Vector-Borne Diseases in California

2002 Annual Report

Vector-Borne Disease Section
California Department of Health Services
August 2003

2002

ANNUAL REPORT

VECTOR-BORNE DISEASE SECTION

INFECTIOUS DISEASES BRANCH

DIVISION OF COMMUNICABLE DISEASE CONTROL

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

Gray Davis
Governor
State of California

Grantland Johnson, Secretary
Health and Human Services Agency

Diana M. Bontá, R.N., Dr.P.H., Director
Department of Health Services

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VECTOR-BORNE DISEASE SECTION

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State of Calfiornia-Health and Human Services Agency

Department of Health Services

California Department of Health Services

DIANA M. BONTÁ, R.N., Dr. P.H.
Director

A NOTE FROM THE CHIEF

GRAY DAVIS
Governor

I am pleased to submit to you the 2002 Annual Report for the Vector-Borne Disease Section (VBDS) of the California Department of Health Services. Program staff conducted surveillance, prevention, and control of existing and emerging vector-borne diseases throughout California in 2002. Our biologists investigated several cases of tick-borne relapsing fever in the greater Lake Tahoe area and the eastern Sierra Nevadas; 20 cases, approximately double the average number, were reported in California residents in 2002. One case of tularemia was detected in Mendocino County; follow-up surveillance by VBDS uncovered evidence of *Francisella tularensis* infection in *Dermacentor* ticks collected near the patient's residence. Numerous plague surveys were conducted at recreational areas in California, and plague control was initiated at three sites where evidence of plague epizootics presented a risk of human exposure.

In 2002, West Nile virus (WNV) spread into the western United States, and was found in 44 states. Over 4,000 human cases of WNV were detected, including 284 deaths, constituting the largest arboviral meningoencephalitis epidemic documented in the Western Hemisphere. The first evidence of local WNV transmission in California was detected in a resident of Los Angeles County who developed WNV meningitis in August. Seven imported cases of WNV infection were also identified in California in 2002. In response to the rapid expansion of WNV, surveillance efforts were intensified in conjunction with collaborating local and state agencies. Our biologists provided WNV consultation to local agencies throughout the state, and encouraged participation in the WNV dead bird surveillance program. Enhanced public awareness resulted in a 50-fold increase in the number of dead birds reported from 2001 to 2002. The statewide effort to prepare for the introduction and establishment of WNV in California has fostered many valuable partnerships between VBDS and other departments and agencies.

VBDS completed the third year of a project to evaluate mosquito production in stormwater treatment devices. Findings from this project were incorporated into testimony before a U.S. House of Representatives subcommittee on the role of stormwater treatment devices in producing habitat for WNV vectors in urban areas. Our biologists also evaluated adult mosquito control products in collaboration with local vector control agencies in the Sacramento Valley.

In July, Mark Novak, Ph.D., was promoted to serve as the Supervising Public Health Biologist for the Northern Region, replacing Ken Townzen, who retired in 2002 after 33 years of service with the Department of Health Services.

Many of you are our collaborators and colleagues and I hope that you find the information contained in this annual report to be of value as we collectively strive to promote and protect the health of all Californians.

Respectfully,

Vicki L. Kramer, Ph.D.

Introduction

The mission of the Vector-Borne Disease Section (VBDS), California Department of Health Services (DHS), is to protect the health and well-being of Californians from insect and animal transmitted diseases and injurious pests. VBDS provides leadership, information, and consultation on vector-borne diseases to the general public and agencies engaged in vector control activities.

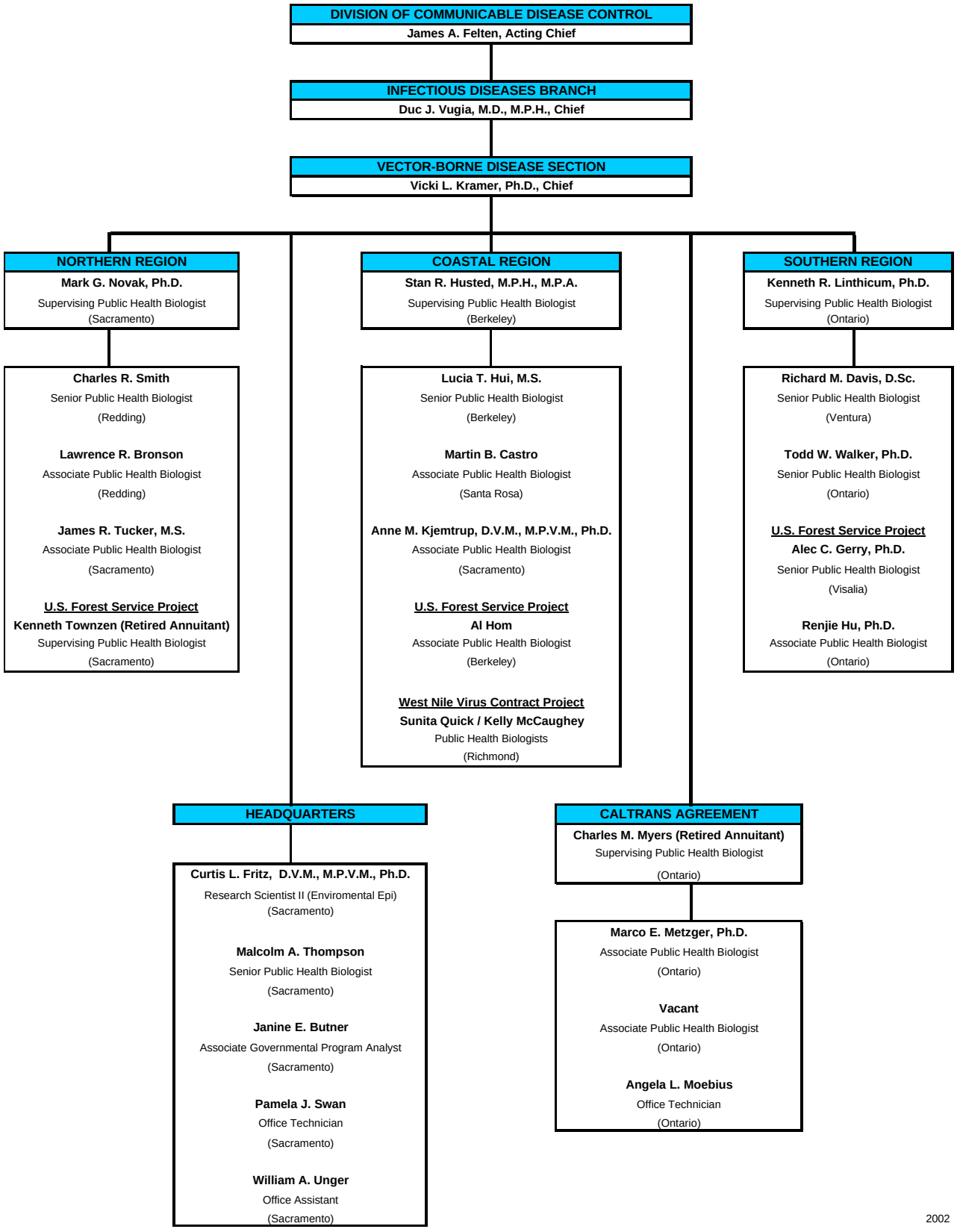
VBDS staff, located in seven regional offices and headquartered in Sacramento, provide the following services:

- Develop and implement statewide vector-borne disease surveillance, prevention, and control programs
- Design and conduct scientific investigations to further knowledge of vector-borne diseases in California
- Coordinate preparedness activities for detection and response to introduced vectors and vector-borne diseases, such as West Nile virus
- Conduct emergency vector control when disease outbreaks occur
- Administer public health exemptions where applicable under the Endangered Species Act in disease outbreaks
- Advise local agencies on difficult public health issues related to vector-borne diseases
- Oversee local vector control agency activities through a Cooperative Agreement
- Oversee the Vector Control Technician Certification and Continuing Education programs
- Provide information, training, and educational materials to governmental agencies and the public
- Provide assistance in coordinating issues related to the management of Africanized honey bees and red imported fire ants
- Advise local governmental agencies, schools, and the public on head lice management
- Maintain the San Francisco Bay Area U.S. Army Corps of Engineers general permit, which allows local vector control agencies to conduct abatement activities
- Oversee Special Local Need permits on restricted use of public health pesticides

This report summarizes surveillance and control activities for plague, hantavirus pulmonary syndrome, and mosquito- and tick-borne diseases in 2002. An update on the California Asian tiger mosquito infestations is included. Activities conducted in the National Forests of California to protect United States Forest Service (USFS) personnel and visitors from vector-borne diseases are included in this report; USFS provides support for these activities through a cost-share agreement. Results from a special project with the California Department of Transportation to examine vector production in stormwater treatment devices are described. VBDS oversees the Vector Control Technician Certification Program; data summarizing the number of exams administered by VBDS and the number of vector control technicians in each certification category are provided. As education and training are important components of a vector-borne disease prevention program, a summary of the many presentations and reports prepared by VBDS staff is included. Many of the state and local agencies with which VBDS collaborated in 2002 are listed in the Acknowledgments section.

Authorizing statutes include: HSC 116108-116120; HSC 116102, et. seq.; HSC 116180; Gov. Code 12582

Personnel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Rodent-borne Virus Surveillance

Hantavirus

Surveillance for hantavirus pulmonary syndrome

Two cases of hantavirus pulmonary syndrome (HPS) were identified in California residents during 2002. Investigations of these cases by the California Department of Health Services (DHS) and collaborating agencies are summarized below.

Mono County, April 2002

A 12-year-old male resident of Mono County presented at a local hospital in April with a four-day history of fever, vomiting, abdominal pain, and slight headache. The patient had no respiratory complaints at admission, but developed respiratory difficulty the following day. Thoracic radiographs revealed diffuse interstitial pulmonary infiltrates. The patient was transferred to a hospital in Los Angeles County for intensive care. He received supplemental oxygen but did not require incubation and recovered without complication.

Serum specimens obtained on the third day of hospitalization tested positive for IgM and IgG antibody to Sin Nombre virus (SNV) at both TriCore Laboratories, University of New Mexico, and a commercial laboratory in southern California. These results were subsequently confirmed at the DHS Viral and Rickettsial Disease Laboratory (VRDL) and the Centers for Disease Control and Prevention (CDC).

Interviews with the patient and his parents and evaluations of the patient's residence were conducted by staff from DHS Vector-Borne Disease Section (VBDS), Mono County Departments of Health and Environmental Health, and Inyo County Department of Environmental Health. The patient's known rodent contact included kicking a dead mouse off the driveway in late January and removing a live mouse from a washing machine in March. The patient reported that during the latter episode he wore leather gloves and a dust mask, and used a plastic bag, a sheet of sandpaper, and a stick to remove the mouse. The patient released the mouse across the street and denied any direct contact with it. The patient reported noting a strong urine odor in the laundry area during this time, but denied observing any rodent urine or feces. Family members recalled no other signs of rodents in the house. The patient's only travel outside the area was a family trip to Mexico in late February.

Examination of the patient's residence revealed no signs of rodents within the home. Squirrels and chipmunks were observed in wood piles and stone retaining walls around the property. Rodent surveillance conducted at the residence and surrounding area yielded two *Peromyscus maniculatus* from the residence: one mouse from near the washing machine in the garage, the other near a neighbor's house. Antibody to SNV was not detected in serum specimens from these rodents.

Santa Clara County, July 2002

A 47-year-old female resident of Santa Clara County presented to a local hospital in July with fatigue, shortness of breath, and right flank pain. Thoracic radiographs taken at admission revealed some lower lobe interstitial and pleural effusion. The patient had a relatively mild clinical course, requiring only minimal supplemental oxygen. She recovered and was discharged one week after admission.

Serum collected on the third day of hospitalization tested positive at a university medical center laboratory for IgM and IgG antibody to hantavirus. These results were confirmed by VRDL and CDC.

The patient reported having briefly observed areas of rodent activity (droppings and urine stains) underneath her house while having a deck rebuilt approximately one week prior to onset. The patient

denied observing any rodent activity inside her home. The patient's only reported travel outside her county of residence was to a rental cabin in Alpine County in early June.

Staff of the Santa Clara County Vector Control District conducted an inspection and rodent surveillance of the case-patient's residence. Aside from a single *Rattus* trapped, no evidence of rodents was observed. Additional efforts by VBDS to collect rodents at the residence and surrounding areas proved equally unsuccessful. Staff of VBDS conducted rodent surveillance at the rental cabin and surrounding facility in Alpine County. Overnight trapping (125 traps) yielded 30 *P. maniculatus* and two *Microtus* sp. VRDL detected SNV antibody in serum specimens from 20 *P. maniculatus* and one *Microtus*. VBDS staff emphasized the need for increased hantavirus awareness and risk management to the Alpine County facility management.

Since 1993, HPS has been diagnosed in 35 California residents. Four of these were identified retrospectively, with onset of illness having occurred in 1980, 1984, and 1992 (2). Twelve (35%) cases had a fatal outcome. An additional two California residents were diagnosed with acute SNV infection without pulmonary manifestations. The mean age of all 37 case-patients was 39 years (range, 12 to 68) and 17 were female. Case-patients were residents of 16 counties—Alameda, Contra Costa (2), Inyo (5), Kern (4), Los Angeles (2), Modoc, Mono (8), Nevada (2), Plumas, Sacramento, Santa Barbara, San Bernardino, San Francisco, Santa Clara (2), Ventura (2), and Yolo (2). Probable and possible sites of exposure included the counties of Alameda, Alpine, Fresno, Inyo (5), Kern (4), Modoc, Mono (11), Nevada (2), Placer, Plumas, Santa Barbara, and Tuolumne, and the states of Arizona, New Mexico (3), Utah, and Washington.

Surveillance for hantavirus in California rodents

Surveillance for hantavirus in rodents was conducted in 15 California counties during 2002. A total of 2,702 rodents were collected and serologically tested for SNV antibody, representing at least 24 species from 12 genera (Table 1). At least one seroreactive rodent was detected in 11 counties. Of 2,172 *Peromyscus* spp. collected, 253 (11.6 %) had serologic evidence of infection with SNV. Seroprevalence was highest in *Peromyscus maniculatus* at 21.8 percent. Active surveillance since 1993 and retrospective analysis of rodent specimens captured since 1975 have identified serologic evidence of SNV infection in 12.1 percent of *P. maniculatus* statewide. At least one seroreactive *P. maniculatus* specimen has been identified in 43 of 53 counties sampled (Table 2). *Reithrodontomys megalotis* and *Microtus californicus* specimens have demonstrated evidence of infection with Sin Nombre-like hantaviruses (El Moro Canyon and Isla Vista, respectively), but these strain variants have not been shown to be pathogenic to humans. Seroreactivity has been occasionally identified in *Neotoma*, *Chaetodipus*, and *Spermophilus* rodents in California and elsewhere; however, it is believed that these species are incidentally infected with SNV and are not competent reservoirs or vectors.

Arenaviruses

Surveillance for arenavirus infection in California residents

No cases of arenavirus infection were detected in California residents in 2002.

Surveillance for arenaviruses in California rodents

Surveillance for the arenavirus Whitewater Arroyo (WWA) in rodents was conducted in one California county during 2002–Orange County–in the final year of a collaborative surveillance project by the Orange County Vector Control District and the University of Texas Medical Branch-Galveston (Table 3). A total of 554 rodents were collected and serologically tested, representing at least 13 species from nine genera (Table 4). Antibody to WWA was detected in two rodent species—*Neotoma fuscipes* and *Peromyscus californicus*. Arenavirus surveillance conducted by or reported to DHS since 1999 has identified serologic evidence of WWA infection in 32 (1.7 %) of 2,315 rodents tested.

Table 1. Serologic evidence of hantavirus (Sin Nombre) in California rodents, 1975-2002.

Species	Common name	2002 No. collected	2002 No. reactive	2002 Percent	1975-2002 No. collected	1975-2002 No. reactive	1975-2002 Percent
FAMILY MURIDAE							
SUBFAMILY SIGMODONTINAE (New World mice and rats)							
Neotoma fuscipes	dusky-footed woodrat	119	4	3.4	792	8	1.0
Neotoma lepida	desert woodrat	90	5	5.6	423	12	2.8
Neotoma sp.	other and unspecified *Neotoma*	4	0		74	2	2.7
Onychomys torridus	southern grasshopper mouse	3	0		4	0	
Peromyscus boylii	brush mouse	457	40	8.8	1370	62	4.5
Peromyscus californicus	parasitic mouse	420	4	1.0	1625	29	1.8
Peromyscus crinitus	canyon mouse	84	2	2.4	183	6	3.3
Peromyscus eremicus	cactus mouse	343	23	6.7	848	31	3.7
Peromyscus maniculatus	deer mouse	836	182	21.8	6315	764	12.1
Peromyscus truei	piñon mouse	32	2	6.3	607	22	3.6
Peromyscus sp.	unspecified *Peromyscus*	0			104	12	11.5
Reithrodontomys megalotis	western harvest mouse	85	11	12.9	510	63	12.4
Sigmodon hispidus	hispid cotton rat	0			22	0	
SUBFAMILY ARVICOLINAE (voles)							
Clethrionomys californicus	California red-backed vole	0			1	0	
Microtus californicus	California vole	12	0		160	29	18.1
Microtus spp.	other and unspecified *Microtus*	7	1	14.3	36	5	13.9
SUBFAMILY MURINAE (Old World mice and rats)							
Mus musculus	house mouse	21	0		256	0	
Rattus spp.	Norway rat and black rat	11	0		168	0	
FAMILY HETEROMYIDAE							
Chaetodipus spp.	pocket mice	169	1	0.6	451	3	0.7
Dipodomys spp.	kangaroo rat	5	0		76	1	1.3
Perognathus parvus	Great Basin pocket mouse	2	0		28	1	3.6
FAMILY SCIURIDAE (squirrels and chipmunks)							
Ammospermophilus leucurus	white-tailed antelope squirrel	0			5	0	
Glaucomys sabrinus	northern flying squirrel	0			1	0	
Sciurus griseus	western gray squirrel	0			1	0	
Spermophilus spp.	ground squirrels	1	0		1249	1	0.1
Tamias spp.	chipmunks	0			284	0	
Tamiasciurus douglasii	Douglas's squirrel	0			8	0	

Source: California Department of Health Services

Table 2. Serologic evidence of hantavirus (Sin Nombre) infection in *Peromyscus maniculatus*, by county, 1975-2002.

	2002			1975-2002		
County	**No. collected**	**No. reactive**	**Percent**	**No. collected**	**No. reactive**	**Percent**
Alameda	22	0		67	2	3.0
Alpine	27	20	74.1	82	31	37.8
Butte				115	14	12.2
Calaveras				45	9	20.0
Colusa				23	9	39.1
Contra Costa				36	0	
Del Norte				49	1	2.0
El Dorado	86	55	64.0	127	61	48.0
Fresno				508	75	14.8
Glenn				4	0	
Humboldt				55	5	9.1
Imperial				6	1	16.7
Inyo	2	0		77	5	6.5
Kern				129	10	7.8
Lake				22	1	4.5
Lassen	124	34	27.4	181	39	21.5
Los Angeles	17	6	35.3	396	22	5.6
Madera				62	8	12.9
Marin				105	3	2.9
Mariposa				46	7	15.2
Mendocino				38	4	10.5
Merced				68	4	5.9
Modoc				71	10	14.1
Mono	46	11	23.9	273	58	21.2
Monterey	19	6	31.6	125	15	12.0
Napa				24	0	
Nevada				150	52	34.7
Orange	98	5	5.1	302	15	5.0
Placer				32	2	6.3
Plumas				67	14	20.9
Riverside	233	15	6.4	820	55	6.7
Sacramento				36	0	
San Bernardino	57	21	36.8	316	29	9.2
San Diego	45	2	4.4	391	19	4.9
San Francisco				30	0	
San Joaquin				11	1	9.1
San Luis Obispo	40	6	15.0	105	11	10.5
San Mateo	15	1	6.7	151	11	7.3
Santa Barbara				322	87	27.0
Santa Clara				43	0	
Shasta				32	4	12.5
Sierra				46	9	19.6
Siskiyou	5	0		122	12	9.8
Solano				3	0	
Sonoma				133	1	0.8
Stanislaus				15	0	
Tehama				35	5	14.3
Trinity				24	8	33.3
Tulare				20	2	10.0
Tuolumne				130	23	17.7
Ventura				190	10	5.3
Yolo				24	0	
Yuba				31	0	
Total	**836**	**182**	**21.8**	**6315**	**764**	**12.1**

Source: California Department of Health Services

Table 3. Serologic evidence of arenavirus (Whitewater Arroyo) in California rodents, by county, 1999-2002.

	2002			1999-2002		
County	**No. collected**	**No. reactive**	**Percent**	**No. collected**	**No. reactive**	**Percent**
Alameda				151	1	0.7
Contra Costa				12	0	
Fresno				59	1	1.7
Inyo				17	0	
Kern				15	1	6.7
Lassen				6	0	
Los Angeles				82	0	
Marin				214	1	0.5
Mono				1	0	
Orange	554	2	< 0.1	1688	24	1.4
Santa Barbara				8	4	50.0
Santa Clara				35	0	
Tuolumne				20	0	
Ventura				9	0	
Yolo				1	0	
Total	**554**	**2**	**< 0.1**	**2318**	**32**	**1.7**

Source: California Department of Health Services

Table 4. Serologic evidence of arenavirus (Whitewater Arroyo) in California rodents, 1999-2002.

Species	Common name	2002 No. collected	2002 No. reactive	2002 Percent	1999-2002 No. collected	1999-2002 No. reactive	1999-2002 Percent
FAMILY MURIDAE							
SUBFAMILY SIGMODONTINAE (New World mice and rats)							
Neotoma fuscipes	dusky-footed woodrat	30	1	3.3	266	10	3.8
Neotoma lepida	desert woodrat	28	0		143	0	
Neotoma sp.	other and unspecified *Neotoma*				104	0	
Peromyscus boylii	brush mouse	46	0		94	1	0.1
Peromyscus californicus	parasitic mouse	118	1	0.1	228	3	1.3
Peromyscus eremicus	cactus mouse	86	0		211	2	0.1
Peromyscus maniculatus	deer mouse	161	0		902	16	1.8
Peromyscus truei	piñon mouse				16	0	
Peromyscus sp.	other and unspecified *Peromyscus*				1	0	
Reithrodontomys megalotis	western harvest mouse	25	0		49	0	
SUBFAMILY ARVICOLINAE (voles)							
Microtus californicus	California vole	3	0		14	0	
SUBFAMILY MURINAE (Old World mice and rats)							
Mus musculus	house mouse	23	0		180	0	
Rattus spp.	Norway rat and black rat	10	0		48	0	
FAMILY GEOMYIDAE (pocket gophers)							
Thomomys bottae	Botta's pocket gopher	1	0		2	0	
FAMILY HETEROMYIDAE							
Chaetodipus spp.	pocket mice	13	0		33	0	
Dipodomys spp.	kangaroo rat				13	0	
FAMILY SCIURIDAE (squirrels and chipmunks)							
Spermophilus spp.	ground squirrels	10	0		11	0	

Source: California Department of Health Services

Plague Surveillance and Control

The California Department of Health Services (DHS) supervises local, state, and federal agencies to conduct a cooperative statewide plague surveillance program. DHS collects, collates, and analyzes information on suspect and confirmed plague activity among humans, domestic pets, and wild animals throughout California. This report summarizes plague activity in California for 2002.

Human cases
There were no confirmed human plague cases in California in 2002.

Domestic pets
Veterinarians submitted specimens from nine domestic cats and one dog with clinical signs suggestive of plague to the DHS Microbial Diseases Laboratory (MDL) for testing. Plague was confirmed in one cat from Nevada County. The cat presented to a Truckee veterinary clinic in mid-August with a four-day history of lethargy and anorexia. The cat was febrile (106 ^{o}F) and had one enlarged submandibular lymph node which was not fluctuant or draining. *Yersinia pestis* was detected by direct fluorescent antibody in an aspirate of the enlarged lymph node. The cat defervesced within 24 hours of having been started on antimicrobial treatment and recovered without complication. The cat belonged to a multi-pet household near Donner Lake, just west of Truckee. Subsequent surveillance identified a plague epizootic among local wild rodents in this area (see below).

Wild animals
Blood samples were collected from 377 wild carnivores, 12 feral pigs, and two opossums from 29 California counties and tested for antibody to *Yersinia pestis* (Table 5, Figure 1). Antibody to *Y. pestis* was detected in 32 (8.8%) specimens, including 21 of 242 coyotes, 4 of 33 black bears, 2 of 18 mountain lions, 3 of 40 raccoons, 1 of 2 skunks, and 1 of 1 badger. Estimated seroprevalence was highest in Plumas County where 13 (50%) of 26 wild carnivores sampled were positive. *Y. pestis* antibody was recorded in carnivore specimens from ten counties: El Dorado, Kern, Lassen, Modoc, Nevada, Placer, Plumas, Sierra, Siskiyou, and Tuolumne.

Serological surveillance of wild rodents for plague was conducted in 23 California counties and samples tested through the cooperative program. *Y. pestis* antibody was detected in rodents from five counties: Inyo, Mono, Nevada, Riverside, and Ventura.

A total of 52 wild rodents and 9 flea pools from wild rodents were submitted to the DHS Microbial Diseases Laboratory for bacteriologic culture. *Y. pestis* was cultured from four chipmunks, all from Nevada County.

In August 2002, an active plague epizootic, confirmed by bacteriological and serological testing of wild rodents and domestic pets, was detected in the vicinity of Donner Lake, just west of Truckee, Nevada County. *Yersinia pestis* was recovered from an ill domestic cat and four chipmunk carcasses, found by local residents in neighborhoods near the lake and in a picnic ground in Donner Memorial State Park, in August. The California Department of Parks and Recreation decided to close the camping and picnic areas of the Park pending further evaluation of the plague transmission risk to the public. During evaluation of the Park by DHS Vector-Borne Disease Section (VBDS) and the Nevada County Health Department wild rodents were found to be heavily infested with fleas; antibody to *Y. pestis* was detected in two chipmunks from park campgrounds.

Based on these findings, plague control measures were implemented to protect park staff and visitors, and additional plague warnings were posted throughout the Donner Lake region. Staff of the VBDS, in cooperation with the California Department of Parks and Recreation and Washoe County (NV) Vector Control, applied Diazinon 2% insecticide dust to rodent burrows via hand dusters and bait-dust stations. At the picnic ground near Donner Lake, liquid deltamethrin applied to modified carpet-lined bait stations was utilized for vector flea control. Following successful flea control, all park facilities were re-opened for public use.

VBDS collaborated with staff of the Environmental Health Departments of Inyo and Mono Counties to conduct control of potential flea vectors of plague at two sites in the Inyo National Forest. Seropositive rodents were detected at both sites in 2001 and 2002. At the Inyo County site, rodent burrows were treated with Diazinon 2% insecticidal dust; at the Mono County site, Diazinon-treated bait stations were deployed and replenished throughout the summer. Follow-up surveillance indicated that estimated flea indices on wild rodents were reduced at both sites compared to 2001.

Table 5. Mammals tested for plague in California, 2002 (All specimens are sera except where otherwise indicated).

County Location[1]	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	Result	Month
Alameda	17	1			
Alpine	1	1			
Contra Costa	0	4			
El Dorado	8	31			
So. Lake Tahoe			Coyote	1:512	April
Ice House Resort, 12N Hwy 50 at Riverton			Black bear	1:64	July
Fresno	4	20			
Humbodlt	0	8			
Inyo	84	0			
Inyo NF, Four Jeffrey CG			CA G Sq	1:64	July
Kern	29	34			
Arvin, 45S			Mountain lion	1:64	April
Frazier Park, 3W			Mountain lion	1:128	August
Frazier Park, 5W			Raccoon	1:64	July
Glenville			Coyote	1:128	September
Glenville			Coyote	1:256	September
Glenville, 1N			Coyote	1:64	October
Tehachapi			Coyote	1:32	August
Lassen	0	5			
Madeline, 3W			Coyote	1:512	May
Madeline, 5S			Coyote	1:256	May
Los Angeles [2]	0	41			
Mariposa	0	19			
Mendocino	0	7			
Modoc	7	15			
Alturas, 8E			Coyote	1:128	May
Alturas, 8E			Coyote	1:64	May
Likely, 2W			Coyote	1:64	May
Mono	98	0			
Inyo NF, Crestview guard/fire station			Chipmunk, LP	1:256	June
Inyo NF, Crestview guard/fire station			Chipmunk, LP	1:256	October
Monterey	35	15			
Nevada	56	2			
Truckee, 10N			Coyote	1:512	April
Truckee			Chipmunk, YP[3]	POS	August
Truckee			Chipmunk, YP[3]	POS	August
Truckee			Chipmunk, YP[3]	POS	August
Donner Memorial SP			Chipmunk, S	1:512	September
Donner Memorial SP			Chipmunk, YP	1:256	September
Donner Memorial SP			Chipmunk, YP[3]	POS	September
Orange	0	1			
Placer	14	17			
Lake Tahoe			Black bear	1:256	July
Plumas	9	21			
Beckwourth, 10N			Coyote	1:256	May
Beckwourth, 10N			Coyote	1:512	May
Beckwourth, 7S			Coyote	1:64	June
Beckwourth, 7N			Coyote	1:64	June
Beckwourth, 3W			Coyote	1:64	June
Beckwourth, 8N			Coyote	1:256	June
Chester			Raccoon	1:2048	May
Chester			Raccoon	1:64	April
Chester			Skunk	1:32	April
Graeagle, 3E			Black bear	1:256	June
Lake Davis			Coyote	1:1024	May
Loyalton, 10NW			Coyote	1:64	April
Vinton, 2N			Coyote	1:64	April

Source: California Department of Health Services

Table 5. Mammals tested for plague in California, 2002 (All specimens are sera except where otherwise indicated). Continued.

County / Location[1]	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	Result	Month
Riverside	250	1			
San Bernardino NF, Marion Mountain CG			CA G Sq	1:256	July
San Benito	0	2			
San Bernardino	203	0			
San Diego	0	12			
San Luis Obispo	25	25			
San Mateo	42	0			
Santa Barbara	10	5			
Santa Clara	7	3			
Sierra	0	1			
Sierraville, 2N			Coyote	1:64	June
Siskiyou	15	32			
Dorris, 6W			Badger	1:512	June
Sonoma	0	20			
Stanislaus	10	0			
Trinity	0	7			
Tulare	9	0			
Tuolumne	0	19			
Pine Crest			Black bear	1:32	June
Ventura	80	0			
Los Padres NF, Chuchupate CG			CA G Sq	1:32	May
Los Padres NF, Chuchupate CG			Chipmunk, M	1:128	June
Los Padres NF, Chuchupate CG			Chipmunk, M	1:32	May
Yuba	1	8			
	1014	377			

[1] Mileage and direction from nearest town may be indicated

[2] Plague surveillance and test results submitted by Los Angeles County Department of Health Services

[3] Carcass

Abbreviations

Location: NF, National Forest
NP, National Park
CG, Campground
SP, State Park

Species: CA G Squirrel, California ground squirrel
Chipmunk LP, Lodgepole chipmunk
Chipmunk M, Merriam's chipmunk
Chipmunk YP, Yellow-pine chipmunk

Source: California Department of Health Services

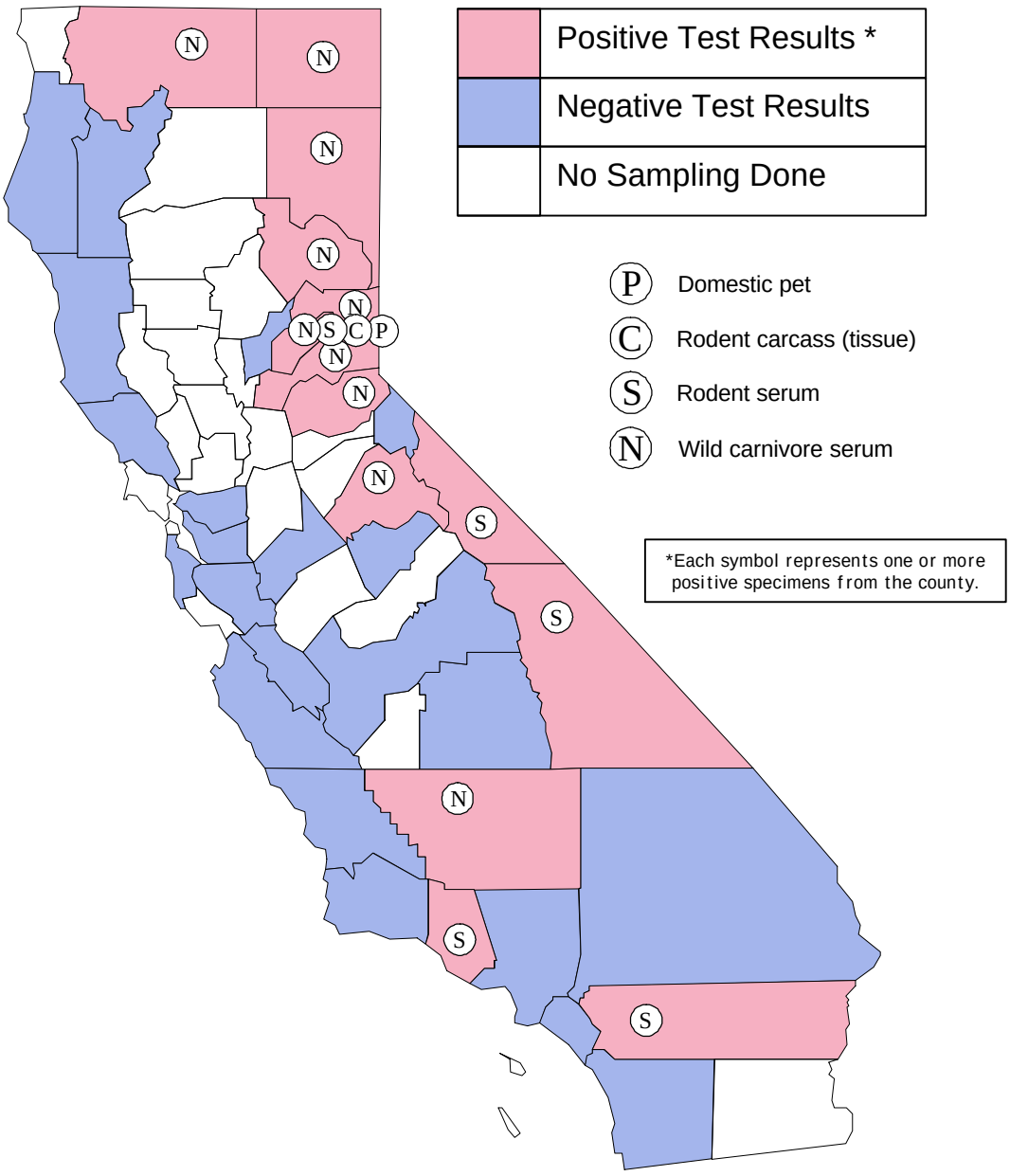

Figure 1. Distribution of specimens tested for evidence of *Y. pestis* by county, 2002.

Source: California Department of Health Services

Tick-borne Disease Surveillance

Ehrlichiosis

One case of human granulocytic ehrlichiosis (HGE) was confirmed in California in 2002. In July, the California Department of Health Services (DHS) Viral and Rickettsial Disease Laboratory detected elevated IgM and IgG antibody to *Anaplasma phagocytophilum* (formerly *Ehrlichia phagocytophila*) in serum from a resident of Humboldt County. The patient was a 54-year-old female who had onset of fever (104 °F), headache, and malaise in May. She recovered without complication following antibiotic treatment. This was the seventh ehrlichiosis case detected in Humboldt County since 1997 and the twelfth autochthonous case from California since 1994 (Marin County – 1 human monocytic ehrlichiosis [HME], 2 HGE; Humboldt County – 2 HME, 5 HGE; Santa Cruz County – 2 HGE).

Lyme disease

A total of 97 cases of Lyme disease were reported to DHS in 2002. Case patients were residents of 33 counties (Table 6). Mendocino County reported the most cases (11) and had the highest population-adjusted incidence at 12.7 cases per 100,000 residents (Figure 2). Of 70 cases for whom site of likely exposure was reported, 36 (51%) had exposure outside their county of residence; 25 (36%) of these reported exposure outside California. The most frequently reported locations of exposure were Mendocino County (13) and the states of Connecticut (7) and New York (5).

The median age of reported Lyme disease cases was 40 years (range, 2 to 85 years) and 50 (52%) were female. Of 88 cases for which race was reported, 84 (95%) were white. Erythema migrans (EM) was identified in 59 (61%) of reported Lyme disease cases. Of 54 cases with EM for which date of illness onset was reported, 25 (46%) occurred between May and August.

VBDS and collaborating agencies conducted tick surveillance in 14 counties in 2002 (Table 7). A total of 3,577 *Ixodes pacificus* (3,569 adults, 8 nymphs), 1,532 *Dermacentor occidentalis* (1,531 adults, 1 larva), and 3 adult *D. variabilis* were collected. Of these, 3,073 *I. pacificus* (3,068 adults, 5 nymphs) were tested for *Borrelia burgdorferi* in seven different laboratories (Table 7). Ticks were tested by culture, indirect fluorescent antibody (IFA), direct fluorescent antibody (DFA) and/or polymerase chain reaction (PCR). Evidence of *B. burgdorferi* was identified in ticks collected from Alameda, Butte, Contra Costa, Lake, and Shasta Counties.

In collaboration with the U.S. Army Center for Health Promotion and Preventive Medicine–West, 814 adult *I. pacificus* collected from Kern, Los Angeles, Madera, Placer, San Bernardino, and Tulare Counties were also tested for *Borrelia* spirochetes not in the *B. burgdorferi* complex. Genetic material detected by PCR in one pool of ten ticks from Driver's Flat, Placer County, resembled that for a relapsing fever spirochete previously described from *I. scapularis.*

A multi-year study on the biology of *I. pacificus* in southern California, initiated in 2001, continued in 2002. DHS Vector-Borne Disease Section (VBDS) and collaborating agencies (Los Angeles County Department of Health Services, Los Angeles County West Vector Control District, and Riverside County Department of Environmental Health) collected ticks from six sites in three different geographic locales (Santa Monica Mountains, Griffith Park, and San Jacinto Mountains) twice per month. VBDS screened a split sample of each tick midgut by DFA; specimens with DFA results suggestive of *Borrelia* infection were forwarded to collaborating laboratories at the University of California, Berkeley and

University of California, Irvine for culture and/or PCR. A total of 923 *I. pacificus* ticks were collected in 2002: 14 from the Santa Monica Mountains, 494 from Griffith Park, and 415 from the San Jacinto Mountains. Of these, 479 ticks were screened by DFA and 18 had results suggestive of *B. burgdorferi* infection; all were culture negative.

A multi-year study of *I. pacificus* and *B. burgdorferi* infection was initiated at Loafer Creek State Recreation Area, Butte County, and Shasta Lake, Shasta County. Evidence of *B. burgdorferi* infection was detected by IFA in 12 of 242 adult *I. pacificus* collected from Butte County and 6 of 339 from Shasta County. Further surveillance at both sites is planned for 2003.

Rocky Mountain spotted fever

Two cases of Rocky Mountain spotted fever (RMSF) were reported in 2002. One case was a resident of Lake County who developed a vesicular cutaneous lesion in July that progressed to form a 2cm eschar. The eschar and the patient's constitutional symptoms (malaise, fever, headache) resolved rapidly following antibiotic treatment. Acute and convalescent sera demonstrated a greater than 64-fold rise in titer to *Rickettsia rickettsii*. The patient had no known recent history of travel outside Lake County.

The second RMSF case was a resident of Riverside County who was likely infected during extensive recent travel in the Midwest.

Tick-borne relapsing fever

In 2002, 20 cases of tick-borne relapsing fever (RF) were reported in California. Cases were 2- to 85-years-old; ten were $\leq$16 years-old. Fifteen (75%) cases had onset of illness between June and August. Cases were residents of 13 counties, but 17 (85%) cases were exposed in the greater Lake Tahoe area or the eastern Sierra Nevadas. One case was exposed near his residence in Lassen County; the likely site of exposure was unknown for two cases.

Nine RF cases were associated with six different sites of exposure in the greater Lake Tahoe area (Nevada, Placer, and Douglas [NV] Counties). VBDS conducted investigations of two exposure sites; evidence of rodent activity and ingress to the implicated buildings were observed, but no ticks were recovered. VBDS provided owners and managers of all six sites with information on RF and guidelines for rodent removal and exclusion.

Eight RF cases were associated with five different sites of exposure in the eastern Sierra Nevada (Mono and Inyo Counties). Staff of Inyo County Environmental Health Department, Mono County Environmental Health, and VBDS conducted tick surveillance at all sites. Twenty-six *Ornithodoros hermsi* (16 adults and 10 nymphs) were collected from one site in Inyo County and three adult *O. hermsi* from two sites in Mono County. *Borrelia hermsii* was identified in two nymphs by PCR conducted at the University of California, Irvine.

Tularemia

In June, DHS was notified by the Mendocino County Health Department of a 40-year-old male resident who presented to his physician with pain and swelling in his hand following a fishing injury sustained at Clear Lake, Lake County. Three days after presentation, the patient developed fever and body aches. The wound healed, but a private laboratory cultured *Francisella tularensis* from the patient's blood. Culture results were subsequently confirmed by the Microbial Disease Laboratory (MDL) and Centers for Disease Control and Prevention (CDC).

The case patient was a caretaker of a ranch in Mendocino County. He had no history of travel or recent tick bites, although he reported many tick bites over the years at the ranch. No other family members or domestic animals at the ranch had been recently ill.

A VBDS investigation of the ranch and the patient's residence in July included rodent sampling, tick collection, and serologic evaluation of domestic animals. Blood samples of two horses, one dog, one cat, and 11 deer mice (*Peromyscus maniculatus)* were submitted to CDC; all were negative for *F. tularensis* antibodies by microagglutination. Cultures of 11 deer mice carcasses by MDL were negative. Two pools of *Dermacentor* spp. larvae removed from deer mice were positive for *F. tularensis* by PCR at MDL. A total of six *Dermacentor* spp. adult ticks and one *I. pacificus* nymph were collected from vegetation near the patient's residence. One pool of two *D. occidentalis* and two pools of *D. variabilis* (3 and 1 ticks each) were positive for *F. tularensis* by PCR; the *I. pacificus* nymph was negative.

Table 6. Reported Lyme disease cases by county of residence, California, 1993-2002.

County	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Reported cases per 100,000 person-years
Alameda	7	1	2	2	3	6	3	4	4	5	0.25
Alpine	0	0	0	0	0	0	0	0	0	0	0.00
Amador	0	0	0	0	0	0	1	0	1	0	0.57
Butte	3	0	1	4	53	13	18	3	2	3	4.84
Calaveras	0	0	0	0	0	0	0	1	0	0	0.25
Colusa	0	0	0	0	0	0	0	0	0	0	0.00
Contra Costa	4	2	0	1	6	2	1	1	5	3	0.26
Del Norte	3	0	2	0	1	0	1	0	0	2	3.25
El Dorado	0	2	4	0	3	2	1	0	0	0	0.75
Fresno	3	0	0	1	0	0	0	1	0	0	0.06
Glenn	0	0	0	0	2	0	1	1	0	0	1.50
Humboldt	6	2	4	5	19	20	14	10	4	4	6.93
Imperial	0	0	0	0	1	0	0	0	0	0	0.07
Inyo	0	0	0	0	0	0	0	0	1	0	0.55
Kern	2	2	1	1	2	2	2	2	0	2	0.24
Kings	0	0	0	0	0	0	0	0	0	0	0.00
Lake	6	1	2	0	1	2	1	0	1	0	2.38
Lassen	0	0	0	0	2	1	2	0	0	2	2.04
Los Angeles	3	2	5	2	6	3	7	2	9	6	0.05
Madera	1	0	0	0	0	0	1	0	0	0	0.16
Marin	4	2	10	0	4	8	4	3	1	4	1.61
Mariposa	0	0	0	0	0	0	0	0	0	1	0.59
Mendocino	23	4	12	3	2	16	8	7	4	11	10.36
Merced	0	0	0	0	2	0	1	1	0	0	0.19
Modoc	0	0	0	0	0	0	0	0	0	0	0.00
Mono	0	0	1	1	0	0	1	0	0	0	2.33
Monterey	4	1	2	0	2	1	2	1	0	5	0.45
Napa	2	0	0	1	3	0	2	2	3	3	1.28
Nevada	5	8	0	2	1	4	5	9	6	3	4.66
Orange	3	0	0	0	0	1	2	3	0	3	0.04
Placer	2	2	1	0	5	4	2	1	4	3	0.96
Plumas	0	0	1	3	0	2	1	0	1	0	3.86
Riverside	3	2	0	1	0	0	0	3	2	1	0.08
Sacramento	1	0	1	0	5	1	1	3	4	1	0.14
San Benito	0	0	0	0	0	0	0	0	1	1	0.37
San Bernardino	1	3	1	0	0	0	1	1	0	0	0.04
San Diego	4	7	6	5	4	0	16	9	3	7	0.22
San Francisco	2	1	1	4	1	7	1	2	3	3	0.32
San Joaquin	1	2	0	1	2	0	0	0	0	0	0.11
San Luis Obispo	1	1	0	1	0	1	1	1	0	0	0.24
San Mateo	3	2	1	2	3	4	4	2	4	4	0.41
Santa Barbara	1	0	3	1	1	3	0	0	1	2	0.30
Santa Clara	2	3	2	2	4	6	2	2	2	6	0.18
Santa Cruz	5	2	3	2	2	2	2	5	9	1	1.28
Shasta	0	3	1	1	0	2	0	0	2	1	0.61
Sierra	0	0	0	0	0	0	0	0	0	0	0.00
Siskiyou	2	1	0	0	1	1	0	0	1	1	1.56
Solano	0	0	0	0	0	0	0	1	1	0	0.05
Sonoma	20	3	11	13	10	15	14	8	6	4	2.25
Stanislaus	1	1	0	3	1	0	0	1	1	0	0.18
Sutter	1	0	0	0	1	0	0	1	1	0	0.50
Tehama	0	1	0	0	1	1	0	2	0	0	0.90
Trinity	1	0	0	1	0	1	13	1	1	1	14.62
Tulare	1	3	1	1	0	1	1	0	2	0	0.27
Tuolumne	1	0	0	1	0	0	0	0	2	1	0.91
Ventura	1	0	0	0	0	2	1	2	2	1	0.12
Yolo	1	1	0	0	0	0	0	0	0	2	0.24
Yuba	0	3	1	0	0	1	1	0	0	0	0.99
Total	**134**	**68**	**80**	**65**	**154**	**135**	**139**	**96**	**94**	**97**	**0.31**

Source: California Department of Health Services

Table 7. *Ixodes pacificus* ticks tested for evidence of *Borrelia burdorferi*, California, 2002.

County	Location	No. ticks tested	No. pools tested	No. pools positive				Laboratory
				Culture	DFA	IFA	PCR	
Alameda	Hayward, Old Highland Park	10	10	-	-	0	-	Sonoma Co. PHL
	Oakland	1	1	-	-	0	-	Alameda Co. PHL
	Oakland	171	171	-	-	3	-	Sonoma Co. PHL
Butte	Loafer Creek State Recreation Area	242	242	-	-	12	-	Washoe Co EH
Contra Costa	Briones Regional Park	40	40	-	-	2	-	CCCMVCD
	Diablo	54	54	-	-	0	-	CCCMVCD
	Lafayette	124	124	-	-	4	-	CCCMVCD
	Moraga	13	13	-	-	0	-	CCCMVCD
	Orinda	8	8	-	-	0	-	CCCMVCD
	San Ramon	100	100	-	-	1	-	CCCMVCD
Kern	Sequoia NF	1	1	-	-	-	0	US Army
Lake	Clear Lake	103	12	8	-	7	-	Sac/Yolo MVCD
	Clear Lake, Dorn Trail	46	9	1	-	2	-	Sac/Yolo MVCD
Los Angeles	Bell Canyon Park	27	3	-	-	-	0	US Army
	Catalina Island	146	15	-	-	-	0	US Army
	Griffith Park	193	193	-	0	-	-	CDHS, VBDS
	Malibu, Charmlee Park	2	2	-	0	-	-	CDHS, VBDS
	Santa Monica Mt Conservancy Parkland	114	12	-	-	-	0	US Army
	Tapia State Park	2	2	-	0	-	-	CDHS, VBDS
Madera	Sierra NF	56	7	-	-	-	0	US Army
Placer	Auburn State Recreation Area	53	5	-	-	-	0	US Army
	Driver's Flat	88	9	-	-	-	0	US Army
Riverside	San Bernardino NF, Santa Rosa Mtns.	117	117	-	0	-	-	CDHS, VBDS
	San Bernardino NF, Spittler Creek Trail	69	69	-	0	-	-	CDHS, VBDS
	San Bernardino NF, Thomas Mtns.	91	91	-	0	-	-	CDHS, VBDS
Sacramento	Mississippi Bar	203	20	0	-	0	-	Sac/Yolo MVCD
	Negro Bar	33	6	0	-	0	-	Sac/Yolo MVCD
	Nimbus	33	7	0	-	0	-	Sac/Yolo MVCD
	Nimbus Dam	1	1	0	-	-	-	Sac/Yolo MVCD
	Snipes Park	31	7	0	-	0	-	Sac/Yolo MVCD
	Willow Creek	38	10	0	-	0	-	Sac/Yolo MVCD
San Bernardino	San Bernardino NF	155	17	-	-	-	0	US Army
Shasta	Shasta NF, Shasta Lake, Bailey Cove CG	29	29	-	-	1	-	Washoe Co EH
	Shasta NF, Shasta Lake, Dekkas Rock	77	77	-	-	2	-	Washoe Co EH
	Shasta NF, Shasta Lake, McCloud Bridge	20	20	-	-	0	-	Washoe Co EH
	Shasta NF, Shasta Lake, Moore Creek	33	33			1		Washoe Co EH
	Shasta NF, Shasta Lake, Nelson Point	139	139			2		Washoe Co EH
	Shasta NF, Shasta Lake, Packers Bay	41	41			0		Washoe Co EH
	Whiskeytown	29	29	-	-	0	-	Washoe Co EH
Tulare	Sequoia NF	174	17	-	-	-	0	US Army
Yolo	Cache Creek	166	21	0	-	0	-	Sac/Yolo MVCD
Totals		**3073**	**1784**	**9**	**0**	**37**	**0**	

Location: NF, National Forest
CG, Campground

Test: DFA, Direct fluorescent antibody
IFA, Indirect fluorescent antibody
PCR, Polymerase chain reaction

Laboratory: Alameda Co. PHL, Alameda County Public Health Laboratory
CDHS, VBDS, California Department of Health Services, Vector-Borne Disease Section
CCCMVCD, Contra Costa County Mosquito and Vector Control District
Sac/Yolo MVCD, Sacramento/Yolo Mosquito and Vector Control District
Sonoma Co. PHL, Sonoma County Public Health Laboratory
U S Army, United States Army Center for Health Promotion and Preventive Medicine - West
Washoe Co. EH, Washoe County Environmental Health Department, Nevada

Source: California Department of Health Services

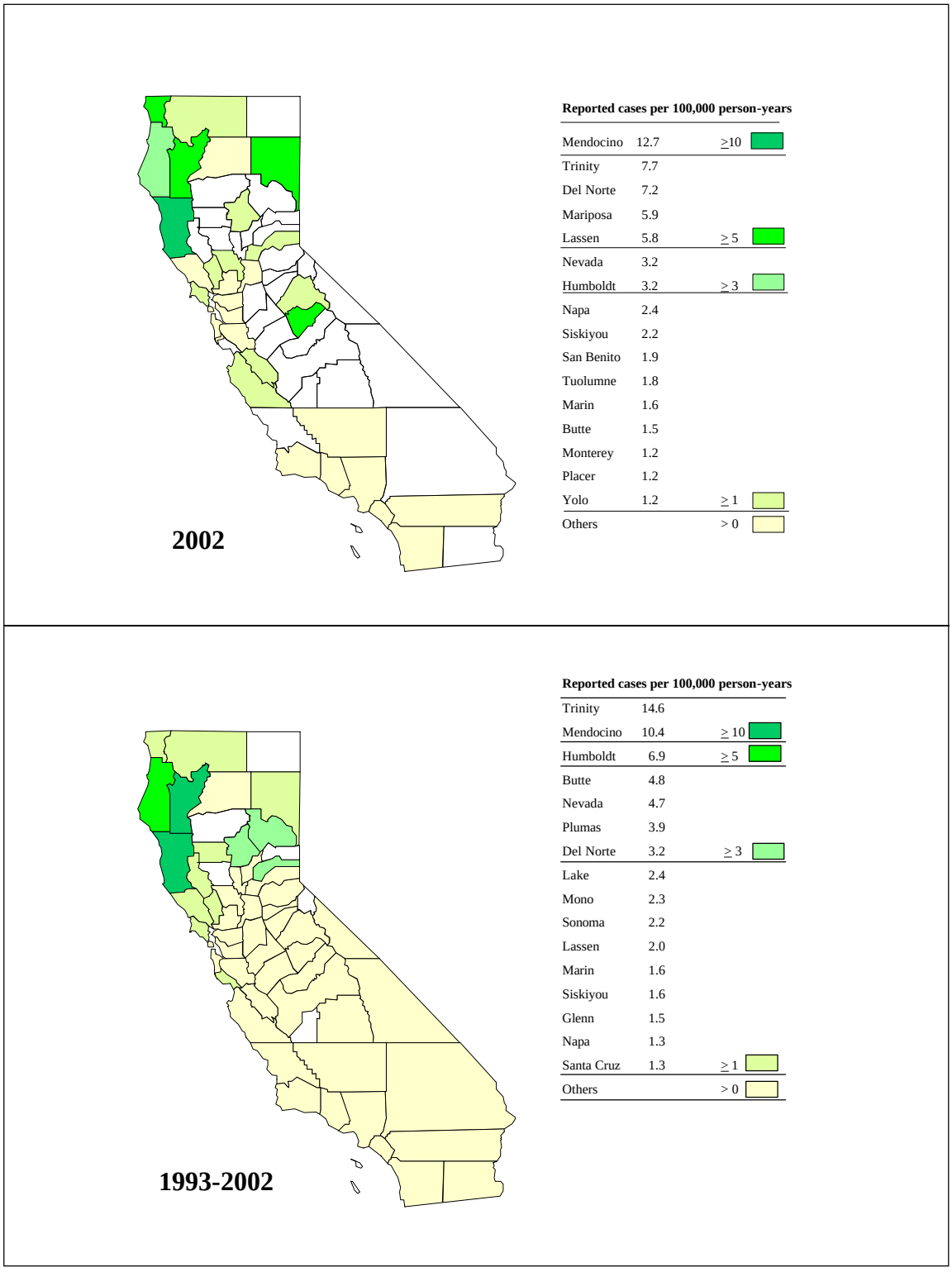

Figure 2. Reported incidence of Lyme disease by county, California.

Source: California Department of Health Services

Mosquito-Borne Encephalitis Virus Surveillance

The California Mosquito-Borne Encephalitis Surveillance Program is a cooperative effort of the California Department of Health Services (DHS), the Universities of California at Davis (UCD) and Berkeley (UCB), the Mosquito and Vector Control Association of California (MVCAC), local mosquito and vector control agencies, local health departments, physicians, veterinarians, and other interested parties. Collaborating agencies in the West Nile virus (WNV) surveillance program include the California Department of Food and Agriculture (CDFA), California Animal Health and Food Safety Laboratory (CAHFS), California Department of Fish and Game (DFG), the U.S. Fish and Wildlife Service, and the Centers for Disease Control and Prevention (CDC).

In 2002, the program included the following components:

1) Diagnostic testing of specimens from human patients exhibiting symptoms of viral meningitis or encephalitis.
2) Enrollment of patients diagnosed with encephalitis into the California Encephalitis Project (CEP), which evaluates demographics, exposure to arthropods, and laboratory evidence to determine etiology.
3) Diagnostic testing of specimens from equids that exhibit clinical signs of viral neurologic disease compatible with arboviral infection (western equine encephalomyelitis [WEE], WNV, and other arboviruses as appropriate).
4) Monitoring and testing of mosquitoes for the presence of St. Louis encephalitis (SLE) and WEE viruses. Tests were also done for WNV, California encephalitis (CE), dengue, and other arboviruses as appropriate.
5) Serological monitoring of sentinel chickens for SLE and WEE antibodies in areas of historical arbovirus activity. Chicken sera from areas where SLE seroconversions occurred and specimens from other regions were also tested for WNV.
6) Surveillance and diagnostic testing of dead birds, especially crows, for WNV.
7) Weekly reporting in the DHS Arbovirus Surveillance Bulletin of the arbovirus testing results in California and arbovirus activity throughout the United States.

Arbovirus diagnostic procedures used in 2002 in California are summarized in Table 8.

Human disease surveillance

The DHS Viral and Rickettsial Disease Laboratory (VRDL) tested sera and/or cerebrospinal fluid specimens from 431 patients for antibodies to WNV, SLE, and WEE, including 251 patients enrolled in the CEP. Clinically, patients represented 132 cases of aseptic meningitis, 251 cases of encephalitis, 11 cases of atypical Guillain-Barré/acute flaccid paralysis, and 37 cases of febrile illness. Neither serologic nor CSF evidence of arboviral infection was detected in any of the patients.

In August, the Los Angeles County Department of Health Services reported detecting antibody to WNV in a local resident. Serologic results were subsequently confirmed by UCD and CDC. The patient was a 31-year-old female resident of Los Angeles County who was hospitalized with aseptic meningitis in mid-August. The case-patient reported no travel outside the Los Angeles area in the weeks preceding onset of illness. Although the case-patient's lack of travel history suggested local exposure, extensive investigation in and around her residence failed to document other evidence of WNV activity.

The California Mosquito-Borne Encephalitis Surveillance Program detected seven cases of WNV infection acquired outside California in 2002. Five cases were California residents who were exposed during travel to WNV-endemic areas of the United States; two cases were residents of other states who became ill and were diagnosed while visiting California.

Equine surveillance

Serum and brain tissue specimens from 83 horses displaying neurological signs were submitted for arboviral testing to the UCD Arbovirus Research Unit (DARU). All specimens tested negative for antibody to WEE. Antibody to WNV was detected in one horse that traveled from Nebraska with onset of illness in September.

Adult mosquito surveillance

Between April and October, 40 local agencies from 33 counties collected adult mosquitos using a total of 633 New Jersey light traps (Table 9).

Thirty-one local mosquito control agencies (Table 9, Figure 3) submitted to DARU a total of 200,578 mosquitoes (4,879 pools) (Tables 10-14) to be tested for arboviruses. WEE was detected in 24 of 3,132 pools of *Culex tarsalis* and four of 864 pools of *Culex quinquefasciatus*, SLE in four pools of *Culex tarsalis* and four pools of *Culex quinquefasciatus*, and CE in one pool of *Culex quinquefasciatus* (Table 15 and Figure 4). All positive mosquito pools were also tested for WNV; none was positive. WEE and SLE isolations from California mosquitoes since 1993 are summarized in Figure 3.

Chicken serosurveillance

Fifty-one local mosquito and vector control agencies maintained 207 sentinel chicken flocks, an increase of 13 flocks from 2001 (Table 9 and Figure 3). Blood specimens from each flock were collected and tested every other week. A total of 24,082 chicken sera from 48 agencies was tested for antibodies to SLE and WEE by VRDL; an additional 3,257 sera were collected and tested by the Sacramento-Yolo Mosquito and Vector Control District (1,589), the San Gabriel Valley Mosquito and Vector Control District (1,268) and the Greater Los Angeles County Vector Control District (40). Because chicken IgG antibody to SLE cross-reacts with WNV, all specimens were screened for WNV using a SLE enzyme immunoassay (EIA). Additional WNV testing was conducted by VRDL on 686 of these sera using IFA and by DARU on 88 sera using neutralization tests. All were negative.

Seroconversions to SLE were detected in Imperial (43) and Riverside (2) Counties (Table 16, Figure 2). The first SLE seroconversion was detected on July 8 in one chicken in Imperial County. The last seroconversions were detected on November 12 in Imperial County. Seroconversions to WEE were detected in Imperial (40), Riverside (8), and San Bernardino (4) Counties (Table 16). The first WEE seroconversions were detected on July 8 in Imperial County. The last seroconversion was detected on November 25 in Imperial County. Seroconversions to SLE and WEE in sentinel chickens since 1993 are summarized in Figure 6.

On October 1, 2002, an outbreak of Exotic Newcastle Disease (END) was detected in southern California that infected thousands of chickens. At the request of CDFA, DHS cooperated with local vector control agencies to arrange testing of the arbovirus sentinel flocks for END. In November, test kits were distributed to each agency participating in the arbovirus surveillance program. Test specimens consisted of cloacal swabs taken from five chickens per flock. A total of 105 specimens at 21 local agencies were tested for END virus by CAHFS in San Bernardino; all specimens were negative.

Dead bird surveillance for West Nile virus
The DHS WNV dead bird surveillance program, initiated in 2000 and supported by a CDC grant, was expanded in 2002. A toll-free hotline was created for the public to report dead birds. The California WNV website was launched and featured an on-line dead bird reporting system. DHS press releases provided information on the dead bird surveillance program and encouraged the public to report dead birds. The DHS Vector-Borne Disease Section (VBDS) provided information on the program to local agencies to encourage their participation.

From January to July, bird species considered for testing were limited to raptors and corvids (crows, jays, magpies, and ravens). From August to November, the species list expanded to include finches, sparrows, blackbirds, and cowbirds. To enhance surveillance efforts in Los Angeles County subsequent to the detection of a human case of WNV infection, the target species list included all birds except chickens and pigeons. Statewide dead bird testing ended on November 30.

The hotline received 3,666 dead bird reports from 56 counties in 2002; 1,560 of these represented target species reports from 54 counties. The number of calls to the hotline increased in August and September following announcement of the human case of WNV infection in Los Angeles County (Figure 7). 653 birds from 45 counties were tested for WNV; all were negative (Table 17). In 2001, 68 dead birds from 19 counties were reported and 18 were tested for WNV.

Weekly arbovirus surveillance bulletin
Between April 25 and December 20, DHS published weekly bulletins reporting arbovirus test results of humans, equids, mosquitoes, sentinel chickens, and dead birds, as well as updates on national WNV activity. Data published in the Arbovirus Surveillance Bulletin from 1998-2002 is summarized in Table 18.

California West Nile virus surveillance web site
In January, DHS, in collaboration with CDFA, MVCAC, and UCD, launched the California WNV website (www.westnile.ca.gov). Information available on the website included press releases, the Arbovirus Surveillance Bulletins, the California Mosquito-Borne Virus Surveillance and Response Plan, WNV website links, and other educational and informational materials. The website also included an on-line form for the public to report dead birds.

West Nile Virus activity in the United States
In 2002, WNV activity was reported in 44 states and the District of Columbia, including 16 states where the virus had not been detected previously. The westernmost expansions of WNV were in Island County, Washington (horse), and Los Angeles County, California (human). There were 4,161 human cases from 39 states and the District of Columbia with 284 fatalities. (66 human cases with 9 fatalities were reported in 2001.) There were 14,045 equine cases from 40 states, 13,672 infected dead birds from 42 states and the District of Columbia, and 4,943 positive mosquito pools (26 species) from 28 states and the District of Columbia. Florida, Iowa, Nebraska, New York, North Carolina, Pennsylvania, and Texas reported seroconversions to WNV in sentinel chicken flocks.

Table 8. Arbovirus diagnostic procedures for California.

	Criteria	Primary test	Confirmatory test	Virus tested		
				SLE	WNV	WEE
Mosquito pools	Collections by local agencies	*in-situ* EIA using vero cell culture (DARU)		X	X	X
Chicken sera	Local agency sentinel flocks	EIA (VRDL)	IFA (VRDL) PRNT as needed (DARU)	X	X	X
Equine sera	Per request of the veterinarian	PRNT (DARU)		-	X	X
Equine tissue	Screened by VPHS	Cell culture (DARU)		-	X	X
Dead birds	Screened by VBDS	Immunohistochemistry on heart, kidney, liver (CAHFS)	Cell culture on kidney and lung (DARU)	-	X	-
Other animals	Screened by VPHS	PRNT for sera (DARU), Cell Culture for tissue (DARU)		-	X	-
Human sera	Screened by VRDL	EIA (for SLE and WEE), IgM-EIA (for WNV) (VRDL)	PRNT (DARU/VRDL)	X	X	X
Human spinal fluid (if no serum available)	Screened by VRDL	EIA (for SLE and WEE), IgM-EIA (for WNV) (VRDL)	PRNT (DARU/VRDL)	X	X	X

Abbreviations: Agencies: CAHFS, California Animal Health and Food Safety Laboratory
DARU, University of California, Davis, Arbovirus Research Unit
VBDS, Vector-Borne Disease Section
VPHS, Veterinary Public Health Section
VRDL, Viral and Rickettsial Disease Laboratory

Assays: EIA, enzyme immunoassay
PRNT, plague reduction neutralization test
IFA, immunofluorescent antibody

Viruses: SLE, St. Louis encephalitis
WEE, western equine encephalomyelitis
WNV, West Nile virus

Source: California Department of Health Services

Table 9. Participation by local agencies in the statewide mosquito-borne encephalitis surveillance program, 2002.

County	Agency	Agency code	New Jersey Light Trap	Mosquito pools	No. flocks	No. chickens	No. sera samples tested
Alameda	Alameda Co. MAD	ALCO	22	61	3	21	286
Butte	Butte Co. MVCD	BUCO	25	30	7	84	1,128
Colusa	Colusa MAD	CLSA	3		1	10	150
Contra Costa	Contra Costa MVCD	CNTR	18	70	4	40	559
Fresno	Consolidated MAD	CNSL	12	44	4	40	444
Fresno	Fresno MVCD	FRNO	9	51	2	20	212
Fresno	Fresno Westside MAD	FRWS	10	27	2	20	226
Glenn	Glenn Co. MVCD	GLEN	4	40	1	13	183
Imperial	Coachella Valley MVCD	IMPR		359	3	30	518
Imperial	Imperial Co. Environmental Health	IMPR			3	28	307
Imperial	Quechan Indian Reservation	IHSY			1	5	10
Inyo	Owens Valley MAP	OWVY	12		0	0	
Kern	Delano MAD	DLNO	8		2	16	161
Kern	Kern MVCD	KERN	20	507	9	90	1,247
Kern	West Side MVCD	WEST	12		3	30	336
Kings	Kings MAD	KNGS	9	8	3	30	341
Lake	Lake Co. VCD	LAKE		124	2	20	269
Los Angeles	Antelope Valley MVCD	ANTV	10		5	35	552
Los Angeles	Greater Los Angeles Co. VCD	GRLA	14	360	4	40	797
Los Angeles	Long Beach Environmental Health	LONG		346	4	40	581
Los Angeles	Los Angeles Co. West VCD	LACW		24	18	210	1,406
Los Angeles	San Gabriel Valley MVCD	SGVA		11	10	60	1,268
Madera	Madera Co. MVCD	MADR	5	12	2	20	200
Marin/Sonoma	Marin-Sonoma MVCD	MARN	21		7	75	983
Merced	Merced Co. MAD	MERC	18	16	6	35	453
Monterey	North Salinas MAD	NSAL	17		1	10	150
Napa	Napa MAD	NAPA			2	10	139
Orange	Orange Co. VCD	ORCO		49	1	10	135
Placer	Placer Co. VCD	PLCR	12		3	30	420
Riverside	Coachella Valley MVCD	COAV	24	1,014	9	80	1,511
Riverside	Northwest MVCD	NWST	12	310	6	60	817
Riverside	Riverside Co. Environmental Health	RIVR	13		6	66	996
Sacramento/Yolo	Sacramento-Yolo MVCD	SAYO	44	456	10	99	1,589
San Bernardino	San Bernardino Co. VCP	SANB	19	39	7	70	1,137
San Bernardino	West Valley MVCD	WVAL			3	30	457
San Diego	San Diego Co. Dept of Health	SAND	13	48	3	30	506
San Joaquin	San Joaquin Co. MVCD	SJCM	50	233	4	48	670
San Mateo	San Mateo Co. MAD	SANM	22	19	3	30	390
Santa Barbara	Santa Barbara Coastal VCD	SBCO		22	4	38	616
Santa Clara	Santa Clara Co. VCD	STCL	18		2	20	285
Santa Cruz	Santa Cruz Co. MVCD	SCRZ	7		1	10	139
Shasta	Burney Basin MAD	BURN	6		2	20	200
Shasta	Shasta MVCD	SHAS	18	76	5	55	741
Solano	Solano Co. MAD	SOLA	13		2	24	195
Stanislaus	East Side MAD	EAST			1	12	169
Stanislaus	Turlock MAD	TRLK	21	313	4	48	619
Sutter/Yuba	Sutter-Yuba MVCD	SUYA	38	143	7	70	971
Tehama	Tehama Co. MVCD	TEHA	9		2	20	220
Tulare	Delta VCD	DLTA	12	33	6	60	751
Tulare	Tulare MAD	TRLE	10		2	20	241
Ventura	City of Moorpark	MOOR	4	5	1	10	160
Ventura	Ventura Co. Environmental Health	VENT	19	29	4	40	498
Total			**633**	**4,879**	**207**	**2,032**	**27,339**

Abbreviations: MAD, mosquito abatement district
MVCD, mosquito and vector control district
MAP, mosquito abatement program
VCD, vector control district
VCP, vector control program

Source: California Department of Health Services

Table 10. Mosquitoes (*Culex* spp.) tested for WNV, WEE, and SLE by submitting county and agency, 2002. (Test results described in Table 15).

		Cx erythrothorax		***Cx pipiens***		***Cx quinquefasciatus***		***Cx tarsalis***		**Total**	
County	**Agency**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Alameda	ALCO							61	3,050	61	3,050
Butte	BUCO							11	579	11	579
Contra Costa	CNTR	11	550	9	450			50	2,500	70	3,500
Fresno	CNSL	2	27			11	411	30	1,110	43	1,548
Fresno	FRNO					20	827	31	1,200	51	2,027
Fresno	FRWS							27	1,309	27	1,309
Glenn	GLEN							33	1,650	33	1,650
Imperial	IMPR	28	1,235			51	2,059	208	9,312	287	12,606
Kern	KERN					21	471	335	10,675	356	11,146
Kings	KNGS							7	350	7	350
Lake	LAKE	1	17					92	4,408	93	4,425
Los Angeles	GRLA	43	1,762			236	8,655	63	2,097	342	12,514
Los Angeles	LACW					21	858			21	858
Los Angeles	LONG					189	6,162	145	5,711	334	11,873
Los Angeles	SGVA	1	31			10	348			11	379
Madera	MADR			11	550			1	50	12	600
Merced	MERC			3	115	3	150	9	391	15	656
Merced	TRLK							122	5,879	122	5,879
Orange	ORCO					36	723	13	300	49	1,023
Riverside	COAV	4	166			81	2,922	852	37,701	937	40,789
Riverside	NWST					148	6,375	111	4,183	259	10,558
Sacramento	SAYO			24	664			214	9,525	238	10,189
San Bernardino	SANB	4	192			18	437	16	378	38	1,007
San Diego	SAND	32	1,580					16	800	48	2,380
San Joaquin	SJCM			63	2,241			140	5,501	203	7,742
San Mateo	SANM			18	660			1	21	19	681
Santa Barbara	SBCO	3	100			8	261			11	361
Shasta	SHAS			17	900			59	3,192	76	4,092
Stanislaus	TRLK			2	65			152	7,197	154	7,262
Sutter	SUYA							96	4,316	96	4,316
Tulare	DLTA					6	245	27	1,099	33	1,344
Ventura	MOOR					5	32			5	32
Ventura	VENT	20	914	4	56			5	152	29	1,122
Yolo	SAYO			2	39			167	7,919	169	7,958
Yuba	SUYA			3	57			38	1,794	41	1,851
Total		**149**	**6,574**	**156**	**5,797**	**864**	**30,936**	**3,132**	**134,349**	**4,301**	**177,656**

Source: California Department of Health Services

Table 11. Mosquitoes (Other *Culex* spp.) tested for WNV, WEE, and SLE by submitting county and agency, 2002.

		Cx erraticus		*Cx restuans*		*Cx stigmatosoma*		Total	
County	**Agency**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Fresno	CNSL					1	24	1	24
Imperial	IMPR	1	6					1	6
Lake	LAKE					7	200	7	200
Los Angeles	GRLA					2	45	2	45
Los Angeles	LONG			1	43	10	192	11	235
Merced	MERC					1	32	1	32
Riverside	NWST					48	1,761	48	1,761
Sacramento	SAYO					1	12	1	12
San Bernardino	SANB					1	10	1	10
Total		**1**	**6**	**1**	**43**	**71**	**2,276**	**73**	**2,325**

Table 12. Mosquitoes (*Culiseta* spp.) tested for WNV, WEE, and SLE by submitting county and agency, 2002.

		Cs incidens		*Cs inornata*		*Cs particeps*		Total	
County	**Agency**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Imperial	IMPR			1	5			1	5
Los Angeles	GRLA	6	198			2	39	8	237
Los Angeles	LACW	1	19	2	89			3	108
Riverside	COAV			21	380			21	380
Santa Barbara	SBCO	3	115			1	10	4	125
Total		**10**	**332**	**24**	**474**	**3**	**49**	**37**	**855**

Table 13. Mosquitoes (*Ochlerotatus* spp.) tested for WNV, WEE, and SLE by submitting county and agency, 2002.

		Oc melanimon		*Oc taeniorhynchus*		*Oc washinoi*		Total	
County	**Agency**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Butte	BUCO	19	990					19	990
Glenn	GLEN	7	350					7	350
Kern	KERN	151	6,594					151	6,594
Kings	KNGS	1	50					1	50
Lake	LAKE	24	1,196					24	1,196
Los Angeles	LONG	1	50					1	50
Merced	TRLK	32	1,548					32	1,548
Riverside	COAV	18	900					18	900
Sacramento	SAYO	15	390					15	390
San Joaquin	SJCM	30	1,111					30	1,111
Santa Barbara	SBCO			4	158	1	22	5	180
Stanislaus	TRLK	5	227					5	227
Sutter	SUYA	6	229					6	229
Yolo	SAYO	32	1,173					32	1,173
Total		**341**	**14,808**	**4**	**158**	**1**	**22**	**346**	**14,988**

Source: California Department of Health Services

Table 14. Mosquitoes (*Aedes* spp., *Anopheles hermsi*, and *Psorophora columbiae*) tested for WNV, WEE, and SLE by county and agency, 2002.

		Ae albopictus		*Ae vexans*		*An hermsi*		*Ps columbiae*		Total	
County	**Agency**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Imperial	IMPR			66	3,075			4	91	70	3,166
Los Angeles	GRLA	2	38			6	239			8	277
Riverside	COAV			34	1,087			4	71	38	1,158
Riverside	NWST					3	98			3	98
Sacramento	SAYO			1	23					1	23
Santa Barbara	SBCO					2	32			2	32
Total		**2**	**38**	**101**	**4,185**	**11**	**369**	**8**	**162**	**122**	**4,754**

Table 15. WEE, SLE, and California Encephalitis virus isolates from mosquito pools, 2002.

Mosquito species	**Date collected**	**County**	**Agency**	**Virus isolated**					
				WEE		**SLE**		**CE**	
				pools	**mosqs.**	**pools**	**mosqs.**	**pools**	**mosqs.**
Culex tarsalis	5-Jun	Riverside	COAV	1	50	-	-	-	-
	12-Jun	Imperial	IMPR	6	300	-	-	-	-
	20-Jun	Riverside	COAV	1	50	-	-	-	-
	25-Jun	Imperial	IMPR	8	384	-	-	-	-
	10-Jul	Imperial	IMPR	1	50	-	-	-	-
	16-Jul	Riverside	COAV	1	30	-	-	-	-
	24-Jul	Imperial	IMPR	-	-	1	50	-	-
	12-Aug	Riverside	COAV	1	50	-	-	-	-
	20-Aug	Imperial	IMPR	-	-	1	15	-	-
	26-Aug	Riverside	COAV	1	50	-	-	-	-
	5-Sep	Imperial	IMPR	-	-	1	50	-	-
	9-Sep	Riverside	COAV	3	150	-	-	-	-
	17-Sep	Imperial	IMPR	-	-	1	50	-	-
	23-Sep	Riverside	COAV	1	26	-	-	-	-
Culex quinquefasciatus	11-Jun	Imperial	IMPR	3	150	-	-	-	-
	9-Jul	Imperial	IMPR	1	27	3	150	-	-
	24-Jul	Imperial	IMPR	-	-	1	50	-	-
	20-Aug	Riverside	NWST	-	-	-	-	1	50
Totals				**28**	**1,317**	**8**	**365**	**1**	**50**

Source: California Department of Health Services

Table 16. Chicken seroconversions to SLE and WEE by county, agency, location, and week sampled, 2002.

SLE

County	Agency	City	7/8	7/22	7/29	8/5	8/12	8/19	9/2	9/16	9/30	10/14	10/28	11/11	11/25	Total
Imperial	IMPR	El Centro							2							2
Imperial	IMPR	Holtville			1		3		3	1						8
Imperial	IMPR	Niland					1	1	5	1			3	2		13
Imperial	IMPR	Niland							4	3						7
Imperial	IMPR	Seeley	1		6			1								8
Imperial	IMPR	Westmoreland				1		3	1							5
Riverside	COAV	Mecca										1				1
Riverside	COAV	North Shore				1										1
			1		**7**	**2**	**4**	**5**	**15**	**5**		**1**	**3**	**2**		**45**

WEE

County	Agency	City	7/8	7/22	7/29	8/5	8/12	8/19	9/2	9/16	9/30	10/14	10/28	11/11	11/25	Total
Imperial	IMPR	El Centro	1	3						1						5
Imperial	IMPR	Holtville	1	2	2		1									6
Imperial	IMPR	Imperial		3												3
Imperial	IMPR	Niland		5			4			1						10
Imperial	IMPR	Niland		1					1			1			1	4
Imperial	IMPR	Seeley	1	3	1				1	1						7
Imperial	IMPR	Westmoreland		4	1											5
Riverside	COAV	Mecca								3		1				4
Riverside	COAV	Oasis								3	1					4
San Bernardino	SANB	Needles								3		1				4
			3	**21**	**4**		**5**		**2**	**12**	**1**	**3**			**1**	**52**

Source: California Department of Health Services

Table 17. Dead birds reported (R) to DHS and tested (T) for West Nile virus, 2002.

	Crow		Hawk		Jay		Magpie		Owl		Raven		Total	
County	**R**	**T**	**R**	**T**	**R**	**T**	**R**	**T**	**R**	**T**	**R**	**T**	**R**	**T**
Alameda	11	5	2	2	5	2	1		2		1	1	22	10
Butte	5		1		5		1		1				13	0
Contra Costa	9	3	4		13	3	1		2	1	1		30	7
El Dorado	1	1	1		8	3	1	1					11	5
Fresno	15	5			28	6			1				44	11
Humboldt	13	1			2				1	1	2	1	18	3
Kings	4	1			3	2							7	3
Los Angeles	168	60	17	12	20	2	2		8	6	6	3	221	83
Marin	15	1	4	1	3								22	2
Merced	4				5	1	3		2				14	1
Napa	2		2	1	2	1			1	1			7	3
Orange	69	26	6		1	1			3		7	5	86	32
Placer	3	1	1		8	1	3				1	1	16	3
Riverside	53	15			6		2		3	1	5	1	69	17
Sacramento	156	27	11	2	164	33	106	24	7	4	8		452	90
San Bernardino	20	13	2	1			3		1		3	1	29	15
San Diego	34	15	7	3	4		1		8	2	4	1	58	21
San Francisco	4	1	4	2					1		1		10	3
San Joaquin	16	6	1		6	2	3	2	1	1			27	11
San Luis Obispo	5	2			3	1							8	3
San Mateo	4		1		4				2		3	1	14	1
Santa Barbara	11	2	3	1	2	1	1						17	4
Santa Clara	33	14	1		14	2	1				3		52	16
Santa Cruz	2	1			7	2					1		10	3
Shasta	11				13	2	2				1	1	27	3
Solano	14	2			5		1	1	3	1			23	4
Sonoma	13	2			4		1		1		1	1	20	3
Stanislaus	7	3			10	6	6	3	1	1			24	13
Sutter	8	1			3	2	1	1					12	4
Tehama	1		1	1	3		1	1					6	2
Tulare	12	2	1		7	1							20	3
Ventura	11	3	2	1	3				1	1	1		18	5
Yolo	44	7	5	2	38	12	14	2	3	1			104	24
Yuba	3	1			2	1	1						6	2
Other counties*	12	4	9	7	16	2	1		4	1	1		43	14
Total	793	225	86	36	417	89	157	35	57	22	50	17	1,560	424
Other species**													2,106	229
Grand total													**3,666**	**653**

*Amador 3 jays (1); Calaveras 1 jay; Glenn 1 crow, 1 owl; Imperial 3 hawks (3); Inyo 1 hawk; Kern 1 crow, 1 hawk (1), 1 owl (1); Lake 1 crow (1); Lassen 1 jay; Madera 1 crow, 1 hawk, 2 jays, 1 owl; Mendocino 2 crow (1), 1 jay, 1 owl, 1 raven; Modoc 1 jay; Mono 1 jay; Monterey 2 crows (1), 2 hawk (2), 1 jay, 1 magpie; Nevada 1 jay; Plumas 1 crow (1), 1 jay; San Benito 1 crow; Sierra 1 jay (1); Siskiyou 1 crow; Trinity 1 crow, 1 hawk (1); Tuolumne 1 jay; Unknown 1 jay

**Blackbird 104 (11), finch 157 (42), sparrow 434 (114), other 1415 (65)

Source: California Department of Health Services

Table 18. Summary of mosquito-borne virus activity in California, 1998-2002.

Year	Humans			Mosquitoes				Chickens			Horses			Dead Birds
	WEE	SLE	WNV	WEE	SLE	CE	WNV	WEE	SLE	WNV	WEE	EEE	WNV	WNV
1998	0	0	N/A	53 KE-42, RI-11	1 RI-1	0	N/A	101 BU-5, IM-26, KE-30, PL-4, RI-28, SB-6, SL-1, SU/YB-1	2 LA-1, OR-1	N/A	0	0	N/A	N/A
	140 tested			3557 pools				134 flocks			5 tested			N/A
1999	0	0	N/A	0	0	0	N/A	3 RI-2, TU-1	25 IM-14, RI-8, SB-3	N/A	0	0	N/A	N/A
	141 tested			3566 Pools				190 flocks			1 tested			N/A
2000	0	0	0	0	30 RI-30	0	0	0	49 IM-11, RI-36, SB-2	0	0	1 ** VE-1	0	0
	226 tested			3901 pools				170 flocks			16 tested			20 tested
2001	0	0	0	0	70 RI-70	9 KE-8, SA-1	0	3 RI-3	62 IM-11, RI-51	0	0	0	0	0
	210 tested			3501 Pools				194 flocks			13 tested			18 tested
2002	0	0	8 CC-1* LA-1 LA-2* OR-1* SF-1* SM-1* VE-1*	28 IM-19, RI-9	8 IM-8	1 RI-1	0	52 IM-40, RI-8, SB-4	45 IM-43, RI-2	0	0	0	1 LA-1*	0
	431 tested			4879 pools				207 flocks			83 tested			653 tested
Total	**0**	**0**	**8**	**81**	**109**	**10**	**0**	**159**	**183**	**0**	**0**	**1**	**1**	**0**

* Imported into California from other states
** Vaccine acquired, not natural transmission

Counties:

BU= BUTTE	CC= CONTRA COSTA	CO= COLUSA	FR= FRESNO	GL= GLENN	IM= IMPERIAL
KE= KERN	KI= KINGS	LA= LOS ANGELES	LK= LAKE	LS= LASSEN	MA= MADERA
ME= MERCED	MD= MODOC	MR= MARIN	OR= ORANGE	PL= PLACER	RI= RIVERSIDE
SA= SACRAMENTO	SB= SAN BERNARDINO	SD= SAN DIEGO	SJ= SAN JOAQUIN	SH= SHASTA	SI= SISKIYOU
SL= SOLANO	SM= SAN MATEO	SN= SONOMA	ST= STANISLAUS	SU= SUTTER	TE= TEHAMA
TU= TULARE	VE= VENTURA	YL= YOLO	YB= YUBA		

Source: California Department of Health Services

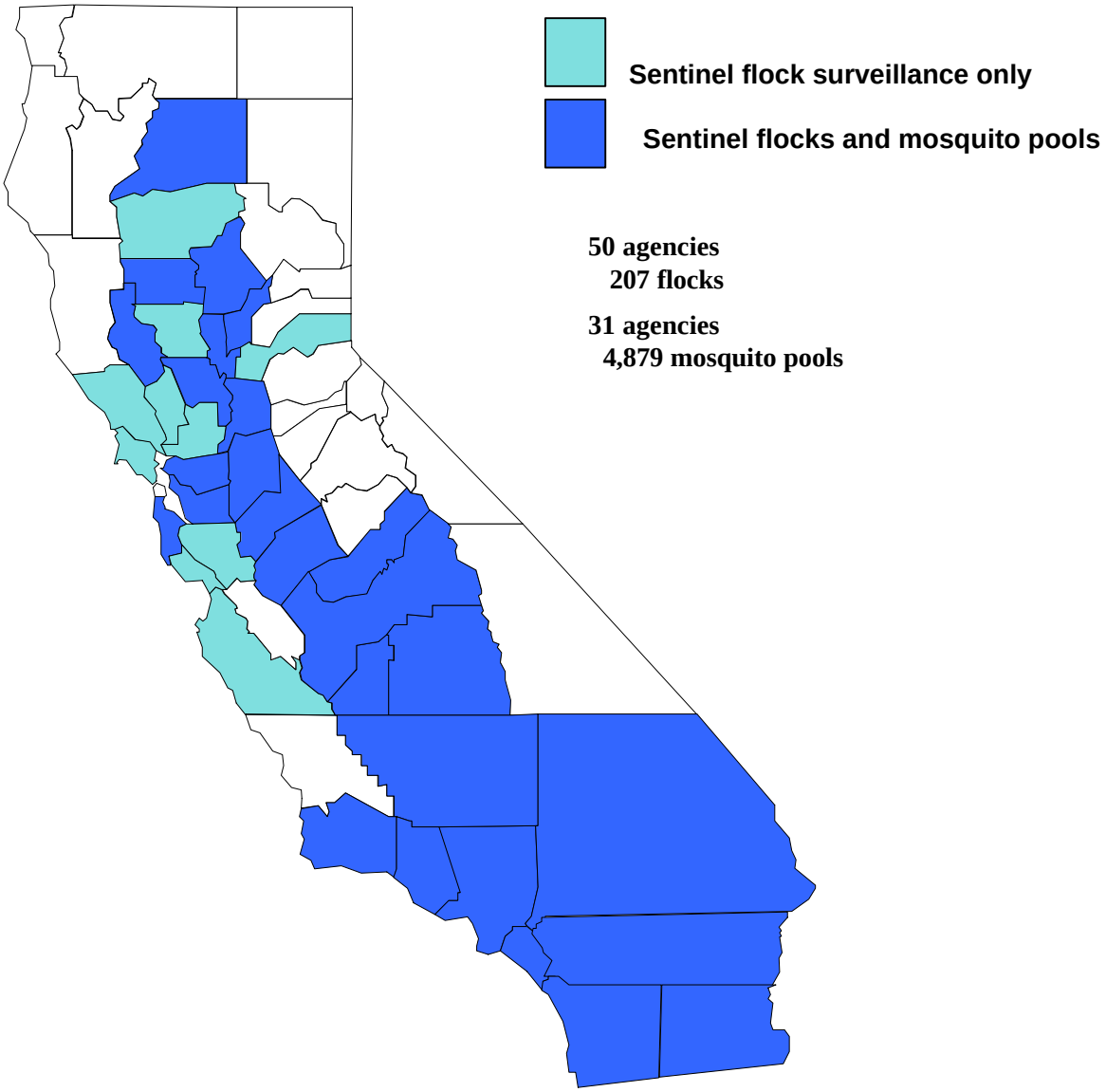

Figure 3. Counties that submitted chicken sera and/or mosquito pools for SLE, WEE, WNV, and CE testing, California, 2002.

Source: California Department of Health Services

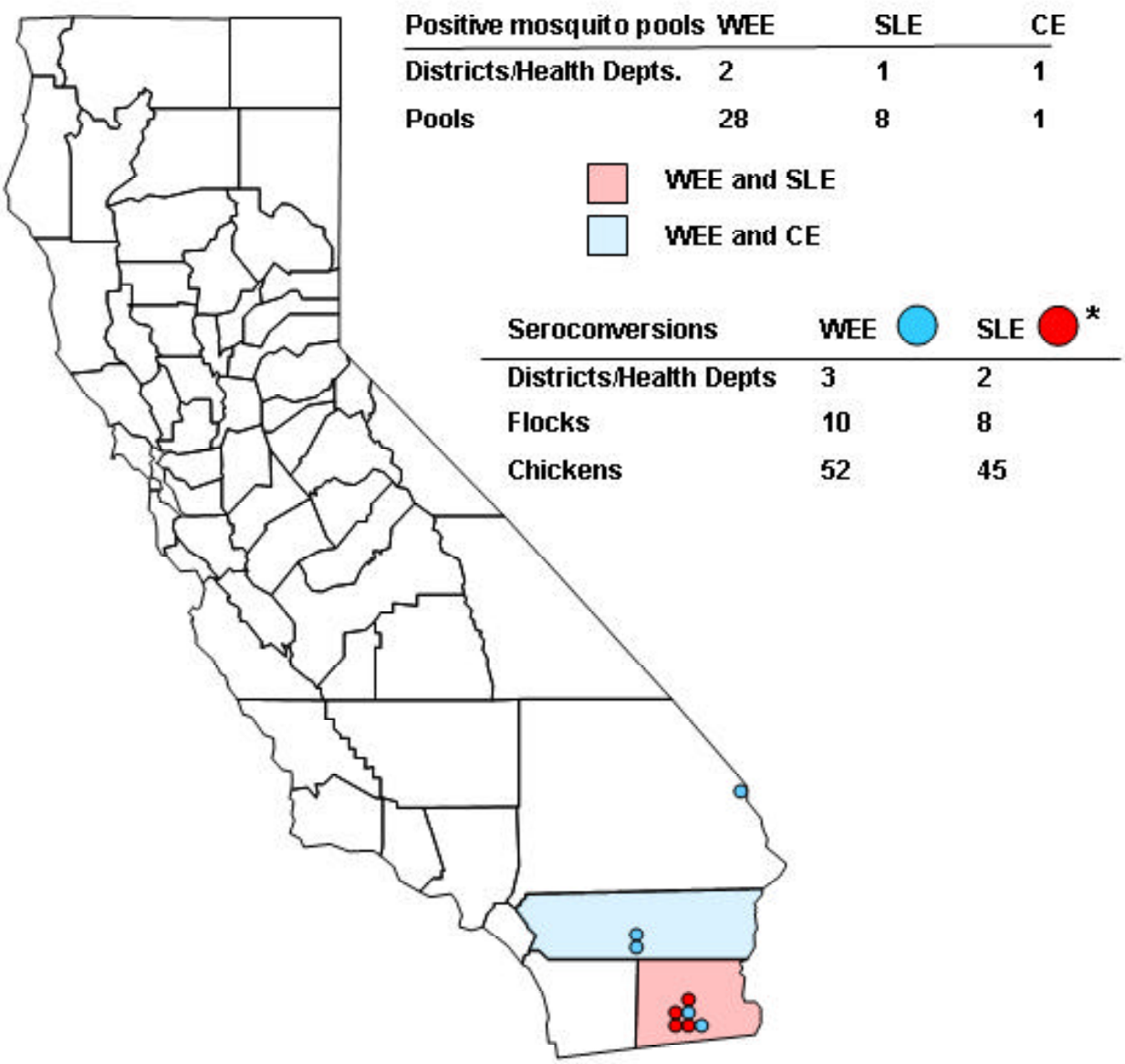

Figure 4. Collection sites of mosquito pools positive for WEE, SLE, or Bunyavirus, and location of sentinel chicken flocks with at least one seroconversion to WEE or SLE, California, 2002.

*Because of scale of map, symbols may represent more than one flock.

Source: California Department of Health Services

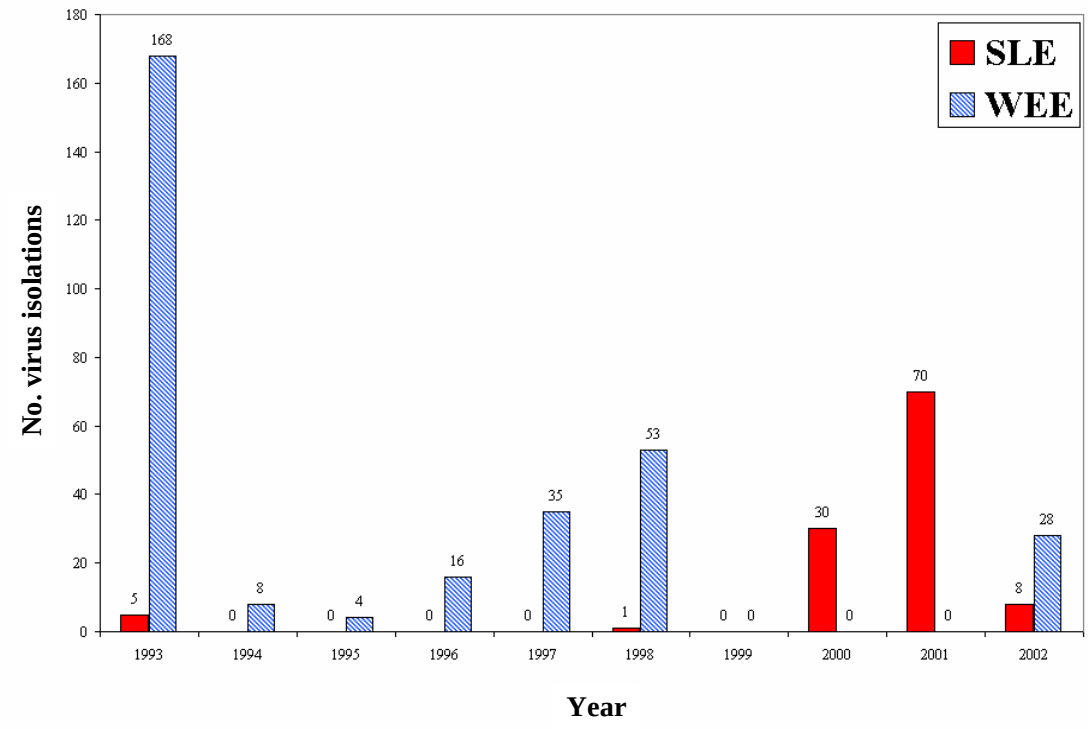

Figure 5. Isolations of SLE and WEE viruses from pooled mosquitoes in California, 1993-2002.

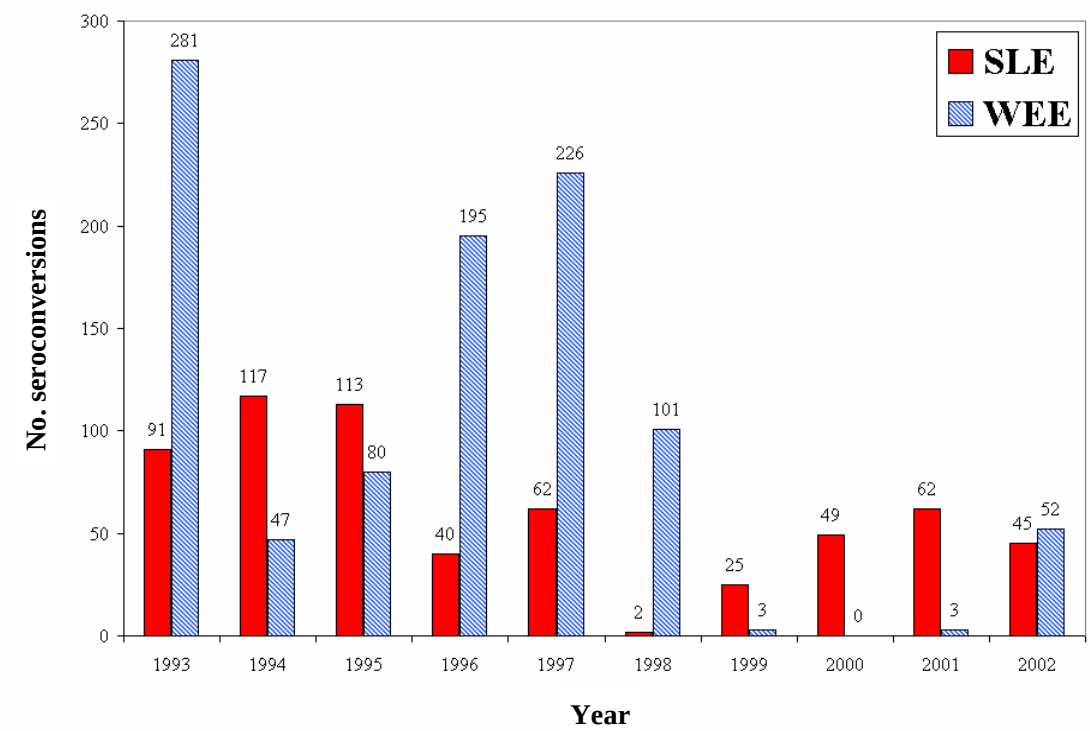

Figure 6. Seroconversions to SLE and WEE viruses in sentinel chicken flocks in California, 1993-2002.

Source: California Department of Health Services

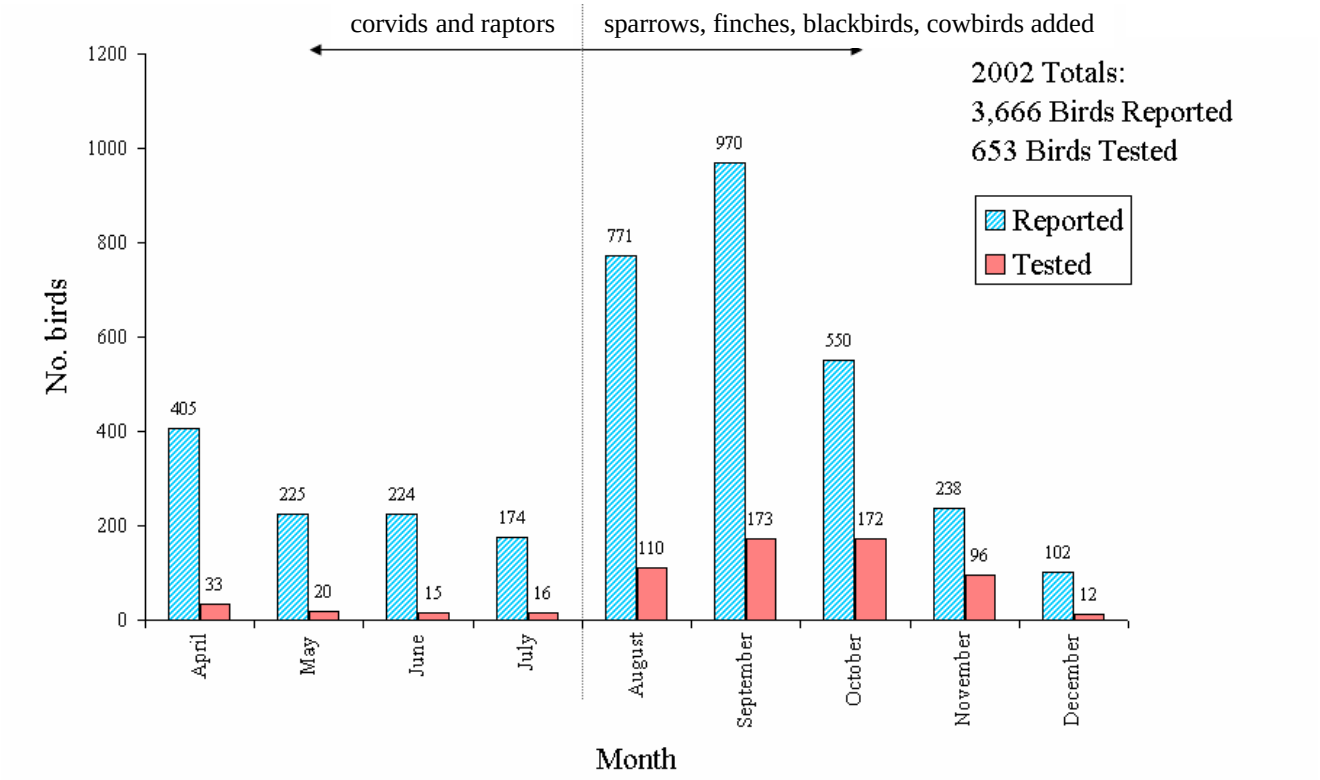

Figure 7. Dead birds reported and submitted by month to the DHS WNV Hotline, California, 2002.

Source: California Department of Health Services

Aedes albopictus Infestations in California

Aedes (Stegomyia) albopictus (Skuse) is an aggressive daytime biting mosquito and a known vector of dengue virus in southern China, Japan, Southeast Asia, and the Seychelles. Although it is a secondary dengue vector to *Ae. aegypti* in urban areas, its importance in the endemic cycle in rural Asia is recognized. *Aedes albopictus* also is a competent experimental vector of chikungunya, eastern equine encephalitis, Mayaro, Ross River, western equine encephalomyelitis, Venezuelan equine encephalitis, Sindbis, and West Nile viruses. West Nile virus was isolated from *Ae. albopictus* specimens collected in Pennsylvania in 2000, and in at least five other states in 2001 and 2002.

Aedes albopictus was detected in California in June 2001 at the ports of Los Angeles and Long Beach. Over the following eight weeks, investigation detected infestations at 15 locations in 6 California counties: 13 locations in southern California (7 in Los Angeles County, 2 in San Bernardino County, 3 in Orange County, and 1 in San Diego County), and 2 locations in northern California (one each in Santa Clara and San Joaquin Counties). This exotic mosquito was imported from southern China in shipments of *Dracaena* species, known commercially as "Lucky Bamboo." Historically, *Dracaena* was imported to the United States from China and other Asian countries in dry containers via airfreight. However, due to increased demand for this ornamental plant, shipments began to arrive in approximately January 2000 via cargo ships in water in refrigerated maritime containers. To keep the plants green during the ocean journey, the plants were placed in 5-8 cm of water in small boxes made of styrofoam, plastic, or cardboard with plastic liners, thereby providing habitat suitable for both adult and immature mosquito stages. All infestation sites were located at importer locations, except for three Orange County infestations, which were secondary distributors for a Los Angeles County importer. Fourteen of the infestations originated from shipments arriving from southern China and one from Taiwan. Hundreds of retail distributors throughout the state were inspected, but no infestations were found.

No evidence of persistent *Ae. albopictus* infestations was observed during active surveillance conducted between mid-November 2001 and March 2002 at sites in southern California that were infested in 2001. However, on April 1, 2002, West Valley Mosquito and Vector Control District (WVMVCD) discovered a population of *Ae. albopictus* at a Chino, San Bernardino County, site that apparently had successfully survived the winter. Adults were collected while attempting to feed, and immature specimens were found in one of the containers that had been flooded in an attempt to propagate *Dracaena* held at the nursery since 2001. These same containers had been used in 2001 to propagate *Dracaena*. Presumably eggs that were oviposited on the containers or on the plants themselves during the infestation in 2001 hatched subsequent to flooding in late March 2002. Immature and adult mosquitoes were identified in the laboratory at WVMVCD; specimens were also prepared for future genotyping. All sources of water at the nursery that contained immature mosquitoes were destroyed and adulticides were applied within the nursery compound. During attempts to rear immature stages in the laboratory, high mortality was observed in pupae. Additionally, reduced fecundity and poor survival of emerging adults were documented. These phenomena are consistent with the effects that are often observed when mosquitoes are exposed to sublethal doses of methoprene. The effects could be due to the residual activity of Altosid® pellets that were applied to containers of *Dracaena* during control efforts earlier in 2001 at the nursery. Subsequent surveillance at this site indicated that *Ae. albopictus* that survived the winter were controlled.

A second population of *Ae. albopictus* that survived through the winter was discovered near a previously infested site in Monterey Park, Los Angeles County, on July 12, by the San Gabriel Valley Mosquito

and Vector Control District (SGVMVCD). Viable *Ae. albopictus* eggs were found in ovitraps placed approximately five meters from the outside wall of the nursery. Subsequent investigation also detected adults immediately outside the perimeter of the nursery (one landing mosquito/min). No immature stages were found in or around the nursery. However, five discarded truck tires were found outside the nursery, one of which yielded seven *Ae. albopictus* larvae after being flooded. No additional larvae were found after the tires were flooded several more times. Subsequent surveillance in the immediate vicinity of the nursery yielded *Aedes* spp. eggs (presumably *Ae. albopictus*) that were collapsed and did not hatch. The area inside and immediately outside the nursery was adulticided with deltamethrin. The nursery moved some weeks later, but the SGVMVCD continued to monitor the vicinity of this site. On August 29, a single *Ae. albopictus* larva was found along with *Culex quinquefasciatus* larvae in an unattended swimming pool approximately 500 meters from the originally infested site. The pool was treated with Golden Bear® GB-1111 larvicidal oil. Ovitraps at this site and in the vicinity did not yield any eggs to date. On October 15, a single *Ae. albopictus* female was found dead in an oviposition cup. She had deposited three eggs that failed to hatch. Surveillance will continue at and around the vacated property.

On August 27, a third population of *Ae. albopictus* was detected in a previously infested nursery in Rowland Heights, Los Angeles County, by the Greater Los Angeles County Vector Control District. Eggs were initially discovered in ovitraps placed inside the nursery, and the following week numerous host-seeking adults and immature stages in containers of *Dracaena* were detected. It is hypothesized that this infestation may represent a new introduction because *Ae. albopictus* mosquitoes were detected only after the nursery resumed importing *Dracaena* in maritime containers from southern China. Control operations consisted of two applications of Scourge® to control adults, followed by a meticulous application of Atosid® pellets to the water of *Dracaena* containers. It appears that control efforts were successful in controlling *Ae. albopictus* and preventing this mosquito from becoming established in the immediate environment around the nursery in Rowland Heights.

The discovery of two distinct over-wintering populations of *Ae. albopictus* in southern California indicates that *Ae. albopictus* from southern China could become established locally. Currently western Texas represents the westernmost establishment of *Ae. albopictus* in the continental United States. Most populations along the western edge of its distribution in the United States occur in local habitats where human-induced alterations to the microclimate create conditions that are suitable to survival. In California it is also important to consider the wide variety of habitats and ecological niches where *Ae. albopictus* has been detected.

It appears that the following actions largely controlled *Ae. albopictus* infestations in California and minimized reintroduction: (1) comprehensive surveillance in and around infested sites, (2) intensive mosquito control operations, (3) an embargo by CDC in July 2001 that prohibited shipments of *Dracaena* in standing water, and (4) *Dracaena* importer/exporter cooperation. Continued vigilance is necessary to detect occult populations of this potentially significant public health vector that may still exist in California, and to prevent reintroductions.

It is estimated that there are more than 2,000 nonindigenous arthropod species currently established in the United States. Data suggest that 5-10% of introduced species become established and 2-3% actually expand their ranges. Efforts to prevent *Ae. albopictus* populations from becoming established may be difficult but will become more crucial in coming years as resources to monitor these mosquitoes may compete with resources to address West Nile virus in California.

Caltrans Special Project: Mosquito Production

Introduction and background

In 1997, the California Department of Transportation (Caltrans) initiated a Best Management Practice (BMP) Retrofit Pilot Program for treating stormwater runoff from selected facilities in Los Angeles and San Diego Counties. The objective of this program was to evaluate the installation and operation, as well as relative benefits and costs, of various structural "treatment" BMP devices for improving water quality. Caltrans retrofit 39 BMPs at 33 strategically selected study sites (e.g., freeway interchanges, park and rides, and maintenance stations) using eight different designs.

Concern was raised that treatment BMP installations, such as those implemented by Caltrans, could potentially impact public health by increasing habitat availability for aquatic stages of disease vectors, particularly mosquitoes. The California Department of Health Services (DHS) entered into a Memorandum of Understanding with Caltrans in 1999 to provide technical expertise regarding vector production and the potential of vector-borne diseases within its stormwater BMP Retrofit Pilot Program. It was the intent of this agreement to document and, where possible, mitigate vector production and harborage at the BMP pilot project sites. The DHS Vector-Borne Disease Section (VBDS) established a comprehensive vector surveillance and monitoring program, developed vector abatement protocols, and recommended design modifications to reduce or eliminate the potential of BMPs to produce or harbor vectors. VBDS also identified which BMPs were least conducive to vector production.

Mosquito surveillance and control: 1999-2001

In May 1999, VBDS initiated a two-year comprehensive vector surveillance and monitoring study for the Caltrans BMP Retrofit Pilot Program. Collaborating local vector control agencies (Greater Los Angeles County Vector Control District, San Gabriel Valley Mosquito and Vector Control District, Los Angeles County West Vector Control District, and San Diego County Vector Surveillance and Control) monitored all BMP study sites weekly for immature stages of mosquitoes. VBDS staff conducted simultaneous evaluations of vegetative cover, predators of immature mosquitoes, evidence of rodent and other vector populations, and selected water quality conditions.

Mosquitoes were the dominant vector species observed within BMP structures. Eight mosquito species were collected from standing water in BMPs, including four that are known vectors of human disease such as viral encephalitis and malaria. Mosquito species collected from BMPs were *Culex stigmatosoma*, *Cx. tarsalis*, *Cx. quinquefasciatus*, *Culiseta incidens*, *Cs. inornata*, *Anopheles hermsi*, *An. franciscanus*, and *Ochlerotatus* (*Aedes*) *squamiger*.

BMPs that maintained permanent sources of standing water in sumps or basins provided excellent habitat for immature mosquitoes. In contrast, BMPs designed to drain rapidly provided fewer suitable habitats and harbored mosquitoes less frequently.

Mosquito surveillance and control: 2002

In June 2001, Caltrans extended funding to VBDS for the BMP/vector special project for an additional two years. Many of the original BMP Retrofit Pilot Program sites were decommissioned by Caltrans shortly after the completion of the initial two-year study. However, collaborating local vector control agencies continued to monitor a few selected BMPs of "special concern" due to their tendency to harbor and breed mosquitoes.

VBDS responsibilities were expanded to include many additional BMP sites in San Diego, Orange, Los Angeles, Siskiyou, and Shasta Counties, and the city of South Lake Tahoe. Orange County Vector Control District and El Dorado County Vector Control joined the collaborative project and periodically monitored several of these new BMP sites for standing water and vector production.

Plan review and design recommendations for mosquito suppression
In 2002, VBDS provided expert consultation and recommendations during the preconstruction phase of BMP plan reviews. This proactive approach was intended to help identify potential vector breeding habitats prior to construction. Plans for stormwater treatment BMPs as well as "litter BMPs" (trash-removing devices) were sent to VBDS for review and comment. These included plans for both new construction and retrofit improvements to existing sites. VBDS made recommendations on certain BMP designs or specific features within a design with the aim of preventing the creation of new vector breeding sites and encouraging stormwater engineers to consider vectors when siting, designing, and building new BMP devices. Because there are many variables that can favor vector production, Caltrans was strongly encouraged to have all BMPs, both new and retrofit, monitored regularly by either VBDS or a local vector control agency to ensure that they did not create threats to public health.

Education and outreach
In 2002, VBDS conducted extensive educational and outreach activities, targeting both the stormwater and vector control communities. The goal of these activities was to raise awareness of the potential public health impacts created by certain BMP devices and the long-term implications associated with their construction.

Publications. VBDS authored and co-authored a series of informative articles and newsletters including: two feature articles in *Stormwater* Magazine, one article in the *California Environmental Health Bulletin*, a detailed paper in the Proceedings and Papers of the 2002 Mosquito and Vector Control Association of California Annual Conference, and an update in the Society for Vector Ecology Newsletter.

Presentations. VBDS gave nine presentations on stormwater and vector issues in 2002. These talks were tailored to widely different audiences and focused primarily on public health concerns associated with existing and anticipated BMPs needed to meet increasingly stringent stormwater quality requirements. Attendees varied with each venue, and included engineers, city and county officials, environmental "special interest" groups, industry representatives, and vector control professionals. Presentations helped to foster many new relationships between stormwater and vector control professionals.

Committees and Task Forces. In 2002, VBDS was invited to participate on the editorial committee for the development of four new California BMP Manuals, sponsored by the California Stormwater Quality Association. VBDS's participation helped to ensure that vector concerns were included in these State manuals, which will likely serve as "models" for local California BMP manuals, and possibly for out-of-state manuals. In addition, VBDS was actively involved in the monthly meetings of the Los Angeles County Department of Public Works BMP Task Force and the bimonthly meetings of the California Storm Water Quality Association. VBDS gave an invited presentation to the Orange County Stormwater Program, New Development/Construction Task Force.

Summary of VBDS activities in 2002
- Regularly inspected Caltrans BMPs for areas of standing water as well as for design and maintenance flaws that had the potential to create breeding habitats.
- Provided Caltrans with comments and recommendations for preventing vector breeding habitats in BMPs based on field observations and/or engineering plans.
- Continued collaboration with local vector control agencies conducting vector surveillance at selected BMP sites.
- Maintained a database on immature mosquito abundance data in BMPs that were monitored by collaborating vector control agencies.
- Presented seminars on issues pertaining to BMP devices and vector production at professional meetings, continuing education seminars, and informal meetings.

- Prepared several publications on BMPs and vectors to educate the stormwater and vector control communities. The goal of these activities was to raise awareness of the potential public health impacts created by certain BMP devices and the long-term implications associated with their construction.

United States Forest Service Activities

In 1992, California Department of Health Services, Vector-Borne Disease Section (VBDS) entered into a Challenge Cost-Share Agreement with the Pacific Southwest Region of the United States Department of Agriculture Forest Service to maintain cooperative surveillance and control of vector-borne diseases within the National Forests. The United States Forest Service (USFS) and VBDS established this agreement to achieve mutually beneficial objectives in pest control and management, mandated by both federal and state law. VBDS and the USFS agreed to work cooperatively in planning and implementing vector-borne disease management programs.

In accordance with this agreement, VBDS staff conducted field activities in the following National Forests in 2002: Angeles, Cleveland, Eldorado, Humboldt-Toiyabe, Inyo, Klamath, Lake Tahoe Basin Management, Lassen, Los Padres, Mendocino, Modoc, Plumas, San Bernardino, Sequoia, Shasta-Trinity, Sierra, Stanislaus, and Tahoe. In addition, VBDS provided consultation, certification, and oversight to autonomous agencies (local environmental health departments and vector control agencies) concerning vector-borne diseases and pesticide applications for public health purposes on USFS land.

Activities conducted by VBDS staff in National Forests included epidemiological investigations of human infections, disease surveillance, risk assessment, risk reduction, and education of USFS personnel and concessionaires. Direct surveillance included the collection and testing of indicator species and vectors for plague, hantavirus, Lyme borreliosis, relapsing fever, and other tick-borne diseases (Table 19); indirect surveillance included visual assessment of vector-borne disease risk factors (e.g., estimating rodent populations and evaluating rodent burrows for abandonment). Based on surveillance information, risk reduction recommendations for vector-borne diseases were made for recreational areas, fire stations, fire lookouts, employee residences, and work places. Recommendations included vector control, rodent management, and habitat modification. Vector suppression actions involving pesticides included training on pesticide safety for USFS personnel or other groups who participated in the control effort. Follow-up evaluations were made to determine whether vector numbers had been adequately reduced. Educational activities involved providing information on specimen collection and identification, vector-borne disease epidemiology, and methods to reduce risk of infection. Posters and brochures produced by VBDS on plague, hantavirus, and Lyme disease were distributed to ranger district offices, USFS concessionaires, USFS fire stations, and individual campgrounds in regions endemic for these diseases. This report includes detailed information on VBDS activities in individual National Forests during 2002.

Table 19. Laboratory testing of specimens collected on USFS lands, 2002.

National Forest	Hantavirus Surveillance (Rodents)		Plague Surveillance (Rodents)		Plague Surveillance (Carnivores)[1]		*Borrelia* Surveillance (*Ixodes T* icks)[2]		Other Pathogen Surveillance (Other Ticks)[3]
	Positive	**Tested**	**Positive**	**Tested**	**Positive**	**Tested**	**Positive**	**Tested**	
Angeles	3	11	0	152[4]	0	44			
Cleveland	5	147			0	13			
Eldorado	55	96			2	31			
Humboldt-Toiyabe	9	42	0	34					
Inyo			4	144					
Klamath					1	32			
Lake Tahoe Basin			0	2					
Lassen			0	1	2	5			
Los Padres			3	88	2	50			
Mendocino					0	27			
Modoc	0	26	0	7	3	15			
Plumas	67	341			13	29			
San Bernardino	5	123	1	266	0	1	0	352	
Sequoia			0	26	5	25	0	175	239
Shasta-Trinity					0	15	6	339	
Sierra					1	27	0	56	
Stanislaus					1	20			
Tahoe					2	19			
Total All Forests:	**144**	**786**	**8**	**720**	**32**	**353**	**6**	**922**	**239**

[1]Carnivore specimens taken directly from or immediately adjacent to USFS lands. Because of the broad home range of carnivores, results obtained can be inferred to a large area, including both USFS and adjacent lands. Many of these specimens were collected by United States Department of Agriculture, Animal Wildlife Services, through a contractual agreement with DHS.

[2]*Ixodes pacificus* ticks tested for infection with *Borrelia* and *Ehrlichia* spp. bacteria. Ticks were tested in collaboration with the United States Army Center for Health Promotion and Preventive Medicine (USACHPPM), the University of California, and the Washoe County (Nevada) Vector Control Laboratory.

[3]*Dermacentor occidentalis* ticks tested for infection with *Bartonella* spp. bacteria. Results are pending.

[4]Testing conducted by the Los Angeles County Department of Health Services.

Source: California Department of Health Services

ACTIVITY SUMMARY BY INDIVIDUAL NATIONAL FORESTS

Angeles National Forest

- Collaborated with the Los Angeles County Department of Health Services (LACDHS) to test rodents for evidence of hantavirus infection. Of the 11 rodents tested, three rodents had antibodies to hantavirus.
- Under a cooperative agreement between DHS and LACDHS, plague surveillance and application of Diazinon 2D insecticidal dust for flea control was conducted by LACDHS and the Los Angeles County Agricultural Commissioner at various campgrounds and picnic areas within the National Forest. In total, 290 lbs of Diazinon 2D dust and 367 lbs of Deltamethrin dust were applied at campgrounds and picnic areas throughout the National Forest. None of 152 ground squirrels (*Spermophilus beecheyi*) captured had antibodies to plague bacteria (*Yersinia pestis*).
- Provided consultation to local mosquito and vector control districts in the Los Angeles Basin regarding vector control considerations associated with the proposed formation of the San Gabriel River National Park. This proposed National Park would incorporate some areas of the Angeles National Forest.

Cleveland National Forest

- Collaborated with the Northwest Mosquito Abatement District, the Riverside County Environmental Health Department (EHD), and the San Diego County EHD to test rodents for evidence of hantavirus infection. Five of the 147 rodents tested had antibodies to hantavirus, indicating a past or current infection.

Eldorado National Forest

- Continued hantavirus studies at Leek Springs Lookout and Lumber Yard Fire Station. Early surveys (conducted in August) resulted in 24 of 33 (73%) and 21 of 21 (100%) deer mice (*Peromyscus maniculatus*) from Leek Springs Lookout and Lumber Yard Fire Station, respectively, with antibodies to hantavirus. These seroprevalence estimates were significantly higher than the 10.5%-11.0% seroprevalence reported for *P. maniculatus* nationwide and the highest recorded in California in 2002. Later surveys (conducted in October) indicated lower seroprevalence estimates: antibody to hantavirus was detected in 8 of 23 (35%) and 2 of 9 (22%) deer mice at Leek Springs Lookout and Lumber Yard Fire Station, respectively. The lower rodent capture success at Lumber Yard, in comparison to the previous survey, was likely due to a recent brush and tree thinning project at the facility. Leek Springs Lookout and Lumber Yard Fire Station personnel were provided with hantavirus information and brochures on rodent-proofing.
- Provided hantavirus and Lyme disease information brochures to the Pioneer Ranger Station in Amador County.
- Conducted hantavirus surveillance at the Placerville Tree Nursery. Three hundred traps were placed in and around the nursery buildings on two consecutive nights. There was no evidence of hantavirus infection in the seven brush mice (*P. boylei*) and three western harvest mice (*Reithrodontomys megalotis*) captured.
- Met with USFS biologist at Pioneer Ranger Station to discuss conducting hantavirus surveys and to provide informational brochures on hantavirus and Lyme disease to station personnel.
- Visually assessed rodent activity at Fashoda, Sunset, Wench Creek, Yellowjacket, and West Point campgrounds. No unusual rodent activity or population changes were noted.
- Visually assessed rodent activity at Caples Creek campground. No active rodents or unusual signs of activity were observed. Educational brochures were provided to the campground host and plague caution sings were posted.
- Visually assessed rodent activity at Gerle Creek, Ice House, Northwind, Silver Creek, Strawberry Point, Wright's Lake, Lumber Yard, Silver Lake, and Silver Pine Point campgrounds. Higher than

normal densities of California ground squirrels were observed at Ice House, Northwind, Strawberry Point, and a private youth camp (Mountain Camp II) near Ice House reservoir. In 1994-95, a plague epizootic which resulted in one human plague infection occurred at Ice House reservoir and Mountain Camp II. Extensive rodent removal operations conducted by VBDS at the time significantly decreased rodent populations; however, recent surveillance indicates that rodent populations have rebounded. No evidence of epizootic activity was observed at any of the campgrounds listed and low rodent densities were observed in all other campgrounds. Plague caution signs were posted at all campgrounds.

Humboldt-Toiyabe National Forest

- Conducted plague and hantavirus surveillance near Bridgeport. Nine of 42 (21%) *P. maniculatus* collected had antibodies to hantavirus. There was no evidence of plague infection in any of 34 rodents tested. Naval personnel from the Mountain Warfare Training Center were provided training in rodent surveillance techniques and assisted VBDS in this surveillance effort.
- Visually assessed rodent activity at Leavitt Meadows, Sonora Bridge, and Obsidian campgrounds. Ground squirrel populations appeared to be low. Historically, ground squirrels have been found infected with plague bacteria in this area.

Inyo National Forest

- As follow up to reports of several cases of tick-borne relapsing fever in 2001, conducted surveillance at Crestview Fire Station. Seventeen chipmunks (*Tamias* spp.) and two ground squirrels were captured and blood samples were submitted for testing to the United States Army Center for Health Promotion and Preventive Medicine (USCHPPM). None of these rodents had antibodies to relapsing fever *Borrelia*. During subsequent surveillance, 11 chipmunks were captured and blood samples were submitted for testing to the University of California at Irvine. Results on these 11 chipmunks are pending.
- Collaborated with the Inyo and Mono County EHDs to evaluate cabins in the Lake George area for risk of relapsing fever.
- Evaluated sites suitable for conducting long-term hantavirus studies. Discussed long-term hantavirus studies with USFS personnel at the White Mountain Ranger Station in Bishop.
- Conducted plague surveillance in collaboration with Inyo County EHD at Four Jeffrey and Big Springs campgrounds. One of 29 rodents captured at Four Jeffrey and none of 30 rodents captured at Big Springs had antibodies to plague bacteria. The flea index at Four Jeffrey was 1.9 fleas per rodent. Subsequent surveillance at Four Jeffrey found none of 35 rodents with antibodies to plague bacteria, and a flea index of 2.6 fleas per rodent. Flea control to reduce the risk of plague transmission was conducted at this site using 20 lbs of Diazinon 2D insecticidal dust. During post-treatment surveillance, none of 18 rodents had antibodies to plague, and the flea index had been reduced to 1.3 fleas per rodent.
- Conducted plague surveillance at Crestview Fire Station. One of 17 chipmunks and none of two ground squirrels had antibodies to plague bacteria. The flea index was 0.26 fleas per rodent. Flea control to reduce the risk of plague transmission was conducted at this site using 2.5 lbs of Diazinon 2D insecticidal dust. During post-treatment surveillance, 11 chipmunks were captured with a reduced flea index of 0.18 fleas per rodent. However, two of these 11 chipmunks had antibodies to plague. Flea control has been conducted at this site for two consecutive years and has resulted in a drop in the flea index from a pretreatment value of 1.2 fleas per rodent to the current 0.18 fleas per rodent. With this very low flea index, the rodents captured during 2002 with plague antibodies were likely infected during previous years.
- Collaborated with Inyo County EHD to collect and test ground squirrel carcasses at Upper and Lower Grays Meadow for evidence of plague infection. Neither of the two carcasses tested showed infection with plague.

- Visually assessed rodent activity at Lower Lee Vining, Cattle Guard, Oh Ridge, Iris Meadow, and French Camp campgrounds in Mono County. Ground squirrel populations appeared to be low. Historically, plague has been found in this area.
- Visually assessed rodent activity at Old Shady Rest and New Shady Rest campgrounds. Rodent activity appeared low at both Old and New Shady Rest campgrounds.
- Provided consultation to USFS personnel regarding the vector-borne disease risk associated with the use of three cabins located near old mines.
- Gave a presentation on vector-borne diseases in the National Forests to USFS personnel at the Inyo County Fairgrounds in Bishop.

Klamath National Forest

- Posted Tree of Heaven campground with tick "Caution" signs and provided educational material on Lyme disease and hantavirus to the campground host. This campground has extensive tick activity in spring and early summer months.
- Conducted tick surveillance on west side of Butte Valley, near Meiss Lake, Siskiyou County. Very little tick activity was observed, probably due to the wet ground and patches of snow present during this surveillance effort. Two western black-legged ticks (*Ixodes pacificus*) and several *Dermacentor* spp. ticks were collected but not retained for testing.
- Visually assessed rodent population at Juanita Lake campground. Rodents were present in low numbers but without obvious signs of mortality due to a plague epizootic. The campground was posted with plague "Caution" signs.
- Provided educational information on hantavirus and plague to USFS personnel at Goosenest Ranger Station and to the Forest Supervisor's Office in Yreka.
- Provided educational information on hantavirus and tick-borne diseases to USFS personnel at Oak Knoll Fire Station to be used during training programs for USFS fire lookout personnel.
- Compiled small mammal trapping data from Klamath National Forest for mapping and analysis of plague occurrence in this region.

Lake Tahoe Basin Management

- Visually assessed rodent activity at Bayview, Camp Richardson Resort, Fallen Leaf, Kaspian, Meeks Bay, and William Kent campgrounds and at the Tallac Visitor Center. The Tallac Visitor Center and Fallen Leaf campground had above normal densities of rodents; however, there was no evidence of a plague epizootic occurring at either site. None of two rodent carcasses (one ground squirrel and one chipmunk) collected at Tallac Visitor Center showed evidence of plague infection. All campgrounds were posted with plague "Caution" signs and campground hosts and USFS personnel at the South Lake Tahoe Ranger Station were given plague and hantavirus educational brochures. A plague epizootic occurred at the Tallac Visitor Center in 2001, underscoring the need for continued plague precautions in this area.
- Discussed rodent management programs with the manager of the Camp Richardson Resort.

Lassen National Forest

- Conducted tick surveillance in the Shingletown area. No ticks were collected from recreation sites at Hat Creek, Horn, and Bridge campgrounds. These sites appear to be low-risk for Lyme disease as elevation may not support large tick populations.
- Inspected Old Station Fire Station for evidence of rodent activity and to evaluate hantavirus risk. All buildings, food preparation areas, and the "bone yard" were inspected for signs of rodent activity. Buildings were well maintained and hantavirus precautions, including the use of rodent traps, were being used by fire station personnel. Handling and decontamination of dirty rodent traps was

discussed. Hantavirus and plague safety issues were discussed with the fire captain and the fire crew on site, and educational brochures were provided.
- Ensured that all Eagle Lake campgrounds were posted with plague "Caution" signs.
- Visually assessed rodent activity at Aspen Grove tent campground. There was moderate ground squirrel activity and some chipmunk activity noted. No signs of rodent mortality due to plague were noted.
- Visually assessed rodent activity at Battle Creek and Almanor north and south campgrounds. No unusual rodent activity was noted. One ground squirrel carcass was collected at Almanor campground; testing showed no evidence of plague infection. Ensured campgrounds were posted with plague caution signs.
- Confirmed that Bogard, High Bridge, and Benner Creek campgrounds had plague "Caution" signs posted by USFS personnel.
- Provided educational information and brochures on hantavirus and plague to USFS personnel at Almanor, Eagle Lake, and Hat Creek ranger stations. Discussed vector-borne disease risk with recreation supervisors at these ranger stations.
- Provided educational brochures and discussed plague and hantavirus risk with new campground host at Hat Creek campground. Ensured that campground was posted with plague "Caution" signs.
- Provided safety presentation on hantavirus epidemiology to USFS personnel during the seasonal start-up meetings for USFS staff at Almanor and Eagle Lake ranger stations. Over 50 personnel attended each presentation.
- Compiled small mammal trapping data from Lassen National Forest for mapping and analysis of plague occurrence in this region.

Los Padres National Forest

- Trapped rodents at Cerro Alto campground to test for the presence of a new *Borrelia* sp. (similar to *Borrelia burgdorferi*, the causative agent of Lyme disease). This potentially infectious agent was isolated in prior years from *I. pacificus* ticks collected at this site. None of the rodents tested had antibodies to the new *Borrelia* bacteria.
- Continued plague ecology and control studies at Chuchupate campground. Feed cubes containing the insecticide Lufenuron have been continually provided to rodents at this campground since it reopened in 2000. This feed-through material has shown good ability to reduce flea numbers on rodents and is harmless to all vertebrates. Ground squirrel numbers have been increasing since the re-opening of the campground. During 2002, three of 61 rodents captured (one ground squirrel and two chipmunks) had antibodies to plague bacteria. These three rodents were likely infected during a previous year as rodent flea numbers remained at very low levels throughout 2002, with flea indices of 0.3 and 0.6 fleas per rodent during spring and summer, respectively. All flea data from this campground, dating back to 1982, is being analyzed to determine the role that flea species at this site may play in the transmission and/or maintenance of plague.
- Conducted plague surveillance at Marian Mountain, Caballo, Toad Spring, and Reyes Creek campgrounds. None of 27 rodents captured at these sites had antibodies to plague bacteria.
- Visually assessed rodent activity at 17 campgrounds, day use areas, and fire stations. All sites had average to low numbers of ground squirrels and chipmunks, indicating a normative risk for plague transmission.
- Visually assessed rodent activity at Valle Vista, Mil Potrero, Chula Vista, Mt. Pinos, and McGill campgrounds. Average to low numbers of ground squirrels and chipmunks were observed at all sites.
- Identified insects and other invertebrates for Santa Maria Ranger District.
- Conducted safety training for Santa Maria Ranger Station personnel.

Mendocino National Forest

- Visually assessed rodent activity at Oak Flat, Pogie Point, Fuller Grove, and Sunset campgrounds around Lake Pillsbury. Ground squirrel numbers were moderate at each campground. A plague risk assessment form was completed for each campground; risk was calculated as low to moderate.

Modoc National Forest

- Conducted hantavirus surveillance at Lava Beds National Monument and on Modoc National Forest lands near Tionesta. None of six wood rats (*Neotoma* spp.) and 20 mice (*Peromyscus* spp.) had antibodies to hantavirus.
- Conducted plague surveillance at Lava Beds National Monument and on Modoc National Forest lands near Tionesta. None of two wood rats (*Neotoma* spp.) and five mice (*Peromyscus* spp.) had antibodies to plague bacteria.
- Visually assessed rodent activity at Headquarters, Hemlock, Medicine Lake, Bullseye Lake, and Paynes Springs campgrounds near Medicine Lake. The two smaller campgrounds—Bullseye Lake and Paynes Springs—had very little rodent activity. The three larger campgrounds supported moderate to high populations of golden-mantled ground squirrels (*Spermophilus lateralis*) and chipmunks. No unusual rodent activity or population changes were noted. All campgrounds were posted with plague cautions by Tule Lake Ranger District personnel.

Plumas National Forest

- Continued long-term hantavirus ecology study at Laufman Fire Station to evaluate seasonal variation in rodent abundance and hantavirus transmission. Using mark-recapture methods, 471 rodents were trapped during 12 trap-night periods (two nights/visit) from April-October. Of the 471 rodent captures, 341 rodents were tested for infection with hantavirus. Of the 341 rodents tested, 67 rodents (or 19.8%) had antibodies to hantavirus. Hantavirus seroprevalence ranged 0-66% with the highest seroprevalence noted during the late summer and fall surveillance. Nearly 27% of rodents captured and over 25% of seropositive rodents were trapped in or around structures at the fire station. Three species of mice—*P. maniculatus, P. boylei,* and *P. crinitus*—were found to have antibodies to hantavirus. Results were communicated to station staff and rodent exclusion efforts were recommended. A hantavirus "Do's and Don'ts" fact sheet was prepared to minimize potential staff exposure to hantavirus infection. This fact sheet was also provided to the Province Safety Officer for distribution.
- Visually assessed rodent activity at Sly Creek and Strawberry Valley campgrounds. Strawberry Valley campground was closed to the public. Plague "Caution" signs were posted and plague and hantavirus epidemiology was discussed with the concessionaire supervisor for both campgrounds.
- Visually assessed rodent activity at the Antelope Lake campgrounds. There were no obvious signs of unusual rodent abundance or activity. All campgrounds were posted with plague caution signs.
- Visually assessed rodent activity at Grasshopper Flat and Lightning Tree campgrounds near Lake Davis. Golden-mantled ground squirrel burrows were noted in both campgrounds. There were no obvious signs of unusual rodent activity or rodent disappearance due to a plague epizootic.
- Provided educational brochures and information to USFS personnel at the Mt. Hough and Beckwourth Ranger Districts. Vector-borne disease risk was discussed with district recreation supervisors.
- Discussed vector-borne disease epidemiology and risk management with two campground hosts at Lakes Basin campground.
- Compiled small mammal trapping data from Plumas National Forest for mapping and analysis of plague occurrence in this region.

San Bernardino National Forest

- Collaborated with the Riverside County EHD, the San Bernardino County Vector Control Program (VCP), and USCHPPM to test *I. pacificus* ticks for evidence of infection with *Borrelia* and *Ehrlichia* bacteria. Ticks were collected from Santa Rosa and Thomas Mountains area as well as the Spittler Creek and Joe Elliot trail areas. None of 352 ticks collected was infected with Lyme *Borrelia*.
- Collaborated with the San Bernardino County VCP and researchers from the University of California at Irvine to identify areas near Big Bear Lake where tick-borne relapsing fever has historically infected humans, and to evaluate the ecological parameters of this disease. Rodent trapping was conducted at one historic transmission site (near Sorrano campground), but no rodents were captured for testing. Several cabins on USFS land were inspected for the presence of rodents or ticks, but none appeared to be infested.
- Tested rodents for evidence of hantavirus infection from campgrounds and trailheads throughout the National Forest in collaboration with the LACDHS, the San Bernardino County VCP, and the Riverside County EHD. Five of 123 rodents tested had antibodies to hantavirus.
- Tested rodents for evidence of plague infection from campgrounds and trailheads throughout the National Forest in collaboration with LACDHS, the San Bernardino County VCP, and the Riverside County EHD. Plague antibodies were detected in one of 266 rodents tested. The single plague-positive rodent was a ground squirrel captured at Marion Mountain campground in July.
- Provided vector-borne disease educational materials and brochures to USFS personnel at the Big Bear ranger station.

Sequoia National Forest

- Provided training in tick surveillance techniques to Tulare County EHD personnel in the vicinity of the city of Three Rivers. None of 174 *I. pacificus* ticks collected was infected with Lyme *Borrelia*. Results are pending on 230 *Dermacentor occidentalis* ticks collected and submitted to be tested for infection with *Bartonella* bacteria.
- Conducted tick surveillance in Walker Basin and along Hwy 178 east of Bakersfield. One *I. pacificus* and nine *D. occidentalis* adult ticks were collected and submitted for testing. The *Ixodes* tick was not infected with *Borrelia* bacteria; results on *Dermacentor* infection with *Bartonella* bacteria are pending.
- Conducted plague surveillance at Camp Wishon and Coffee Creek campgrounds east of Porterville. None of nine rodents captured at Camp Wishon had antibodies to plague bacteria. Rodent numbers were unusually low at Coffee Creek (no ground squirrels captured). However, flagging of rodent burrows at Coffee Creek resulted in the capture of many fleas.
- Visually assessed rodent activity at campgrounds in the vicinity of Lake Isabella. Rodent numbers were high at all campgrounds as evidenced by a large number of juvenile ground squirrels. It was expected that the population would decrease due to high juvenile mortality.
- Conducted plague surveillance at Boulder Gulch campground (the site of a plague epizootic in 1995). Rodent numbers were very high (28 ground squirrels captured in 32 traps), but not unusual for mid-spring (May) due to the high number of juvenile ground squirrels present. None of 17 adult ground squirrels tested had antibodies to plague bacteria. The remaining 11 ground squirrels were juveniles and were released without taking a blood sample. The flea index at this site was very high: approximately 18 fleas/squirrel. Results and precautionary measures were discussed with USFS personnel at the district office.
- Inspected temporary fire camps in Kernville and Johnsondale to evaluate vector-borne disease risk at the request of the USFS fire management staff at the McNally Fire Incident Command Center (in Kernville). Information was provided on site-specific vector-borne disease risks, and recommendations were made to reduce the risk of disease exposure at temporary camps and in the vicinity of the fire lines.

- Conducted research study at Boulder Gulch campground to determine effectiveness of ground squirrel population estimate techniques. Estimation techniques evaluated included visual estimation and a mark-release-recapture technique. Population estimates were also conducted three times per day to determine if diurnal variation in population could be determined.
- Provided educational materials and brochures to USFS personnel at the Lake Isabella Visitor Center for posting at the Visitor Center and at USFS facilities and campsites.
- Provided information on bird mites to USFS personnel at the district office in Porterville in response to USFS personnel complaints of mite infestation. A private company was contracted to control the infestation.

Shasta-Trinity National Forest

- Conducted Lyme disease risk assessment study at 12 recreation sites in the vicinity of Lake Shasta. Sites included Hirtz Bay, Dekkas Rock, Nelson Point, Bailey Cove, McCloud Bridge, Packers Bay, Moore Creek, Pine Point, Gregory Creek, Lakeshore East, Antlers, and Lakeside campgrounds. Two sites, Antlers and Lakeside campgrounds, contained little suitable tick habitat and few adult *Ixodes* ticks were collected at these sites. The remaining ten sites provided suitable tick habitat and adult ticks were abundant from December 2001 through March 2002, with a dramatic reduction in adult tick numbers by May. Ticks were most abundant along roadsides and trails near campground areas. One of 29 *I. pacificus* ticks collected from Bailey Cove campground, two of 77 *I. pacificus* ticks collected from Dekkas Rock, one of 33 *I. pacificus* ticks collected from Moore Creek, and two of 139 *I. pacificus* ticks collected from Nelson Point were infected with *B. burgdorferi*; none of 20 *I. pacificus* ticks collected from McCloud Bridge and 41 *I. pacificus* ticks from Packers Bay was infected with Lyme *Borrelia*. Surveillance results were communicated to Shasta Lake Ranger District.
- Assessed tick abundance at the Pollard Gulch recreation site along the Sacramento River. Tick abundance at this site was high and tick bite prevention precautions were recommended.
- Assessed suitability of habitat for ticks at areas within Yolla Bolla Ranger District. Basin Gulch campground reopened recently and appeared to contain suitable tick habitat. Although no ticks were collected in October, fall rains which generally signal the start of adult tick activity had not yet begun.
- Visually assessed suitability of tick habitat at Hobo Gulch, Big Bar, and Bag Flat campgrounds and Canyon Creek trailhead. Habitat at Hobo Gulch and Big Bar campgrounds is suitable for *I. pacific*us. Future tick surveillance efforts will be directed at these two sites.
- Visually assessed rodent activity at two camping sites in Brokeoff Meadows. Few rodents were observed and there was no indication of increased plague risk.
- Visually assessed rodent activity at Hobo Gulch, Big Bar, and Bag Flat campgrounds and Canyon Creek trailhead. Rodent numbers at all sites were low.
- Visually assessed rodent activity at McBride Springs and Sand Flat campgrounds on Mt. Shasta. Some golden-mantled ground squirrel and chipmunk activity was noted at both sites, but there was no indication of increased plague risk.
- Discussed vector-borne disease epidemiology and hantavirus prevention with USFS personnel at the Mt. Shasta Ranger Station.
- Discussed hantavirus risk and provided safety recommendations and educational brochures to USFS personnel at Harrison Gulch Ranger Station. This visit was a follow-up to rodent problems reported by USFS personnel during 2001. Rodent control is now being conducted by a private pest control company.
- Discussed hantavirus and plague prevention measures with the fire captain and fire crew at Ash Creek Fire Station. Employees reported observing unusual mouse activity indoors. Inspected station buildings for signs of rodent activity, reviewed trap placements, and discussed related safety issues. Rodent exclusion recommendations were provided.

- Provided educational brochures and information on the epidemiology of hantavirus, plague, and Lyme disease to USFS personnel at Big Bar Ranger Station.

Sierra National Forest

- Conducted Lyme disease risk assessment in the Bass Lake area. None of 32 and none of 24 adult *I. pacificus* collected at Way of the Mono Trail and Wishon Point campground, respectively, was infected with *B. burgdorferi*. No ticks were collected at Forks campground.
- Discussed vector-borne disease epidemiology and risk with USFS personnel at North Fork Ranger Station. Provided educational brochures on plague and Lyme disease.

Stanislaus National Forest

- Visually assessed rodent activity at Highland Lakes, Alpine West, Silver Tip, Pine Marten, and New Spicer campgrounds. No unusual signs of rodent activity or population changes were noted. Plague "Caution" posters were placed on bulletin boards. Discussed vector-borne disease risk and provided educational brochures to campground hosts at all campgrounds except Highland Lakes.
- Visually assessed rodent activity at Deadman, Baker, Eureka Valley, Pigeon Flat, and Dardanelle's campgrounds. No unusual signs of rodent activity or population changes noted. Plague "Caution" signs were placed on bulletin boards. Provided plague and hantavirus educational brochures to campground hosts at all campgrounds except Pigeon Flat.
- Provided information on vector-borne disease epidemiology and risks associated with recreational campgrounds to campground concessionaire managers servicing this National Forest.
- Discussed vector-borne disease epidemiology and disease risks with USFS personnel at Alpine Ranger Information Station and Hathaway Pines Ranger District. Educational brochures were provided for distribution.
- Discussed vector-borne disease epidemiology and risks with USFS personnel at the MiWok and Summit Ranger Stations, and at Dardanelle's Information Station. Educational brochures were also provided for distribution.

Tahoe National Forest

- Issued a public health alert in collaboration with local public health agencies in response to evidence of a plague epizootic at Donner Memorial State Park and the surrounding Donner Lake and Truckee area. Donner Memorial State Park was closed in early September for the remainder of the tourist season while other public places and private parks within the area were temporarily closed to reduce the risk of plague transmission to humans.
- Posted plague "Caution" posters at Berger Creek, Diablo, Salmon Creek, and Sardine Lake campgrounds, all of which are located in an area with a history of plague epizootics.
- Visually assessed rodent activity at Goose Meadows, Silver Creek, Granite Flat, Upper Little Truckee, Lower Little Truckee, and Sagehen Creek campgrounds. No unusual rodent activity or population changes were noted.
- Visually assessed rodent activity at Prosser, Boca, Lakeside, Annie McCloud, Upper Little Truckee, Lower Little Truckee, Cold Creek, Cottonwood, and Indian Springs campgrounds, and at the Truckee Work Station. Significant plague epizootic activity in the Truckee area prompted inspections of many campgrounds within the region. No evidence of plague transmission or rodent die-off was observed at any of the area campgrounds. Granite Flat, Goose Meadows, and Silver Creek campgrounds had greater numbers of rodents than were observed earlier in the season. Significant rodent densities were also noted at Prosser and Boca campgrounds as well as at the Truckee Work Station. Low to normal rodent densities were observed at all other campgrounds. All campgrounds were posted with plague "Caution" signs and campground hosts were provided with plague and

hantavirus educational brochures. Plague "Caution" signs and educational brochures were also provided to USFS personnel at the Truckee Ranger Station for dissemination.
- Discussed vector-borne disease epidemiology and risks with USFS personnel at the Sierraville Ranger Station. Educational brochures and plague caution signs were provided for distribution.
- Discussed hantavirus epidemiology with the campground concessionaire supervisor for the campgrounds in the Donner Lake area. Recommendations emphasized safety precautions that should be communicated to campground hosts who live in recreational vehicles parked on site.
- Compiled small mammal trapping data from Tahoe National Forest for mapping and analysis of plague occurrence in this region.

OTHER SERVICES PROVIDED

- Provided training in vector-borne disease epidemiology and vector control to USFS personnel, county environmental health departments, and vector control districts that work on USFS lands. Training is provided through annual workshops, special seminars and presentations, and field demonstrations.
- Updated a by-forest contact list of USFS biologists, district rangers, fire management officers, recreation officers, and safety officers. This contact list will assist VBDS biologists to communicate investigation and surveillance findings to appropriate USFS personnel, and will also help to ensure that all areas of the USFS in California are receiving service by VBDS.
- Updated a contact list for USFS Region 5 campground concessionaire companies. This contact list will enable VBDS biologists to contact campground hosts to discuss vector-borne diseases. This contact list will also assist VBDS in the investigation of human disease cases where the site of infection was thought to be a USFS campground.
- Mailed VBDS capabilities letter to all USFS Forest Supervisors, district offices, and campground concessionaires. This letter described the services that the VBDS staff can provide to the USFS and included contact information for VBDS biologists.
- Updated the California Plague Compendium which serves as a useful source of information regarding the current and historical aspects of plague ecology in California.
- Developed a presentation on small mammals of public health importance that can be used by USFS safety officers during employee training sessions.
- Participated as members of the California Tick-borne Disease Working Group to identify critical information gaps in our knowledge of tick-borne diseases in California. This group also provides focus to University of California and DHS research projects designed to answer critical questions of tick-borne disease ecology.

Vector Control Technician Certification Program

The California Department of Health Services (DHS) administers the Public Health Vector Control Technician certification examination in May and November each year. The purpose of this examination is to certify the competence of government agency personnel in the control of vectors for the health and safety of the public. Authority to administer this exam is found in Health and Safety Code, Section 106925, which requires every government agency employee who handles, applies, or supervises the use of any pesticide for public health purposes to be certified by DHS. Standards governing certification of local agency vector control personnel are found in Title 17 of the California Code of Regulations, Sections 30001-30061. The first DHS-sponsored certification examination to qualify agency personnel in Mosquito Control was held in April 1974.

To become certified in a control category, applicants must pass the Core section and at least one Specialty section of the examination. The Core section consists of questions relating to the safe and effective use of pesticides. Specialty sections contain questions relating to the control of relevant vectors of the other exam sections listed in Table 20. Successful examinees are issued a gold certification card, which is valid for two years in the qualified categories specified on the card. To maintain their full certification status in subsequent two-year cycles, Certified Technicians are required to pay annual renewal fees and meet minimum continuing education requirements. Successful examinees electing not to participate in continuing education are issued parchment certificates in the categories in which they qualified. These Certified Technicians (Limited) employees may not use pesticides except under the direct supervision of a Certified Technician.

Through 2002, 1,143 Vector Control Technicians employed at 103 local public health agencies held 2,516 certificates (Table 21). The local agencies include 53 Mosquito Abatement Districts, Mosquito and/or Vector Control Districts and other special districts, 36 departments of county government, 13 departments of city government, and the Vector-Borne Disease Section of DHS.

Table 20. Results of certification examinations administered in 2002.

Exam section	No. Exams given	No. passed (%)
Core	161	119 (74.0)
Mosquito Control	140	79 (56.4)
Terrestrial Invertebrate Vector Control	106	62 (58.5)
Vertebrate Vector Control	104	66 (63.5)
Totals	**511**	**326 (63.8)**

Table 21. Vector Control Technician certificates in effect as of December 2002.

	No. certificates		
Certification category	**Full status**	**Limited status**	**Sum**
Mosquito Control	668	194	862
Terrestrial Invertebrate Vector Control	548	221	769
Vertebrate Vector Control	563	322	885
Totals	**1779**	**737**	**2516**

Source: California Department of Health Services

Staff Presentations and Publications

Presentations

JANUARY

- ***Aedes albopictus* Infestations in California**
  Mosquito and Vector Control Association in California (MVCAC) Annual Conference, Yosemite: *Kenneth Linthicum*
- **The "Dark Side" of Stormwater Runoff Management: Vectors Associated with BMPs**
  MVCAC Annual Conference, Yosemite: *Marco Metzger*
- **Methods for the Assessment of Tick-Borne Disease Exposure Risks**
  MVCAC Annual Conference, Yosemite: *Todd Walker*
- **Surveillance for Mosquito-borne Encephalitis Virus Activity and Human Disease in California, 2001**
  MVCAC Annual Conference, Yosemite: *Vicki Kramer*
- **Update on DHS Lyme Disease Program and the Lyme Disease Advisory Committee**
  MVCAC Annual Conference, Yosemite: *Anne Kjemtrup*
- **West Nile Virus: Are We Prepared?**
  MVCAC Annual Conference, Yosemite: *Vicki Kramer*
- **Human Lice and Are They Nice?**
  San Francisco County Trans-Bay Terminal Custodial Staff, San Francisco: *Al Hom*
- **The Downside of Stormwater Runoff Management: Disease Vectors and Structural BMPs in Southern California**
  Los Angeles County Public Works, BMP Task Force Meeting, Alhambra: *Marco Metzger*
- **Disease Vectors Associated with Stormwater Treatment Devices in Southern California**
  Caltrans, Encroachment Permits Branch, Storm Water Training and Workshop, San Bernardino: *Marco Metzger*
- **Emerging Vector-Borne Diseases in California**
  Alta Bates Summit Medical Center, Grand Rounds, Berkeley: *Anne Kjemtrup*

FEBRUARY

- ***Aedes albopictus* Associated with Lucky Bamboo in California**
  State Public Health Vector Control Conference, Ft. Collins, CO: *Vicki Kramer*
- **Vector-borne Diseases in California: 2000-2001**
  State Public Health Vector Control Conference, Ft. Collins, CO: *Vicki Kramer*
- **Widespread Infestations of *Aedes albopictus* in California in 2001**
  American Mosquito Control Association Annual Conference, Denver, CO: *Vicki Kramer*
- **Rodents and Diseases**
  Rodent Summit, National Park Service, San Francisco: *Curtis Fritz*
- **Nuisance Flies**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Alec Gerry*
- **Yellowjackets**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Lucia Hui*
- **Mites of Public Health Significance**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Kenneth Linthicum*
- **The "Dark Side" of Stormwater Runoff Management: Vectors Associated with BMPs**
  MVCAC, Coastal California Region, Continuing Education Seminar, San Ramon: *Marco Metzger*
- **Sylvatic Rodents of California and Public Health**
  MVCAC Coastal-Region Continuing Education Workshop, San Ramon: *Jim Tucker*

- **Spiders**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Marco Metzger*
- **Fleas**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Richard Davis*
- **Head Lice**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs: *Renjie Hu*, Vacaville: *Stan Husted*
- **Africanized Honey Bees and Red Imported Fire Ants**
  DHS/MVCAC Arthropods of Public Health Significance Workshop, Santa Fe Springs and Vacaville: *Todd Walker*

MARCH

- **West Nile Virus Preparedness in California**
  West Nile Virus National Planning Meeting, Atlanta, GA: *Vicki Kramer*
- **West Nile Virus in the United States and Our California Program to Detect Its Arrival**
  Butte County Mosquito and Vector Control District Training Session, Oroville: *Marty Castro*
- **Plague as an Agent of Bioterrorism**
  20th Vertebrate Pest Conference, Reno, Nevada: *Curtis Fritz*
- **The California Department of Health Services Plague Surveillance and Control Program**
  20th Vertebrate Pest Conference, Reno, Nevada: *Charles Smith*
- **Arenaviruses in the Western United States**
  20th Vertebrate Pest Conference, Reno, Nevada: *Curtis Fritz*
- **Vector-Borne Disease Threats: Is California Prepared?**
  USDA/Gordon Conference on New Frontiers in Chemical and Biological Terrorism Defense, Ventura: *Richard Davis*
- **Predicting Epidemics of Rift Valley Fever in East Africa Using Remote Sensing**
  USDA/Gordon Conference on New Frontiers in Chemical and Biological Terrorism Defense, Ventura: *Kenneth Linthicum*
- **Nuisance Flies**
  Tulare County Continuing Education, Visalia: *Alec Gerry*
- **West Nile Virus**
  Kiwanis Quarterly Meeting, Walnut Valley: *Alec Gerry*
- **Linkage between Vector-borne Disease Incidence and Climate**
  NASA/Penn State University Health-Environment Alliance Symposium, Hershey, Pennsylvania: *Kenneth Linthicum*
- **Vector-borne Diseases and the Bioterrorism Threat**
  MVCAC Southern San Joaquin Valley Region Continuing Education Workshop, Visalia: *Mark Novak*
- **Plague, Hantavirus, and Tick-borne Diseases in California, an Update**
  Lava Beds National Monument Staff Safety Meeting, Tulelake: *Charles Smith* and *Larry Bronson*

APRIL

- **Field Identification of Wild Rodents, Plague and Hantavirus Prevention**
  California Department of Fish and Game, Region II, Redding: *Charles Smith* and *Larry Bronson*
- **West Nile Virus in the United States and Our California Program to Detect its Arrival**
  Northern California Entomology Club, Davis: *Marty Castro*
- **Tales of an Itinerant Epidemiologist**
  Veterinary Epidemiology, School of Veterinary Medicine, University of California, Davis: *Curtis Fritz*

- **The Black Death: A Danse Macabre with Plague through the Ages**
  Epidemiology & Control of Infectious Diseases, School of Public Health, University of California, Berkeley: *Curtis Fritz*
- **Hantavirus Pulmonary Syndrome**
  Epidemiology & Control of Infectious Diseases, School of Public Health, University of California, Berkeley: *Curtis Fritz*
- **West Nile Virus**
  Kiwanis Quarterly Meeting, City of Industry: *Alec Gerry*
- ***Aedes albopictus* in California**
  UC Mosquito Workshop, Palm Springs: *Kenneth Linthicum*
- **Dead Bird Carcass: Reporting, Handling and Shipping**
  Bird Identification Workshops: Elk Grove and Clovis: *Al Hom*
- **Rodent Surveillance for Disease Investigation**
  Virology Seminar, Department of Plant and Microbial Biology, University of California, Berkeley: *Lucia Hui*
- **Lyme Disease in California**
  Lyme Disease Resource Center Annual Conference, Ukiah: *Lucia Hui*
- **Lyme Disease, Prevention and Protection**
  East Bay Regional Park Districts, Oakland: *Lucia Hui*
- **Update on DHS Lyme Disease Program and the Lyme Disease Advisory Committee**
  Butte County Lyme Disease Support Group, Chico: *Anne Kjemtrup*
- **Vector-borne Diseases and the Bioterrorism Threat**
  MVCAC Sacramento Valley Region Continuing Education Workshop, Yuba City: *Mark Novak*
- **Evaluation of Vectorial Capacity as a Predictor of Bluetongue Transmission to Cattle in Southern California**
  Department of Entomology, University of California, Riverside: *Alec Gerry*
- **Globalization of Viral Hemorrhagic Fevers: Importance of Identifying Linkages between Virus, Ecosystems, and Climate**
  Southern California Vector Control Districts Conference on Emerging Arboviral Diseases in the Western United States, Anaheim: *Kenneth Linthicum*
- ***Aedes albopictus* in California: Biology and Behavior**
  Seventh World Congress on Environmental Health, San Diego: *Kenneth Linthicum*
- **Biology and Control of Fleas Associated with California Ground Squirrels**
  Department of Entomology, University of California, Riverside: *Marco Metzger*
- **Vector-borne Diseases and the Bioterrorism Threat**
  Seventh World Congress on Environmental Health, San Diego: *Mark Novak*
- **Insect Transmitted Diseases: Worldwide**
  California Association of Public Health Laboratory Directors Symposium, San Jose: *Todd Walker*

MAY

- **West Nile Virus Program in the United States and California**
  World Congress on Environmental Health, San Diego: *Stan Husted*

JUNE

- **Wildlife Diseases and Prevention**
  US Forest Service, Los Padres National Forest, Santa Maria Ranger District, Santa Maria: *Richard Davis*
- **California West Nile Virus Dead Bird Surveillance Program**
  Shasta County MVCD, Redding: *Sunita Quick*
- **West Nile Virus Surveillance Program (Mosquitoes, Dead Birds, Sentinel Chickens)**
  DHS Viral and Rickettsial Disease Laboratory, Richmond: *Stan Husted*

- **West Nile Virus: Overview**
  Coastal MVCAC Managers Meeting, Salinas: *Al Hom*
- **West Nile Virus: Overview**
  San Benito County Environmental Health Department, Hollister: *Al Hom*
- **Lyme Disease in California, Protection and Prevention**
  Pacific Gas and Electricity Company Safety Officers, San Francisco: *Lucia Hui*
- **West Nile Virus Surveillance and Preparedness in California**
  Mariposa County Environmental Health, Mariposa: *Mark Novak*
- **West Nile Virus Surveillance and Preparedness in California**
  Tuolumne County Environmental Health, Sonora: *Mark Novak*
- **Vector-Borne Diseases in the National Forests: Hantavirus and More!**
  Inyo National Forest Employee Responsibilities Training, Bishop: *Todd Walker*
- **Vector-Borne Diseases in California**
  Lawrence Hall of Science, UC Berkeley, Sagehen Research Station, Truckee: *Jim Tucker*

JULY
- **California West Nile Virus Dead Bird Surveillance Program**
  San Diego County Environmental Health Department, San Diego: *Sunita Quick*
- **California West Nile Virus Dead Bird Surveillance Program**
  Imperial County Health Department, El Centro: *Sunita Quick*

AUGUST
- **An Introduction to West Nile Virus**
  San Benito County Animal Control, Hollister: *Al Hom*

SEPTEMBER
- **Identifying the Enzootic Cycle of Human Ehrlichiosis in California**
  Society of Vector Ecology Conference, Albuquerque, NM: *Vicki Kramer*
- **California West Nile Virus Dead Bird Surveillance Program**
  Berkeley Environmental Health Department, Berkeley: *Sunita Quick*
- **West Nile Virus in the US and in California**
  47th Annual Conference of the California Directors of Environmental Health, San Diego: *Kenneth Linthicum*
- **Disease Vectors Associated with Stormwater Treatment Devices in Southern California**
  Orange County Stormwater Program, New Development/Construction Task Force Workshop, Irvine: *Marco Metzger*
- **Sylvatic Plague in California**
  California Parks and Recreation, Donner Memorial State Park: *Jim Tucker*
- **West Nile Virus**
  Inyo and Mono County Public Health Staff Workshop, Mammoth Lakes: *Todd Walker*

OCTOBER
- **Tales of an Itinerant Epidemiologist**
  Veterinary Epidemiology, School of Veterinary Medicine, University of California, Davis: *Curtis Fritz*
- **Vector-Borne Diseases in California**
  Northern California Environmental Health Directors, Lake Tahoe: *Anne Kjemtrup*
- **Preparing for West Nile Virus Arrival in California**
  Northern California Environmental Health Directors, Lake Tahoe: *Stan Husted*
- **California West Nile Virus Dead Bird Surveillance Program**
  Executive Board of the California Animal Control Association, Alameda: *Kelly McCaughey*

- **West Nile Virus**
  MVCAC South San Joaquin Valley Continuing Education Workshop, Visalia: *Alec Gerry*
- **West Nile Virus Preparedness**
  San Francisco Health Department, San Francisco: *Al Hom*
- **West Nile Virus Overview**
  San Francisco County Safety and Hazard Committee Workshop, San Francisco: *Al Hom*
- **An Overview of Arbovirus Surveillance in California, 1969-2001**
  Wetlands without Mosquitoes Workshop, Concord: *Lucia Hui*
- **The "Dark Side" of Stormwater Runoff Management: Vectors Associated with BMPs**
  Wetlands without Mosquitoes Workshop, Concord: *Marco Metzger*
- **West Nile Virus Surveillance in California Vector Populations**
  San Diego County Office of Public Health Rapid Response Team's Animal Health Surveillance Group, San Diego: *Kenneth Linthicum*
- **West Nile Virus Surveillance and Preparedness in California**
  MVCAC Northern San Joaquin Valley Region Continuing Education Workshop, Modesto: *Mark Novak*
- **California West Nile Virus Dead Bird Surveillance Program**
  MVCAC Northern San Joaquin Valley Region Continuing Education Workshop, Modesto: *Sunita Quick*
- **Vector-Borne Diseases in California**
  University of California Natural Reserve System, UC Berkeley, Sagehen Research Station, Truckee: *Jim Tucker*
- **Wild Rodents and Rodent-Borne Diseases and Control**
  MVCAC South San Joaquin Continuing Education Workshop, Visalia: *Richard Davis*

NOVEMBER

- **West Nile Virus and Vector-Borne Disease Update**
  PAPA Workshop, Santa Maria: *Richard Davis*
- **Introduction to West Nile Virus**
  Alameda County Environmental Health Department, Oakland: *Al Hom*
- **West Nile Virus Overview**
  San Francisco Park & Recreations Department, San Francisco: *Al Hom*
- **The "Dark Side" of Stormwater Runoff Management: Vectors Associated with BMPs**
  California Environmental Health Association, 2002 Southern Update, Anaheim: *Marco Metzger*
- **West Nile Virus Surveillance and Preparedness in California**
  MVCAC Sacramento Valley Region Continuing Education Workshop, Willows: *Mark Novak*
- **Vector-borne Diseases in California - a Review**
  Mariposa County Extension Continuing Education Workshop, Hornitos: *Mark Novak*
- **West Nile Virus Surveillance and Preparedness in California**
  Mariposa County Extension Continuing Education Workshop, Hornitos: *Mark Novak*
- **Laws and Regulations Affecting Vector-borne Disease Control in California**
  Mariposa County Extension Continuing Education Workshop, Hornitos: *Mark Novak*

DECEMBER

- **The Application of Liquid Deltamethrin on Sciurid Rodents to Control Fleas**
  MVCAC Coastal Region Continuing Education Workshop, San Ramon: *Jim Tucker*
- **Vector Control Challenges Presented by Stormwater Treatment Devices**
  Alameda County West Nile Virus Seminar for Environmental Managers, Oakland: *Marco Metzger*
- **West Nile Virus Surveillance and Preparedness in California**
  University of California at Davis (EPP 290), Davis: *Vicki Kramer*
- **West Nile Virus Surveillance and Preparedness in California**
  PAPA Continuing Education Workshop, Sacramento: *Mark Novak*

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