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://leateam.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.elecdata.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) CO_2-baited CDC light trap

(2) CO_2-baited BG Sentinel trap (http://www.bg-sentinel.com/en/mosquito_trap_tests.html)
(3) CO_2-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 CO_2-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
(http://health.state.ga.us/pdfs/epi/gers/Mar08GER.pdf)
(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) Anautagenous
(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