

# SHASTA MOSQUITO AND VECTOR CONTROL DISTRICT 2005 ANNUAL REPORT

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## HISTORY

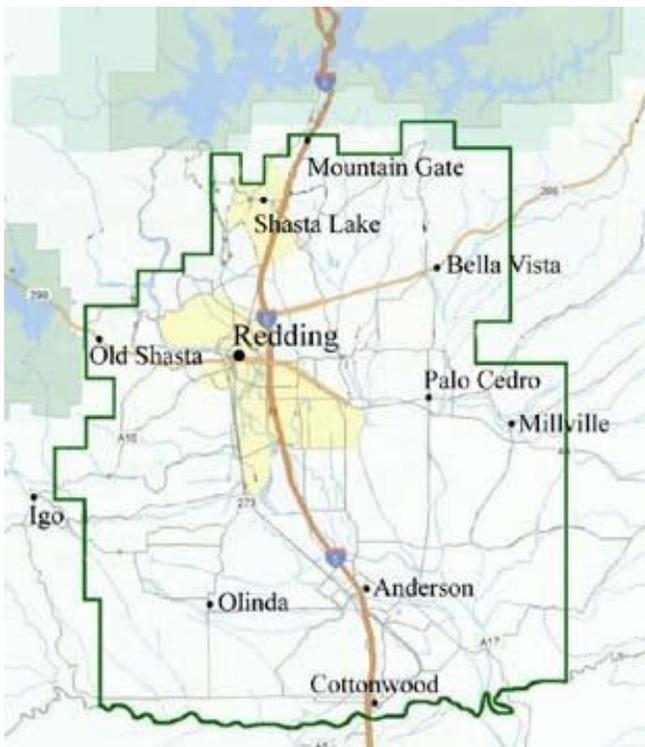
The first local mosquito control district was formed in 1919 in the Redding area and formation of other districts in the Anderson and Cottonwood areas followed in the 1920's. These districts were formed to combat the terrible mosquito problems that plagued the area at that time. Malaria (a disease transmitted by mosquitoes) was widespread when the districts were formed. The Anderson, Cottonwood, and Redding areas had some of the highest malaria rates in the continental United States. Malaria and other mosquito-borne diseases are uncommon in the District today, however the



Early Mosquito Control

mosquitoes that transmit these diseases are still abundant in this area and the potential for serious human health diseases transmitted by mosquitoes still exists. In the mid 1950's the districts consolidated into one district and annexations to the district occurred over the years as more and more people moved into areas with heavy mosquito populations that had previously been sparsely populated with people.

## DISTRICT ORGANIZATION



District Boundaries

The Shasta Mosquito and Vector Control District is a special district type of government agency operating within the boundaries of Shasta County. The District encompasses approximately three hundred eighty-four square miles and includes the incorporated cities of Anderson, Redding and Shasta Lake. The District boundaries extend from Mountain Gate on the north to Cottonwood Creek on the south and extend from the town of Shasta on the west to Millville on the east. A five member Board of Trustees governs the District. One Board member is appointed by the city council of each of the incorporated Cities within the District, Anderson, Redding and the City of Shasta Lake. Additionally, two Board members are appointed by the Shasta County Board of Supervisors. The Board establishes District policy and is responsible for expenditures of the District. The District is financed by a share of property taxes and from mosquito and vector surveillance and control benefit assessment charges. The benefit assessment amounts, which vary for different

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parcels, are determined by land use and size, and are collected on Shasta County property tax bills. Only the people within the District pay the benefit assessment charges. The District does not receive any share of sales tax, cigarette tax, motel occupancy tax, gasoline tax, state grants, or other allocations. In the 2004-2005 fiscal year, the District's income was approximately \$1.48 million; approximately 62% derived from property taxes and 38% from the benefit assessment charge. An additional \$466,587 was transferred from other accounts to help defray increased operational expenses as a result of the District's efforts to control the spread of West Nile Virus. These accounts included the District's Emergency Response Fund and Building Fund among others. An additional \$200 thousand in one-time grant money from the State of California was awarded to the District to help with unbudgeted expenses related to the control of West Nile Virus in the District in fiscal year 2005-2006. Approximately \$50 thousand was also awarded to the District by the State for control work outside of District boundaries for the same period of time. In the 2005 year, the District employed twelve full-time people, one part-time person, and three seasonal people.

### **Benefit Assessment Election**

In the fiscal years 2003-2004 and 2004-2005 combined the Shasta Mosquito and Vector Control District spent a total of \$563 thousand over its budget for increased surveillance and control measures inside the District. This was due to changes in the District's program that had to be instituted in the face of the arrival of West Nile Virus in and near the District. Detailed information about these increased activities is contained in the report on WNV that is attached as an addendum to this report. For those two years the District dealt with these increased costs by shifting monies previously set aside for long-term funding of large expenditures such as infrastructure and purchase of equipment. The District was aware that these additional sources of money could not be tapped long-term as a funding strategy to sustain the high level of mosquito control that was required due to the presence of WNV in the environment.

In addition, concerns over a source of stable funding for emergency services out-of-District, and raids by the California state government on local property tax monies to make up for State budget shortfalls prompted the Shasta Mosquito and Vector Control District to survey in and near the District in 2004 to assess the level of support for alternative funding measures for the District. Based upon the results of the survey an election following Proposition 218 guidelines was held to allow District property owners to vote whether to add a new benefit assessment to their property tax bills maintain and improve mosquito control services within the District. The benefit assessment already in place prior to the election had a base rate of \$7.02 for a single-family residence on less than an acre. The new benefit assessment proposed in the election was \$15.96 for a single-family residence. The actual amount of the assessment for any particular piece of property would vary depending upon the uses of the property, and the "benefit" received by the property owner.

Property owners within the District approved the measure, which required a 50% plus one majority to pass, by a 65% favorable vote. The new benefit assessment will bring in approximately \$948 thousand dollars per year to the District at its inception. This compares with \$475 thousand that was generated by the old benefit assessment, which has been in place since 1995. The new benefit assessment will be levied in place of, not in addition to, the old benefit assessment. If WNV becomes less of a human health problem over time, and the District is able to scale back its current increased control efforts, the amount of the benefit assessment charged

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to property owners can be decreased. Also the benefit assessment can be increased to compensate for inflation. The amount of the assessment must be based upon a budget that accurately reflects the District's actual cost of providing services throughout the year.

### DISTRICT ACTIVITY

The District performs mosquito control activities and vector information services to protect the public's health from diseases and nuisance caused by mosquitoes and other vectors. Vectors are defined as small animals or arthropods that spread disease causing organisms or cause discomfort to the humans and domestic animals. Examples of vectors are mosquitoes, flies, fleas, ticks, spiders and stinging insects, such as yellowjackets. Examples of some diseases transmitted by vectors other than mosquitoes are Lyme Disease transmitted by ticks and plague transmitted by fleas.



Mosquito Larvae

Adult mosquitoes are flying insects that, after taking a blood meal, lay their eggs in water. The mosquito eggs need water to develop into larvae and then into adult mosquitoes. The life cycle of mosquito development repeats itself and, unabated, staggering numbers of mosquitoes are produced and transmission of diseases occurs. Examples of water sources where mosquitoes lay their eggs and develop are: ornamental ponds, industrial and agricultural water, lakes, river isolations,

wetlands, sewer ponds, buckets, cans, and holes in trees. Anything that holds water can and often does produce or breed adult mosquitoes. Mosquitoes that transmit the human diseases Malaria, Western Equine Encephalitis, St. Louis Encephalitis and West Nile virus are common within the District. Heartworm is an often-fatal disease of dogs and cats transmitted by mosquitoes that breed in the oak treeholes that are abundant within the District. In the spring the District devotes a great deal of time to the control of these mosquitoes, which are also a serious biting pest of humans.

In addition to these diseases, there are new, emerging diseases transmitted by mosquitoes, which can become a serious human health problem within the District. The West Nile virus, which first appeared in the United States in New York in 1999, and has killed hundreds of people, countless wild birds, and thousands of horses in the U.S. since its arrival, is a disease transmitted by mosquitoes. Migrating birds and blood-feeding mosquitoes have spread West Nile virus throughout the U.S. in the five years since its introduction. In 2004, West Nile virus (WNV) was found for the first time in Shasta County in 90 wild birds, 4 sentinel chickens, five people and 30 horses. Though an increase in WNV activity throughout California occurred in 2005, the District's stepped-up control efforts actually resulted in an overall decrease in the amount of WNV detected within the District in 2005 when compared to 2004. In 2005 West Nile Virus was detected in 28 wild birds, seven sentinel chickens, one person and one horse within the District. West Nile virus is an example of the ever-present human health risks from new, emerging human diseases transmitted by mosquitoes. The type of mosquito that transmits the West Nile Encephalitis Virus disease is the most abundant species of mosquito found in the District. Detailed information regarding surveillance and control efforts related to WNV in 2005 are contained in an addendum to this report.

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The District's mosquito control program is a comprehensive control program, which uses state of the art equipment, techniques and products to control mosquitoes and protect the public's health and well-being. District employees are licensed in mosquito control and receive on-going training and continuing education to keep licenses current. Aerial photographs of the District are utilized and all known mosquito-breeding sources within the District are mapped. District personnel survey these sources for mosquito breeding on a regular basis and perform control activities when necessary. Control activities to kill mosquito larvae in water sources include the use of mosquito-eating fish, drainage, reduction, or elimination of mosquito breeding sources and/or chemical control.

The District's chemical control program focuses on killing mosquito larvae in the water (larviciding) before they become adult mosquitoes. The District's larviciding chemical control program includes the use of relatively new types of chemicals that are effective in killing mosquito larvae but are safe for non-target organisms. Most larviciding chemicals are by-products of bacteria or chemicals that are mosquito growth regulators. These chemicals are often very specific to mosquito larvae. To be effective they often must be applied to specific species of mosquitoes and at specific developmental stages of the mosquito's life cycle. District technicians must be well-trained and knowledgeable in order for these types of chemicals to be effective in killing mosquito larvae. These products are considerably more expensive than more conventional pesticides. They are only applied directly to standing water sources where the presence of mosquito larvae has been confirmed. These products quickly biodegrade and do not spread elsewhere in the environment. Other larviciding products are highly refined oil-based products that float on the water, which suffocate mosquitoes by creating a barrier that prevents the developing mosquitoes from breathing oxygen at the surface of the water. These products dissipate after a few days.



Larviciding at a Vernal Pool

The District performs adult mosquito (adulticide) control when large numbers of adult mosquitoes create severe pest problems or when an increased risk to human health from diseases carried by mosquitoes is present. Adulticide chemicals are applied in ultra low volume amounts and the pesticides used in these applications are not harmful to non-target organisms at the rates used for adult mosquito control. The adulticide applications are performed in the early morning or late evening. Most adulticides used by the District are pyrethroid products similar to products used in homes and on pets to control insect pests. Adulticiding products are dispensed by highly specialized, truck-mounted equipment. The equipment dispenses very small volumes (about two tablespoons per acre) of adulticide in extremely small droplets that are intended to drift through an area rather than deposit on plants, water or other surfaces. These products quickly dissipate and are broken down by sunlight.

Chemicals are also used for vegetation control work around the margins of certain water sources. Weeds may protect mosquito larvae from natural predators like mosquitofish and prevent mosquito larvicides from reaching sources. Vegetation control chemicals are also used

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to maintain access to mosquito breeding sources.

All pesticide work is done through cooperative agreements with the California Department of Health Services in cooperation with the California Department of Pesticide Regulation. All pesticide use is reported to these agencies on a monthly basis.

The District monitors the effectiveness of its mosquito control program by placing insect traps throughout the District. Contents of these traps are collected weekly and mosquitoes are identified and tabulated as to species and numbers of mosquitoes. (See "Adult Mosquito Monitoring Program" later in this report). This information is also added to a statewide surveillance database of mosquito population statistics.

The District performs physical control to reduce or eliminate mosquito-breeding areas. A District-owned backhoe is used to maintain and clean certain drainages to reduce mosquito breeding areas, as well as doing trail access work for mosquito breeding sources. The District utilizes the California Department of Forestry Conservation Crews from Sugar Pine Conservation Camp to perform hand brush cutting activities to maintain access trails to mosquito breeding sources.

The District gives input to the planning departments of Shasta County and the cities of Anderson, Redding and Shasta Lake on proposed developments, etc. to reduce or prevent the creation of new mosquito breeding sources, assure adequate drainage, and access to mosquito breeding sources.

Public information and education is an important part of the control process. The District provides information on its activities by talking to schools and organizations and distributing literature. The District also plans and staffs an exhibit at the Shasta District Fair annually. Educational materials relating to District activities are provided to the public in static displays at the Turtle Bay museums. In addition, the District provided training and demonstration supplies to the Museum Teen Volunteers to talk to visitors at Turtle Bay about mosquito and vector control issues. The District provides information to various media to inform residents about District activities and to promote help in minimizing or eliminating mosquito breeding sources, particularly sources around the home, such as standing water in buckets, tires, birdbaths, etc.

The District responds to calls for service by having a technician visit, survey and discuss the mosquito problem with the caller. When possible and necessary, additional mosquito control is performed to respond to mosquito problems.

In addition to the District's mosquito control program, the District has a vector control program, which involves answering calls and providing information regarding vectors. Information on diseases caused by non-mosquito vectors such as Lyme Disease transmitted by ticks and plague transmitted by fleas, is also disseminated. The District provides literature, advises people on what they can do and/or recommends help from a non-specific private pest control agency.

The District also conducts an encephalitis surveillance program to monitor the human health risk from mosquito-transmitted diseases (See Encephalitis Surveillance Program in this report). This program uses sentinel chicken flocks placed throughout the District. District personnel take blood samples from these chickens throughout the mosquito season. The California Department

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of Health Services Viral and Rickettsial Disease Lab tests these blood samples for the presence of encephalitis antibodies. Live adult mosquitoes are also collected by the use of special traps. These mosquitoes are collected, sorted, grouped by species, sent to the University of California at Davis and tested for the presence of encephalitis virus. The results of the chicken blood tests and live adult mosquito virus tests are used by the District to determine the risk for transmission of Western Equine Encephalitis, St. Louis Encephalitis, and West Nile virus to humans. Should the program indicate an increased risk for mosquito-transmitted disease, the District's adult mosquito control program could be increased to protect the public's health.

### **RESULTS OF DISTRICT ACTIVITY**

An on-going challenge for the District is to provide information to the public on the District's activities and resulting public benefit. Shasta Mosquito & Vector Control District provides a high level of mosquito control, which protects the public's health and comfort from diseases and nuisance caused by mosquitoes through the use of environmentally compatible, state of the art products and techniques. Adult mosquito control programs are conducted early in the morning or late in the evening when public outdoor activity level is lowest. Much of the District's other control activities take place in remote inaccessible areas out of public view. Therefore many citizens may not realize that the lack of mosquito problems and diseases caused by mosquitoes in this area is the result of efficient, effective on-going mosquito control. Potential human health problems from diseases caused by mosquitoes such as Malaria, Western Encephalitis and St. Louis Encephalitis as well as Dog Heartworm in pets are an ever-present risk. New emerging diseases, such as West Nile virus and other mosquito-borne diseases present on-going challenges for mosquito control.

### **PROFESSIONAL AFFILIATIONS**

The Vector Control Joint Powers Agency provides for various insurance needs of the District while providing a substantial cost savings to the District. The District also belongs to the Mosquito and Vector Control Association of California for benefits such as the continuing education of mosquito control technicians, legislative representation, funding for mosquito research through the MVCAC Research Foundation, and the gaining and sharing of information on the effective operation and management of mosquito and vector control districts. These affiliations have been useful in developing a unified statewide approach to dealing with issues of mutual concern, such as the arrival of West Nile virus and legislative efforts to protect and provide funding for mosquito control in California. As part of a larger unified body we can help to assure that support of mosquito and vector control will be a component of regulations affecting public health pest control chemicals and other issues that affect the health of the public.

The District is a supporting member of the Turtle Bay Museums and Arboretum. This has given district personnel a new venue for the distribution of information on the methods and importance of mosquito and vector control in northern California. Additionally, it has given District personnel access and input with key officials involved in making land use decisions involving mosquito-breeding wetlands within the city limits of Redding affecting a large segment of the public served by the District.

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## WEST NILE VIRUS Overview

West Nile virus (WNV) is a type of mosquito-borne virus that has contributed significantly to the workload of Shasta Mosquito and Vector Control District since before its detection within the District in July of 2004. Prior to 1999 the disease was limited to Africa, West Asia, and the Middle East. In 1999 an outbreak of West Nile virus was reported in New York City. Since that time it has spread to all states except Alaska, and Hawaii. In the United States 2,949 people were diagnosed with and 116 people died from West Nile virus in 2005. Nearly 30% of all WNV human disease in the U.S. occurred within California in 2005. This disease is particularly devastating to horses and birds where obvious neurological symptoms and death are common. WNV activity was found throughout Shasta Mosquito and Vector Control District in 2005.

Like Western Equine encephalitis and St. Louis encephalitis, mosquitoes transmit West Nile virus and the reservoir hosts are usually birds. Unlike these other encephalitis diseases West Nile virus often makes the birds sick and is especially fatal to birds in the Corvid family (crows, jays, ravens and magpies). West Nile virus has also been found in many other species unaffected by other types of encephalitis, such as dogs, seals, and alligators.

Most people infected with WNV do not show symptoms. Some people develop mild symptoms that include fever, headache, body aches, skin rash and swollen lymph glands. More severe symptoms include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. The U.S. Centers for Disease Control estimates that 1 in 150 persons infected with the West Nile virus will develop a more severe form of disease. West Nile virus was first detected in California in mosquito pools in the Salton Sea area in July of 2003.

Further information about the detection of WNV within the District in 2005 can be found in the sections on surveillance later in this report. Due to the significance of the role of WNV in District activities within the District, a complete report about WNV and the District's efforts to contain its spread can be found as an addendum at the end of this annual report.

**West Nile virus Task Force:** In 2003, Shasta Mosquito and Vector Control District joined with thirteen other agencies and organizations with interests in health, the environment, animal control and wildlife issues to form a countywide task force to develop a Shasta County West Nile virus Action Plan. The action plan outlines the roles of the specific agencies and organizations based upon different surveillance indicators of the presence or absence of WNV in or near Shasta County. The group also provided an effective way of disseminating new information about the West Nile virus issue to and from various groups that previously had little contact with one another prior to the introduction of WNV into the United States. Answers to common questions and talking points to be used by the different groups were developed to assure the public that members of the task force were all educated, united, and prepared to deal with the WNV issue within Shasta County. Draft press releases were prepared, reviewed, and approved by the group. Also an email list was put in place to assure that all future contacts from members of the task force were mutually acceptable and agreed with the best information available to the group. In 2005 with West Nile virus in the Shasta County area, the task force proved to be a very useful tool, particularly in the dissemination of information to affected agencies and the public. In particular, efforts by Shasta County Public Health to provide materials, information

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and support in the area of public information took a tremendous load off of the District. This freed up time for the biology staff to conduct more intensive surveillance activities.

## PUBLIC INFORMATION ACTIVITIES

Effective public health protection through mosquito and vector control depends largely on the efforts of informed citizens to prevent and control these pests around their homes and properties. Everyone needs to know how to avoid exposure to vector-borne disease in environments where pests of public health importance may be found. Since the beginning of mosquito control efforts in California in the early 1900s major emphasis has been put on educating the public about protecting themselves against health threats posed by mosquitoes and other vectors.

Shasta Mosquito and Vector Control District's comprehensive pest management strategy includes an active program of public health education. The District provides over twenty-five brochures on a wide variety of topics related to mosquitoes as well as other vectors and the diseases they spread. In the course of their work, all District personnel answer questions from the public based upon years of training and experience in all phases of disease and vector issues. Biologists on-staff provide answers to questions by phone, email or in person on any topic related to vectors, diseases, insects in general and pest management that may require additional special expertise. The District Biologist also gives talks to classrooms, civic groups or any club, organization or agency with an interest in the type of work we do, as well as interviews with the press and broadcast media. Topics covered range from mosquito biology and personal protection against vectors to careers in biology and vector control.

This annual report is provided to local government officials and other stakeholders to educate them about the activities of the District. On request, the District Manager or Biologist will give presentations in person to local government or private businesses, agencies and governing bodies to inform them about mosquito control issues and District activities. In addition to government agencies, groups addressed by District personnel in 2005 included the Rotary Club, Soroptimist Club, Rose Society, Anderson Garden Club, Pacific Gas and Electric Company personnel, and the Pesticide Applicators Professional Association. Additionally, in 2005 interviews were given with KNVN Channel 24, KHSL Channel 12, KRCR Channel 7, 9, Northstate Public Radio, and KQMS Radio as well as the Valley Post and Record Searchlight newspapers throughout 2005. Most interviews were brief pieces about the developing West Nile virus issue within the District.



SMVCD Web Site

The District's field trip program was in its fifth year. Due to increased workload associated with preparations for West Nile virus in 2005, the field trip program was not promoted as heavily as it has been in past years. Four classroom groups of about fifty students each visited the District's

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Educational Demonstration area in 2005. Field trips at the District were conducted in May. Classes attending the field trips were shown such things as mosquitofish rearing, weather observation, sentinel chickens and a light trap together in a relatively small and aesthetically pleasing location. The field trips lasted about two hours and the participants generally brought sack lunches to eat under the gazebo and on the lawn. We received excellent feedback and hope that time will permit us to host more field trips in 2006. Other presentations were done for students at Pioneer High School, West Valley High School and a two-day field trip event at a local farm where one of our chicken flocks is located.

The District's fair display that deals with the public health importance of vector-borne disease and the nature of the work done by the District was updated this year for the Shasta District Fair in June. The fair booth this year was twenty-feet (two booth spaces) wide. Topics in the display included District activities such as biological, physical and chemical control of mosquitoes. Live specimens included mosquito eggs, larvae, pupae and adults as well as mosquito fish. The booth was manned full-time with at least one District employee present at all times. During peak activity there were three employees at the booth. A substantial amount of high quality materials related to West Nile Virus information (brochures, information cards, checklists, etc.) were provided by Shasta County Public Health for the District to distribute at the booth. The District finds the fair booth to be an effective way to get our message out to thousands of people who live within the District that allows one-on-one contact between District personnel and a large segment of the public. The District has committed to continue using the booth in future years and to be sure that it is manned at any time when the public has access to it.

Shasta Mosquito and Vector Control District has a web site with a wealth of information and links related to mosquito and vector control, and District activities. The site allows the public to access information about meetings of the District's Board of Trustees. Forms on the website allow the public to ask biologists questions via email or submit service requests online. Due to the workload associated with West Nile Virus in 2005, few changes were made to the Web Site. At the end of 2005 the District obtained broadband Internet access through a new Internet provider. Because of this, the web sit will have a new address and improved functionality beginning in 2006.

### SERVICE REQUESTS

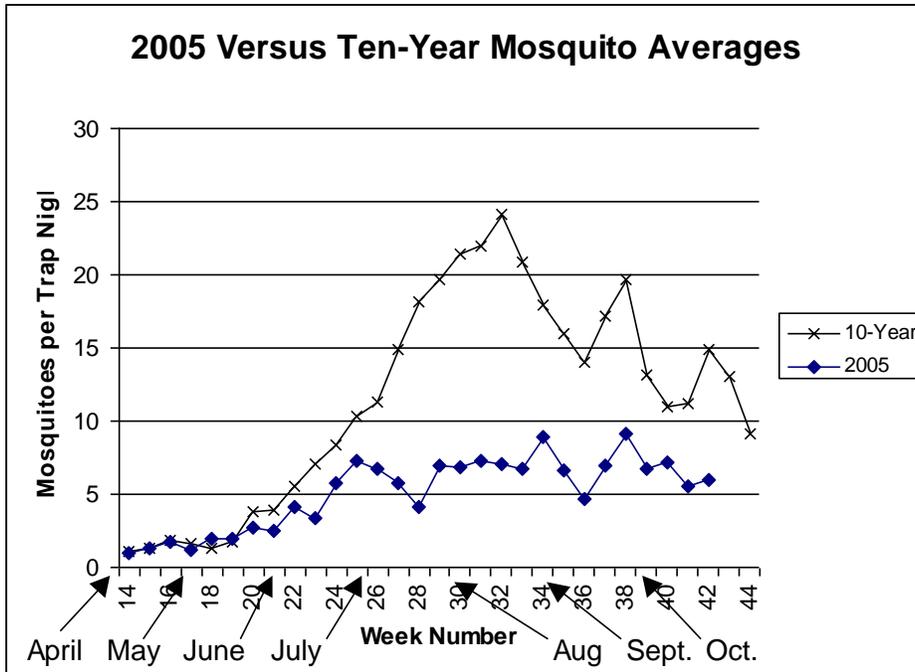
District personnel personally respond to all requests for service by members of the public within the District. Types of services performed include providing information, distributing mosquitofish, and performing various types of mosquito control as needed.

|                         |  |
|-------------------------|--|
| Total Service Requests: | 919 (some requests have multiple causes) |
| Mosquito Complaints     | 393                                      |
| Requests for Fish       | 493                                      |
| Other                   | 71                                       |
| Outside District        | 7  |

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## ADULT MOSQUITO LIGHT TRAP PROGRAM

Adult mosquito traps are used by the District to monitor adult mosquito population trends. Traps are placed strategically throughout the entire district to attract and capture mosquitoes over long



periods of time. Mosquitoes from the traps are sorted and counted weekly to provide statistics used by the District to set mosquito control priorities. A total of twenty traps comprised the adult mosquito surveillance program, which was operated from April through October 2005. Per night tallies of mosquito numbers from all operational traps were reported to the California Department of Health Services as part of an integrated statewide surveillance program

Adult Mosquito Light Trap Counts

Mosquitoes achieved peak populations of 9.08 mosquitoes per trap night on about September 29. The common species observed in the traps throughout the season was *Culex pipiens*, a species that has been implicated in the spread of West Nile virus. The District's increased control of adult mosquitoes, particularly in the early season kept mosquito populations to about 1/3 of seasonal averages compared to the previous ten years. The average number of mosquitoes per trap night in 2004 was down 68.7% and 38.4% compared to the years 2004 and 2003 respectively. Despite generally low mosquito populations throughout the District, certain industrial areas create significant mosquito breeding problems for the District. This is a source of concern for the District since the species of mosquito produced at these locations is a known vector of West Nile virus. The District devotes substantial effort every year to trying new techniques and products to control mosquitoes in industrial settings. Additional time has also been spent controlling mosquitoes breeding in urban water sources, such as catch basins, that were less of a threat to carry disease prior to the arrival of WNV.

## ENCEPHALITIS SURVEILLANCE PROGRAM

Mosquito-borne encephalitis diseases are viral diseases transmitted to birds, humans and horses by mosquitoes. In California these diseases include western equine encephalomyelitis, Saint Louis encephalitis and West Nile virus. These viruses are found naturally in birds where they usually cause no obvious physical symptoms (except for West Nile virus), but can be transported long distances by bird migration. Shasta Mosquito and Vector Control District is part of a

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statewide, integrated program for the detection of mosquito-borne virus diseases. Evidence of WNV was found throughout Shasta County by every method of surveillance used by the District and other agencies for detection of this mosquito-borne disease in 2005.

**Sentinel Chicken Flocks:** Mosquito-borne viruses in California have birds as their natural reservoir hosts. For this reason Shasta Mosquito and Vector Control District maintained chicken flocks to check for the presence of mosquito-borne diseases in the bird population that are transmissible to humans and horses. Cooperating landowners within the district allowed their properties to be used by the District as sentinel chicken locations. There were five sites with twelve chickens per flock within the District. Chickens were bled every two weeks from April 28 through October 13, for a total of 780 blood samples, which were submitted to the California Department of Health Services (DHS) for analysis in 2005. Seven chickens in two flocks within the District were found positive for West Nile Virus in 2005. The affected flocks were located at the District office, and the east Cottonwood area of southern Shasta County.

**Mosquito Pools:** In seventeen areas of high mosquito occurrence, samples of live mosquitoes were collected, sorted, grouped by species, placed into vials, and tested for the presence of encephalitis viruses. A total of 179 samples of live mosquitoes, generally 12 to fifty mosquitoes per sample, were tested either in-house or at the U.C. Davis Arboviral Research Unit. None of the samples submitted to Davis in 2005 was found positive for any mosquito-borne diseases. Two samples tested in-house at the District were found positive for WNV. No other evidence of any type of mosquito-borne disease was found in mosquitoes within the District in 2005. Three different species of mosquitoes in Shasta Mosquito and Vector Control District have been found infected with WNV since its arrival in the District in 2004.

**Dead Bird Surveillance:** The spread of West Nile virus on the east coast has been characterized by conspicuous die-offs of birds – particularly in the crow family. The California Department of Health Services has instituted a program to receive and test dead birds submitted by mosquito districts for the detection of West Nile virus. When someone finds a dead bird they are encouraged to call the state West Nile virus Hotline, 1-877-WNV-BIRD. Depending on workload and the prevalence of WNV in a particular area, Districts may collect dead birds to test for the presence of WNV or merely track the locations of dead birds as a statistical indicator of the level of WNV activity in affected areas. Twenty-eight dead birds from within the District were tested and found positive for WNV in 2005. More detailed information on dead bird testing for WNV within the District is contained in the addendum on District WNV activity attached to this report.



Technician Collects a Dead Magpie

**Out of District Control and Surveillance:** The imminent threat of the arrival of West Nile virus raised new concerns about how Shasta County could deal with a public health emergency in the event of the occurrence of WNV or other mosquito-borne diseases outside of areas covered by

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organized mosquito districts. Shasta Mosquito and Vector Control District considered that allowing WNV to become established within Shasta County, but outside the District, increased the risk that this disease could be brought into the District by infected birds or mosquitoes.

The District had to consider several issues before deciding to perform any sort of mosquito control work outside the District. The California State Health Code only permits mosquito control by District personnel outside of District boundaries within the flight range of mosquitoes. This does not take into account the role of birds in transporting diseases such as WNV. Also the District needed assurance that the Shasta County Board of Supervisors and the Local Agency Formation Commission (LAFCO) felt that mosquito control for public health protection outside of the District was appropriate and necessary. The District also considered the fact that there was not adequate surveillance information available to our personnel to indicate the level and extent of mosquito breeding outside of District boundaries. Without this information the District could not make informed decisions about where mosquito control could or should be conducted outside the District. Finally, the District was concerned that it might not be appropriate to take equipment, materials, and manpower paid for by residents of the District and use it to provide services to people who have historically chosen not to pay for mosquito control services.

In 2003 and 2004, the District was reimbursed by Shasta County for surveillance and emergency mosquito control work done outside of District boundaries. This money was an unanticipated expense taken out of the Shasta County Public Health budget. In 2005 one-time money was provided in the California State Budget for unbudgeted expenses incurred by local agencies due to the costs of emergency West Nile virus response. Among other things this money could be used for emergency mosquito control outside of established vector control district boundaries within the state. Shasta County Public Health received a grant from the state of California to reimburse local mosquito control agencies (Shasta MVCD and Burney Basin Mosquito Abatement District) for emergency mosquito control activities outside of established district boundaries. Approximately \$55 thousand was earmarked for out-of-District control efforts by Shasta Mosquito and Vector Control District. The District expended approximately \$50 thousand of this money in 2005 to operate its truck-mounted equipment for adult mosquito control in populated areas within Shasta County that are outside of District boundaries.

The District recognizes that money from the public health budget and one-time money from the State cannot be used to sustain a comprehensive mosquito control effort in areas not currently served by the District. There is general agreement between the District and Shasta County Public Health that people who are outside the District should have to pay for District services, as residents within the District do, if they are to continue to receive those services on an ongoing basis. A survey conducted by the District in 2004 shows that support for a benefit assessment to provide mosquito control services outside of the District is moderate to high in unserved areas of Shasta County. The potential annexation of these areas will be an important issue for consideration by the District in the coming years.

### **RESEARCH**

University of California researchers have continued to study *Culex pipiens* mosquito larvae from Shasta Mosquito and Vector Control District. University personnel have had difficulty in raising these mosquitoes in laboratory conditions, so the District traps live samples, and sends them to

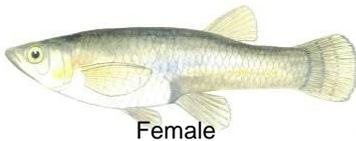
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researchers for use in various projects. These mosquitoes have been found to transmit West Nile virus in a laboratory setting.

In 2004 the District began to cooperate in a five-year study of the effectiveness of certain types of traps for catching egg-laying female mosquitoes. These mosquitoes are more likely to be carrying viral diseases than other mosquitoes in the general mosquito population. Sampling methods that can more selectively target these mosquitoes may be much more effective at monitoring mosquito-borne diseases in nature than current mosquito trapping methods. This research is being conducted by the U.C. Davis Arboviral Research Unit with funding from the U.S. Centers for Disease Control. Mosquitoes trapped in the course of this experiment have provided an additional source of live mosquitoes for virus testing by the District.

All of the above research is intended to be reported to professional pest control and health protection associations and some of it is slated for publication in peer-reviewed journals.

### **BIOLOGICAL CONTROL**



Female

The Shasta Mosquito and Vector Control District uses the mosquito-eating fish (*Gambusia affinis*) to control mosquito larvae in permanent water sources within the



Male

district. Mosquito-eating fish are maintained in holding ponds, and transferred to holding tanks at the district office. In addition to stocking natural areas throughout the District by mosquito control technicians, mosquito-eating fish are distributed free-of-charge to residents within the district for use on their properties. Fish can either be delivered to residents by District Personnel or picked up by District residents at the District office for use in permanent water sources anywhere within the District. The following is a summary of District activities related to the distribution of *Gambusia affinis* in 2005:

|                          |                          |
|--------------------------|--------------------------|
| Fish Retrieving:         | 69.25 Hours Retrieving   |
| Fish Transferring:       | 11.50 Hours Transferring |
| Fish Stocking:           | 106.17 Hours Stocking    |
| Fisheries Maintenance    | <u>228.50</u> Hours      |
| Total Biological Control | 283.24 Hours             |

### **CHEMICAL CONTROL**

The Shasta Mosquito and Vector Control District uses a variety of chemical control techniques in circumstances where other methods are ineffective or impractical. Larvicides are applied to standing water to control mosquito larvae in areas that cannot be controlled by mosquito-eating fish due to their inaccessibility, transient nature, or other factors. Very sophisticated chemicals are used for larvicide work that do not adversely affect the environment due to their highly specific nature and the very low doses which can be used for mosquito control work. These products provide a high level of control, but are more expensive and require more training and continuing education for the mosquito control technicians.

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The presence of large numbers of adult mosquitoes, or the detection of mosquito-borne diseases within the District triggers application of adulticides in areas of concern. Adulticides are applied at ultra-low volumes (ULV) as aerosols over large areas. Pesticides used in these applications are not harmful to non-target organisms at the rates used for adult mosquito control. The applications are generally made before dawn under very stringent weather guidelines to provide maximum effectiveness while minimizing human exposure.

Vegetation control products are used by the District to eliminate cover around the edges of water sources that may provide protection to developing mosquito larvae and/or prevent mosquito sprays from getting to the water surface. Vegetation control products are also used to help keep trails open and maintain access to mosquito sources. All pesticide work is done through cooperative agreements with the California Department of Health and the California Department of Pesticide Regulation. All pesticide use is reported to these agencies on a monthly basis.



Adult Mosquito Control

Adulticiding:

629.17 Hours

Total Acres

216669.71 Acres Treated

Larviciding:

Agricultural Sources

230.75 Hours

13.66%

Industrial Sources

211.42Hours

12.51%

Natural Sources

931.08 Hours

55.11%

Residential Sources

316.17 Hours

18.72%

Total Larviciding

1544.58 Hours

100.00%

Total Larviciding Acres:

1672.53 Acres Treated

Chemical Vegetation Control

571.58 Hours

Total Acres

220.67 Acres Treated

**PHYSICAL CONTROL:**

The Shasta Mosquito and Vector Control District has a program to reduce or eliminate mosquito breeding areas by managing the water sources where mosquitoes breed. Such physical control includes clearing vegetation around pond or stream banks, improving drainage, and providing access for other types of control work. The District works in cooperation with the local California

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Department of Fish and Game.

## Equipment:

|                      |             |
|----------------------|-------------|
| Total Cat Time       | 19.17 Hrs.  |
| Total Backhoe Time   | 234.17 Hrs. |
| Helper Time          | 104.08 Hrs. |
| Total Equipment Time | 357.42 Hrs. |

## Physical Control By Hand

|                                |                   |
|--------------------------------|-------------------|
| Brushing                       | 538.25 Hours      |
| Brushing by Sugar Pine         | 53.67 SMVCD Hours |
| Burning                        | 574.17 Hours      |
| Empty Containers               | 1.75 Hours        |
| Beaver Dam Removal             | <u>8.17 Hours</u> |
| Total Physical Control by Hand | 1176.01 Hours     |



Backhoe Source Reduction

## SOURCE PREVENTION INPUT

With the cooperation of the planning departments of Shasta County and the cities of Anderson, Redding and Shasta Lake, the District reviews proposed development, such as subdivisions and lot splits, in an attempt to reduce the creation of new mosquito breeding sources, to ensure adequate drainage, and District access to mosquito breeding sources.

## WEATHER MONITORING

Weather has significant effects on mosquito activity as well as the District's ability to perform chemical mosquito control. For this reason four weather monitoring towers are located throughout the District to provide real-time information to District personnel. This information is vital to help guide mosquito control efforts.

Increased temperatures speed up the rate at which mosquitoes reproduce. Increases in precipitation increase areas of standing water in which mosquitoes can breed. Other factors such as unseasonably cold temperatures, low humidity and high wind decrease the level of mosquito activity. For this reason, the weather station located at the District office provides continuous data on temperature, humidity, wind speed and precipitation which is stored on a computer where the information can be used for data analysis useful to District personnel and researchers.

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Many chemicals used to control pests often have legal limitations placed on their use related to appropriate weather conditions. Products used by District personnel for controlling weeds must be used in a manner that prevents unreasonable risk. Some of these products cannot be used when temperatures are too high because they tend to evaporate and drift into areas where they can harm non-target plants. High winds can also carry herbicides beyond their target area and cause damage to non-target plants. With four weather stations monitoring wind and temperature throughout the District it is possible to be sure that chemical vegetation control is done only when and where weather conditions are appropriate for safe, effective and legal for the use of these herbicide products.

Proper weather conditions are vitally important to assure the safety and efficacy of products applied for adult mosquito control. These products are put out by highly specialized application equipment that applies very low doses of concentrated mosquito control products in the form of extremely fine droplets over large areas. To be effective these products must drift through an area and stay low to the ground where the mosquitoes are flying or resting. The weather condition that allows this to occur is called a temperature inversion. This means that cold air near the ground is capped by a layer of warmer air above. This keeps the air near the ground from rising, and carrying the mosquito control product out of the target area. The four weather stations within the District take temperature readings at eight feet and thirty feet above the ground to ascertain whether a temperature inversion is present. Adult mosquito control is not performed unless the presence of an inversion assures that safe and effective use of these products is possible.

# SHASTA MOSQUITO & VECTOR CONTROL DISTRICT

A detailed black and white line drawing of a mosquito, shown from a side profile, facing left. It has long, thin legs, a segmented body, and two large, patterned wings. The drawing is positioned behind the word 'MOSQUITO' in the main title.

## 2005 ANNUAL REPORT

William C. Hazeleur, District Manager  
John Albright, District Biologist

District Board of Trustees  
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Board of Trustees Meetings are held the third Tuesday of each month at 1:30 p.m. at the District Office:

19200 Latona Road  
Anderson, CA

Agendas are available online at [shastamosquito.org/Agendas/current\\_agenda.html](http://shastamosquito.org/Agendas/current_agenda.html)