Overview of Mosquito Control Programs in Chatham County, Georgia

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Chatham County is the most northern coastal county in Geogia, with a land area of approximately 438 square miles. Chatham County Mosquito Control has a staff of thirty, including one seasonal position and is fortunate to be an independent county department, reporting directly to the County Manager. This paper gives a functional overview of the program with a discussion of five services.

Chatham County uses an integrated pest management approach to mosquito control and obviously, surveillance is essential. Thirty-nine species of mosquitoes are known to occur in the county, of which only eleven are important nuisance species or disease vectors. *Culiseta melanura* (Coquillett) and *Culex quinquefasciatus* Say are the only two species from which we have isolated Eastern Equine Encephalitis (EEEV) virus and West Nile virus (WNV), respectively. Surveillance begins in our front office, where calls from our residents are individually plotted on a county map using different colored pins for each day of the working week. This map is used to locate trouble spots, as indicated by a cluster of pins. After a significant rain event, our staff's direct field observations corroborate the telephone requests for service, and there is little need to inspect each residence. However, during drier periods, staff members investigate many of the calls, suspecting artificial container species or other isolated situations that create a localized problem. The map is then used to plan both ground and aerial adult control missions.

Several hundred potential larval mosquito habitats have been identified and are treated with aircraft when necessary. There are at least 93 rain and tidally influenced larval sites on our barrier islands and hammocks totaling over 580 acres, over 6,200 acres of numerous inland, rain influenced, larval habitats, and more than 5,670 acres of dredge material containment areas along the Savannah River. These latter sites are used to contain the water and silt pumped out of the Savannah River to maintain the shipping channel. The total acreage of all our potential larval mosquito aerial targets is more than 12,000 acres. We have never aerially treated all that acreage after any rain or tidal event in our history. A significant weather event typically requires the treatment of 3,000 to 5,000 acres.

GPS technology is extensively used in our program, and particularly in the surveillance of aerial targets. Each larval site is assigned a unique identification number. Within 24 hours following a rain or tidal event, entomology technicians survey all such sites.

Figure 1: Entrance to Chatham County Mosquito Control administration building.

Table 1: Example of aerial larviciding target list compiled from field surveys.								
Air Tractor Targets, August 9, 2005								
Area	Site Description	Site #	Acres	Water Depth	Larval Density	Instar	Date	Map Printed
DMCA	14-B	4144	350	3	3	2	9-Aug	X
Plantation	Fife	4131	835	4	5	2	9-Aug	X
Elba	Elba DMCA	4093,4095	265	3	4	1,2	9-Aug	X
ICW	J-45	4090	52	1+	5	1,2	9-Aug	X
	Constantine's	4240	80	3	5	1	9-Aug	X

First, sites that must be treated by aircraft are inspected. Using the county radio system, they begin the daylong process of calling in the target identification numbers of all aerial sites found to be positive for mosquito larvae. Staff entomologists record these findings, creating an Excel spreadsheet. The size of the smaller targets generally remains constant for each event. Entomology technicians compute the acreage of the larger targets using complex ArcGis® 9 software. At the end of the first day, the total acreage of all larval mosquito aerial targets requiring treatment is known. Pertinent data, such as location of active sites, acreage, larval density, etc. are recorded in tabular form for quick reference by aerial crews while treating (see Table 1).

While the two pilots begin larviciding all aerial targets, the entomology technicians return to the field to hand treat the remaining smaller targets, many of which are in or near residential areas. They use various means to control larvae. Mosquito fish are used wherever possible and entomology technicians will restock ponds that have lost their fish during periods of drought. The primary larvicides applied by hand are Golden Bear Oil® (GB 1111), Altosid® Pellets and Altosid® XR Briquets.

Detecting the presence of EEEV and WNV is also an important component of our surveillance program, using sentinel chickens and Centers for Disease Prevention and Control (CDC) miniature light traps. The sentinel chickens are set at six fixed locations for one night each week during the season. After one night in the field, the sentinel chickens are returned to a mosquito-free coop at our facility. A blood sample is taken and analyzed two weeks after the field exposure. Multiple "sets" of chickens are used in the program. After a negative

Figure 2: MD 500E being loaded with specially designed larvicide trailer.

Figure 3: The Piper Navajo Chieftain is used for adulticiding.

finding, sentinel chickens are put back in the rotation for field surveillance. Individual birds are only used at a single location throughout the season.

Concurrently, CDC traps baited with dry ice are set at all sentinel chicken sites. However, to lessen competition with the sentinel chickens, these traps are positioned five to twenty-five meters away from sentinels. *Culiseta melanura* and *Coquillettidia perturbens* from these traps are tested for viral infection. CDC traps are used at additional sites to monitor vector species of EEEV as well as nuisance mosquito species.

Surveillance for WNV has become an increasingly important aspect of mosquito control throughout the United States in the last several years. Gravid traps (Hausherr's Machine Works, Tom's River, NJ) are set in 28 locations throughout the more urbanized portions of the county. Each of the 28 sites is monitored once per week. These traps are highly effective in capturing *Cx. quinquefasciatus,* which is the primary vector species of WNV in coastal Georgia. A hay infusion media is used and the traps are set in late afternoon and retrieved the following morning.

Mosquitoes collected in the CDC or gravid traps are placed on dry ice in coolers in the field and brought to the laboratory where they are identified and sorted on a chill table. Up to 20 mosquitoes are placed in 1.5 ml cryogenic vials and stored at -70°F until they are shipped to the Southeastern Cooperative Wildlife Disease Study in Athens, GA for viral analysis.

Our facility operates a Spray Systems Maintenance Shop to calibrate and repair ground-based spray equipment, and perform vehicle maintenance. Maintenance shop staff also service small equipment such as generators, air compressors, lawn mowers, and mosquito surveillance traps. They are on call 24 hours a day to support field operations.

Ground control staff have two missions: ground based ultra-low volume spray operations and stormwater catch basin treatment. Chatham County is divided into 54 spray areas, each requiring four to five hours to treat for adult mosquito control. Residents requesting notification are called prior to all operations. A binder of information specific for each spray area is carried in the spray vehicle. The binder contains maps detailing specific spray instructions, a list of which properties to avoid treating and which residents have requested that trucks come on the property. The binder also includes the pesticide label, material safety data sheet, and a Chatham County accident report form. All vehicles

Figure 4: High pressure adulticiding rig mounted on MD 500E helicopter.

Figure 5: All dispersal equipment, gasoline powered machines, and vehicles are maintained by Spray Systems Maintenance Shop staff.

Figure 6: Maintenance staff clean trails for easy access for surveillance and hand treatment.

carry a spill kit and ground control staff are required to maintain a Georgia Pesticide Applicators License.

Based on observations spanning 5 years, the highest WNV transmission area appears to be centered in a 23.5 square mile area in the heart of Savannah that includes the downtown, historic, and Victorian districts of the city. This is the most densely populated area of Savannah with the oldest stormwater infrastructure. Nine of the ten Chatham County residents diagnosed with laboratory-confirmed cases of WNV in 2003 and 2004 resided within this "hot zone." Having such a well-defined risk area allowed us to use motorized scooters to treat the stormwater catch basins. We first used the scooters in 2005 and worked out the logistics of using a scooter-based catch basin treatment program. The products used were Altosid® Pellets and Altosid® Pellets WSP. Using the water soluble packets proved to be most efficient, and looking to the future, gives us the ability to use similarly packaged formulations of *Bacillus sphaericus* Neide and alternate products to minimize the risk of developing pesticide resistance in our *Cx. quinquefasciatus* populations.

Figure 7: Motorized scooters are used to treat catch basins in West Nile virus high risk areas.

Two pilots and 2 aircraft mechanics conduct our aerial surveillance

and treatment operations and perform aircraft maintenance.

An Air Tractor 402A is used to larvicide large targets including the dredged material containment areas along the Savannah River, and a number of inland sites. Altosid® Liquid Larvicide Concentrate is mixed with sand at our facility. We have a storage silo and scale that dispenses sand into a self-propelled mixer. After formulating the material, the Air Tractor is driven into position and a conveyor is rotated to place the chute over the hopper of the aircraft. The mixer is then driven to the conveyor to dump the load onto the conveyor and into the aircraft. The Air Tractor is loaded with the turbine engine running and the propeller feathered in the neutral position. Filling takes approximately two minutes, and the pilot returns for a refill every 45 to 60 minutes. The pilot notifies staff of his return about 10 minutes before landing so that the Altosand mixture is ready for loading as soon as the aircraft taxis into position.

A Piper Aztec fitted with an internal tank and pump and two Micronair nozzles is one of the aircraft used for adulticiding in Chatham County. Missions are conducted during the daylight hours just after dawn or just before sunset, and require approximately one hour for completion.

We also operate two MD 500E helicopters. Both have identical airframes and external attachment points allowing all helicopter equipment to be mounted on either aircraft. For larviciding, we use Isolair broadcast spreaders that have been modified to disperse the Altosand formulation. The spreaders hold about 400 pounds of material each, and are filled from a specially designed trailer. The trailer has two compartments. The smaller rear compartment is outfitted with 2 screw augers that form a "V" in the rear of the trailer. The aircraft taxies into the "V" for filling. The screw augers bring up the Altosand formulation and release it into flexible 4-inch tubes placed into the Isolair Spreader tanks.

During the past several years, a number of high pressure liquid adulticiding sprayers have been designed and built by our aviation staff. These are used to conduct adult mosquito control with our MD 500E helicopters.

Currently we are using naled in the emulsifiable formulation marketed as Trumpet®, in both our rotary and fixed-wing aircraft for adulticiding missions. All four of our aircraft use Ag-Nav GPS systems and have data logging capability. Mission records are downloaded,

Figure 8: Amphibious long-reach excavator used to drain water from dredge spoil sites along the Savannah River.

Figure 9: MD 500E helicopter on display at a local school Career Day event.

superimposed over digital maps of the treatment area, and printed to create a permanent record of the operations. These records demonstrate that we do not spray over schools, hospitals and groups gathered for outdoor events.

Our Maintenance Services division has 6 personnel and performs a variety of functions. The most important is our ditching operation in the dredged material containment areas along the Savannah River. Large rotary ditchers cut trapezoidal shaped ditches three to four feet deep and three to four feet wide. They are spaced approximately 100 feet apart and function by dewatering the sites after rainfall to prevent mosquitoes from completing development in these containment areas that total more than 5,600 acres. This operation is conducted year round. Maintenance Services also maintains trails throughout the county that are used by surveillance staff to gain access to mosquito larval sites requiring routine inspection and treatment. Finally, this division maintains the grounds totaling 6.3 acres, and nine structures that make up Chatham County Mosquito Control.

All staff help at various public education events during the year. Typically, we bring equipment and a display board to local school career days, and participate in Earth Day, Hurricane Expo, National Night Out and other local events. Staff members also give presentations for numerous local organizations including Lions and Rotary Clubs, and homeowner associations. Items distributed during public events are refrigerator magnets with our contact information, stadium cups promoting our "Terminate the Tiger" campaign, and information brochures on the Asian tiger mosquito and West Nile virus.

We conduct a comprehensive mosquito control program using integrated pest management principles. Chatham County staff members are fortunate to operate out of a new facility designed specifically for mosquito control.

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