



**PACIFIC SOUTHWEST** CENTER OF  
**VECTOR-BORNE DISEASES** EXCELLENCE IN

**PIHOA**  
PACIFIC ISLAND HEALTH  
OFFICERS' ASSOCIATION

# Support for the US Pacific Regional IVM Plan for Mosquito Surveillance

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Co-Director, Pacific Southwest Center of Excellence in Vector-Borne Diseases



**UC DAVIS**  
UNIVERSITY OF CALIFORNIA

# PACIFIC ISLAND VECTOR MANAGEMENT IMPROVEMENT: A STRATEGY AND ITS IMPLEMENTATION

Dr. Grayson Brown

Public Health Entomologist

Pacific Island Health Officers Association





# 28 EPIDEMICS IN THE S. PACIFIC IN 2012 - 2014

## Vector Borne Disease has been a continuing problem in the Pacific islands

Source: Roth A, Mercier A, Lepers C, Hoy D, Duituturaga S, Benyon E, Guillaumot L, Souares Y. Concurrent outbreaks of dengue, chikungunya and Zika virus infections – **an unprecedented epidemic wave** of mosquito-borne viruses in the Pacific 2012–2014. Euro Surveill. 2014;19(41):pii=20929.





# CURRENT SITUATION: FRAGMENTED

Island	Surveillance Method <sup>1</sup>	Vector Identification Capability	Control Options Used <sup>2</sup>	Insecticide Resistance Testing <sup>3</sup>	Virologic Vector Tests	Community Outreach Program
Saipan (CNMI)	Ov	Partial	PCC	No	No	
FSM -- Chuuk	No	No	MB, LC	No	No	Yes
FSM -- Kosrae <sup>a</sup>	Ov, GAT	No	MB, LC	No	No	
FSM -- Pohnpei <sup>b</sup>	No/GAT	No	No	No	No	
FSM -- Yap	No	No	No	No	No	
Guam -- Civilian	Ov, GAT, uLT	Yes	MB, LC, SR	CDCBT	No	Yes
Guam -- Military	Ov, iLT	Partial	SR, PCC	No	No	Yes
Palau	Ov	Yes	MB, SR, LC, ULV	WHOPES	No	Yes
RMI -- Majuro	No	No	MB, LC	No	No	

## Legend

Ov – Ovitraps

GAT – Gravid Aedes Trap

xLT – Light Trap, incandescent, ultraviolet

MB – Mist Blower

LC – Laticide

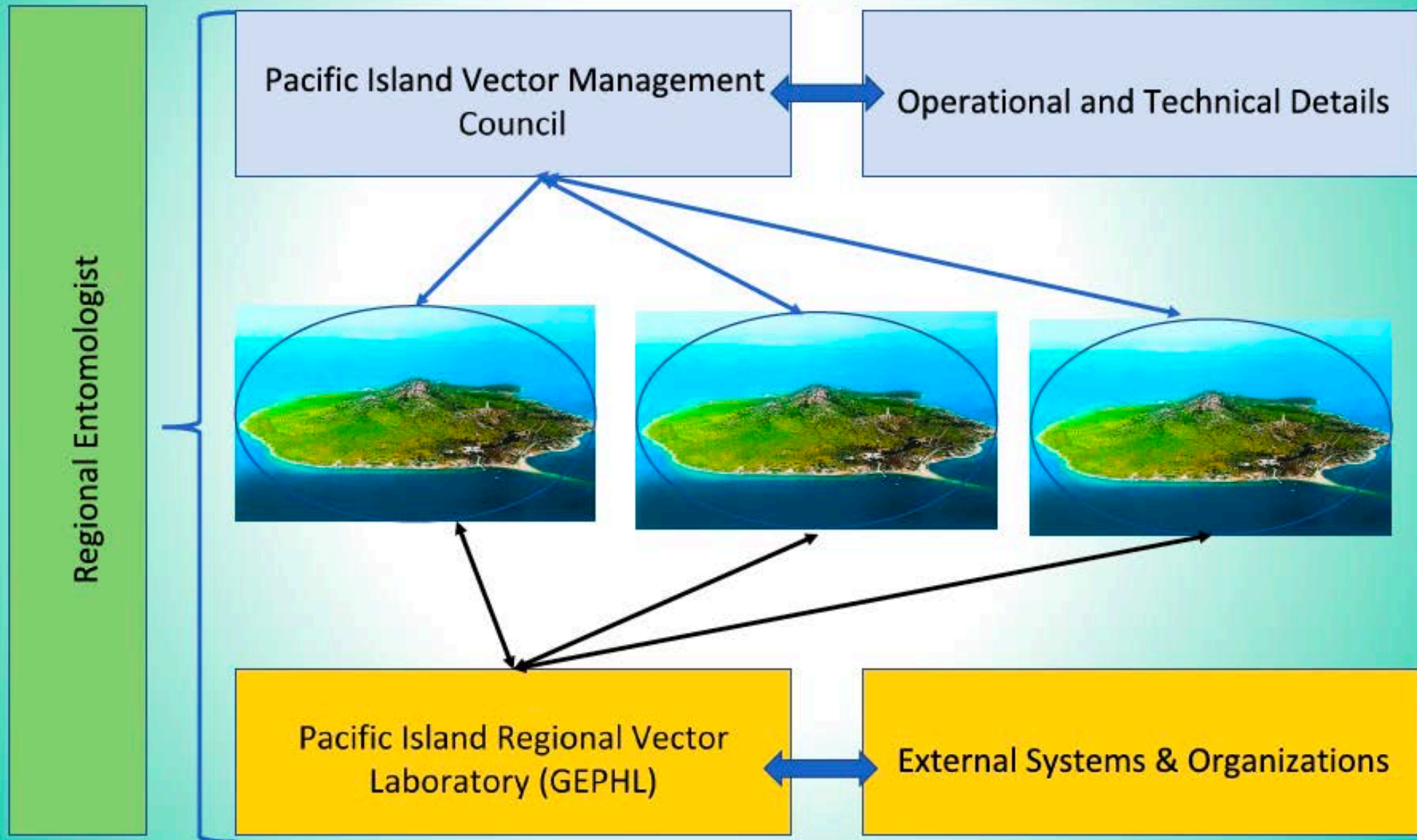
SR – Source Reduction

PCC – Pest Control Company

ULV – Ultra Low Volume spray



# OVERALL PROGRAM ORGANIZATION





UCDAVIS

UNIVERSITY OF CALIFORNIA  
UCRIVERSIDE



# PACIFIC SOUTHWEST CENTER OF VECTOR-BORNE DISEASES EXCELLENCE IN




**MVCAC**  
Mosquito and Vector Control  
Association of California

# Pacific Southwest Center of Excellence in Vector-Borne Diseases



- One of five CDC regional CoEs
- Covers CA, HI, AZ, NV, UT, & USAPIs
- CDC-funded partnership between UCD, UCR and regional stakeholders in public health and mosquito control
- 2017 – 2021
- Goal: To enhance the capacity of our region to respond to VBDs that affect human health



Connect with us!  
**Website:** [pacvec.us](http://pacvec.us)  
 **@PacVecCenter**

# PacVec At-A-Glance

vector genetics  
vector control  
cell biology computer science  
epidemiology  
entomology  
ecology arbovirology  
engineering toxicology  
statistics environmental chemistry  
public health





# Recent Challenges in the Pacific Southwest

- Spread of invasive *Aedes*
  - 2011: 3 cities with *Ae. albopictus*
  - 2017: 150 cities with *Ae. aegypti*
    - 56 cities with *Ae. albopictus*
- Emergence of Zika virus
  - 2015-2018: > 600 infected travelers
- Dengue outbreaks in American Samoa, Palau
- West Nile virus
- Return of St. Louis encephalitis virus, 2015-present
- Emergence of *Rhipicephalus sanguineus* and RMSF in the Southwest
- Other tick-borne pathogens (*Rickettsia* 364D, *Borrelia miyamotoi*)
- Outbreak of *Rickettsia typhi* in southern California

# Data Management, Analysis, Visualization, & Sharing



# Data Sharing & Visualization:

## The CalSurv Family

- States/Territories
  - California, Guam, Utah, New Jersey
- Agencies:
  - CA: 78 agencies
  - PIHOA: 1 agency
  - UT: 13 agencies
  - NJ: 25 agencies
- Data:
  - 1.5 million collection events, 8.8 million trap-nights



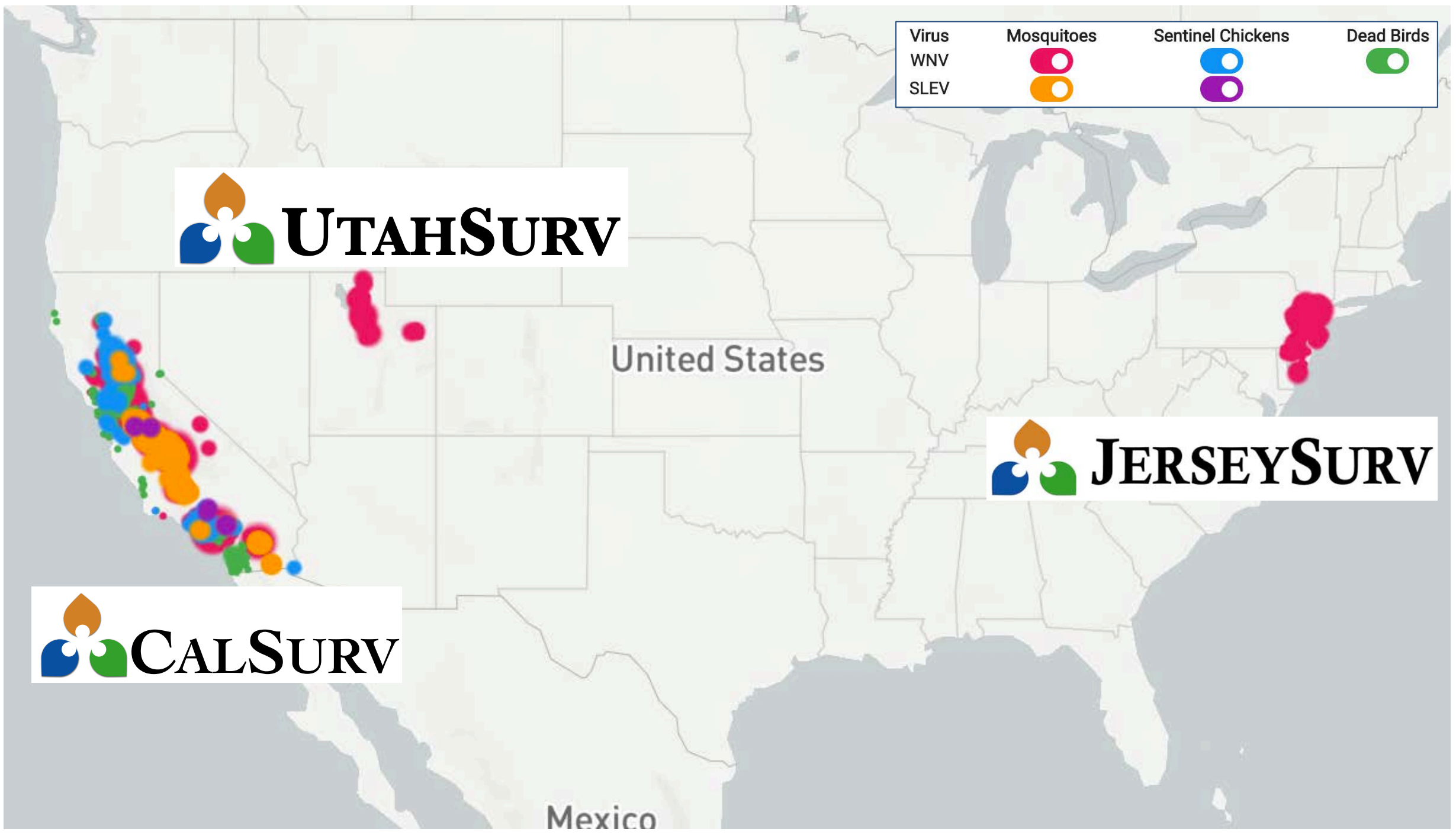
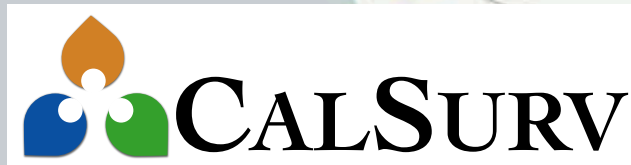
# Guiding Principles



- Rapid reporting
  - Immediate reporting of test results to source agency via email
  - Immediate updates to databases & maps
- “Value Added”
  - Integrates with daily workflows to make IVM easier
  - Tools for data analysis and visualization
- Global scalability
- Originating agencies retain all data rights
- User-level permissions and passwords
- Data import/export, exchange with 3<sup>rd</sup> party software



Virus	Mosquitoes	Sentinel Chickens	Dead Birds
WNV			
SLEV			



### ❑ Online platform for management and analysis of VBD surveillance data

- Surveillance Sites
- Mosquito Collections
- Mosquito Testing
- Sentinel Animal Testing
- Insecticide Applications
- Insecticide Resistance

### ❑ Established in 2006

### ❑ Used by agencies large and small

- Direct data entry, analysis, and export
- API for connection to in-house software

Sites Arthropod Sentinel DiSen Carcass Diagnostics Application Resistance Tools Settings Help Logout

Config Abundance Pools

#### Update Collection

Collection ID: 5674

\*Trap Type: CO2

\*Collection Date: 2015-08-25 Trap started the evening of 2015-08-24.

\*# of Traps: 2

\*# of Nights/Trap: 1

Trap(s) at Site: 243032 - Z42-Core Rd

DD DMS DM Map

Latitude: 38.357533  
If the Latitude is in the southern hemisphere, the value must be prefixed by the minus '-' sign.

Longitude: -121.44697  
If the Longitude is in the western hemisphere, the value must be prefixed by the minus '-' sign.

Identified By:

☒ Trap(s) ran with no problems?

Comments:

Count of Species

Species	M	F - Mixed	F - Unfed	F - Bloodfed	F - Gravid	Σ F	Unknown Sex	Eggs	Larvae	Pupae
1 Culex tarsalis	1	56				56				
2 Culex pipiens	2	270				270				
3 Aedes melanimon		2				2				
4 Anopheles freeborni		1				1				
5 Aedes vexans		23				23				
6						0				
	3	352	0	0	0	0	0	0	0	0

→ Pools

#### Current Agency

By changing agencies, settings may adjust to accommodate agency-specific rules.

SAYO (Administrator)

☐ Keep block collapsed.

#### Link Pools

Click here to link unassociated pools to this collection.

#### Last Collection #1

Collection #: 5764  
Trap Type: GRVD  
Trap at Site: 213009  
Collection Date: 2015-08-25  
# of Trap Nights: 1  
Identified By:  
Trap Problems?: No  
Add Date: 2015-08-25 01:54 PM

#### Last Collection #2

#### Last Collection #3

#### Last Collection #4

#### Last Collection #5

#### Used 2015 Pool #s

#### Open 2015 Pool #s

The following ranges are available for use for Surveillance Year: 2015

4485 - 150000



# Surveillance Site Management

\*Site Code **GUAM** 000024

Site Name Port Authority of Guam 004

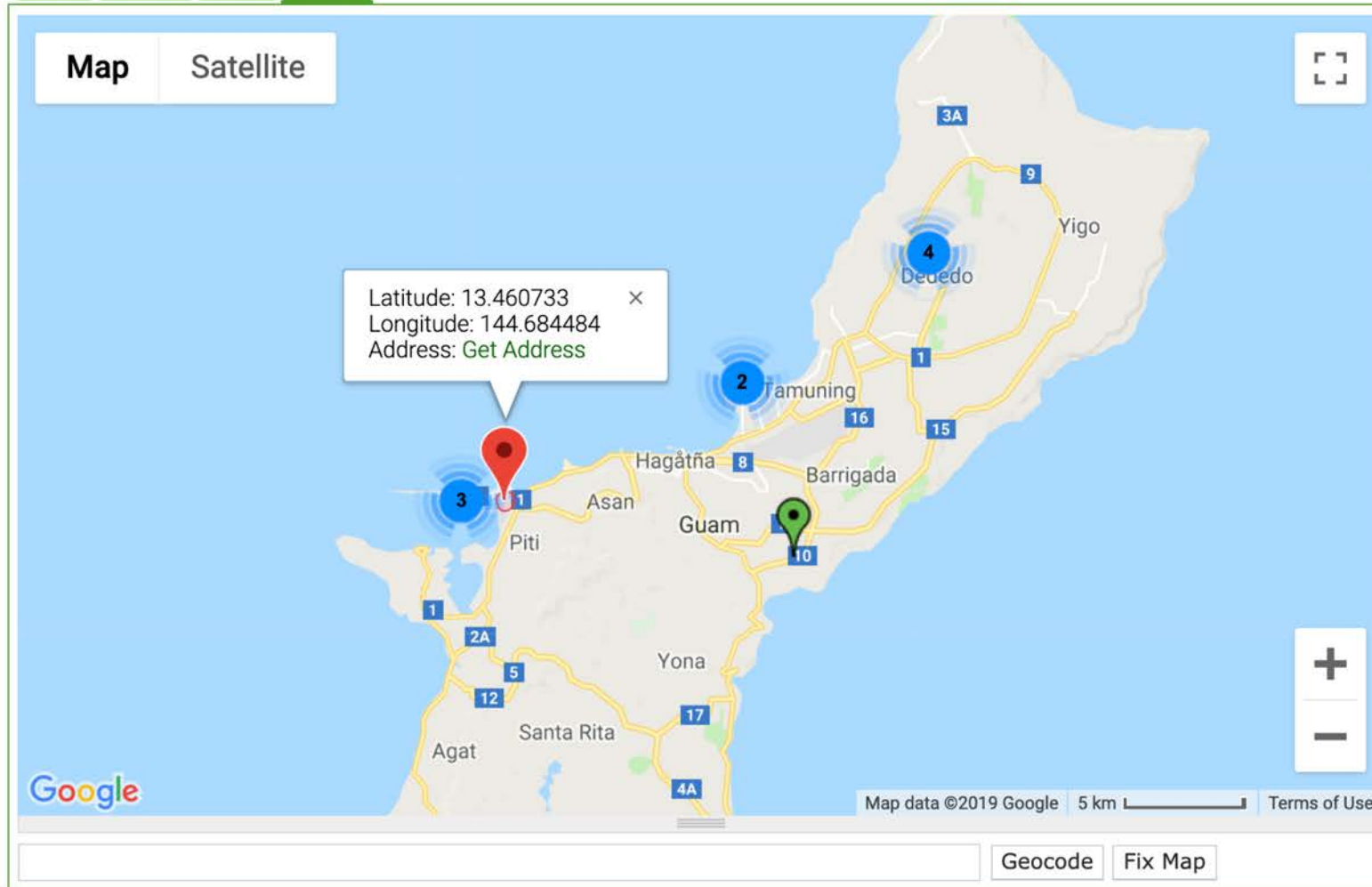
\*Coordinates

DD

DMS

DM

Map



# Mosquito Surveillance: Data Entry

Sites Arthropod Sentinel DiSen Carcass Diagnostics Application Resistance Tools Settings Help Logout  
Config Abundance Pools

## Update Collection

Collection ID 5674

\*Trap Type CO2

\*Collection Date 2015-08-25  Trap started the evening of 2015-08-24.

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Identified By

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Comments

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Species	M	F - Mixed	F - Unfed	F - Bloodfed	F - Gravid	Σ F	Unknown Sex	Eggs	Larvae	Pupae
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5 Aedes vexans		23				23				
6						0				
	3	352	0	0	0	0	0	0	0	0

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Add Date: 2015-08-25 01:54 PM

### Last Collection #2

### Last Collection #3

### Last Collection #4

### Last Collection #5

### Used 2015 Pool #s

### Open 2015 Pool #s

The following ranges are available for use for Surveillance  
Year: 2015

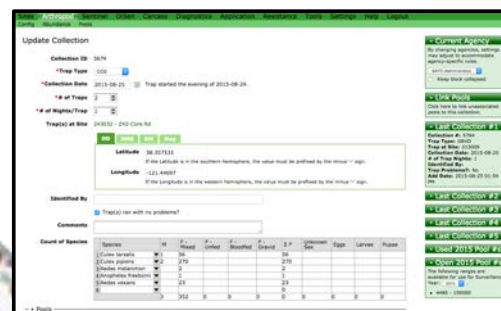
4485 - 150000

→ Pools

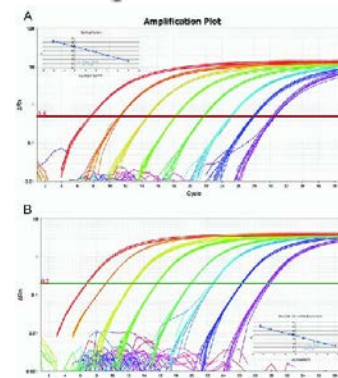




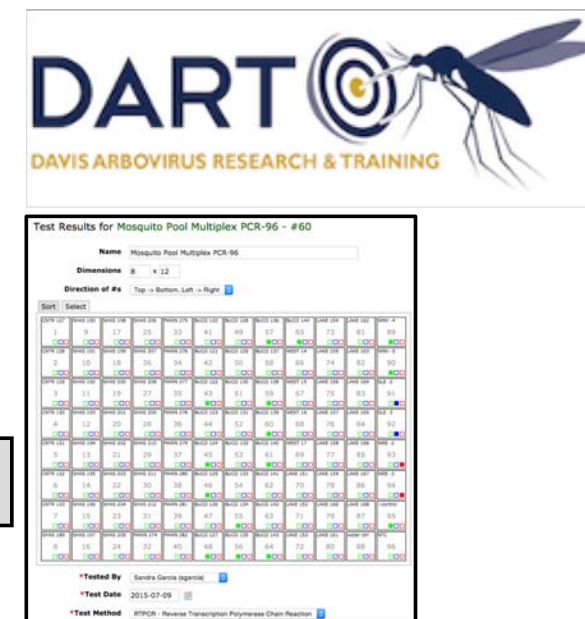
California Vectorborne  
Disease Surveillance Gateway



## Field data entry



## Laboratory data entry



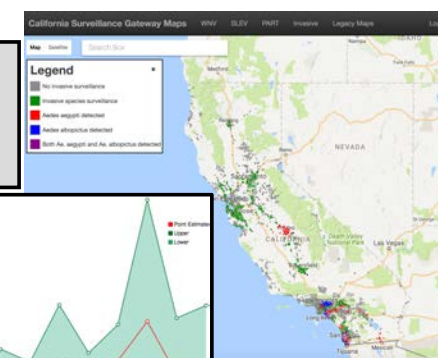
## National Databases



ArboNET  
MosquitoNET



## Interactive Maps and Tools

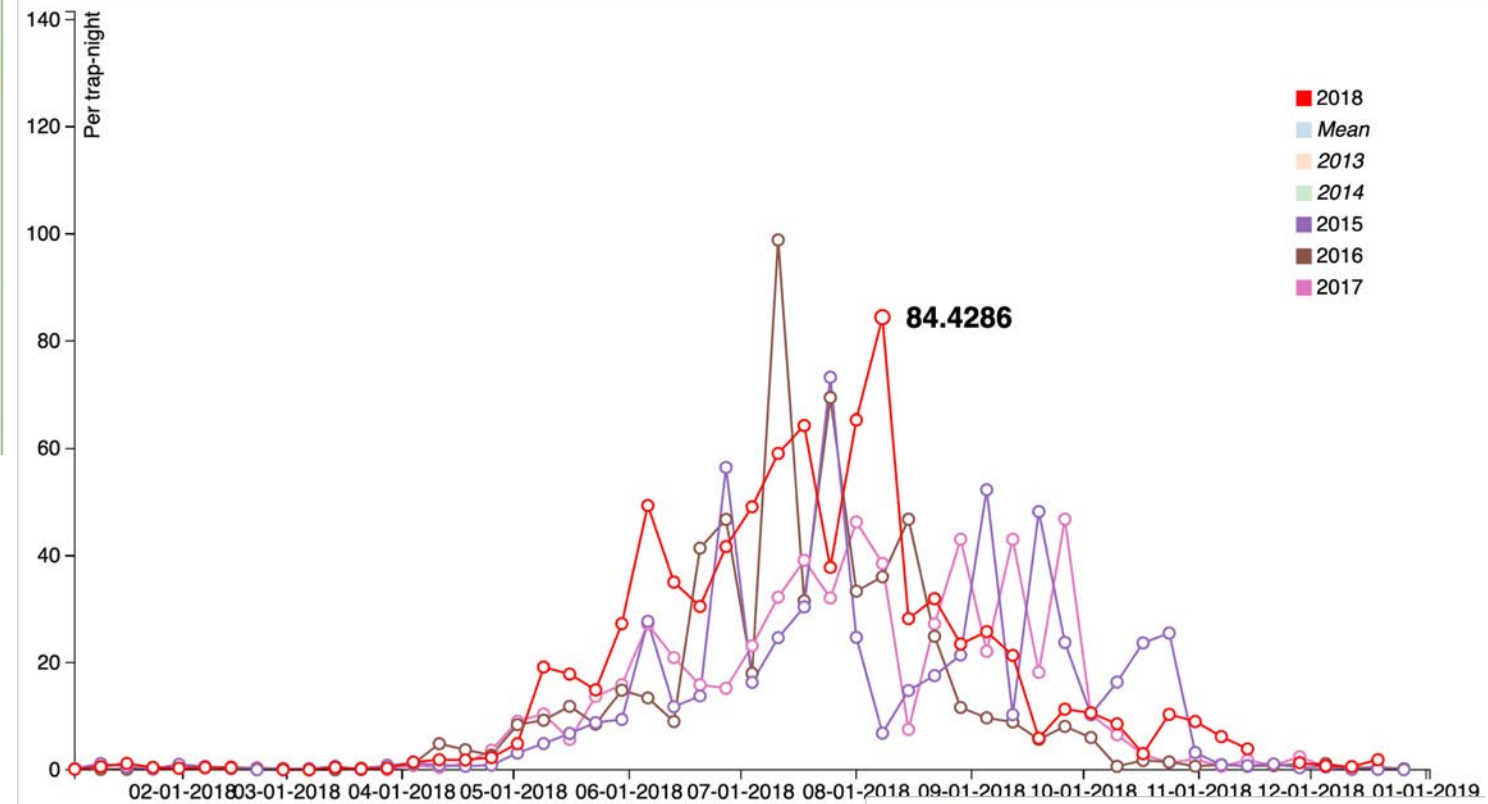
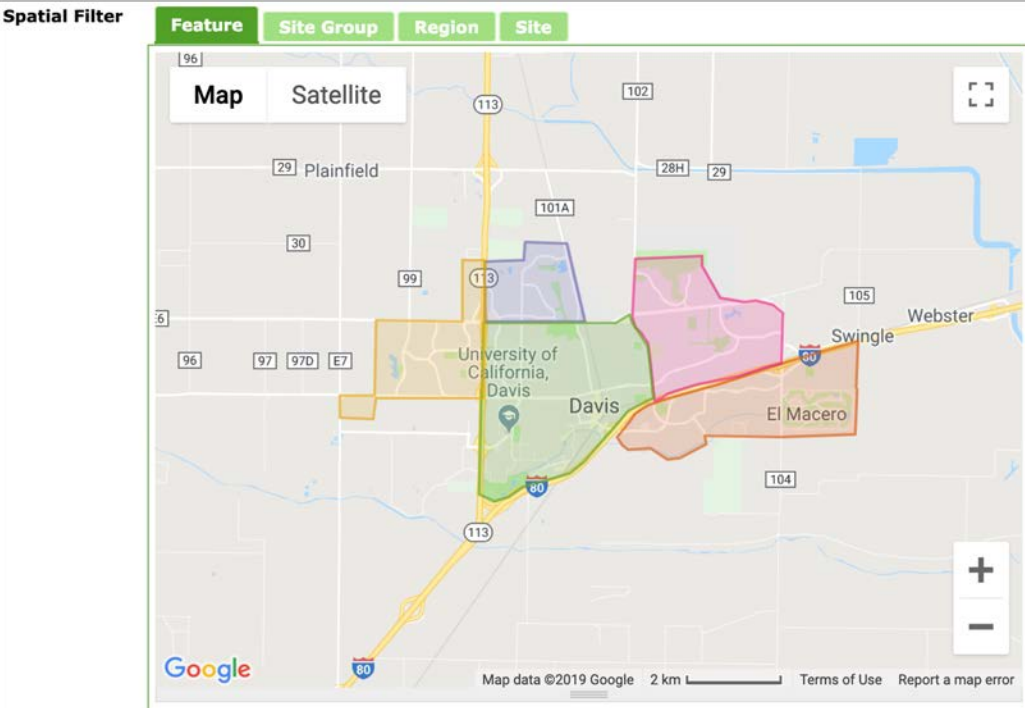


Arbovirus bulletins,  
Automated emails



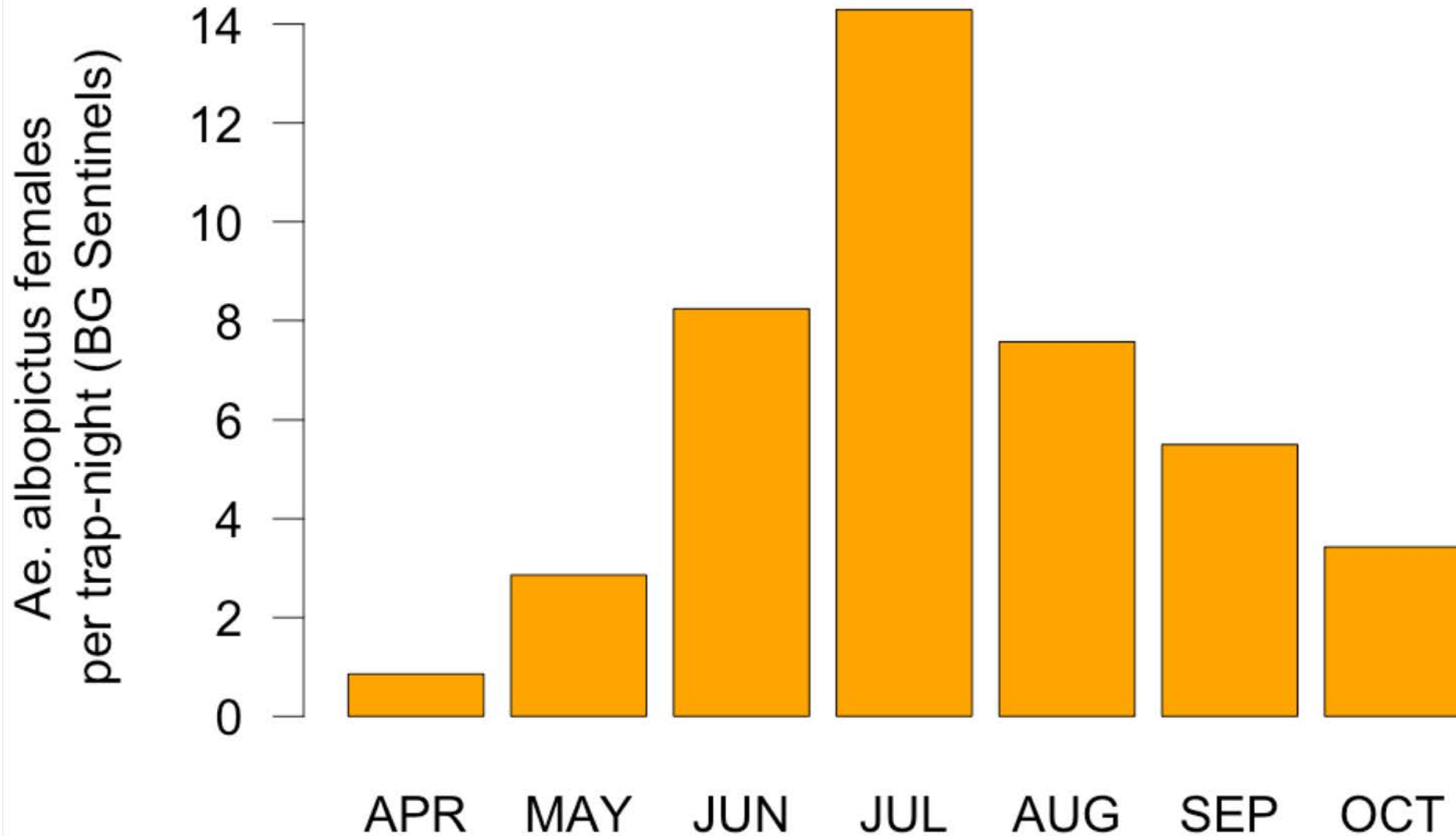


# Data Visualization: Abundance Anomaly



# Data Visualization:

## Guam DEH Mosquito Surveillance, 2018



# Insecticide Resistance

- Bottle bioassays, Larval bioassays, KDR

## New Bottle Bioassay

\*Date: 03-23-2018  
 \*Material: Deltamethrin  
 Technical Grade  
 Lot #: A130  
 \*Species: Aedes aegypti  
 \*Mosquito Source: ☐ Colony ☒ Field  
 Map:

Tested By:   
 Description:   

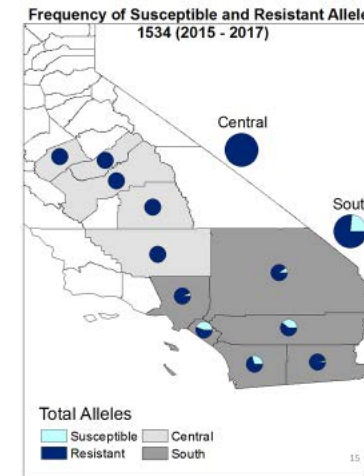
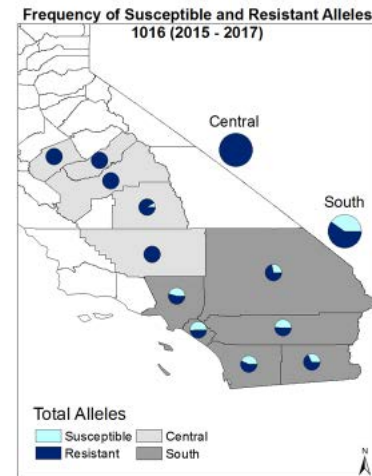
Replicate	Control	1	2	3	4
Time	Alive	Alive	Alive	Alive	Alive
0 minutes	25	25	25	23	23
15 minutes	25	25	25	22	23
30 minutes	25	25	24	22	17
45 minutes	25	20	22	17	10
60 minutes	25	15	12	10	1
75 minutes	25	12	3	7	0
90 minutes	25	7	0	2	0
105 minutes	25	0	0	0	0
120 minutes	25	0	0	0	0
135 minutes	25	0	0	0	0
150 minutes	25	0	0	0	0
165 minutes	25	0	0	0	0
180 minutes	25	0	0	0	0

\*Trap Type: BGSENT  
 \*Collection Date: 05-23-2017  
 Trap started the evening of 05-22-2017.  
 \*# of Traps: 1  
 \*# of Nights/Trap: 1  
 Trap(s) at Site: 000708 - Oasis  
 DD DMS DM Map  
 Latitude: 33.732284  
 If the Latitude is in the southern hemisphere, the value must be prefixed by the minus '-' sign.  
 Longitude: -116.22191  
 If the Longitude is in the western hemisphere, the value must be prefixed by the minus '-' sign.  
 Identified By:   
☒ Trap(s) ran with no problems?  
 Comments:   
 Count of Species:
 

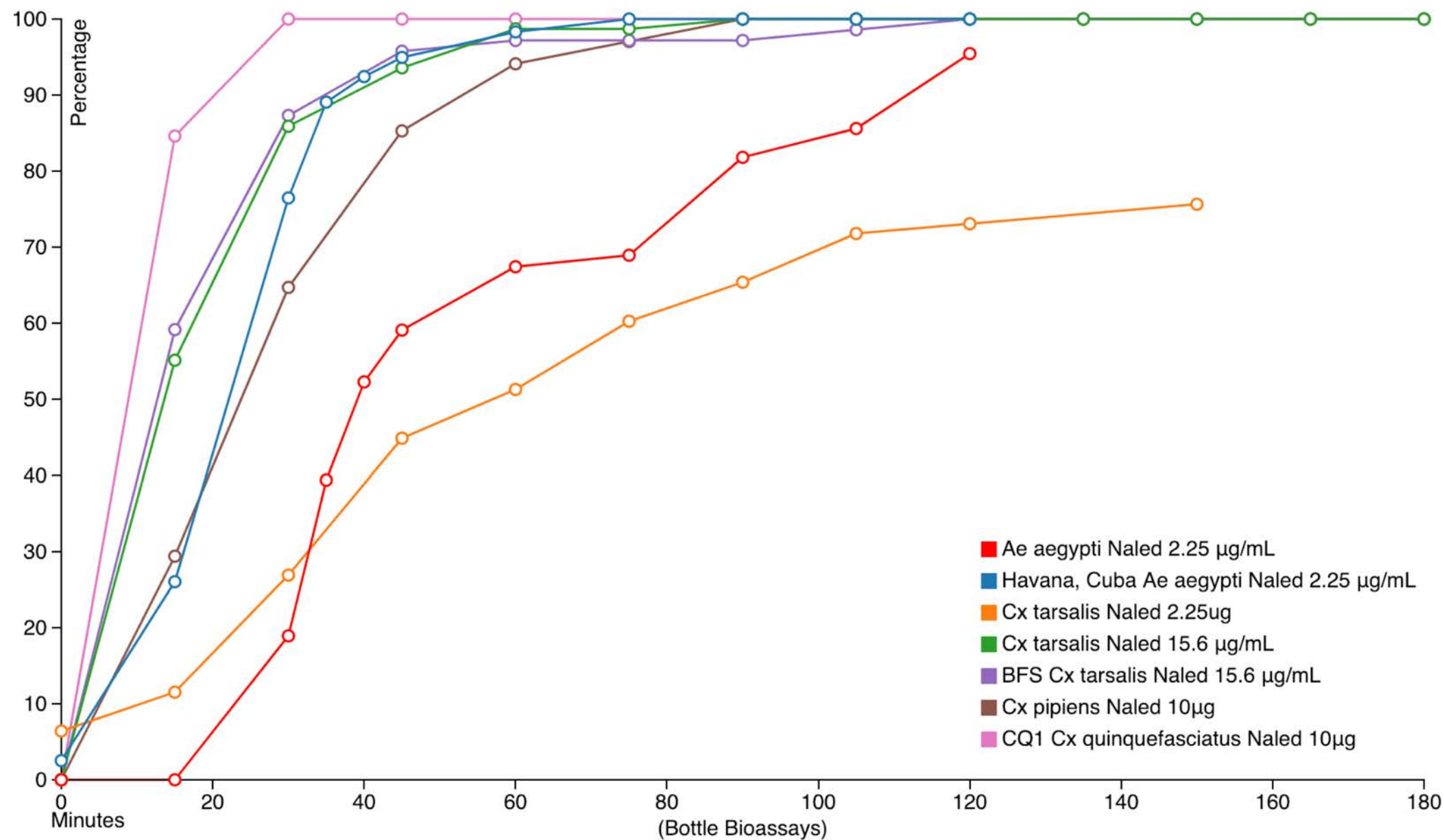
Species	M	F - Mixed	F - Unfed	F - Bloodfed	F - Gravid	Σ F	Unknown Sex	Eggs	Larvae	Pupae
1	0	0	0	0	0	0	0	0	0	0

 \* KDR Tubes:
 

Include?	Tube #	Storage	Collected Live	Collection Date	Site Code	Trap Type	Life Stage	Sex	Species
<input checked="" type="checkbox"/>	COAV17- 120	Dry	Yes	05-23-2017	000708	BGSENT	Adult	M	Aedes aegypti







# California Mosquito-borne Virus Surveillance and Response Plan

Risk Level	Avg. Daily Temperature	Adult mosquito abundance	Mosquito MIR/1,000	Chicken Seroconversions	Dead Bird Infections	Human Cases
<b>1</b>	<56°F	< 50% 5-yr. Avg.	0	0 in region	0 in region	
<b>2</b>	57-65°F	50-90% 5-yr. Avg.	0.1 – 1.0	≥ 1 in region, 0 in agency	≥ 1 in region, 0 in agency	
<b>3</b>	66-72°F	91-150% 5-yr. Avg.	1.1 – 2.0	1 flock in agency	1 in agency	≥ 1 in region, 0 in agency
<b>4</b>	73-79°F	151-300% 5-yr. Avg.	2.1 – 5.0	2 flocks in agency	2-5 in agency	1 in agency
<b>5</b>	>79°F	> 300% 5-yr. Avg.	> 5.0	>2 flocks in agency	>5 in agency	>1 in agency

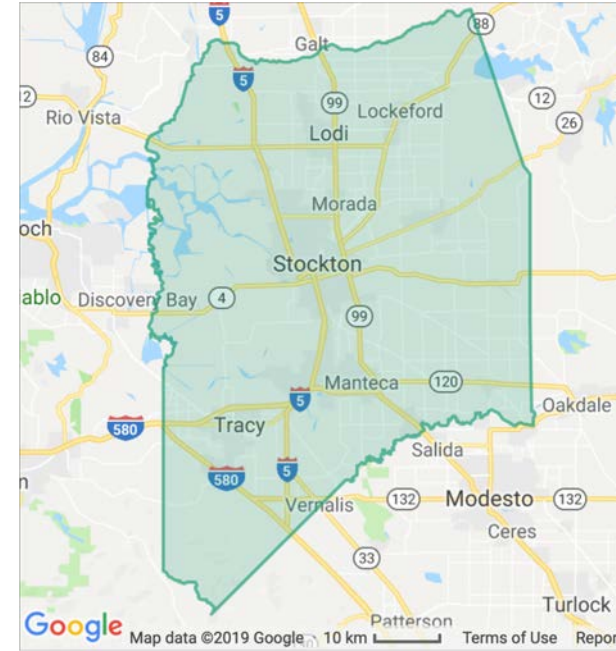
SCORE	RISK LEVEL
1.0—2.5	Normal season
2.6—4.0	Emergency planning
4.1—5.0	Epidemic

On the web at  
<http://westnile.ca.gov/resources.php>

# CalSurv Gateway Risk Calculator



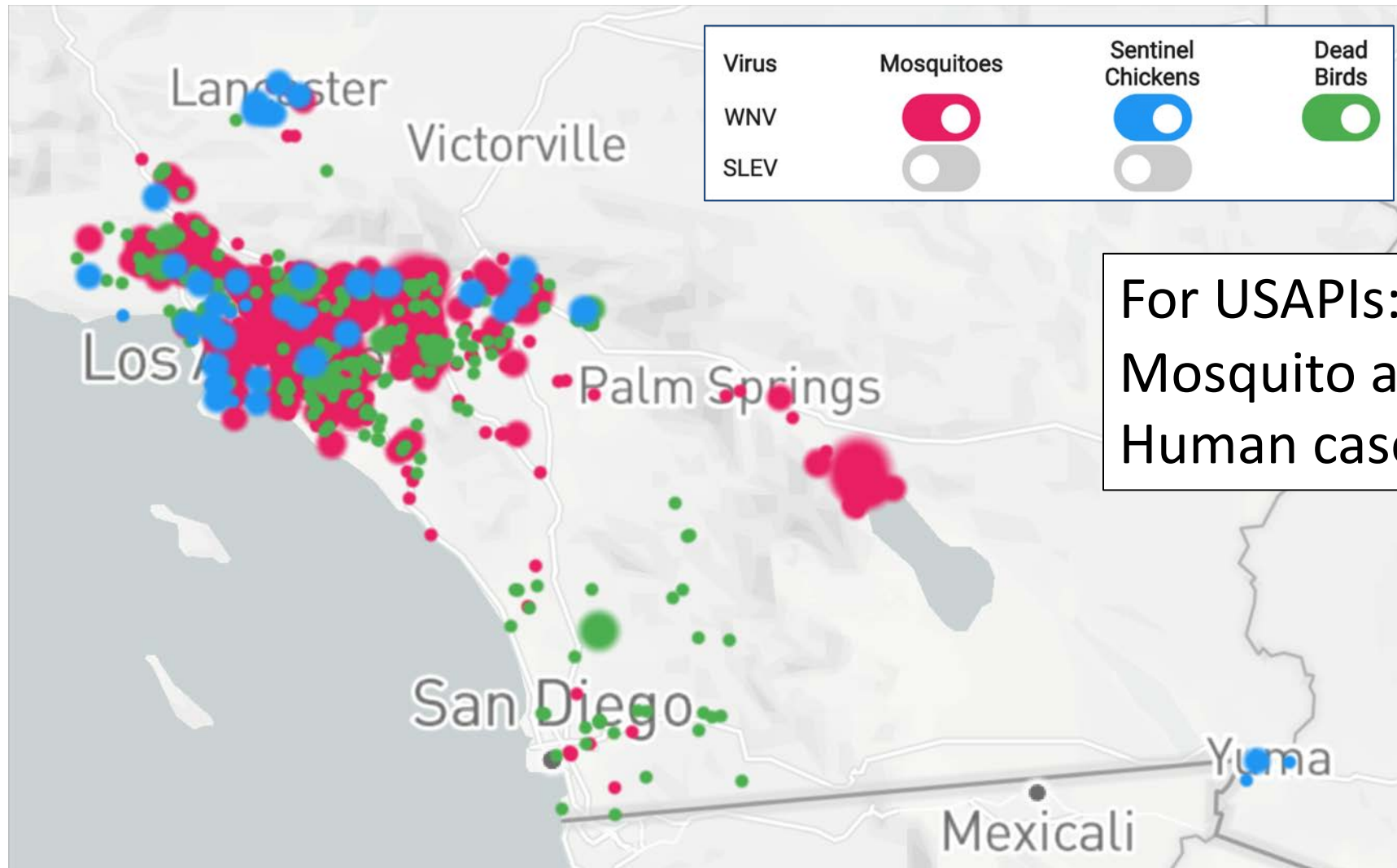
Time Interval	2018 by Week
Agency	San Joaquin County MVCD
Spatial Filter	San Joaquin County
Target	WNV
Trap Type	CO <sub>2</sub> -baited traps, gravid traps
Sex	Female mosquitoes
Species	<i>Culex tarsalis</i> , <i>Culex pipiens</i>



	05-05-2018	05-12-2018	05-19-2018	05-26-2018	06-02-2018	06-09-2018	06-16-2018	06-23-2018	06-30-2018	07-07-2018	07-14-2018	07-21-2018	07-28-2018	08-04-2018	08-11-2018	08-18-2018	08-25-2018	09-01-2018	09-08-2018	09-15-2018	09-22-2018	09-29-2018	10-06-2018	10-13-2018	10-20-2018	10-27-2018
<b>Risk</b>	1.3	1.8	1.5	1.8	2.3	2.3	2.8	2.8	3.5	4	3.8	4.5	4.3	4.5	4.5	4.5	4.3	4.3	4.5	4	3.8	4	3.8	3.3	3	2.5
<b>Environment</b>	2	3	2	2	3	3	4	4	4	4	5	5	5	4	4	4	3	3	4	3	3	3	3	3	2	2
<b>Abundance</b>	1	2	1	2	3	3	3	3	4	5	4	4	3	5	4	4	4	4	5	5	5	5	5	4	3	3
<b>Infection</b>		1	1	1	1	1	2	2	3	4	3	5	5	5	5	5	5	5	5	4	3	4	3	2	3	1
<b>Dead Bird</b>	1	1	2	2	2	2	2	2	3	3	3	4	4	4	5	5	5	5	5	4	4	4	4	4	4	4



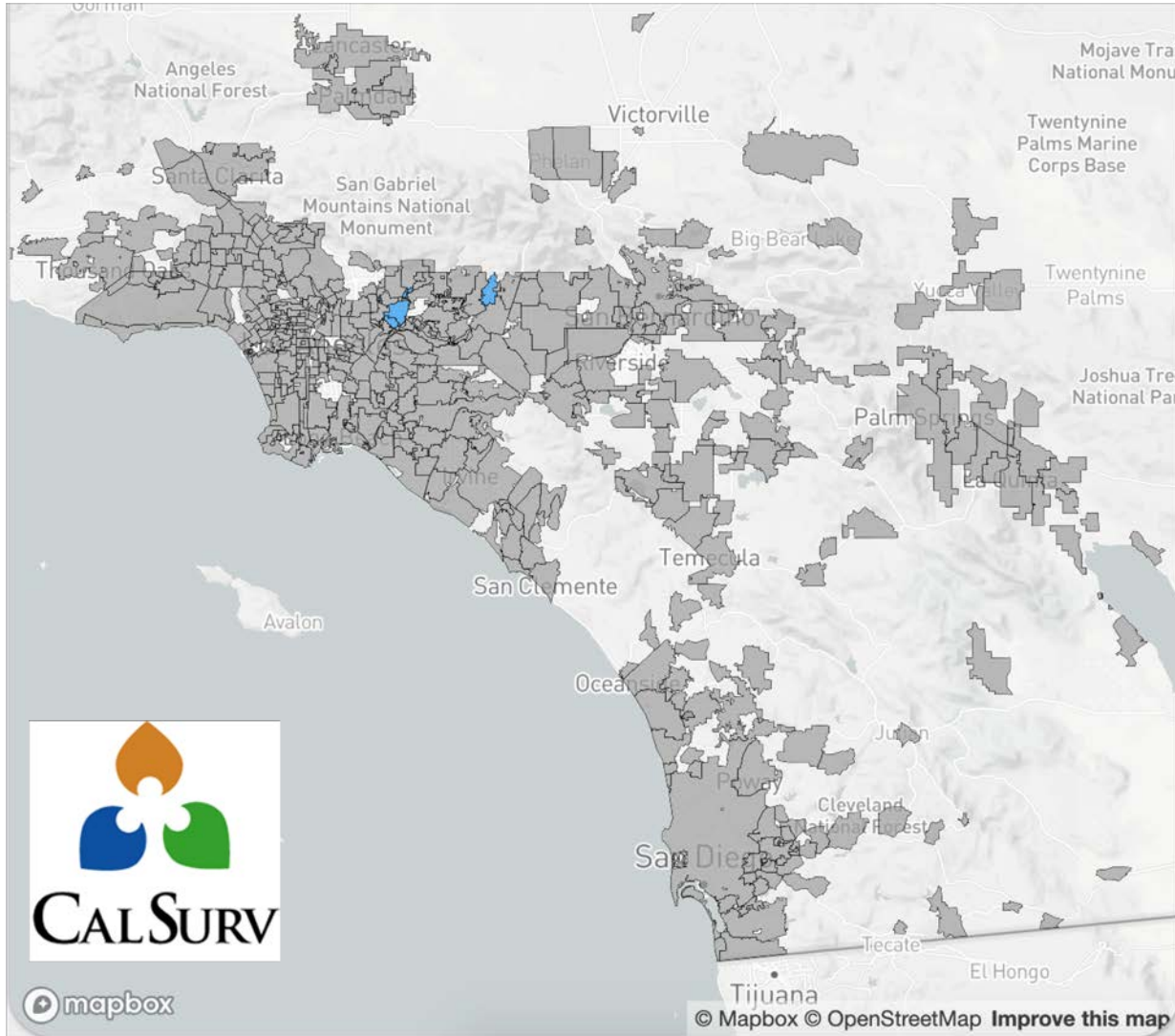
# West Nile virus detections by method, 2017



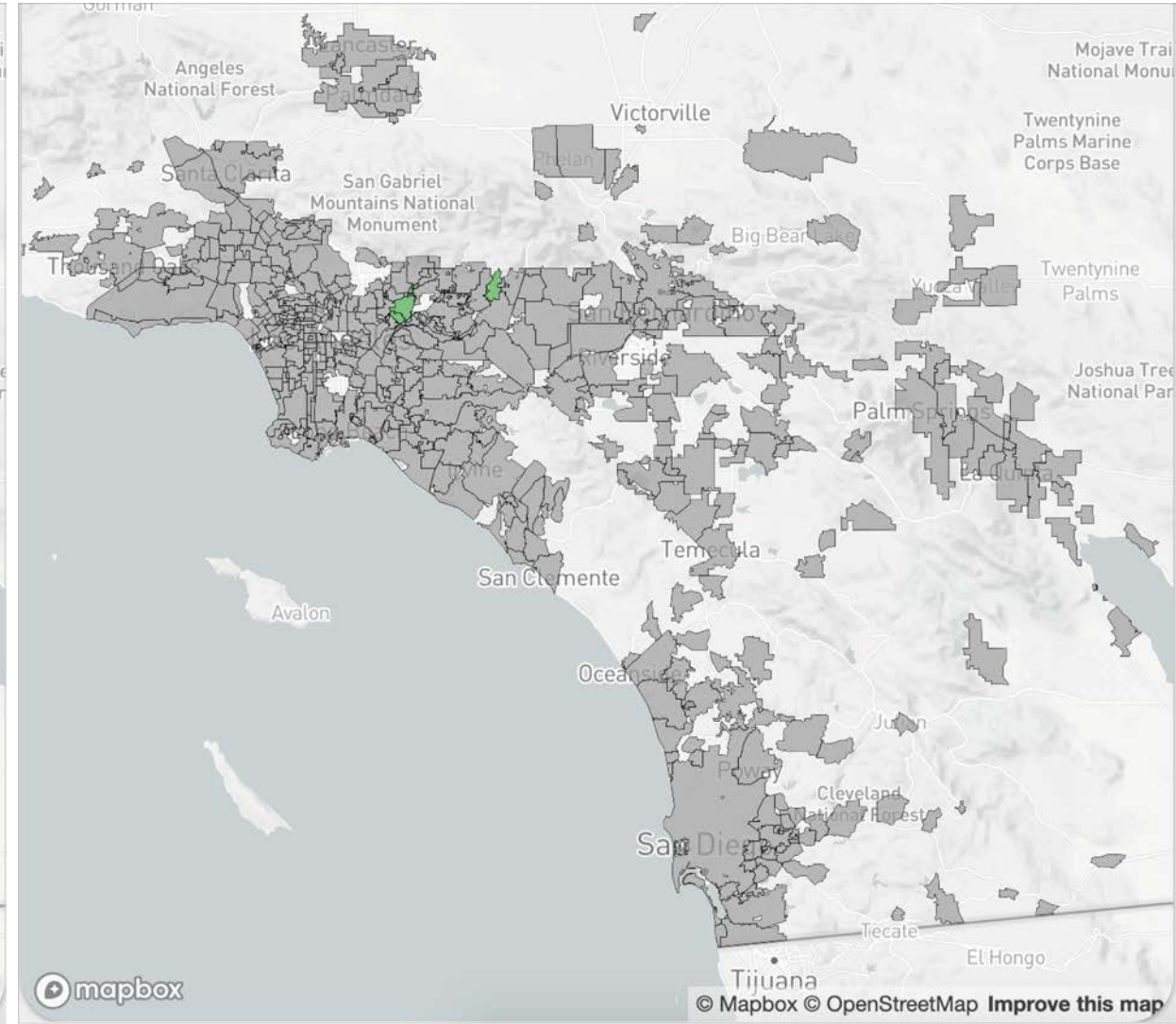
<https://maps.calsurv.org>

2011 2012 2013 2014 2015 2016 2017 2018

*Ae. albopictus*



*Ae. aegypti*

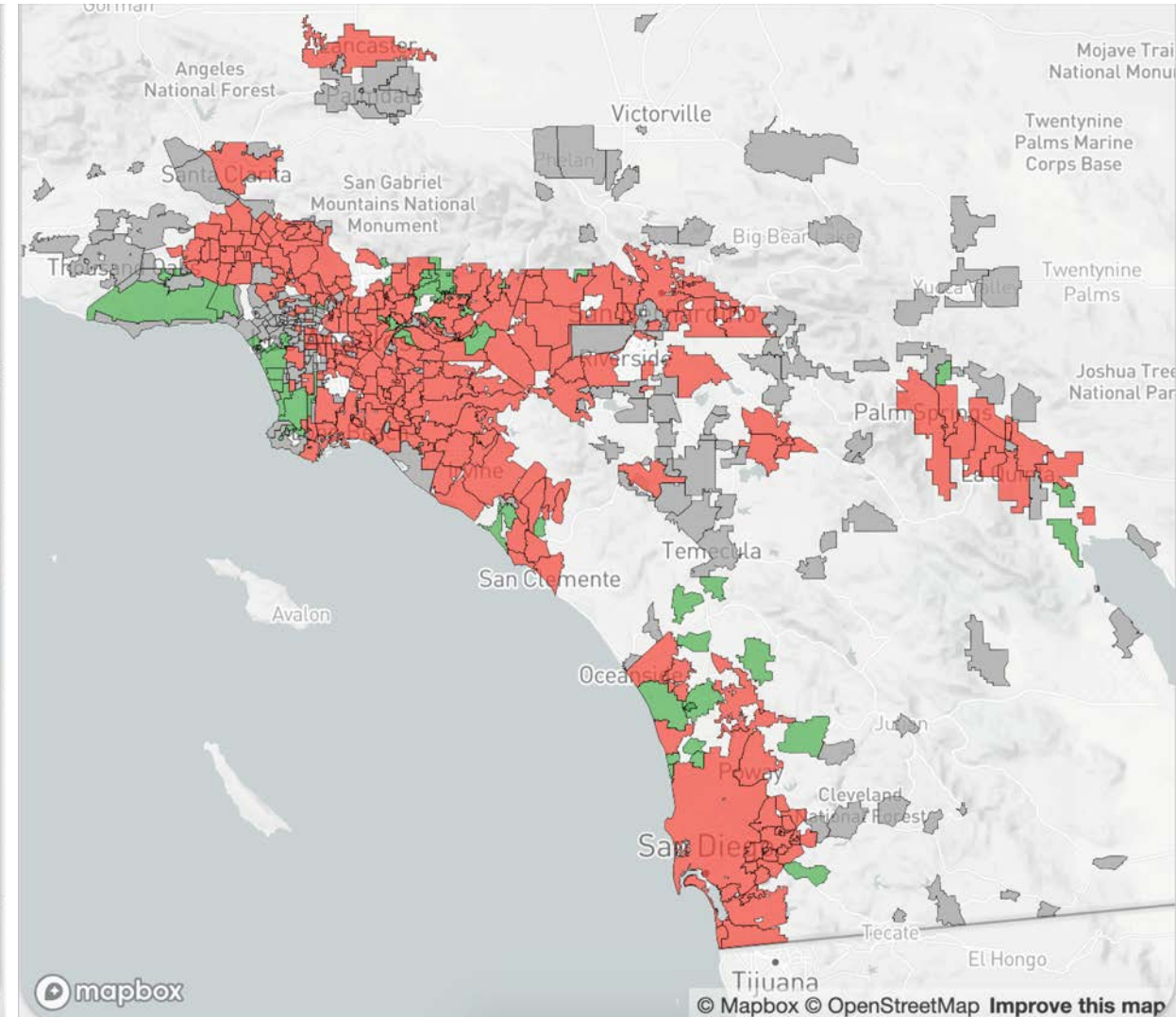
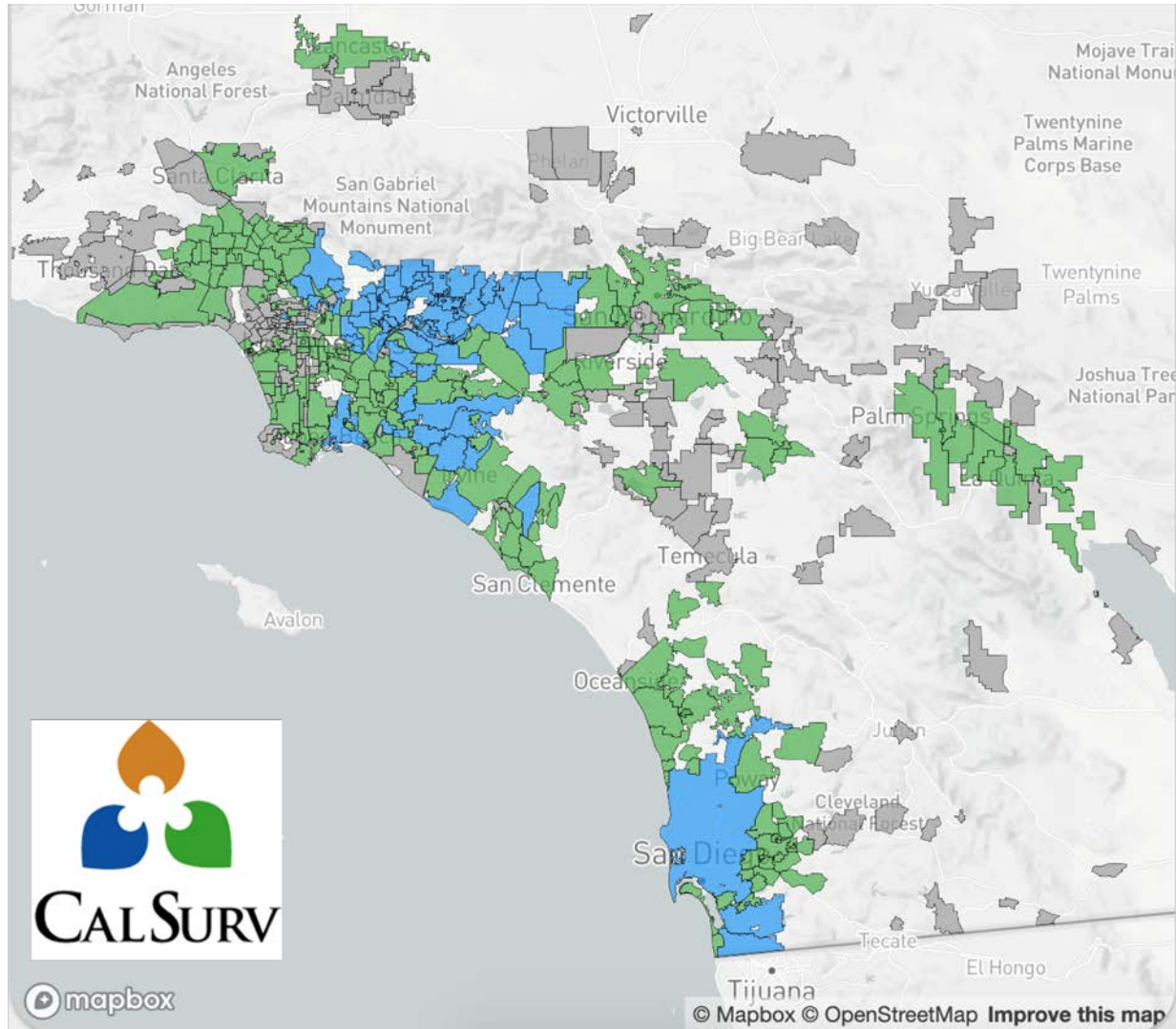




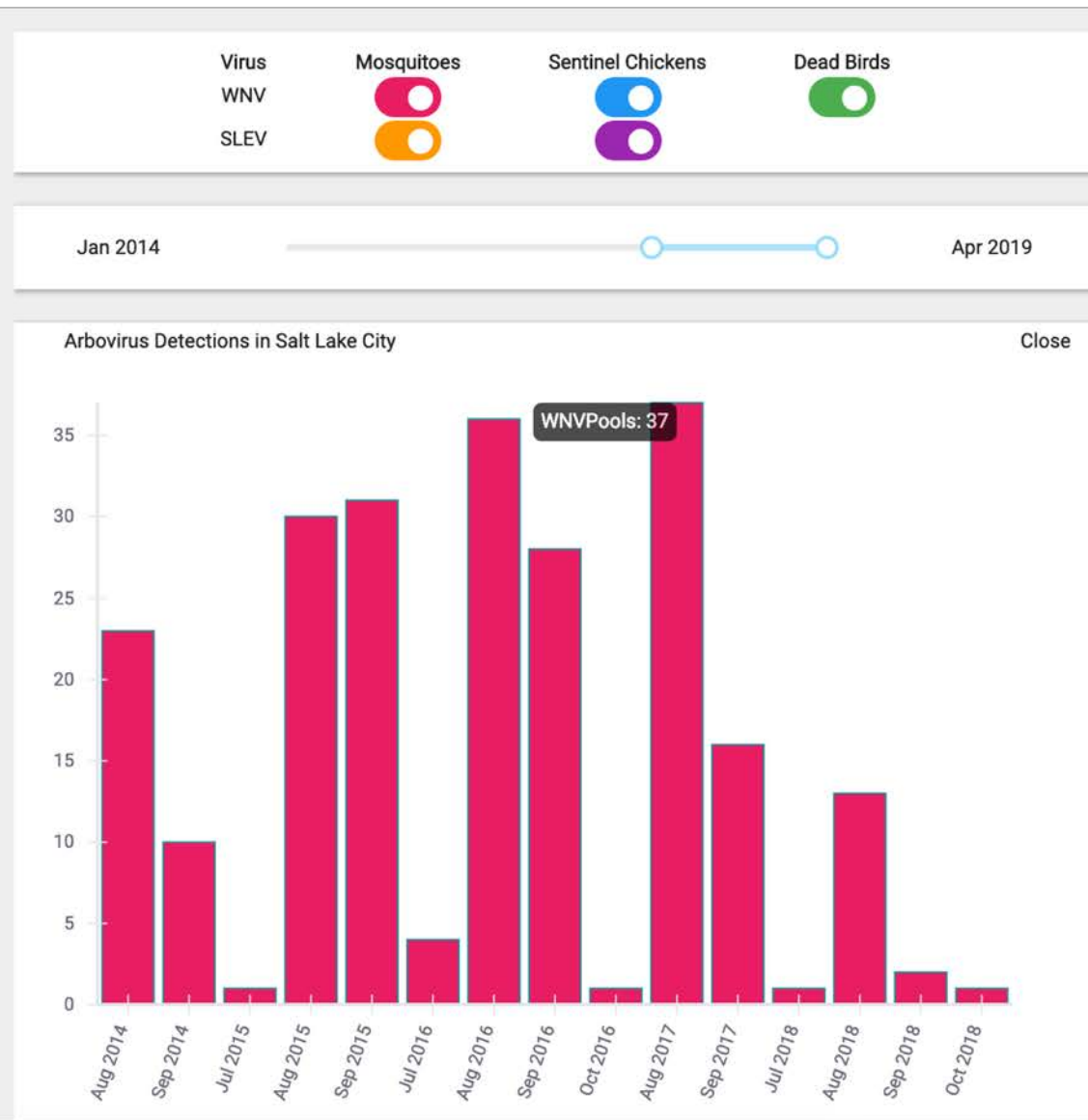
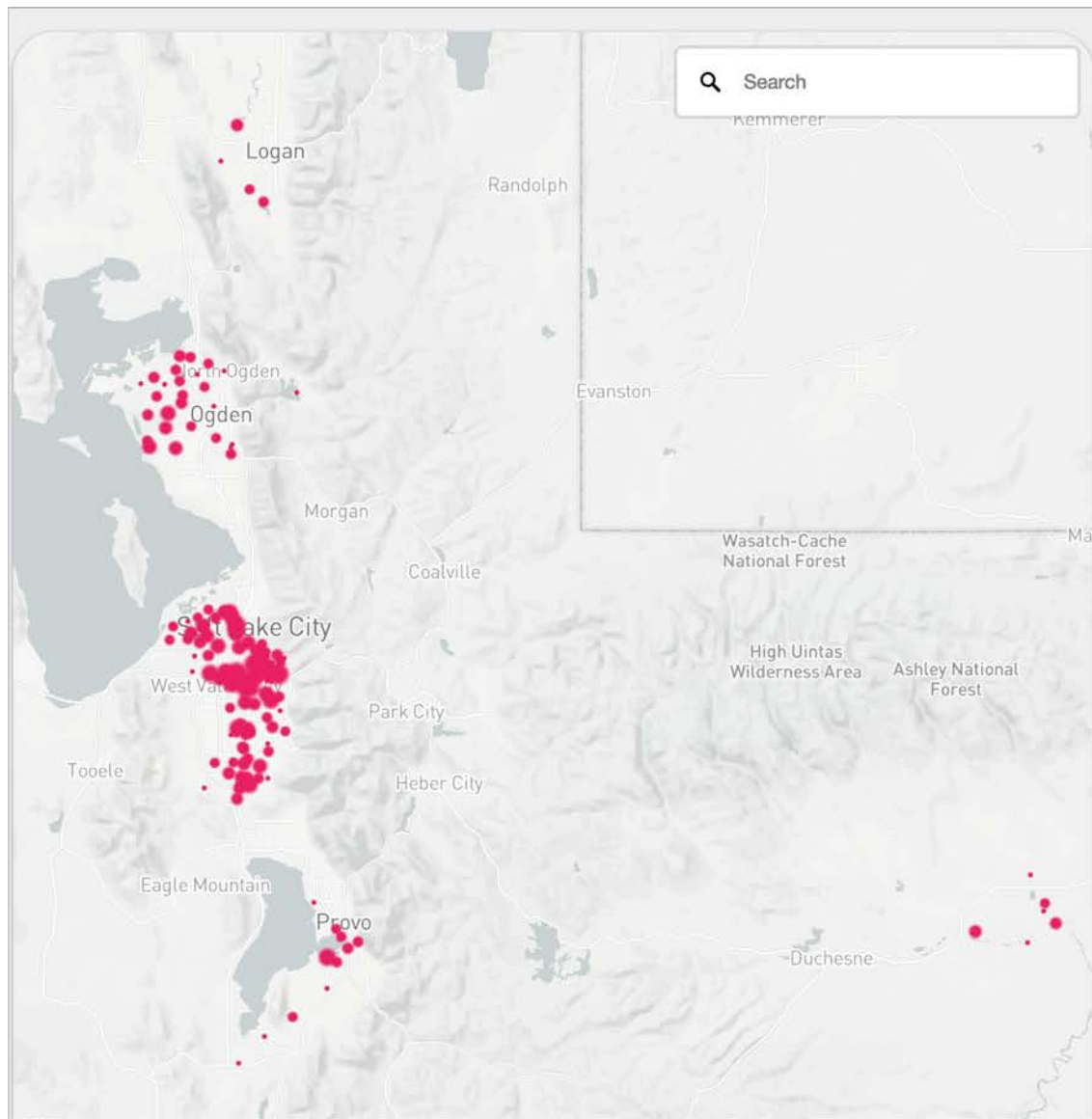
2011 2012 2013 2014 2015 2016 2017 **2018**

*Ae. albopictus*

*Ae. aegypti*







# Training Opportunities



**2019 AMCA “Train the Trainer” Certification  
Workshop for Best Practices in Mosquito Control  
April 25, 2019**

- Honolulu, Hawaii
- Four representatives from USAPIs to attend through PacVec CoE travel support: Guam, CNMI, FSM, RMI

# Training Opportunities



- Tiered approach
  - Short course(s) on insecticide resistance testing, vector biology and management
  - Shadowing program for early-career leaders from USAPIs to spend time with comprehensive vector management programs
    - Planned visits from CNMI and Kosrae
    - Summer 2019
    - ~ 2 week travel to Los Angeles and Houston
    - May include visit to CDC

# Discussion Points for the Executive Board

- Pacific Island Vector Management Council off to a great start
  - Monthly meetings via Zoom
  - Sharing of resources, keys, guidelines
  - Assessing capacity and procurement needs
- Importance of PIHOA Regional Entomologist
- Vision and needs for regional data sharing
  - CalSurv to integrate human data
  - Region-specific risk model? Other tools?



# Acknowledgements:

PIHOA:

Grayson Brown

Guam Division of Env. Health:

Claire Baradi, Rosanna Rabago

CNMI CHC Bureau Env. Health:

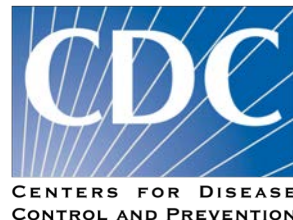
Esther Muna, Aileen Benavente

+ Members of the Pacific Island  
Vector Management Council



**PACIFIC SOUTHWEST** CENTER OF  
**VECTOR-BORNE DISEASES** EXCELLENCE IN

Funding:



**Contact Information:**

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[cmbarker@ucdavis.edu](mailto:cmbarker@ucdavis.edu)