The Importance of Mosquito Disease Surveillance to a Control Program

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Purpose of Disease Surveillance

• The purpose of the surveillance program at SCMAC is:
  – To provide current information on the occurrence of encephalitis viruses within Saginaw County.
  – To locate areas that our control efforts need to be focused, in order to reduce the possibility of disease transmission.
  – Provides better understanding of arboviruses within Saginaw County
Arbovirus 101

- Arboviruses are a large group of viruses that are spread mainly by blood sucking insects.
  - In the US usually spread by infected mosquitoes.
  - Birds are most often the source of infection for mosquitoes.

- Mosquitoes take multiple blood meals
  - thus they can get the virus from a bird and then pass it to other birds, animals, or humans when they seek another blood meal.
Common Michigan Arboviruses

- Encephalitis transmitted by mosquitoes is an arbovirus (arthropod-borne virus)

- The Arbovirus of concern to us are:
  - St. Lewis Encephalitis (SLE)
  - Eastern Equine Encephalitis (EEE)
  - La Crosse Encephalitis (LAC)
  - West Nile Virus (WNV)
Arbovirus Transmission Cycle

Amplification Cycle

Dead End Hosts

Bridge Vector
Types of Disease Surveillance

• Mosquito

• Corvid
Mosquito Surveillance

- Adults – Traps
  - Population levels – Nuisance?
  - Disease Threat
  - Adult Activity
  - Control Efficacy

- Larvae – Habitat Surveys
  - Catch Basins, Tires, Sewage Lagoons, etc.
  - Control Efficacy

- Eggs – Ovibuckets
  - Species Presence & Abundance
  - Vertical Transmission

Where, When & How SCMAC Treats
Mosquito Surveillance

• During the summer months, the Biology staff at SCMAC collect tens of thousands of mosquitoes through our trapping program.

• Many of these mosquitoes are important disease vectors.
  – All primary disease vectoring mosquito species are processed and shipped to MSU for PCR testing.
  – This allows us to determine if they are carrying any arbovirus.
New Jersey Light Trap

- Many mosquitoes attracted to light
  - Lots of “junk” bugs
- Open areas near trees and shrubs
- Traps run on regular schedule
  - 25 Traps, 3 Nights/Week
  - Trapping Dusk to Dawn
- Uses standard electric power
CDC Light Trap

• Greater Portability - Sample remote areas
  – Lightweight / battery - powered
• Use light &/or CO$_2$ as attractant
  – Large collections of mosquitoes
  – Can use additional attractants
• 5 – 10 traps, 4 Nights/Week
Gravid Traps

- Important disease surveillance
- Captures blood fed females – *Culex*
  
  *Vectors – WNV, SLE*
- Portable – battery powered
- Bait – “stink” water attractant
  - e.g. Hay-infusion, Grass
    - 10:1:1 – Hay, Whey, Yeast (1 week soak)
- 5 Traps, 4 Nights/Week

Gravid means an adult female mosquito that has taken a blood feeding.
CDC Light Trap – “Elevated”

- *Culex* sampling – Bird Nesting
  - Sampling Arbovirus – Amplification Cycle
- Use of dry ice (CO$_2$)
- 20 feet into tree canopy
- Solitary tree along wooded edge or in yard
Other Traps

- Ovitraps
- Resting Boxes
- Variations of the basics
  - Collection Bottle Rotator CDC
  - BG Sentinel
Processing Mosquitoes

• The mosquitoes are brought back to the lab and keep in the freezer prior to processing.
• Mosquitoes are Id’d and sorted.
• Species totals are recorded in our database.
• Non vector species and males are discarded.
Processing cont.

• Mosquito vectors submitted for testing are:
  
  – *Culex pipiens*  WNV / SLE
  – *Culex restuans*  WNV / SLE
  – *Culex erraticus*  WNV / EEE
  – *Aedes japonicus*  WNV / LAC
  – *Aedes triseriatus*  LAC
Processing cont.

- Up to 50 individuals per vial.
- Placed in vial with 3 steel BB’s.
- Vialed by species per location and date.
- Culex from the same trap event are combined.
- Samples are kept frozen and submitted to MSU weekly.
Catch Basins

• Catch Basin surveillance
  – Monitor population growth
  – Initiate treatment when thresholds are met.
  – Important *Cx. pipiens* habitat
Corvid Surveillance

• Reports of dead or sick birds.
  – Citizens are encouraged to report dead bird sightings.
  – Biology technicians investigate and/or collect the dead bird.
Corvid Surveillance cont.

• In the lab the condition of the bird is evaluated.
• If decomposing > 24hr or infested with insects
  – the sample is discarded.
• Suitable Birds – “fresh”
  – an oral swab is performed.
  – Samples are sent to the Diagnostic Center for Population & Animal Health at MSU for testing.
Response to Arbovirus Surveillance

• Positive results or large numbers of vector mosquitoes may result in the following:
  – Increase mosquito trapping.
  – Investigate for new larval habitats.
  – Begin adulticiding area of concern.
In Summary

• Mosquito Disease Surveillance helps SCMAC:
  – Protect Public Health
    • Identify the occurrence of viruses within the County.
    • keep the public informed in advance of possible health concerns.
  – Provides better understanding of arboviruses and their distribution and cycles.
  – To adjust and focus our control efforts.
    • Areas of high larval and/or adult concentrations.
Thank You