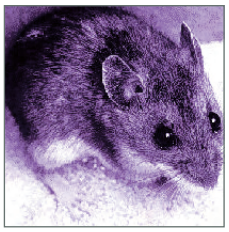
2010 Annual Report




Vector-Borne Disease Section
California Department of Public Health

California Department of PublicHealth

2010

ANNUAL REPORT

VECTOR-BORNE DISEASE SECTION

INFECTIOUS DISEASES BRANCH

DIVISION OF COMMUNICABLE DISEASE CONTROL

CENTER FOR INFECTIOUS DISEASES

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

Edmund G. Brown Jr.
Governor
State of California

Diana S. Dooley, Secretary
Health and Human Services Agency

Ron Chapman, MD, MPH, Director
Department of Public Health

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Chapters

Preface

I am pleased to present to you the 2010 Annual Report for the Vector-Borne Disease Section (VBDS) of the California Department of Public Health (CDPH). VBDS staff conducted surveillance, prevention, and control of existing and emerging vector-borne diseases throughout California in 2010.

Tick-borne diseases documented in California in 2010 included Lyme disease (73 cases), Rocky Mountain spotted fever (6), tick-borne relapsing fever (5), and tularemia (7). Many of these cases prompted follow-up surveillance to evaluate risk and implement measures to reduce exposure to ticks and tick-borne pathogens. In a collaborative project with the U.S. Centers for Disease Control and Prevention, Colorado tick fever virus was detected in *Dermacentor* ticks in two northern California counties; this was the first detection in decades. With this finding, CDPH worked with those local health departments to send the message to their physicians to consider testing patients for Colorado tick fever if indicated.

Plague activity was detected in several regions in California, including at Plumas-Eureka State Park (Plumas County) where elevated risk of transmission prompted closure of campgrounds in August. VBDS initiated flea suppression and the campgrounds were reopened for the Labor Day weekend. Hantavirus was also detected in several California counties; four hantavirus cardiopulmonary syndrome cases were identified, including one fatality from Mono County in an employee of Bodie State Park. In Death Valley National Park, 33% of the cactus mice, *Peromyscus eremicus*, tested for SNV (SNV) were seropositive; an infection rate previously observed only in deer mice, *P. maniculatus*, in California.

West Nile virus (WNV) activity was detected in 36 counties in 2010. The number of human cases (111) was similar to the number identified in 2009; 6 cases were fatal. Throughout the year, VBDS staff worked diligently with the Mosquito and Vector Control Association of California to evaluate implementation of the National Pollution Discharge Elimination System (NPDES) permit for mosquito control activities. Also in 2010, VBDS upgraded our mosquito reference collection and initiated mosquito identification training for local agencies.

After 12 years of collaboration, the interagency agreement between CDPH and the California Department of Transportation ended in 2010. Work under this agreement focused on minimizing mosquito production in stormwater treatment devices while maintaining water management and water quality goals.

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.

Vicki L. Kramer, Ph.D., Chief
Vector-Borne Disease Section

Acknowledgements

VBDS works with numerous local, state, and federal agencies, private and commercial organizations, and members of the medical community in its efforts to monitor, prevent, and control vector-borne diseases in California. Some of VBDS's key collaborators in 2010 are listed here.

Rodent-borne Disease

U.S. Department of Agriculture (USDA); Forest Service (USFS); U.S. Department of Interior National Park Service (NPS); Special Pathogens Branch, U.S. Centers for Disease Control and Prevention (CDC); Washington State Department of Health; Humboldt County Department of Health and Human Services (HHS); Inyo County Environmental Health Services (EHS) Nevada County Public Health Department (PHD); Mono County HHS; Nevada County Environmental Health Department (EHD); Alameda County Vector Control Services District (VCSD); Coachella Valley Mosquito and Vector Control District (MVCD); Orange County Vector Control District (VCD); Riverside County Vector Control Program (VCP); San Bernardino County VCP; San Diego County VCP; Santa Clara County VCD; Santa Cruz County MVCD; West Valley MVCD; Viral and Rickettsial Diseases Laboratory Branch (VRDL), California Department of Public Health (CDPH)

Flea-borne Disease

USDA Animal and Plant Health Inspection Service, Wildlife Services; NPS; El Dorado County Environmental Management Department; Fresno County Department of Agriculture; Inyo County EHS; Kern County Department of Public Health (DPH) and EHS; Los Angeles County Agricultural Commissioner/Weights and Measures; County of Los Angeles Public Health (PH), EH, Vector Management; Mono County HHS; Nevada County PHD and EHD; Placer County HHS; Riverside County VCP; Sacramento County HHS; San Bernardino County VCP; Santa Clara County VCD; Tulare County HHS; West Valley MVCD; School of Veterinary Medicine, University of California, Davis (UCD); Microbial Diseases Laboratory Branch, CDPH

Tick-borne Disease

United States Army Center for Health Promotion and Preventative Medicine-West; NPS; Rickettsial Zoonoses Branch, Division of Global Migration and Quarantine, and Division of Vector-Borne Infectious Diseases, CDC; Rocky Mountain Laboratories, National Institutes of Health; Arizona Department of Health Services; Coconino County (Arizona) Health Department; Washington State Department of Health; Alameda County VCSD; Calaveras County EHD; Coachella Valley MVCD; Contra Costa County MVCD; Imperial County PHD; Lake County VCD; Marin County HHS; Marin-Sonoma County MVCD; Napa County MAD; Riverside County VCP; San Benito County HHS; San Joaquin County MVCD; San Luis Obispo PHD; San Mateo MVCD; Santa Cruz County MVCD; Sacramento-Yolo County MVCD; Shasta County MVCD; VRDL and California Office of Binational Border Health, CDPH

Mosquito-borne Disease

California Animal Health and Food Safety Laboratory; California Department of Food and Agriculture (CDFA); Mosquito and Vector Control Association of California; participating local health departments, physicians and veterinarians, and local mosquito and vector control agencies; Center for Vectorborne Diseases, UCD; Center for Advanced Research of Spatial Information, Hunter College of The City University of New York; VRDL and Veterinary Public Health Section, CDPH; West Nile Virus Dead Bird hotline, CDPH

Other Vectors and Public Health Pests

CDFA; Coachella Valley MVCD; Los Angeles County Agricultural Commissioner/Weights & Measures; Los Angeles County DPH; Orange County VCD; San Gabriel Valley MVCD; San Francisco Department of Public Health; San Francisco Housing and Homeless Programs; Alameda VCD; San Francisco; CDC

Reports and Public Information Materials

Greater Los Angeles County VCD; Sacramento-Yolo MVCD; Office of Public Affairs, CDPH

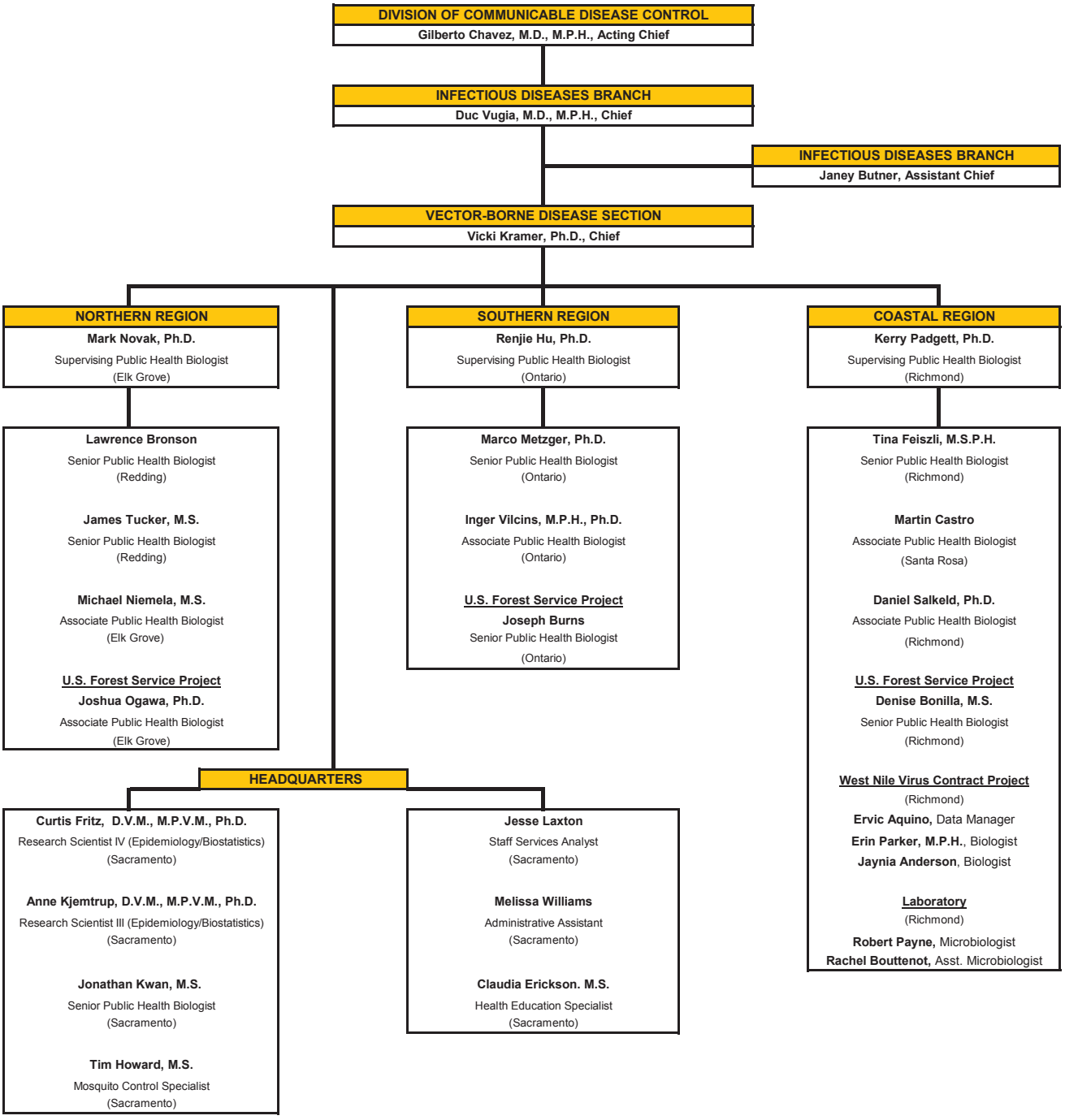
Annual Report Technical Assistance

Claudia Erickson, M.S., C.H.E.S.

Vector-Borne Disease Section

The mission of the California Department of Public Health (CDPH) Vector-Borne Disease Section (VBDS) is to protect the health and well-being of Californians from arthropod- and vertebrate-transmitted diseases and injurious pests. (Authorizing statutes: Health and Safety Code Sections 116108-116120, 116102, et. seq., and 116180; Government Code Section 12582) VBDS provides leadership, information, and consultation on vector-borne diseases to the general public and agencies engaged in the prevention and control of vector-borne diseases. VBDS staff, located in five 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 in disease outbreaks where applicable under the Endangered Species Act
- Advise local agencies on public health issues related to vector-borne diseases
- Advise local agencies on regulatory issues pertaining to mosquito control
- 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 bed bugs, Africanized honey bees, and red imported fire ants
- Advise local 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



Other VBDS staff during part of 2010:

Justin Harbison, Ph.D., Associate Public Health Biologist
Laura Zamora, Microbiologist
Josh Cano, Database Assistant
Linda Parsons, Administrative Analyst

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Rodent-borne Disease

Hantavirus cardiopulmonary syndrome is the most important rodent-borne disease in California. Since the disease was first identified in 1993, the Vector-Borne Disease Section has collaborated with county, state, and federal public health agencies to identify and investigate human cases of disease, to survey and study Sin Nombre virus infection in wild rodents, and to prepare and promote preventive information for the general public.

Human disease surveillance

Cases of hantavirus cardiopulmonary syndrome (HCPS) were diagnosed in four California residents in 2010.

Mono County, June 2010

A 42-year-old woman presented to a local hospital with fever, chills, myalgia, and recent shortness of breath. The patient was hypotensive, could maintain oxygen saturation at only 80 percent on room air, and had increased densities on chest X-ray. She recovered following 10 days at a tertiary care hospital. Elevated serum antibodies to Sin Nombre virus (SNV) were detected at both the Nevada State Public Health Laboratory (NSPHL) and the CDPH Viral and Rickettsial Diseases Laboratory (VRDL). Staff of VBDS and Mono County Environmental Health (EH) evaluated the patient's residence, the most likely place of exposure. No evidence of rodent ingress was observed in the house, though signs of rodent activity (gnawing, fecal material) were observed in one of the outdoor storage sheds. Three deer mice collected over two nights were negative for IgG antibody to SNV. It was concluded that the patient's exposure most likely occurred while entering and working in one of the storage areas. VBDS recommended sealing points of possible rodent ingress to reduce hantavirus transmission risk.

Inyo County, July 2010

A 41-year-old man presented to a local hospital with two day history of fever, headache, myalgia, and mild shortness of breath. Atypical pneumonia was diagnosed and he was released. He presented the next day in acute respiratory distress, with vomiting and worsening headache. Oxygen saturation was 78 percent on room air and thoracic radiographs showed diffuse bilateral interstitial infiltrates. He was airlifted to a tertiary care facility and maintained on a ventilator. He was discharged 11 days later. Serum collected at admission revealed elevated IgM and IgG antibodies to SNV at the NSPHL. Staff of Inyo County Health & Human Services and Inyo County Environmental Health interviewed the patient's wife and evaluated his residence and the salvage yard where he worked. No evidence of rodent activity was observed around his residence; one dead rodent and a rodent nest were observed at the salvage yard. Moderate evidence of rodent activity was noted in several yard locations, including cargo containers, enclosed structures, and salvaged vehicles, with adjacent vegetated habitat possibly providing the source of rodents. Training in the prevention of hantavirus was provided to all employees.

Mono County, August 2010

A 61-year-old man presented to a local hospital with four days of myalgia and two days of diarrhea with vomiting and a cough developing within the last 24 hours. Oxygen saturation was 90 percent on room air. Thoracic radiographs were described as "near white-out." He was airlifted to a tertiary care hospital where he remained hypoxic despite intubation and oxygen, and deteriorated into ventricular tachycardia. He died shortly after admission. IgM and IgG antibodies to SNV were detected in ante- and post-mortem sera at NSPHL

and VRDL. The case-patient lived in his personal motor home at Bodie State Park. Mono County Environmental Health and VBDS inspected the motor home and potential exposure sites in park facilities. Rodent droppings were observed throughout the patient's motor home including under the bed, in food pantry drawers, on the sofa, in the floor vents, in the carpet, and in clothing drawers. A mouse nest and numerous mouse droppings were noted directly beneath the bed. Minimal evidence of rodents was observed at the park facilities. A total of 16 rodents were collected over one night's trapping. Serum antibodies to SNV were detected in four deer mice. SNV was detected by polymerase chain reaction (PCR) in all four seroreactive rodents. PCR products from rodents collected in one park office and east of the motor home most closely matched the genetic sequence of a SNV isolate from the patient's tissues. Recommendations for rodent control and clean-up were provided to park officials.

San Mateo County, September 2010

A 54-year-old woman was admitted to a local hospital with ten days of abdominal pain, fever, nausea, and shortness of breath. Oxygen saturation on room air was 86 percent and diffuse bilateral effusions were noted on thoracic radiographs. She recovered after three days in the hospital. VRDL detected IgM and IgG antibodies to SNV in serum collected at admission. The patient visited Yosemite National Park approximately two weeks prior to onset. She noted mouse feces on the table in her tent cabin and observed 1-2 live mice run across the floor. She had swept her cabin with a broom provided. Staff of VBDS and the National Park Service evaluated the tent cabins and noted gaps between the tent and floor foundation, doorway threshold, and chimney exit hole; wood, stones, and other debris piled outside buildings that could serve as rodent harborage; and inadequate materials and protocols for disinfection of potentially contaminated areas. VBDS staff reviewed these findings with NPS personnel and offered recommendations for hantavirus risk reduction.

Of the 56 HCPS cases identified in California residents since 1980, 19 (34%) had a fatal outcome. Early recognition of the disease, hospitalization, and initiation of cardiopulmonary support increases the likelihood of a favorable recovery.

Rodent surveillance

In 2010, 1,177 rodents of the genera *Microtus, Neotoma, Peromyscus,* and *Reithrodontomys* were collected and tested for serum antibodies to SNV (Table 1). At least one seroreactive *Peromyscus* sp. was detected in eight of 16 California counties in which *Peromyscus* spp. were sampled in 2010 (Table 2). Of 1,085 Peromyscus spp. tested, 43 (3.9 %) had serologic evidence of infection with SNV. Seroprevalence was highest in *Peromyscus maniculatus* at 6.0 percent (Table 2). R. *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 variations have not been shown to be pathogenic to humans.

Table 1. Serologic evidence of hantavirus (Sin Nombre) infection in California rodents, 2001 - 2010

		2010			2001-2010	
Species	Common name	No. collected	No. reactive	Percent	No. collected	No. reactive
Neotoma spp.	woodrats	11	0	0	1,136	35
Peromyscus boylii	brush mouse	104	1	1.0	2,526	93
Peromyscus californicus	parasitic mouse	122	0	0	1,579	23
Peromyscus crinitus	canyon mouse	13	0	0	295	10
Peromyscus eremicus	cactus mouse	350	16	4.6	2,723	102
Peromyscus maniculatus	deer mouse	467	28	6.0	7,621	1,058
Peromyscus truei	piñon mouse	25	0	0	350	10
Peromyscus sp.	unspecified *Peromyscus*	4	0	0.0	61	3
Reithrodontomys megalotis	western harvest mouse	67	10	14.9	652	56
Microtus spp.	voles	14	2	14	255	19

Table 2. Serologic evidence of hantavirus (Sin Nombre) infection in *Peromyscus maniculatus* in California 2001 - 2010

	2010			2001-2010		
County	No. collected	No. reactive	Percent	No. collected	No. reactive	Percent
Alameda	35	0	0	198	1	0.5
Alpine				76	26	34.2
Amador						
Butte				13	5	38.5
Calaveras				5	1	20.0
Colusa						
Contra Costa				20	2	10.0
Del Norte						
El Dorado	64	9	14.1	825	230	27.9
Fresno				114	17	14.9
Glenn						
Humboldt						
Imperial						
Inyo	2	1	50.0	30	6	20.0
Kern						
Kings						
Lake						
Lassen	50	2	4.0	843	129	15.3
Los Angeles				72	7	9.7
Madera				42	10	23.8
Marin				18	1	5.6
Mariposa				5	1	20.0
Mendocino						
Merced						
Modoc				19	0	0
Mono	16	4	25.0	684	198	28.9
Monterey				39	7	17.9
Napa				43	8	18.6
Nevada				23	7	30.4
Orange				1,661	70	4.2
Placer						
Plumas	18	5	27.8	95	24	25.3
Riverside	51	0	0	1,384	184	13.3
Sacramento						
San Benito				5	0	0
San Bernardino	63	5	7.9	438	41	9.4
San Diego	130	0	0	540	24	4.4
San Francisco				13	0	0
San Joaquin						
San Luis Obispo				42	6	14.3
San Mateo				87	9	10.3
Santa Barbara				79	13	16.5
Santa Clara	8	0	0	21	0	0
Santa Cruz	8	0	0	8	0	0
Shasta	6	2	33.3	16	3	18.8
Sierra				58	9	15.5
Siskiyou	12	0	0	53	8	15.1
Solano						
Sonoma						
Stanislaus						
Sutter				7	0	0
Tehama						
Trinity						
Tulare	4	0	0	4	0	0.0
Tuolumne				48	8	16.7
Ventura				6	2	33.3
Yolo				1	0	0
Yuba						
Douglas, NV				5	1	20.0
California	**467**	**28**	**6.0**	**7,640**	**1,058**	**13.8**

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Flea-borne Disease

Plague is the principal flea-borne disease under surveillance in California. The California Department of Public Health collaborates with local, state, and federal agencies to conduct a statewide plague surveillance program. The Vector-Borne Disease Section collects, collates, and analyzes information on suspect and confirmed plague activity among humans, domestic pets, and wild animals throughout California to evaluate the potential risk of plague transmission to the public and, where necessary, implement preventive and control actions. Typhus fever is another flea-borne disease of public health concern in California.

Human disease

No cases of plague in humans were reported in 2010.

Typhus is a bacterial illness transmitted by fleas from wild rats or opossums. Most typhus cases occur in residents of a few small areas in the Los Angeles basin. Persons living in areas endemic for typhus should avoid contact with opossums and maintain proper flea control on their outdoor pets.

Forty-one cases of typhus fever were reported to CDPH in 2010; two of these met criteria for a confirmed case, 38 were probable, and 1 was suspect. The case-patients were residents of Los Angeles (29), Orange (11), and San Bernardino (1) Counties.

Domestic pets

No cases of plague in domestic pets occurred in 2010. In July, a domestic cat from Frazier Park, Kern County, presented to a local veterinary clinic with clinical signs suggestive of plague but *Y. pestis* was not detected in pharyngeal swab specimen by fluorescent antibody or culture.

Wild animals

CDPH-VBDS plague surveillance results in 2010 included the testing of 561 wild rodents and 348 carnivores from 33 California counties (Figure 1, Table 3).

Wild rodents tested for plague antibodies included: 237 California ground squirrels from nine counties, 22 golden-mantled ground squirrels from three counties, 114 chipmunks from 10 counties, 15 Douglas' squirrels from three counties, 24 woodrats from 7 counties, and 147 mice (several genera) from seven counties. A yellow-bellied marmot, a northern flying squirrel were also tested for *Y. pestis* antibodies. One California ground squirrel and two shadow chipmunks tested positive for *Y. pestis* antibodies; *Y. pestis* infection was detected in one California ground squirrel carcass (Table 3).

Carnivores tested for antibody to *Y. pestis* included: 221 coyotes from 24 counties, 60 black bears from seven counties, eight bobcats from four counties, 18 mountain lions from 11 counties, four red foxes from one county, seven gray foxes from five counties, 25 raccoons and five striped skunks

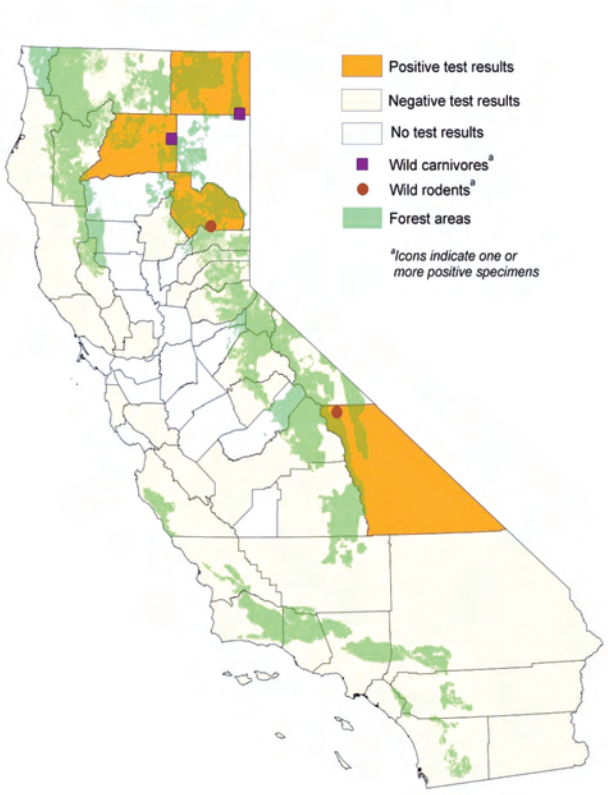

Figure 1. Mammals tested for evidence of *Yersinia pestis*, California, 2010

from three counties. Antibodies to *Y. pestis* were detected in a single coyote from Modoc County and a coyote and bobcat from Shasta County, (Table 3). Additionally, 28 feral pigs from 6 counties also tested negative.

Inyo County

Significant flea loads (averaging 12 fleas per rodent) and a single elevated antibody titer were observed among ten California ground squirrels in July from Millpond Campground (Table 3). Inyo County health officials posted plague warning signs, notified the campground concessionaire, and conducted flea suppression. The campground was closely monitored for signs of plague activity (dead and/or dying rodents, burrow abandonment) through the remainder of the 2010 recreational season.

Plumas County

In August, the CDPH Microbial Diseases Laboratory detected *Y. pestis* in a California ground squirrel carcass collected in late July from Plumas-Eureka State Park (Table 3). VBDS initiated additional surveillance of rodents at the park. Sera were collected and tested from 61 rodents: 41 shadow chipmunks, 11 deer mice, five Douglas' squirrels, three California ground squirrels, and one bushy-tailed woodrat. Antibodies to *Y. pestis* were detected in one shadow chipmunk (Table 3). The presence of plague bacteria (positive carcass), coupled with the serological evidence, signs of burrow abandonment, a high density of plague-susceptible rodents, a flea index that exceeded nine fleas per ground squirrel, and a history of plague activity at this location, indicated increased risk of transmission to park visitors. On August 18, state park officials voluntarily closed the campgrounds, until flea suppression measures were completed. One flea pool from California ground squirrel fleas out of 11 flea-pools collected after park closure tested positive for *Y. pestis*.

These results do not include data from plague surveillance programs of local agencies that conduct their own testing.

Table 3. Mammals tested for plague in California, 2010. (All specimens are sera unless otherwise indicated.)

County / Location	No. rodents tested	No. carnivores tested	Positive specimens		
			Species	**Result**	**Month**
Alpine	2				
Butte		2			
El Dorado	2				
Fresno		9			
Humboldt		6			
Imperial		1			
Inyo	65				
Millpond County Park, Campground			CA G Sq	1:128	July
Kern		60			
Lake		1			
Los Angeles		33			
Mariposa		29			
Mendocino		22			
Modoc		49			
Modoc National Forest, Patterson Campground			Coyote	1:512	July
Mono	43				
Monterey		3			
Nevada	1				
Placer		10			
Plumas	93	17			
Plumas Eureka State Park			CA G Sq	POS	July
Plumas Eureka State Park			Chipmunk, S	1:256	August
Plumas Eureka State Park			Chipmunk, S	1:1024	August
Plumas Eureka State Park			CA G Sq (fleapool)	POS	August
Riverside	78	1			
San Benito		17			
San Bernardino	23				
San Diego	76	4			
San Luis Obispo		5			
San Mateo	67				
Santa Barbara		5			
Santa Clara	1				
Shasta	13	21			
McArthur, 10 miles South			Coyote	1:512	September
McArthur, 10 miles South			Bobcat	1:32	September
Sierra		5			
Siskiyou	34	31			
Sonoma		4			
Trinity		11			
Tulare	45				
Ventura	18	2			
Total	561	348			

Abbreviations

Species CA G Sq: California ground squirrel (*Otospermophilus beecheyi*)
Chipmunk, S: Shadow chipmunk (*Tamias senex*)

Location CG: Campground
Result POS: Positive for *Y. pestis* bacteria

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Tick-borne Disease

At least eight tick-borne diseases exist in California. The goal of the Vector-Borne Disease Section is to reduce human morbidity from tick-borne diseases in California through ongoing surveillance of the disease-causing agents and vectors, investigation of human cases as necessary, management of tick populations when appropriate and possible, and timely dissemination of findings and prevention messages to public health and vector control agencies, medical personnel, and the public.

Human disease surveillance

Lyme disease

A total of 73 cases of Lyme disease were reported to the California Department of Public Health (CDPH) in 2010; 64 of these met the surveillance case definition criteria for a confirmed case, and nine were probable. Of the 64 confirmed cases, case-patients were residents of 21 counties (Table 4). The most cases (7) were reported from Santa Cruz County. Of 22 cases for which county of likely exposure was reported, 16 (73%) were exposed outside California. The most frequently reported locations of likely exposure were the states of Massachusetts and New York. For the past ten years, the northwestern counties of California had the highest incidence of Lyme disease (Figure 2).

The median age of confirmed Lyme disease cases was 33 years (range, 5 to 74 years) and 37 (58%) were male. Of 48 cases for which race was reported, 42 were white, four were Asian-Pacific Islander, and one each was black and American Indian. Erythema migrans (EM) was identified in 31 (50%) cases, 24 (77%) of whom had onset of EM between May and September.

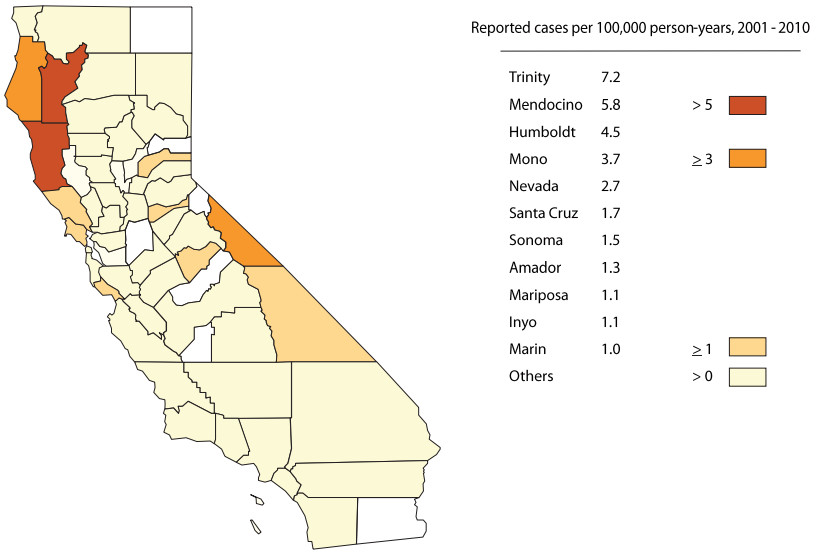

Figure 2. Population-adjusted incidence of Lyme disease, California, 2001 - 2010

Table 4: Reported confirmed Lyme disease cases by county of residence, California, 2001 - 2010

County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Incidence per 100,000 person-years
Alameda	3	5	1	0	5	3	2	6	1	1	0.18
Alpine	0	0	0	0	0	0	0	0	0	0	0
Amador	1	0	0	0	0	1	2	0	0	1	1.33
Butte	1	3	2	2	0	1	0	2	1	0	0.56
Calaveras	0	0	0	0	0	0	0	0	0	0	0
Colusa	0	0	0	0	0	0	0	0	0	0	0
Contra Costa	5	3	4	0	4	1	0	1	0	0	0.18
Del Norte	0	2	0	0	0	0	0	0	0	0	0.69
El Dorado	0	0	0	3	3	3	2	2	2	1	0.92
Fresno	0	0	0	0	0	1	0	2	0	1	0.05
Glenn	0	0	0	0	0	0	0	0	0	0	0
Humboldt	4	4	5	7	11	5	7	6	4	6	4.51
Imperial	0	0	0	0	0	0	0	0	0	0	0
Inyo	1	0	0	0	0	1	0	0	0	0	1.08
Kern	0	2	1	0	2	1	2	5	1	2	0.21
Kings	0	0	0	0	0	0	0	0	1	0	0
Lake	1	0	1	1	1	0	1	0	0	0	0.79
Lassen	0	2	0	0	0	0	0	0	0	0	0.57
Los Angeles	9	6	7	2	8	11	9	8	3	5	0.07
Madera	0	0	0	0	0	0	0	0	0	0	0
Marin	1	4	4	0	3	7	2	2	1	2	1.03
Mariposa	0	1	0	1	0	0	0	0	0	0	1.12
Mendocino	4	11	6	2	1	0	5	11	6	6	5.80
Merced	0	0	0	0	0	0	0	0	0	0	0
Modoc	0	0	0	0	0	0	0	0	0	0	0
Mono	0	0	3	1	0	0	0	0	0	1	3.66
Monterey	0	5	1	1	0	0	0	0	0	1	0.19
Napa	3	3	0	1	1	0	3	0	1	0	0.90
Nevada	6	3	4	1	3	2	3	2	1	3	2.84
Orange	0	3	2	0	1	2	1	1	0	5	0.05
Placer	4	3	0	2	2	3	0	1	2	0	0.55
Plumas	1	0	0	0	0	0	0	0	0	0	0.47
Riverside	2	1	2	1	4	0	0	1	4	0	0.08
Sacramento	4	1	4	2	6	3	2	0	1	0	0.17
San Benito	1	1	0	0	0	0	0	0	0	0	0.35
San Bernardino	0	0	2	0	0	0	0	1	0	0	0.02
San Diego	3	7	2	4	8	9	5	3	8	6	0.18
San Francisco	3	3	3	1	7	5	5	4	1	1	0.41
San Joaquin	0	0	0	0	0	0	0	0	0	0	0
San Luis Obispo	0	0	0	0	1	0	0	1	0	0	0.08
San Mateo	4	4	5	1	4	2	0	2	1	3	0.36
Santa Barbara	1	2	2	2	0	0	2	2	0	1	0.29
Santa Clara	2	6	4	0	2	9	2	0	2	5	0.18
Santa Cruz	9	1	8	3	0	6	5	2	4	7	1.73
Shasta	2	1	0	2	2	0	0	0	0	1	0.45
Sierra	0	0	0	0	0	0	0	0	0	0	0
Siskiyou	1	1	0	0	0	0	0	0	0	0	0.44
Solano	1	0	0	0	0	0	0	0	0	0	0.02
Sonoma	6	4	9	2	9	8	8	10	9	5	1.47
Stanislaus	1	0	0	0	1	0	0	1	1	0	0.08
Sutter	1	0	0	0	0	0	0	0	0	0	0.11
Tehama	0	0	0	0	0	0	0	0	0	0	0
Trinity	1	1	1	3	3	0	1	0	0	0	7.22
Tulare	2	0	2	0	0	0	1	0	0	0	0.12
Tuolumne	2	1	0	0	1	1	0	0	0	0	0.88
Ventura	2	1	1	2	1	0	5	2	0	0	0.17
Yolo	0	2	0	1	0	1	1	0	0	0	0.27
Yuba	0	0	0	0	0	0	0	0	0	0	0
California	92	97	86	48	94	86	76	78	55	64	0.21

Rocky Mountain spotted fever

Six cases of Rocky Mountain spotted fever were reported to CDPH in 2010. One of these met the surveillance case definition criteria for a confirmed case and five were probable. The one confirmed case was 52-year-old woman from Orange County.

Tick-borne relapsing fever

Five cases of tick-borne relapsing fever (TBRF) were reported to CDPH in 2010. Case ages ranged from 10 to 58 years and three were female. Case patients were residents of four counties: Alameda (2), Mono, Nevada, and Placer. Four patients were residents of or visitors to the Lake Tahoe area in the three weeks prior to onset. The fifth patient reported no travel outside Mono County prior to onset. In addition, CDPH was alerted to a case of TBRF diagnosed in a resident of Washington State who was likely infected while vacationing in El Dorado County.

Tularemia

Seven cases of tularemia were reported to the CDPH in 2010; five of these met criteria for a confirmed case. Transmission via tick bite was suspected for two cases. A 48-year-old male resident of Napa County reported tick bites on his arm and abdomen approximately two weeks prior to onset of conjunctivitis. An eight-year-old male resident of Sacramento County reported hiking in an area where *Dermacentor variabilis* and *D. occidentalis* ticks have been identified but he recalled no tick bite prior to onset of illness.

Tick surveillance

Ixodes pacificus and Borrelia spirochetes

Local, state and federal agencies collaborated in 2010 to collect 3,756 western black-legged ticks (*Ixodes pacificus*) in 20 counties. Of these, 1, 059 *I. pacificus* from 18 counties were tested by direct fluorescent antibody assay (DFA), or immunofluorescent antibody (IFA) test for *Borrelia* spirochetes (Table 5).

DFA is a screening test used to detect the genus *Borrelia* in ticks. Further specific identification on 2000 tick samples will be determined by polymerase chain reaction by CDPH-VBDS.

Of 721 adult *I. pacificus* tested, eight ticks (1%) from five counties were positive in a DFA assay with generic *Borrelia* antibodies. Two of 40 ticks (5%) tested from Napa County were positive for *B. burgdorferi* with the genus-specific IFA test.

Ixodes pacificus nymphs (n=338) were collected from seven counties. Twenty-two (6.5%) *I. pacificus* nymphs from El Dorado, Marin, and Santa Cruz counties were positive by DFA with generic *Borrelia* antibodies.

Colorado Tick Fever Virus

To investigate current status of Colorado tick fever (CTF) virus in California, VBDS collected 34 *D. andersoni* ticks in Nevada and Siskiyou Counties and 229 *D. occidentalis* ticks from nine northern California counties (Alameda, Contra Costa, El Dorado, Lassen, Modoc, Nevada, Plumas, Siskiyou, and Yuba). CTF has historically been documented

in Lassen, Plumas, Sierra, Nevada and Mono Counties; additional counties were included in the surveillance exercise for comparison. Ticks were tested by polymerase chain reaction (PCR) by the Division of Vector-Borne Diseases, Centers for Disease Control and Prevention (DVBD-CDC). Two of 32 *D. andersoni* (6%) from Nevada County and 8 of 54 *D. occidentalis* (14.8%) in Siskiyou County were positive for CTF virus.

Tick-borne relapsing fever

In 2010, VBDS staff conducted surveillance for tick-borne relapsing fever (TBRF) in rodents in Sequoia-Kings Canyon National Park at a campground where TBRF had been reported historically. Blood samples from 23 Lodge-pole chipmunks (*Tamias speciosus*) were tested by PCR at University of Nevada, Department of Animal Biotechnology for relapsing fever group *Borrelia*. *Borrelia hermsii* DNA was detected in 5 (21.7%) chipmunks.

Tularemia

In 2010, VBDS, in collaboration with Sacramento-Yolo Mosquito Vector Control District (SYMVCD) and Napa County Mosquito Abatement District (NCMAD), conducted surveillance for *Francisella tularensis* in ticks collected from Sacramento and Yolo Counties (SYMVCD) and Napa County (NCMAD) as follow-up to previous human cases with tick exposure history. Ticks were tested by PCR at the DVBD-CDC.

202 *Dermacentor occidentalis* and 265 *D. variabilis ticks* were collected in Sacramento and Yolo Counties. One of 24 pools of *D. occidentalis* (minimum infection prevalence = # of positive pools / # of ticks collected multiplied by 100 = 0.5%) and 5 of 35 pools of *D. variabilis* (minimum infection prevalence = 1.9%) were positive by PCR for *F. tularensis*, type B. Ninety-six *D. variabilis* and 23 brown dog ticks (*Rhipicephalus sanguineus*) were collected from Napa County. Three of 18 pools *of D. variabilis* (minimum infection prevalence = 3.1%) were positive for *F. tularensis*, type B; none of the *R. sanguineus* ticks were positive.

Table 5. *Ixodes pacificus* ticks tested for evidence of *Borrelia* spirochetes, California, 2010[a]

County Location	No. Ticks Tested Adults	No. Ticks Tested Nymphs	No. Ticks Positive Adults (% pos)	No. Ticks Positive Nymphs (% pos)	Laboratory
Alameda					
Livermore	1		0		CDPH, VBDS
Calaveras					
Natural Bridge	18		0		CDPH, VBDS
Vallecito	1		0		CDPH, VBDS
Contra Costa					
Tilden Regional Park	50		0		CDPH, VBDS
El Dorado					
Cronan Ranch Regional Trails	14		1 (7.1)		CDPH, VBDS
Dave Moore Nature Area	2		0		CDPH, VBDS
Folsom SRA	60	27	1 (1.6)	1 (3.7)	CDPH, VBDS
Marshall Gold Discovery Park	14	18	0	1 (5.5)	CDPH, VBDS
Lake					
Cache Creek Natural Area	6		0		CDPH, VBDS
Lakeport	21		0		CDPH, VBDS
Lower Lake	6		0		CDPH, VBDS
Snow Mountain	8		2 (25)		CDPH, VBDS
Los Angeles					
San Dimas Canyon County	12		0		CDPH, VBDS
Marin					
China Camp SP	15	139	0	13 (9.4)	CDPH, VBDS
Mariposa					
El School	1		0		CDPH, VBDS
Mariposa	62	1	2 (3.2)	0	CDPH, VBDS
Midpines	12		0		CDPH, VBDS
Yosemite National Park	21	2	0	0	CDPH, VBDS
Napa					
Archer Taylor Preserve	40		2 (5)[b]		Napa MAD
Wild lake Ranch Preserve	50		0		Napa MAD
Nevada					
Empire Mines STP	7		0		CDPH, VBDS
Malakoff Diggins STP	6		0		CDPH, VBDS
South Yuba River SP	6		0		CDPH, VBDS
Yuba River SP	7		1 (14.3)		CDPH, VBDS
Placer					
Hidden Falls Regional Park		1		0	CDPH, VBDS
Santa Cruz					
Forest of Nisene Marks SP	56		0		CDPH, VBDS
Henry Cowell SP	67		0		CDPH, VBDS
Wilder Ranch	74	148	0	7 (4.7)	CDPH, VBDS
Sierra					
Tahoe National Forest	5		1 (20)		CDPH, VBDS
Solano					
Vacaville	5		0		CDPH, VBDS
Sonoma					
Jack London SP	6		0		CDPH, VBDS
Stanislaus					
Del Puerto Canyon County	6		0		CDPH, VBDS
Tuolumne					
Columbia SP	1	1	0	0	CDPH, VBDS
Yosemite National Park	10		0		CDPH, VBDS
Yuba					
Collins Lake	1		0		CDPH, VBDS
Harmon Grove County Park	16		0		CDPH, VBDS
Tahoe National Forest	34	1	0	0	CDPH, VBDS
Total	**721**	**338**	**10 (1.4)**	**22 (6.5)**	

[a] All tested by direct flourescent antibody test (DFA) to genus only unless otherwise noted.

[b] Tested by indirect flourescent antibody test (IFA)specific for *Borrelia burgdorferi*, agent of Lyme disease

Abbreviations:

Location: SP, State Park
STP, State Historic Park
Laboratory: CDPH, VBDS, California Department of Public Health, Vector-Borne Disease Section
Napa MAD, Napa Mosquito Abatement District

4 Mosquito-borne Disease

Mosquito-borne diseases under surveillance in California include the endemic arboviral diseases caused by West Nile virus, western equine encephalomyelitis virus, and St. Louis encephalitis virus, as well as the travel-associated diseases caused by *Plasmodium* spp. (malaria) and dengue virus. Endemic arbovirus surveillance is performed under the California Arbovirus Surveillance program, a cooperative effort of multiple state and local entities.

Human disease surveillance

West Nile virus

Serological diagnosis of human infection with WNV and other arboviruses was performed at VRDL and 26 local county public health laboratories. Local laboratories tested for WNV using an IgM or IgG immunofluorescent assay (IFA) and/or an IgM enzyme immunoassay (EIA). Specimens with inconclusive results were forwarded to the VRDL for confirmation or further testing with a plaque reduction neutralization test (PRNT). Additional WNV infections were identified through testing performed at blood donation centers.

A total of 111 symptomatic and 17 asymptomatic infections with WNV were identified in 2010 (Table 6). Of the 111 clinical cases, 38 (34%) were classified as West Nile fever and 73 (66%) were West Nile neuroinvasive disease (i.e. encephalitis, meningitis, or acute flaccid paralysis). Cases were residents of 18 counties and 63 (57%) were male. Incidence was highest (6.5 cases per 100,000 persons) in Glenn County (Figure 3). The median ages for West Nile fever and neuroinvasive cases were 55 years (range, 23 to 89 years) and 57 years (range, 10 to 89 years), respectively. The median age of the six WNV-associated fatalities was 66 years (range, 49 to 75 years).

No cases of western equine encephalomyelitis (WEEV) or St. Louis encephalitis (SLEV) were identified in California residents in 2010.

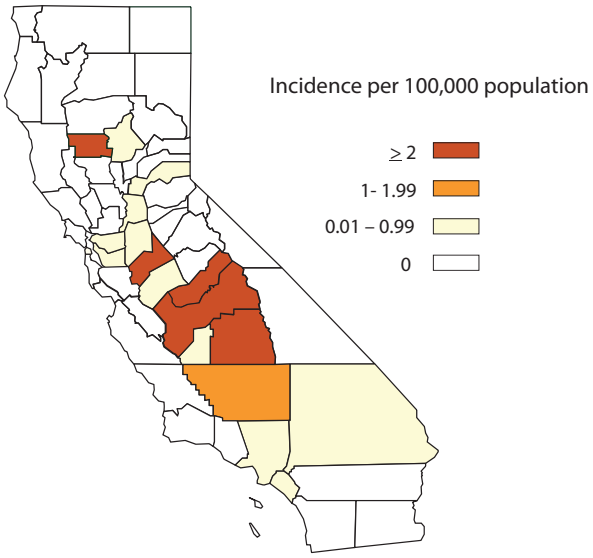

Figure 3. Human infection with West Nile virus, California 2010

Table 6. Reported WNV human cases by county of residence, California, 2006-2010

County	2006	2007	2008	2009	2010	Incidence per 100,000 person-years
Alameda	1	0	1	0	1	0.04
Alpine	0	0	0	0	0	0.00
Amador	0	0	0	0	0	0.00
Butte	31	16	6	2	1	4.87
Calaveras	0	0	1	0	0	0.42
Colusa	4	2	1	0	0	5.89
Contra Costa	8	3	4	5	4	0.45
Del Norte	0	0	0	0	0	0.00
El Dorado	2	0	1	1	0	0.42
Fresno	11	17	3	13	23	1.36
Glenn	12	7	1	0	2	14.25
Humboldt	0	0	0	0	0	0.00
Imperial	1	3	0	0	0	0.42
Inyo	0	0	0	0	0	0.00
Kern	49	140	2	18	15	5.14
Kings	1	7	2	3	1	1.70
Lake	2	0	0	0	0	0.59
Lassen	0	0	0	0	0	0.00
Los Angeles	13	36	156	20	4	0.44
Madera	0	2	0	1	7	1.23
Marin	1	0	0	0	0	0.08
Mariposa	0	0	0	0	0	0.00
Mendocino	0	2	0	0	0	0.43
Merced	4	4	1	4	1	1.02
Modoc	2	0	0	0	0	3.70
Mono	1	0	0	0	0	1.35
Monterey	0	0	0	1	0	0.05
Napa	1	1	0	0	0	0.28
Nevada	1	0	0	0	0	0.19
Orange	6	9	71	4	1	0.56
Placer	8	4	6	0	3	1.21
Plumas	0	0	0	0	0	0.00
Riverside	4	17	62	3	0	0.77
Sacramento	15	25	13	0	12	0.90
San Benito	0	0	0	0	0	0.00
San Bernardino	3	4	36	2	5	0.46
San Diego	1	15	35	4	0	0.34
San Francisco	0	0	0	0	1	0.02
San Joaquin	8	10	12	10	6	1.24
San Luis Obispo	1	0	0	0	0	0.07
San Mateo	0	0	0	0	0	0.00
Santa Barbara	0	0	1	0	0	0.05
Santa Clara	5	4	1	0	0	0.11
Santa Cruz	0	0	0	0	0	0.00
Shasta	4	9	1	0	0	1.46
Sierra	0	0	0	0	0	0.00
Siskiyou	0	0	0	0	0	0.00
Solano	8	1	1	0	0	0.45
Sonoma	0	1	0	0	0	0.04
Stanislaus	11	21	17	14	12	2.68
Sutter	12	3	0	0	0	2.93
Tehama	6	4	4	0	0	4.27
Trinity	0	0	0	0	0	0.00
Tulare	6	10	5	4	12	1.58
Tuolumne	0	0	0	0	0	0.00
Ventura	3	1	0	0	0	0.09
Yolo	27	2	1	2	0	3.11
Yuba	5	0	0	1	0	1.49
Total WNV disease	**278**	**380**	**445**	**112**	**111**	**0.95**
Asymptomatic Infections[a]	14	29	53	17	20	
Total WNV infections	**292**	**409**	**498**	**129**	**131**	**1.03**

[a] WNV infections detected through blood bank screening; no associated illness reported

Malaria

One hundred sixteen confirmed cases of malaria were reported to CDPH in 2010. Case-patients were residents of 25 California counties and 63 (54%) were male. The median age was 35 years (range, 2 to 84 years). Of 109 cases for which *Plasmodium* species was determined, 53 were *P. falciparum*, 51 *P. vivax*, 3 *P. ovale*, and 2 *P. malariae*. Case-patients reported travel to Africa (59), Asia (44), Central America (5), the Caribbean (2), Oceania (1), and North (1) and South America (1); 60 (52%) case-patients reported travel to either India or Nigeria. Travel history was not available for three patients.

Dengue

Forty-two cases of dengue reported to CDPH in 2010 met the case definition for a probable case of dengue fever. No cases of dengue hemorrhagic fever or dengue shock syndrome were reported. Case-patients were residents of 20 California counties and 21 (50%) were male. The median age was 41.5 years (range, 6 to 63 years). Case-patients reported travel in Asia (17), Central (10), North (9), and South America (2), the Caribbean (2), and Africa (1); countries of travel most frequently reported were Mexico (8), India (5), Nicaragua (5), and Thailand (5). Travel history was not available for one patient.

Mosquito surveillance

A total of 801,714 mosquitoes (25,856 pools) collected in 34 counties were tested at the University of California, Center for Vectorborne Diseases (CVEC) or at one of two local agencies by a real-time (TaqMan) reverse transcriptase-polymerase chain reaction (qRT-PCR) for SLEV, WEEV, and WNV viral RNA. 1,193 pools were positive for WNV. (Table 7).

Nine local agencies also tested an additional 119,256 mosquitoes (5,574 pools) for WNV or WNV/SLEV using either RT-PCR or a commercial rapid assay-RAMP® (Rapid Analyte Measurement Platform, Response Biomedical Corp). From all pools tested, WNV was detected in 1,305 mosquito pools from 24 counties; 1,286 were positive by RT-PCR and 19 were positive by RAMP only (Table 11).

Table 7. Mosquitoes tested by PCR for St. Louis encephalitis (SLEV) [a], western equine encephalomyelitis (WEEV)[a], and West Nile (WNV) viruses, California 2010

County	No. mosquitoes tested[b]	No. mosquito pools tested	WNV positive pools[b]	WNV Minimum Infection Rate, by PCR only[c]
Alameda	3,958	118	0	0.00
Alpine	0			
Amador	0			
Butte	5,771	121	7	1.21
Calaveras	0			
Colusa	0			
Contra Costa	13,107	370	1	0.08
Del Norte	0			
El Dorado	0			
Fresno	36,372	959	130	3.57
Glenn	1,314	27	0	0.00
Humboldt	0			
Imperial	3,633	74	0	0.00
Inyo	1,772	40	0	0.00
Kern	62,928	1,625	277	4.40
Kings	28,013	784	65	2.32
Lake	13,556	340	3	0.22
Lassen	0			
Los Angeles	154,015	4,137	57	0.37
Madera	2,655	87	9	3.39
Marin	434	10	0	0.00
Mariposa	0			
Mendocino	0			
Merced	9,419	252	9	0.96
Modoc	0			
Mono	0			
Monterey	0			
Napa	1,334	45	0	0.00
Nevada	0			
Orange	0			
Placer	36,304	1,496	36	0.99
Plumas	0			
Riverside	171,366	4,314	71	0.41
Sacramento	63,627	4,779	205	3.22
San Benito	0			
San Bernardino	24,639	1,085	27	1.10
San Diego	4,640	152	1	0.22
San Francisco	0			
San Joaquin	685	18	1	1.46
San Luis Obispo	0			
San Mateo	58	2	0	0.00
Santa Barbara	14,707	338	0	0.00
Santa Clara	1,376	209	0	0.00
Santa Cruz	543	12	0	0.00
Shasta	9,075	324	0	0.00
Sierra	0			
Siskiyou	0			
Solano	1,352	30	1	0.74
Sonoma	2,619	68	0	0.00
Stanislaus	47,137	1,241	86	1.82
Sutter	13,606	342	26	1.91
Tehama	0			
Tulare	44,199	1,100	168	3.80
Tuolumne	0			
Ventura	973	23	0	0.00
Yolo	24,146	1,265	11	0.46
Yuba	2,381	69	2	0.84
Total	**801,714**	**25,856**	**1,193**	**1.49**

[a] No mosquito pools were positive for SLEV or WEEV in 2010

[b] Tested by University of California at Davis Center for Vectorborne Diseases or local mosquito/vector control agency. Does not include mosquitoes tested by local agencies for WNV only.

[c] Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1000

Statewide, the minimum infection rate (MIR) - defined as 1,000 times the number of infected mosquito pools divided by the number of mosquitoes tested - of WNV in mosquitoes was 1.2; the MIR was highest (4.4) in Kern County (Figure 4). Since 2003, the California statewide MIR of WNV has ranged from a low of 0.08 (2003) to a high of 2.1 (2004).

West Nile virus was identified from seven *Culex* species (*Cx. erythrothorax, Cx. pipiens, Cx. quinquefasciatus, Cx. restuans, Cx. stigmatosoma, Cx. tarsalis, Cx. thriambus*) (Figure 4, table 8) , and three other species (*Aedes vexans, Anopheles freeborni, Culiseta incidens)* (Table 8). The first RT-PCR confirmed detection of WNV in mosquitoes in 2010 was from a *Cx. tarsalis* pool collected in San Bernardino County on May 4. The last detection of WNV in mosquitoes was from a *Cx. tarsalis* pool collected in Riverside County on November 23.

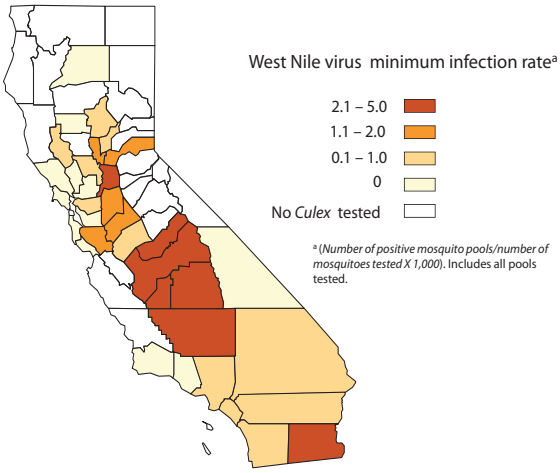

Figure 4. *Culex* spp. mosquitoes infected with West Nile virus , California 2010

Table 8. Mosquitoes tested for West Nile virus (WNV) California, 2010

Mosquito Species	No. pools tested	No. mosquitoes	WNV positive	Minimum Infection Rate[a]
***Culex* species**				
Cx erraticus	4	189	0	0.00
Cx erythrothorax	1,823	66,614	5	0.08
Cx pipiens	6,467	107,747	243	2.26
Cx quinquefasciatus	9,440	332,390	555	1.67
Cx restuans	8	227	3	13.22
Cx stigmatosoma	826	10,571	9	0.85
Cx tarsalis	11,350	356,671	467	1.31
Cx thriambus	48	125	1	8.00
unknown	3	46	0	0.00
All *Culex*	**29,969**	**874,580**	**1,283**	**1.47**
***Anopheles* species[b]**				
An freeborni	99	3,030	1	0.33
All *Anopheles*	**185**	**4,972**	**1**	**0.20**
***Aedes* species[c]**				
Ae vexans	24	745	1	1.34
All *Aedes*	**337**	**12,792**	**1**	**0.08**
Other species[d]				
Culiseta incidens	577	13,721	2	0.15
unknown	234	11,700	18	1.54
All other	**939**	**28,626**	**20**	**0.70**

[a] Minimum Infection Rate = (No. pools positive/No. mosquitoes tested) X 1000
[b] Other *Anopheles* species tested: f*ranciscanus, hermsi*
[c] Other *Aedes* species tested: *dorsalis, fitchii, melanimom, nigromaculis, sierrensis, squamiger, washinoi*
[d] Other species tested: *Culiseta inornata, Culiseta particeps, Coquilletidia peturbans, Psorophora columbiae*

Sentinel chickens

In 2010, 48 local mosquito and vector control agencies in 39 counties maintained 221 sentinel chicken flocks (Table 9). Blood samples were collected from chickens every other week and tested for antibodies to SLEV, WNV, and WEEV by an EIA at the CDPH VBDS. Positive samples were confirmed at the VBDS laboratory by IFA and western blot, or by PRNT as needed.

Out of 25,945 chicken blood samples that were tested, 281 seroconversions to WNV were detected among 63 flocks in 21 counties (Table 9). Statewide, 14.3 percent of sentinel chickens seroconverted to WNV. Since 2003, WNV seroconversions in chickens have ranged between the low of 3.2 percent (2003) and the high of 30.4 percent (2005). In 2010, the first WNV seroconversions were detected in Imperial and Riverside Counties on June 28, and the last seroconversion was detected in Riverside County on November 15.

Table 9. Sentinel chickens tested for St. Louis encephalitis (SLEV)[a], western equine encephalomyelitis (WEEV)[a], and West Nile (WNV) viruses, California 2010

County	No. flocks	No. chickens[b]	No. WNV positive flocks	WNV positive sera
Alameda	2	14	0	0
Alpine	0			
Amador	0			
Butte	7	84	3	7
Calaveras	1	10	0	0
Colusa	1	10	1	4
Contra Costa	5	55	2	4
Del Norte	0			
El Dorado	0			
Fresno	4	26	3	7
Glenn	1	11	0	0
Humboldt	0			
Imperial	1	26	1	15
Inyo	0			
Kern	15	172	12	86
Kings	0			
Lake	2	12	0	0
Lassen	0			
Los Angeles	48	328	2	2
Madera	2	22	2	9
Marin	1	6	0	0
Mariposa	0			
Mendocino	0			
Merced	8	48	4	8
Modoc	0			
Mono	0			
Monterey	2	20	0	0
Napa	3	31	0	0
Nevada	2	20	0	0
Orange	1	10	0	0
Placer	7	42	2	4
Plumas	0			
Riverside	22	294	8	44
Sacramento	9	71	4	6
San Benito	1	10	0	0
San Bernardino	18	116	4	11
San Diego	2	20	0	0
San Francisco	0			
San Joaquin	1	10	1	1
San Luis Obispo	0			
San Mateo	1	10	0	0
Santa Barbara	5	49	0	0
Santa Clara	6	42	0	0
Santa Cruz	2	20	0	0
Shasta	7	56	0	0
Sierra	0			
Siskiyou	0			
Solano	3	36	1	2
Sonoma	4	24	0	0
Stanislaus	5	52	4	21
Sutter	5	50	2	13
Tehama	3	30	1	1
Tulare	4	40	4	26
Tuolumne	0			
Ventura	4	40	0	0
Yolo	4	29	1	5
Yuba	2	20	1	5
Total	**221**	**1,966**	**63**	**281**

[a] No sentinel chickens were positive for SLEV or WEEV in 2010
[b] Reflects planned standard number of chickens per flock. Actual number may vary due to mortality or replacement of seroconverted chickens.

Dead bird and tree squirrel surveillance for West Nile virus

In 2010, the WNV hotline and website received 10,463 dead bird reports from the public in 56 counties. Dead bird carcasses were tested either at CVEC by RT-PCR, or at one of 25 local agencies by RT-PCR, RAMP or VecTest (Medical Analysis Systems, Inc., Camarillo, CA). In 2010, CVEC began differentiating between acute (recent within current surveillance season) and chronic (exposed at an undeterminable time in the past) infections in WNV positive dead birds. These changes were initiated based on research conducted by CVEC and improved testing methods. Of the 1,953 carcasses deemed suitable for testing, WNV was detected in 598 (31%) carcasses from 36 counties; 416 were reported acute infections (Table 10) and 182 were reported as chronic infections. Of the acute infections, 373 were confirmed positive by RT-PCR, 31 by VecTest, and 12 by RAMP (Table 10, Figure 5). In 2010, the first WNV positive dead bird was an American Crow reported from Los Angeles County on February 28, and the last WNV positive dead bird was an American Crow reported from Santa Clara County on December 17. In 2010, 415 dead squirrels were reported through the WNV Hotline; 108 carcasses were tested and WNV RNA was detected by RT-PCR in 24 (22%) carcasses from eight counties (Table 11). These included ten fox squirrels (*Sciurus niger*), eight eastern gray squirrels (*S. carolinensis*), five western gray squirrels (*S. griseus*), and one California ground squirrel (*Otospermophilus beecheyi*); this was the first time WNV has been detected in a ground squirrel from California.

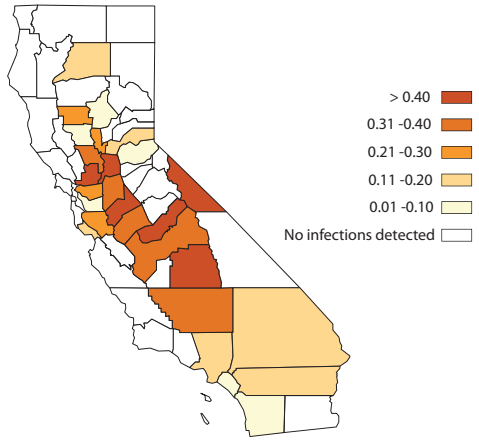

Figure 5. Prevalence of West Nile virus infection in dead birds, California, 2010

Table 10. Dead birds reported, tested[a], and positive[b] for West Nile virus, California 2010

County	Reported	Tested	Positive	Percent Positive
Alameda	310	55	1	1.8
Alpine	0	0	0	0.0
Amador	20	0	0	0.0
Butte	377	82	6	7.3
Calaveras	35	4	0	0.0
Colusa	20	13	1	7.7
Contra Costa	923	32	8	25.0
Del Norte	0	0	0	0.0
El Dorado	185	40	2	5.0
Fresno	427	58	22	37.9
Glenn	20	13	3	23.1
Humboldt	7	1	0	0.0
Imperial	6	0	0	0.0
Inyo	14	2	0	0.0
Kern	247	40	13	32.5
Kings	44	2	0	0.0
Lake	74	10	0	0.0
Lassen	9	2	0	0.0
Los Angeles	1,194	232	41	17.7
Madera	73	18	13	72.2
Marin	75	0	0	0.0
Mariposa	7	0	0	0.0
Mendocino	19	2	0	0.0
Merced	257	38	14	36.8
Modoc	14	4	0	0.0
Mono	12	2	1	50.0
Monterey	101	12	0	0.0
Napa	22	0	0	0.0
Nevada	53	7	0	0.0
Orange	193	206	17	8.3
Placer	277	60	9	15.0
Plumas	5	3	0	0.0
Riverside	243	5	1	20.0
Sacramento	1,310	280	115	41.1
San Benito	26	4	0	0.0
San Bernardino	489	91	10	11.0
San Diego	229	110	2	1.8
San Francisco	49	4	0	0.0
San Joaquin	478	85	26	30.6
San Luis Obispo	77	13	0	0.0
San Mateo	158	24	0	0.0
Santa Barbara	51	13	0	0.0
Santa Clara	842	126	32	25.4
Santa Cruz	76	20	4	20.0
Shasta	76	31	4	12.9
Sierra	1	0	0	0.0
Siskiyou	8	0	0	0.0
Solano	137	2	1	50.0
Sonoma	143	0	0	0.0
Stanislaus	346	77	34	44.2
Sutter	40	4	1	25.0
Tehama	44	9	0	0.0
Trinity	5	0	0	0.0
Tulare	184	39	21	53.8
Tuolumne	19	2	0	0.0
Ventura	166	35	0	0.0
Yolo	208	41	14	34.1
Yuba	37	0	0	0.0
Totals	**10,462**	**1,953**	**416**	**21.3**

[a] Tested by University of California at Davis Center for Vectorborne Diseases or local mosquito/vector control agency

[b] Does not include chronic infections

Horse Surveillance for West Nile Virus

Serum or brain tissue specimens from horses displaying neurological signs were tested for arboviruses at the California Animal Health & Food Safety Laboratory (CAHFS). West Nile virus infection was detected in 19 unvaccinated horses from 11 counties (Table 11). Five of the horses died or were euthanized as a result of their infection.

Table 11. Infections with West Nile virus in California, 2010

County	Humans[a]	Horses	Dead Birds	Mosquito Pools	Sentinel Chickens	Dead Squirrels
Alameda	1	0	1	0	0	0
Alpine	0	0	0	0	0	0
Amador	0	1	0	0	0	0
Butte	1	1	6	7	7	1
Calaveras	1	0	0	0	0	0
Colusa	0	0	1	0	4	0
Contra Costa	5	0	8	4	4	0
Del Norte	0	0	0	0	0	0
El Dorado	1	0	2	0	0	0
Fresno	28	4	22	130	7	2
Glenn	2	0	3	0	0	0
Humboldt	0	0	0	0	0	0
Imperial	0	0	0	10	15	0
Inyo	0	0	0	0	0	0
Kern	15	1	13	277	86	0
Kings	2	0	0	65	0	0
Lake	0	0	0	3	0	0
Lassen	0	1	0	0	0	0
Los Angeles	4	0	41	57	2	1
Madera	10	5	13	9	9	0
Marin	0	0	0	0	0	0
Mariposa	0	0	0	0	0	0
Mendocino	0	0	0	0	0	0
Merced	2	0	14	9	8	0
Modoc	0	0	0	0	0	0
Mono	0	0	1	0	0	0
Monterey	0	0	0	0	0	0
Napa	0	0	0	0	0	0
Nevada	0	0	0	0	0	0
Orange	1	0	17	19	0	2
Placer	4	0	9	36	4	0
Plumas	0	0	0	0	0	0
Riverside	0	0	1	71	44	0
Sacramento	13	2	115	205	6	4
San Benito	0	0	0	0	0	0
San Bernardino	5	0	10	41	11	2
San Diego	0	0	2	1	0	0
San Francisco	1	0	0	0	0	0
San Joaquin	7	1	26	57	1	0
San Luis Obispo	0	0	0	0	0	0
San Mateo	0	0	0	0	0	6
Santa Barbara	0	0	0	0	0	0
Santa Clara	0	0	32	10	0	6
Santa Cruz	0	0	4	0	0	0
Shasta	0	0	4	0	0	0
Sierra	0	0	0	0	0	0
Siskiyou	0	0	0	0	0	0
Solano	0	1	1	1	2	0
Sonoma	0	0	0	0	0	0
Stanislaus	12	1	34	86	21	0
Sutter	0	0	1	26	13	0
Tehama	0	0	0	0	1	0
Trinity	0	0	0	0	0	0
Tulare	15	1	21	168	26	0
Tuolumne	0	0	0	0	0	0
Ventura	0	0	0	0	0	0
Yolo	0	0	14	11	5	0
Yuba	1	0	0	2	5	0
State Totals	**131**	**19**	**416**	**1,305**	**281**	**24**

[a]Includes asymptomatic infections detected through blood bank screening

Throughout California, enzootic data continued to document WNV activity during every season of the year, including the winter period. For the third consecutive year, only WNV was detected. WEE was last detected in 2007, and SLE has not been detected since 2003.

5

Other Vectors and Public Health Pests

The Vector-Borne Disease Section provides assistance to and coordination between local and state agencies for the management of other vectors and public health pests including Africanized honey bees, red imported fire ants, scorpions, lice, bed bugs, and scabies. The Vector-Borne Disease Section may also perform active surveillance, special projects, and intervention for these pests when necessary.

Red Imported Fire Ants

VBDS continues to serve as liaison with the California Department of Food and Agriculture (CDFA), county agriculture departments, and local vector control agencies that conduct surveillance and eradication programs for red imported fire ants (RIFA). The CDFA reported that over 7,100 acres of chiefly agricultural land in Madera, Merced, and Stanislaus Counties were treated for RIFA infestation in 2010. In southern California, CDFA continued to monitor limited RIFA infestations in San Bernardino, western Riverside, and San Diego Counties. Enforcement of RIFA quarantine regulations remain a high priority within the statewide CDFA red imported fire ant program.

The Coachella Valley Mosquito and Vector Control District reported that over 13,500 acres were treated for RIFA infestation within their district in 2010. Treatments were conducted in 14 communities on residential, country club, golf courses, and public land sites. Sixty-seven square miles in the Coachella Valley (Riverside County) remain under CDFA quarantine guidelines. The Orange County Vector Control District Fire Ant Program conducted or contracted out over 9,000 treatments on over 13,000 sites in Orange County in 2010. Additionally, over 20,000 acres were surveyed for RIFA activity. All of Orange County (790 square miles) remains under RIFA quarantine. The Los Angeles County Agricultural Commissioner and Weights and Measures Department RIFA Eradication Program conducted 1,184 treatments on RIFA infested properties in Los Angeles County. Over 7,000 properties in 32 communities were surveyed for RIFA activity. Surveys have identified 1,076 RIFA infested sites in 19 communities that are currently under treatment. In 2010, 62 properties were declared RIFA eradicated. 8.5 square miles of Los Angeles County remain under RIFA quarantine.

Lice, Bed Bugs, and Scabies

VBDS continued a cooperative project on urban public health pests and associated diseases with San Francisco Project Homeless Connect and the Centers for Disease Control and Prevention, Fort Collins, CO. In 2010, VBDS set up a booth at two San Francisco Project Homeless Connect events to educate homeless clients and their providers about urban public health pests, offer head, body, and pubic louse checks, administer a survey designed to investigate the epidemiology of body lice infestation in San Francisco homeless, and provide consultation on bed bug and scabies complaints. Ninety-seven clients received consultations at the booth and 96 completed surveys. Four hundred body lice were collected from 18 clients, and 35 head lice were collected from three clients. *Bartonella quintana* (the agent of trench fever) was detected in lice from four body lice infested clients (22%) and one headlice infested client (33%). Clients with lice were offered free insecticidal lotions through the pharmacy division of the event. Clean donated clothing was provided to infested clients. Consultation was offered to 11 people with bed bug bites or complaints.

6 Caltrans Stormwater Project

The Vector-Borne Disease Section worked with the California Department of Transportation (Caltrans) from 1999 to 2010 to decrease mosquito production associated with structural Best Management Practices installed to reduce pollution carried by by stormwater runoff. The Vector-Borne Disease Section designed, implemented, and evaluated projects aimed at minimizing mosquito production in these structures while maintaining water management and water quality goals.

Summary of accomplishments – 1999 to 2010

A Memorandum of Understanding (MOU) between VBDS and the California Department of Transportation (Caltrans) was revised and renewed three times since its inception in 1999. Funding was used to support at least two full-time VBDS staff and five one-year interns under the California Epidemiologic Investigation Service Fellowship Program. Interagency agreement funding expired June 30, 2010. Activities conducted in 2010 focused on writing up completed field studies for publication.

Multi-Year Field Studies

Several multi-year field studies of Caltrans stormwater Best Management Practices (BMP) were conducted along freeways and highways in the counties of San Diego, Los Angeles, Orange, Placer, and El Dorado. The primary objectives of these studies were to document the presence of mosquitoes in BMPs, identify structural and non-structural causes for standing water, and develop and evaluate non-chemical measures to minimize mosquito production, including structural and operational design changes, specific repairs, exclusion techniques, biological controls, and maintenance intervals.

A total of 127 BMP structures were monitored covering a wide spectrum of available stormwater technologies, both above and below ground. Seventeen species of larval mosquitoes were collected, five of which are vectors of diseases including WEE, SLE, WNV, and malaria. The variety of species observed underscored that these structures could provide suitable habitat for even the most fastidious mosquito species. Among the identified causes for standing water were design features, construction flaws, and dry-weather urban runoff. Several design changes were implemented to reduce the access to, incidence, and/or duration of standing water. The degree to which mosquito production was reduced through design changes varied widely; control was particularly difficult in structures that received persistent flows of dry weather urban runoff. Maintaining a shorter regular maintenance schedule was critical to mosquito control in certain installations.

Short-Term Field Studies

Simultaneous with multi-year projects, short-term field studies were carried out in southern California concerning the ecology of *Culex quinquefasciatus* mosquitoes. This species thrives in belowground habitats created by many types of BMPs, particularly proprietary devices. There was an extensive prevalence of these mosquitoes in belowground BMPs and the potential for year-round larval development. Gravid females were able to access sources of standing water through both vertical and horizontal openings and successfully oviposit on water accessible only via conveyance pipes of small diameters and convoluted courses. Newly emerged males and females were able to detect, navigate through, and exit conveyance pipes under nearly lightless conditions. Studies aimed at finding exclusion techniques were largely unsuccessful, leading to the

conclusion that most belowground BMPs will require routine monitoring and chemical treatment for mosquito management.

Nationwide Survey

A nationwide survey of stormwater management and vector control agencies was conducted between 2007 and 2009 to gather information that would be useful for Caltrans in the development of future policies related to mosquito and vector control in stormwater BMPs. The questionnaire solicited information on the prevalence and types of BMPs that produced mosquitoes, efforts taken to minimize mosquito production in these structures, the costs of associated mosquito management, public health policy changes in response to the introduction and spread of West Nile virus, and identification of additional needs of stormwater management and vector control agencies to prevent future vector-borne disease crises.

The 12 year Caltrans MOU provided a unique collaborative opportunity between two disparate California agencies. Studies and recommendations emanating from the collaboration benefit all Californians in reducing mosquito breeding and potential disease transmission. Efforts and accomplishments led to national awareness and intervention to prevent mosquito production in storm water treatment devices.

In total, 585 agencies in 50 states and the District of Columbia were contacted of which 329 participated with nearly equal representation of stormwater and mosquito control agencies. Stormwater BMPs were reported from every state and only Maine and Washington D.C. did not report associated mosquito production. The types of BMPs reported to harbor mosquitoes included detention and/or retention basins, grass swales, stormwater treatment wetlands/ponds, infiltration basins/ trenches, belowground proprietary systems, and bioretention systems. These data corroborated previous findings in California by VBDS and emphasized that BMPs can create mosquito habitat throughout the United States. Results of the survey overwhelmingly suggested a need for greater interagency collaboration and improved education and outreach to raise awareness of the association between stormwater and mosquito production.

Education and Outreach

Since 1999, VBDS has proactively focused substantial energy on education and outreach activities within Caltrans and throughout the stormwater management community to raise awareness of the potential for mosquito production as an unintended consequence of stormwater BMP construction. Information was disseminated by means of seminars, public testimonies, interagency reports, magazine articles, newsletters, fact sheets, web-based publications, and peer-reviewed articles. An underlying message was the need for interagency and interdisciplinary collaboration and compromise in order to meet the needs of both public health and water quality.

In total, VBDS authored and coauthored eight publications in peer-reviewed journals, six published proceedings, seven publications in trade magazines, letters to the editor, newsletters, web blogs, one web-based review article, and over 300 pages of interagency reports, memoranda, and plan-reviews. Additionally, one peer-reviewed journal publication is in press, and three others are in preparation. Staff have given over 65 oral presentations at workshops, local, national, and international conferences.

7

U.S. Forest Service Cost-share Agreement

In 1992, the Vector-Borne Disease Section entered into a Challenge Cost-Share Agreement with the Pacific Southwest Region of the United States Department of Agriculture Forest Service (USFS) to maintain cooperative surveillance and control of vector-borne diseases within the National Forests. This report highlights some of the vector-borne disease monitoring, risk assessment, risk reduction, and education of personnel, concessionaires, and the public that the Vector-Borne Disease Section and local collaborators conducted at the 18 National Forests in California in 2010.

Angeles National Forest

Upon request, VBDS staff conducted a hantavirus survey and risk assessment of associated structures at the San Dimas Experimental Forest facility. None of the nine *Peromyscus boylii* mice captured and tested was positive for antibodies to Sin Nombre Virus (SNV), the causative agent for hantavirus cardiopulmonary syndrome (HCPS). VBDS conducted tick flagging and visual surveys of diurnal rodent activity at selected locations: no ticks were found and ground squirrel activity was considered low at all sites checked. The Los Angeles County Department of Public Health Vector Management Program conducted extensive vector-borne disease monitoring on the Angeles National Forest. The county's public health laboratory tested 175 California ground squirrels for evidence of plague. One, a California ground squirrel (*Otospermophilus beecheyi*) at Los Alamos Campground tested positive for serum antibodies to *Yersinia pestis*, the causative agent of plague. The campground was closed until flea and ground squirrel reduction activities could be completed. General flea control was conducted at selected locations by the Los Angeles County Agricultural Commissioner's Office. In addition, 21 carnivores from lands adjacent to the Forest tested negative for serum antibodies to *Y. pestis*.

Cleveland National Forest

Routine monitoring for tick and rodent-borne diseases and plague was conducted by VBDS staff and in collaboration with San Diego County Department of Environmental Health Vector Surveillance and Control Program at locations throughout the Forest. None of the 39 ticks tested was positive for the organisms that cause Lyme disease (*Borrelia burgdorferi*) or tularemia (*Francisella tularensis*). One brush mouse (*Peromyscus boylii*) of thirteen mice (*Peromyscus* spp.) was positive for serum antibody to SNV. Although plague positive ground squirrels were sampled from State Park lands, none of 55 rodents sampled from USFS campgrounds and neither of two carnivores sampled from lands adjacent to the Forest, was positive for serum antibody to *Y. pestis*. In addition, VBDS staff visually inspected facilities and provided consultation on rodent reduction and exclusion to the Trabuco Ranger District and distributed vector-borne disease prevention safety brochures and tick identification cards to staff.

Eldorado National Forest

VBDS staff monitored ticks, rodent-borne disease, and plague at select locations on the Forest. Adult tick surveillance was conducted at Tiger Creek Afterbay Picnic Area and tick warning placards were posted after adult *Ixodes pacificus* were collected. A multi-year rodent-borne disease project to gather data on long-term trends in rodent population dynamics and SNV transmission at Leek Springs Lookout and Lumberyard Fire Station, concluded at the end of the year. Serum antibodies to SNV were detected in 9 of 64 deer mice and in

none of three long-tailed voles (*Microtus longicaudus*) captured. Mouse numbers, as measured by trap success, and the seropositive proportion were significantly lower than last year's findings. A marmot from Caples Lake tested negative for evidence of *Y. pestis* infection. Staff contacted the Forest Supervisor's office to discuss rodent proofing of Forest facilities and provided vector-borne disease education and safety materials to Georgetown, Placerville and Pacific Ranger District offices as well as campground concessionaires. Staff posted numerous campgrounds with plague caution signs.

Inyo National Forest

Two deer mice (*Peromyscus maniculatus*) tested negative for serum antibodies to SNV. Serum antibody to *Y. pestis* was detected in none of 13 and 19 rodents sampled from Upper Falls Tract and Twin Lakes campground, respectively. Upper Falls Tract, a long-term lease, private residence area in the Mammoth Lakes Basin region, recorded two plague positive Lodgepole chipmunk (*Tamias speciosus*) carcasses in 2009. Additionally, VBDS staff evaluated rodent activity at campgrounds in the Mammoth Lakes and Lee Vining areas and presented vector-borne disease safety information to Forest concessionaires and volunteers and discussed vector-borne disease issues with the Forest Safety Officer. Upon request, a PowerPoint vector-borne disease prevention presentation was provided to the Forest Safety Officer for the annual All Employee Safety Meeting.

Klamath National Forest

VBDS staff conducted adult tick surveillance at sites along the southwest edge of Butte Valley, Herd Peak Road and along Forest Road 3, one mile southwest of Sam's Neck Road where more than 50 *D. occidentalis* were collected. Serum samples from 19 carnivores tested negative for antibodies to *Y. pestis*. VBDS biologists discussed vector-borne disease issues with Goosenest Ranger Station staff and left educational materials for redistribution to staff at Grass Lake Fire Station and Mt. Hebron Work Center.

Lake Tahoe Basin Management Unit

A yellow pine chipmunk carcass from land adjacent to USFS lands tested negative for plague antibodies. VBDS staff reposted Fallen Leaf Campground with a plague caution placard and vector-borne disease issues were discussed with the area concessionaire manager. Staff presented vector-borne disease awareness and safety training to more than 30 area concessionaires and managers at Camp Richardson Resort and distributed vector-borne disease educational and safety pamphlets to Taylor Creek Visitor Center staff. A VBDS Public Health Biologist met with the Safety Officer to discuss vector-borne disease awareness and safety training for Unit staff.

Lassen National Forest

One golden-mantled ground squirrel carcass from Cave Campground tested negative for presence of plague bacteria and serum samples from four carnivores tested negative for antibodies to *Y. pestis*. VBDS staff conducted visual surveys for rodent presence and activity at Hat Creek and Cave campgrounds and noted both campgrounds were properly posted with plague caution placards. Staff provided campground hosts with vector-borne disease educational and safety information and discussed hantavirus prevention. VBDS discussed hantavirus safety and continued rodent ingress issues at Almanor Ranger Station and distributed vector-borne disease educational and safety information to Almanor and Eagle Lake Ranger District personnel and concessionaires.

Los Padres National Forest

In collaboration with the Ventura County Environmental Health Program, VBDS conducted direct plague surveillance at Chuchupate Campground. None of 18 rodents sampled were positive for serum antibodies to *Y. pestis*. None of 10 carnivores sampled from lands adjacent to the Forest were positive for serum antibodies to *Y. pestis*. VBDS staff visited the Temescal Fire Station of the Forest and provided USFS staff with vector-borne disease prevention and educational materials.

Mendocino National Forest

VBDS tested ticks collected from Lower Blue Slides Creek trail. *Borrelia* spp. were detected in 2 of 8 ticks by direct florescent antibody test. Two mountain lions from lands near USFS boundaries tested negative for plague antibodies. VBDS staff met with the Forest Safety Officer and discussed vector issues that may impact recreation sites and USFS staff stationed at facilities on the forest, especially in facilities that are seasonally staffed. Safety training availability was also discussed. Vector-borne disease educational brochures were provided for distribution to staff at these and other sites on the Forest.

Modoc National Forest

VBDS staff conducted adult tick surveillance along Forest Service Road 44N22 and in Howard Gulch Campground. No ticks were found at either site. The campground was posted with a plague caution sign and no evidence of epizootic activity was observed. One coyote of 40 carnivores sampled from lands adjacent to USFS lands was positive for antibodies to *Y. pestis*.

Plumas National Forest

VBDS collected three and five *D. andersoni* ticks, respectively, along Milford Grade Road near Granite Springs and at Laufman Fire Station. VBDS staff continued a multi-year rodent-borne disease project employing mark-recapture methods at Laufman Ranger Station. Serum antibodies to SNV were detected in two deer mice and one harvest mouse from 87 rodents sampled. One California ground squirrel (*O. beecheyi*) collected in Plumas Eureka State Park, adjacent to USFS lands, was positive for plague bacteria. None of 11 carnivores was positive for serum antibodies to *Y. pestis*. VBDS discussed vector-borne disease prevention with USFS personnel and concessionaires at the Beckwourth Ranger District and Antelope Lake Recreation area and provided VBDS educational materials and plague posters. Staff ensured plague caution signs were posted at campgrounds around the Forest.

San Bernardino National Forest

Routine surveillance for tick and rodent-borne diseases and plague was conducted by VBDS staff, in collaboration with the Riverside County Department of Environmental Health Vector Control Program and the San Bernardino County Vector Control Program, at numerous campgrounds and other locations throughout the Forest. None of 81 *Peromyscus* spp. tested was positive for serum antibodies to SNV. None of 42 rodent samples tested positive for serum antibodies to *Y. pestis*. In addition, staff conducted visual surveys of rodent activity and numbers at several campgrounds in the Mountaintop Ranger District. VBDS gave presentations on vector-borne disease prevention and safety awareness to Mountaintop Ranger District staff at the Big Bear Discovery Center and the Idyllwild Ranger District at Keenwild Station and distributed safety and prevention brochures and materials to staff at both locations.

In the 1930s, the San Bernardino Mountains were the most common human exposure site for tick-borne relapsing fever (TBRF). Soft ticks (*Ornithodoros hermsi*) collected from the Big Bear Lake area were used in infection experiments to help researchers identify the bacterial agent (*Borrelia hermsii*) that causes TBRF. Today, most TBRF infection occur above 4,000 feet in the Lake Tahoe and eastern Sierra regions, and are most often associated with homes and structures that harbor sylvatic rodent nests.

Sequoia National Forest

Samples submitted from 18 coyotes and one mountain lion collected on or adjacent to Forest lands all tested negative for serum antibodies to *Y. pestis*. Staff discussed concerns about plague caution signs posted in campgrounds with Forest leadership.

Shasta-Trinity National Forest

VBDS staff conducted adult tick surveillance at several sites throughout the Forest. All sites flagged produced ticks with over 100 *I. pacificus* ticks collected from a roadside across from McCloud Bridge Campground. From 17 carnivore samples submitted for serological testing, a bobcat and coyote were positive for antibodies to *Y. pestis*. Big Bar and Weaverville Ranger District personnel were contacted and vector-borne disease issues were discussed. Disease safety and prevention brochures and tick identification cards were provided for distribution to USFS personnel and Forest visitors.

Sierra National Forest

VBDS flagged for adult ticks at McCabe Flat Campground, Rosebud Picnic Area, and McClendon Beach Day Use Area but no ticks were found. A black bear tested negative for serum antibody to *Y. pestis*.

Six Rivers National Forest

Six carnivores from lands adjacent to the Forest tested negative for antibodies to *Y. pestis*. VBDS staff conducted visual inspections of the Mad River and Gasquet District Ranger Station and Ruth Lake Fire Station, with an emphasis on hantavirus safety. Recommendations made included exclusion, snap trapping, and disinfection techniques. Inspection results were discussed with the District and Forest Safety Officers. VBDS attended the annual Forest Safety teleconference and discussed scheduling safety presentations for the Forest as well as surveillance activities for hantavirus and Lyme disease. Staff presented hantavirus risk reduction measures to USFS personnel at the Forest Supervisor's Office and discussed vector-borne disease issues with the Supervisor and Deputy Supervisor. VBDS provided the Lower Trinity District Ranger with safety and disease prevention information and educational brochures.

Stanislaus National Forest

In 2010, a yellow pine chipmunk carcass from Silver Valley Campground tested negative for plague bacteria. VBDS visited numerous campgrounds, trailheads, and day use areas throughout the Forest to check for evidence of plague activity and ensure sites were posted with plague caution placards. Staff gave vector-borne disease prevention presentations at Hathaway Pines Ranger Station to District and fire crew personnel and to staff at Camp Wolfboro, Boy Scouts of America. Disease prevention brochures and materials were distributed to Mi-Wok and Groveland Ranger Districts, Dorrington and Arnold Fire Stations, and campground concessionaires when available.

Tahoe National Forest

VBDS conducted adult tick surveillance at select locations around the Forest. One of three *I. pacificus* ticks from Fiddle Creek Trail tested positive by DFA for *Borrelia* spp. Ticks tested from Dark Day and Oregon Creek Campgrounds were negative by DFA for evidence of *Borrelia* infection. Five carnivore samples from lands adjacent to the Forest tested negative for serum antibodies to *Y. pestis*. Upon request of USFS personnel, VBDS conducted visual surveillance and risk assessments for hantavirus and tick-borne relapsing fever at Grouse Ridge, Babbitt Peak, and Sardine Lookouts, and Lewis Mill and Stampede Fire Stations. Written recommendations for reducing risk to USFS personnel and visitors to the facilities were given to the Forest Safety Officer. In addition, numerous campgrounds throughout the Forest were visited and checked for the presence of plague caution and/or warning placards. During visits, campground concessionaires were contacted and educated regarding plague and hantavirus risk. VBDS staff presented vector-borne disease safety and awareness training to all Ranger Districts along with the distribution of safety literature and brochures.

Table 12. Surveillance for selected vector-borne disease agents in U.S. National Forests, California 2010

National Forest	Hantavirus (*Peromyscus* mice)[a]		*Yersinia pestis* (rodents)		*Yersinia pestis* (carnivores)[b]		*Borrelia* spp. (*Ixodes* ticks)	
	Positive	Tested	Positive	Tested	Positive	Tested	Positive	Tested
Angeles	0	9	1	175[c]	0	21		
Cleveland	1	12[c]	0	55	0	2	0[c]	19[c]
Eldorado	9	64	0	15	0	1		
Inyo	0	2	0	32				
Klamath					0	19		
Lake Tahoe BMU			0	1				
Lassen			0	1	0	4		
Los Padres			0	18	0	10		
Mendocino					0	2	2	8
Modoc					1	40		
Plumas	3	71	1	2	0	11		
San Bernardino	0	91	0	42				
Sequoia					0	10		
Shasta-Trinity					2	17		
Sierra			0	7	0	13		
Six Rivers					0	6		
Stanislaus			0	1	0	1		
Tahoe					0	5	1	12
Total, all forests	**13**	**249**	**2**	**349**	**3**	**162**	**3**	**39**

[a] *Peromyscus* species mice only. Total rodents tested = 263; total rodents positive = 13

[b] Carnivore specimens taken directly from or adjacent to USFS lands. Because of the broad home range of some carnivores, results obtained can be inferred to a large area, including both USFS and adjacent lands.

[c] Some testing conducted by county public health laboratories

Other

VBDS staff from around the state responded to various requests from Forests and Region 5 Headquarters. Hantavirus surveillance was conducted in response to concerns of continued rodent activity in a storage building at Region 5 headquarters. Written general and specific rodent exclusion and reduction recommendations were provided. Staff also assisted R5 with a mosquito control issue near facilities in Solano County and responded to an inquiry regarding venomous snake concerns on the Angeles NF. VBDS also responded to Safety Officer questions regarding causes of viral paralysis. Quarterly reports of VBDS activities on R5 lands were distributed.

8

National Park Service Cooperative Agreement

In 2007, the National Park Service signed a cooperative agreement with the Vector-Borne Disease Section to develop a vector-borne disease prevention program for the 24 National Park units in California. The National Park Service Office of Public Health provided funding for a three-year pilot program to support the Vector-Borne Disease Section to conduct surveillance, perform site evaluations, and provide expert consultation to help reduce the risk of vector-borne diseases to visitors and staff.

Death Valley National Park (DEVA)

In March 2010, VBDS conducted rodent collection for hantavirus assessment in and around Scotty's Castle, Wildrose campground, National Park Service (NPS) staff offices, the visitor center in Furnace Creek, and NPS housing and administrative buildings in Cow Creek. Forty-three of 45 *Peromyscus* spp. rodents collected were cactus mice (*P. eremicus*). Serum antibodies to Sin Nombre virus (SNV) were detected in 14 cactus mice (33%) and one deer mouse (*P. maniculatus*) (50%); 14 of the 15 seroreactive rodents were collected near Scotty's Castle. This work represented the first evidence of SNV in *Peromyscus* sp. rodents in DEVA. VBDS provided DEVA staff with recommendations for removal, exclusion, and decontamination of areas susceptible to rodent infestation.

Thirty-three percent of cactus mice collected in Death Valley had serum antibodies to SNV, a much greater proportion than the 3.7 percent estimated for this species statewide. It is unknown to what degree cactus mice shed SNV and present a risk of HCPS.

Joshua Tree National Park (JOTR)

Staff of VBDS and NPS conducted building evaluation and rodent collection for hantavirus surveillance at seven locations in JOTR in May 2010. Trapping was conducted overnight at selected campgrounds, ranger stations, visitor centers, and staff housing. Twenty-two rodents, including 16 *Peromyscus* spp., were collected; serum antibodies to SNV were detected in one cactus mouse (6.3%) collected near Cottonwood Spring staff housing. Evidence of rodent activity (e.g., feces) in several buildings motivated VBDS to recommend measures for reducing incentives (i.e., food, harborage) and points of ingress for rodents in buildings.

Lassen Volcanic National Park (LAVO)

VBDS conducted a visual survey of plague susceptible rodent species at Butte Lake Campground in September 2010. Chipmunks, golden-mantled ground squirrels, and pine squirrels were active with approximately one rodent seen for every three campsites. At that time, rodent populations were abundant with no indication of burrow abandonment. Recommendations were made to LAVO staff to post campground with plague "Caution" signs and to re-evaluate rodent populations and plague risk upon reopening in 2011.

Sequoia-Kings Canyon National Park (SEKI)

VBDS placed carbon dioxide-baited adult mosquito traps at 17 locations in August 2010. *Aedes sierrensis* and four species of *Culiseta* were collected, though the number of mosquitoes was low and few man-made breeding sources were observed. In September, rodents were collected at two campgrounds for hantavirus, plague, and tick-borne relapsing fever surveillance. A total of 45 rodents of five species was collected. Molecular evidence of infection with *Borrelia hermsii*, the agent of tick-borne relapsing fever, was detected in 5 of 23 (22%) chipmunks (*Neotamias speciosus*). Serum antibodies to neither SNV nor *Yersinia pestis* were detected in any rodents. Detection of *B. hermsii* in chipmunks at both campgrounds motivated VBDS to emphasize the need for rodent exclusion and removal of rodent incentives (i.e., food, harborage) in and around buildings.

Whiskeytown National Recreation Area (WHIS)

In February 2010, VBDS biologists met with the WHIS Resources Chief to discuss vector-borne disease issues of concern including rodent-borne hantavirus. Vector-borne disease educational brochures were provided for staff and visitor center use. Tick-borne diseases, tick exposures, and hantavirus safety protocols were discussed with the Administrative Assistant of Whiskeytown Environmental School, operated by the Shasta County Office of Education within WHIS jurisdiction, and educational brochures were provided for staff and student use.

Yosemite National Park (YOSE)

In April and May 2010, VBDS staff logged over 50 hours of flagging vegetation for ticks at over 20 locations in YOSE. Forty-one adult *Ixodes* spp. ticks were collected, mostly from the Hetch Hetchy and Wawona areas. In September, VBDS staff conducted hantavirus risk assessment in Tuolumne Meadows following report of a case of hantavirus cardiopulmonary syndrome in a recent visitor. Rodent harborage opportunities (e.g., stacked firewood) and structural deficiencies that could allow rodent ingress (e.g., gaps in door threshold) were noted in and around cabins. In addition to removal/correction of these factors, VBDS recommended providing staff and guests with information and supplies to safely clean and decontaminate cabins.

9

Vector Control Technician Certification Program

The California Health and Safety Code (§106925) requires every government agency employee who handles, applies, or supervises the use of any pesticide for public health purposes to be certified by the California Department of Public Health. The Vector-Borne Disease Section administers the Public Health Vector Control Technician certification examination twice each year to certify the competence of government agency personnel to control vectors for the health and safety of the public.

To become certified in a control category, applicants must pass the Core section and at least one Specialty section of the examination. Each applicant to the examination pays a fee for each section requested on the application. The Core section consists of questions about the safe and effective use of pesticides. Specialty sections of the examination include the Biology and Control of Mosquitoes in California, Arthropods of Public Health Significance in California, and Vertebrates of Public Health Importance in California (Table 13). Successful examinees are issued a gold certification card that is valid for two years in the qualified categories specified on the card. To maintain full certification status in subsequent two-year cycles, Certified Technicians must pay annual renewal fees and fulfill minimum continuing education requirements. Successful examinees who elect not to participate in continuing education are issued parchment certificates in the categories in which they qualified. These Certified Technicians (Limited) employees may use pesticides only under the direct supervision of a Certified Technician.

Table 13. Results of certification examinations administered in 2010.

Exam section	No. Exams Given	No. Passed (%)
Core	98	56 (57)
Mosquito Control	92	48 (52)
Terrestrial Invertebrate Control	68	32 (47)
Vertebrate Vector Control	74	44 (59)
Totals	332	180 (54)

Over 61 continuing education programs were provided to Vector Control Technicians in 2010. VBDS staff presented at over 20 of these programs.

Through 2010, 1,289 Vector Control Technicians employed at 115 local public health agencies and CDPH held 3,063 certificates (Table 14). The agencies include 53 mosquito abatement districts, mosquito and/or vector control districts and other special districts, 44 departments of county government, 16 departments of city government, the University of California, and CDPH.

Table 14. Vector Control Technician certificates in effect as of December 2010

	No. Certificates		
Certification Category	**Full Status**	**Limited Status**	**Total**
Mosquito Control	845	282	1,127
Terrestrial Invertebrate Vector Control	668	239	907
Vertebrate Vector Control	683	346	1,029
Totals	2,196	867	3,063

Table 15 compares the certification status among employees of Mosquito and Vector Control Association of California (MVCAC) corporate member agencies and non-MVCAC member agencies.

Table 15. Certification status among MVCAC corporate member agencies and non-MVCAC agencies.

	Certified Technicians		Certified Technicians (Limited)	
Agency Type	**No. Agencies**	**No. Employees**	**No. Agencies**	**No. Employees**
MVCAC	61	792	21	154
Non-MVCAC	23	73	40	283
Totals	84	865	61	437

10 Presentations and Publications

Vector-Borne Disease Section staff present information on vector-borne diseases at scientific conferences, continuing education workshops, university courses, and organization training sessions. Research projects in which the Vector-Borne Disease Section was a principal or collaborating investigator are published in the peer-reviewed scientific literature.

Presentations

VECTOR-BORNE DISEASES, GENERAL

Surveillance of Vector-Borne Diseases in California

Anne Kjemtrup: Arthropod-Borne Zoonotic Diseases: Basic Principles and Methods of Study (ESPM 145), University of California, Berkeley
Principles of Epidemiology Course (EPM 405), University of California, Davis

Epidemiology and Prevention of West Nile Virus and Lyme Disease in CA

Anne Kjemtrup: Epidemiology & Control of Infectious Diseases (PH253B), School of Public Health University of California, Berkeley

The Public at the Intersection of Data, Facts, Media and Messaging

Anne Kjemtrup: Introduction to Epidemiology (Humbio151), Stanford

Public Health Surveillance: Idealism versus Realism

Anne Kjemtrup: Topics in Public health Seminar (SPH 290), University of California, Davis

Vector-Borne Diseases in California: 2008-2009 Update

Vicki Kramer: State Public Health Vector Control Conference, Fort Collins, CO

Vector-Borne Diseases of Concern in Camp Wolfeboro

Michael Niemela: Boy Scouts of America Staff Training, Camp Wolfeboro, Stanislaus National Forest

Vector-Borne Diseases of Concern in Yosemite National Park

Michael Niemela: Staff Training, El Portal

Overlooked Vector-Borne Diseases

Michael Niemela: Stanislaus County West Nile Task Force Meeting, Modesto

Vector-Borne Diseases in Tahoe National Forest

Joshua Ogawa: Sierraville Ranger District Safety Meeting, Tahoe National Forest, Sierraville
Truckee Ranger District Safety Meeting, Tahoe National Forest, Truckee

The Vector-Borne Diseases Section: Their Mission: To Protect the Health and Well-Being of Californians from Insect and Animal Transmitted Diseases and Injurious Pests.

Jim Tucker: USFS Mendocino National Forest Supervisors Office, Willows

RODENT-BORNE DISEASE

Plague and Hantavirus

Curtis Fritz: Epidemiology & Control of Infectious Diseases (PH 253B), School of Public Health, University of California, Berkeley

Hantavirus Cardiopulmonary Syndrome in Yosemite

Michael Niemela: NPS Staff and Concessionaire Training, Curry Village

Luberyard-Leek Springs Lookout Hantavirus Surveillance Data Summary

Jim Tucker: USFS Pioneer Ranger District, Pioneer

FLEA-BORNE DISEASE

Plague and Campground Safety

Joshua Ogawa: California Land Management Concessionaires, Tahoe National Forest, Downieville
California Land Management Concessionaires, Lake Tahoe Management Unit, South Lake Tahoe
American Land and Leisure Concessionaires, El Dorado National Forest, Crystal Basin Visitor Center

High Altitude Plague Epizootic in Mono County

Joseph Burns: 78th Annual Conference of the MVCAC, Sacramento

TICK-BORNE DISEASE

Ticks and Rocky Mountain Spotted Fever in California

Renjie Hu: MVCAC Southern Regional Continuing Education Workshop, Anaheim

An Update on Tick-Borne Spotted Fever Group Rickettsiae in Southern California

Renjie Hu: 78th Annual Conference of the MVCAC, Sacramento

Balancing Response and Reassurance in face of Nonspecific Tick-Borne Disease Testing

Anne Kjemtrup: West Coast Epidemiologists Annual Meeting, Yreka

Zoonotic *Babesia*

Anne Kjemtrup: Epidemiology of the Zoonosis Class, (PHR 212), University of California, Davis

Surveillance for Lyme Disease in California with Emphasis on the Laboratory Role

Anne Kjemtrup: California Association for Medical Laboratory Technology, East Bay, Continuing Education Symposium, Berkeley

Basic Molecular Investigations have Changed Assumptions about *Babesia* and other Piroplasm Parasites Infecting Humans and Animals

Anne Kjemtrup: Vector-Borne Infectious Diseases: Changing Patterns (PHR 214). University of California, Davis

Tick-Borne Diseases

Joshua Ogawa: Yuba River Ranger District Safety Meeting, Tahoe National Forest, Camptonville

Tick-borne Spotted Fever Group *Rickettsia* Surveillance in California Ticks from Mexican Border to Oregon

Kerry Padgett: 78th Annual Conference of the MVCAC, Sacramento

The Detection of Potential Pathogens in Ticks

Inger Vilcins: Northern California Parasitologists Meeting – American Society for Parasitology, San Francisco State University, San Francisco

Tick-Borne Disease

Inger Vilcins: South San Joaquin Valley Regional Continuing Education, Visalia

MOSQUITO-BORNE DISEASE

West Nile Virus Dead Bird Surveillance Program

Jaynia Anderson: 78th Annual Conference of the MVCAC, Sacramento

Surveillance for Mosquito-Borne Encephalitis Virus Activity in California, 2009

Tina Feiszli: 78th Annual Conference of the MVCAC, Sacramento

Private Land Mosquito Control BMP(s) and Beyond

Tim Howard: Northern Sacramento Valley Continuing Education, Sacramento

Emerging Arbovirus Surveillance in California

Jonathan Kwan: Sacramento-Yolo Mosquito and Vector Control District Board of Trustees Meeting, Elk Grove

Malaria in the United States and Abroad

Michael Niemela: MVCAC San Joaquin Valley Regional Continuing Education Workshop, Visalia

CALTRANS STORMWATER PROJECT

Stormwater and Mosquitoes: A Decade of Study
Marco Metzger: 78th Annual Conference of the MVCAC, Sacramento

Stormwater BMPs with an Emphasis on Emerging LIDs
Marco Metzger: Southern California Vector Control Environmental Taskforce, Vector Minimization Workshop, Los Angeles

Study of Stormwater BMPs along SR-125, San Diego County
Marco Metzger: Southern California Vector Education Cooperative, October CEU Program, San Diego

U.S. FOREST SERVICE

Vector-Borne Diseases in California's National Forests
Joseph Burns: Inyo NF Concessionaire Safety Meeting, Mammoth Lakes
Inyo NF Volunteers Meeting, Mammoth Lakes
Mountaintop Ranger District, San Bernardino National Forest

Vector-Borne Diseases in Region Five
Michael Niemela: Stanislaus National Forest Supervisor Talk
Staff Training, Calaveras Ranger District, Stanislaus National Forest

OTHER VECTORS AND PUBLIC HEALTH PESTS

"Don't Let the Bed Bugs Bite" A Review of Current Bed Bug Literature and Resources
Denise Bonilla: 78th Annual Conference of the MVCAC, Sacramento

Re-Emergence of Bedbugs in California
Tina Feiszli: Aging Services of California, Berkeley

Update on Brown Widow Spiders in California
Marco Metzger: Southern California Vector Education Cooperative, October CEU Program, San Diego

Biogeography of the Forensically Important Flies of California
Michael Niemela: 78th Annual Conference of the MVCAC, Sacramento

Taxonomy and Ecology of the Forensically Important Flies of California
Michael Niemela: Forensic Entomology (ENT 158), University of California, Davis

The Public Health Importance of Triatoma Bugs in California
Michael Niemela: Bohart Museum, Staff Meeting, University of California, Davis

DVD CONTINUING EDUCATION VIDEO PRESENTATION

An Introduction to Zoonoses
Curtis Fritz: CDPH and MVCAC California Vector Control Training DVD, Category D

Rat Bite Fever
Curtis Fritz: CDPH and MVCAC California Vector Control Training DVD, Category D

Brown is the New Black: *Latrodectus Geometricus* in California
Marco Metzger: VBDS Continuing Education Video Presentation Series, Section C

Plague Surveillance and Control
Mark Novak: Continuing Education Workshop: Vertebrates of Public Health Significance in California, Section D

MISCELLANEOUS

A Scientific and Empathetic Approach to Public Health Education
Claudia Erickson: 78th Annual Conference of the MVCAC, Sacramento

Searching the Want Ads: What Do I Do with a Masters in Public Health?
Curtis Fritz: Topics in Public Health Seminar (EPP 298-012), University of California, Davis

Arthropods of Public Health Importance
Tim Howard: Lassen County Ag Continuing Education, Lassen
Pesticide Toxicology and Applicator Safety
Tim Howard: PAPA CE Program, Chico
Public Health Surveillance: Conveying Numbers with Meaning
Anne Kjemtrup: 78th Annual Conference of the MVCAC, Sacramento
GIS Workshop
Jonathan Kwan: 78th Annual Conference of the MVCAC, Sacramento
The Vertebrate Pest Control Research Advisory Committee – 10 Reasons Why You Should Be Interested
Mark Novak: 78th Annual Conference of the MVCAC, Sacramento
Feral Animals of Australia
Inger Vilcins: Alameda (Coastal Region) Continuing Education, Alameda, CA
Host Identification Through Blood Meal Analysis
Inger Vilcins: 78th Annual Conference of the MVCAC, Sacramento

Posters

Marina E. Eremeeva, Maria L. Zambrano, Kyle F. Abramowicz, Sandor E. Karpathy, **Denise Bonilla**, **Martin Castro, Mike Niemela, Mark Novak**, Peter Bonkrude, **Larry Bronson**, Bonnie Ryan, Brittney Mills, Dave Woodward, Sandi Courcier, Terry Sanderson, Steve Schutz, Eric Ghilarducci, Chindi Peavey, Jamesina J. Scott, Ron Keith, Bill Pitcher, Gregory A. Dasch, **Kerry Padgett**. *Dermacentor occidentalis* and the Risk of Spotted Fever Group Rickettsiosis in Northern California. 2010 Annual Meeting of American Society for Microbiology (San Diego May 23-27, 2010)

Publications

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11

Reports and Public Information Materials

One of the overarching goals of the Vector-Borne Disease Section is to provide clear and effective information on prevention of vector-borne diseases to interested organizations and the general public. The Vector-Borne Disease Section pursues this goal through a variety of print and other media. Listed below are preventive materials that were newly developed or revised in 2010.

Rodent-borne Diseases

- *Rodents and Hantavirus,* brochure (revised)

Flea-borne Diseases

- *Facts about Plague,* brochure (revised)

The "Don't Let the Ticks Bite Curriculum Guide for Teachers" developed in 2010 received national attention with a link posted to the Centers for Disease Control and Prevention Tick webpage.

Tick-Borne Diseases

- *Don't Let the Ticks Bite,* curriculum guide for teachers
- *Tick-Borne Disease Prevention: Stuff for Kids,* webpage

Mosquito-Borne Diseases

- *West Nile Virus Activity* – North Coastal Region, Seasonal E-Newsletter
- *West Nile Virus - Keep it On Your Radar*, website presentation for physicians, emergency room flyer
- *Common Nuisance and Vector Mosquitoes of National Parks and National Forests of California,* electronic document, National Park Service distribution

Other Vectors and Public Health Pests

- *Bed Bugs Fact Sheet* (revised)
- *Easy to Read Bed Bug,* fact sheet (revised)
- *Don't let the Bed Bugs Bite* (revised)

- *Conenose Bugs in California: Information for Vector Control Agencies and Health Professionals*, fact sheet
- *Nuisance Flies Fact Sheet*, webpage

Vector Control Technician Certification Program

- *Pesticide Application and Safety Training for Applicators of Public Health Pesticides*, training manual (revised)
- *Vertebrates of Public Health Significance,* training manual (revised)

Stormwater Management

- *Checklist for Minimizing Vector Production in Stormwater Management Structures*, new resource added to CDPH website
- *Mosquito Myth-Busting 101: Belowground Stormwater BMPs and Mosquitoes*, web blog @ www.stormh20.com/blogs

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