

# AERIAL MOSQUITO LARVAL CONTROL – SPRING 2023

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## ABSTRACT

The Central Massachusetts Mosquito Control Project has the ability to utilize aerial applications of mosquito larvicide to reduce the number of early summer pestiferous adult mosquitoes. This program is a supplement to the ground-based larvicide program, and targets larger, inaccessible wetland bodies with *Bacillus thuringiensis israelensis* granules. Participating towns in the 2023 spring aerial larvicide application included Billerica, Boxborough, and Chelmsford. The application for all three towns took place over two days, April 19<sup>th</sup> and 20<sup>th</sup>. Pre- and post application larval surveillance showed a 92.88% overall reduction in the emergence of spring mosquito species at treated monitoring sites, while untreated areas displayed a population decline of 10.27%.

## OBJECTIVE

Each spring the mosquito species *Ochlerotatus abserratus* and *Ochlerotatus excrucians* develop in the temporary woodland pools of the CMMCP service area. Both of these species are quite pestiferous, but fortunately are univoltine, having only one generation per year. Any eggs laid by the adults of this species will not hatch until the following spring. Although they aren't usually associated with mosquito-borne disease, *Oc. abserratus* and *Oc. excrucians* have the potential to carry Jamestown Canyon virus (Andreadis 2005). In addition to *Oc. abserratus* and *Oc. excrucians*, the species *Ochlerotatus canadensis* may develop in these temporary pools, but unlike the other two species, *Oc. canadensis* can be multivoltine. This species may therefore have multiple generations, and can also harbor West Nile virus and Eastern Equine Encephalitis (Andreadis 2005). These

three aforementioned species are the predominant early season species and likely the main cause of mosquito control request calls during that time. Generally speaking, targeting mosquitoes while they are in the larval stage is more effective than later when they develop into adults, due to their contained nature. Adult mosquitoes are not restricted to their standing water larval habitats, and can travel great distances, resulting in a less efficacious control tactics compared to an aerial larvicide application. By utilizing aerial larvicide, a significant number of pestiferous and potential disease carrying *Oc. abserratus*, *Oc. excrucians*, and *Oc. canadensis* can be reduced.

## METHODS AND MATERIALS

As with previous spring aerial larvicide applications by CMMCP, *Bacillus thuringiensis israelensis* (Bti), under the product name of AquaBac 200G® (EPA Reg. No. 62637-3), was used to reduce

the number of mosquito larvae in target areas. Bti is a bacterium that naturally occurs in certain soils, and when applied to an application medium can be utilized as a larvicide. This particular formulation of Bti is certified organic and is the same one that is used in the ground larvicide program of CMMCP (CMMCP 2023). Control is achieved through this bacterium strain when a target specific toxin is created and ingested by the mosquito larvae. Normal digestion is disrupted within the larvae, and typically results in control within a 48-hour window (Extension Toxicology Network 1996). With the approach of pupation, feeding begins to slow for mosquito larvae in the 4<sup>th</sup> instar stage and is nonexistent once pupation occurs. Because of this factor the Bti product is most effective in the early to mid larval development. The application rate of AquaBac 200G® used for this aerial application was 5lbs/acre (2.5-10lbs/acre label range) (AquaBac 200G® label).

North Fork Helicopters (Cutchogue, New York) was again selected to perform the aerial application, with CMMCP staff assisting at the staging areas. Several factors were involved in the selection of aerial targets. These included historical mosquito activity, proximity to human activity, pre-application surveillance, and size. Aerial targets tend to be at least 5 acres, and difficult to treat by field technicians on the ground. These wetland bodies are categorized through DEP as wooded swamp, deciduous, conifer, mixed, shallow marsh, or shrub swamp (MassGIS 2017). Other wetlands in the area not meeting these classifications are investigated and treated by CMMCP field technicians if warranted through

ground larviciding. The Billerica and Boxborough portions of the application took place on April 19<sup>th</sup>, with the Chelmsford areas being treated April 20<sup>th</sup>. Warren Farm in Chelmsford was used as a helicopter staging area for Billerica and Chelmsford. Minute Man Airfield (Stow, MA) was used as a staging area for the Boxborough application. In 2023 approximately 500, 600, and 470 acres were designated for treatment in Billerica, Boxborough, and Chelmsford respectively. As per 333CMR 13.04 (7) a legal notification of the aerial larvicide was placed in The Boston Globe on February 9<sup>th</sup>, 2023, and also posted on the CMMCP website (<http://www.cmmcp.org/>) (Appendix A).

The Generic Environmental Impact Report (GEIR) establishes a standard for monitoring aerial applications in Massachusetts (Massachusetts Department of Agricultural Resources 2009). This protocol involves recoverable dip stations (RDS) where each town involved must contain at least one treatment RDS for every 250 acres treated. For a control comparison, an additional RDS outside the application areas must be established for each town. The relative level of control achieved by the aerial intervention can then be determined by comparing the larval amounts observed prior to the application to afterwards. At target wetlands selected to become RDS, ten positions are marked and larval surveillance occurs at each, prior to and following the aerial application. This also occurs at the untreated site designated to be the control RDS for each town. Documented observations include the number of mosquito larvae and instar stage, as well as presence or absence of Bti granules following the

application. Any larvae sampled during the pre-application surveillance are immediately returned once the data has been collected. This action is to ensure the post-application results are not impacted by the sampling itself.

## RESULTS

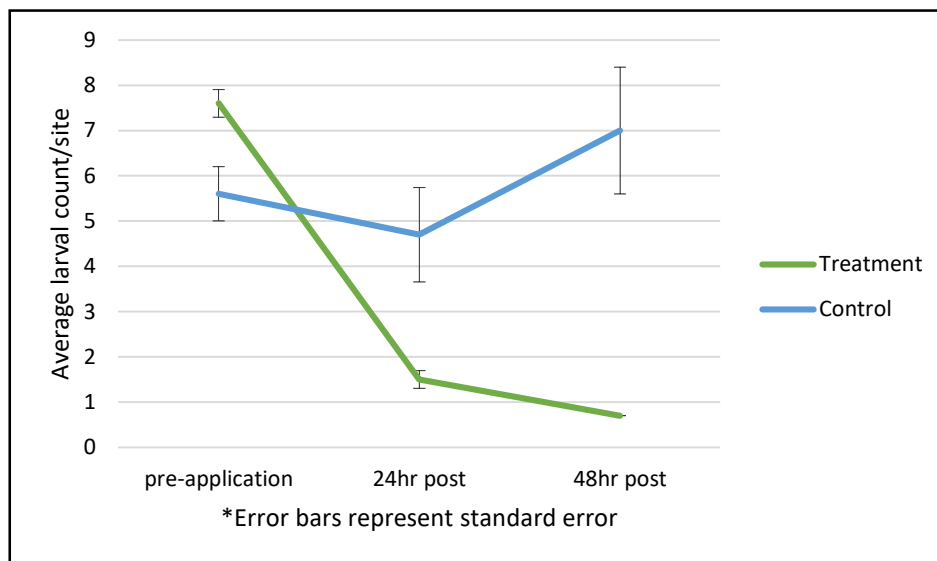
The Billerica, Boxborough, and Chelmsford treatment RDS indicate that the 2023 spring aerial larvicide had an

overall observed larval reduction of 92.88% from pre-application levels. Individually, the Billerica treatment RDS exhibited a 92.22% decrease, the Boxborough treatment RDS a 78.87% decrease, and the Chelmsford treatment RDS showed a 99.33% decrease. There was an overall decrease of 10.27% from pretreatment levels for the three untreated (control) RDS (Table 1; Figures 1-4).

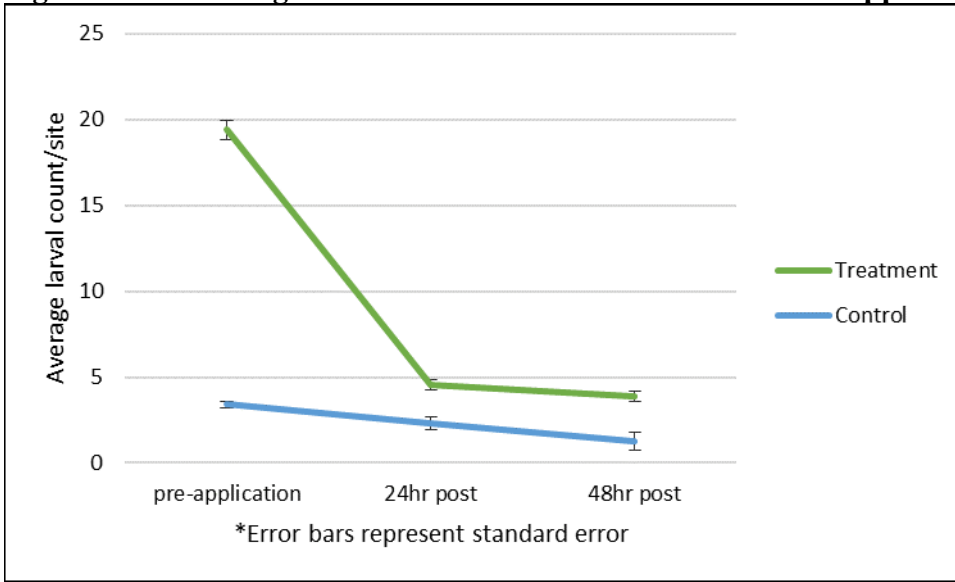
**Table 1: Larval Surveillance of Treatment and Control RDS**

Treatment Sites	Pre-application	Post-application	Observed Change
BIL (T1)	31	0	-100.00%
BIL (T2)	45	7	-84.44%
BOX (T3)	36	9	-75.00%
BOX (T4)	74	24	-67.57%
BOX (T5)	84	5	-94.05%
CHM (T6)	225	3	-98.67%
CHM (T7)	179	0	-100.00%
<b>Overall:</b>	<b>674</b>	<b>48</b>	<b>-92.88%</b>
Control Sites	Pre-application	Post-application	Observed Change
BIL (C1)	56	70	25.00%
BOX (C2)	34	13	-61.76%
CHM (C3)	280	249	-11.07%
<b>Overall:</b>	<b>370</b>	<b>332</b>	<b>-10.27%</b>

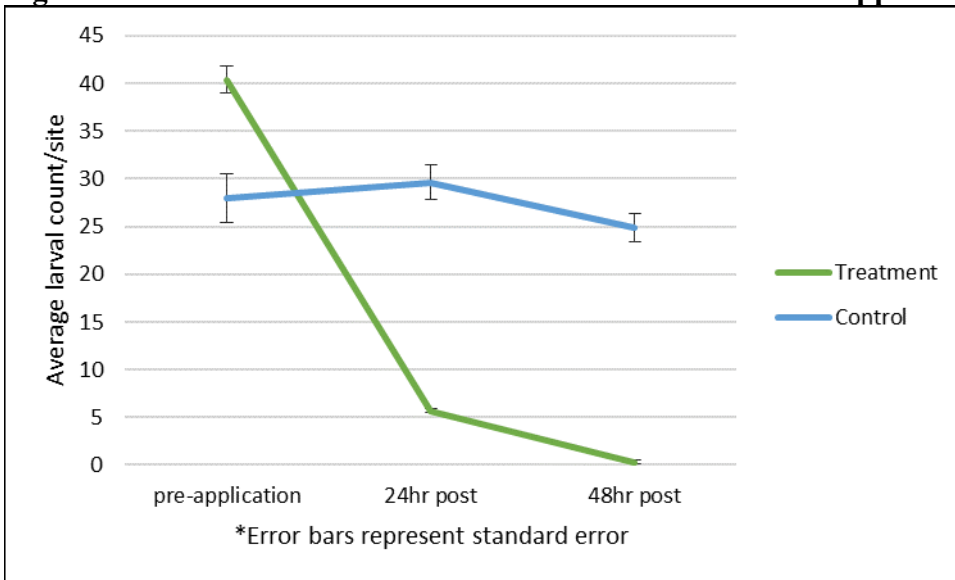
**Figure 1: Billerica Treatment RDS Results Pre- and Post Application**



**Figure 2: Boxborough Treatment RDS Results Pre- and Post Application**



**Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application**



### DISCUSSION

Larval inspections prior to the application indicated suitable levels of mosquito development for the intervention. The application for Billerica and Boxborough was planned for and conducted on April 19<sup>th</sup>, with Chelmsford completed the following day. Through post-application surveillance, it was shown that the

treatment events resulted in a high level of control with an 92.88% overall reduction in target mosquito species. The untreated control sites had a 10.27% decrease observed in mosquito larvae during the same time period. In past aerial larvicide operations, the untreated control sites often exhibit a minor increase in mosquito larvae, but a decrease is not unheard of as adult emergence can occur. Rainfall

following the initial observations can also expand the larvae habitat and weaken the concentration of larvae.

Field technicians noted observations of Bti granules at the majority of RDS in Billerica, Boxborough, and Chelmsford. The individual surveillance flags without visible larvicide product had less larvae reduction, but those did not significantly impact the overall level of control achieved. This spring aerial larvicide application has demonstrated significant control of *Oc. abserratus*, *Oc. excrucians*, and *Oc. canadensis* mosquito larvae populations. As these species are the majority of early summer pestiferous mosquitoes, their reduction from this aerial larvicide intervention will in turn decrease the number of requests for adult mosquito control from local residents. The reduction of these species is also important due to their potential involvement in the transmission of mosquito-borne disease. This program will be further reviewed to ensure success in future seasons.

#### ACKNOWLEDGEMENTS

The authors would like to acknowledge the towns of Billerica, Boxborough, and Chelmsford for participating in this program; North Fork Helicopters for conducting the aerial application; Clarke Mosquito Control Products for supplying the Aquabac 200G®; Minute Man Airfield, Stow and Warren Farm, Chelmsford for providing loading zones; the CMMCP Commission, and the CMMCP staff for larval monitoring, larval identification, site selection, map development and assisting with the helicopter application.

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## APPENDIX A

### Legal Notice - Aerial Application to Control Mosquito Larvae

Per 333CMR 13.04(7)(a), the Central Mass. Mosquito Control Project (CMMCP), North Fork Helicopters and/or other contractors will be conducting aerial applications to control mosquito larvae over selected large wetlands in Worcester and Middlesex counties. The applications will be conducted during the daylight hours from March 1 to October 31, 2023 as conditions warrant. The trade name(s) of the product(s) to be used are Aquabac 200G EPA Reg. #62637-3; Vectobac G EPA Reg. #73049-10; FourStar Bti CRG, EPA Reg. #85685-4; Natular G EPA Reg. #8329-80; Natular G30 EPA Reg. #8329-83. For additional information please contact Tim Deschamps at (508) 393-3055.