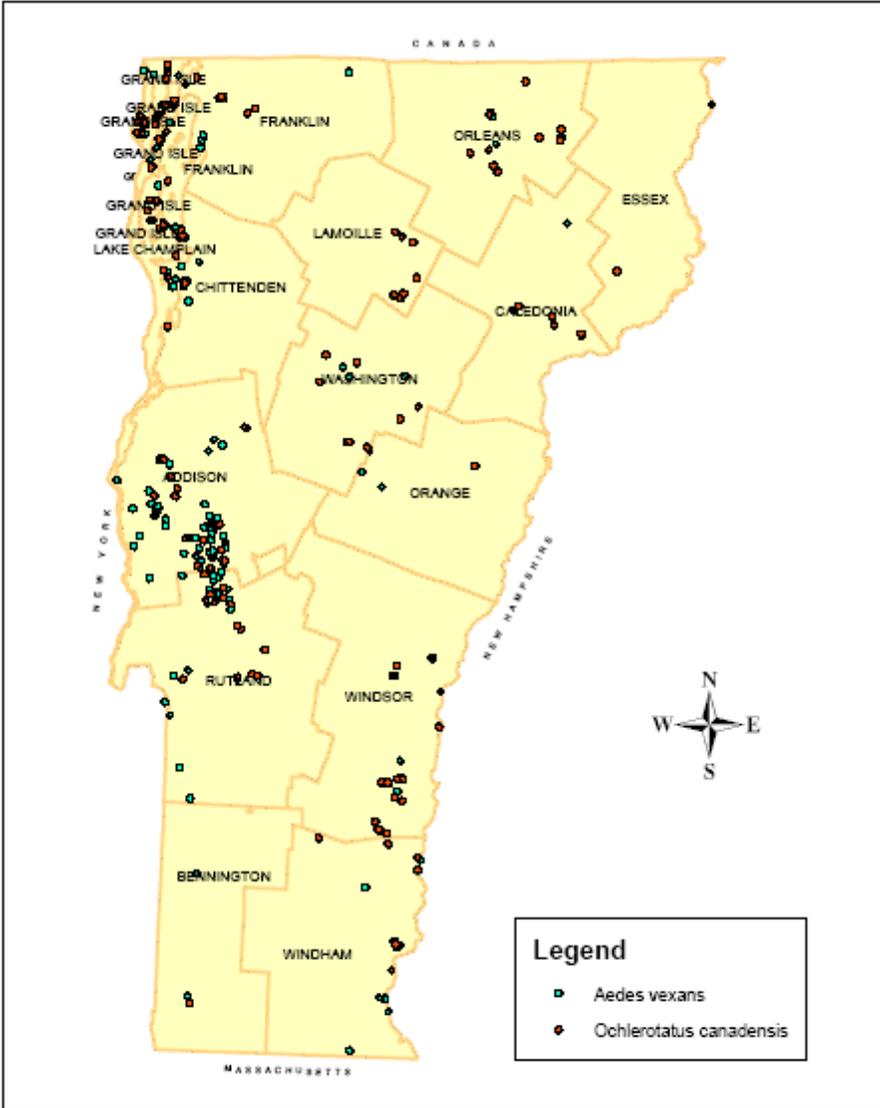
# Transmission Cycle of EEV



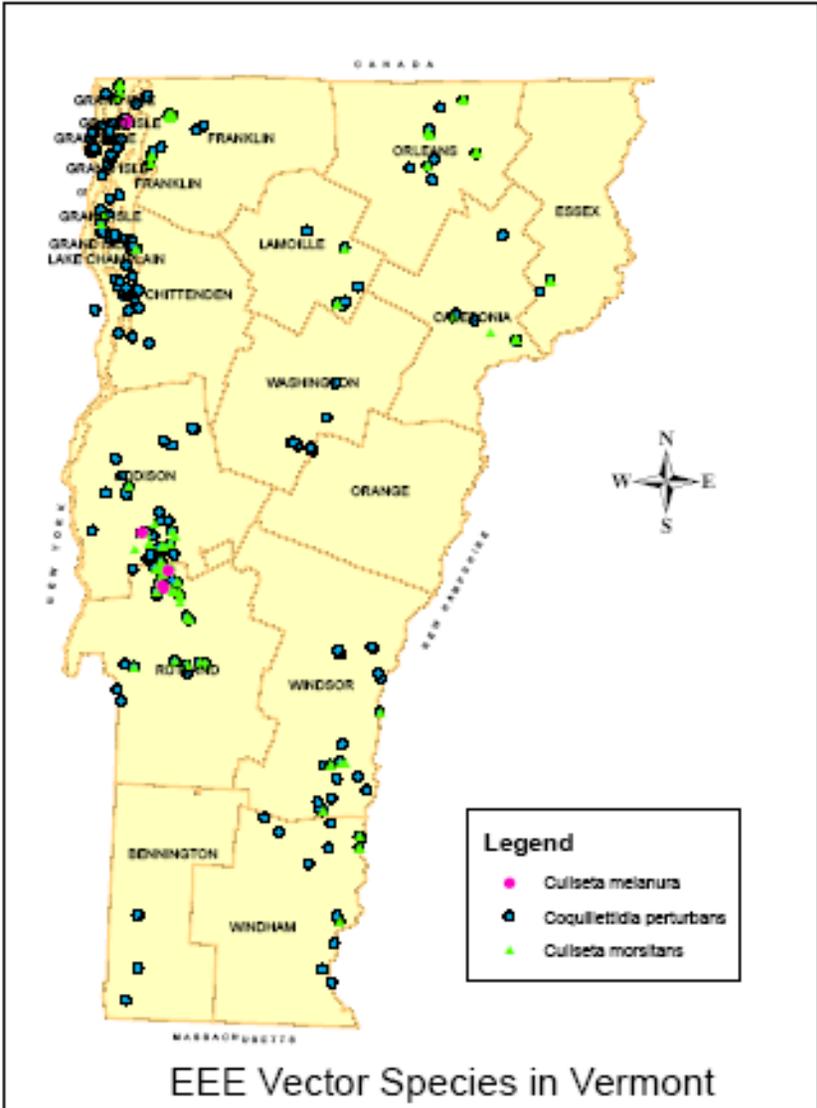
*Culiseta melanura* = enzootic vector

- This mosquito mostly bites birds, but sometimes bites mammals.
- Bridge vectors = mosquito species (*Aedes*, *Coquillettidia*, *Culex*) that bite birds and mammals, believed to be responsible for transmitting virus from birds to mammals.
- Bridge vector mosquitoes may play a role, but more recently proposed that *Culiseta melanura* is responsible for transmitting virus to mammals.

# EEE Mosquito Vector Species



EEE Vector Species in Vermont



EEE Vector Species in Vermont

# Transmission cycle of EEEV

Mosquito vector



Amplifying host



Dead-end hosts



Bridge vector



# Thankfully, EEE Appears to Be Rare.

- Most pathogenic mosquito-borne disease in the U.S.
  - ▣ EEE causes more severe illness than West Nile virus.
  
- Human case fatality rate: ~35%
  - ▣ *Death is more common in older people.*
  
- Among survivors, severe neurological problems in ~50% of cases
  - ▣ *This is especially true for children.*



# Symptoms of EEE Illness



- ❑ Incubation period 4 -10 days
- ❑ Systemic presentation:
  - ▣ *Chills, fever, malaise, arthralgia (joint pain), myalgia (muscle pain)*
  - ▣ *Lasts 1 to 2 weeks*
  - ▣ *Recovery complete as long as no central nervous system involvement*
- ❑ Encephalitic presentation:
  - ▣ *Fever, headache, irritability, restlessness, drowsiness, anorexia, vomiting, diarrhea, cyanosis, convulsions, coma*

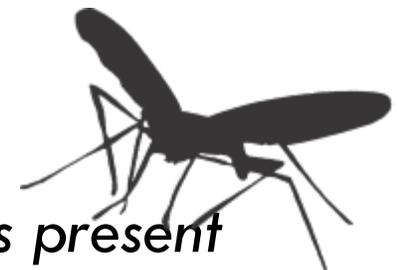
# Other Species Affected

- horses and donkeys
- llamas and alpacas
- emus and pheasants
- also puppies, harbor seal, cow, African penguin, deer
- *Vaccine licensed for horses –  
may also be effective in llamas, alpacas and emus*



# What did we know about EEE in Vermont?

- Until 2010, no evidence of the virus detected here
- Surveillance
  - ▣ *Zero cases of human or animal illness reported*
  - ▣ *Limited mosquito surveillance*
- Seemed likely to be here
  - ▣ *Found in neighboring states and Quebec*
  - ▣ *Acidic hardwood swamps and vector species present*
  - ▣ *Activity increasing in Northeast?*
    - *New areas of concern in ME and NH*
    - *Increases in human cases in MA*

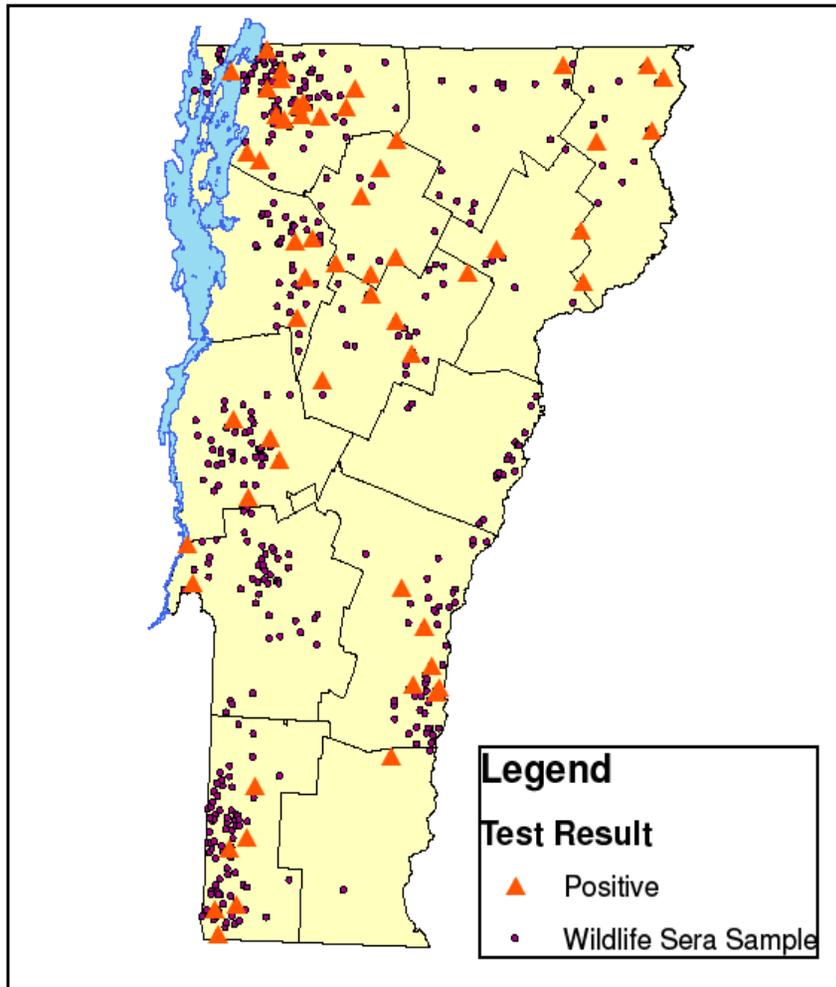


# Deer & Moose Serosurvey



- 2010 hunting season
  - ▣ deer get bitten by a lot of mosquitoes
  - ▣ and then develop detectable antibodies
  - ▣ deer survive infection, although clinical illness has been reported
  - ▣ they have a limited range ~ 1 square mile in summer
  - ▣ blood is readily available during hunting season
- 500+ blood samples collected from deer/moose at check stations during youth weekend and opening weekend of rifle season
- Samples sent to CDC to test for antibodies

# 2010 Results

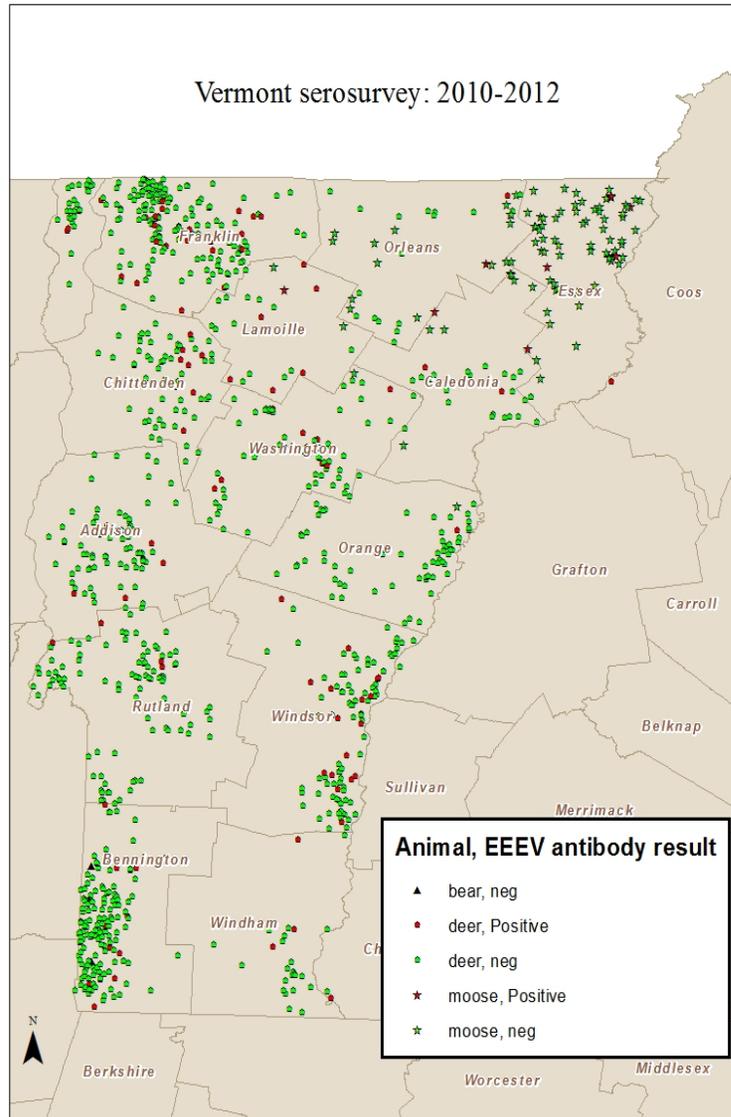


- Deer = 50/489 (10.2%)
- Moose = 6/21 (28.6%)
- 8 positive yearlings
- Widespread distribution of virus
- Not necessarily clustered near *Culiseta* habitat
  
- *No evidence in 2010 of EEE illness in domestic animals or people. Risk for transmission to people appeared to be low.*

# What did the Deer Serosurvey Tell Us?

- EEE virus is present and widespread in Vermont.
- We need to keep up surveillance – both among humans and animals.
- More complete mosquito surveillance would be ideal, but it's expensive.
- We must continue to alert Vermonters about the public health importance of taking precautions to prevent mosquito bites.





## 2010-12 Results

- 3 years of data
- Still showing evidence of widespread exposure among deer to EEE virus

# Mosquito Surveillance – *Trapping & Testing*

- *Culiseta* habitat = prefer acidic swamps (red maple, cedar)
- Overwinter as larvae deep in crypts formed by pockets of water around tree roots – difficult to larvicide
- Brandon, Leicester, Salisbury area = largest acidic swamp
- Adults first emerge in April/May, but are not infected with EEE virus. Second emergence of adults in late June/July have been found to be infected. We don't know why this is.



# Resting Box Traps



- Best method for collecting *Culiseta melanura* species
- Passive device: serves as a resting place for blooded mosquitoes from dawn to noon
- Attracts blooded, gravid and host-seeking *Culiseta melanura*
- 2012 mosquito trapping surveillance focused on largest hardwood swamp, which also had high mosquito activity and active mosquito control districts

# 2012: First EEE Detections in Mosquitoes

- Mostly from one trap site in southern Addison County
- EEE detections for several weeks in a row starting in late July



# First Evidence of EEE in Domestic Animals

- Sept. 21, 2011 – report of ill emus
  - ▣ Southern Rutland County near large acidic swamp
- Several emus in a flock developed severe illness: hemorrhagic gastroenteritis, ataxia
- Earliest onset Sept. 25
- By Sept. 21, 14 emus had died
- Last death on Sept. 24
- 19 of 93 died, 2 birds recovered
  - ▣ all ages affected



# First Reports of EEE in People

- 2 people diagnosed with EEE in late August 2012
- Both lived in area where mosquitoes tested positive for EEE, and both later died from the illness
- 2 horses also diagnosed with EEE – first time in Vermont



**Health Advisory**  
September 6, 2012

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## Human Cases of Eastern Equine Encephalitis in Vermont

To: Vermont Healthcare Providers, Hospitals, and Ambulatory Care Centers  
From: Harry Chen, MD, Health Commissioner

– Please Distribute Widely –

As of the beginning of September 2012, the first two human cases of Eastern Equine Encephalitis (EEE) have been confirmed in Vermont. Both are adults from the Addison and Rutland County area where mosquito pools have recently tested positive for EEE and West Nile virus (WNV). In addition, one case of WNV was confirmed in a Chittenden County resident. Overall, arboviral activity is still relatively low in the community.

# Plans for 2013



- Mosquito surveillance (trapping and testing) in known EEE area
  - ▣ Data to be posted online
- Human and veterinary surveillance
- Public information/outreach
  - ▣ Preventing mosquito bites
- Online risk map
  - ▣ Updated throughout season
  - ▣ Will determine risk warnings (moderate/high) for residents

# EEE and West Nile Virus Prevention

- Promote use of personal protection:
  - ▣ Cover skin. Wear long sleeves and long pants.
  - ▣ Use insect repellent labeled effective against mosquitoes. (DEET, Picaridin or oil of lemon eucalyptus for skin, permethrin for clothing)
  - ▣ Cover baby carriages/outdoor play spaces with mosquito netting.
  - ▣ Fix holes in screens. Make sure they are tightly attached.
  - ▣ Avoid outdoor activities when mosquitoes are active.
- Eliminate mosquito breeding habitats.
  - ▣ Reduce standing water.
- Vaccinate horses and other susceptible animals.

# HOW DO I CHOOSE AN INSECT REPELLENT?



1- 2 hours



2-4 hours



5 - 8 hours

## ON SKIN

### MOSQUITOES

Protection varies by species of mosquito.

Most mosquitoes that transmit diseases in the US bite from dusk-dawn.

Choose the appropriate repellent for the length of time you'll be outdoors. Reapply according to product instructions

<10% DEET  
<10% picaridin

~15% DEET  
~15% picaridin/KBR 3023  
~30% oil of lemon eucalyptus/PMD

~20%-50% DEET

### TICKS

Other factors affecting efficacy include: individual chemistry, sweat, numbers of bugs. Apply creams and lotions 15 to 20 minutes before going outdoors.

Generally, repellent with 20 – 50% DEET is recommended to protect against tick bites.

In areas where both mosquitoes and ticks are a concern, repellents with 20 – 50% DEET may offer best, well-rounded protection.

The American Academy of Pediatrics has recommended that repellents containing up to 30% DEET can be used on children over 2 months of age.

The repellents shown here meet CDC's standard of having EPA registration and strong performance in peer-reviewed, scientific studies. They reflect products currently available in the U.S.

## ON CLOTHING AND GEAR

### Permethrin



Permethrin treatment of clothing and equipment can provide protection against mosquitoes and ticks through multiple washings. Follow label instructions.



[www.healthvermont.gov](http://www.healthvermont.gov)

Vermont Department of Health