

Excellence in Environmental Health Award
INVASIVE *Aedes* SURVEILLANCE PROGRAM

Submitted by:
San Bernardino County
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Overview

San Bernardino County Department of Public Health Division of Environmental Health Services (EHS) is dedicated to improving the quality of life for all residents and visitors by protecting public health. The San Bernardino County Mosquito and Vector Control Program (SBCMVCP) enforces the State of California Health and Safety Code and San Bernardino County Code relating to vector-borne disease and nuisance pests within its jurisdiction. Mosquito-borne diseases are some of the most significant public health risks. Population growth, increased number of individuals traveling around the world, and urbanization have increased the risks of mosquito-borne diseases being transmitted. In order to implement programs targeting this threat, programs must first determine if a threat exists and to what extent. SBCMVCP created the Invasive *Aedes* Surveillance Program (IASP) to address invasive mosquitoes that could not be trapped efficiently using traditional methods used for other mosquito species. The IASP was needed to accurately assess the presence of invasive mosquitoes. This program allowed the SBCMVCP to articulate and address this public health risk and subsequently secure and allocate needed resources to address the issue.

Problem

In recent years, invasive *Aedes* mosquitoes have been identified in California. These mosquitoes are able to transmit Zika virus and other vector-borne diseases. In order to determine a course of action SBCMVCP must determine where the invasive species is breeding and their abundance in an area.

In 2015, SBCMVCP trapped one *Aedes aegypti* and one *Aedes albopictus* mosquito with CO₂ traps using traditional trapping methods, but was not able to replicate the results. This kept SBCMVCP from pursuing additional resources needed for a more robust *Aedes aegypti* program to protect public health against the spread of vector-borne disease. The SBCMVCP team believed *Aedes aegypti* mosquitoes were potentially present in many areas throughout the jurisdiction, but were not able to verify this due to the low number of *Aedes aegypti* mosquitoes being caught.

Solution

Surveillance is one of the three major components of vector control. In order to deploy operational abatement, enforcement, and community education, the composition and spatial distribution of the mosquito species, and disease presence must be determined. Surveillance is the backbone of every mosquito and vector control operation because it gives information to plan with and act on.

The IASP includes trapping methods that are tailored to the behavior of *Aedes* mosquitoes. These trapping methods are more efficient, resulting in higher trapping counts when *Aedes* mosquitoes are present. These results helped secure grant funding and aided in resource allocation.

Implementation

In 2016, SBCMVCPC conducted routine trapping in several cities. An *Aedes Aegypti* was trapped in Colton during this time. SBCMVCPC did follow up trapping and was able to replicate the results, catching one additional specimen. Understanding an established population may be present, multiple CO2 traps were deployed within the city of Colton. With the understanding that *Aedes* mosquitoes do not travel far and with the goal of accurately articulate their populations in a small area, SBCMVCPC decided to place multiple CO2 traps approximately 200-300 ft. from each other to see if the *Aedes* population and its boundary could be better determined with improved trapping results. This was the beginning of the IASP development plan.

The IASP development plan was initiated in mid 2016 based on using clusters of CO2 traps in suspected areas of *Aedes* breeding. In 2016, 62 *Aedes aegypti* specimens were trapped using this new technique, a large increase over the 2 *Aedes* mosquito specimens caught in 2015.

SBCMVCPC finalized the IASP in March 2017. This program is based on the fact that *Aedes aegypti* mosquitoes will not travel more than approximately 1600 feet in their lifetime. In urban/suburban environments, they tend to breed on or near residential property due to landscaping and irrigation customs and their preference to take blood meals from humans rather than other animals.

The IASP is activated whenever a potential breeding source for *Aedes aegypti* is identified, a complaint regarding day biting mosquitoes is received, or when any *Aedes aegypti* mosquitoes are trapped. A set of six Carbon Dioxide (CO2) traps are set within a distance of 250 feet from each other to simulate a higher density of CO2 sources to attract these mosquitoes that don't travel far. Prior to the implementation of this practice, SBCMVCPC was setting traps approximately a quarter mile apart as recommended for *Culex* mosquitoes, which can fly up to 20 miles for a blood meal. This previous method of trapping *Aedes aegypti* was akin to trying to find a "needle in a haystack".

Trapping results from cluster trapping was reviewed and when *Aedes aegypti* mosquitoes were caught, the cluster would be re-centered on the trap that had the highest count of *Aedes aegypti* mosquitoes. This re-centering and re-trapping helped determine where established populations and breeding location were most likely present.

With this trapping information in hand, staff would be deployed to accomplish two goals:

1. Locate and abate the breeding source and
2. Conduct door to door community education

To locate and abate the breeding sources staff would survey-breeding locations suited to *Aedes* species. Areas such as manholes, storm drains, utility vaults and residential property where common inspection locations. Staff would also conduct door to door surveys to educate residents on how to prevent mosquito breeding on their property, how to identify signs of mosquito breeding, and actions to protect themselves.

Stakeholders

SBCMVCPC provides quality and responsive services to county residents, business owners, and visitors within its jurisdiction covering an area of 19,493 square miles with a population of over 1 million residents.

The SBCMVCPC stakeholders are residents, business owners, visitors, city officials, and county and state agencies. The IASP is implemented in areas where *Aedes aegypti* have been identified and trapped in the jurisdiction. Information regarding surveillance, operations and community outreach and education activities are included in the program's website, social media posts, door-to-door surveys, health fairs and community events.

Cost of Program

Program funds were initially used for surveillance staff to research *Aedes aegypti* mosquitoes and CO2 traps from other mosquito surveillance programs were used. CO2 traps cost an average of \$100 per reusable trap, plus the cost of dry ice and batteries at \$2.50 per week per trap. Approximately 48 traps were used initially, on a weekly basis, during the mosquito-breeding season. The development of initial educational flyers and brochures cost \$1,200.

SBCMVCPC used existing resources for the IASP implementation. CO2 traps were set in reconfigured patterns to trap *Aedes aegypti* rather than setting out any additional traps, resulting in no cost increase. During this period it was determined that *Aedes aegypti* was present and therefore a public health threat in the County. This allowed the SBCMVCPC to secure grant funding of \$150,000 over 16 months to address invasive *Aedes aegypti* mosquitoes more fully. This funded program created better articulation of risk and improved responses.

This established grant program now used defined resources. This included the annual average salary for a Vector Control Technician at \$97,730, who inspects, abates and enforces state and local code; and the annual average salary for a Public Service Employee (PSE) at \$33,280, who sets, collects and services traps as well as conducting door-to-door surveys. The remainder of funding was used for pesticide, equipment and educational material.

Results

Since the inception of the IASP, the SBCMVCPC has trapped 2,713 *Aedes aegypti* mosquitoes in the cities and areas of Bloomington, Colton, Fontana, Grand Terrace, Highland, Loma Linda, Mentone, Muscoy, Redlands, Rialto, San Bernardino, and Yucaipa. The SBCMVCPC has been able to demonstrate the existence and risk of these mosquitoes in the communities it serves. Besides being able to determine that invasive *Aedes aegypti* mosquitoes are present in our area, these outcomes have provided an opportunity for SBCMVCPC to demonstrate the need for additional resources to develop and implement a more extensive program specifically targeting *Aedes aegypti* mosquitoes.

SBCMVCPC has been holding meetings with the public and city and county staff in order to ensure our program collaborates effectively and keeps stakeholders informed and safe. This has allowed for an integrated approach that leverages stakeholders' capabilities creating a synergistic outcome.

Data from mosquito collection and analysis, funding secured and education conducted demonstrate the IASP success. The performance measures included:

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| • Mosquitoes trapped | 2,713 |
| • People reached through block surveys | 3,848 |

Implementation of the current cluster trapping practice for surveillance provided SBCMVCPC's staff with a better understanding of *Aedes aegypti* mosquitoes and how to better protect public health. Since community outreach and education along with abatement of this type of mosquito is critical, the implementation of this practice has proven to be one of the best tools utilized by SBCMVCPC. The creation of the IASP allowed SBCMVCPC to determine what type of training and educational materials were needed for the communities served. The IASP also helped to prioritize which areas to address, based on the number of mosquitoes trapped and identified.

The implementation of the IASP has helped SBCMVCP to:

- Determine changes in the abundance of *Aedes* mosquitoes,
- Evaluate efforts by comparing pre-implementation and post-implementation data utilizing the current trapping practice,
- Obtain a more accurate measurement of existing *Aedes* mosquito populations in the jurisdiction,
- Make appropriate decisions regarding abatement and response,
- Provide appropriate training to SBCMVCP staff, and
- Provide appropriate education to communities and stakeholders.

Summary

The IASP results have been vital in achieving the primary SBCMVCP goal of protecting public health by reducing potential vector-borne disease transmission. This program has given SBCMVCP the ability to accurately communicate risk to the community. It has been very successful at collecting mosquitoes when other methods have not. As a result resources have been obtained that otherwise would not have been. Data from the IASP has also assisted in the utilization of existing resources using a risk based approach. Abatement, surveillance and educational resources have been deployed in the most needed areas because of the IASP. The IASP has been found to be a very sustainable practice and will continue to be used to pursue SBCMVCP's goal of public health protection.