

Mid-Atlantic Mosquito Control Association - 36th Annual Meeting
Feb 22-24, 2011

1) Tuesday, Feb 22nd

a) **History of Public Health in New Hanover County** - David Rice

- i) One of the oldest health departments in the US
 - (1) 131 years of service (since June 14, 1879)
 - (2) Oldest health department in NC
- ii) Thomas Fanning Wood, MD - father of NC public health
- iii) Yellow Fever - 1862
 - (1) Ship (Kate) came into port in 1862
 - (2) >654 people died from yellow fever brought on the ship
 - (3) Also dealing with:
 - (a) An ongoing smallpox epidemic
 - (b) Civil War
- iv) 1877 - NC Board of Health created
- v) 1879 - New Hanover County Board of Health
 - (1) Drainage & Water
 - (2) Epidemics
 - (3) Sanitation
 - (4) Public Nuisance
- vi) Biggest early problems
 - (1) Smallpox
 - (2) Sanitation
- vii) Publication - Our Communal Health, 1915
- viii) Other highlights
 - (1) 1930s - war against mosquitoes
 - (2) 1940s - malaria control
- ix) Ever evolving program

b) **Mosquito Control as a Public Service: Serving the Public Beyond Serving Oneself** - David Jenkins

- i) Creating positive social change
 - (1) A deliberate process of creating and applying ideas
 - (2) Results in the improvement of human condition
- ii) How does this relate to mosquito control
 - (1) Surveillance
 - (2) Control
 - (3) Public education
- iii) Bottom line - protect citizens from vector-borne diseases and manage mosquito populations to ensure a good quality of life
- iv) Complaint process
 - (1) Receive a complaint
 - (a) Collect information
 - (i) Name
 - (ii) Address
 - (iii) Location

- (iv) Nature of complaint
 - (b) Be polite
 - (c) Follow up
 - (2) Addressing the complaint
 - (a) Be polite
 - (b) Find out when the mosquitoes are biting and where
 - (c) Educate
 - (d) Investigate as needed
 - v) Local media can be your friend
 - (1) PSAs
 - (2) Scheduled events
 - vi) Presentations
 - (1) Home owner associations
 - (2) Schools
 - vii) Post info on county website and Facebook
 - viii) Education works
 - (1) Reduction in chronic complainers
 - (2) Less trash
 - (3) Continued support for your program
- c) **Culex Flight Activity in Suffolk, VA** - Charles Abadam
 - i) Looking at variations in *Culex* behavior geographically
 - (1) Studies
 - (a) Reddy et al 2007 - Questing and Oviposition Behavior
 - (b) PA WNV Control Program, 2007-2009
 - (2) When did the behaviors occur
 - (3) Helps to fine tune adulticiding efforts
 - ii) Results from 2 studies in NE US
 - (1) MA - 2 hours after sunset
 - (2) PA - highest activity found from 9-11 PM
 - iii) What about Suffolk County, VA
 - (1) Would temperature make a difference in oviposition behavior?
 - (2) Experimental design
 - (a) 2 trapping sites (gravid traps)
 - (b) One meter transects
 - (c) Trapped from April - September
 - (d) Trapped once a month
 - (i) Set one hour before sunset
 - (ii) Collected at one hour intervals
 - (iii) Stopped one hour after sunrise
 - (3) Identified mosquitoes on site
 - (4) Did not collect egg rafts
 - (5) Weather info
 - (a) Temperature
 - (b) Wind speed
 - (c) Humidity
 - (6) Results

- (a) Huge peak of activity one hour before sunset through 2 hours after sunset
 - (b) Spikes in activity an hour before sunrise and an hour after sunrise
- (7) Conclusions - oviposition behavior similar to what was found in the NE
- d) **Evolution of Delaware's Open Marsh Water Management - Paul Zarebicki**
 - i) What is OMWM?
 - (1) Management tool used in coastal saltwater marshes to reduce mosquito breeding
 - (2) Improves habitat resources for fish and birds
 - (3) Restores marsh quality
 - ii) Budget -
 - (1) Use to do 3000 acres a year
 - (2) Down to under 100 acres
 - (3) Winter activity
 - iii) Army Corp of Engineers permit - every 5 years
 - (1) Pre- and post-project evaluations of vegetation
 - (2) Evaluation of benefits
 - iv) Benefits
 - (1) Uses selective excavation of mosquito-breeding habitat to produce permanent water ponds that support fish
 - (2) Cost saving - pesticide use reduction
 - v) Minimizing environmental impact
 - (1) Spoil is thinly spread to avoid changes in vegetation
 - (2) Non-tidal and semi-tidal areas
 - vi) Equipment used
 - (1) Rotary Excavator
 - (a) Used on larger, softer marshes
 - (b) Large scale projects
 - (2) Conventional equipment used in smaller, more mineral environments
 - (3) Swamp Devil
 - (a) Open water areas
 - (b) Mudflat habitats
 - vii) Changes in program
 - (1) Seeing rising sea levels
 - (a) Changes in habitat seen - losing vegetation
 - (b) Drier areas are now wet and breeding
 - (2) Traditionally
 - (a) Treated upper tidal areas
 - (b) Larger areas
 - (3) Newer projects - "higher" areas
 - (a) Low lying agricultural fields and vacant lots
 - (b) Traditionally were too dry to be big breeding problems
 - viii) ~4000 acres of OMWM currently installed in Delaware
 - (1) Re-evaluating the older systems
 - (2) Maintaining where required
 - (3) Very effective for mosquito control

- e) **Sustaining Members Presentations**
 - i) Leading Edge - Mike Reynolds
 - (1) DropVision - droplet characterization system
 - (2) MapVision - web based GIS system
 - (3) <http://leatteam.com/index.htm>
 - ii) ADAPCO - Steve Mulnar
 - (1) GA Rep - Trey English
 - (2) 2 new products
 - (a) Agnique WSP
 - (b) Monitor LT - larvicide tracking technology
 - (3) <http://www.myadapco.com/>
 - iii) Electronic Data Solutions - Ryan Pearson
 - (1) Sentinel GIS
 - (a) ESRI
 - (b) Trimble GPS
 - (2) Software and hardware technology
 - (3) <http://www.elecddata.com/>
 - iv) UNIVAR - Joe Andrews
 - (1) General pest control
 - (2) Active in vector management
 - (a) Pemethrin-based product line
 - (b) Bti line from Valent
 - (c) Altosid products
 - (d) New - PyroFos
 - (3) Barrier spray products and equipment
 - (4) <http://www.univarusa.com/>
- f) **Evaluation of Three Methodologies for the Population-Level Control of *Aedes albopictus* and *Aedes aegypti*** - Chris Lesser
 - i) Need for control
 - (1) Both species are a huge nuisance
 - (2) Both are competent vectors
 - (3) Both are daytime biters
 - (4) Both come off asynchronously
 - (5) Both are difficult to control on a large scale
 - ii) Purpose
 - (1) Develop an effective control measure for albos and aegypti
 - (2) Independent of source reduction or public education
 - (3) Large scale control
 - iii) Testing protocol
 - (1) Ground ULV larviciding
 - (2) Combined with time-sensitive adulticiding applications
 - iv) Product used - Altosid
 - v) Results - close to 100% control after 16 days
 - vi) Study
 - (1) 4 study sites - old residential
 - (a) Larvicide only

- (b) Adulticide only
- (c) Both larvicide and adulticide
- (d) Control - nothing
- (2) Products
 - (a) Altosid 5% liquid
 - (b) Permethrin/PBO 30:30
- (3) Applications occurred ~1 hour before sunset
- (4) Surveillance
 - (a) 30 ovitraps per site (LBJs)
 - (b) 2 different designs
- (5) Results
 - (a) Reduction seen in adulticide plus larvicide plot
 - (b) Adulticide only - similar to control site
 - (c) Larvicide only - saw an increase in numbers
- g) **Teacher Workshops and Where They Can Lead** - Jeannine Dorothy
 - i) Teacher workshops provide new educators to teach many groups of children
 - ii) Where to start
 - (1) Choose a county
 - (2) Choose a school level (elementary, middle, or high) - should be the grade level in which they teach info that works with this kind of program
 - (3) Find the Science Coordinator
 - (4) Write a proposal
 - (5) Work with the teachers to develop the program
 - (a) Make it interactive
 - (b) Cover a range of topics
 - (6) Decide who is doing the work
 - (7) Decide who is paying for the program
 - iii) The workshop
 - (1) Wetlands Scavenger Hunt -
 - (a) Welcome and ice breaker
 - (b) Learn about wetlands ecosystems
 - (2) Mosquitoes & Their Impact
 - (a) Pro and con
 - (b) Diseases
 - (c) Research
 - (d) Control
 - (3) Mosquito Biology
 - (a) Life cycles
 - (b) Parts of the mosquito
 - (c) Classification
 - (d) Habits & habitats
 - (e) Host preference
 - (f) Breeding areas
 - (4) Activities
 - (a) Skeeter Scramble - a day in the life...
 - (b) Rearing mosquitoes in the classroom

- (c) Field trip
- (5) Wrap-up
 - (a) SKETO game (bingo)
 - (b) Sale of items using skeeter bucks earned during the program
 - (c) Prizes
- iv) SUCCESS!!
 - (1) Written into the curriculum - Skeeters Unit
 - (a) Baltimore School system
 - (b) 2nd grade
 - (2) Skeeter Daily Fact Chart
 - (3) Homework supports mosquito source reduction
- h) **Eastern Equine Encephalomyelitis Virus** - Nathan Burkett-Cadena
 - i) Background
 - (1) First recognized in MA in 1831 - 75 horse died
 - (2) One of the most pathogenic of all mosquito-borne viruses
 - ii) Ecology
 - (1) Clustering seen in "plain" ecotypes
 - (2) Transmission foci are freshwater swamp areas
 - iii) Transmission cycle
 - (1) Enzootic vectors - primarily *Culiseta melanura*
 - (2) Bridge vectors - many species
 - (3) Primary reservoir - birds
 - (4) Temporal clustering
 - (a) Edman & Taylor. 1968. Science
 - (b) Feeding shifts - birds to mammals
 - iv) Study
 - (1) Muscogee National Forest
 - (2) Collected resting mosquitoes
 - (a) Blood meal analysis
 - (i) Primary avian hosts
 1. Great blue heron
 2. Yellow-crowned night heron
 - (ii) Correlation between when birds are in rookery and when mosquitoes are feeding on the birds
 - (b) Overwintering
 - (i) Probably not in avian host
 1. Short viremic period
 2. Too few vectors over the winter
 3. EEE rarely found in migrating birds
 - (ii) Probably not in primary vector
 - (iii) What about bridge vectors?
 1. Fumigated hollow trees
 - a. Found *Anopheles punctipennis*, *Cx erraticus*, *Cx peccator*, *Ur sapphirina*
 - b. No positives found
 2. Collected from animal dens - no positives found

- (iv) How about other vertebrate hosts?
 - 1. Reptiles and amphibians
 - a. Amphibians did not become viremic
 - b. Reptiles did but few species became viremic enough to serve as a reservoir - needs more work
 - 2. Other mammals???
 - (3) Host reproductive biology drives timing of EEEv epidemics
 - i) **AMCA: Legislative & Regulatory Updates** - Bill Meredith
 - i) Some products are not going to be re-registered because of additional testing being required by EPA
 - ii) NPDES & CWA issues
 - iii) Mosquito Control funding
 - (1) ELC grants
 - (a) Through the CDC
 - (b) Provides state support
 - (2) Proposal to eliminate millions of dollars to CDC
 - (a) Probably won't happen right now
 - (b) FY12 - we will be screwed
 - j) **Sustaining Members**
 - i) Clarke - Joe Stickhouser (<http://www.clarke.com/>)
 - ii) Valent BioSciences - Jim Andrews
 - (1) GA Rep - Candace Royals
 - (2) <http://www.valentbiosciences.com/>
 - iii) Dynamic Aviation - Caleb Stitely (<http://www.dynamicaviation.com/>)
 - iv) Summit Chemical - Zack Cohen
 - (1) Manufacturing & Packaging
 - (2) <http://www.summitchemical.com/>
- 2) Wed, Feb 23rd - Morning Session
 - a) **Consilience Of Mosquito Control Operations and Associations** - Nolan Newton
 - i) Consilience - The Unity of Knowledge
 - (1) EO Wilson
 - (2) 1988
 - ii) Unification of ideas and knowledge
 - iii) What does this have to do with mosquitoes?
 - (1) Many different levels of knowledge in mosquito control
 - (2) Everything from local to state to regional to national associations
 - (3) University and researchers
 - (4) Industry and applied research
 - iv) Problems
 - (1) Compartmentalized knowledge
 - (2) Restricted knowledge flow up and down
 - (3) Poor communication within and outside of mosquito control
 - (4) Imprecise and incorrect knowledge flow
 - v) What can be done?
 - (1) Visit state and federal legislators
 - (2) AMCA Washington Day

- (3) Write state and federal representatives (fax)
- vi) A modest proposal
 - (1) Need better coordination between AMCA, SOVE, and NAVCO on federal issues
 - (2) Regular conferences calls would help
 - (3) Allies
 - (a) AMCA (www.mosquito.org) - Croplife (<http://www.croplifeamerica.org/>)
 - (b) SOVE (<http://www.sove.org/Home.html>) - California Mosquito & Vector Control Association (<http://www.mvcac.org/>)
 - (c) National Association of Vector Control Officials
 - (i) Association of State & Territorial Health Officials (<http://www.astho.org/>)
 - (ii) CSTE (<http://www.cste.org/dnn/>)
- vii) Need more transparency
 - (1) Mosquito control is of vital public health importance
 - (2) Educate the public and the legislators
 - (3) Need to educate people better about pesticides and risk
- viii) What to do?
 - (1) Use our allies
 - (2) Get professional groups working together
 - (3) Make sure our leaders know the facts
- b) **Demise of Small Programs** - Rosmarie Kelly
- c) **The Armed Forces Pest Management Board: A Unique Global Asset** - LTC Bill Sames
 - i) Military entomology
 - (1) ~60 different diseases of concern
 - (2) Important to keep teams intact and members healthy
 - (3) Wide variety of entomology jobs
 - (a) VBD risk assessment
 - (b) Research and development
 - (c) Vaccine work
 - (d) Technical expertise
 - (e) Training & certification
 - (f) Promotion of world health
 - ii) Current engagements
 - (1) Disease issues
 - (a) Sandflies
 - (b) Cutaneous leishmaniasis
 - (2) Control efforts
 - (3) Education
 - iii) Humanitarian efforts (work with USAID)
 - (1) Haiti
 - (a) Medical component
 - (b) Control of malaria & dengue
 - (2) Work at a wholesale (big) level

- (3) Leave retail (individual) level to locals and smaller groups
 - iv) AFPBM Mission
 - (1) Use IMM techniques
 - (2) Best Management Practices
 - (3) Divisions
 - (a) Administration & Support
 - (b) Operations
 - (i) Vector control
 - (ii) Pest issues
 - (iii) Natural resources/invasive species
 - (iv) Research - Deployed War Fighter Protection Program
 - (c) Information Services
 - (i) Free to the public
 - (ii) Collect and disseminate information
 - 1. Online database - <http://afpmb.org/>
 - 2. Technical guides
 - 3. Living hazards database - species worldwide that cause injury and death to humans
 - 4. Image library
 - a. Available for use
 - b. Just credit photographer
 - (iii) Great source for journal articles and other literature
 - (iv) Free training DVDs
 - 1. Ticks
 - 2. Adult mosquitoes
 - 3. Larval mosquitoes
 - (v) DoD pesticide use
 - (vi) Walter Reed Biosystematics Unit
- d) **Sustaining Member Presentations**
 - i) AMVAC - Peter Connelly
 - (1) Pesticides
 - (a) Trumpet
 - (b) Dibrom
 - (c) Naled
 - (2) Barrier spray
 - (3) Nuvan strips
 - (4) <http://www.amvac-chemical.com/>
 - ii) Bayer Environmental Science
 - (1) Permethrin
 - (a) Oil-based
 - (b) Water-based
 - (2) Scourge
 - (a) Up for re-registration
 - (b) Not going to do so
 - (3) No end date from EPA for stopping the manufacturing at this point

- (4) http://www.bayerprocentral.com/BAYER/CropScience/BackedByBayer.nsf/id/EN_Home
- iii) Curtis DynaFog
 - (1) Manufacturing of application products
 - (a) ULV
 - (b) Thermal foggers
 - (c) Surveillance equipment (CDC light traps)
 - (d) Mapping & reporting recorders (DYNA TRAX II)
 - (2) Sell through UNIVAR and their own offices
 - (3) In-house repairs (Indiana)
 - (4) Global company
 - (5) <http://www.dynafog.com/home.html>
- iv) Central Life Sciences - Charlie Pate
 - (1) Altosid (sold through a variety of companies)
 - (a) Larvicide
 - (b) Many formulations
 - (c) IGR
 - (2) Zenivex (sold through ADAPCO)
 - (a) Etofenprox
 - (b) Ether-pyrethroid
 - (c) Reduced risk pesticide
 - (d) No PBO used
 - (3) Mavrik
 - (a) Barrier spray
 - (b) Pyrethroid
 - (i) Low phytotoxicity
 - (ii) Sticks to plants
 - (iii) Once it dries it is non-toxic to honeybees
 - (4) <http://www.centrallifesciences.com/>
- e) National NPDES - Bill Meredith
 - i) <http://cfpub.epa.gov/npdes/>
 - ii) Background
 - (1) Lawsuits
 - (a) Talent (Oregon)
 - (i) Herbicide application
 - (ii) FIFRA violation
 - (iii) End result - fish kill
 - (iv) Environmentalists brought a lawsuit against the Talent Irrigation District and won
 - (b) Forsgren (Northwest)
 - (c) Several mosquito control cases
 - (d) NYC/No-Spray Coalition
 - (2) EPA asked to make a rule concerning a need for a permit
 - (a) Nov 2006 - "Final Rule" issued
 - (b) No NPDES permit required
 - (3) Environmentalists brought multiple lawsuits to the circuit courts

- (4) Lawsuits consolidated into the 6th Circuit Court
- (5) Farm groups got worried and asked for a rule to confirm their exemption from the CWA
- (6) 6th Circuit Court vacated the EPA "Final Rule" in Jan 2009
- (7) EPA refused to appeal that decision
 - (a) Essentially were asking the new administration to support a "Bush" ruling
 - (b) Asked for a 2-year stay to develop a permit
 - (c) Pesticide user groups did appeal but case was refused
- (8) FIFRA problems
 - (a) No IMM requirement
 - (b) No reporting requirement
- iii) NPDES permit
 - (1) Problems
 - (a) Costly
 - (b) Labor-intensive
 - (c) Disruptive
 - (d) Subject to citizen lawsuits
 - (2) Permit required by 9 April 11
 - (3) Final EPA PGP was to be issued in Dec 2010
 - (a) No final permit is as of yet available
 - (b) States waiting for EPA before finalizing their own permits
 - (c) Joint ASWPCA, AAPCO, NASDA letter to EPA sent 2/11/11 asking EPA to ask for a 6-month extension
 - (d) Will 6th Circuit Court grant an extension? Probably
 - (4) Legislative side
 - (a) Letter sent to the House of Representatives from 34 major pesticide user groups
 - (b) Urging Congress to intervene
 - (c) New Bill
 - (i) This rose jointly in two committees having oversight of FIFRA and the CWA
 - (ii) Propose no NPDES permits are needed for pesticide applications covered under FIFRA
- f) **Delaware NPDES Update** - Bill Meredith
 - i) Not ready
 - (1) Water Resources Regulator is new
 - (2) Water Resources Director is resigning
 - ii) 2 meetings on NPDES issue
 - (1) 1st meeting - 6 people
 - (2) 2nd meeting - 10 people
 - iii) Programs will have to continue spraying regardless
 - iv) Expect that the environmental groups will begin taking action starting April 10th
- g) **GA NPDES Update** - Rosmarie Kelly
- h) **MD NPDES Update** - Jeannine Dorothy

- i) Mosquito control overseen by state
 - (1) NPDES permit asking for same info as is already required by state
 - (2) Worried about financial and support issues
 - (3) Lots of duplication of effort by 2 different state agencies
- ii) Right now the state permit is in good shape
 - (1) Requiring larvicide maps now
 - (2) Asking for adulticiding maps when they are ready
- i) **NC NPDES Update** - Nolan Newton
 - i) Issues
 - (1) Law - only Dept of Ag can regulate pesticides in NC
 - (2) CWA - Limited resources to put together the permit
 - (3) Don't think this will be a big issue
 - ii) Training programs set up in conjunction with ULV calibration program being impacted
 - (1) Funding cuts
 - (2) Personnel cuts
 - iii) Cost to mosquito control - high (Jeff Brown's document)
 - (1) Since 1956 - state has supported mosquito control
 - (2) Mosquito control protects about half of the state's population
 - (3) Every program practices IMM
 - (4) Costs
 - (a) Total annual projected cost - \$4.1 million
 - (b) Current spending - \$5.3 million
 - (c) Increase under NPDES would be \$5 million
 - (5) Many small programs would have to close
 - (6) Many jobs would be lost
 - iv) State is currently looking at individual permits for every agency
 - v) Bill currently in state House states that no regulation that costs money can be passed
- j) **VA NPDES Update** - George Wojcik
 - i) Agriculture folks are working on permit
 - ii) State is looking at core services
 - iii) Positions are not being filled
 - iv) No one available to regulate or enforce this permit
 - v) Proposed general permit
 - (1) All operators under a certain use pattern are covered
 - (2) Similar to GA EPD
 - (3) Records already kept under Dept of Ag oversight
 - (a) Was 2 years - will now be 3 years
 - (b) Some additional reporting
 - (c) Nothing sent in
 - (4) Endangered species act info must be kept
 - (5) Adverse incident reporting to both agencies
- k) **WV NPDES Update** - no update
- l) **PA NPDES Update** - Andy Kyle
 - i) DEP will be doing permitting - 6 regions

- (1) Responsibility given to an engineer
- (2) Mosquito control was not consulted
- ii) Affected programs
 - (1) Black fly suppression
 - (2) Vector control (WNV)
 - (3) Gypsy moth program
 - (4) Large pest control applicators
- iii) Concerns
 - (1) Want all application events listed for entire season
 - (a) Ok for black fly program
 - (b) Won't work for mosquito control (anti-IMM)
 - (2) Want a map of every possible treatment site
 - (3) Report number of acres treated
 - (a) Ok for mosquito control
 - (b) Not so good for black fly program
 - (4) Current annual threshold - 600 acres
- iv) Changes made
 - (1) Will make permit similar to EPA version
 - (2) Will need an NOI prior to season
 - (a) Black fly
 - (b) Mosquito
 - (3) Counties with WNV funding will only need one statewide permit
 - (4) Black fly program
 - (a) One permit for each major waterway treated (3)
 - (b) One for special usage streams
 - (c) Need to work with NJ as well
- m) **SC NPDES Update** - LA Williams
 - i) No improvement in water quality will be seen
 - ii) Combined department of health and environmental control
 - (1) Talked with water quality people - they have primacy
 - (2) Educated the water quality people about mosquito control
 - iii) State PGP
 - (1) Statewide general permit
 - (2) Meeting held
 - (a) Primarily commercial folk
 - (b) 2 environmental activists
 - (i) One concerned about waters in the upper part of the state
 - (ii) Other wanted a day by day accounting of control activities
 - (3) Threshold limits set
 - (a) NOI required -
 - (i) Submit electronically
 - (ii) Submit a signed paper copy
 - (b) Follow FIFRA
 - (c) Keep good records
 - (d) Good idea to do more than required to show good faith
 - (4) Unfunded mandate

- (a) Going to charge \$100 to each program annually
 - (b) No reporting requirement at this point
 - n) **Round Table Discussion**
 - i) What will proposed stay of mandate do to momentum in Congress to make changes to CWA and FIFRA?
 - ii) EPA draft permit is liberal and flexible in its current state
 - (1) Nationwide state/federal working group
 - (2) 3 meetings to look at permit language
 - (a) Original permit draft was very costly and impractical
 - (b) Reasonable changes have been made to make the permit as user-friendly as possible
 - (c) Environmental groups are not happy - feel the permit is too lax
 - (i) Want 30 days notice before control begins
 - (ii) Want testing
 - (iii) Want access to all data and plans
 - (3) Litigation is in the future
 - iii) Adverse incident reporting
 - (1) Environmental groups do not want applicators to be reporting the incidents
 - (2) Want regulatory monitoring
- 3) Wed, Feb 23rd - Afternoon Session
 - a) **Surveillance for LAC Virus Vectors: An Evaluation of 4 Mosquito Traps and Their Gonotrophic Biases** - Brian Byrd
 - i) A lot of LAC seen in western NC
 - ii) Vector species
 - (1) Primary vector - *Ochlerotatus triseriatus*
 - (2) Probable secondary vector- *Aedes albopictus*
 - (3) Another possible player - *Ochlerotatus japonicus*
 - iii) Research question
 - (1) Age matters
 - (a) Nulliparous - low risk
 - (b) Parous - high risk
 - (2) Younger mosquitoes are more of a nuisance
 - (3) Disease transmission rises as abundance drops after blood feeding and egg laying
 - (4) Are there inherent physiological differences in traps?
 - iv) Determining mosquito age
 - (1) Nulliparous - ovarian tracheal skeins are tightly wound
 - (2) Parous - skeins become uncoiled
 - (3) Reference: Evaluations of Mosquito Age Grading Techniques Based on Morphological Changes, L. E. Hugo, S. Quick-miles, B. H. Kay and P. A. Ryan, *Journal of Medical Entomology* May 2008: Vol. 45, Issue 3, pp 353-369
 - v) Traps
 - (1) CO₂-baited CDC light trap

- (2) CO₂-baited BG Sentinel trap (http://www.bg-sentinel.com/en/mosquito_trap_tests.html)
- (3) CO₂-baited Fay-Prince trap
- (4) Tackle box type infusion-baited gravid trap
- vi) Protocol
 - (1) Traps
 - (a) Traps set pre-dawn
 - (b) Visited after lunch to collect
 - (c) Collected again after 9 PM
 - (d) Rotated traps to next trap position
 - (2) Mosquitoes
 - (a) ID to species
 - (b) Determine physiological status
 - (c) Determine blood meal status (1-4%)
 - (d) Determine gravidity
 - (e) Virus testing - not done yet
- vii) Results
 - (1) BG Sentinel collected 58% of mosquitoes
 - (a) Most *Oc albopictus*
 - (b) Most *Oc triseriatus*
 - (2) Gravid trap collected about the same number of *Oc japonicus* as the BG Sentinel trap
- viii) Parity status
 - (1) BG Sentinel trap collected the most parous mosquitoes (60%)
 - (2) Gravid trap collected the most gravid mosquitoes (90%)
 - (3) *Aedes albopictus* were primarily nulliparous
- ix) Conclusions
 - (1) BG Sentinel doesn't seem to be different than the other CO₂-baited traps except in abundance
 - (2) BG Sentinel best for collecting parous mosquitoes
 - (3) Gravid traps still best for arbovirus surveillance
- b) **Molecular Studies of *Aedes atlanticus* and *Aedes tormentor*** - Charlie Sither
 - i) Adult females are almost indistinguishable
 - ii) Larvae are easily distinguishable
 - iii) Viruses isolated
 - (1) WNV
 - (2) KEY
 - (3) EEE
 - iv) Morphological characteristics (Bruce Harrison)
 - (1) Brown scales on occiput of *Oc tormentor* do not extend to eyes
 - (2) Brown scales on occiput of *Oc atlanticus* do extend to eyes
 - v) Molecular study
 - (1) Methods
 - (a) Extracted gDNA
 - (b) PCR amplification
 - (c) Gene target area - ITS2

- (d) TOPO-TA cloning
- (2) Used reared specimens to determine if molecular identification was possible
- (3) Sequenced and analyzed
 - (a) Differences in number of base pairs
 - (b) Heterogeneity exists
 - (c) 94% similarity
- (4) Tested results on unknowns - 100% match with morphological IDs
- vi) Second strategy under consideration - restriction enzyme digest
- vii) Also looking to sequence across a broader geographic range
- c) **Ecology of LAC Encephalitis Virus in Western North Carolina: Anthropogenic Effects** - Gideon Wasserburg
 - i) Ecological approach
 - (1) Look at interactions between ecological systems and infectious agents
 - (2) Look at distribution and abundance of disease agents
 - ii) Why does disease occur?
 - (1) Overlap between disease, agent, host, and vector
 - (2) Proper ecological conditions
 - iii) Approach is:
 - (1) Holistic
 - (2) Mechanistic
 - (3) Predictive
 - iv) Looking for correlates of risk
 - v) Current focus is on how humans affect the environment and the risk of arboviral diseases
 - (1) Original study system was cutaneous leishmaniasis
 - (a) Rat-sand fly system with humans as an incidental host
 - (b) Study done in Israel
 - (c) Model
 - (i) Increase in soil moisture due to human disturbance
 - (ii) Increased abundance of host and vector
 - (iii) Spillover into humans
 - (2) Current study is LAC encephalitis virus
 - (a) Small mammal-mosquito system with humans as an incidental host
 - (b) Vertical and venereal transmission play a factor
 - (c) Study question - Is apparent increase in LAC associated with changes in landscape use?
 - (d) Looking at *Oc triseriatus* and *Ae albopictus*
 - (e) Possible mechanisms
 - (i) Effect on vector abundance
 - (ii) Effect on vector survival
 - (iii) Effect on host abundance
 - (f) Study design
 - (i) 6 historic case sites
 - (ii) Sampled mosquitoes using gravid traps
 - (iii) Collected resting mosquitoes using an aspirator

- (iv) Egg counts
- (g) Environmental variables
 - (i) Abundance of containers
 - (ii) Plants
 1. Type
 2. Coverage
 3. Size
- (h) Preliminary results
 - (i) Egg laying
 1. Increase in number of eggs correlates to an increase in number of water-holding containers
 2. No difference between number of eggs seen in peridomestic and forest habitats
 - (ii) Bloodmeal and gravidity vary among species and location
 - (iii) Additional analyses are forthcoming
 - (i) Conclusions to date
 - (i) No clear-cut anthropomorphic effect
 - (ii) Definite effect - container abundance
- d) **Prevalence of Bacterial Pathogens in Ixodid Ticks in Chatham County, NC - Charlie Apperson**
 - i) Tick bites occasionally result in the transmission of pathogens
 - (1) 60% are zoonoses
 - (2) Just and FYI - 80% of pathogens with a high potential for bioterrorism are zoonotic
 - ii) Ticks require a bloodmeal to complete their life cycle
 - iii) Common ticks of NC
 - (1) American dog tick - *Dermacentor variabilis*
 - (2) Brown dog tick - *Rhipicephalus sanguineus*
 - (3) Dark-legged (deer) tick - *Ixodes scapularis*
 - (4) Lone star tick - *Amblyomma americanum*
 - iv) Tick-borne diseases
 - (1) Lyme Disease
 - (2) Spotted fever rickettsioses, including RMSF
 - (3) *Ehrlichia chaffeensis* infection, formerly HME
 - (4) *Anaplasmosis phagocytophilum* infection, formerly HGA
 - v) Deer are important in the tick life cycle
 - vi) Some specifics
 - (1) Lyme disease
 - (a) Distribution does not match up with the distribution of the vector
 - (b) Disease associated with feeding of nymphal stage
 - (c) *Peromyscus* mice, as well as some other small rodents, important reservoirs
 - (d) Black-legged ticks
 - (i) 2-year cycle
 - (ii) Nymphs feed prior to larvae and infect rodents
 - (e) Case rates lower as you go south

- (i) Ticks feed on lizards
 - (ii) Dead end host for the spirochete
 - (iii) Breaks transmission cycle
- (2) RMSF (<http://www.cdc.gov/mmwr/PDF/rr/rr5504.pdf>)
 - (a) 2 primary vectors - geographic differences, east to west
 - (b) Pathogen - *Rickettsia rickettsia*
 - (c) Wide variety of *Rickettsia* spp cause similar diseases
 - (d) Increasing incidence of cases in NC - 10 fold increase since 2000
 - (e) >95% of cases are not laboratory confirmed
 - (i) Collaborative eco-epidemiological study
 - (ii) Looking for true disease burden
- vii) Enhanced surveillance study (RMSF)
 - (1) Disease data collection
 - (a) Chatham County NC outpatient clinics
 - (b) 4 physician practices from area
 - (2) Case classification
 - (a) Probable
 - (b) Confirmed
 - (3) Tick surveys
 - (a) Primarily collected lone star ticks
 - (b) Also collected American dog ticks and deer ticks
 - (c) Found a high number of ticks containing rickettsial species (at 44% of sites)
 - (d) Some other pathogens reported as well
 - (e) Results
 - (i) Negative correlation between infection in ticks of *R amblyommii* and other rickettsial species
 - (ii) 6 of 15 *Ixodes scapularis* nymphs were infected with *Borrelia burgdorferi*
 - (4) *R amblyommii* may be the problem pathogen and not *R rickettsia*
- viii) A lot of questions generated from this study
- e) **The Effects of Attractant Volume on Mosquito Collection Success Using Gravid Traps - Mike Hutchinson**
 - i) Hypotheses
 - (1) High volume -
 - (a) Suction effect
 - (b) Larger odor plume
 - (2) Low volume - better chance mosquito will get below the collection pipe
 - ii) Design
 - (1) Compared 4 volumes
 - (2) Used the Reiter/Cummings gravid trap
 - (3) Volumes
 - (a) 2 liters - ½ gallon
 - (b) 4 liters - 1 gallon
 - (c) 6 liters - 1½ gallons

- (d) 8 liters - 2 gallons
- (4) Used attractant of same age
- (5) Used new traps
- (6) Used sites with homogeneous habitat
- (7) Omitted trap data when it rained
- (8) Set traps at dusk
- iii) Attractant
 - (1) 5lbs hay
 - (2) ½ cup lactalbumin on the first round
 - (3) Used about ½ cup of old solution when making new
 - (4) Let sit for 2 weeks
 - (5) Replaced hay every 2-3 weeks
- iv) Study site
 - (1) 6 locations
 - (2) Primarily sewage treatment plants
 - (3) Set traps randomly
 - (4) Rotated traps clockwise
- v) Initial tests
 - (1) High volume hypothesis
 - (a) Suction
 - (i) Used probes to measure intake of air up the pipe
 - (ii) Air velocity increases as volume of water increases
 - (iii) Statistically significant
 - (iv) Functionally significant???
 - (b) Odor plume increase - didn't check
 - (2) Low volume hypothesis - lots of room to get under trap
- vi) Results
 - (1) *Culex pipiens*
 - (a) 2 liters worked best
 - (b) 8 liters was the worst
 - (2) Similar results seen with *Culex restuans*
 - (3) Increased suction was not a factor
 - (4) Combination of high levels of attractant and suction rippled the water which may have effected desire to oviposit
- vii) Conclusions
 - (1) Using just 2 liters increases trap effectiveness by at least 30%
 - (2) Less work operationally
 - (3) Why - maybe mosquitoes fly back and forth before they land to oviposit
- viii) Unanswered question - How low can you go?
- 4) Thurs, Feb 24th
 - a) **The *Culex pipiens* Complex in the USA** - Harry Savage
 - i) Why the interest? Primary WNV & SLE vectors
 - ii) Complex
 - (1) *Culex pipiens quinquefasciatus*
 - (a) Does not diapause
 - (b) Southern house mosquito

- (2) *Culex pipiens pipiens form pipiens*
 - (a) Physiological diapause
 - (i) Enter a hibernaculum
 - (ii) Do not blood feed overwinter
 - (b) Northern house mosquito
 - (c) Anautogenous
 - (d) Mate in swarms in open areas
 - (3) *Cx pipiens pipiens form molestus*
 - (a) Does not diapause
 - (b) Overwinters underground
 - (c) Autogenous
 - (d) Stenogamous - mate in tight places
 - (4) Pipiens-quincs hybrids
- iii) Separating taxa
- (1) "Old school"
 - (a) Barr 1957
 - (b) DV/D ratio (male genitalia)
 - (2) HotACE.2 assay
 - (a) Aspen & Savage, 2003
 - (b) Savage et al, 2007
 - (3) Microsatellites
 - (a) Evolve rapidly
 - (b) Highly variable
 - (c) Repeating units of 1-6 nucleotides
 - (d) Allows for characterization of individual specimens
 - (4) Study
 - (a) Collected mosquitoes along a transect
 - (i) Mississippi River Basin
 - (ii) From New Orleans to Wisconsin
 - (b) Structure analysis to analyze data
 - (i) Cluster membership for individual specimens
 - (ii) Data collected from 14 sites
 - (c) Kothera et al, 2009
 - (5) Hybrid zone
 - (a) Very broad
 - (b) Extends further south than originally believed
 - (c) Area where 10-20% of specimens are hybrids, depending on analysis used
- iv) Populations of form molestus in the USA
- (1) Where are they found?
 - (a) Boston - Speilman, 1957
 - (b) Also found in Chicago and a few other sites
 - (c) Primarily confined to northern urban areas
 - (d) Old infrastructure sites are good sites, but this is variable
 - (2) Where did they come from?
 - (a) Europe?

- (i) Both forms came over separately from Europe
 - (ii) Populations in different sites would be similar, which is not true
 - (b) Originate from above ground populations of form *pipiens*
 - (i) Populations at different sites are very different
 - (ii) Likely evolved separately from above ground populations
- v) Bloodmeal study
 - (1) References
 - (a) Hamer et al, 2009
 - (b) Savage et al, 2007
 - (c) Mackay et al, 2010
 - (2) Sites
 - (a) Illinois
 - (b) Tennessee
 - (c) Louisiana
 - (3) Top 8 hosts explain most of the variation of blood feeding at each site
 - (a) Robin - 28.1% overall
 - (b) Cardinal - 9.6% overall
 - (c) Human - 7.9% overall
 - (d) Grackle - 6.2% overall
 - (e) House sparrow - 5.7% overall
 - (f) Mourning dove - 4.7% overall
 - (g) Domestic dog - 3.8% overall
 - (h) Opossum - 2.5% overall
 - (i) Horse - 2.1% overall
 - (j) Northern raccoon - 7.4% overall
 - (4) Variation seen at each site
 - (a) Some due to availability of the host
 - (b) Some unexplained
 - (i) Can not assume hybrids are the reason
 - (ii) Can not assume form *molestus* are the reason
 - (c) What about high rates of human blood feeding in Chicago?
 - (i) Hamer et al, 2009
 - (ii) Collection methods??
 - (iii) Urbanization??
 - (d) Bloodmeal databases are available in the literature
- b) ***Ixodes affinis*, an Enzootic Vector of *Borrelia burgdorferi* ss, Newly Discovered and Common in Eastern North Carolina - Bruce Harrison**
 - i) Tick collecting
 - (1) Started Oct 2008
 - (2) 31,108 total specimens
 - (a) 24,882 *Amblyomma americanum*
 - (b) 1,050 *Dermacentor variabilis*
 - (c) 3,108 *Ixodes scapularis*
 - (d) 853 *Ixodes affinis*
 - (e) 1215 other
 - (3) Collection methods

- (a) Dragging
 - (b) Tick attachment
- (4) Numbers skewed towards coastal NC
- (5) Very few ticks found in the mountain region
- ii) Black-legged ticks
 - (1) 8 *Ixodes* species found that are similar to *Ixodes scapularis*
 - (2) 6 are found occasionally on humans
 - (3) Lyme disease
 - (a) *Ixodes scapularis*
 - (b) Up to 40% of nymphs infected with *Borrelia burgdoferi* ss in the north
- iii) “AH HA” moment
 - (1) *Ixodes affinis*
 - (a) Not found in NC
 - (b) Published account of one specimen found in 1987 from a deer
 - (2) Collected on a CDC light trap
 - (a) Gates County
 - (b) April 2008
 - (c) Not identified until 2009
 - (3) Originally a Central-South American species
 - (a) First found in FL in 1953
 - (b) Spread to GA and SC
 - (c) Found in NC in 2008
 - (4) Biology/seasonality (phenology)
 - (a) Adults active March-November
 - (i) Active during the summer
 - 1. Peak time is April through August
 - 2. Largest numbers were in July
 - (ii) *Ixodes scapularis* is a winter tick - not found in the summer
 - (b) No published documentation that they bite humans
 - (c) Found in the Coast and Coastal Plain regions
 - (i) Primary host - cotton mouse & eastern wood rat
 - (ii) Also found on
 - 1. Marsh rice rat
 - 2. Hispid cotton rat
 - (iii) Coastal species
 - (5) Habitat
 - (a) Moist shaded woods
 - (b) Near water
 - (c) Not found in open sunlit areas
 - (6) Hosts
 - (a) Mammals and birds
 - (b) Found on large mammals, but not humans
 - (7) Identification -
 - (a) Easy to confuse with *Ixodes scapularis*
 - (b) Do have distinctive characteristics, but they are subtle
 - (8) Harrison et al, J Vector Ecology, 2010

- iv) What Bruce thinks
 - (1) In the NE US
 - (a) *Ixodes scapularis* immatures feed on white-footed mice and pick up *Borrelia burgdorferi* ss
 - (i) This mouse does not occur along the coastal south
 - (ii) We still have Lyme Disease reported in the south
 - (b) Adults are found on deer
 - (2) Apperson et al, 1993
 - (a) Switch in immature feeding behavior in the south
 - (b) *Ixodes scapularis* larvae & nymphs feed on lizards and skinks in the southern US
 - (3) Tested ticks
 - (a) 383 specimens *Ixodes scapularis* -
 - (i) <1% positive for *Borrelia burgdorferi* ss
 - (ii) 99% were negative
 - (b) 186 specimens of *Ixodes affinis* - only 39% were negative for a *Borrelia* spp
 - (4) What hosts are available?
 - (a) Change in numbers of rodent and reptile species available as hosts geographically
 - (i) More rodents as you go further north
 - (ii) More reptiles further south
 - (b) Similar changes seen from east to west
 - (c) Changes in deer populations as well
- v) Take home message - look at the big picture
- c) **Education & Outreach: Let's Help Each Other** - Carl Sivertsen
 - i) Website - (<http://www.fairfaxcounty.gov/hd/westnile/>)
 - ii) Challenges
 - (1) Highly educated population
 - (2) Near Washington DC
 - (3) 1.2 million residents in 400 sq mi
 - (4) High income area
 - (5) Over 100 languages spoken in Fairfax County
 - iii) Why do outreach?
 - (1) To help residents help us control mosquitoes
 - (2) To educate residents on ways to avoid mosquito bites
 - (3) To be visible
 - (4) To let community leaders know that the funding is well spent
 - (5) To learn more about what the community needs and wants
 - iv) Supplies needed
 - (1) Good people
 - (2) Mosquitoes in a jar
 - (3) Tent, table, good-looking display
 - (4) Free take away items
 - (a) Repellent wipes
 - (b) Plastic insects

- (c) Magnets
 - (d) Tattoos
 - (e) Lots of other things
 - (5) Quality educational material
 - (a) Need good artists
 - (b) Need to continually review materials
 - (c) The message stays the same
 - v) Opportunities
 - (1) Fairs
 - (2) Festivals
 - (3) Concerts
 - (4) PTA
 - (5) Scouts
 - (6) Outdoor stores
 - (7) Police/fire -
 - (a) Especially for info on traps
 - (b) They are NOT bombs
 - (8) Media
 - (9) Movie Theaters - preshow scroll
 - vi) Obstacles
 - (1) Not understanding the value of outreach
 - (2) Making it complicated
 - (a) KISS
 - (b) Bottom line - mosquitoes bite people, people do not want to be bit
 - (3) Money - can be an issue
 - (a) Time: 40-100 staff hours
 - (b) >\$500 before printing
 - vii) Coming Soon!
 - (1) Customizable education and outreach materials
 - (2) Through AMCA
 - (3) Print on demand - no start up costs
 - (4) A percentage of sales go back to the AMCA educational fund
 - (5) Lots of pictures available
- d) State Reports**
- i) DE - Paul Zarebicki
 - (1) 2010
 - (a) Aggressive *Oc canadensis* larvicide program in Spring
 - (b) Very wet, but leaf out brought good drying
 - (c) Easy mosquito year overall; larvicide and adultice amounts below average
 - (d) Vector-borne diseases were average to low; no human cases
 - (2) 2011
 - (a) Severe budget shortfall
 - (b) Staff is well below normal
 - (c) So far it has been a dry year
 - (3) <http://www.fw.delaware.gov/Services/Pages/MosquitoSection.aspx>

- ii) MD - Jeannine Dorothy
 - (1) 2010
 - (a) 3 distinct regions
 - (i) Eastern Shore
 - 1. Spring larvicide
 - 2. Bone dry until late August
 - 3. Zero mosquitoes caught in traps over a long period
 - (ii) Southern MD
 - 1. Driest summer in years
 - 2. Complaints down 50%
 - (iii) Central/Western MD
 - 1. Very wet Spring
 - 2. Ground spray up 50%
 - 3. Rainfall into Oct
 - 4. Large numbers of mosquitoes
 - (b) Highest WNV years since 2003
 - (c) No EEE+ from problem refuge that typically breeds lots of *Cq perturbans* with lots of positives usually detected -
 - (i) Refuge is now dropping water levels in ponds
 - (ii) Mosquito numbers have dropped somewhat
 - (2) 2011
 - (a) Problem - no work, no money
 - (b) Will be starting later than normal in 2011
 - (c) Probably dropping 4 county programs in 2011
 - (3) http://www.mda.state.md.us/plants-pests/mosquito_control/index.php
- iii) NC - Brian Byrd
 - (1) Vector-borne diseases
 - (a) Mosquito-borne
 - (i) WNV
 - (ii) LAC
 - (iii) Some travel-associated malaria
 - (b) Tick-borne
 - (i) Lyme
 - (ii) RMSF
 - (iii) Ehrlichiosis
 - (2) Mosquito numbers were generally low
 - (a) Mostly dry
 - (b) Some very hot weather
 - (c) Complaints were mostly down
 - (d) One or two big storm pushed the limits of available funding
 - (3) Budget issues
 - (4) Some things that helped
 - (a) Make use of neighborhood resources
 - (b) Keep everyone trained
 - (c) Keep good records
 - (5) <http://www.ncmvca.org/>

- iv) PA - Mike Hutchinson
 - (1) Arboviral diseases
 - (a) WNV program, 2010
 - (i) 29 of 67 counties in program in 2010
 - (ii) 7th or 8th in country for human cases
 - (iii) 2nd in positive mosquito pools
 - 1. Primarily *Cx pipiens* and *Cx restuans*
 - 2. 9 positive pools from other species
 - 3. Calculate MLE statewide
 - (iv) Birds - 20 of 56 positive
 - (v) 7 horse cases
 - (b) LAC
 - (i) Limited testing
 - (ii) No positives
 - (c) EEE
 - (i) Limited testing
 - (ii) Habitat not good for *Cs melanura*
 - (iii) No positives
 - (d) SLE
 - (i) Monumental effort to detect virus
 - (ii) No positives
 - (2) Reduced budget
 - (a) Sampling cut
 - (b) No light traps set
 - (3) <http://pavectorcontrol.org/>
- v) SC - Tammy Brewer
 - (1) 2010 was very dry - drought conditions continue
 - (2) WNV
 - (a) Primarily gravid traps
 - (i) 1200+ pools tested
 - (ii) 11 positive pools
 - (b) Some birds and horses tested - 1 positive bird
 - (c) 51 humans tested - 1 case
 - (3) EEE - 2 positive horses
 - (4) Dengue - all travel acquired
 - (a) Human cases
 - (i) 5 confirmed
 - (ii) 8 probable
 - (b) Worry about dengue virus getting into *Ae albopictus*
 - (c) Did door-to-door education and sampling
 - (5) Chikungunya - 1 imported case
 - (6) SCMCA 2011 - Annual Meeting
 - (a) Hickory Knob State Park
 - (b) November 2-4
 - (c) <http://www.scmca.net/>
- vi) VA - Tim DuBois

- (1) 2010 season
 - (a) Weather
 - (i) Spring - heavy rain
 - (ii) Dry through much of season
 - (iii) Wet at end of season
 - (b) WNV - average season
 - (c) EEE in southeast
 - (d) Norfolk Lab closed
 - (i) BL3 Lab
 - (ii) Last testing lab in state
 - (iii) Moved to using VecTest or Ramp test
- (2) NPDES - good working draft
- (3) <http://www.mosquito-va.org/>
- vii) WV - unable to come to meeting
- viii) GA - Jeff Heusel
 - (1) Mild year
 - (a) Wet winter and early spring
 - (b) Mosquitoes
 - (i) Lots of nuisance species
 - (ii) *Cs melanura* and bridge vector numbers were high
 - (c) EEE horse cases, but no human cases
 - (2) Arboviruses
 - (a) Human cases
 - (i) 13 human cases of WNV
 - (ii) 2 LAC cases
 - (iii) 7 cases imported dengue, including 2 DHF
 - (iv) 1 Chikungunya case
 - (b) Mosquito testing
 - (i) ~5000 submitted
 - (ii) 99 WNV+
 - (iii) 3 EEE+
 - (iv) Some other viruses
 - (c) Birds
 - (i) 8 submitted
 - (ii) 4 WNV+
 - (3) GMCA meeting - www.GAmosquito.org
 - (a) Oct 19-21, 2011
 - (b) Athens, GA