2011 Annual Report

Bay County Mosquito Control

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History of Organization

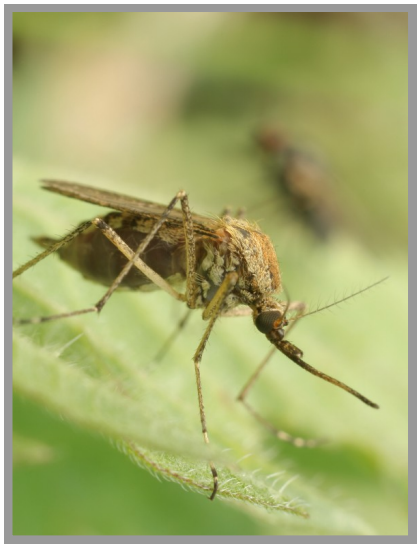
Bay County Mosquito Control began operations within the organizational structure of the Bay County Health Department and under the auspices of the Bay County Executive in January of 1985. The program began in 1977 as part of the bi-county district, Saginaw-Bay Mosquito Control Commission.

Mosquito "control" doesn't mean elimination, but involves IPM (Integrated Pest Management) methods designed to reduce the number of mosquitoes so they no longer unfavorably affect the health and quality of life of Bay County residents.

As one of the divisions of the Environmental Affairs and Community Development Department, we acknowledge the importance of serving the public by providing services without producing adverse impacts on the environment. The program consists of field operations, biological surveillance, disease surveillance, and education.

Bay County is one of four Michigan counties with formal, comprehensive mosquito control programs. A Technical Advisory Committee (TAC), composed of local and state professionals, reviews program operations each March.

Funding is received from a special millage for the control and abatement of mosquitoes and the diseases borne by mosquitoes. The current 0.45 mill tax levy was renewed on August 5, 2008 for an additional eight years in Bay County with an overwhelming approval rating of 84%. This millage rate has been in place since 1988.



NPDES

Throughout 2010 and 2011, mosquito control districts nationwide have been working with their regulators regarding National Pollutant Discharge Elimination System (NPDES) permits. Mosquito control pesticide applications in the past have been regulated by FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and were exempt from needing a NPDES permit. However, a 2009 court decision found that most biological and chemical pesticide applications to "waters of the State" were considered pollutants under the Clean Water Act (CWA). As a result, a NPDES permit (as of October 31, 2011) will now be required for these types of discharges. The 2012 control season will, no doubt, look different than seasons of the past due to our need to obtain the NPDES permit from the Michigan Department of Environmental Quality (MDEQ).

We will be required to submit a Notice of Intent, a Pesticide Discharge Management Plan, and additional reporting requirements, including an annual report, to the MDEQ. Many of the details have not been worked out, but we have seen that the state permit will be more stringent than the federally-issued permit, which could significantly impact our control operations.

We had a taste of the paperwork that will surely be involved when we were required in 2011 to get permission to apply larvicides to both sewage lagoons and certain catch basins throughout Bay County. A Water Treatment Additive (WTA) form had to be submitted by NPDES-permitted facilities to the DEQ for approval to treat their catch basins or sewage lagoons for mosquito larvae. Once the permittee obtained DEQ approval (a paperwork process initiated by Bay County Mosquito Control), staff could treat the habitats. This process was quite lengthy and led to a delay in initial treatment.

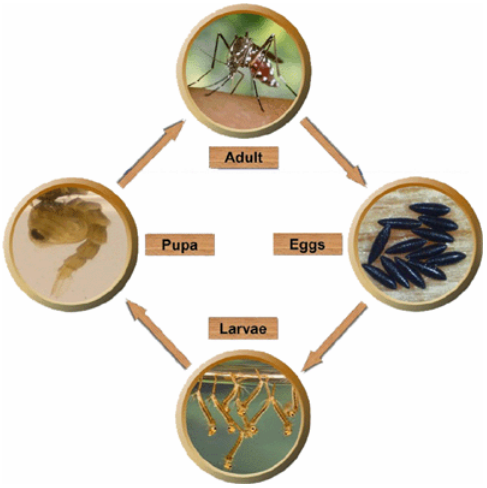
The intent of NPDES is positive, including promoting Integrated Pest Management, following appropriate procedures for pesticide use like calibration and maintenance of equipment, education, reducing discharges by using Best Management Practices, using the lowest amount of pesticide necessary to effectively control mosquitoes, promoting source reduction, conducting surveillance before control, etc. These are the same ideals held by Bay County Mosquito Control. These are all principles, though, that we have been executing for decades under FIFRA, so the new regulation seems duplicative.

Surely, changes are on the horizon for Bay County Mosquito Control and we hope that our goals and objectives will not be compromised due to increased legislation.

Mosquito Biology and Life Cycle

Mosquitoes are aquatic insects that undergo a complete metamorphosis involving four distinct stages—egg, larva, pupa, adult—throughout their life cycles. Female mosquitoes can develop several hundred eggs with each blood meal and lay them in or around water. The eggs are laid (where standing water accumulates after rain or flooding) either singly or attached to one another to form an egg raft that floats on the water's surface. Once eggs hatch, larvae emerge, wriggling through the water. The larvae are filter feeders that eat voraciously and outgrow their skin. Larvae undergo four stages or instars before they change into pupae, which happens about one week after the eggs initially hatch. Pupae do not feed and are often found at the surface of water (like larvae) where they can breathe. Inside the pupa's protective shell, the mosquito transforms into the winged adult. Eclosion is the emergence of the adult mosquito from the pupal case. These newly-emerged adults use the cast skin for support until their wings and body dry, at which time they fly away. The whole life cycle is typically a quick process, taking about a week to complete. The time required to complete the life cycle is dependent on temperature—the warmer the water, the more quickly a mosquito develops.

After mating, females seek out an animal upon which to feed and this blood provides protein to develop eggs. Males do not bite, but do have sucking mouthparts to obtain plant nectar as a source of energy; females do this as well. Next, females search for an aquatic habitat or moist ground to deposit eggs. Although there are exceptions to the rule, most adult mosquitoes live for a period of four to eight weeks.



Spring Larval Surveillance

As a result of spring flooding due to rainfall or snowmelt, the potential exists each year for significant spring mosquito larval development in the woodland areas of Bay County. Spring aerial treatment utilizing one helicopter and two fixed wing aircraft is conducted when larvae reach the second or third instar growth stage. Monitoring larval development is critical in order to have a timely application of *Bti* (*Bacillus thuringiensis israelensis*), a bacterium eaten by larvae that causes mortality within 48 hours. The *Bti* may be used as a food source by other aquatic organisms that occupy the same woodland pool habitats.

Surveillance is an essential part of the spring mosquito control program. Mosquito larval surveillance begins in late March. This year first instars were observed in woodland pools on March 24. Woodlots were wet at the onset—basically an average year. Rainfall in March totaled 2.51", which is less than one-tenth of an inch above the historical average while April saw 5.96" of precipitation, mostly in the form of rain (3.14" above average). From April 3-4, 1.55" of rain fell, with an additional 4.18" falling from April 18-30. During this period, rainfall was recorded every day except for three and these continuous rains flooded new areas and triggered a new hatch of larvae, many of which were *Aedes vexans*, a summer species. Pools formed in many woodlots and monitoring indicated low-to-medium density (1-10 larvae per dip) in most sites. Pre-treatment larval counts were taken between one and four days before treatment in 37 woodlots and post counts followed within five days of treatment.

Aerial calibration took place on April 18th with treatment beginning immediately and lasting eight days until April 25th. The entire spring program took place later than usual, as 2011 had an unprecedented cold spring with larvae developing slowly. Aircraft were calibrated to deliver approximately 5 pounds of *Bti* per acre for most of the application. On April 14, however, both airplanes were recalibrated to 4 pounds per acre to treat Mt. Forest and Gibson townships, which allowed us to expand treatment acreage.

Quality control of the spring aerial campaign was accomplished with the help of a full-time supervisor and four certified technicians. Staff walked through 101 treated woodlots over the course of the campaign in order to determine both the average number of *Bti* granules per square foot, which helped confirm the dosage rate, and locate possible skips or misses occurring with the aerial application. The number of granules per square foot averaged 4.68 for all woodlots checked.

Post counts indicated an overall average 99.5% larval mortality (Table 1). Most woodlots had excellent *Bti* coverage and, as usual, where there was *Bti*, there were either no mosquito larvae found or only dead larvae floating throughout the water column. Frogs, tadpoles, seed shrimp, fairy shrimp, water fleas, copepods, and caddisflies that were observed in the woodland water habitats before treatment were found in large numbers after treatment, as well.

Adult emergence of spring *Aedes* and *Aedes vexans* mosquitoes from seasonally flooded woodlots took place from approximately May 8-20.

Mt. Forest Township woodlot. The black tub was placed to collect *Bti* granules in order to check the dosage rate.

Table 1

Bay County Mosquito Control Spring Treatment 2011 - Bti Evaluation				
		Larval Count		
Location	**Applicator**	**Pre**	**Post**	**Mortality**
Bangor 4 - Bangor Oil Well	Helicopter	1.7	0	100%
Bangor 31 - St. Maria Goretti Church	Helicopter	0.65	0	100%
Bangor 33 - Bangor and Zimmer	Helicopter	1.96	0.14	92.9%
Beaver 4 - 1576 Cottage Grove	Fixed Wing	3.64	0	100%
Beaver 5 - Carter and Cottage Grove	Fixed Wing	1.88	0	100%
Beaver 9 - 1585 Cottage Grove	Fixed Wing	1.74	0	100%
Frankenlust 2 - Four Mile and Delta	Helicopter	5.44	0	100%
Frankenlust 3 - Delta by Automotive Bldg.	Helicopter	13.82	0	100%
Frankenlust 7 - 259 Amelith Road	Helicopter	4.44	0	100%
Fraser 6 - Townline 16 by 7 Mile Rd.	Fixed Wing	0.8	0	100%
Fraser 11 - Camp Fishtales	Fixed Wing	0.57	0	100%
Fraser 15 - Fraser Twp. Firebarn	Fixed Wing	7.83	0	100%
Fraser 22 - Fraser Twp. Hall	Fixed Wing	0.7	0	100%
Garfield 9 - 11 Mile N. of Erickson	Fixed Wing	1.18	0	100%
Garfield 10 - Garfield Twp. Park	Fixed Wing	2.32	0.02	99.1%
Garfield 15 - Methodist Church	Fixed Wing	0.7	0	100%
Garfield 26 - Crump Fox Club	Fixed Wing	1.22	0.04	96.7%
Kawkawlin 2 - 2080 LeBourdais Rd.	Fixed Wing	3.85	0	100%
Kawkawlin 30 - Bay City Bowmen's	Fixed Wing	0.82	0	100%
Kawkawlin 30 - White Birch Village	Fixed Wing	1.6	0	100%
Monitor 9 - 1306 Wheeler	Helicopter	4.26	0	100%
Monitor 20 - Fraser and N. Union	Helicopter	4.67	0	100%
Monitor 23 - Rocking Horse Ranch	Helicopter	1.58	0	100%
Monitor 28 - Mackinaw Road Tech Park	Helicopter	0.93	0	100%
Monitor 34 - Fremont Cemetery	Helicopter	0.7	0	100%
Mt. Forest 17 - Carter north of Cody-Estey	Fixed Wing	1.36	0	100%
Mt. Forest 21 - Mt. Forest School	Fixed Wing	1.02	0	100%
Mt. Forest 21 - Mt. Forest Firebarn	Fixed Wing	1.12	0	100%
Pinconning 19 - Pinconning County Park	Fixed Wing	1.12	0	100%
Pinconning 23 - K C Hall Water Street	Fixed Wing	0.78	0	100%
Williams 16 - Carter and N. Union	Fixed Wing	2.04	0	100%
Williams 19 - Victoria Woods Trailer Park	Fixed Wing	3.28	0.14	95.7%
Williams 20 - Forest School/Daycare	Fixed Wing	3.1	0	100%
Williams 21 - Forest Edge	Fixed Wing	3.42	0.04	98.8%
Williams 30 - Rockwell and Salzburg	Fixed Wing	6.89	0	100.0%
Frankenlust 3 - Delta Mackinaw Road	**Control**	1.5	1.66	0.0%
Mt. Forest 30 - Pinconning and County Line	**Control**	1.6	1.98	0.0%
Mt. Forest 30 - Pinconning and County Line	**Control**	1.6	1.38	13.8%
AVERAGE TREATED MORTALITY				**99.5%**
AVERAGE TREATED MORTALITY (Corrected)				**95.4%**

Summer Larval Surveillance

Surveillance is the key component of an Integrated Pest Management (IPM) program and there are two main types — larval and adult — both of which are done to monitor mosquitoes county-wide to determine distribution, density, and species composition. Surveillance is a combined effort conducted by larviciding crews, field supervisors, and biology personnel.

Staff conducted routine surveillance of probable mosquito breeding sites using a standard pint-sized dipper. Stagnant water sites included ditches, catch basins, flooded fields, woodlots, and tires. Roadside ditch larval site inspections, termed sequential sampling, occurred weekly throughout the county with larval samples collected and identified to determine the need for control. Three hundred one larval samples representing thirteen species were identified; the majority were *Aedes vexans* followed by *Culex restuans* and *Culex pipiens*. Eleven larval samples were identified as *Aedes japonicus,* the newest mosquito species to Bay County, which was found breeding in tires, containers, ornamental ponds, and tree holes. The 2011 season brought the first larval *Psorophora ciliata*, which was found breeding along the Saginaw Bay beach-front within a flooded cattail area in Hampton Township.

To assess the activity of *Culex* mosquitoes in city and suburban catch basins, biology staff randomly inspected 40-50 basins on five occasions. The basins are a perfect habitat, providing *Culex* mosquitoes with organically-rich standing water and decomposing leaf litter, which provides a bacterial food source. *Cx. restuans* larvae were found by June 17, which prompted the initial treatment using VectoLex CG and Natular XRT. In order to determine efficacy and longevity of the control materials, basins were inspected every three weeks. VectoLex provided control through four weeks-post-treatment, while Natular-treated basins were hand-treated once this season.

Quality control continued to be an essential function for biology technicians. Habitats that were recently treated were re-checked to ensure control materials were properly applied and effective. Quality control efforts began with surveys of woodlots in April to assure proper treatment. Container, roadside ditch, floodplain, and catch basin surveys continued as the summer wore on.

Aedes japonicus is a container-breeding mosquito species native to Asian countries. It was first discovered in Bay County in 2005 in its adult form, but began to crop up in larval samples in 2006. The following two figures show how this invasive species has begun to occupy several habitats including artificial containers (Figure 1) and tires (Figure 2) through the years. Technicians also sampled *Ae. japonicus* larvae to a lesser extent in ornamental ponds, cross country drains, tree holes, roadside ditches, and ponds.

Figure 1

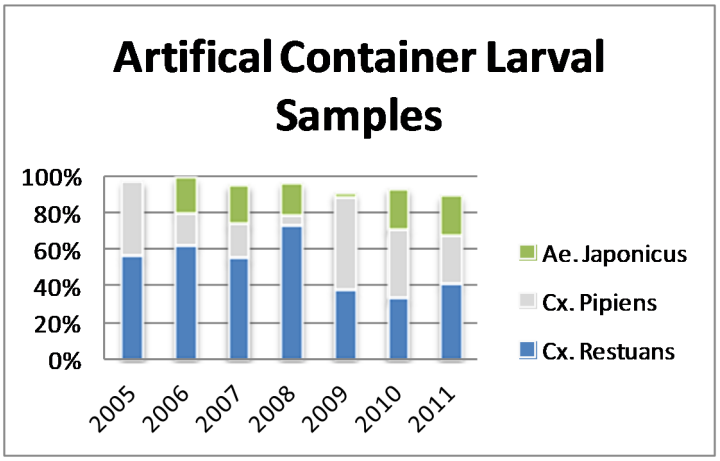
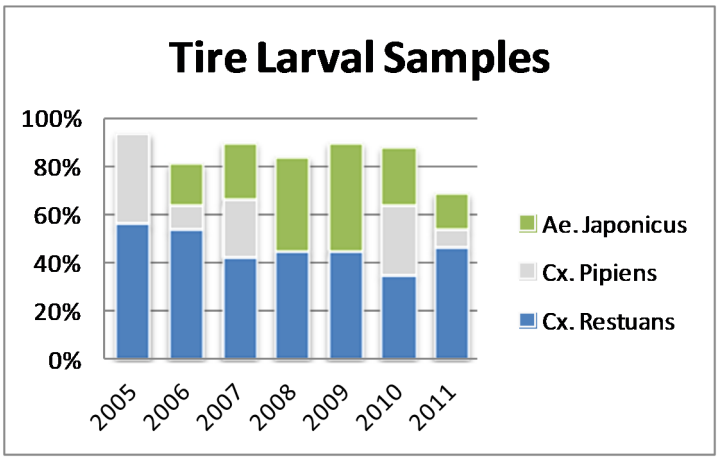


Figure 2



New Jersey Light Traps

As in previous years, Bay County Mosquito Control completed regular mosquito trapping throughout the season. Trapping data is critical to the mosquito management program as it helps recognize mosquito numbers, species, and whether or not any of the mosquitoes are a disease threat. One of the main tools used in adult surveillance is the New Jersey Light Trap. Beginning in mid-May and continuing through mid-September, adult mosquitoes were collected in 15 traps placed throughout the county. The traps were placed in backyards where there was little or no competing light source. Samples were gathered three times each week, followed by counting and species identification. The total capture was 15,400 (Table 2), slightly below (6%) the 2010 season and slightly higher than the historical average of 15,025.

Table 2

Species	May	Jun	Jul	Aug	Sep	TOTAL
Ae. vexans	263	2488	2933	1773	206	7663
Ae. intrudens	0	3	5	2	1	11
Ae. implicatus	6	13	1	0	0	20
Ae. stim/fitchii	6	52	10	0	0	68
Ae. canadensis	0	6	2	3	0	11
Ae. triseriatus	0	13	2	1	2	18
Ae. trivittatus	2	14	4	22	0	42
Ae. sticticus	0	3	0	0	0	3
Ae. japonicus	0	2	5	1	2	10
An. punctipennis	1	108	370	42	2	523
An. quadrimaculatus	2	599	1433	673	53	2760
An. walkeri	5	174	732	454	385	1750
An. perplexens	0	7	0	2	0	9
Cs. inornata	6	44	18	8	1	77
Cs. morsitans	0	2	2	1	1	6
Cq. perturbans	0	45	1142	126	0	1313
Cx. pipiens	0	73	179	300	26	578
Cx. restuans	23	133	36	14	3	209
Cx. territans	1	5	41	32	3	82
Ps.ciliata	0	2	0	11	0	13
Ps.ferox	0	0	0	2	0	2
Ur. sapphirina	0	0	7	20	6	33
Damaged	6	100	57	36	0	199
Male Mosquitoes	51	1770	1379	1493	94	4729
Total Females	321	3886	6979	3523	691	15400

Twenty-two species were collected during the 2011 season and the most predominant was *Aedes vexans*, representing 50% of the total. It is not unusual for *Ae. vexans* to rank first because it is the floodwater mosquito and hatches after heavy rains flood ditches, fields, and woodlots. The *Anopheles* species (*quadrimaculatus*, *walkeri*, *punctipennis*, and *perplexens*) represented 33% of the total catch, while the cattail marsh mosquito, *Coquillettidia perturbans* ranked third with 8.5%. *Cq. perturbans* came on a little later than usual, but its numbers were higher than the historical average of 7.6%. Finally, we watched, with great interest, our newest mosquito species, *Aedes japonicus,* whose numbers remained virtually unchanged since 2008 with ten captured. The average number of *japonicus* collected since 2005, the first year they were discovered, is 11. The number of larvae collected, however, indicates more adults must be present. We may not yet have found the best trapping mechanism for this particular species.

Figure 3 shows a historical perspective of light trap collections with the average number collected in a given year represented by the solid blue line. As you can see, the number collected in 2011 was slightly above average. Typically, total number of females corresponds with the amount of rainfall received and this year our heaviest rains came in April. May saw some measured rainfall every other day, while June had a 1.5" rain event over a four-day period from June 21-24. July was very hot and dry; August rains didn't lead to much flooding and that trend continued through mid-September.

Figure 4 (page 13) shows mosquito species collected per trap night throughout the summer. Summer floodwater *Aedes* peaked the week of June 7, July 5, and to a lesser extent on August 8. These peaks followed major rain events by 1-2 weeks. Figures 5 and 6 (page 14) show adult mosquito abundance trends for two of the most active species, *Ae. vexans* and *Cq. perturbans*.

Historical Light Trap Collections

Figure 3

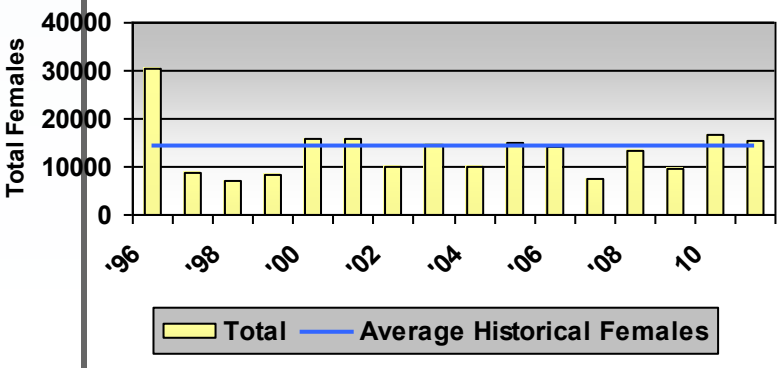
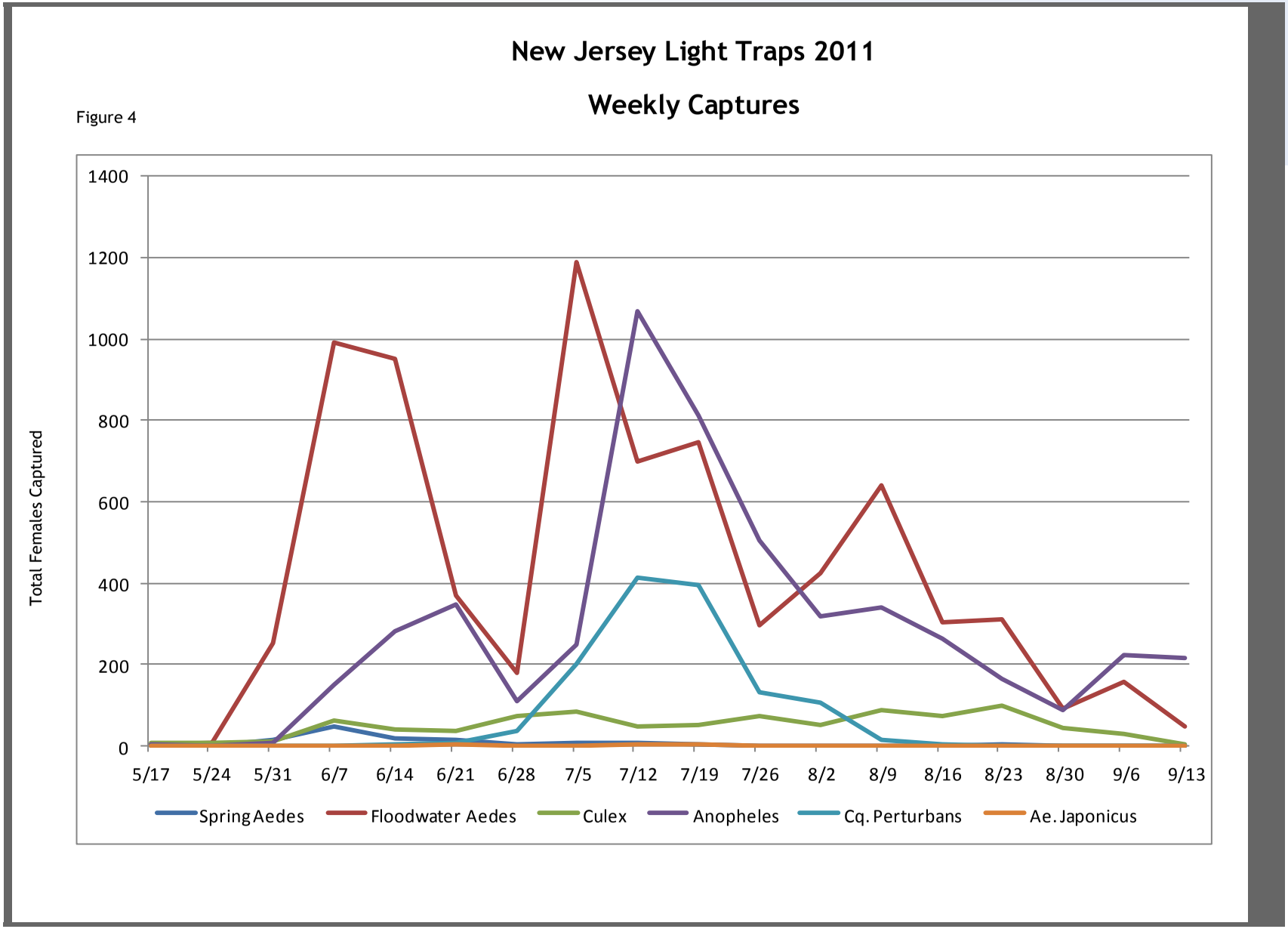


Figure 4


New Jersey Light Traps 2011
Weekly Captures
Total Females Captured
1400
1200
1000
800
600
400
200
0
5/17
5/24
5/31
6/7
6/14
6/21
6/28
7/5
7/12
7/19
7/26
8/2
8/9
8/16
8/23
8/30
9/6
9/13
Spring Aedes
Floodwater Aedes
Culex
Anopheles
Cq. Perturbans
Ae. Japonicus

New Jersey Light Traps 2011
Adult Mosquito Abundance Trends

Figure 5

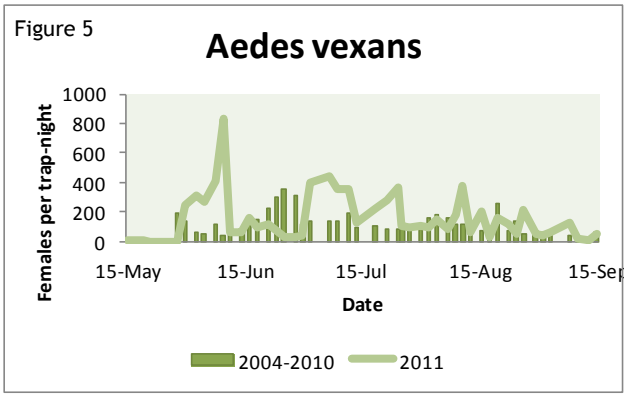
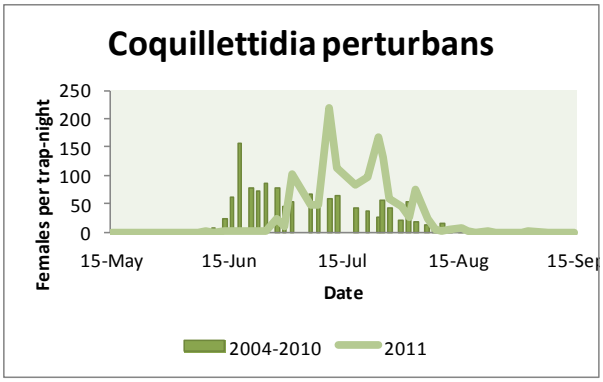


Figure 6



The species shown here, *Ae. vexans* and *Cq. perturbans*, are considered two of the most significant in Bay County. *Ae. vexans* is widespread throughout the county, while *Cq. perturbans* crops up regionally, especially along the Saginaw Bay and even inland where cattail marshes abound.

Ae. vexans larvae are found in temporary rain-filled pools or floodwater pools with several generations emerging each summer. Adults are bothersome daytime and evening biters and have a long flight range—over five miles. This year there was a major hatch in early June, mid-July, and again, in early August. The highest peak in Figure 5 (corresponding to early June) was brought about by heavy rains that fell in mid-to-late May.

During 2011, populations of *Cq. perturbans* were above-average for most of the summer (Figure 6). Twenty-five percent more females were collected in New Jersey Light Traps compared to the historical average. 2011 also saw more *Cq. perturbans* captured in CDC traps allowing for 1.5 times more individual females submitted for disease testing (*Cq. perturbans* are vectors of Eastern Equine encephalitis) compared to last year. This species was a little late to appear with numbers not rising until early July compared to the past few years when many were seen as early as mid-June.

CDC Traps

CDC Traps are another mechanical trap utilized in Bay County Mosquito Control's adult surveillance program. The CDC Trap attracts blood-seeking female mosquitoes with the use of dry ice (carbon dioxide) as bait. Traps are placed overnight within woodlots, summer festival grounds, treatment sites, and personal residences. Usually the traps hold diverse species and larger mosquito numbers compared to New Jersey Light Traps. Traps are also used to assess homeowner complaints, gather arbovirus information, and record changes in abundance of mosquitoes before and after control operations.

These traps are quite good at sampling most of the district's 20+ individual mosquito species, each one being a little different from the other due to where they prefer to breed, their biting habits, flight range, and ability to transmit disease.

Total number of mosquitoes captured in CDC traps this year was 24,740 (Table 3—page 18). *Ae. vexans* (and other summer floodwater *Aedes*) remained at the top ranking spot, representing 59% of the total with *Cq. perturbans* numbers up from 2010, comprising 21% of this year's total. Twenty-one species in six genera were collected and identified, averaging 93 females per trap, down slightly compared to 102 in 2010. The average number of females in 2009, 2008 and 2007 was 97, 175 and 118, respectively. This year we increased the traps placed per week from 16 to 20 in order to sample more areas. We plan to continue this practice in the future.

Some traps sampled the same locations while others were placed based on dead bird reports, mosquito complaints, or other indicators of possible virus or nuisance risk.

Mosquitoes from CDC Traps, like New Jersey Light Traps, were tested for mosquito-borne viruses in batches of between 5-25 individuals of a particular species sampled from the same location. There was one West Nile Virus-positive pool of *Culex* mosquitoes collected from a CDC Trap placed in Pinconning Township this summer.

CDC Traps

Table 3

Species	May	Jun	Jul	Aug	Sep	TOTAL
Ae. vexans	0	3652	4336	1544	1422	10954
Ae. cinereus	0	2	0	0	0	2
Ae. intrudens	0	0	26	15	2	43
Ae. implicatus	0	124	15	2	0	141
Ae. stim/fitchii	0	167	43	2	0	212
Ae. canadensis	0	260	1161	52	0	1473
Ae. provocans	0	0	0	0	0	0
Ae. triseriatus	0	35	83	115	6	239
Ae. trivittatus	0	319	2713	600	19	3651
Ae. japonicus	0	0	2	8	3	13
An. punctipennis	0	5	11	2	1	19
An. quadrimaculatus	0	558	337	395	9	1299
An. walkeri	0	46	103	53	132	334
An. perplexens	0	0	0	2	0	2
Cs. inornata	0	2	24	6	0	32
Cq. perturbans	0	241	4620	299	14	5174
Cx. pipiens	0	15	185	417	37	654
Cx. restuans	0	77	44	1	0	122
Cx. territans	0	0	2	5	0	7
Ps. ferox	0	0	38	94	14	146
Ps. ciliata	0	0	0	1	0	1
Damaged/Others	0	47	147	27	1	222
Total Females	0	5550	13890	3640	1660	24740

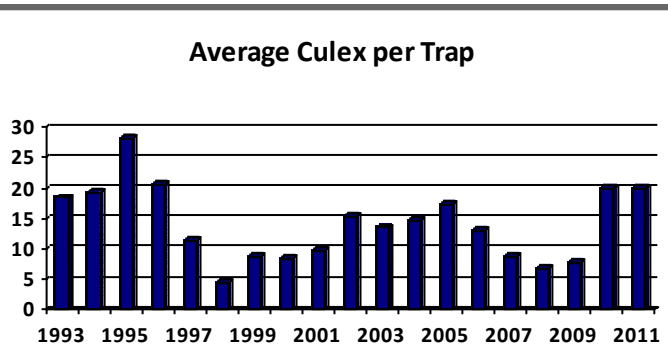
Gravid Traps

Gravid traps offer another method to collect female mosquitoes, primarily *Culex* species that have taken a blood meal and are searching for a suitable place to lay eggs (oviposit). This trap is selective for female mosquitoes that have at least one blood meal; therefore, the traps provide a good means for early West Nile Virus (WNV) detection.

A solution containing water, brewer's yeast, whey, and guinea pig pellets is allowed to ferment for about a week before being poured into a plastic tub, over top of which sits the gravid trap. This organically-rich water is the attractant to gravid (egg-bearing) females.

Gravid trap placement ran from June through September and 146 traps captured 3,367 mosquitoes (2,960 *Culex* species, 33 *Ae. japonicus*, 31 *Ae. vexans*, 10 *Anopheles* species, 1 *Ae. triseriatus*, 1 *Cq. perturbans*, 3 Spring *Aedes*, 5 *Cx. territans*, 9 *Cs. inornata*, 1 *Ur. sapphirina*, 24 damaged females and 289 males). Traps are placed in a variety of locations, including the immediate area of WNV activity. *Culex* mosquitoes collected in gravid traps are grouped together and submitted to Michigan State University (MSU) for WNV-detection. Figure 7 shows a historical perspective of the average number of *Culex* mosquitoes collected per gravid trap. Collections from 2011 mirror those from 2010.

Figure 7



Disease Surveillance

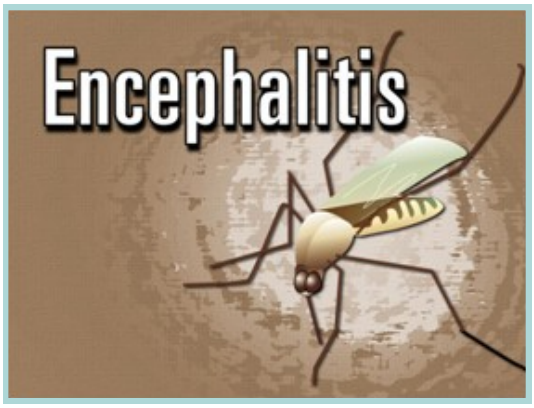
Since the inception of Bay County Mosquito Control, efforts have been targeted at controlling known disease vectors as well as nuisance mosquito species. While reducing annoyance and improving quality of life are important, the primary goal of our program has always been to reduce mosquito numbers in order to decrease the risk of diseases transmitted by them. Since WNV came on the scene in 2001, our efforts at disease prevention and public education have taken on a bigger role.

St. Louis encephalitis, Eastern Equine encephalitis, LaCrosse encephalitis, West Nile virus, and dog heartworm are all mosquito-borne pathogens found in Michigan. Mosquito pools are submitted to MSU's Microbiology and Molecular Genetics Department to be analyzed for these disease agents.

A mosquito pool is a group of up to 25 mosquitoes of the same species collected from a trap, placed in a vial, and tested for mosquito-borne disease. Five hundred eighteen pools containing 9,912 females representing a variety of species were tested with the following results:

- *Coquillettidia perturbans* (269 pools/5,716 females/no positives)
- C*ulex* restuans/pipiens (242 pools/4,150 females/**8 positives**)
- Culiseta inornata (5 pools/31 females, no positives)
- *Aedes japonicus* (2 pools/15 females/no positives)

A positive pool indicates local mosquitoes are infected with West Nile Virus and are capable of transmitting it to humans and other hosts. Seven of the eight positive pools were collected from a gravid trap placed at Monitor Township Park on August 2 and were comprised of *Culex pipiens/restuans* mosquitoes. The eighth positive pool was comprised of *Culex pipiens* mosquitoes taken with a CDC trap at the Pinconning Conservation Club on August 3. All mosquitoes collected after the initial positives were detected, tested negative.



The dead bird surveillance program was established in 2001 by the Michigan Department of Community Health in collaboration with local agencies. We rely on Bay County citizens reporting dead birds as one method of WNV surveillance. The number of phone calls reporting dead birds throughout the community remained nearly the same from 2010. Seventeen calls were received last year with eighteen this year. This number is down significantly from 100 in 2008 and 27 in 2009. In 2011, twenty-two dead birds were reported, most of which were Blue Jays (8), American Crows (6), House Sparrows (4), Finches (2), Robins (1), and Common Grackles/ European Starlings/other blackbirds (1). All dead bird sightings were logged onto Michigan's Emerging Diseases website www.michigan.gov/emergingdiseases. After initial screening by staff, a total of nine crows or jays were tested with **two testing positive**—one from Essexville on September 1 and one from the south end of Bay City on September 6. Using the WNV VecTest kit, American Crows and Blue Jays are tested to determine infection rates. Both samples were confirmed positive by MSU's Diagnostic Center for Population and Animal Health. Compared to 2008-2010, disease activity showed a rebound for Bay County.

Statewide, there were 33 human cases reported through October 24, 2011 (Table 4) with 2 fatalities occurring in Macomb and Wayne Counties. Twenty-four positive mosquito samples were found in Bay, Ingham, Saginaw, Tuscola, and Wayne Counties with over 8,400 samples tested from 15 counties .

In 2010, a large outbreak of Eastern Equine Encephalitis (EEE) in horses occurred primarily in the southwest portion of Michigan with 56 lab-confirmed equine cases and 77 additional suspect cases. This year, only three equine cases were mapped in Midland, Arenac, and Missaukee Counties—well outside southwest Michigan. There was, however, an additional horse case that tested positive for WNV in Van Buren County.

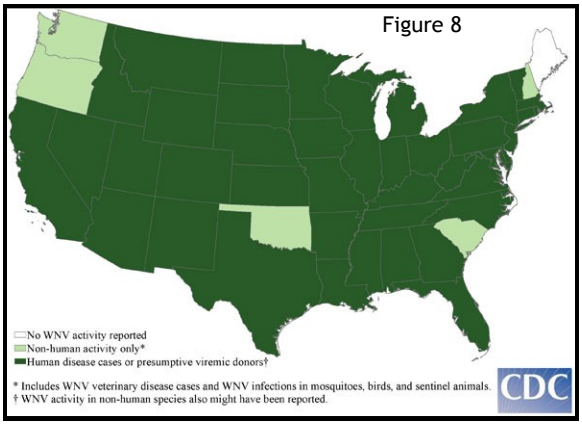
Table 4

Michigan Human WNV

Year	Total Cases	Fatalities
2011	33	2
2010	29	3
2009	0	0
2008	17	0
2007	13	2
2006	55	7
2005	62	4
2004	16	0
2003	19	2
2002	614	51

Nationally, there were 658 human WNV cases with 40 deaths, as of November 29. Most of the U.S. cases (Figure 8) occurred in California (151 cases/8 deaths), Arizona (58/4), and Mississippi (51/5). The dark green color on the map indicates human infections occurring somewhere in the state.

Figure 8



Product Evaluations

A small-scale evaluation of Agnique MMF and Agnique MMF-G was conducted to evaluate efficacy. Two trials were held on July 1 and July 8 looking at various dosage rates of the liquid product (0.2, 0.5, and 1 gal/acre) and a 7 lb/acre dosage of the granular formulation. The evaluation showed that excellent control was achieved 24-hour post-application. At that mark, over 90% mortality was recorded with all dosages, while untreated controls averaged 2% mortality. Both Agnique formulations took longer to work against younger larvae (first and second instars) compared to third and fourth instars and pupae.

Resistance Testing

Resistance testing is accomplished by running bottle bioassays, which are tests to see if specific amounts of insecticide are effective against mosquitoes. Bottle bioassays are simple, quick tests of the response of our mosquitoes (whether they're lab-reared or collected in the field) to the adulticide used to control them. The goal of the bioassay is to measure the time it takes for a given insecticide to kill the adult mosquito.

Bioassays can provide an early warning of decreased effectiveness due to insecticide resistance. These tests allow us to know how well the products we buy are performing. Four adult bottle bioassays were performed for the active ingredients permethrin and etofenprox , which are used in the adulticides Biomist® 4 + 4 ULV and Zenivex® E4 RTU, respectively. If we find that mosquitoes are becoming resistant to the products we use, we would switch to a different product or an insecticide with a different active ingredient. Both products provided quick knockdown of the adult mosquitoes.

Weather

Weather plays an important role in mosquito control—details for 2011 are included here. A late-March snowstorm dumped over 8" of snow across the Saginaw Valley. April was marked by rainy conditions with the 3rd wettest April on record and 15 days with measurable rain. As usual, April was also characterized with wide swings in temperature from 83° F on April 10th to 39° F on April 18th. Overall, the spring was a cool one marked by a late start to planting by area farmers.

The trend of above-normal precipitation continued through May and the most exciting weather event for the month was an EF1 tornado on May 31 that destroyed a barn and damaged homes as it tracked through Beaver Township along Parish Road.

June saw slightly above-average rainfall with 3.49" recorded on average. There were, however, local rain extremes with 5" of rain falling at several sample stations north of Linwood Road that led to our highest spike of *Aedes vexans* on July 5. Likewise, a rain event on July 22 saw no rainfall in southern Bay County, but averaged 1.5" north of Linwood Road with 4" recorded in the city of Pinconning.

There were 8 days in July where temperatures reached 90° or above. There were also 12 days with lows of 70° or higher; warm evenings like these will be coupled by a spike in complaint calls due to increased mosquito activity. August was a pretty average month, although there were a few storms with straight-line winds. Drier, cooler weather prevailed in September, which allowed us to confidently shut down operations at the end of the month.

Figure 9 (page 24) shows the average rainfall amounts that were measured in rain gauges placed throughout the county. Rain events that drop over an inch of rain are typically sufficient to cause a new hatch of mosquitoes. There were five such rain events that occurred during summer 2011.

Table 5 (page 24) lists weather data occurring in Bay County during November-December of 2010 and January through October, 2011. As far as rainfall is concerned, April stands out as a month of extremes due to rainfall measuring much above the historical average. The April rains stimulated summer *Aedes* to hatch, a trend that we see far too often. Temperature extremes were seen in July with mean temperatures averaging nearly five degrees above normal.

Figure 9

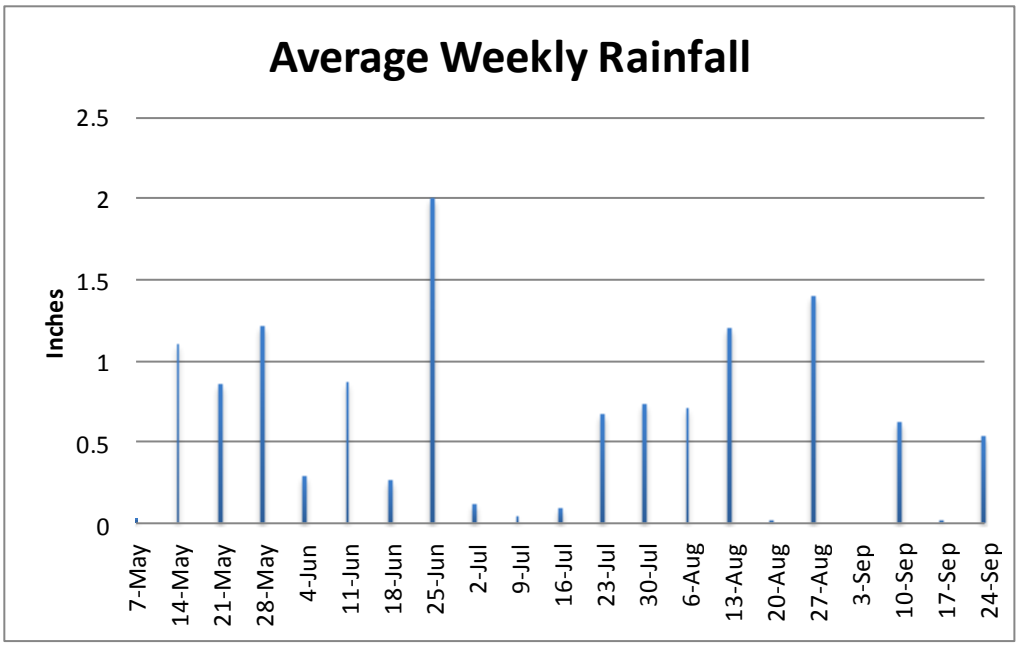


Table 5

Month	Normal Rainfall	2010/2011 Rainfall	Departure from Normal	Normal Average Mean Temp.	2010/2011 Average Mean Temp.	Departure from Normal
November	2.65”	2.43”	- 0.22”	38°	39.9°	+1.9°
December	2.11”	1.2”	-0.91”	27°	24.9°	- 2.1°
January	1.77”	1.32”	- 0.45”	21.4°	18.8°	-2.6°
February	1.57”	1.63”	+0.06”	23.8°	23.4°	-0.4°
March	2.42”	2.51”	+0.09”	33.5°	30.7°	-2.8°
April	2.82”	5.96”	+3.14”	45.4°	45.2°	-0.2°
May	2.74”	3.56”	+0.82”	55.4°	55.9°	+0.5°
June	3.06”	3.49”	+0.43”	66.8°	67.5°	+0.7°
July	2.5”	2.26”	- 0.24”	71.2°	76.1°	+4.9°
August	3.31”	3.51”	+0.2”	68.8°	70.4°	+1.6°
September	3.83”	2.6”	-1.23”	61.3°	61.2°	-0.1°
October	2.52”	2.14”	-0.38”	52.4°	54.4°	+2.0°

Spring Aerial Campaign

The mosquito control season begins in April with aerial larviciding to control spring woodland mosquitoes. The operation targets vulnerable larvae before they reach the adult, biting stage. The aerial program has gone on for over three decades in the Saginaw Valley and remains the best way to dramatically decrease numbers of spring *Aedes* mosquitoes. The preferred control method uses a bacterial product known as *Bti* (*Bacillus thuringiensis israelensis*).

Earl's Spray Service, Inc. of Wheeler, Michigan used two aircraft to apply *Bti* to 40,560 woodland acres in the following townships: Beaver (5,720 acres), Fraser (5,000 acres), Garfield (5,880 acres), Gibson (480 acres), Kawkawlin (3,330 acres), Mt. Forest (340 acres), Pinconning (8,340 acres), and Williams (3,910 acres). Clarke of Roselle, Illinois utilized one Jet Ranger helicopter to apply *Bti* to 7,559.65 acres in the following townships: Bangor (2,230.8 acres), Frankenlust (705.15 acres), Hampton, Portsmouth, Merritt, and Bay City East (918.65 acres), Mt. Forest (2,672.05 acres), and Monitor (1,033 acres).

Calibration, loading, and fueling of the fixed wing aircraft took place at Barstow Airport in Midland while a variety of loading and fueling sites throughout the county were used for the helicopter in order to decrease ferry time. Sites were treated with VectoBac® *G Bti* corncob granules at a dosage rate of between 4-5 pounds per acre.

40-pound bags of *Bti* used in the helicopter operation

Spring Ground Surveillance/Larviciding

Four certified technicians and one supervisor helped with aerial quality control, conducting post-treatment surveys to assess *Bti* application. Following the completion of the aerial treatment program, these same technicians were the first to begin inspections and subsequent ground treatment using primarily *Bti* and BVA2 larvicide oil to manage the larvae or pupae. Field technicians began to treat woodland pools with larvicide oils, concentrating on smaller woodlots not feasibly treated by aircraft.

Table 6 lists the number of acres treated by foot crews and material used in smaller tracts of woodlots during the 2011 spring season. Almost 200 acres received larval treatment by ground crews to control the emergence of the pestiferous spring *Aedes* mosquito. The crews checked 161 sites, dipping each one, to determine the need for treatment. A total of 96 sites were treated; less than 1% were dry due to a very rainy April. A total of 613.59 pounds of *Bti* and 68.5 gallons of BVA-2 larvicide oil were dispensed at a dosage rate of 5 pounds/ acre and 1 gallon/acre, respectively. First pupae were recorded between May 2-6 and significant emergence of spring *Aedes* adults occurred between May 9-15. This initiated adulticiding or the control of adult mosquitoes through fogging operations.

Table 6

Spring Ground Treatment

Township	Acres Treated	BVA2 (gal)	Bti (lb)
Bay City East	2.2		11.18
Bay City West	5.9		29.29
Bangor	31.1	19.76	56.76
Essexville	1.6		8
Frankenlust	5.7		28.65
Fraser	40.7	13.71	135.11
Garfield	9.1	9.06	
Hampton	16.4		82.1
Kawkawlin	13.8	11.11	13.63
Merritt	0.5		2.6
Monitor	25.7	5.12	103.1
Pinconning	19	9.74	46.27
Portsmouth	8.2		41
Williams	11.2		55.9
Total	**191.1**	**68.5**	**613.59**

Summer Larviciding

Bay County residents enjoy spending time outdoors during summertime, but the presence of mosquitoes can interfere with outdoor recreation. We try hard, therefore, to reduce mosquito numbers so residents can enjoy Michigan's all-too-short summer.

Our comprehensive mosquito control program focuses on routine surveillance and control of potential breeding sites to prevent adults from emerging. The program involves MDA-certified technicians applying insecticides to stagnant water throughout the county. During the breeding season, a team of 21 technicians inspect water habitats guided by a database of known breeding sites, citizen complaints, and high trap numbers. Homeowners are notified of property inspections either in person or through the use of a door hanger.

Efforts directed at larval control are accomplished by using bacterial, chemical, or sanitary (dumping water from containers) methods. The district uses several natural bacterial products for control of larval mosquitoes. These include VectoBac®G (*Bti*), Aquabac® XT and VectoBac® 12AS (Liquid *Bti*), *Bti* Briquets™, VectoLex® CG (*Bacillus sphaericus*) and Natular® XRT *Saccharopolyspora spinosa*). Chemical insecticides routinely used include temephos (Allpro® ProVect 1G and Abate® 4-E), alcohol-based monomolecular surface films (Agnique® MMF and Agnique® MMFG) and petroleum-based oil (BVA2). The Agnique MMF was used near the Lake Huron beachfront as well as sensitive wetland areas.

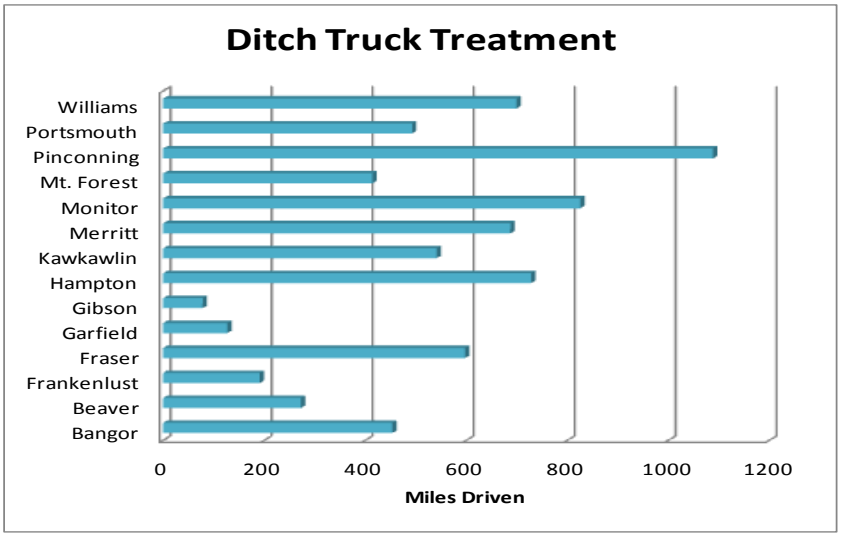
Larval Sites: The total number of breeding sites changes each year as new sites are added to the database and others are deleted. A total of 19,575 larval site inspections were conducted this season, but only 17% (3,280) of those were actually treated with a larvicide material. These numbers are in keeping with previous years' data. Some of these sites were permanent breeding habitats while others were temporary and included ditches, containers, fields, woodlots, tires, idle pools, ornamental ponds, and Saginaw Bay beachfront. Larvae are sampled by quickly skimming the water's surface with a dipper; some are collected and returned to the lab for identification. Technicians also control mosquitoes by dumping water from buckets, pails and other man-made containers (one method of source reduction) on a regular basis. This is the preferred method to eliminate mosquitoes from breeding in containers.

Events: In addition to surveillance and control in neighborhoods throughout the county, special attention is given to summertime outdoor recreational events, such as the Auburn Cornfest, Munger Potato Festival, Pig Gig Ribfest, and River of Time, to name a few. According to the Bay Area Convention and Visitors Bureau, over a half million people attend these types of festivals. Controlling larvae prevents adults from emerging and interfering with outdoor recreation and activities.

Ditch Treatments: Bay County's topography is very flat and most roadways are flanked by ditches, which divert water from the county's 1,400 linear miles of roads. In addition, ditches serve as breeding grounds for mosquitoes, so a lot of attention is given to monitoring mosquito activity within them. In fact, surveys are made by lab personnel once each week. Most problems with breeding occur after major rainfall events, which stimulate mosquito eggs to hatch.

This year, ditch trucks logged 7,204.7 miles driven, which was just 220 miles shy of what was driven during the 2010 treatment season, dispensing 18 gallons of Abate 4E mix (9 ounces of Abate 4E), 1,829.5 gal of AquaBac® XT mix (246.5 gal *Bti*), and 2,991.3 gal of Natular 2E mix (11.7 gal Natular 2E). Figure 10 shows in which townships the ditch truck treated the most miles. Pinconning Township had an especially busy year due to eight rain events, three of which were thunder-storms that popped up in the township and then headed out into the Saginaw Bay, thereby affecting no other areas of the county.

Figure 10



Sewage Lagoons: Sewage lagoons are perfect breeding zones for *Culex* mosquitoes as they're filled with polluted, highly organic water all summer long. Two sewage lagoons were monitored this season—White Birch Village and Pinconning McDonalds— resulting in 24 treatments, 83% of which were done at White Birch Village. The district did not actually get approval from the Michigan Department of Environmental Quality (MDEQ) to apply larvicides to the sewage lagoons until July 27. Afterwards, the following products were dispensed: 34 *Bti* Briquets, 6.75 pounds of *Bti*, 37.01 pounds of ProVect 1%, 4.7 gallons of Abate 4E mix, 9 gallons of Natular 2E mix, and 24.59 gal of BVA2. Since the MDEQ did not approve the use of temephos during 2010, we were happy to have this effective product back in our arsenal at least for sewage lagoons.

Catch Basins: Treatments of catch basins control *Culex restuans* and *Culex pipiens* mosquitoes, who are known vectors of both St. Louis encephalitis and West Nile virus. These species are not considered nuisance mosquitoes, as they feed primarily on birds; however, controlling disease vectors is extremely important in our efforts to decrease disease potential and maintain public health. Staff monitored mosquito breeding in catch basins and treated a total of 23,993 individual habitats. Figure 11 shows the number of catch basins treated in each township or city. The bulk of treatment took place in Bay City, Bangor Township, Hampton Township, and Monitor Township, the most urban areas of the county.

All basins were treated using either Natular® XRT (8,039 individual tablets) or VectoLex® CG bacterial larvicide (414.94 pounds). In addition, for catch basins that contained mosquito pupae, 586 Agnique MMF Paks were deposited into basins. Most of the pupa-inhabited catch basins were located around the downtown Bay City area.

Figure 12 illustrates percentages of each larvicide used to treat the catch basins this season. Basins treated with VectoLex were treated multiple times, depending on when larval surveillance showed that control had stopped. Treatments typically begin at the end of May or early June, but treatments in 2011 did not begin until the end of June, as the MDEQ did not give official approval until that time.

Figure 11

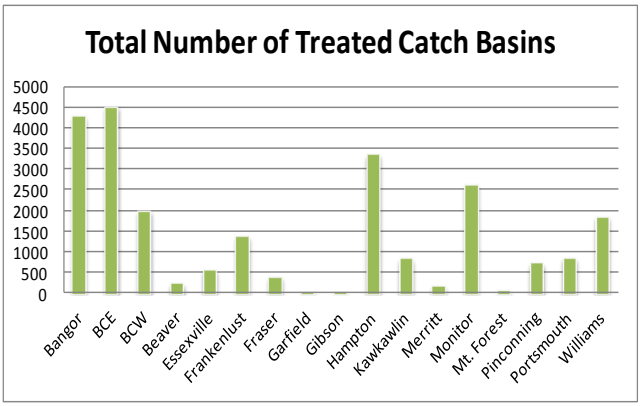
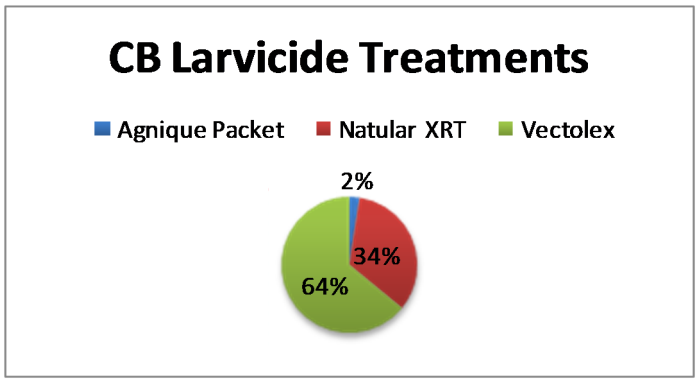


Figure 12



Retention Ponds: Bay County is home to over 120 retention ponds that are designed to hold storm water until the water either percolates or evaporates, which returns the area to its normally dry state.

Floodwater mosquitoes are usually the first to appear in retention ponds, but *Culex* and *Anopheles* mosquitoes can also be found. BCMC certified technicians surveyed 123 different retention ponds, making 448 individual visits throughout the summer. Of those 448 surveys, no treatment was needed 75% of the time, which is essentially the same trend seen in the search and destroy operation. However, on the days when treatment was necessary, the following larvicides were used to control either larvae or pupae: *Bti* Briquets (78), *Bti G* (330.97 lb), BVA2 (18.9 gal), AquaBac XT mix (18 gal), Agnique MMF-G Paks (5), and Agnique MMF (0.24 oz).

More and more aerial maps are used in conjunction with a database of known breeding sites. Technicians utilized maps during the 2011 season, which detailed the location and size of each retention pond as shown on an aerial map. This gave technicians a way to quickly locate the ponds allowing for more efficient surveillance and treatment.

Search and Destroy: Besides the larviciding activities previously discussed (ditch trucks, sewage lagoons, retention ponds, and catch basins), technicians also spent most days engaged in what is known as Search and Destroy. This simply means that technicians search for and control immature mosquitoes in various breeding habitats, most of which are shown in the chart below.

Artificial Containers	Catch Basins (Wild)	Cross Country Drains
Flood Plains	Flooded Fields	Flooded Woodlots
Idle Pools	Ornamental Pools	Ponds
Rain Barrels	Roadside Ditches	Tires

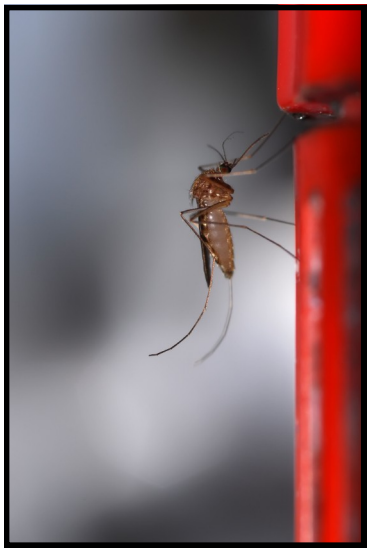
It is important to select the appropriate control material and formulation based on what mosquito life stage is encountered in the water habitat. Timing of the application is also crucial as is the amount of product applied. As technicians search for mosquito breeding, they also educate Bay County citizens about how to prevent mosquitoes from breeding in containers around residents' backyards. Technicians leave door hangers when they encounter tires, reminding folks about our scrap tire drives and the need to recycle tires in order to prevent mosquitoes from breeding there.

Table 7 illustrates the control materials dispensed during Search and Destroy activities.

Table 7

Control Material	Amount Dispensed
Abate 4E	50.3 gal of mix
Agnique MMF G	46.8 lb
Agnique Paks	15
Agnique MMF	4 gal
AquaBac XT	30 gal
Bti	2,854 lb
BVA2	409.9 gal
Bti Briquets	860
Natular 2E	23 gal of mix
ProVect 1%	235.1 lb
VectoLex	4.63 lb

Adulticiding



While larval control is the preferred method of treatment, it is virtually impossible to find and treat all breeding sites, so adulticiding (fogging to kill adult mosquitoes in flight) is also carried out to control mosquitoes. Adult mosquito activity will increase following periods of heavy rains that cause new mosquito broods to hatch. Fogging adult mosquitoes includes the use of ULV (Ultra Low Volume) equipment that allows a relatively small amount of material to be dispensed from the spray equipment. Application rates are adhered to by using GPS units with SmartFlow technology in each truck. Label recommendations are strictly followed to assure proper dosage rates and droplet sizes during adulticide applications. To accomplish the latter, droplet measurements are taken several times throughout the season. The first droplet characterization session took place in early May with Rob Cascioli and Roger Newberry (Clarke) using the AIMS (Army Insecticide Measuring System) to measure aerosol droplets (see picture at right); software was utilized to store electronic files. Subsequent checks of droplet sizes took place using the Teflon® slide method.

When weather conditions are conducive to fogging (temperatures above 50°F and winds below 10 mph), eight certified technicians fog cities and townships that have either the highest mosquito populations or noted disease activity. This year saw the routine use of the permethrin product Biomist® 4+4 ULV. Mosquitoes must come in contact with the droplets in order for the insecticide to be effective so adulticiding activities take place after sunset when most mosquito species are active and bees have returned to their hives.

For management purposes, Bay County initiated the use of route maps during adulticiding operations. These road maps of each township show the most efficient route to follow when adulticiding so all roads are treated and no roads are treated twice. The maps also highlight addresses of medical and no spray residences. Medical residences (of which there are 61) are homes that qualify to be a part of our Medical Needs Program because at least one resident is allergic to mosquito bites or has verifiable medical needs. The medical condition must be confirmed by a medical doctor. No spray residences are homes that prefer not to be treated for mosquitoes; there are 100 such addresses.

Adulticiding Treatment

Table 8

Township	Biomist 4 + 4 (gal)	Kontrol 4-4 (gal)	Aqua Reslin (gal)	Miles Treated
BANG	550.55	93.83		2822.8
BCE	78.12	29.91	0.17	455.3
BCW	56.96	21.5		346.1
BEAV	201.08	48.59		1148.8
ESSE	21.05	4.35		108.9
FRAN	171.8	19.88	1.57	907.5
FRAS	213.07	24.87		1114.5
GARF	150.73	52.14		884
GIBS	129.8	47.95		833.9
HAMP	285.33	51.63		1437.1
KAWK	407.06	53.3		2062.7
MERR	107.73	9.58		557.2
MONI	480.26	78.86		2469.4
MTFO	141.47	56.85		915.9
PINC	187.28	32.49		1055.1
PORT	150.42	40.22	0.21	781.2
WILL	335.16	48.61		1779.5
TOTAL	**3,667.87**	**714.56**	**1.95**	**19679.9**

During the 2011 season, the "Long Driveway Program" continued. This program is designed to fog inhabited properties that sit a considerable distance off the main road and that do not receive adequate adult mosquito control during normal fogging operations. Sixty-seven such addresses were placed on route maps to be fogged on a regular basis, an increase of 7% from 2010.

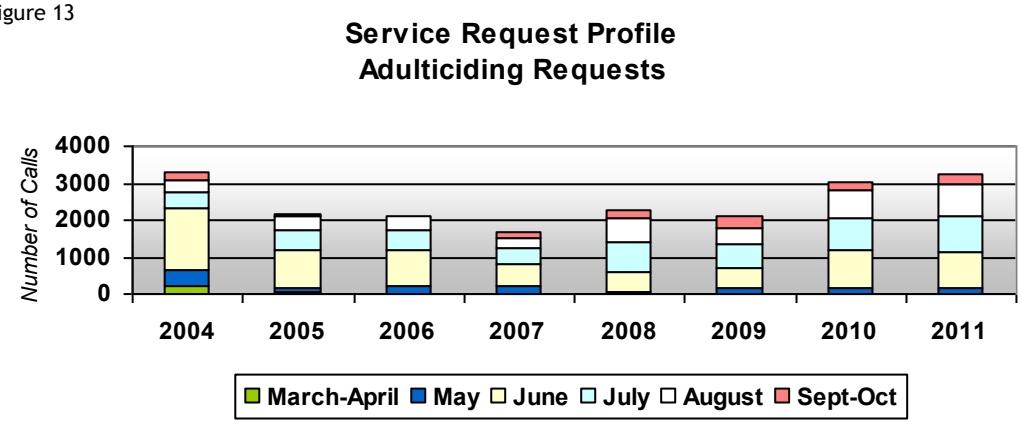
Table 8 reveals that 19,679.9 miles were logged during adulticiding operations and nearly 4,400 gallons of adulticide were dispensed, with the majority being Biomist 4 + 4 ULV (3,667.87 gallons).

Customer Calls

Traps are the primary indicator of mosquito activity, but customer calls are also used as a means to indicate where adult populations are problematic. Office staff answered and technicians responded to 3,233 adult mosquito service requests received from Bay County citizens. Most (2,646) of the calls were regular service requests for adulticide treatment due to nuisance mosquitoes; however, nearly 60% of these calls came from re-peat callers. An additional 587 calls represented special event spray requests. In comparison to 2010, the level of adulticide service requests increased by 7%. Most of the calls were received in June (1,000), followed by July with 966; calls peaked about two weeks after major rain events.

Three hundred five calls were also received reporting standing water with potential mosquito breeding, with an additional 100 larviciding calls logged into the system that accompanied an adulticide event request. Regardless of the type of service request, all were responded to in a professional, courteous, and prompt fashion. Figure 13 represents a historical profile of adulticide requests.

Figure 13



Scrap Tire Drives

Scrap tire drives are one method of source reduction, the removal or elimination of breeding sources that currently are or have the potential to breed mosquitoes. Two community tire drives were held this season—one in the Spring and one in the Fall with 4,266 tires collected—17% more than was collected in 2010.

Semi-trailers are filled at our field station or other satellite locations such as Pinconning County Park, where county residents are able to bring tires at our spring tire drive. Trailers are then hauled back to Environmental Rubber Recycling where tires are recycled at the Flint facility. Tires are ground into chips and shipped to Michigan power plants to be burned as tire-derived fuel (TDF).

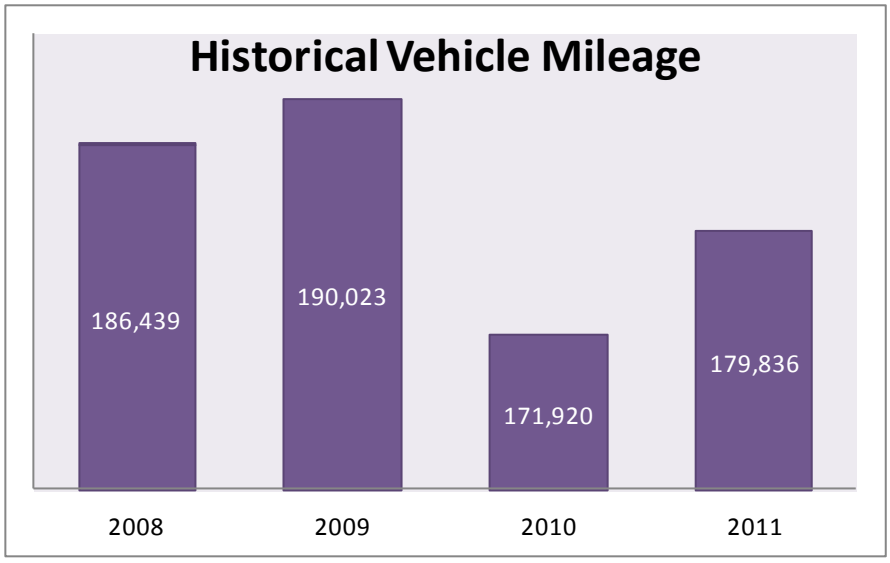
Vehicle Maintenance/Mileage

Bay County Mosquito Control's state-certified mechanic maintains the 32-vehicle fleet as well as four Bay County Animal Control vehicles, which are billed for parts and labor. Besides vehicles, the shop maintains forklifts, ULV foggers, ditch truck sprayers, and various types of equipment. From time to time, specialized equipment is designed and fabricated.

During the 2011 season, as Figure 14 shows, 179,836 miles were driven, which is just shy of the 20-year average of 191,631 miles and represents 4% more miles than were driven in 2010. Vehicle maintenance repairs included the following: brake systems (30), fuel systems (10), front end repairs (14), truck oil changes (72), electrical systems (42), drive lines (4), new tires (32), and used tire repair (15).

In addition to maintaining the vehicles, the mechanic was responsible for repairing and maintaining equipment used by mosquito control staff. Equipment repairs included: ULV oil changes (52), ULV repairs (38), ditch truck repairs (30), Hudson® pressure sprayer repairs (10), spreader repairs (17), CDC Trap repairs (6), and New Jersey Light Trap repairs (4).

Figure 14



Education

Efforts are made to inform and educate Bay County residents about mosquito control methods and mosquito-borne diseases. A great deal of education takes place every day through hundreds of personal contacts in the field and calls to the office. Periodic interviews by newspaper, television, and radio allows discussion of news affecting the public, such as spring aerial treatment, summer programs, homeowner property inspections for water elimination, West Nile encephalitis, and scrap tire drives. Staff training is also held on a regular basis to update staff on various topics including safety, disease activity, and policies and procedures.

Presentations are also given to various groups, including school-based programs, such as the presentation (shown at right) given at Kolb Elementary School. Brochures and handouts are developed and distributed at various locations and our website (www.baycounty-mi-gov/MosquitoControl) is updated regularly.

Membership/Certification

Membership in professional organizations remains vital in accessing updated and new information and maintaining good working relationships with peers. Membership with the non-profit Michigan Mosquito Control Association (MMCA), American Mosquito Control Association (AMCA), and The Entomological Society of America (ESA) are maintained. All are beneficial due to conferences, publications, networking, and legislative advocacy.

All staff members maintain certification with the Michigan Department of Agriculture in both the Core and 7F (Mosquito Control) categories. Two training sessions were held in May and June with 33 new and returning technicians in attendance. Staff also attended MMCA's 25th annual meeting in Grand Rapids, Michigan in February and the MMCA 2011 Mosquito Control Training Session in October in Bay City, both of which offered continuing education credits.

BCMC's program plan was reviewed and approved in January by the Department of Agriculture as part of our Comprehensive Community Outreach as mandated in Regulation 637.

Staff attended the Technical Advisory Committee (TAC) annual meeting in March 2011 where the 2010 annual report and 2011 program plan were presented for review and approval.

Table 8

2011 Insecticide Use Summary

Trade Name	Application Rate	Active Ingredient Dosage	Amount Used
Temephos 1%	10 lbs/acre	0.1 lb temephos/acre	226.56 lb
Abate® 4E concentrate	1.5 fl oz/acre	0.0468 lb temephos/acre	0.75 gal
Bactimos Bti Briquets™	1/100 square feet	7000 AA (Aedes aegypti) Bti ITU/mg	1319.5 briquets
VectoBac® G	5 lbs/acre	0.4555 billion Bti ITU/acre	206,694.1 lb
Bti Liquid	1 pint/acre	0.605 billion ITU/acre	135 gal
Agnique® MMF-G Pak 35	1/160-350 square feet	2.24-6.88 lb alcohol-based surface film/acre	617 ea
Agnique® MMF	0.2—1.0 gal/acre	0.2—1.0 gal alcohol-based surface film/acre	0.52 gal
Agnique® MMF-G	7-21.5 lbs/acre	2.24—6.88 lb alcohol-based surface film/acre	164.22 lb
BVA2 Mosquito Larvicide Oil	1—5 gal/acre	0.987-2.96 gal petroleum distillates/acre	646 gal
VectoLex® CG	5-80 lbs/acre	0.115-1.84 billion BsITU/acre	412.02 lb
Masterline® Kontrol 4-4	0.676 fl oz/acre	0.00176 lb permethrin/acre 0.00176 lb PBO/acre	662.485 gal
Biomist® 4 + 4 ULV	0.75 fl oz/acre	0.00175 lb permethrin/acre 0.00175 lb PBO/acre	3500 gal
Natular™ XRT	1 XRT tablet/catch basin	6.25% spinosad/tablet	8,258 tablets
Natular™ XRG	5 lbs/acre	0.125 lb spinosad/acre	0.02 lb
Natular™ 2EC	1.1-2.8 fl oz/acre	0.017-0.044 lb spinosad/acre	17.825 gal

Map of Bay County, Michigan