

Drones and the Future of Mosquito Control

By Matthew Dupont
Brunswick County



Someone once said, “Drones are a good tool to go after high valued targets.” In this case, those “high valued targets” are mosquito larvae. Drones merge the abilities between the physical and the digital. They are versatile, fascinating tools. The tasks they can accomplish vary from the mundane (aerial photography) to the spectacular (treating an area with chemical).

Brunswick County began utilizing unmanned aircraft systems, or drones, into their mosquito control program a few years ago for surveillance purposes. The drone gave technicians access to view hard to reach areas to survey for larval habitation. So, when the opportunity arose for us to purchase

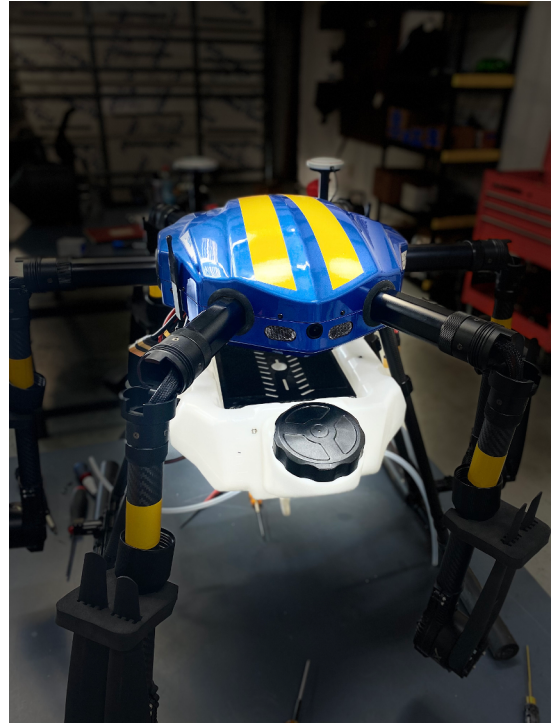
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a system that would be able to treat habitats with larvicide, the opportunity could not be passed up.

Purchasing the proper system for the job was not an easy task. The team at Leading Edge helped during the entire process, showing us different options for treating areas, helping us determine which drone would be suitable for the habitats we treat, and where and how to obtain the necessary and required licensing and permits to legally fly the drone and apply product.

Leading Edge presented three different options of drones to us based on payload, or the amount of weight of product that the drone could carry, while remaining under 55 lbs. In accordance with FAA regulations, the drone must remain under 55 lbs. to be able to fly under certain classification. We chose to implement the PrecisionVision 22 into our program, with the max payload at 22 lbs. The system was set up for liquid larvicide and granular larvicide treatment, utilizing spray nozzles and a modified granular hopper for respective treatment.



With the purchase of the drone came the necessity of obtaining the proper licensing for

applying larvicide. The drone pilot, (myself), had to apply for a pesticide license for aerial application. An apprenticeship under a licensed pilot was also needed. Finally, the drone system needed to be flown under the FAA Part 107 certification. However, since Brunswick County is a government entity, the FAA permitted us to fly under an exemption, with required documentation from our department, as well as our county lawyers and legal team, stating our intents and purposes of using the drone in mosquito habitat larvicide efforts. What seemed like months to gain access to fly became a mere few weeks for permission to be granted.

Once all the proper paperwork was obtained, the drone was properly calibrated for the products we chose to use. Test runs were performed, and the drone was set to our program's specifications and needs. Trials for certain products are still being performed and data may be provided in the future.

We believe that the implementation of unmanned aircraft systems, in our program and in future programs in mosquito control, will not only benefit larvicide and adulticide efforts, but also increase the longevity of mosquito control technicians.



Legislative Update

**By Meredith Spence Beaulieu,
NCMVCA Legislative Chair**

It's been a busy few months on the legislative front! First and foremost, lawmakers have been working to pass a federal budget. Throughout this process, the NCMVCA has been working hard alongside the American Mosquito Control Association (AMCA) and other state and local organizations to ensure that the needs of vector control entities are considered. A primary push has been asking for the Strengthening Mosquito Abatement for Safety and Health (SMASH) Act to be fully funded. The SMASH Act, which was authorized and passed into law in 2019, would provide state, local, tribal, and territories resources for comprehensive mosquito control and abatement programs grounded in integrated mosquito management if funded. Fully funding the SMASH Act would require an additional \$100 million to be appropriated to the Centers for Disease Control and Prevention (CDC) specifically for these provisions. The NCMVCA signed on to the AMCA's Appropriations funding request, contacted each NC Representative and Senator with this request, and recently reached out to again emphasize this key public health priority as both the House and Senate budgets move into the markup phase.

We also signed onto three legislative/appropriations priority letters led by the Vector-Borne Disease Network (<https://www.entsoc.org/sci-pol/VBD-Network>):

- A request for the Subcommittee on Labor, Health and Human Services, Education, and Related Agencies to provide adequate funding to the CDC in their appropriations bill. The letter specifically mentioned the SMASH Act, the Kay Hagan Tick Act (which would reauthorize funding for the Centers of Excellence and authorize grant funding to states and communities), and data modernization as particular public health priorities necessitating funds.
- A request for the Committee on Appropriations to provide adequate funding to the CDC (again, specifically for the items listed above).
- A request to the CDC to fund the Vectorborne Disease Surveillance System (VectorSurv), which provides standardized spatial tools and calculators that allow public health agencies to assess trends, map risk patterns, and evaluate interventions in real-time.

On the regulatory side, the US Environmental Protection Agency (EPA) recently sought public comment on the US Fish and Wildlife Service's draft biological opinion on malathion, which found that 78 species and 23 critical habitats could be adversely affected by its use. The AMCA submitted a comment to the EPA in response to this call.

There was also a recent Request for Information for "Developing the National Public Health Strategy for Prevention and Control of Vector-Borne Diseases in Humans"

(<https://www.federalregister.gov/documents/2021/04/27/2021-08167/request-for-information-rfi-developing-the-national-public-health-strategy-for-the-prevention-and>), where relevant entities were asked to share input on recommended priorities for addressing vector-borne diseases in the US, and strategies, research, and programmatic efforts that would help meet these needs. The AMCA solicited feedback from its membership on these issues and submitted a comment summarizing the response themes. The Entomological Society of America, which is the lead organizer of the Vector-Borne Disease Network, also submitted a comment to this request for information.

Finally, I represented North Carolina at the AMCA's annual Washington Conference in May. The two legislative priorities emphasized during the visits were funding for the SMASH Act (https://www.mosquito.org/resource/resmgr/docs/meetings_events/washington_conference/2021/FINAL_SMASH_Act_position_pap.pdf), and considerations related to the Endangered Species Act and its potential impacts on mosquito control operations (https://www.mosquito.org/resource/resmgr/docs/meetings_events/washington_conference/2021/FINAL_ESA_position_paper.pdf). I virtually visited with the offices of Rep. Adams (NC-12), Rep. Butterfield (NC-1), Rep. Hudson (NC-8), Rep. Murphy (NC-3), Rep. Price (NC-4), Rep. Ross (NC-2), Rep. Rouzer (NC-7), Sen. Burr, and Sen. Tillis to share the importance of these measures for the control of mosquitoes and mosquito-borne diseases in NC.

We'll continue to monitor these and other legislative and regulatory issues affecting vector control in North Carolina and advocating on your behalf. As always, please feel free to reach out to me with any questions, concerns, or interest in getting more involved with legislative affairs at meredithspence@gmail.com.

“Rockin’ in the free world” – *Aedes atropalpus* “holds on”

By Brian Byrd, PhD, MSPH
Western Carolina University

With apologies to Niel Young, Tom Waites, Wilson Philips, and others (but not Justin Bieber), this article shares some of our rock pool mosquito work we’ve finished over the last few years. The good news is that *Aedes atropalpus* has “held on” and is still abundant in some rock pools, but the bad news is that the invasive species *Aedes japonicus* is also abundant in some pools. They both appear to be rockin’ freely, sometimes in similar environs.

Rock pools are “permanent” containers that come in all shapes and sizes (**Figure 1**) that are common in some riverine environments. *Aedes atropalpus*, commonly called the “American rock pool mosquito”, is an autogenous mosquito that doesn’t require a blood meal to lay her first batch of eggs. Thus, this species is not considered a mosquito of public health importance. Historically, this mosquito garnered very little attention from mosquito control professionals as it was not very abundant, rarely pestiferous, and not considered a disease vector. However, after the introduction of the invasive species *Aedes japonicus*, a number of investigators reported a potential decline or displacement of *Aedes atropalpus*. If true, then we have a situation where a non-vector mosquito is being replaced by a vector species. *Aedes japonicus* is a known vector of La Crosse and West Nile viruses.

Figure 1. Rock Pools



A. Former WCU students Alan Goggins and Samantha Kunze collect mosquitoes and measure water quality parameters on the Chattooga River, Georgia, B. The author sampling rock pools on the West Fork of the Pigeon River (Haywood County, NC), C. Rock pools containing *Aedes atropalpus* on the French Broad River (Madison County, NC).

Over the years, our field observations (both professional (Figure 1 B) and recreational (Figure 1 C)) suggested that although both species could be found in rock pools, in some scenarios, the native species appeared more commonly in more exposed (sunny) pools. These pools are often warmer than the shaded pools sometimes found at the same general location or on different (e.g., headwaters) parts of the same river. Using field collected data from 2009-2015, we compared the presence and proportions of the two species in pools based on water surface temperatures in over 500 observations. The water temperatures strongly predict the presence of the species over a broad range (11 – 39.8°C) of observations. We observed that for every unit of increase in temperature (°C) the odds of collecting *Ae. atropalpus* larvae increased by 0.34 while the odds of collecting *Ae. japonicus* larvae decreased by 0.28. The study, [published in the *Journal of Vector Ecology*](#), suggests that despite the successful invasion by *Aedes japonicus*, the native species remains well established. Furthermore, the aquatic thermal conditions may play important, yet distinctly different, roles in both species' ecology.

The role of temperature on rock pool *Aedes* abundance appears to play out seasonally based on a study of rock pool phenology conducted by WCU's Corey Day. Corey sampled rock pools over the course of a year at two rapids on the same river (Chattooga River); one collection site was characterized by shaded pools near the headwaters (Bull Pen) and the other site commonly contained sunny open pools (Bull Sluice).

Save the Date!

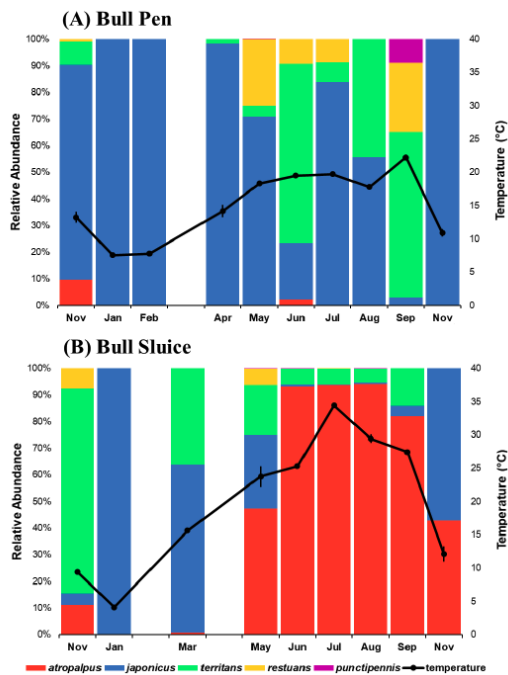
The NCMVCA will be having a virtual educational conference (free for current members) again this year: **November 9-10, 2021**.

More details will be forthcoming as the agenda is developed...we plan to apply for NC REHS and Pesticide Applicator CEUs.

Matt DuPont (NCMVCA Vice-President) is organizing the conference this year.

If anyone is interested in being a presenter, please contact Matt (matthew.dupont@brunswickcountync.gov) for more information.

Figure 2. Seasonal Abundance



Seasonal (~monthly) species composition and average rock pool temperature at time of sampling. A) Bull Pen rapid (Chattooga River, Jackson County, NC), B) Bull Sluice rapid (Chattooga River, Rabun County, GA)

Corey found that although *Aedes atropalpus* was rarely found at the higher elevation site (Bull Pen), it was highly abundant at the downstream site during the summer months (**Figure 2, Red Bars**). The invasive species was present at both sites year-round, but in much lower abundance during the summer at the site when *Ae. atropalpus* was highly abundant. Corey also observed the presence of early instar *Ae. japonicus* during the winter (overwintering larvae) and the likelihood of winter hatching of *Ae. japonicus* eggs. This study was recently [published in the *Journal of the American Mosquito Control Association*](#).

A number of studies have reported that temperature is recognized as an important component of the invasion biology of *Ae. japonicus*. However, the impacts of temperature on the population growth and fitness of *Ae. atropalpus* were essentially unclear. Corey conducted another study rearing *Ae. atropalpus* larvae at three temperature ranges reflecting ecologically important temperatures in natural rock pools: a low temperature range (mean: 19°C) where *Ae. japonicus* are commonly found and *Ae. atropalpus* is often rare, a middle temperature range (mean: 25°C) where both species are often naturally found in similar relative abundances, and a higher temperature range (mean: 31°C) where *Ae. atropalpus* is the more common species in nature. Corey measured survival, developmental time, wing length, and fecundity to calculate a finite population growth rate at each temperature. His results indicate that *Ae. atropalpus* population growth suffers in colder rock pools. This also informs, in some respects, the reported and perceived displacement of the species in temperate habitats. His work was recently [published in the *Journal of Medical Entomology*](#).

Taken together, the American Rock Pool Mosquito still has healthy natural populations in the Southern Appalachian region, including western NC and northeastern GA. However, the high abundance of the invasive species in these natural habitats is a concern as this species is a known vector of public health importance. Many of the rock pools that we've sampled are near

(or in) recreational areas frequented by outdoor enthusiasts including individuals fishing, hunting, kayaking, rafting, or hiking.

Rock pools are a fascinating natural system that are often full of many different organisms. We've determined that the dominant (by abundance) organisms in most of the rock pools in our region are indeed mosquitoes. It is likely that some rock pool mosquitoes have developed some oviposition and egg hatching traits that benefit them as they inhabit risky (flood-prone) habitats. In one additional study, we determined that even within the same species (*Ae. atropalpus*) egg laying behavior likely changes seasonally depending on diapause conditions. Non-diapausing eggs are more commonly laid on the surface of the water, while diapausing eggs are oviposited on rock surfaces at the water edge more commonly. In addition, we also investigated the role of vibrations on hatching rates as part of the oviposition study [published in the Journal of Vector Ecology](#).

Collectively, we now know a little more about these rock pool species. However, although we've been studying rock pools throughout the US for more than a decade (**Figure 3**), we still have more questions than answers.

Figure 3. Rock pools over the years.



A) the author's youngest son (Evan) collecting mosquitoes on the Pigeon River (2011), B) Author and Evan sampling from a rock pool in western Texas (2014), C) Graduate student Corey Day coaxing Evan to do some work on the Chattooga River (2019).

Have something to share in the next issue of Biting Times? Contact Kyle Godbey at Godbeynk@forsyth.cc

Please update your memberships prior to the 2021 virtual conference!



New Membership Application or Renewal Form

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In Memoriam

It is with great sadness that we announce the passing of two of our NCMVCA members, Joe Andrews and Keith Studt. Joe left us on June 19, and Keith passed on July 5th. Both of these long standing NCMVCA members had touched the hearts of many of us in both the private and public sector of the Vector Control industry. Please see the announcement below regarding Joe Andrews' virtual memorial service, and also please see the link for Keith Studt's announcement.

Resolutions from the NCMVCA for both of these individuals will be coming soon.

Please register in advance to attend the memorial service for Joe Andrews. To register, click this link, or paste it into your browser.

<https://abtech.zoom.us/meeting/register/tj0tdGrqj0oH91MI3aEm8RGWLAV69uCJMjT>

If you have any questions about registering, please contact Laurie Manley at Imanley2887@gmail.com

After registering, you will receive a confirmation email containing information about joining the Zoom session for the memorial service 7/31/21 at 1:00 pm.

Keith Studt Obituary

Biting Times, Summer 2021

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