

Mosquito Control in the Wolverine State

by Carl W Doud, Bill W Stanuszek and Charles E Dinsmore

Mosquito abatement districts are relatively common throughout the US coastal region, but rather sparse in the north central states. Yet, geography, topography and climate combine to create pockets in this region where both nuisance and disease risk have motivated residents to support comprehensive mosquito control (MC) operations. One such area occurs in eastern central Michigan, where a tightly knit community of mosquito control districts with common roots operates.

Four neighboring counties in the Saginaw Valley region of Michigan have dedicated MC districts: Bay, Midland, Saginaw and Tuscola; see Figure 1. Saginaw Valley is the state's largest drainage basin, formed largely from the action of ice lobes advancing and retreating during glacial periods. This flat, low-lying watershed offers many ideal mosquito habitats.

The history of mosquito-borne disease in Michigan is noteworthy. Prior to 1880, Michigan was known as the "home of malaria," accounting for an estimated 50 to 75% of illness reported in the state (Kleinschmidt 1941). During the 1940s and 1950s, malaria was brought under control and eventually eradicated. Since that time, however, mosquito-borne encephalitis viruses (encephalitides) have posed the greatest arthropod-borne risk to residents: St Louis Encephalitis (SLE), Eastern Equine Encephalitis (EEE), LaCrosse Encephalitis (LAC) and since 2002, West Nile virus (WNV).

The greatest recorded outbreak of SLE in the United States occurred in 1975 and played a significant role in the establishment of MC districts in Michigan. Chicago was a major outbreak epicenter and shockwaves were felt in neighboring Michigan.

Following the outbreak, local government officials and the public in the Saginaw Valley recognized the need for dedicated, comprehensive MC programs. A survey of the region by Michigan State University concluded that the nuisance and disease risk warranted such a capability. The issue of a millage-funded tri-county mosquito control district was brought before voters of Saginaw, Bay and Midland counties in 1976; see Figure 2. The measure passed in Saginaw and Bay

counties, but failed in Midland. The failure to approve in Midland County was largely due to an existing MC program in the City of Midland. Under the direction of Dr Vaughn Wagner and an eight member staff, the Saginaw-Bay Mosquito Control Commission opened their doors on January 1, 1977; see Figure 3. Saginaw-Bay MCC served the two counties until separate districts were established for each in 1985, resulting in the Saginaw County Mosquito Abatement Commission

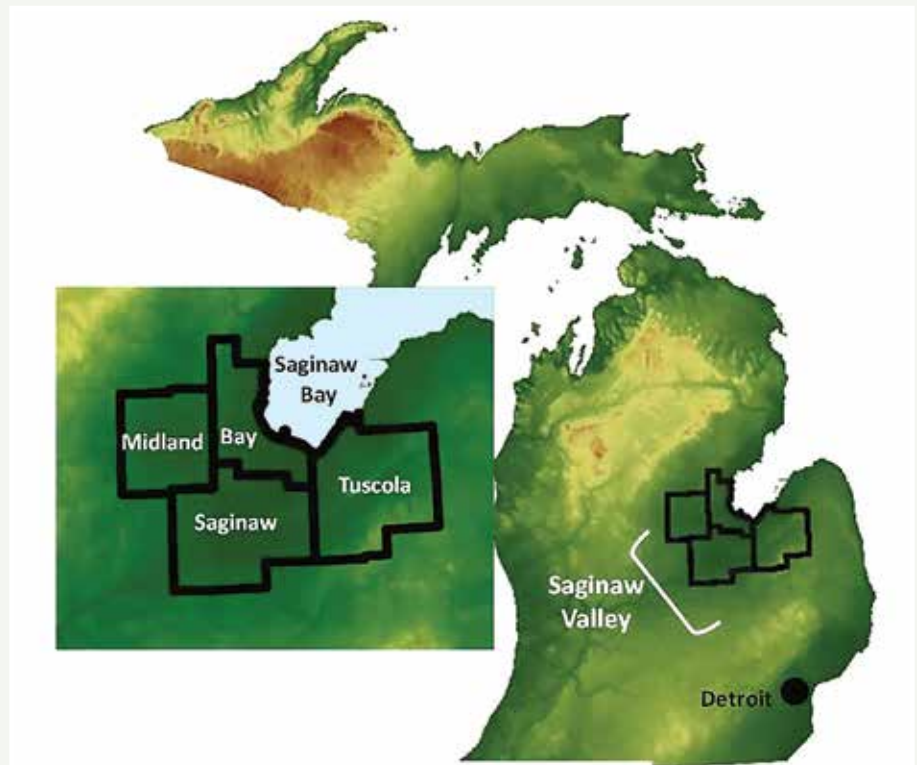


Figure 1: Topographical map of Michigan and Saginaw Valley area.



Figure 2: 1976 mosquito control election campaign bumper sticker.

(SCMAC) and Bay County Mosquito Control (BCMC).

By 1982, interest in county-wide MC service gained traction and that year voters in Midland County approved the establishment of Midland County Mosquito Control (MCMC). Tuscola County Mosquito Abatement (TCMA) was established in 1997, becoming the fourth Michigan county with a MC program. No other counties in the

state have programs, though a number of cities and townships contract MC services.

Characteristic of the northern latitudes, endemic mosquito species take full advantage of the shorter warm season and often emerge with great voracity. This requires MC operations to anticipate spring emergence and carefully time and plan control activities. Michigan mosquitoes are classified

into four major habitat groups; spring floodwater, summer floodwater, permanent water and container/tree hole species; see Table1.

Aedes stimulans, *Ae excrucians*, *Ae provocans* and *Ae canadensis* are common spring floodwater species in Michigan. Each goes through a single generation per year, hatching from eggs laid the previous year(s) in woodland leaf litter, submerged in pools formed from melting snow and rains the following spring; see Figures 4 & 5. Larvae emerge around March and because of the cool temperatures often do not develop to adults until mid-May. Females are long lived and will lay a number of broods of eggs in May-June, and by the end of June most of these mosquitoes have completed their annual cycle. Control of spring floodwater species takes a lot of effort by the Michigan MC organizations each year. An extensive aerial *Bti* larviciding program is carried out by the counties involving treatment of over 130,000 acres of woodlots. These



Figure 3: Ribbon cutting ceremony for the newly-established Saginaw-Bay Mosquito Control Commission, May 1977.



Figure 4: Dr Tom Wilmot, former Director of Midland County Mosquito Control, holds a jar containing larvae from icy woodland pools.



Figure 5: Surveillance for spring floodwater mosquito larvae often begins while snow remains on the ground.

Habitat	Species	Diseases vectored
Spring floodwater	<i>Aedes canadensis</i>	WNV, EEE, DHW
	<i>Ae communis</i>	
	<i>Ae excrucians</i>	DHW
	<i>Ae intrudens</i>	
	<i>Ae provocans</i>	WNV
	<i>Ae sticticus</i>	WNV, DHW
	<i>Ae stimulans</i>	WNV, DHW
Summer floodwater	<i>Ae cinereus</i>	WNV, DHW
	<i>Ae trivittatus</i>	WNV, DHW
	<i>Ae vexans</i>	WNV, DHW
	<i>Psorophora ciliata</i>	
	<i>Ps ferox</i>	DHW
Container/tree hole	<i>Ae triseriatus</i>	LAC, WNV, DHW
	<i>Ae japonicus</i>	WNV
Permanent & semi-permanent water	<i>Anopheles quadrimaculatus</i>	WNV, DHW
	<i>An punctipennis</i>	WNV, DHW
	<i>An walkeri</i>	WNV, DHW
	<i>Coquillettidia perturbans</i>	EEE, DHW
	<i>Culex pipiens</i>	WNV, SLE, DHW
	<i>Cx restuans</i>	WNV, SLE, DHW
	<i>Cx territans</i>	WNV, DHW
	<i>Uranotaenia sapphirina</i>	

DHW - Dog heartworm | EEE - Eastern Equine encephalitis
LAC - La Crosse encephalitis | SLE - St Louis encephalitis | WNV - West Nile virus

Table 1: Common mosquitoes of the Saginaw Valley region in Michigan.

One interesting species that occurs in the area is *Ae sollicitans*, the salt marsh mosquito. Though miles from coastal salt marshes, Saginaw Valley has a significant amount of salt brine. In fact, Dow Chemical, located in Midland County, was established in this region due to the abundance of salt brine used in chemical manufacturing. The brine was deposited from the shallow seas that covered the area during the Mississippian geologic era. A number of salt seeps, along with some brine mining and oil extraction operations, create limited bodies of saline water suitable for *Ae sollicitans* in the area.

Saginaw Valley is known for a number of natural wetland areas, which produce an abundance of permanent water mosquito species. The cattail mosquito, *Coquillettidia perturbans* and several *Anopheles* species are associated with these habitats. Furthermore, *Cq perturbans* is an important EEE vector and appears in tremendous numbers around July. The method of larval breathing – attaching underwater to aquatic vegetation – makes control particularly difficult with traditional larvicides. Therefore, adulticiding for *Cq perturbans* is often the only viable control method available.

are among the largest *Bti* aerial treatments in the country.

About the time the spring species wane, the summer floodwater species are on the increase. Examples include *Ae vexans*, *Ae trivittatus* and *Ae sticticus*. These mosquitoes go through multiple generations per year and are largely responsive to rainfall events throughout the summer. They are commonly found in flooded fields, roadside ditches, and woodland pools. Rain is carefully tracked and analyzed to guide surveillance and control activities. Efforts to treat the larval stage are a priority to prevent adult emergence. Nevertheless, the vast amount of suitable larval habitat makes complete control with larvicides impossible.



Figure 6: Engineered mosquito habitat elimination by SCMAC.



Figure 7: Margaret Breasbois instructs elementary students on mosquito life stages as part of SCMAC's public outreach program.

Since the introduction of WNV, surveillance and control of *Culex* species in environments such as storm drains and catch basins has become increasingly important. All districts have developed extensive mapping of catch basin locations and substantial resources are dedicated to their surveillance and treatment. Saginaw County has a fleet of 10 mopeds that are used to efficiently treat catch basins in the urban areas of Saginaw and neighboring towns.

Primary among container species are the endemic *Ae triseriatus* and recently introduced *Ae japonicus*. *Aedes japonicus* expanded to Michigan about eight years ago and is now firmly established. Though not a disease risk to the extent of *Ae albopictus*, *Ae japonicus* has been demonstrated to be a competent vector of WNV. Fortunately, the districts are beyond the present northern limit for *Ae albopictus*.

Each county's operations differ slightly due to issues such as budget, expertise and distribution of the rural and urban areas. All, however, emphasize larval control and truck-mounted ULV adulticiding. A unique position at Saginaw County is a source reduction project manager responsible for developing drainage projects that eliminate

mosquito larval habitats; see Figure 6. SCMAC also employs an education coordinator for public outreach and education programs focused on a variety of mosquito related topics; see Figure 7. Publications, presentations, and social media are extensively used to inform the public.

One of the challenges for MC in this area is the seasonality of the work, compared with the southern US. Because the mosquito season lasts just through the warm, and not so warm, months of the year, we must hire and quickly train the majority of our staff each spring. There are a few technicians that tend to return from previous seasons, but only being able to offer employment for six months of the year means that individuals often end up leaving after a season or two to find more consistent employment. As a result, each spring involves not only surveying and preparing for upcoming control operations, but we must also devote much effort to screening, hiring, training, certifying and equipping a full contingent of technicians. So if we are a bit slow responding to you in April – you now know why!

Despite the challenges and intense season each year, Michigan's mosquito control activities enjoy a large amount

of popular support. We often hear accounts of residents venturing into other regions of the state that do not enjoy the benefits of comprehensive mosquito control, and how thankful they are for our service. The public has continued to vote for over thirty years for ongoing millage requests, ensuring that the services are funded in the four counties. Each district will continue to focus on quality and responsive service, with the goal of providing expert mosquito control to those we are charged to serve.

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REFERENCE CITED

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