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About the Cover:
The community of Rio, located in northeast Martin County, Florida, along the St Lucie River, measures only 542 acres. It was one of two local areas where dengue cases were identified in Martin County during Fall 2013. The photo shows the Rio Civic Center road sign posting after the Martin County Health Department gave a presentation on dengue and asked for help in combating the disease, by cleaning up water-holding containers in residential yards. Photo taken September 6, 2013 by Gene Lemire.

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There have been several important changes to Wing Beats of late, and your Editor-in-Chief hereby reports ‘em like he sees ‘em.

Plus ça change, plus c’est la même chose: The more things change, the more they stay the same. Eighteen years ago a disagreement between the American Mosquito Control Association (AMCA) and the Florida Mosquito Control Association (FMCA) eventually led to the removal of AMCA from the cover and masthead of Wing Beats. Fortunately, a new profit-split agreement was crafted and approved in 1998, a situation that lasted until January 2014, when the FMCA Board declined to renew the agreement. With the agreement between AMCA and FMCA dissolved, references to AMCA were regrettably removed from the cover and Table of Contents page of the Spring 2014 issue of Wing Beats. The situation remains unchanged with this issue. However, we feel optimistic that a new arrangement favorable to both associations will be forthcoming. Don’t expect editorial updates in these pages, but we will certainly inform you when the matter has been successfully resolved and a new agreement is in place.

At the end of last issue, my brother and colleague, Dr Jack Petersen, stepped down as Wing Beats Managing Editor. Jack came on board in the Spring of 2006, back when the both of us had just assumed our new editorial responsibilities. In those days our offices were a mere 5-minute walk from each other, enabling us to communicate frequently and collaborate effectively. We established a ritual of having lunch at a local seafood restaurant on the first Wednesday after an issue went to press, to celebrate the completion of one issue and begin planning for the next. Jack has been a tireless supporter of the publication, speaking with potential authors at meetings, giving presentations to encourage submissions and reviewing countless manuscripts. I will miss his enthusiasm, good counsel and sense of humor. While he has repeatedly reminded me he is no longer Managing Editor, Jack has promised to stay involved – ex officio and all that – and for that I am most grateful.

The status of the Editor-in-Chief has also changed. In early 2013 Jack and I privately pledged to step down from the Wing Beats Editorial Desk after the Spring 2014 issue. That decision was based on our 8 years as volunteers – as of Spring 2014 – a date that would also mark Volume 25 of the magazine. Having reached that milestone, it felt like a good time to cut back on our substantial volunteer hours. Our respective spouses also were supportive (and likely not displeased) of that mutual decision, and our resignations were submitted in August 2013. A month or so later, however, I was asked to reconsider my resignation if the position were to become compensatory. My answer was: “Yes.” The matter was brought before the FMCA Board of Directors at the Association’s Fall Meeting and subsequently approved, and so my name remains at the top of the masthead. I am grateful for the support of the FMCA Board for allowing me to continue doing a job I love – and getting paid to do it!

While experts can debate the likely causes, the new millennium seems to have brought a resurgence of the cosmopolitan container species, Aedes aegypti and Ae albopictus, a dynamic duo that have proven to be competent vectors of the viruses that cause dengue and chikungunya. Locally transmitted dengue fever re-emerged in Florida in 2009 and now appears to be well-established. In January of this year the US Centers for Disease Control and Prevention in Atlanta (CDC) reported that chikungunya fever has great potential to be imported to the southern United States. Two articles in this issue discuss the emerging threat of dengue and chikungunya viruses, including a first-hand account from a local outbreak in Fall 2013. They will likely not be the last articles on the subject.

Our next issue will celebrate the Silver Jubilee of Wing Beats magazine, founded in Fall 1990 by Dr Charlie Morris, an extension entomologist with the University of Florida’s Florida Medical Entomology Laboratory, in Vero Beach, FL. Twenty-five years later, Wing Beats is still going strong, thanks to continued industry support and readers like you. Yours truly is truly honored to be a part of it all!
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As the director of Martin County Mosquito Control, one of my many responsibilities is to control mosquitoes to the point where the chance of contracting a mosquito-transmitted disease is minimal. Of course, not all of the responsibility of getting a disease from mosquitoes rides on the back of mosquito control. The public also has to be a major player for this effort to be successful. That is one of the reasons mosquito control and the health department put out notices to protect the public from mosquito bites each summer.

The summer of 2013 was to be no exception when it comes to mosquitoes. Rains and warm weather always mean the beginning of mosquito season. How bad a season it will be is never predictable, each season being different due to weather events. On August 8, 2013 a call from the Martin County Health Department changed the normalcy of controlling mosquitoes.

Even though we have a great relationship with the Health Department, a call from them is never social in nature. It’s usually the prelude to a potential problem. Sure enough, I was told that three people might have acquired dengue fever locally. This didn’t come as a great surprise as the primary vector for this disease mosquito, Aedes aegypti, had recently made a giant comeback in the area. However, the news of a potential disease outbreak creates a totally different scenario on how to proceed with the season.

For years many organizations in the field of mosquito research and control have warned that shrinking budgets could put the country at risk for the reoccurrence and emergence of mosquito borne disease. This has been happening at an alarming rate. To have a dengue outbreak in two small towns – Rio and Jensen Beach in Martin County, Florida – is evidence that we are not immune to this, and other, diseases.

My job took on a new aspect: Ignore the other components of the job as much as possible and mobilize the division into teams to combat the disease threat. We immediately responded to the likelihood of local transmission before notification of a positive confirmation. The implication of
A disease threat merits prompt action. The possibility of people sick with the virus lets you know that disease transmission is taking place and that the need to squash the mosquito population (no pun intended) as quickly as possible is eminent.

Martin County consists of 556 square miles, bounded by the Atlantic Ocean on the east, Palm Beach County to the south, Lake Okeechobee to the west and Saint Lucie County to the north. Martin County Mosquito Control is a multi-faceted organization responsible for controlling mosquitoes, aquatic weeds, weeds in right-of-ways and natural areas, and African bees. As with many small operations, resources are limited, with budget constraints requiring us to do more with less. This leads to developing creative ways of getting the job done and requires maximizing workloads while increasing efficiency in all of our undertakings.

Two man teams were quickly mobilized to go door-to-door, informing citizens of containers that were rearing mosquitoes and the potential threat of disease caused by these mosquitoes. If containers could be turned over or dumped, the teams assisted the homeowners. Containers that were too large to have the water removed were treated with larvicide. Areas heavily infested with adult mosquitoes were treated with insecticides applied by truck, aircraft or hand-held equipment.

Educating the public through brochures, door hangers, news media and door-to-door contact was standard procedure. For weeks we were dedicated to teaching people that containers and anything that could hold water in their yards or businesses was potential larval habitat for the mosquito vector of dengue fever. During the first several weeks we
received continuous calls from the Health Department confirming that other cases of dengue were being found. Each new call was responded to with the same vigor as the first. It took several weeks of continuous sweeps through many of the same neighborhoods before we started seeing residents take heed of our advice and manage the containers holding water in their yards.

As the weeks went by, our traps collected fewer and fewer Aedes aegypti adults and our larval surveillance demonstrated that we were being successful with our control efforts. The public reported an absence of mosquito bites and the incidence of dengue confirmations decreased.

Dengue is not a new disease so there has been a lot of research on the best way to control the elusive little insect that transmits it. Going door-to-door is time consuming and takes lots of personnel. However, no other method gets the public involved as much as this does. Though we went through every control method available to us, it was, ultimately, feet on the ground, pounding the pavement every day and speaking with people that paid off with tremendous dividends. Neighbors spoke to each other and when the talk of the town is emptying containers in your yard to avoid a disease, the message begins to be taken seriously.

Figure 4: Mosquito technician John Kesler inspects a boat for Aedes aegypti. The area is a huge boating community and many boats were found to be producing mosquito larvae.

Figure 5: Inspector Steve Noe uses a hand-held thermal fogger for adult mosquito control in a neighborhood with dense and abundant vegetation. Thermal fogging proved to be an effective control technique, giving the inspector a good visual on where and how far the insecticide was drifting.
One of the many challenges we faced was that the epidemic area was in an old Florida neighborhood where people work and socialize outside at early dusk, the prime biting time for this mosquito. Many people are used to getting a few mosquito bites and consider it a way of life in Florida. To some extent this is true. South Florida is tropical and is not only a human paradise but also a bug oasis. There is no way to control mosquitoes to the extent that one will not receive an occasional bite when going outdoors. This fact should be a reminder that when mosquitoes are out, people need to think about retreating to screened porches and air-conditioned spaces, especially during outbreaks, to avoid the chance of getting a disease.

As my wife constantly tells me, “This too will pass.” The dengue outbreak in Martin County slowly came to an end. We had significantly reduced the mosquito population. The public was cooperating by keeping their yards free of containers. When the Health Department lifted its dengue fever advisory in December 2013, twenty-two people had been diagnosed with dengue. The Health Department conducted an extensive door-to-door survey, collecting four hundred blood samples from persons who might have acquired the disease, and found forty more presumptive cases of dengue.

Have things gone back to normal? No. We are still making sweeps and keeping a diligent eye on the Rio and Jensen Beach area where dengue was most prevalent. We are still finding *Ae aegypti*, not only in this area, but in almost every area of the county. The dengue outbreak was one of the top local news stories of the year and many people are still vigilant about maintaining a mosquito-free yard. The challenge now is this summer. Can we manage to keep this little mosquito at bay with the public’s help – or will 2014 see another outbreak?

---

**Figure 6:** Inspector Robert Dulin sprays a junkyard in the area that was producing larvae and had an abundance of adult mosquitoes.
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December 2013 saw the first human cases of chikungunya fever in the Caribbean island of St Martin. This is the first time in the Western Hemisphere that the disease has spread to humans from infected mosquitoes. Since May 9, 2014, the Pan American Health Organization (http://www.paho.org) has reported approximately 4,200 confirmed and over 45,000 suspected cases of the disease from 15 additional countries in the Caribbean region, including French Guiana in South America.

During the last seven years, the chikungunya virus (CHIKV) has expanded its geographical range, causing sustained epidemics of unprecedented magnitude in Asia and Africa. Although areas in Asia and Africa are considered to be endemic for the virus – where the vector is Aedes aegypti – outbreaks in many new territories in the Indian Ocean islands and in Italy have occurred and were fueled by infected Aedes albopictus. The recent re-emergence of CHIKV has heightened the world’s public health awareness and concern about this virus.

The US Centers for Disease Control and Prevention (CDC) has predicted that CHIKV will eventually make its way onto the American mainland. Several medical entomologists in the mosquito control community feel that this event may occur sometime this year – 2014 – and that entry may first occur in Florida.

As most of us are aware, Aedes aegypti and Aedes albopictus are present throughout most of Florida. The broad distribution of these two competent mosquito vectors, coupled with the lack of human exposure to CHIKV, places human populations at risk for the infection and spread of the virus. In other areas of the world, hundreds to thousands of cases of chikungunya fever have appeared in relatively short time spans, often a few weeks to months. If large outbreaks were to occur in the US general population, they would likely tax existing healthcare systems and the public health infrastructure, as well as negatively impact local economies if the available workforce suddenly becomes debilitated by this disease.

In response to the threat of CHIKV entering into Florida, the Navy Entomology Center of Excellence (NECE), Jacksonville, FL hosted its Symposium for Disease Vectors and Control Techniques on March 14, 2014; see Figure 1.

The event was an interactive day where more than 40 attendees from 9 Florida mosquito control districts, 2 Florida county departments of health, United States...
Department of Agriculture Center for Medical and Veterinary Entomology, Florida Department of Health, CDC, Florida Fish and Wildlife Conservation Commission, the Armed Forces Pest Management Board, Innovative Vector Control Consortium, including NECE staff gathered together to share their experiences and work together to prepare for future arthropod disease risks to deployed warfighters and civilians. Specifically, the symposium addressed the developing threat of CHIKV as well as the persistent threat of dengue in the US and the utilization of thermal fogging in integrated vector management.

The goal of the symposium was to use our collective knowledge and firsthand experience with dengue in discussing what the response should be to prevent the presence of (or contain) CHIKV in Florida. Furthermore, the diverse backgrounds of attendees allowed the discussion to address critical issues surrounding emerging and consistent threats posed by mosquito-transmitted pathogens.

While the discussion did not provide specific measures to be taken, it identified critical information gaps in current arboviral response plans and provided increased awareness of new challenges that may arise if and when CHIKV enters the United States. Results from the open forum discussions suggested that if the vector of CHIKV were Ae aegypti, then domestic container surveillance and associated control measures currently used for dengue could provide an example, or framework, in which to address CHIKV. If Ae albopictus proved to be the only vector of CHIKV, then different, and more expansive efforts at surveillance with different control methods would have to be implemented. If both species were involved in virus transmission, then considerable effort and expense would be required for surveillance and control, because Ae aegypti and Ae albopictus have several ecological and biological differences related to developmental habitat and host biology; see Table 1.

Moreover, it is quite probable that the species responsible for autochthonous (local) transmission of CHIKV would not be identified in a timely enough manner to assist in determining appropriate surveillance and control measures, but that both species would have to be targeted.

In any event, many unanswered questions remained regarding surveillance and control following the symposium’s panel discussions. As a result, the formation of a working group was suggested for developing specific plans of response for dengue and CHIKV for Florida, and at the time of this writing is currently being organized.

### REFERENCE CITED


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**Table 1: Ecological and biological differences of *Aedes aegypti* and *Aedes albopictus* as competent vectors of chikungunya virus (PAHO CDC 2011).**

<table>
<thead>
<tr>
<th><strong>Aedes aegypti</strong></th>
<th><strong>Aedes albopictus</strong></th>
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<tr>
<td>Main vector in Africa where disease is endemic.</td>
<td>Incriminated in recent epidemics.</td>
</tr>
<tr>
<td>Most likely important in urban areas.</td>
<td>More significant in temperate areas where already established.</td>
</tr>
<tr>
<td>More closely associated with humans, in homes feeds preferentially on humans.</td>
<td>Feeds readily on humans but also feeds on a broader range of bloodmeal hosts.</td>
</tr>
<tr>
<td>Develops most frequently in containers on household premises.</td>
<td>Develops in peridomestic habitats and natural habitats.</td>
</tr>
<tr>
<td>Doesn’t overwinter.</td>
<td>Overwinters in egg stage - occupies more temperate climates.</td>
</tr>
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</table>

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Mosquito Bites and Mosquito Allergy by David DeMay

Of the 10 plagues mentioned in the Bible, insects are the cause of three, namely, gnats (or lice), flies, and locusts. With 3.4 billion people at risk, over 200 million contracting and 700,000 deaths annually, malaria outstrips all biblical plagues combined (World Health Organization: http://www.who.int/malaria/en/). Africa accounts for 90% of the deaths and most of those are below the age of 5. Mortality reflects complete failure of the immune system to overcome the pathogen. Mortality is but one side of the problem, as morbidity creates a huge impact on human populations especially in the developing world. The tiny female mosquito, who needs blood in order to produce eggs for the next generation, is the culprit. A miniscule amount of saliva, far less than a drop of water, is needed for her to efficiently draw blood while potentially delivering a parasite or virus.

Within that miniscule amount of saliva is a host of complex biological compounds. Once the human body receives a sufficient concentration in a timely manner, the immune system is triggered to mount a defensive response, known as a papule, against the foreign compounds. A papule is a raised solid elevation of skin, about the size of a penny, which may become warm, itchy and red. The response may last for more than a week.

Peng and Simons (1998) reported the first study of natural desensitization to mosquito bites in humans. A 23-year-old male volunteer received 100 Culex quinquefasciatus bites every 2 weeks for 10 months.

The typical immune sequence is:

**Stage 1:** no reaction

**Stage 2:** delayed reaction only

**Stage 3:** immediate and delayed reaction

**Stage 4:** immediate reaction only

**Stage 5:** no reaction

A papule occurs in stages 2, 3, and 4. The volunteer remained in stage 1 for three weeks then progressed through stages 2, 3 and 4 from the third week to the nineteenth week. During this period, his blood was monitored for biochemical and cellular changes associated with an immune response. Subsequent studies would include and verify the protein histamine and antibodies (immunoglobulins: IgE, IgG4 and IgG1). Indeed, at week 21 (or about 5 months) he reached stage 5. Essentially anyone who shows no reaction (papule: blister-like skin reaction) could be at either stage 1 or 5. If one has reacted to bites in the past but is no longer reactive to them, then one is at stage 5.

Da (Dalton) is a standard unit of measurement on an atomic or molecular scale, with a single Da being the mass of a single neutron, which is nearly identical to that of a single proton. The aggregate sum of the constituent elements and their respective masses for a molecule can be expressed in thousand (kilo) Daltons (kDa). In the past this was known as the molecular weight.

Mosquito allergens are salivary gland proteins which range in mass from 21 kDa to 37 kDa. An unusually large protein at 64 to 67 kDa produced by Aedes aegypti is identified as an important allergen. At least one role of these proteins is to prevent blood clotting in order to insure efficient blood uptake by the mosquito.

In the world of proteins, size matters. If the typical protein is about...
0 amino acids long and these 21 to 37kDa mosquito salivary proteins are 750 to 1300 amino acids long, they are obviously complex, and have been shown to be evolutionarily conserved. They would also likely be chemically similar in all mosquito species. Hence, if you reach stage 5 from bites of a local mosquito species you are very likely to be non-reactive to mosquito bites from any number of other species, even in other far away locations. In fact, desensitized to Cx quinquefasciatus, the previously cited volunteer was shown to be desensitized to Ae taeniorhynchus and Ae aegypti as well. Additionally, there is some evidence that one may be desensitized to other dipteran bites.

Commonly with married couples, the male will declare that he is non-reactive to mosquitoes, yet his wife reacts to all insect bites. He is likely to be outdoors and exposed to insect bites and obtained natural immunity and is desensitized. He is probably at stage 5, while his wife is somewhere between stages 2 and 4. While remaining between stages 2 to 4 may be unpleasant, Donovan et al (2007) suggest that the skin reaction may confer protection, effectively blocking the movement of malaria parasites into the bloodstream. If so, this would be an evolutionary fitness value to the individual.

What specific allergen concentration and time factors lead to stage 5 are unknown, and undoubtedly differ from one person to another. Indeed, some people remain in stages 2 to 4 for years. Whereas localized skin reactions are common, full blown (anaphylactic) or systemic reactions are extremely rare. Aedes albopictus has been identified as the most common mosquito species associated with systemic allergic reactions (Peng et al 2004). The DNA of one species shared allergen, a 37kD protein named rAed a 2, has been cultured in a recombinant (baculovirus/insect cell) system (Peng et al 2006) producing a high yield allergen product useful as a skin test to diagnose mosquito allergy. Researchers at this time are endeavoring to isolate and purify the allergens and at least 6 commercial companies have crude preparations to facilitate desensitization for those who have serious reactions, a condition Simons and Peng (1999) described as Skeeter Syndrome.

Will there ever a cure for the common mosquito bite? Well, not just yet. But stay tuned!

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Back in the day – prior to the year 2006 – Lee County Mosquito Control District’s (LCMCD) aerial mosquito larviciding procedures were generally a ‘Show-Me’ process. An inspector would ride with the pilot and point out to him where treatment was needed or merely provide verbal instructions with maps. The inspector would stay at the loading site to maximize the larvicide payload, while the pilot would perform the application. Verbal communication in conjunction with memory can become jumbled resulting in, on occasion, misunderstandings and errors. All too often the question asked was “Where did you spray?” which had the same answer every time, “Where you told me to spray!” Although precision of application was good considering the tools available, the pilot had to be a master in multitasking between piloting the aircraft, synchronizing the spray on/off trigger with aircraft speed and spray system lag, looking for citizens within the treatment area as well as various obstacles associated with tree-top flight. Maintaining correct swath width was a seat-of-the-pants type of determination which worked well with a straight road as a reference, but was varied in open marsh with no points of reference; see Figure 1.

Prior to 2000, accurate location determination by the satellite-
based Global Positioning System (GPS) had “Selective Availability” (SA) for military use only. GPS signals were seriously degraded, making them useless in determining an individual’s location. In 2000, by Presidential Executive Order, the SA degradation of GPS signals was turned off. This action initiated an onslaught of accurate GPS-based industries developing products for all facets of daily living and commercial enterprises, including mosquito control.

LCMCD began exploring the use of GPS tracking for our aerial larviciding program and in 2006 installed Ag-Nav II GPS pesticide application guidance systems on two of our helicopters. The pilots were asked to turn on the system to merely track where they flew and sprayed. This was a dramatic change in the normal routine. During the 2007 season, the Ag-Nav Guia units and light-bars were installed in additional aircraft and the pilots were asked to incorporate the swath guidance into their treatment regime. Swath guidance was established by creating an A-B line on one side of the treatment area and entering a non-specific number of swaths. This allowed the guidance system to provide swath lines across the treatment area upon which to line up the aircraft; see Figure 2. At this time the pilot had to manually increment to the next swath while turning the aircraft around.

GPS mediated aerial larvicide application and tracking was fully implemented in 2008. However, treatment assignments were still by “show-me” and swath guidance was from an initial A-B line for each treatment. This season of full GPS mediation brought larviciding record improvements of, providing knowledge of exactly where the application occurred, where the pilot did not spray, confirmation of continued equipment calibration and reconciliation of reported treatments against GPS records. From this information we were able to answer citizen concerns with precision and maps, confirm correct spray track location, spray swath accuracy and aircraft ground speed. The physical properties of applications steadily improved throughout the season.

Now that we were comfortable with using GPS tracking for our aerial larviciding by 2009, Gene Sutton, our Chief pilot, suggested using polygons – outlined spray blocks on a map – to define every treatment. This concept was problematic to management as well as inspectors and pilots, due to the anticipated increase in workload. Questions developed about the time needed to create all these polygons. Who will create them? What happens with the polygon when the treatment area expands and shrinks? How will they be identified? When Gene offered to draw all the polygons from his recollection of historical treatments, make them large enough so they would not need to be modified and confirm their accuracy with the inspectors, management relented and agreed to give the concept a try. Google Earth was the platform on which polygons were drawn and they received identification.
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numbers based on the existing treatment zone scheme with two additional levels of precision. Because each polygon was assigned a unique identifier, they were not to be changed. The treatment, however, did not have to include the entire polygon. Also, no treatment was to be made outside the polygon. With the use of these polygons and parameters of treatment, a paradigm shift occurred in how we performed aerial larviciding. Polygon use brought us into the era of precision aerial larviciding. Each treatment was now defined and constrained by the polygon prior to larviciding. The inspector was now fully responsible for the treatment. No maps and no verbal descriptions were necessary. No ambiguity existed. The inspector would select the polygon by number, with the selected polygon loaded into the Guia by the pilot, who would then spray only the polygon. During this season the “Show-me” process of aerial larviciding faded into the history book; see Figure 3.

In 2010 the inspectors and pilots developed proficiency in polygon use. On-the-job training for polygon modification and manipulation within the Google Earth environment gave inspectors the skills to adjust polygons to reflect the dynamic nature of the larval mosquito habitat. The original large polygons were modified to reflect the larviciding patterns of 2009, which were shown by the spray tracks. Smaller polygons with unique identification numbers were added within the large ones to provide the inspectors with polygons which they could resize and manipulate to create precise treatment polygons; see Figure 4.

The concept of ‘Auto On/Off’ spray (Auto-Boom) was brought into the program in 2011. Improvements realized from this feature included increased precision in larvicide placement at the perimeters of the polygons and, most importantly, the pilot’s focus was now solely on flying the helicopter, avoiding obstacles and staying on swath. Without auto-boom the pilot had to watch for the beginning or end of the polygon and correctly time the on/off trigger by taking into account aircraft ground speed and spray...
system lag; see Figure 5. Allowing the Guia to take over this process required a leap of faith. Initially three set points were needed to be entered into the Guia, satellite communication lag, spray system pressure buildup lag and spray system pressure down lag. These set points were different for each aircraft and changed as filters or nozzles clogged. At our suggestion, Ag-Nav programmed the computer to perform auto calibration for these lags. With the installation of a flow switch on a single nozzle the computer was provided the lag time between spray trigger on and when the spray came out of the nozzle as well as when it stopped. With this data the software is able to perform the calculations itself and change them as necessary; see Figure 6. The result was that each swath was inside and up to the edge of each polygon.

In 2012 a complete larviciding protocol based on treatment polygons was developed. The inspector selects the polygons to be larvicided and modifies them when necessary. The selected polygons are copied to a USB drive and converted to Guia format. The day’s polygon missions are delivered to the pilot on the USB drive or e-mailed. Upon receiving the polygon missions, the pilot can review the day’s work on his computer and plan the entire day’s flight. Polygons in close proximity can be bundled as a ‘Project’ so they are sprayed as a single mission. The polygon missions can be assigned a treatment sequence number. This relieves the pilot from having to pick and choose in flight the next polygon to spray. The pilot only needs to fly the polygon and line up with the first swath to begin the treatment. When finished he pushes the ‘Next Area’ key and follows guidance to the next area already lined up with the first swath without any in-flight distractions of mission setup.
The result of developing GPS mediated aerial larviciding has been a tremendous increase in efficiency. The “Show-Me” flight is a thing of the past. The pilot has the day’s flight completely planned without any in-flight mission setup, leaving at the beginning of the day with the first load and spraying it out before landing in the field to receive the next load. The inspector can perform ground inspections while the pilot is airborne. Treatment accuracy has improved by magnitudes. Application precision is up to the edge of the treatment block. Equipment calibration is continuously verifiable. Treatment records are completely reconcilable as well as inventory records. The spray track records are available for review to solve application issues and to address citizen concerns. Lee County Mosquito Control District is now coloring within the lines with larvicide and is a land of one thousand polygons; see Figure 7.

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There is no substitute for experience and it is impossible to teach it. Yet, there are few things more valuable than being able to call upon experience to make decisions. Experience also helps us surround ourselves with mentors who have their own skill sets and expertise and can provide good advice. The ultimate decision is up to us, but being able to seek advice from people who “have been there and done that” is often more valuable and expedient than trying to figure things for ourselves. In the end, you’ve just got to give it a go, and whether you make the right decision or not, at least you are making progress and gaining that all-important experience (Branson 2014).

Having fundamental knowledge of the biology and ecology of a target species is vital to vector-borne disease control. However, the success of any program hinges on its manager’s ability to mix biology with reality and put all the available pieces together to form a practical and realistic plan designed with measurable and achievable goals that can be implemented in a reasonable timeframe.

When it comes to malaria control, there are a handful of notable examples of well-designed, thorough and systematic mosquito control programs that resulted in almost-complete disease elimination when implemented. Unfortunately, though there are well documented examples of significant victories against malaria and other vector-borne diseases, a good number of them date back to the late 1800s and early 1900s and have been pushed aside by many as not relevant today.

During the last few years of the 1800s and the first few of the 1900s, for instance, suspecting the link between the presence of mosquitoes and the onset of malaria, Dr Giovanni Batista Grassi convinced Italian government authorities and the general population to adopt what was later described as physical prophylaxis of houses. He argued that placing screens on doors and windows to keep mosquitoes out of homes would help reduce malaria. By the end of 1903, just under a year after its implementation, Grassi’s recommendations helped reduce malaria transmission by 90% from Italy’s Pontine Marshes (Desowitz 1991).

At about the same time of Grassi’s work in Italy, the first attempt to construct a canal across the Isthmus of Panama that would connect the Atlantic and the Pacific Oceans began under French leadership. The project was abandoned around the turn of the Century after two attempts that claimed approximately 21,900 lives, in great part due to malaria, yellow fever and landslides. The United States launched a third try soon after the French abandoned theirs, but the hazardous conditions continued and claimed another 5,600 lives in the first few years. In response to the high numbers of mosquito-borne disease cases, Dr (Colonel) William Gorgas was placed in charge of all field sanitation and vector control operations in the Canal Zone, as workers continued to dig the trench under the American flag. Gorgas’ dogged persistence to make Panama healthy for Americans, Panamanians and workers from other countries eventually succeeded in reducing mosquito-related morbidity and mortality, helped improve working and living conditions in and around the Canal Zone and was instrumental to the completion of the project. The Canal officially opened in 1914 (Haskin 1914).

In the United States of the 1930s, getting people to sleep under insecticide-treated bed nets or getting better medications to people with active malaria had little to no effect (Sledge and Mohler 2013). Instead, malaria was eliminated from the US, in large part because the government destroyed mosquito larval habitat through large-scale drainage projects, backed up by the creation of local public health infrastructure. It was speculated that the decline in malaria cases was associated with reduction of farming practices in the hardest hit areas, as tenant farmers left to seek factory jobs and other employment in non-malarious areas of the country, but that was not the case. The mosquito control program was so effective that the population actually increased in highly endemic areas over the course of the 1930s (Beaubien 2014).

Two of the most remarkable victories against malaria and its vectors that have remained in virtual anonymity during the “modern malaria era” are the eradication of malaria from all of “Mandate Palestine” under Dr Israel Kligler in the early 1920s, and the eradication of Anopheles gambiae from a 54,000 square kilometer area of northeastern Brazil under Dr Fred Soper in the second half of the 1930s.

Kligler (1930) first outlined his visionary malaria control and
elimination program in 1920. In 1921, with the support of the Rockefeller Institute, he embarked upon pioneering epidemiological research studies and later joined Hebrew University in 1925. That same year, the prestigious League of Nations Malaria Commission toured Mandate Palestine to assess the malaria situation. Kligler convincingly demonstrated that his integrated model would eliminate malaria from Mandate Palestine within a short period of time and would help keep it under control well into the future. Furthermore, he argued that his approach to vector control could be the key to winning the global war against malaria. A handful of years after he started, the malarious marshlands occupying the area known as Mandate Palestine, now Israel, was declared malaria free, and has remained malaria free uninterruptedly ever since!

In the 1930s, Soper was asked by the Rockefeller Foundation to assist Brazil’s ministry of health in controlling a malaria outbreak affecting a significant portion of the population and claiming a large number of lives. After surveying the area, he found Anopheles gambiae firmly established in the provinces of Ceará, Rio Grande del Norte and Paraíba in the northeastern part of the country (Soper 1943). What is significant about Soper’s work is not only that he managed to eradicate An gambiae from an area the size of Togo, in central equatorial Africa, but that he completed his work in 18 months and with approximately US $6 million in today’s currency. Soper understood the grave threat nature can pose to humanity, and he demonstrated what can be achieved when humanity uses thought and action to boldly fight back (Western Culture Global 2009).

The visionary works of Kligler during the Mandate Palestine period and the determination of Soper in Brazil are but two of the outstanding success stories of malaria control and elimination in the 20th century. Unfortunately, these achievements, along with the other aforementioned examples, have not been adopted by many of today’s malaria control program funding agencies and organizations as benchmarks to emulate.

According to the World Health Organization’s (WHO) World Malaria Report for 2013, global efforts to control and eliminate malaria have saved an estimated 3.3 million lives since 2000, reducing malaria mortality rates by 45% globally and by 49% in Africa. Expansion of prevention and control measures has been mirrored by a consistent decline in malaria deaths and illness, despite an increase in the global population at risk of malaria between 2000 and 2012. Increased political commitment and expanded funding have helped to reduce the incidence of malaria by 29% globally, and by 31% in Africa. According to Dr Margaret Chan, WHO Director-General, “This remarkable progress is no cause for complacency, as absolute numbers of malaria cases and deaths are not going down as fast as they could. The fact that so many people are infected and dying from mosquito bites is one of the greatest tragedies of the 21st Century” (WHO 2013a).

While these reports are encouraging, the figures reported are not without controversy, as many malaria workers continue to insist that the current morbidity and mortality figures are serious underestimations and the goals of eliminating malaria within this decade too ambitious. In fact, Dr Robert Newman, director of the WHO’s Global Malaria Program until late 2013, has been quoted as saying that “Zero malaria deaths by 2015 is wildly ambitious” (Knols 2011). Moreover, a report from an interview stated “A British leading expert on malaria has revealed insecticides used on nets in Africa are failing” (Mitchelmore 2013), mainly due to the advent of vectors developing resistance to the insecticides contained in the mosquito nets’ fibers.

In 1996, World Health Assembly Resolution No. 15.13 of the Fiftieth World Health Assembly declared the mosquito as Public Enemy Number One and asked member States to promote integrated pest-management approaches (WHO 1997). Unfortunately, today’s approach to malaria control is nowhere close to what Resolution No. 15.13 intended.

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Now, well into the 21st Century, many malaria control program managers, malariologists, field entomologists, environmental engineers, epidemiologists and mosquito control professionals around the world are perplexed as to why funding agencies and organizations continue to overlook the successes of a century ago and have not considered modifying the focus on malaria control interventions to include today’s modern mosquito control technology, methods and materials.

International funding agencies and country malaria control programs must go through a paradigm shift and focus their attention on fully active mosquito control methods. They should consider this adage, often attributed to Albert Einstein: Insanity is doing the same thing over and over again while expecting different results each time.

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From Where I Sit: Notes from the AMCA Technical Advisor by Joe Conlon

The time for our Washington Legislative Conference is drawing nigh and I thought it appropriate to discuss its purpose and setup so as to increase Wing Beats readership participation in this most worthy endeavor.

The legislative outreach program was first organized by George Wicherman from Lee County Mosquito Control District (Florida) as a means of making the voice of mosquito control heard by legislators on Capitol Hill. George, in his extensive interactions with federal agencies and services, saw the need for federal dialogue on a national scale as pressures from various activist groups began to mount, pushing the federal regulatory apparatus to enact increasingly restrictive policy. George initiated the Washington Legislative Conference as a means to bring some balance to this process. Thankfully, his vision has now morphed into an integral part of the AMCA work calendar.

Upon Mr. Wichterman’s retirement, Dr Bill Meredith from Delaware graciously assumed the challenge of organizing the three-day event that remains to this day. For ten years, Bill worked to coordinate conference speakers in addition to defining the legislative and regulatory issues that attendees would bring to their respective legislators. This was an enormous undertaking and Bill deserves a great deal of praise for the extensive hours he logged above and beyond his normal workday in ensuring the Washington Legislative Conference remained a vital and worthwhile endeavor. This organizational task is now allocated to the AMCA Past President by AMCA Board of Directors decree. In this year’s case, the estimable Dr Tom Wilmot from Midland County Mosquito Control (Michigan) has the reins.

Over the years, the AMCA has increasingly sought to make this important event more affordable so as to boost participation. Costs of attending this event have been partially offset by AMCA not charging a registration fee. In addition, Central Life Sciences has been offering fellowships covering up to $1000 of travel costs for first time participants who would not be able to attend otherwise. Many times these stipends are used by smaller mosquito control entities to ensure their voice is heard by their respective legislators on Capitol Hill. Hats off to Central Life Sciences for this tangible means to increase the participation of vector control personnel in exercise of a constitutional right.

The conference always begins on Monday afternoon and ends Wednesday at noon. Although the congressional visits remain the principle activity of the conference, attendees will attend several talks on Monday afternoon that include presentations on our principle regulatory concerns in addition to a general overview of the current Washington regulatory apparatus. In addition, several presentations address the proper way of conducting Capitol Hill visits. The primary
driver of the Monday afternoon session is to acquaint the attendee with our priority needs and strategies and to assure the attendee that everything will be done to make them feel comfortable in conducting visits to their respective legislators. This is critical, as many are intimidated by the prospect of speaking with congresspersons and senators. Rest assured that in all likelihood you will not be seeing the legislator him/herself. More likely, you’ll speak with a legislative aide, who will ask questions and take notes with which they’ll brief the legislator afterwards. These aides are bright, dedicated and energetic, but poorly paid. Their job is to listen to what you have to say and convey your concerns and “asks” to the legislator for possible action.

This is not as intimidating as it sounds because your legislator genuinely desires and needs to hear the concerns of his/her constituents – that’s why they’re there. Even legislators with whom you profoundly disagree philosophically are generally amenable to concepts that help maintain the health of their constituents. They are certainly not experts in the field of mosquito control and they NEED your input to make informed decisions on issues affecting the health of their constituents. Thus, they generally welcome brief discussion of your concerns. These concerns are encapsulated for the attendee in three one-page “Issue Papers” that define the concerns, discusses the background and concludes with a statement of what we want the legislator to do – support a certain piece of legislation, contact a fellow legislator, etc – the “ask.” The point here is that we ensure that you’re prepared to answer questions about the concerns you raise and we go to great lengths to make you comfortable with the process. To this end, first-timers are almost always paired with someone who has done this in the past and serves as the group spokesperson. This gives the first time attendee the chance to observe and contribute when they feel at ease doing so.

Be advised that yours may not be the only perspective on a particular issue. Other groups with agendas inimical to ours may have presented their views already in their own visits – as is their right. But that’s the beauty of the system. All stakeholders are afforded the opportunity to make their case. Should you choose not to take advantage of the occasion to make your concerns known, don’t be surprised if a legislator makes a choice you deem ill-advised – based on input from an anti-pesticide group that made its point in your absence. You may deem your worth as public health professionals to be self-evident, but if the only views heard by legislators are those from your opposition, you shouldn’t be shocked that they act upon the only information they’ve been given.

On Wednesday morning after the congressional visits, the AMCA generally invites speakers in key positions at EPA, US Fish and Wildlife Service, and other federal agencies who can provide a Washington-eye view of legislative and regulatory issues which impact our services. These presentations are extremely informative and often provide unique perspectives underlying the rationales driving regulatory decisions with which we might disagree. You would be mildly surprised at the pressures exerted by various competing interests on the most mundane of issues – whose adjudication may appear patently obvious to us, but becomes a bit less cut-and-dried when confounders come to light.
Wednesday also provides an opportunity for attendees to discuss their experiences with the various legislators and staff whom they visited the previous day. It’s fascinating listening to the many differing reactions of legislators to our issues. Sometimes the reactions – be they positive or negative – are substantive. Sometimes they hinge on a fit of pique at some other legislator across the aisle, who made them angry at something and they’re not going to support any legislation by the offending congressman out of sheer spite. On such petulant banalities are decisions sometimes made. Remarkable.

Be advised also that this is not lobbying in the strict sense, for one has to register to be considered a paid lobbyist. This is the exercise of your time-honored right to bring your concerns to your federal representative’s attention. I’ve visited over 60 countries in my day and this ability to seek redress through visitation to a government official is a singularly unique and precious guarantee – it should not be taken likely nor taken for granted.

Many brave men and women have died to give you that opportunity, and you make light of their profound sacrifice should you refuse to take the initiative on your own behalf.

The bottom line remains that the vector control community is continually challenged by legislative and regulatory forces responding to both internal and external pressures. We must ALL be prepared to contribute to the defense of our profession and the populace we protect. Sadly, we cannot take for granted that the manifest benefits that we provide in terms of quality of life and prevention of mosquito-borne disease are fully appreciated by activist groups that consider the demonstrable illness and death to be expected in our absence as acceptable collateral damage in their war against “toxic chemicals.” Believe me, these groups are making what amounts to those arguments on a daily basis to politicians, the media – and a scientifically naïve community that could vote you out of existence if persuaded.

Please consider attending future Washington Conferences. AMCA will make it a rewarding and worthwhile experience as you more fully engage in our participatory democracy. It may sound corny, but I come to more fully appreciate our system of government each time I attend – for I have had my say – something denied to so many around the world. Whether the outcome is what I may have wanted or not, I’ve at least had the opportunity to state our case.

Don’t let activists make the sole case that legislators hear.

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