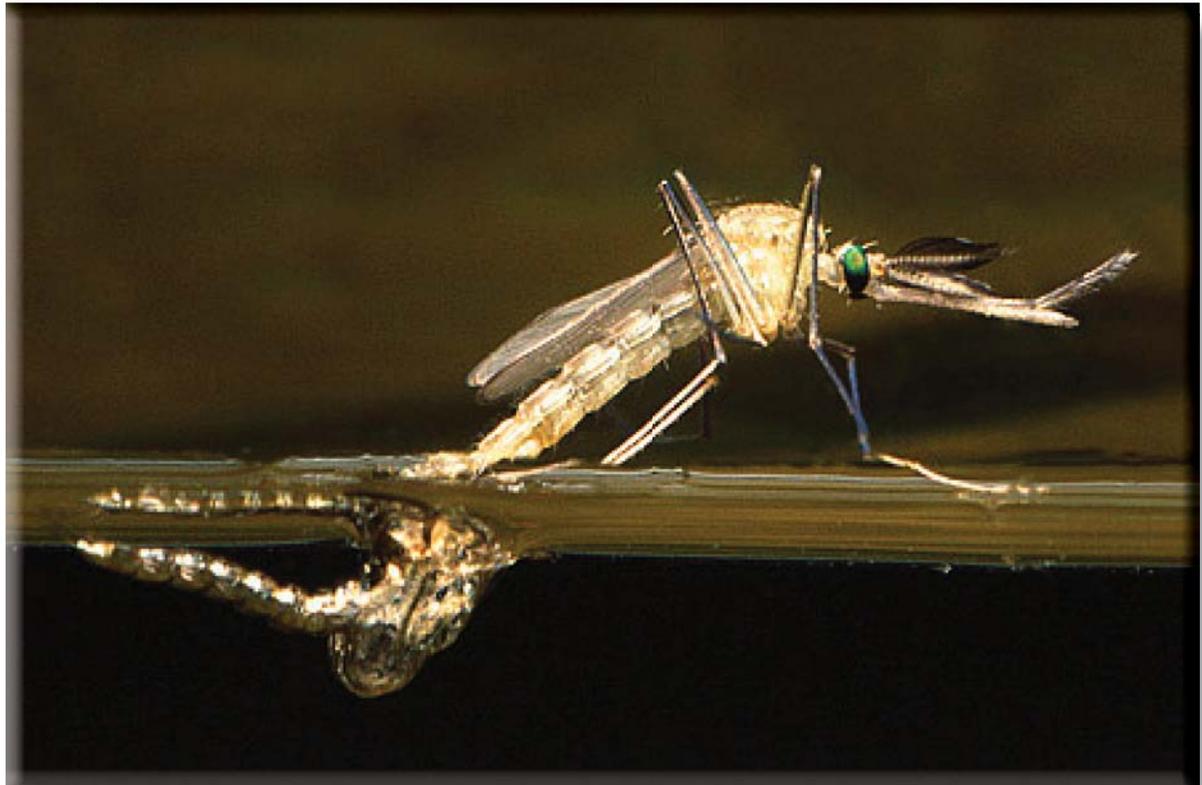


2007 Annual Report

Garfield County Cooperative Mosquito Control Program

Garfield County



October 2007

Colorado Mosquito Control, Inc.

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On The Cover:

A *Culex pipiens* female emerges from pupal case at water surface. This disease-vector mosquito will soon mature, take a blood meal and be capable of transmitting West Nile Virus and other mosquito-borne encephalitides (primarily to birds). Birds serve as the primary reservoir for West Nile and other viruses. *Culex tarsalis* will feed on both birds and humans thus vectoring the virus to the human dead-end host. In Colorado, West Nile Virus is here to stay. Over 450 human cases have been reported in Colorado so far this year.

Colorado Mosquito Control, Inc.

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**GARFIELD COUNTY COOPERATIVE
MOSQUITO CONTROL PROGRAM
GARFIELD COUNTY
ANNUAL REPORT 2007**

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***THE GARFIELD COUNTY COOPERATIVE
MOSQUITO CONTROL PROGRAM
MISSION STATEMENT***

The need to protect residents and visitors from the health risks, severe annoyance, and discomfort associated with biting mosquitoes is a chronic annual problem. The primary objective of the Garfield County Cooperative Mosquito Control Program is to suppress the development of larval mosquitoes in wetland and other sites, to monitor and reduce numbers of adult mosquitoes thereby reducing overall mosquito populations to an acceptable low-biting level, while reducing the threat of mosquito-borne disease transmission, all at the least possible cost, and with the least possible impact on human health and the natural environment.

CMC OBJECTIVES

Colorado Mosquito Control, Inc. as the contractor for the Garfield County Cooperative Mosquito Control Program will use proven scientific integrated pest management (IPM) methods of survey, inspection, diagnosis, biological/biochemical controls, natural enemies and limited low-toxicity pesticide applications to professionally accomplish the objectives of the Program. All of the methods and materials used have been reviewed and registered by the U.S. EPA, Centers for Disease Control, the Colorado Department of Agriculture and the American Mosquito Control Association.

Colorado Mosquito Control, Inc.

Colorado Mosquito Control, Inc. (CMC) is a large-scale contractor specializing in complete integrated mosquito control services. CMC utilizes an aggressive preemptive Integrated Pest Management (IPM) approach to controlling mosquito populations within contracted areas. CMC was established in 1986, is the largest private company specializing in mosquito control in Colorado, and is the only company in Colorado offering complete IPM mosquito control services.

CMC currently has programs across the state of Colorado including: Homeowners Associations, Incorporated Cities and Towns, Mosquito Control Districts, Counties, Indian Reservations, and others. Geographically, CMC reaches from the Ute Mountain Ute Reservation in the southwest corner of the state to Morgan County in northeastern Colorado.

***Integrated Pest
Management:***

“A process consisting of the balanced use of cultural, biological, and least-toxic chemical procedures that are environmentally compatible and economically feasible to reduce pest and vector populations to a tolerable level”

Cooperative Program

Garfield County and all seven communities again participated in an extensive cooperative mosquito control effort during 2007. During the fall of 2006 and spring of 2007, efficacy of the established program was greatly improved through remapping and data analysis. CMC has continued to receive input from residents on new larval sites, and areas with large numbers of adult mosquitoes. This has allowed the program to evolve even further and include previous unknown areas of concern. CMC will maintain its commitment to provide top quality service, and continuous improvement in an effort to minimize the threat of West Nile Virus and other mosquito borne disease to citizens and to reduce mosquito annoyance.

2007 Cooperating Entities

Battlement Mesa

Carbondale

Garfield County

Glenwood Springs

New Castle

Parachute

Rifle

Silt

2007 SEASON PERSPECTIVE

With over 21 years of service under our belts, we have come to expect the unexpected. We know that each Colorado summer will present a unique set of temperature, precipitation, irrigation, and human interactions that combine to create new and different challenges in both mosquito control and mosquito-borne disease proliferation and control. 2007 again showed these assumptions to be correct.

In monthly reports earlier this season, the 2007 mosquito season was described as the "Perfect Storm 2" in reference to the 2003 "Perfect Storm" season in which all of the environmental variables that dictate mosquito populations and mosquito-borne disease came together to produce the worst epidemic of arthropod-borne human disease in Colorado history. Early in the 2007 season, environmental and climatic conditions actually looked worse in some areas than in 2003. Early season rains and high temperatures produced *Culex tarsalis* populations that in most areas of Colorado were well above 2003 levels. Numerous graphs and charts follow that will illustrate these numbers.

Fortunately, with lessons learned over the past four years in Garfield County, and with the cooperation of the Garfield County municipalities, CMC recognized these patterns and was able to focus and ramp up effective larval control in areas with historically high numbers of culex mosquitoes. This led to a decrease in culex numbers during the peak of the season over 2006, at the same time when infection rates are on the rise.

Again, 2007 can be described as yet another unusual year with temperatures throughout the season above the normal. Temperatures were very hot early on and well above normal late in the season. According to NOAA, the season was also above the areas rainfall average, with only March and May

being slightly below normal.

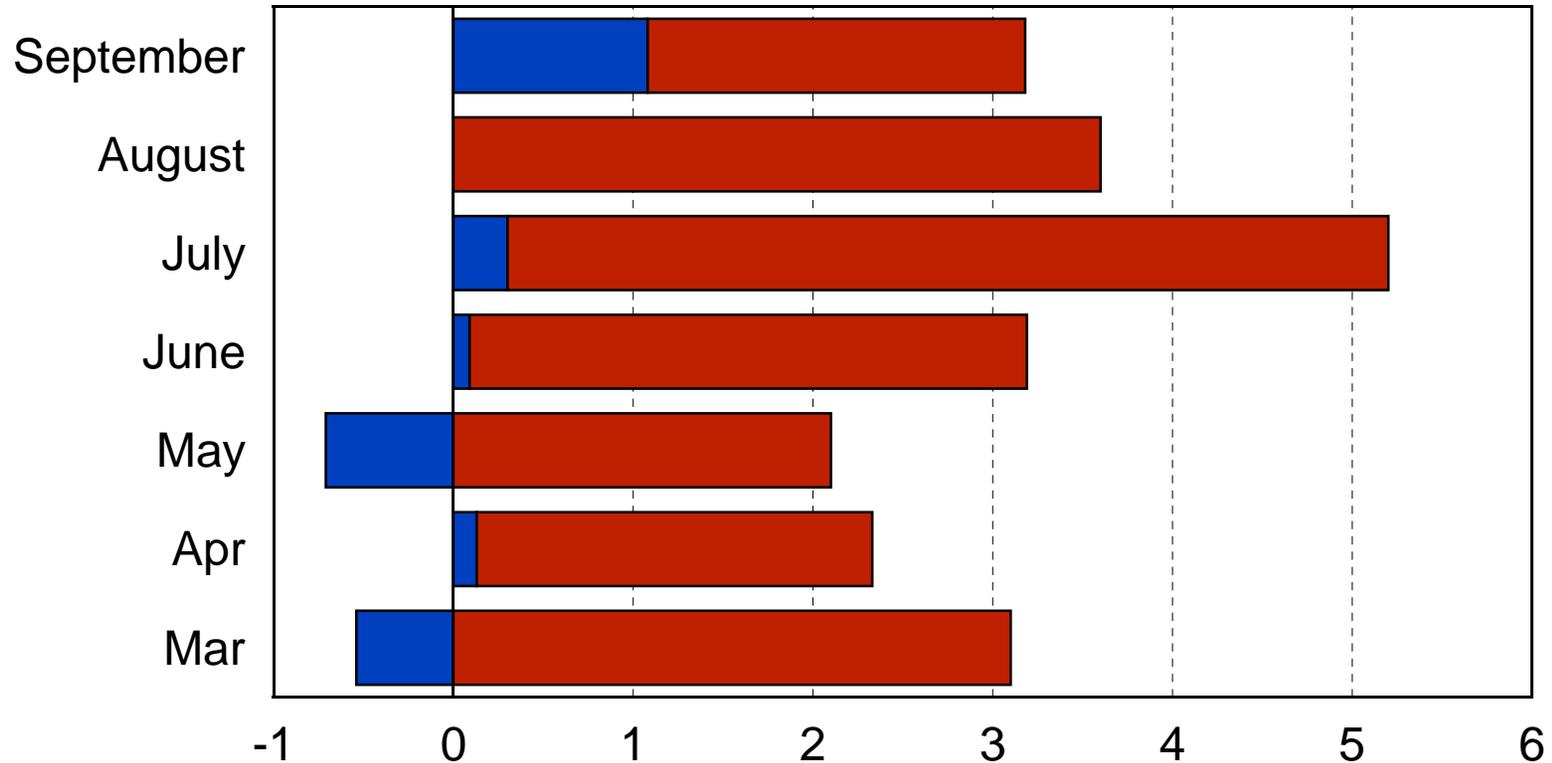
The vast majority of the mosquitoes (*Aedes/Ochleratattus*) with which we must normally contend are associated with newly applied floodwater via rain or irrigation or older standing stagnant water (*Culex*). Thus mosquito population trends are almost always dependent on either heavy rains (over 0.5 in.) or the agricultural flooding of fields for irrigation. Most of the significant mosquito populations early in the season were *Culex* species since the only prominent source of water for breeding was existing standing stagnant water in marshes (such as Cottonwood Park), or other wetlands. The early season prominence of *Culex* mosquitoes heightened the threat and likelihood of West Nile Virus human disease transmission later in season, which turned out to be an accurate prediction.

Unfortunately, to add insult to injury August saw a dramatic increase in temperatures above the norm. This coupled with above average rainfall in July, increased mosquito production significantly. Using past history and our CMMS (Comprehensive Mosquito Management System) we were able to focus and known production sites and increase larval control in these areas. Focusing on these areas allowed us to decrease culex production lower than in 2006.

2007 Field Activities

2007 West Slope Climate Data

Departures From Normal

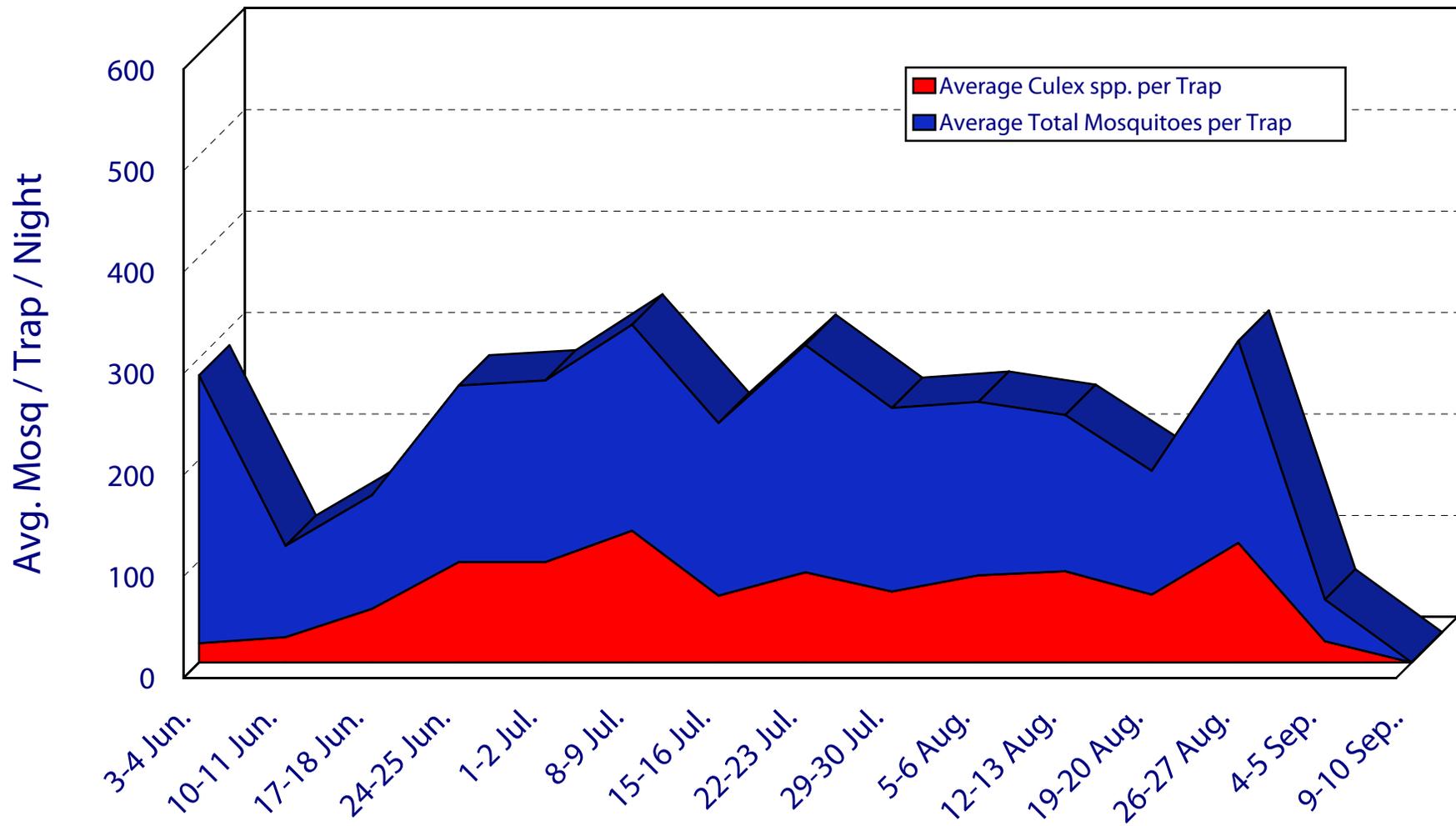


	September	August	July	June	May	Apr	Mar
Precipitation (inches)	1.08	0	0.3	0.09	-0.71	0.13	-0.54
Temperatures (degrees F)	2.1	3.6	4.9	3.1	2.1	2.2	3.1

■ Precipitation (inches) ■ Temperatures (degrees F)

CDC Trap Composite Culex vs. All Mosquitoes

2007 Garfield County Mosquito Control Program



Field activities began in late March for the 2007 season. The earliest activity of the season was taking GIS maps which were updated and revised over the fall and winter and site ground-checking them. Mapping larval sites is an ongoing process, and in every program citizen reports of new larval sites result in many new sites being added to the existing larval inspection routes.

Hiring of seasonal technicians also began in March, and continued into late May. As the CMC service area continues to grow, hiring an adequate number of top quality field technicians has become a challenge. For the Garfield office, 5 technicians were hired with a new manager George Johnson. Cynthia Corson, a three year veteran, returned again this year as our surveillance manager and Garfield Field Supervisor. She has committed to stay with us another 3 years minimum, and her experience again this year proved extremely valuable.

CMC's Annual Field Technician Classroom Training Day took place on May 14th with over 75 new and returning field technicians in attendance. Field training by CMC management and veteran employees lasted throughout May, with a few late hires being trained during early June. By early June, CMC was fully staffed and had daytime and evening shift crews trained and in the field. During the mid June to mid August time period, field mosquito control operations were in full swing. The final day for larval inspections and control was Friday, September 28th.

Mosquito trapping was planned through September 21st, however windy and wet weather conditions effectively eliminated much of the final week of mosquito trapping and associated adult spraying operations.

WEST NILE VIRUS 2007

Background

West Nile Virus (WNV) was first identified in Uganda in 1937. Since that time, activity has been documented throughout Africa, Europe, West and Central Asia, and areas of the Middle East. The virus made its first appearance to North America in 1999 when it was documented in New York City. WNV comes from a family of viruses known as Flaviviridae and is closely related to other viruses which can have severe effects on both humans and animals such as Japanese Encephalitis and St. Louis encephalitis.

WNV has a wide range of symptoms which can range from mild flu like symptoms to death. Of humans affected, nearly 80% will show no symptoms at all. The majority of people who do show symptoms will usually suffer from flu like symptoms. However, approximately 1% of people will develop much more severe symptoms including meningitis (inflammation of the linings surrounding the brain and spinal cord), encephalitis (inflammation of the brain), or very rarely poliomyelitis which can cause paralysis in parts of the body.

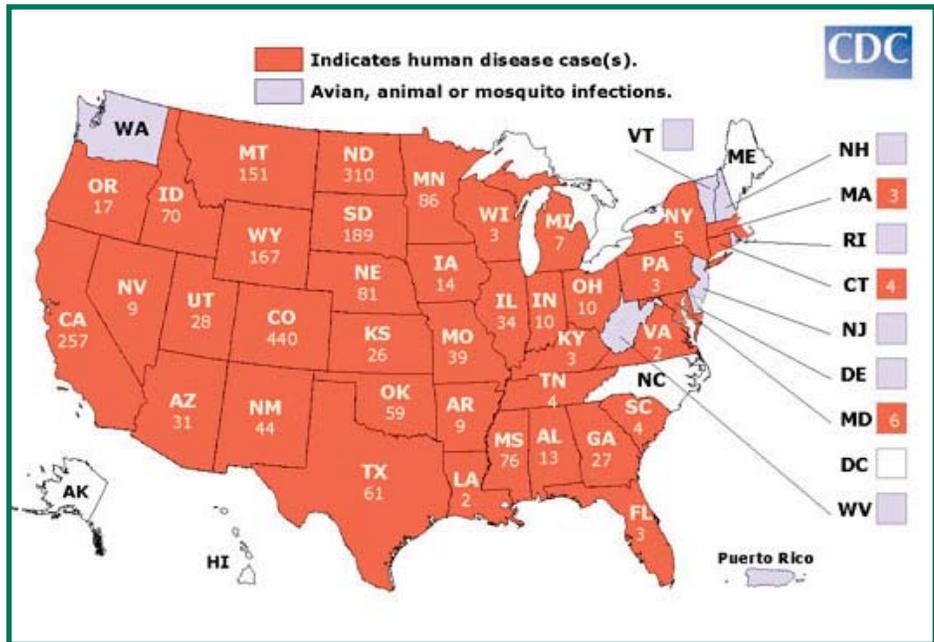
Since the introduction of WNV to the United States in New York City in 1999, the virus has made a complete westward expansion to the West Coast. Starting in the Northeastern parts of the United States, the virus steadily progressed through the South, the Midwest, the Rocky Mountain region, and now the Western States.

WNV Activity 2002-06

Cases of human WNV disease have been seen throughout a large part of the country with many states including Colorado, rebounding to near epidemic outbreaks of human disease.

Colorado first saw activity of the virus late in the summer of 2002. In 2003 Colorado was the hardest hit state compiling 2947 human cases and 63 deaths most of which occurred along the Front Range. By 2004 the majority of the cases shifted to the Western Slope and the state totaled 291 cases with 4 deaths (Mesa County).

In Colorado in 2004 and 2005 WNV activity was spread throughout the state with no particular clustering in any one region. In 2006 with early hot and dry conditions *Culex* mosquitoes had an early surge which increased early season viral amplification which showed up in August and September as hundreds of positive mosquito pools and then over 269 human WNV cases along the northern Front Range and in hot spot areas such as Delta county across the state. 7 deaths occurred in 2006 in Colorado.



WNV Activity 2007

As described above, early season weather conditions were perfect for the rapid development and sustainability of large *Culex tarsalis* and *pipiens* populations. Also early positive mosquito pool tests indicated trouble from the start. The first positive mosquito pools (3) were from Larimer County on June 19th. Weld County was next with positive pools showing up on July 6th. Mesa County had their first positive pool on July 12, with Garfield coming in shortly after that on July 17th. Mesa County had a total of 19 positive mosquito pools for the season. Garfield had 2 positive pools, but a total of 5 reported human cases, a dramatic rise from previous seasons. West Nile was here in force and was very wide-spread very, very early.

LARVAL MOSQUITO CONTROL

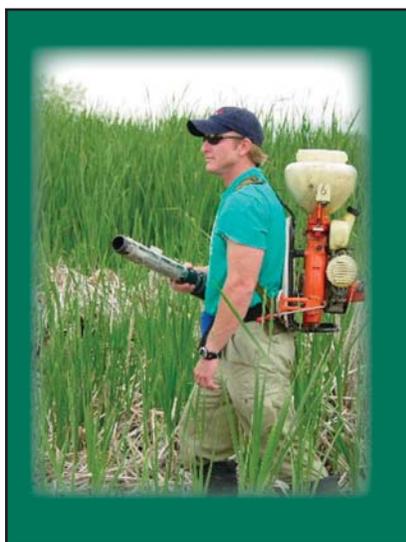
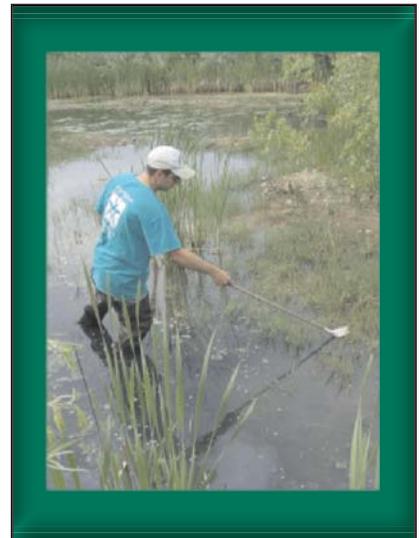
Practical experience and research have shown that the most effective way to control mosquito populations is through an aggressive Integrated Pest Management (IPM) approach. This approach aims at using a variety of concepts, tools, and products to reduce a pest population to tolerable levels. Translating these ideas to mosquito control, CMC has found the most environmentally and economically sound approach is through targeting the aquatic larval stage of the mosquito. Targeting this stage prevents the emergence of the adult mosquito and thus the inevitable result of disease and nuisance. Over 93% of Colorado Mosquito Control, Inc. (CMC) operational efforts are focused on larval control.

Larval mosquito control can be achieved in several ways including biological, biochemical, chemical, and mechanical means. Although there are a variety of methods of reducing larval populations some may have greater consequence than benefit. Mechanical or habitat modification is a technique which may be used, but the area to be modified and the extent to which the work will affect the surrounding area must be carefully reviewed. Permanent ecological damage may occur if extensive habitat change has taken place. True biological controls may, too, have costs which outweigh the benefits or competency of their control capacity. Predatory fish serve as a good example of this.

The mosquito fish (*Gambusia affinis*), an introduced species, while an effective predator on mosquito larvae, may have much larger dangers to native fish of Colorado waters. A very aggressive eater and rapid reproducer, *Gambusia* often out-compete their native counterparts. Due to these factors the Colorado Division of Wildlife (CDOW) has placed restrictions on the stocking and use of the fish. However, this year CMC obtained, stocked and distributed a supply of fathead minnows (*Pimephales promelas*), a native Colorado species. Fish were made available to residents of some areas for placement in irrigation

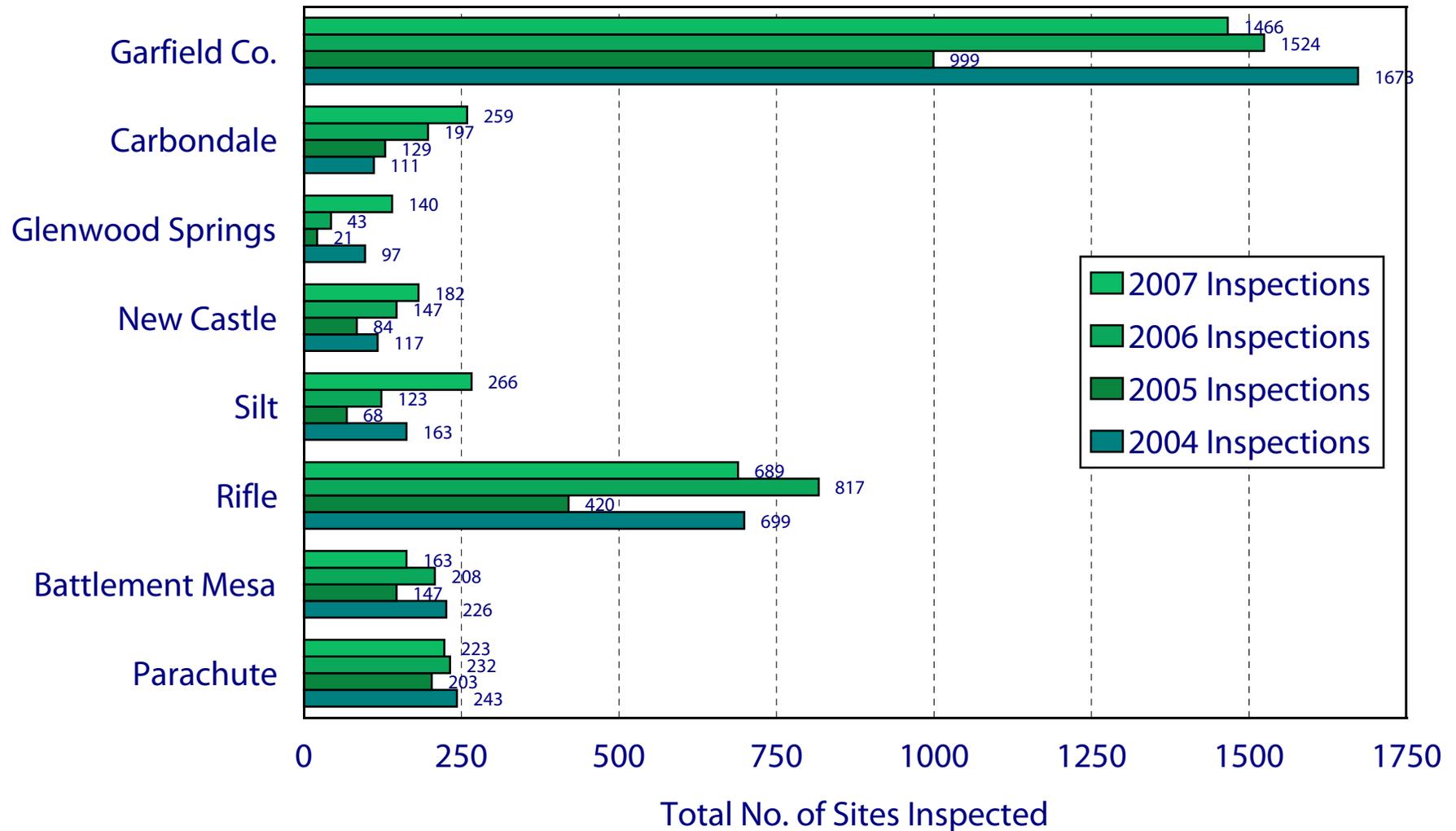
or ornamental ponds. In general however, predatory fish and other biological controls such as bird and bats do not provide sufficient control of mosquito populations to be used as the sole mechanism. Other methods must be used to gain adequate larval mosquito population reductions.

CMC's favored method of larval mosquito control is through bacterial bio-rational products. The main product used by CMC is a variety of bacteria (*Bacillus thuringiensis var. israeliensis*). *Bti* as it is known has become



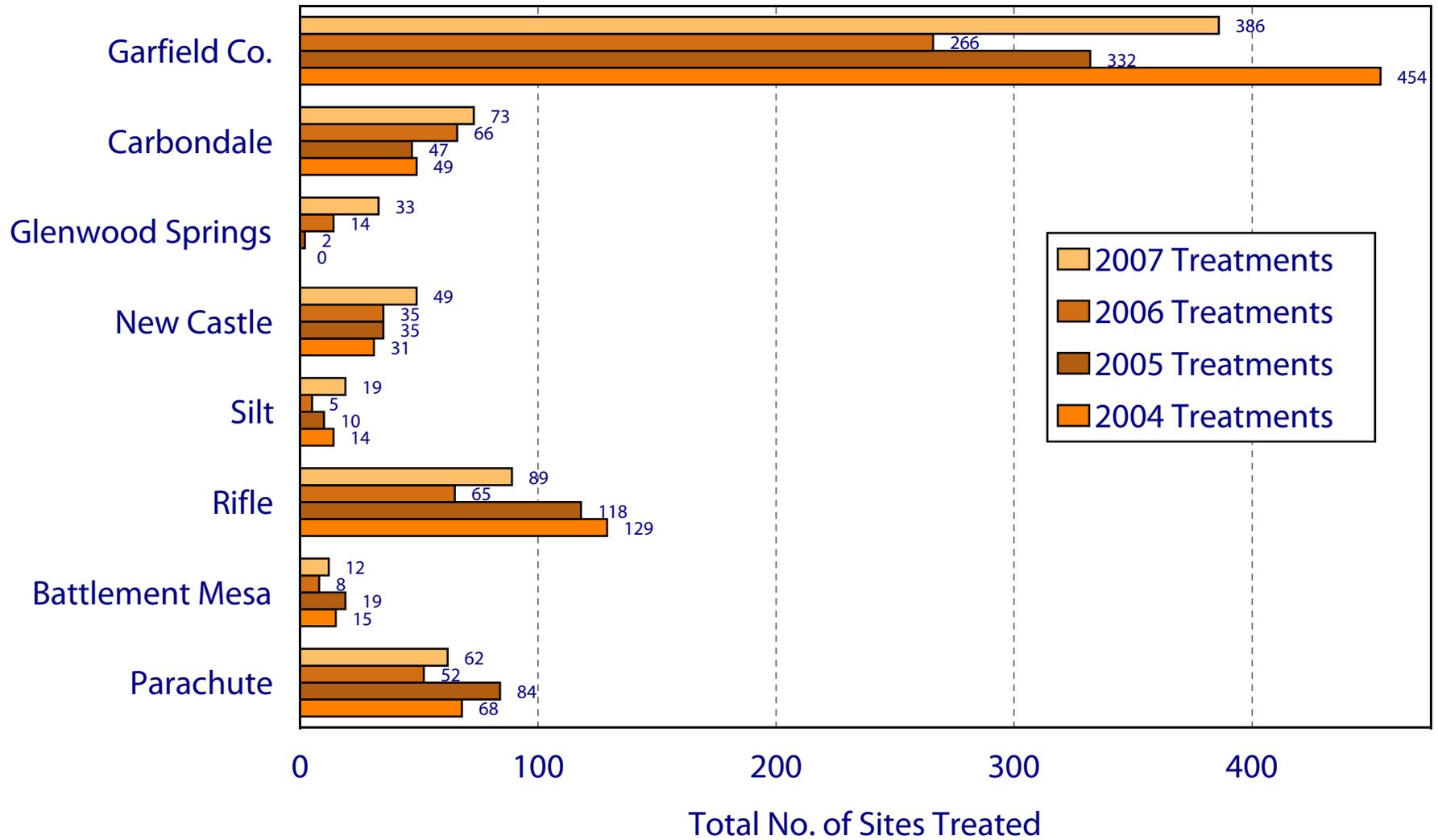
Larval Site Inspections by Service Area

2004-'07 Garfield County Mosquito Control Program



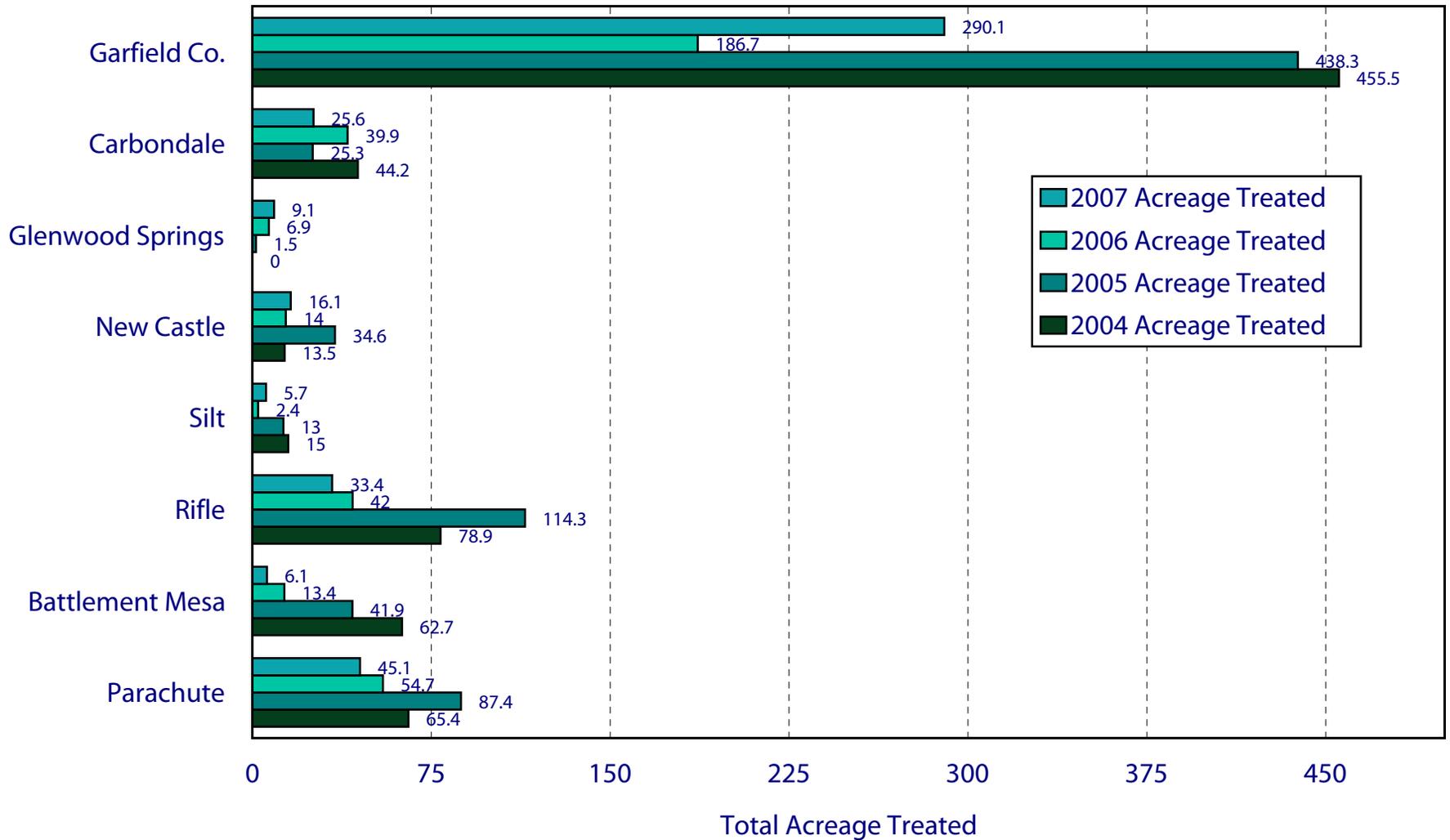
Larval Site Treatments by Service Area

2004-'07 Garfield County Mosquito Control Program



Larval Acreage Treated by Service Area

2004-07 Garfield County Mosquito Control Program



the cornerstone of mosquito control programs throughout the world. The benefits include its efficacy and lack of environmental impacts. When used properly, successful control without impact to aquatic invertebrates, birds, mammals, fish, amphibians, reptiles, or humans can be achieved. A broad label allows for the use of the product in the majority of the habitats throughout the Garfield County area.

Another bacterial product closely related to *Bti* is *Bacillus sphaericus* (*Bs*). In addition to all of the benefits of *Bti*, *Bs* is by definition a true biological control agent in that it remains in the system through multiple broods, or generations, of mosquitoes. Unfortunately the residual benefit of the control comes at a cost in price of approximately three times that of *Bti*.

Other larval control products include a growth regulator (methoprene), a mineral oil, and an organophosphate (Abate). Methoprene is a synthetic copy of a juvenile growth hormone in larval mosquitoes. The hormone prevents normal development of the adult mosquito in the pupal stage eventually causing death. While a good control product, the cost is prohibitive to be the predominant product in a large scale program. However, in areas such as the retention ponds at the new Target shopping area in Glenwood Springs, this control product proves highly effective. Abate, the one chemical larval control product CMC uses, serves as an effective product, but label restrictions limit its use in many areas. CMC limits the use of chemical larvicides to areas with little biodiversity, such as road side ditches. The benefits of these products are the availability of 30 and 150 day formulations. Mineral oil is the only product effective on the pupal stage and therefore is an essential tool when pupae are found.

All the fore mentioned methods and products represent the essential ingredients of Integrated Pest Management. Mosquitoes are very well adapted animals and can be found in many different habitat types from a cattail marsh to a cup littered on the side of the road. A variety of tools must

be used to prevent resistance and ensure the best method will be available for any given situation.

CMC constantly strives to improve its operations. Most recently CMC has implemented several high tech solutions to what historically has been a particularly low tech industry. CMC's "CMMS" (Computerized Mosquito Management System) utilizes historical data to analyze and identify areas and sites of particular importance. Additionally, a sample of larvae from all sites found to be breeding is collected and brought back to the lab for identification purposes. This allows for a specific knowledge of each site especially in the event of a disease outbreak where a particular species has been found to be the vector. Targeted inspections then allow for resources to be allocated efficiently.

CMC SURVEILLANCE LABORATORY

Data on mosquito abundance and species identity is critical in the operation of a successful mosquito

control program. Over the past few years identifying, packaging and sending Culex mosquito pool samples off to the CDPHE Labs for virus testing has also become critically important in the battle against West Nile and other mosquito-borne disease. The Colorado Mosquito Control Surveillance Laboratory managed by Dr. Michael “Doc” Weissmann has become the largest single source of adult and larval mosquito surveillance data in the state of Colorado.

CMC employs two kinds of traps to monitor mosquito populations. The CDC light trap uses carbon-dioxide from dry ice as bait to attract female mosquitoes seeking a blood meal from a breathing animal. Once attracted by the CO₂, the mosquitoes are lured by a small light to a fan that pulls them into a net for collection. The Gravid Trap uses a tub of highly-organic water as bait to attract female mosquitoes that are looking for a place to lay their eggs. A fan placed close to the water surface forces mosquitoes that come to the water into a collection net. Once back in the laboratory, the contents of the trap nets are counted and identified by technicians trained to recognize the Colorado mosquito species.

In 2007, Colorado Mosquito Control monitored a statewide network with more than 3,640 trap nights set, collecting 632,692 adult mosquitoes that were counted and identified to species by the CMC Surveillance Laboratory. While individual traps provide only limited information, trap data is interpreted in the context of historical records for the same trap site, going back in time more than a decade in some areas. Individual traps are also compared to other traps from around the region that were set on the same night and therefore exposed to similar weather conditions. Technicians working in the Surveillance Laboratory at Colorado Mosquito Control, Inc. are trained to provide

accurate species-level identification of mosquito specimens, for both adults and larvae. More than 50 mosquito species are believed to occur in Colorado, and 29 of those were identified from samples processed during the 2007 season from across the state.

Additionally, the CMC Surveillance Laboratory conducts an intensive larval identification program with over 8,000 larval mosquito samples collected by I&L technicians prior to larviciding being identified to species. This information is now invaluable in targeting mosquito control efforts as we gain a greater understanding of the habitat types preferred by Colorado mosquito species and the seasonality of these habitats as sites for mosquito development.

Specimens and data collected from these traps and larval identification are used in:

- Determining effectiveness of larval control efforts. Each mosquito species prefers specific kinds of habitats for larval development. If a trap includes large numbers, it could indicate the presence of an unknown larval habitat and, based on the species identification and known habitat preference for that species, direct field technicians as to possible sources of the mosquitoes collected.



- Determining larval and adult mosquito species which helps illustrate the threat of mosquito-borne disease amplification and transmission.
- Determining where adult control efforts were necessary. While mosquito eradication is impossible, significant population reduction is achievable. In places where larval control was insufficient, especially in neighborhoods where adult mosquitoes migrated in from larval sources outside of the control area, it may be necessary to use adulticide methods such as ULV truck fogging or barrier sprays of nearby harborage areas. Trap counts that were in excess of an acceptable threshold for the area would trigger adult control



measures.

- Surveillance for Mosquito-borne Disease. Historically, CMC efforts were targeted primarily at controlling mosquito nuisance problems with limited disease surveillance. However, since the arrival of the West Nile Virus in Colorado in August of 2002, the paradigm has shifted toward disease prevention and control. Accurate species identification of the mosquitoes in the traps is important when monitoring species population trends. It also is necessary for evaluating whether a population spike represents an actual increase in disease transmission potential or only an increased nuisance level. Additionally, a majority of the *Culex* specimens collected in the CMC traps during the 2007 season were sent to the CO State Health Department laboratory or one of the regional county laboratories to be tested for West Nile Virus and other mosquito-borne diseases. The infection rates of West Nile Virus in *Culex* mosquitoes in 2007 was comparable to the unprecedented high rates in 2003 season, the only real difference between 2007 and 2003 seems to be in the actual overall number of *Culex* mosquitoes at the end of the season, not in the percentage of mosquitoes that were infected with the virus.

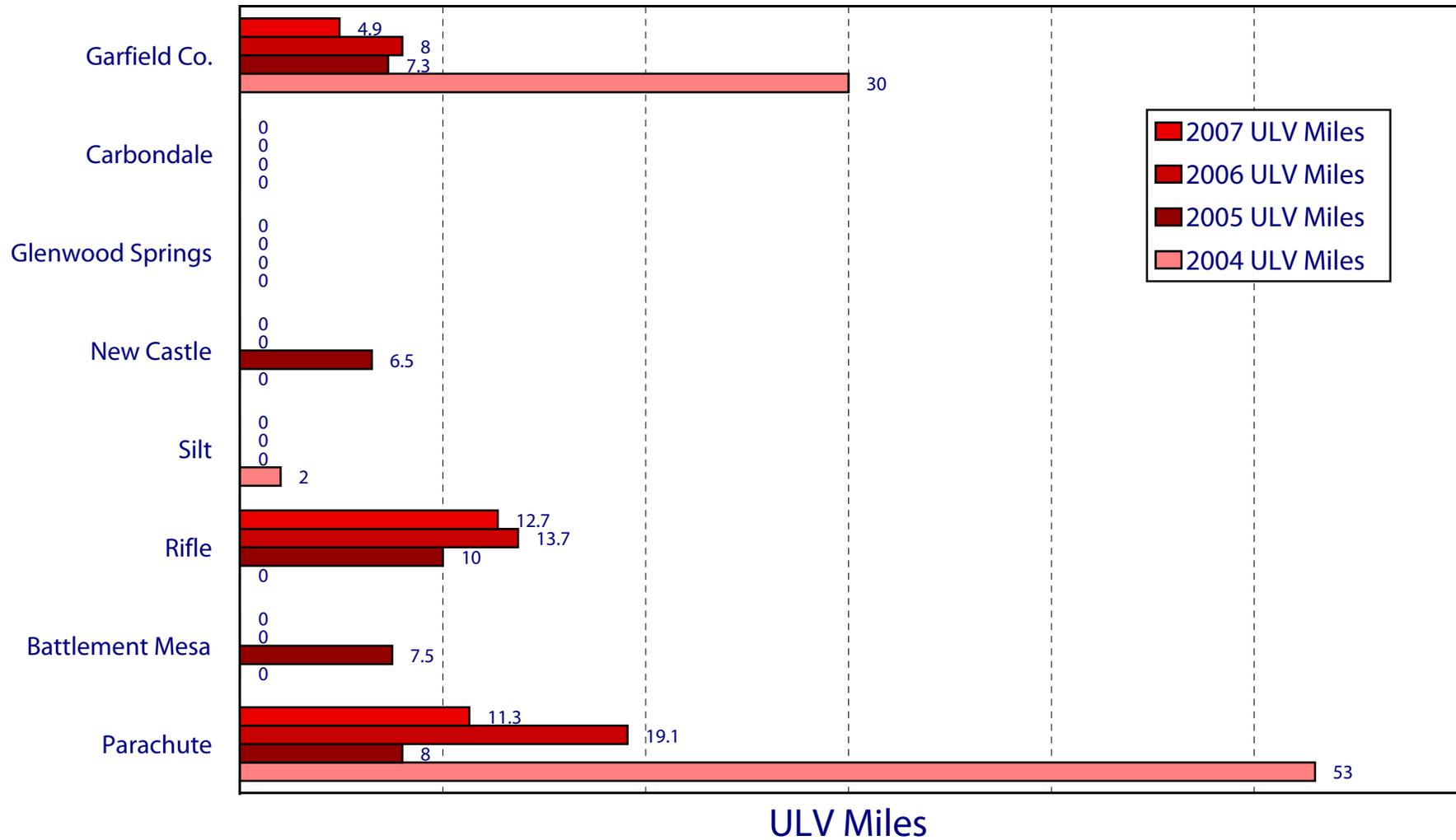
2007 has shown that it is critically important to continue mosquito surveillance and control operations in future years. The threat of West Nile Virus and other mosquito-borne diseases is here and is not going away.

2007 ADULT CONTROL

Controlling the adult mosquito is an essential

ULV Adulicide Comparison By Service Area

2004-07 Garfield County Mosquito Control Program



component of a fully Integrated Mosquito Management Program. Although the primary focus of our programs is on larval control first and foremost, adult control methods are used when data shows that adult populations of mosquitoes are present in large numbers and/or there is an imminent threat of mosquito-borne disease transmission. Adult mosquitoes can come from unknown unidentified sites or may migrate in from uncontrolled areas. Adult mosquito surveillance efforts discussed above can help to pinpoint these unidentified larval sites and target both larval and adult control efforts. These large adult populations bring with them discomfort, concern, and the potential for disease transmission.

The Garfield County Cooperative Mosquito Control Program uses all available data from CDC light traps, Mosquito Hotline annoyance calls, and field technician reports to focus adult mosquito control efforts on specific, very limited “targeted” areas. In parts of the community where high numbers of mosquito annoyance calls are received, “floater” CDC light traps are set to evaluate adult population levels and species make-up. In most cases, a direct correlation is evident between areas with high complaint calls and high trap counts. While this correlation allows us to focus adult control in these areas, the emphasis is placed on finding the source of breeding and continued larval control measures.

Colorado Mosquito Control uses state of the art technology, correct application timing, and least-toxic products to minimize all non-target impact. All adult mosquito control is accomplished using calibrated Ultra Low Volume (ULV) equipment and performed after dusk. This type of equipment produces droplets averaging 12 microns in diameter and allows for a minimal amount of product to be put into the environment. These treatments take place in the evening when mosquitoes are flying in greater numbers and non-target activity is greatly reduced. Using this application technique, the overall goal of minimal environmental impact and effective adult control is achieved in the targeted area.

In 2006 we introduced the water-based product AquaLuer for ULV adult mosquito control and continued its use in 2007. Its active ingredient; permethrin is highly effective against mosquitoes, while the water-base provides a much more environmentally sound solution to traditional petroleum oil-based adulticides. Results this year have again proven that this is the right choice for the adulticide portion of the Integrated Mosquito Management Program.

Colorado Mosquito Control again offered short term residual backpack barrier treatments for special city and town events such as concerts in the park and festivals, as well as to areas such as walking and bike paths showing above average mosquito populations. If the adult mosquito population is moderate, although more labor intensive, it is often more effective to spray a localized harborage area to provide control during an event or for outdoor activities. Barrier treatments are typically effective for a period of 2 to 4 days, and present a very low toxicity profile to humans and domestic animals. If the mosquito population is high or the area is too large, barrier treatments are complimented with ULV adulticiding previous to the event.

As we look towards the 2008 season, we will continue to evaluate treatment areas, and any new control products coming to the market, and as always listen to the goals and needs of our customers so that we will again have an effective program with the least amount of impact to the environment.

ENVIRONMENTAL RESPONSIBILITY

Colorado Mosquito Control puts forth incessant effort to minimize environmental impacts while maximizing efficiency and efficacy of our programs. Using the framework of Integrated Pest Management (IPM) and through the implementation of new and existing technologies, we have been able to develop the most sustainable mosquito control programs in the country while maintaining successful control of mosquito populations with minimal impact to human health and the environment.

INTEGRATED PEST MANAGEMENT (IPM)
INTEGRATED MOSQUITO MANAGEMENT (IMM)

CMC has always strived to create the most comprehensive mosquito control programs using the principles of Integrated Pest Management (IPM). IPM allows for management of pests only after careful analysis of the pest at hand and thoughtful selection of methods that will have the greatest efficacy, and the least environmental, economic, and health impacts has been performed. With this, CMC uses only products and application methods that target mosquitoes with minimal risk to non-target organisms or human health. For our Integrated Mosquito Management (IMM) programs, the staple product is *Bacillus thuringiensis israeliensis* (Bti). Bti is the most favorable mosquito control product on the market today and has found favor with both traditional mosquito control programs as well as with environmental advocates for its efficacy in controlling mosquitoes while maintaining target specificity and lack of adverse health effects. Over 90% of CMC's operational applications continue to be with Bti.

However, a true IPM or IMM program cannot rely on the use of a single control method and does not exist without the use of all available tools to control mosquitoes at specific locations or life stages. CMC utilizes a number of techniques to control mosquitoes site specifically through the additional use of native fish as biological controls, biological/bio-rational products such as Bti and *Bacillus sphaericus* (Bs), target specific Insect Growth Regulators (IGR) and mineral oil. Additionally, adult mosquito control continues to be a very small, but integral part of a true IMM program. While adult control is at times necessary in any mosquito control program, CMC recognizes the inherent risks of any pesticide application and through implementation of our Comprehensive Mosquito Management System (CMMS) database, extensive adult and larval surveillance, and input from field personnel we have been able to reduce adult applications throughout our program areas to target those areas only truly necessary. Even through 2007 was a high mosquito population year, average adulticide applications have been reduced in most areas (excluding West Nile Virus emergency control applications).

TECHNOLOGY

While the principles of IPM/IMM serve as a framework for control, CMC has always understood the importance of technology and its value in improving efficiency, accuracy, and efficacy of our field surveillance, larval and adult control operations. Years of program development and refinement have resulted in the creation of vast array of geospatial, operational, and historical data.

Comprehensive Mosquito Management System (CMMS)

2007 marks the first full year implementation of our Comprehensive Mosquito Management System (CMMS). CMMS has been built from the ground up over the past 14 years specifically to address the need of comprehensive data collection, storage analysis and reporting. With 300,000+ site inspection records, CMMS allows us to quickly analyze the history of individual sites to assess their potential for larval development based on a variety of factors such as time of year, number of inspections, history of water presence, larval presence and treatments. The end result is a targeted listing of sites for field technicians to inspect that has been specifically chosen based on a complex algorithmic analysis of historical data. Targeting of sites increases our ability to prioritize sites that have the highest potential to produce mosquitoes and limit time spent on low

potential sites. This has led to overall fewer site inspections, but greater site acreage treated through the 2007 season. Other environmentally oriented added benefits include reduced labor, fewer miles driven and less gasoline used (i.e. a smaller carbon footprint!). The true measure of our larval control efficiency is calculated by the average acreage treated per site visit. Further, CMMS provides for the quick composition of reports. These reports allow for more rapid data retrieval and analysis as well as faster customer service response.

Geographic Information Systems (GIS)

Geographic Information Systems (GIS) have become an invaluable tool in a variety of industries from business applications, to disaster preparedness to biological and environmental applications. CMC was one of the first mosquito control organizations to understand its usefulness and make a commitment to and implement GIS application to mosquito control starting in the mid-1990's. CMC maintains a large catalog of geospatial data detailing locations of potential larval breeding sites, associated site information such as habitat type, water source, and landowner information, adult mosquito surveillance data and resident contact information. All GIS work is performed in house by CMC personnel and is never subcontracted which can lead to increased turnaround time, better accuracy and a better understanding of the data.

Digital Interactive Reports

Another new addition to CMC's programs this year has been the introduction of a new interactive program data reporting system. Based on an informational "dashboard", this is a first for the mosquito control industry and allows users to access historical data from number of inspections and treatments to adult surveillance data and adulticide data in an easy to ready graphical format. Interactive reports are updated consistently to contain all current data throughout the season.

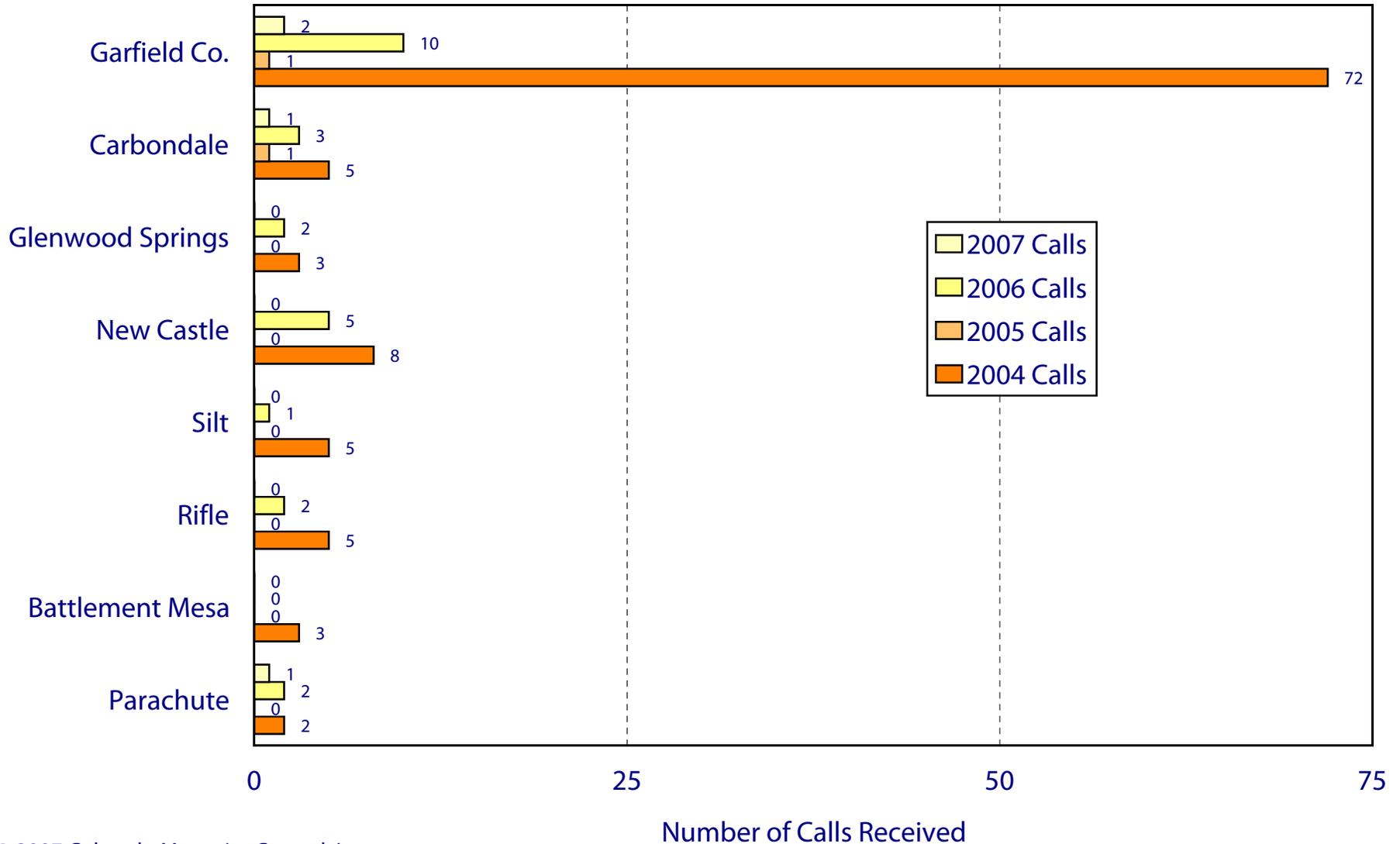
FUTURE

There are few new or novel larval or adult control products in development, and no "magic bullet exists, thus continued program evolution along an environmentally oriented path must come from the implementation of new technologies as they emerge to traditional mosquito control activities. CMC is currently exploring the possibility of utilizing "real-time" infrared satellite imagery to better locate and time larval development site inspections in conjunction with our CMMS database targeting system. CMC remains committed to improved environmentally sound mosquito control through the use technology.

2007 PUBLIC RELATIONS AND EDUCATION

MosquitoLine Calls by Service Area

2004-07 Garfield County Mosquito Control Program



Colorado Mosquito Control also places a heavy emphasis on public relations, customer service, and community education. With the introduction and continued media coverage of West Nile Virus, residents have become increasingly more involved with mosquito control operations. In 2007 our staff focused on providing area residents and visitors with information on the program, what they can do to help, and offer solutions to localized problems such as mosquito breeding habitats, localized annoyance and protection from West Nile viral disease.

Customer Service

Customer service was again a very high priority. We take pride in training each and every technician so that they have the confidence and information to provide residents with the correct answers to sometimes difficult questions. Each field technician spends part of their day responding to resident concerns in their work area. This in-field customer service personalizes each mosquito control program, provides us with local information on mosquito activity and provides the valuable opportunity to truly communicate face to face with the residents we serve. Residents are always encouraged to call the Mosquito Hotline to report areas with high mosquito annoyance and potential standing water breeding habitat. These calls compliment CDC light trap data, allow us to pinpoint problem areas, and ultimately provide another valuable resource for our control efforts.

Another important component of CMC's customer service is the notification and shutoff database. Providing residents with this option has proven to be an effective tool in community relations. Our database is updated throughout the year to ensure that the names, phone numbers, and addresses are correct before any spraying is planned within a given community. This service is also often seen as another way that their community officials place an importance on understanding and meeting the different needs of each resident.

Community Outreach and Education

In 2007 CMC further increased our community outreach programs to provide residents and visitors with a better understanding of the value and scope of their mosquito control program. Outreach has proven to have a very positive impact on the community. Throughout the summer outreach events were attended such as Farmer's Markets, city council meetings, concerts, and fairs. The feedback we received was extremely positive not only from residents, but from local government attendees as well. These outreach programs provided information and education on all areas of mosquito control. Individual program services were discussed, but an emphasis was also placed on what individuals can do to eliminate standing water on and around their property, how to reach us via phone and website, and even the proper application of mosquito repellents. However the one of the most important messages conveyed was the importance and minimal environmental impact of larviciding. Many residents often see mosquito control as only a fog truck spraying down the street. Residents learned that over 90% of what their program involves is larval control, and that this provides lower environmental impacts and highly successful mosquito population reduction. Because of the positive feedback of these educational outreach programs, we will continue these throughout the upcoming 2008 mosquito control season.

SUMMARY

The 2007 Garfield County Cooperative Mosquito Control Program remained in the spot-light this year with the strong reemergence of West Nile Virus in Colorado. Fortunately the 2007 "Perfect Storm 2" with the strong resurgence of WNV across the state did not compare to the original 2003 "Perfect Storm" WNV epidemic. Unfortunately we have been correct in our prognostication that in future years Colorado would see increased West Nile Virus activity, particularly human cases and associated deaths. This resurgence in mosquito-borne disease clearly illustrates the continued need for on-going mosquito control, mosquito surveillance and vigilance.

CMC's website continues to be successful, based on the number of "hits", favorable e-mails and requests for more information received from county residents and literally from around the world.

Colorado Mosquito Control, Inc. continues to effectively serve the residents of Garfield County and the Garfield County Cooperative Mosquito Control Program using integrated mosquito management and state of the art technology to reduce mosquito nuisance and the related potential for disease transmission including West Nile Virus. CMC continued to promote a responsible IPM approach to mosquito management, fully utilizing all available biological control techniques while minimizing the use of chemical pesticides. CMC has been able to develop both a cost-effective and efficient program in Garfield County over the past seasons and looks forward to continued service in 2008 and beyond. We also know that there is always room for improvement and have high expectations for program improvements and new successes in future years.

Colorado Mosquito Control, Inc.

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CMMS™
Colorado Mosquito Control, Inc.

LARVAL-DATA SUMMARY

by REPORT DATE: 1/1/2007 to 10/1/2007

by COUNTY: Garfield

	Total Site Inspections	No. Wet Sites	Percentage Wet Sites	No. Sites Treated	Percentage Breeding*	Total Acres Treated
Battlement Mesa	163	67	41.10%	12	17.91%	6.1
Carbondale, Town of	259	219	84.56%	73	33.33%	25.6
Garfield County Unincorporated	1466	1087	74.15%	386	35.51%	290.1
Glenwood Springs, City of	140	79	56.43%	33	41.77%	9.1
New Castle, Town of	182	140	76.92%	49	35.00%	16.1
Parachute, Town of	223	177	79.37%	62	35.03%	45.1
Rifle, Town of	689	408	59.22%	89	21.81%	33.4
Silt, Town of	266	83	31.20%	19	22.89%	5.7

* (Sites Treated/Sites Wet)



CMMS
Colorado Mosquito Control, Inc.

MosquitoLine Call Summary

by REPORT DATE: 1/1/2007 to 10/1/2007
 by COUNTY: Garfield

County	Customer	
Garfield		
	Carbondale, Town of	1
	Garfield County Unincorporated	2
	Parachute, Town of	1
	Total Calls	4

CMMS - Comprehensive Mosquito Management System

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ADULT TRAP DATA - SPECIES SUMMARY

by REPORT DATE: 1/1/2007 to 10/1/2007
 by COUNTY: Garfield

Species	Total
Aedes (Oc.) dorsalis	472
Aedes (Oc.) increpitus	53
Aedes (Oc.) melanimon	1419
Aedes (Oc.) nigromaculis	31
Aedes (Oc.) sticticus	2
Aedes (Oc.) trivittatus	4
Aedes cinereus	256
Aedes vexans	7526
Aedes-Ochlerotatus species	13
	9776
Anopheles hermsi	1622
	1622
Culiseta inornata	913
	913
Culex erythrothorax	3002
Culex pipiens	282
Culex salinarius	1
Culex tarsalis	6681
	9966
Operational but empty	0
Trap malfunction	0
	0

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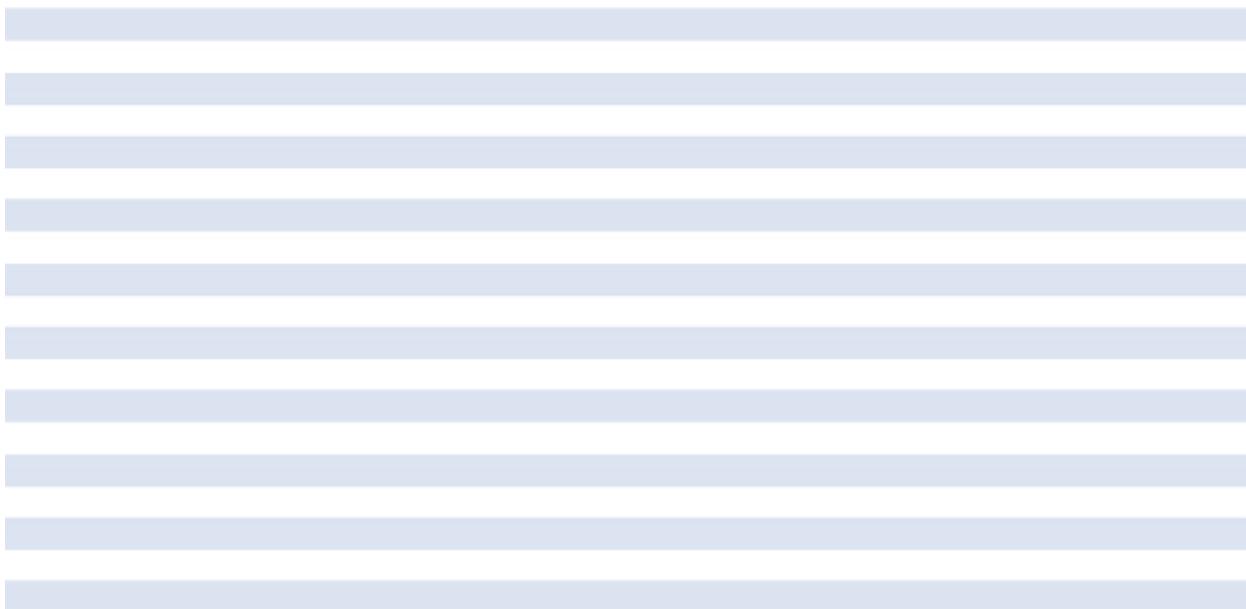
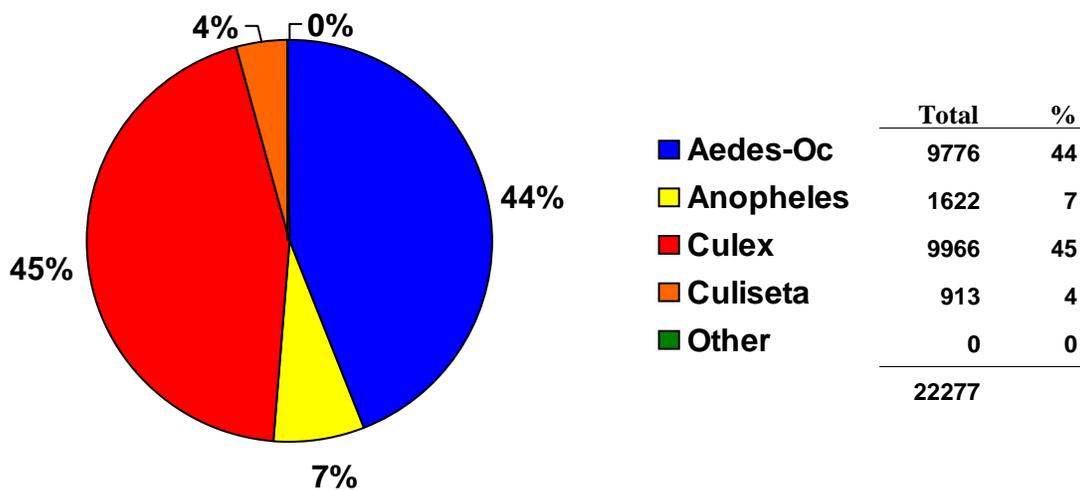


ADULT TRAP DATA - SPECIES SUMMARY

by REPORT DATE: 1/1/2007 to 10/1/2007
 by COUNTY: Garfield

Species

Total



CMMS - Comprehensive Mosquito Management System

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ADULTICIDE - CUSTOMER

by REPORT DATE: 1/1/2007 to 10/1/2007
 by COUNTY: Garfield

Subdiv/Area	Material	Start Time	End Time	Miles
Garfield County Unincorporated				
Truck ULV				
8/23/2007 COALRIDGE HIGH	AquaLuer ULV	8:07 PM	8:26 PM	4.9
			Truck ULV	Sum
				4.9
				Avg
				4.9
				Min
				4.9
				Max
				4.9
Parachute Town of				
Truck ULV				
7/3/2007 COTTONWOOD PARK	AquaLuer ULV	10:20 PM	10:46 PM	3.0
8/1/2007 COTTONWOOD PARK	AquaLuer ULV	8:58 PM	9:07 PM	1.0
8/1/2007 NORTH SIDE	AquaLuer ULV	8:38 PM	8:49 PM	2.0
8/15/2007 COTTONWOOD PARK	AquaLuer ULV	8:21 PM	8:39 PM	3.0
8/23/2007 DOWNTOWN	AquaLuer ULV	9:37 PM	9:45 PM	1.5
8/23/2007 COTTONWOOD PARK	AquaLuer ULV	9:21 PM	9:28 PM	0.8
			Truck ULV	Sum
				11.3
				Avg
				1.9
				Min
				0.8
				Max
				3.0
Rifle Town of				
Truck ULV				
7/3/2007 MILE POND	AquaLuer ULV	9:43 PM	10:05 PM	3.9
7/3/2007 LYONS PARK	AquaLuer ULV	9:30 PM	9:38 PM	1.2
8/15/2007 MILE POND	AquaLuer ULV	9:21 PM	9:50 PM	4.0
8/15/2007 MIDDLE SCHOOL	AquaLuer ULV	9:06 PM	9:17 PM	1.0
8/23/2007 MILE POND	AquaLuer ULV	8:46 PM	9:04 PM	2.6
			Truck ULV	Sum
				12.7
				Avg
				2.5
				Min
				1.0
				Max
				4.0
Grand Total Miles				28.9

2007 Garfield County CDC Light Trap Composite Data

Total number of trap/nights set: 142
 Total number of mosquitoes collected: 22,487
 Average mosquitoes per trap/night: 158

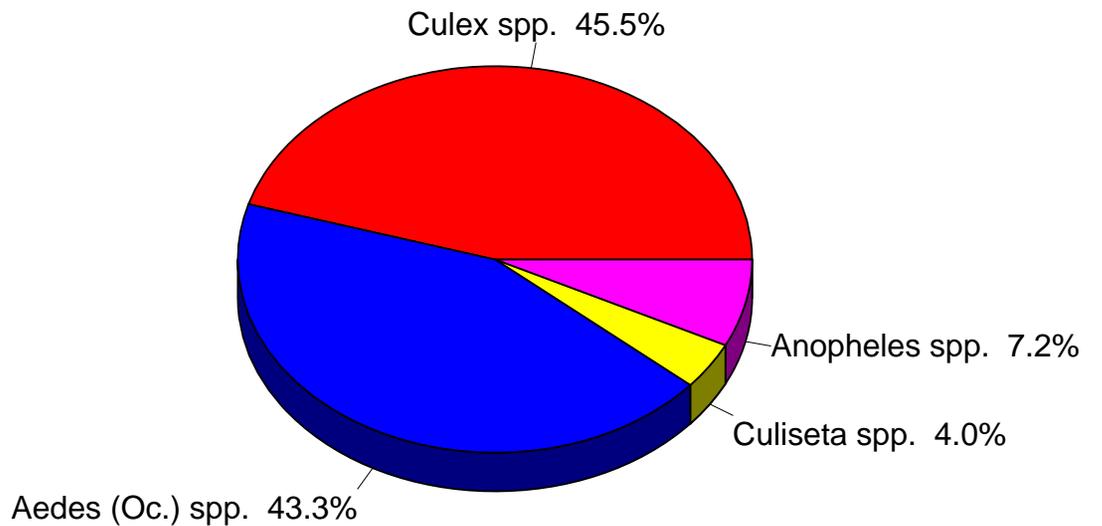
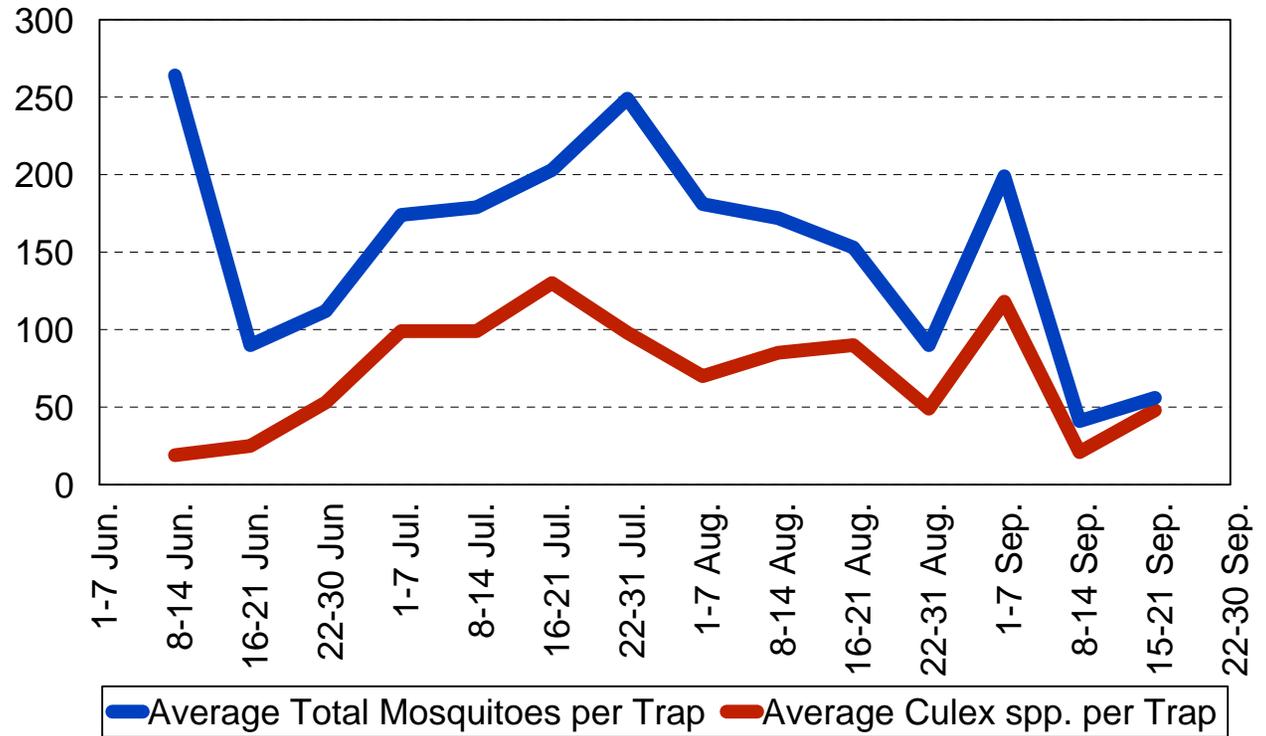
Trap sites included in this data: BM-06, CD-02, CD-11, GW-08, NC-02, PR-01, RF-01, RF-15, RF-16, and SI-09

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) increpitus*
- Aedes (Oc.) melanimon*
- Aedes (Oc.) nigromaculis*
- Aedes sticticus*
- Aedes (Oc.) trivittatus*
- Anopheles hermsi*
- Culex erythrothorax*
- Culex pipiens*
- Culex salinarius*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes (Oc.)</i> spp.	9,726	43.3%
<i>Anopheles</i> spp.	1,622	7.2%
<i>Coquillettidia</i> spp.	0	0.0%
<i>Culex</i> spp.	10,234	45.5%
<i>Culiseta</i> spp.	905	4.0%



BM-06: Battlement Mesa 300 Road

Season: 2007
Trap Type: Light/CO₂
Location: Battlement Mesa 300 Road
GPS: N39° 27.021', W108° 2.365'

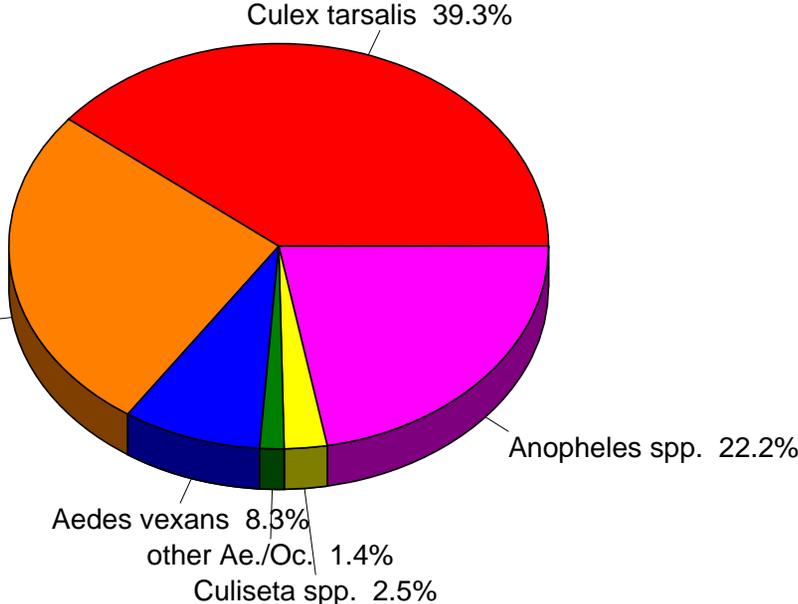
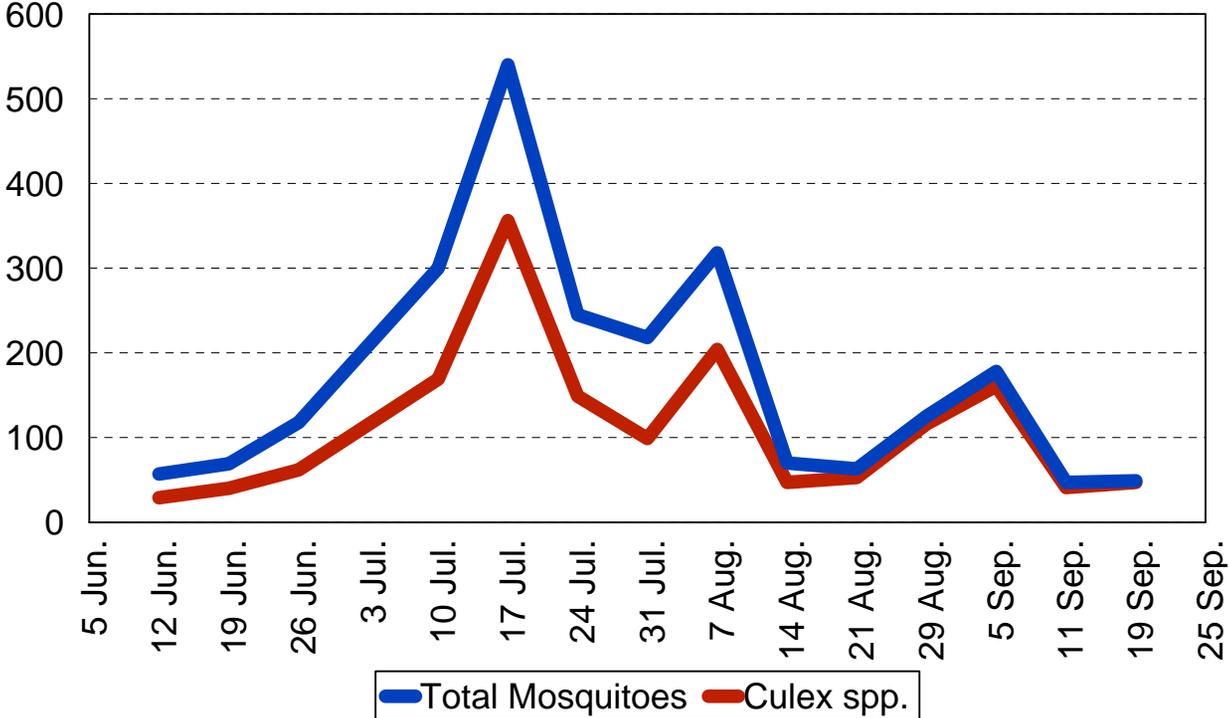
Total number of trap/nights set: 14
Total number of mosquitoes collected: 2,397
Average mosquitoes per trap/night: 171

Species collected:

- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) increpitus*
- Aedes (Oc.) melanimon*
- Anopheles hermsi*
- Culex erythrothorax*
- Culex pipiens*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	199	8.3%
Other <i>Aedes/Ochlerotatus</i>	33	1.4%
<i>Anopheles hermsi</i>	533	22.2%
<i>Culex tarsalis</i>	941	39.3%
Other <i>Culex</i>	632	26.4%
<i>Culiseta inornata</i>	59	2.5%



CD-02: Carbondale Saint Finbar

Season: 2007

Trap Type: Light/CO₂

Location: Carbondale, in Saint Finbar "neighborhood"

Behind Aspen Equestrian Center

GPS: N39° 24.229', W107° 9.512'

Total number of trap/nights set: 14

Total number of mosquitoes collected: 156

Average mosquitoes per trap/night: 11

Species collected:

Aedes cinereus

Aedes vexans

Aedes (Oc.) dorsalis

Aedes (Oc.) increpitus

Aedes (Oc.) melanimon

Aedes sticticus

Anopheles hermsi

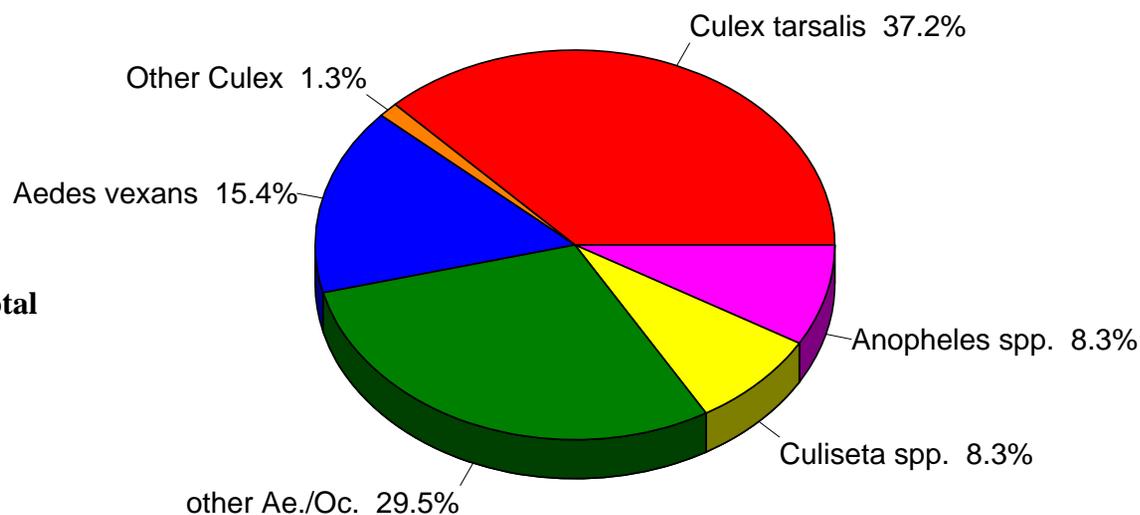
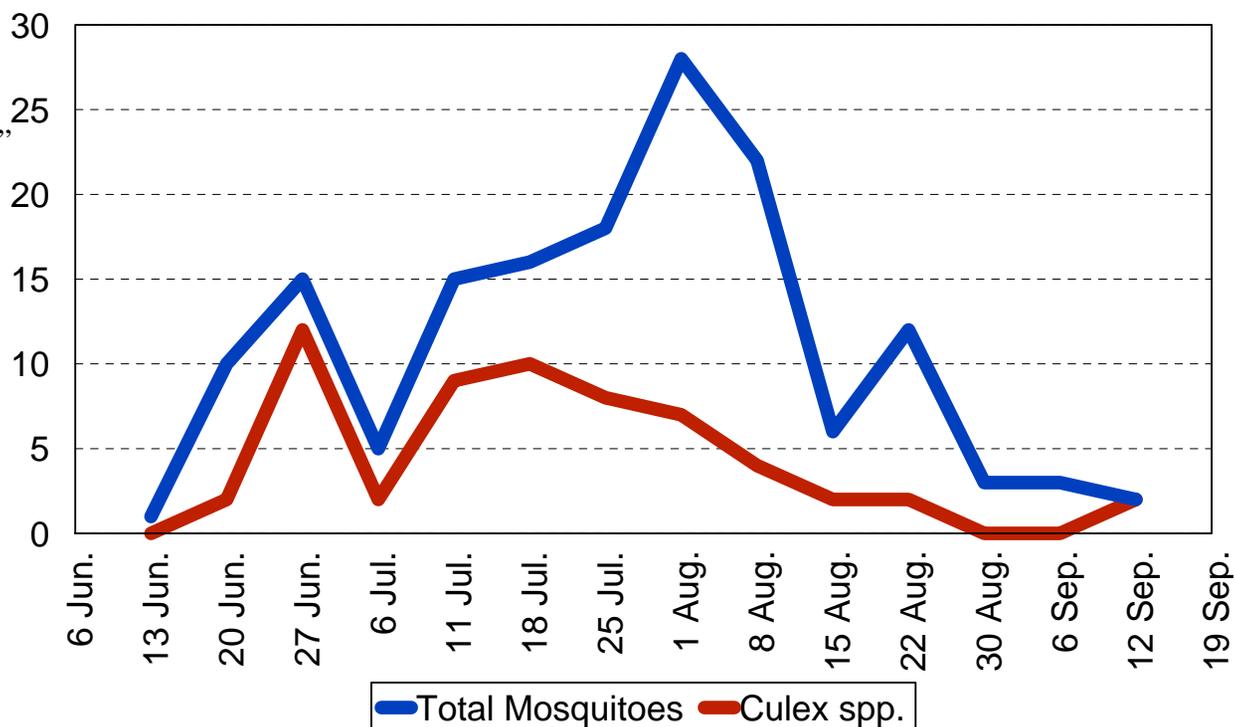
Culex pipiens

Culex tarsalis

Culiseta inornata

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	24	15.4%
Other <i>Aedes/Ochlerotatus</i>	46	29.5%
<i>Anopheles hermsi</i>	13	8.3%
<i>Culex tarsalis</i>	58	37.2%
Other <i>Culex</i>	2	1.3%
<i>Culiseta inornata</i>	13	8.3%



CD-11: Carbondale – CRMS

Season: 2007

Trap Type: Light/CO₂

Location: Carbondale, Colorado Rocky Mountain School campus

GPS: N39° 24.470', W107° 13.637'

Total number of trap/nights set: 14

Total number of mosquitoes collected: 106

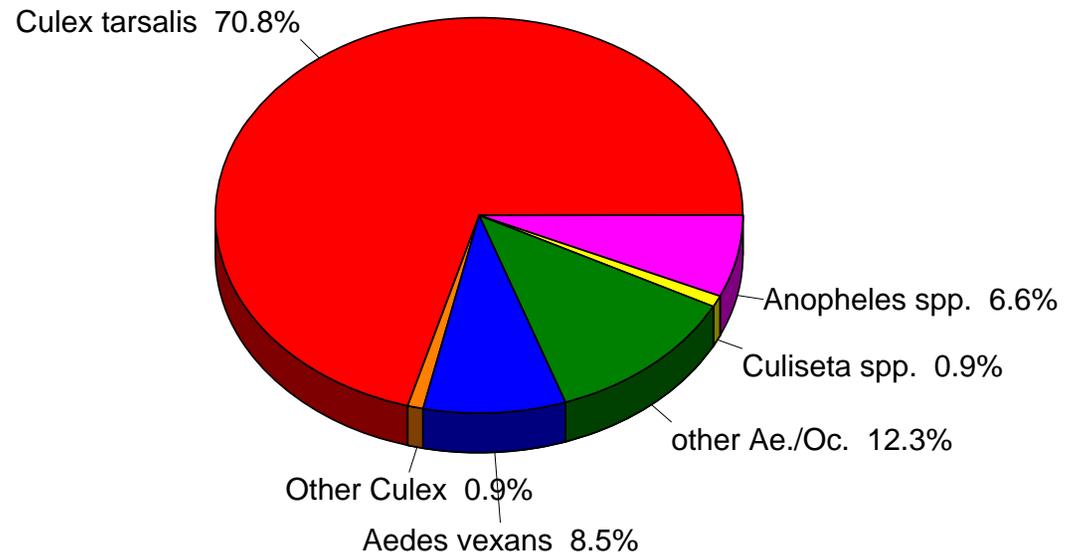
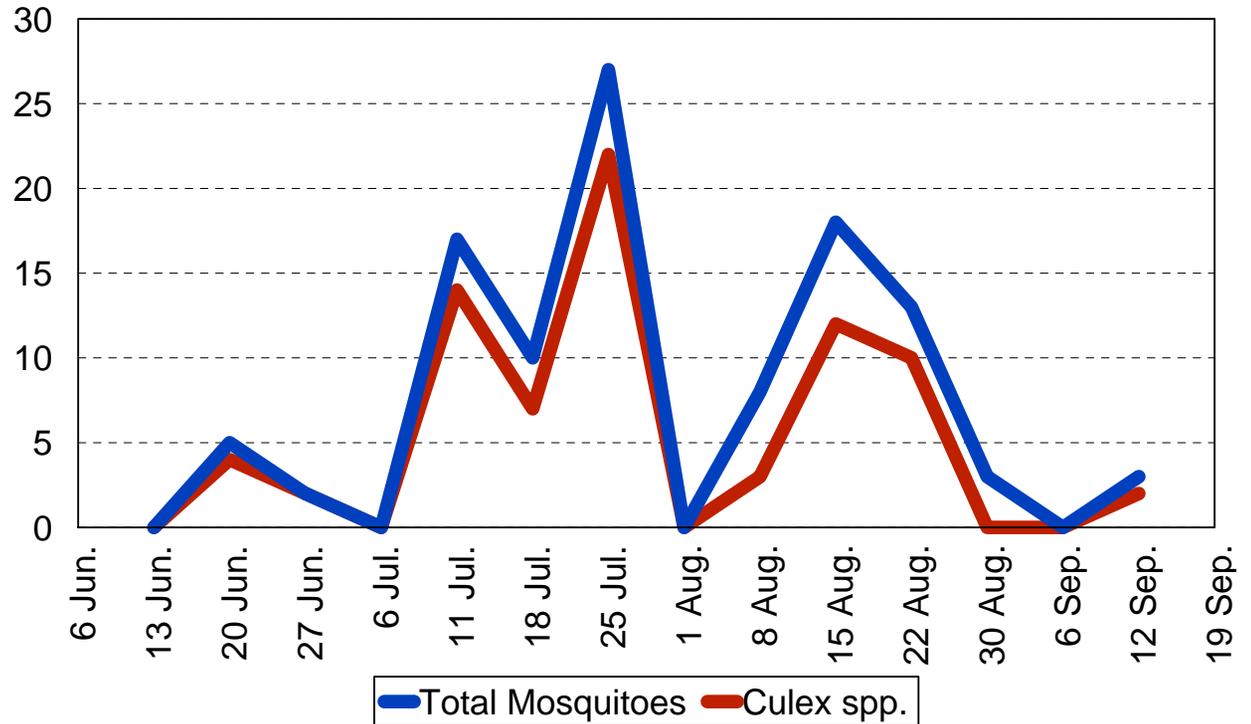
Average mosquitoes per trap/night: 8

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) increpitus*
- Aedes (Oc.) sticticus*
- Aedes (Oc.) trivittatus*
- Anopheles hermsi*
- Culex pipiens*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	9	8.5%
Other <i>Aedes/Ochlerotatus</i>	13	12.3%
<i>Anopheles hermsi</i>	7	6.6%
<i>Culex tarsalis</i>	75	70.8%
Other <i>Culex</i>	1	0.9%
<i>Culiseta inornata</i>	1	0.9%



GW-08: Glenwood Springs Recreation Center

Season: 2007

Trap Type: Light/CO₂

Location: Glenwood Springs Recreation Center

GPS: N39° 33.065', W107° 20.288'

Total number of trap/nights set: 13

Total number of mosquitoes collected: 15

Average mosquitoes per trap/night: 1

Species collected:

Aedes vexans

Aedes (Oc.) dorsalis

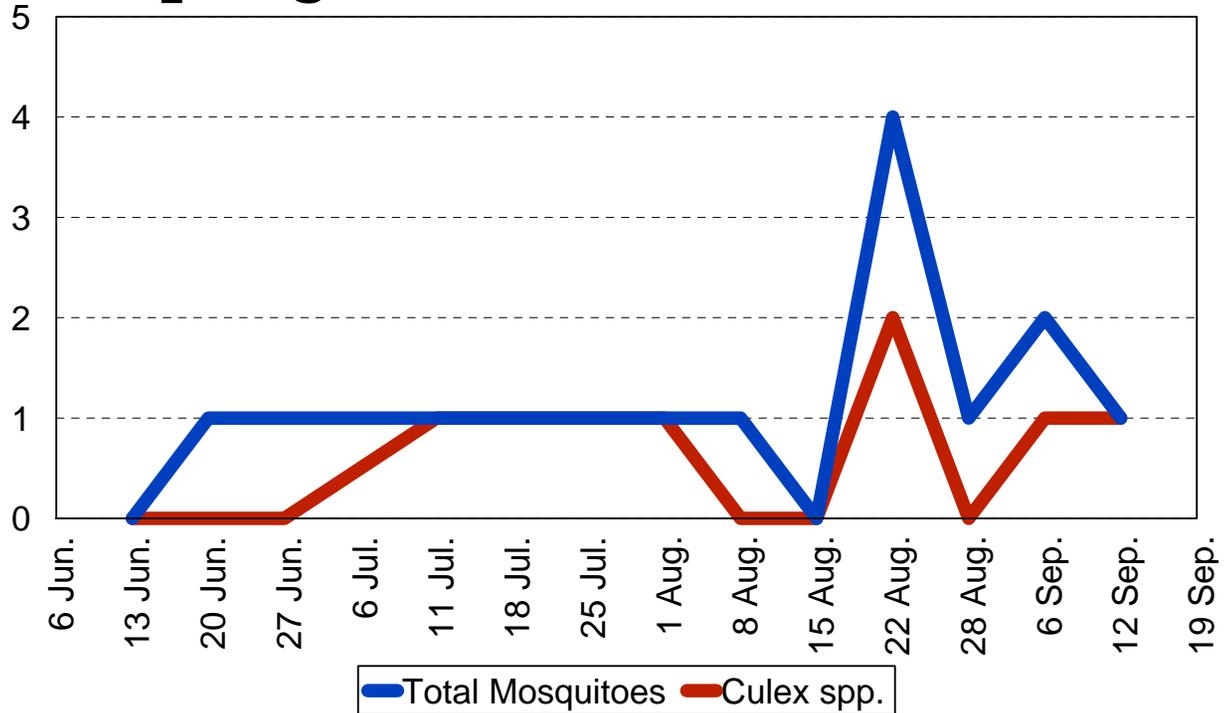
Aedes (Oc.) melanimon

Aedes (Oc.) nigromaculis

Culex pipiens

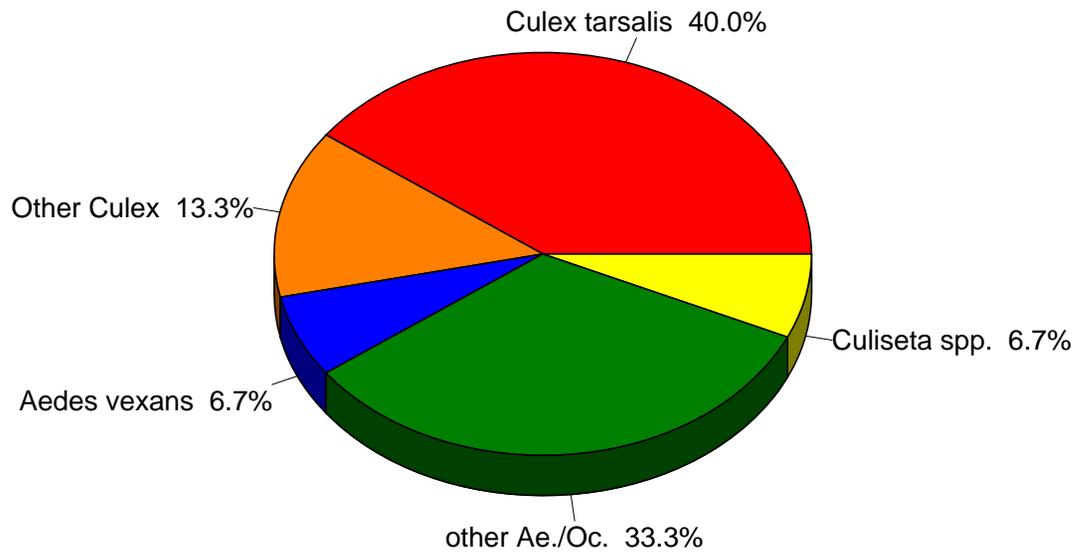
Culex tarsalis

Culiseta inornata



Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	1	6.7%
Other <i>Aedes/Ochlerotatus</i>	5	33.3%
<i>Anopheles hermsi</i>	0	0.0%
<i>Culex tarsalis</i>	6	40.0%
Other <i>Culex</i>	2	13.3%
<i>Culiseta</i> spp.	1	6.7%



NC-02: New Castle – Mikala Lane

Season: 2007

Trap Type: Light/CO₂

Location: New Castle, next to 271 Mikala Lane

GPS: N39° 34.504', W107° 32.439'

Total number of trap/nights set: 13

Total number of mosquitoes collected: 37

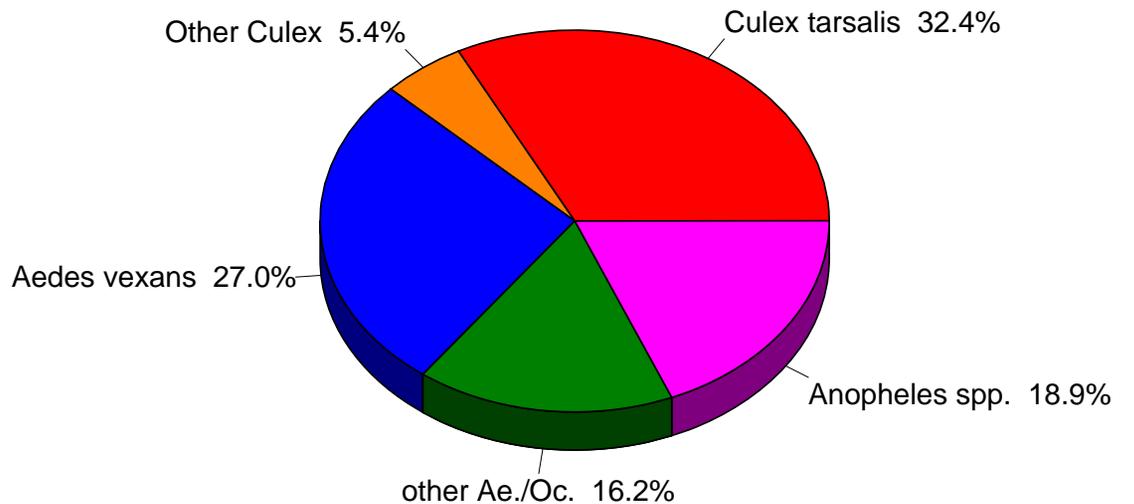
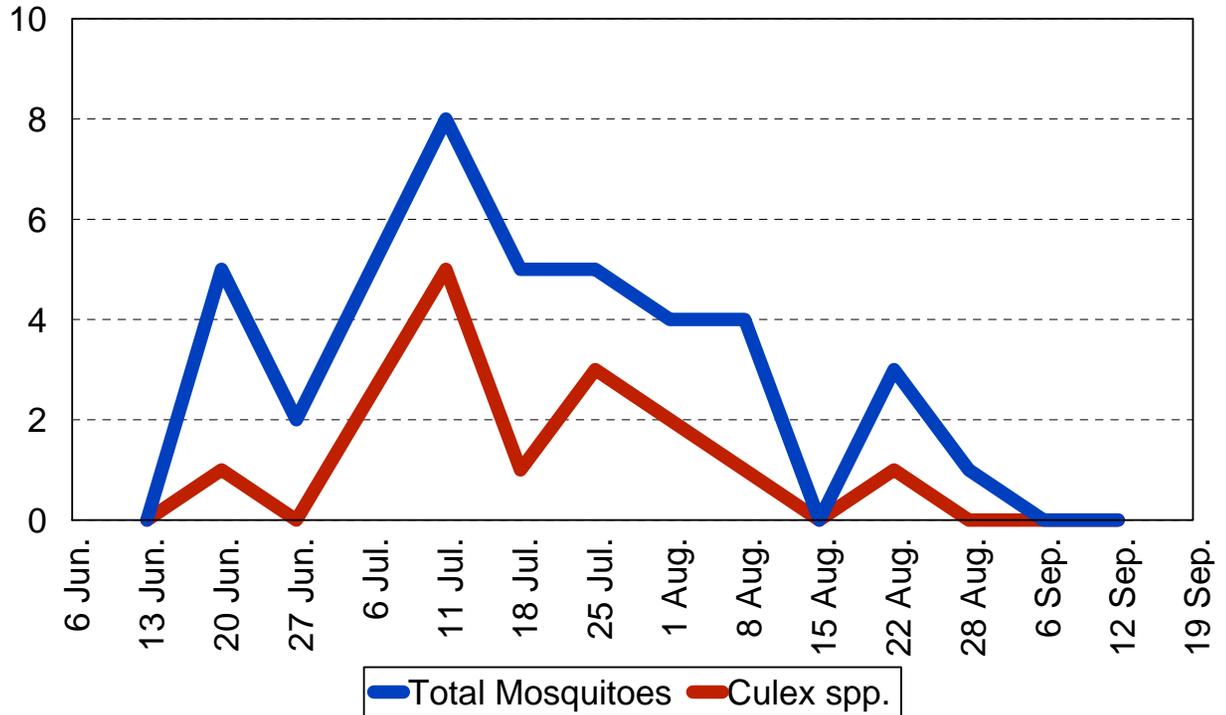
Average mosquitoes per trap/night: 3

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) increpitus*
- Aedes (Oc.) melanimon*
- Anopheles hermsi*
- Culex pipiens*
- Culex tarsalis*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	10	27.0%
Other <i>Aedes/Ochlerotatus</i>	6	16.2%
<i>Anopheles hermsi</i>	7	18.9%
<i>Culex tarsalis</i>	12	32.4%
Other <i>Culex</i>	2	5.4%
<i>Culiseta spp.</i>	0	0.0%



PR-01: Parachute Cottonwood Park

Season: 2007

Trap Type: Light/CO₂

Location: Parachute, west of Cottonwood Park next to fishing/wildlife-watching ponds

GPS: N39° 26.603', W108° 2.901'

Total number of trap/nights set: 14

Total number of mosquitoes collected: 5,705

Average mosquitoes per trap/night: 408

Species collected:

Aedes vexans

Aedes (Oc.) dorsalis

Aedes (Oc.) increpitus

Aedes (Oc.) melanimon

Aedes (Oc.) trivittatus

Anopheles hermsi

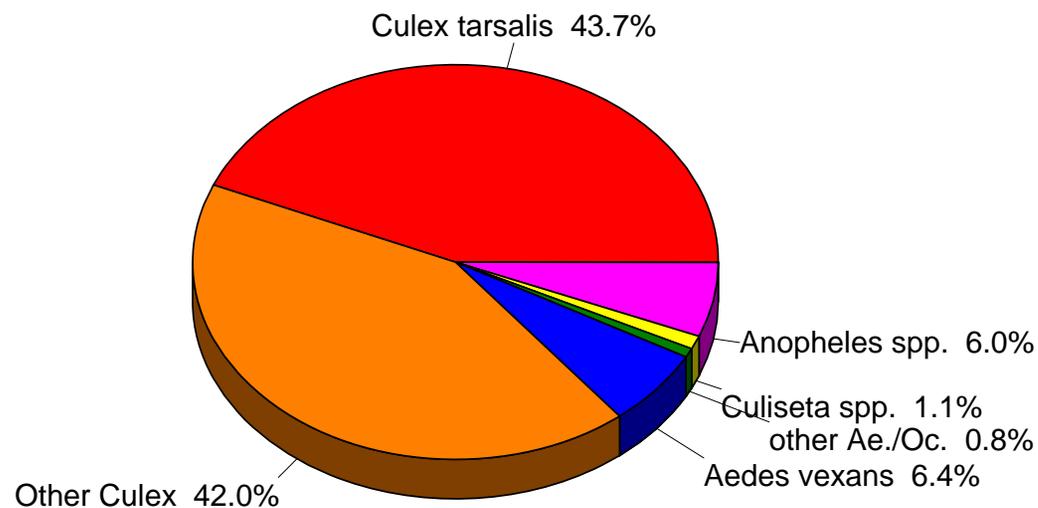
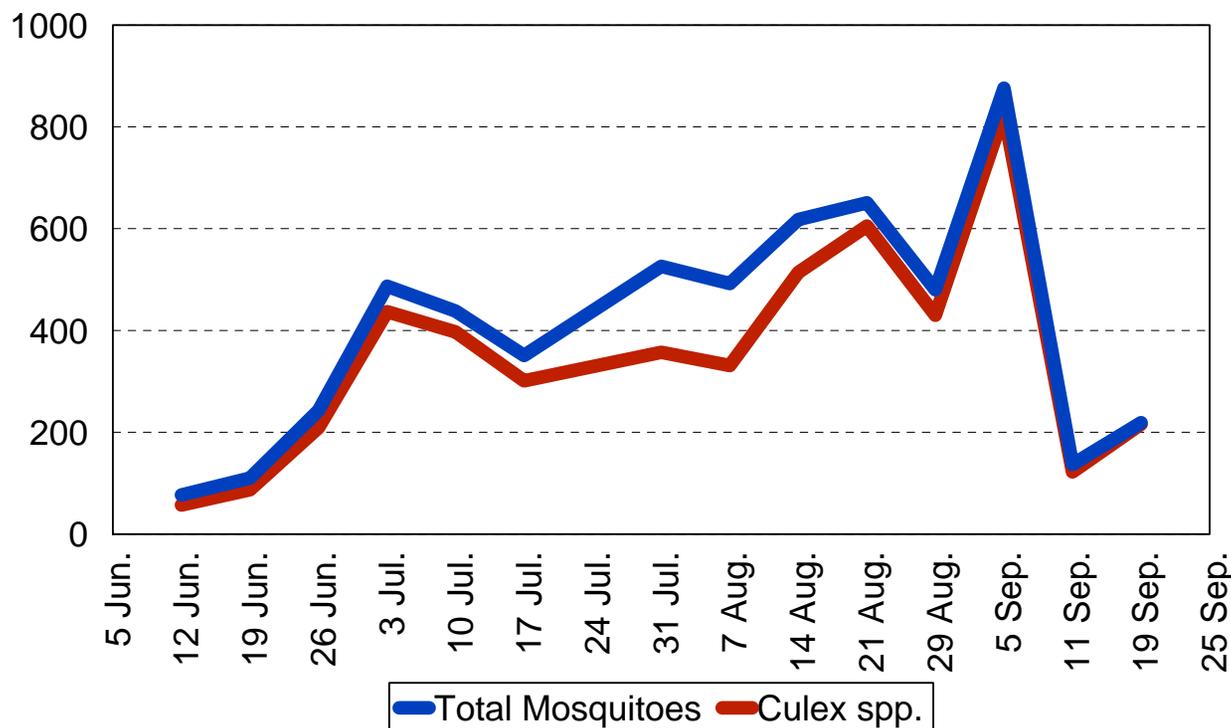
Culex erythrothorax

Culex tarsalis

Culiseta inornata

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	366	6.4%
Other <i>Aedes/Ochlerotatus</i>	43	0.8%
<i>Anopheles hermsi</i>	342	6.0%
<i>Culex tarsalis</i>	2495	43.7%
Other <i>Culex</i>	2395	42.0%
<i>Culiseta inornata</i>	64	1.1%



RF-01: Rifle Lyons Park Rest Area

Season: 2007

Trap Type: Light/CO₂

Location: Rifle, next to marsh south of Lyons Park Rest Area

GPS: N39° 31.509', W107° 47.137'

Total number of trap/nights set: 15

Total number of mosquitoes collected: 2,210

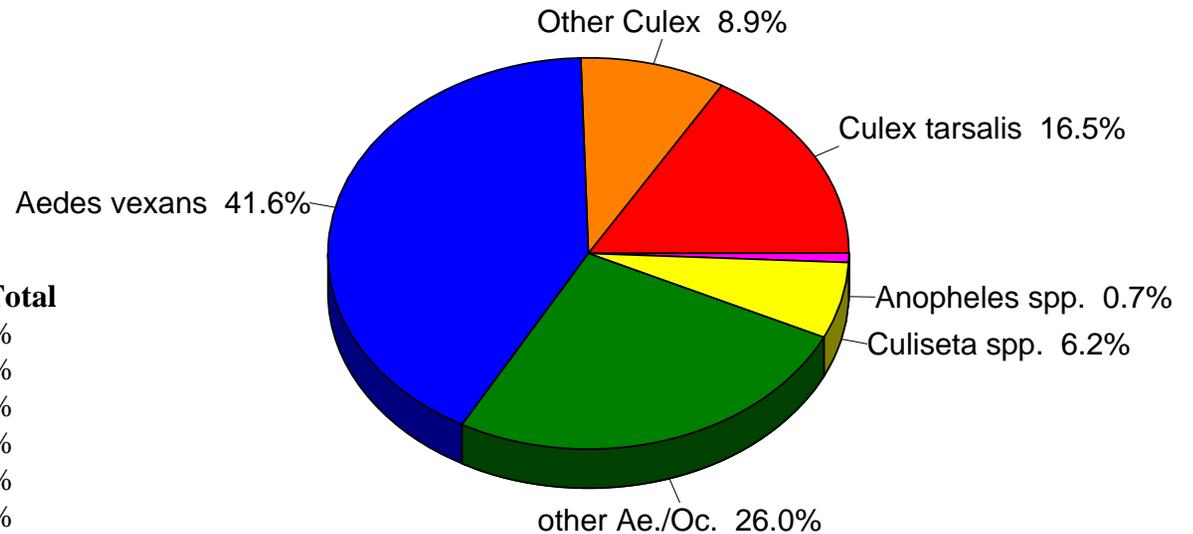
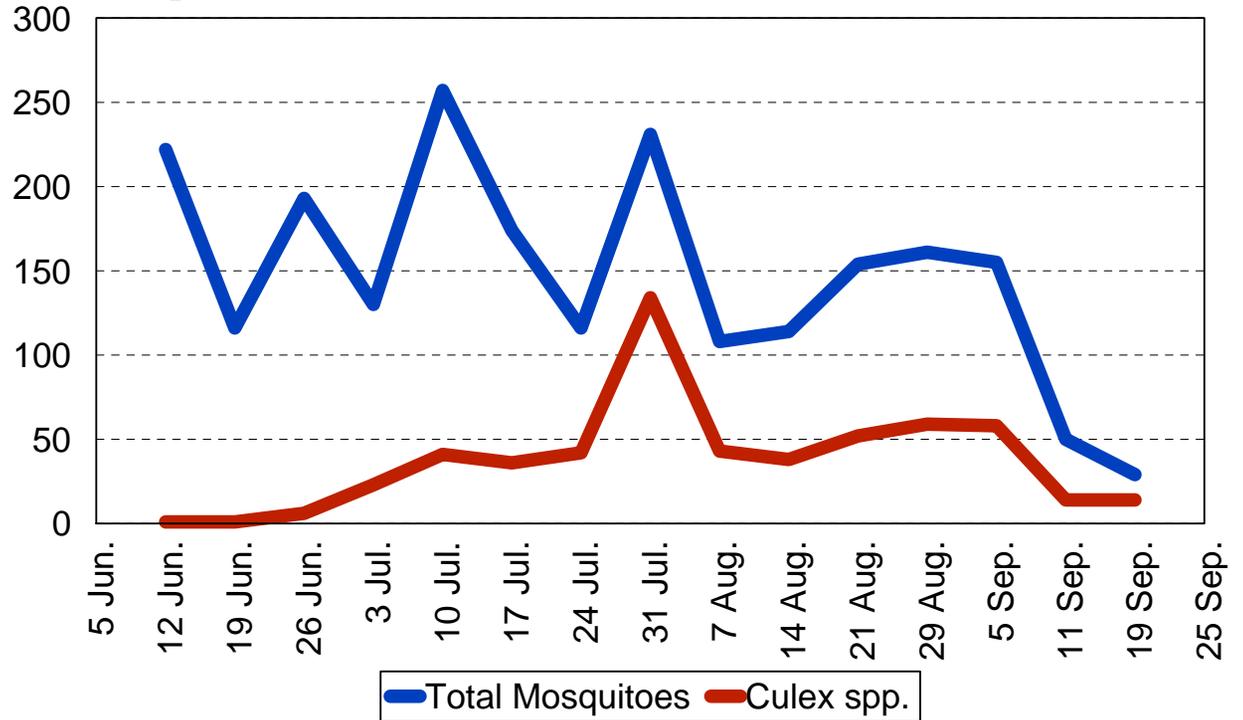
Average mosquitoes per trap/night: 147

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) melanimon*
- Aedes (Oc.) nigromaculis*
- Anopheles hermsi*
- Culex erythrothorax*
- Culex pipiens*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	919	41.6%
Other <i>Aedes/Ochlerotatus</i>	575	26.0%
<i>Anopheles hermsi</i>	16	0.7%
<i>Culex tarsalis</i>	365	16.5%
Other <i>Culex</i>	197	8.9%
<i>Culiseta inornata</i>	138	6.2%



RF-15: Rifle Mile Pond Road

Season: 2007

Trap Type: Light/CO₂

Location: Rifle, off Mile Pond Road 0.2 miles from Ardvark Storage Facility

GPS: N39° 32.071', W107° 45.279'

Total number of trap/nights set: 15

Total number of mosquitoes collected: 5,746

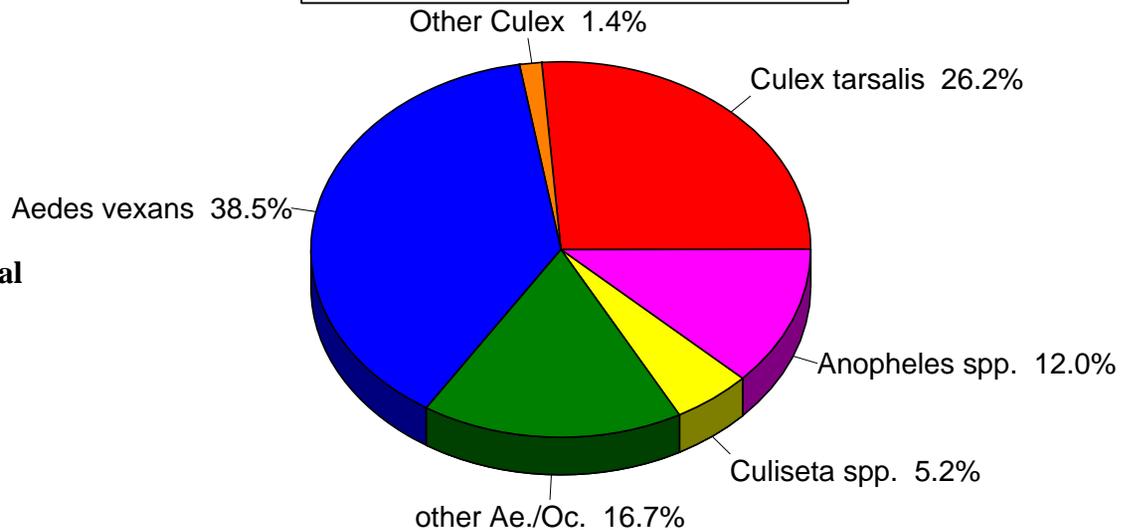
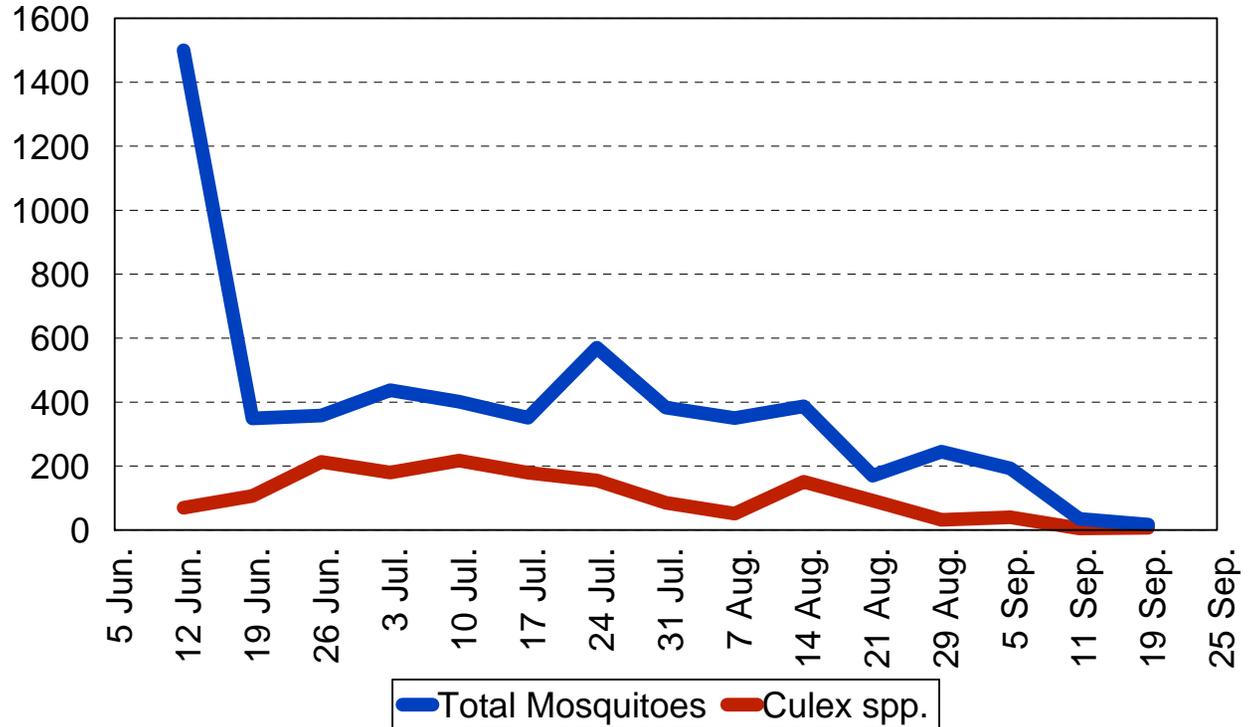
Average mosquitoes per trap/night: 383

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) increpitus*
- Aedes (Oc.) melanimon*
- Aedes (Oc.) nigromaculis*
- Aedes (Oc.) trivittatus*
- Anopheles hermsi*
- Culex erythrothorax*
- Culex pipiens*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	2210	38.5%
Other <i>Aedes/Ochlerotatus</i>	962	16.7%
<i>Anopheles hermsi</i>	692	12.0%
<i>Culex tarsalis</i>	1504	26.2%
Other <i>Culex</i>	80	1.4%
<i>Culiseta inornata</i>	298	5.2%



RF-16: Rifle Middle School

Season: 2007

Trap Type: Light/CO₂

Location: Rifle, behind Rifle Middle School

GPS: N39° 32.147', W107° 47.171'

Total number of trap/nights set: 15

Total number of mosquitoes collected: 3,178

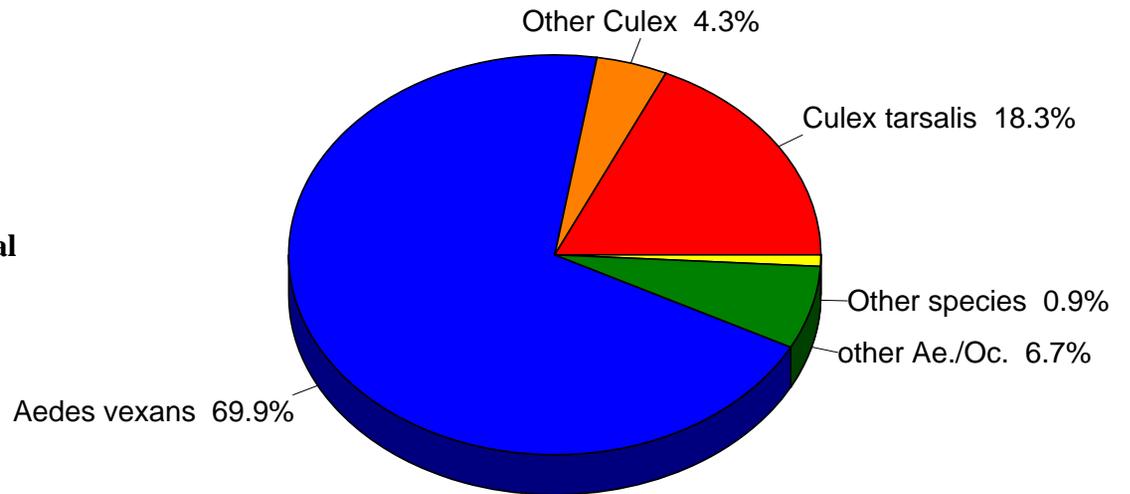
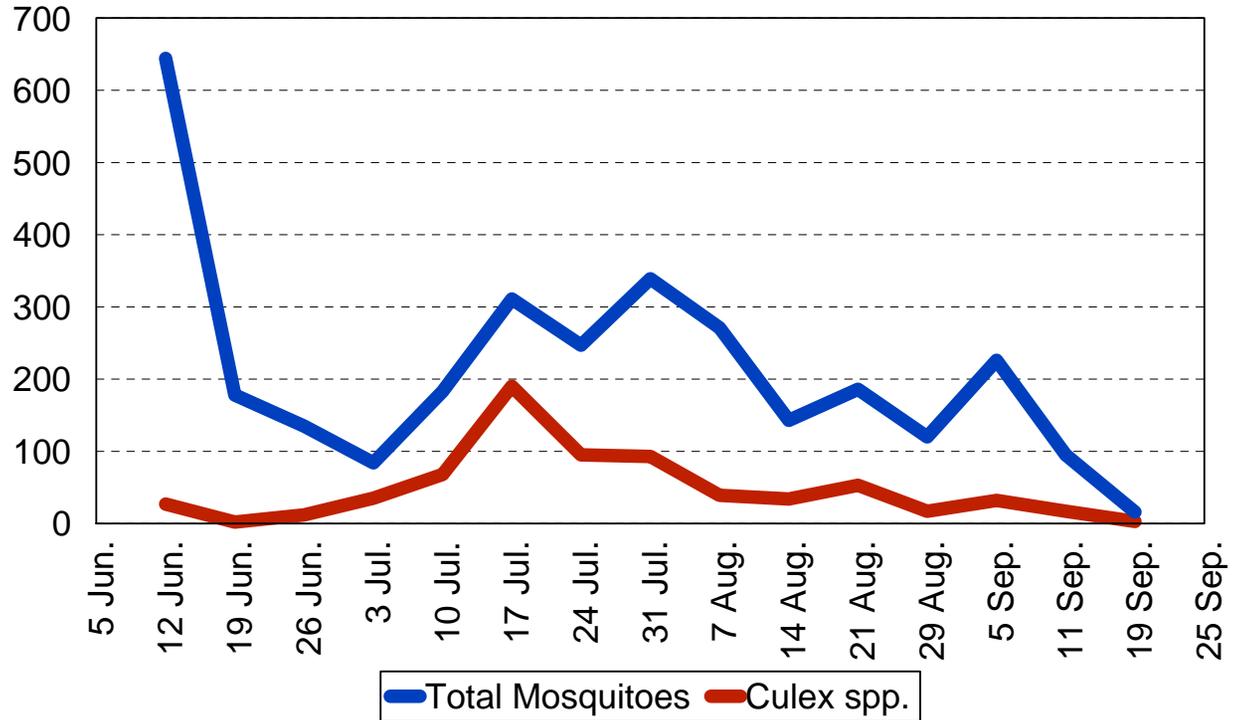
Average mosquitoes per trap/night: 212

Species collected:

- Aedes cinereus*
- Aedes vexans*
- Aedes (Oc.) dorsalis*
- Aedes (Oc.) inerepitus*
- Aedes (Oc.) melanimon*
- Anopheles hermsi*
- Culex erythrothorax*
- Culex pipiens*
- Culex salinarius*
- Culex tarsalis*
- Culiseta inornata*

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	2221	69.9%
Other <i>Aedes/Ochlerotatus</i>	212	6.7%
<i>Anopheles hermsi</i>	5	0.2%
<i>Culex tarsalis</i>	580	18.3%
Other <i>Culex</i>	137	4.3%
<i>Culiseta inornata</i>	23	0.7%



SI-09: Silt Kum & Go

Season: 2007

Trap Type: Light/CO₂

Location: Silt, 905 Main Street
at Kum & Go Store

GPS: N39° 32.765', W107° 39.137'

Total number of trap/nights set: 15

Total number of mosquitoes collected: 2,937

Average mosquitoes per trap/night: 196

Species collected:

Aedes cinereus

Aedes vexans

Aedes (Oc.) dorsalis

Aedes (Oc.) increpitus

Aedes (Oc.) melanimon

Aedes (Oc.) nigromaculis

Anopheles hermsi

Culex erythrothorax

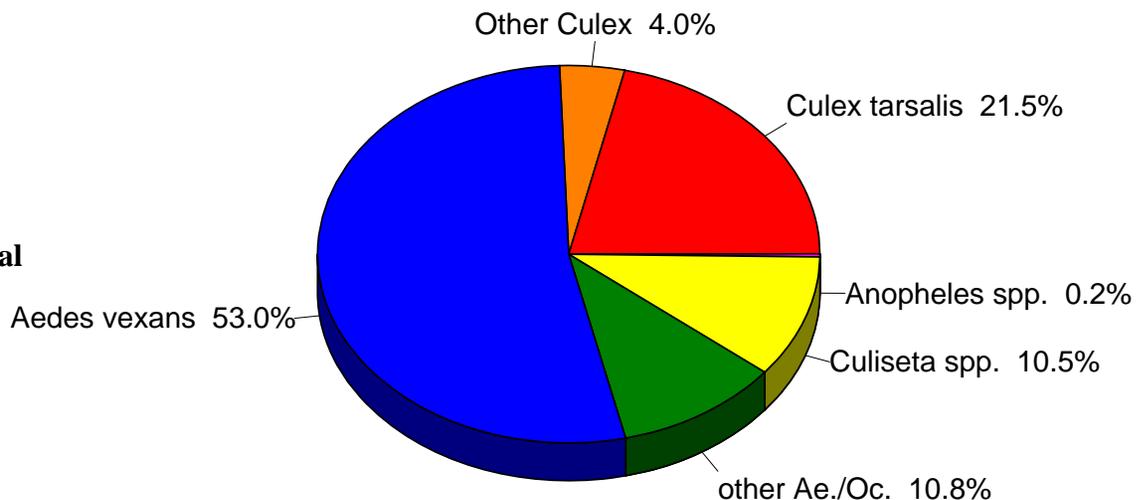
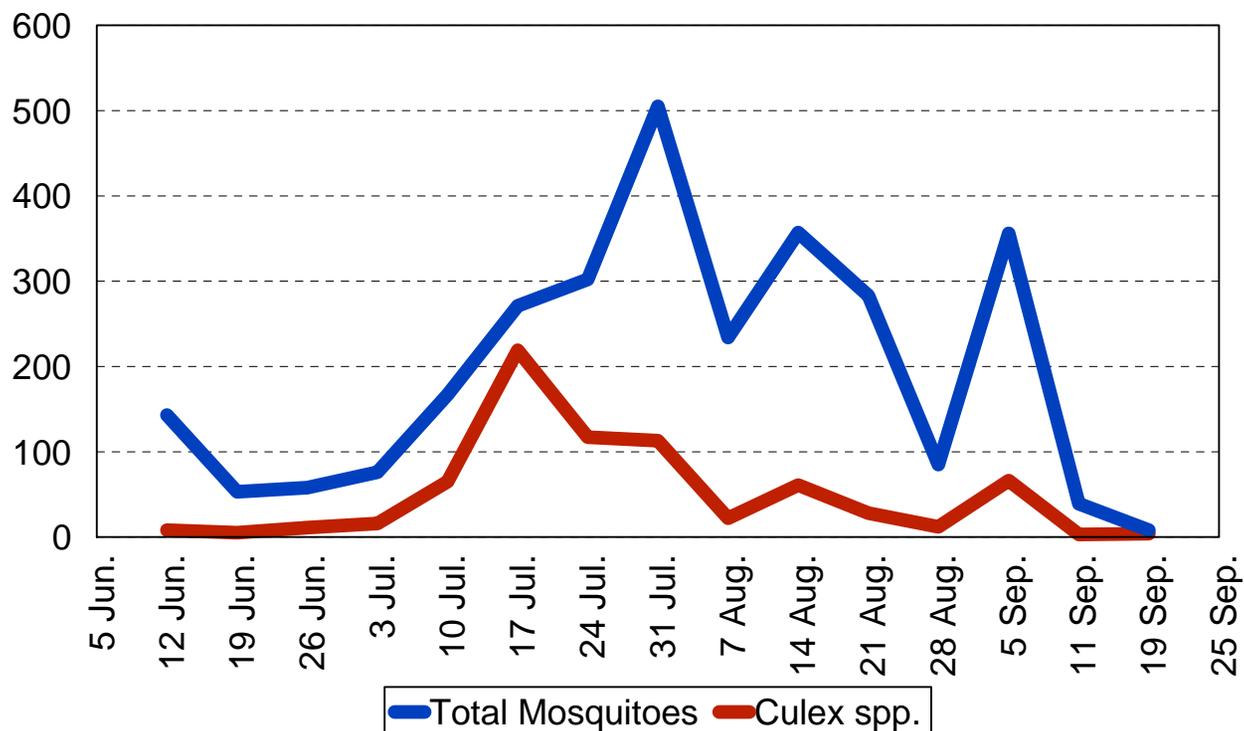
Culex pipiens

Culex tarsalis

Culiseta inornata

Species abundance:

Species	Number	Percent of Total
<i>Aedes vexans</i>	1556	53.0%
Other <i>Aedes/Ochlerotatus</i>	316	10.8%
<i>Anopheles hermsi</i>	7	0.2%
<i>Culex tarsalis</i>	632	21.5%
Other <i>Culex</i>	118	4.0%
<i>Culiseta inornata</i>	308	10.5%





COLORADO MOSQUITO CONTROL, INC.
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