Welcome to the Conservation Lecture Series

https://www.wildlife.ca.gov/Conservation/Lectures

Questions? Contact Margaret.Mantor@wildlife.ca.gov

CDFW Conservation Lecture Series

The Conservation Lecture Series is organized by CDFW's Habitat Conservation Planning Branch. The lecture series is designed to deliver the most current scientific information about species that are of conservation concern.

Below is a list of lectures and speakers for the Conservation Lecture Series. Lectures are open to anyone who is interested in participating. Participants may attend in-person or remotely via webinar. Please be sure to register for each class. Lectures are recorded and posted for those unable to attend the day of the event. Visit the archive page to see recordings of past lectures.

Subscribe to receive email updates and invitations to upcoming lectures.

Upcoming Lectures

Development of multi-threaded wetland channels and the implications for salmonids and ecosystem rehabilitation - November 19, 1:00-3:00 pm. Presented by Dr. Brian Cluer and Lauren Hammack

The land clearing and draining industriousness of the early European settlers largely erased riparian wetlands and multi-threaded channels from the California landscape, as well as from our collective consciousness. Incised, simplified channels are the result of those efforts and what we tend to manage our waterways to be. The importance of multi-threaded channels for ecosystem function and biotic productivity is beginning to be understood and taken into account

The Wildlife Society (TWS) Upcoming Ever

Videos and Past Lectures

- Process Based Stream Restoration (Dr. Pollo
- San Joaquin Kit Fox (Dr. Cypher)
- Metrics for Quantifying Ecosystem Impacts an Restoration Success (Dr. Rubin)
- American Badgers (Dr. Jessie Quinn)
- Design Validation Monitoring Klamath Watershed (D.J. Bandrowski, Aaron Marin, an Rocco Fior)
- Dogs Moving Conservation Forward (Dr. Deborah (Smith) Woollett and Aimee Hurt)
- Black Swans, Brown River (Dr. Viers)
- White-Nose Syndrome in Bats (Wyatt)
- Invasive Watersnakes (Dr. Todd)
- Tricolored Blackbird (Dr. Meese)

Lecture Schedule

Monarch Butterflies in California **Samantha Marcum, USFWS**	**March 18, 1:00-3:00, Sacramento**

Brown Marmorated Stink Bugs

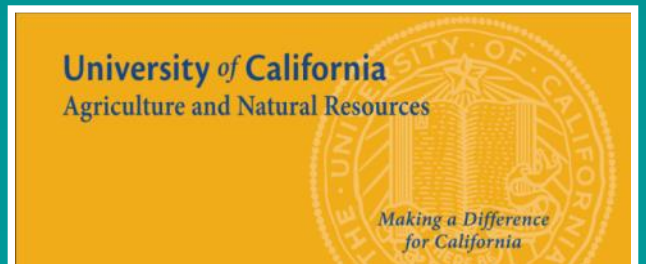
Calif. Dept. of Fish and Wildlife Lecture Series

Jan. 25, 2016

Chuck Ingels

UC Cooperative Extension, Sacramento County

http://cesacramento.ucanr.edu



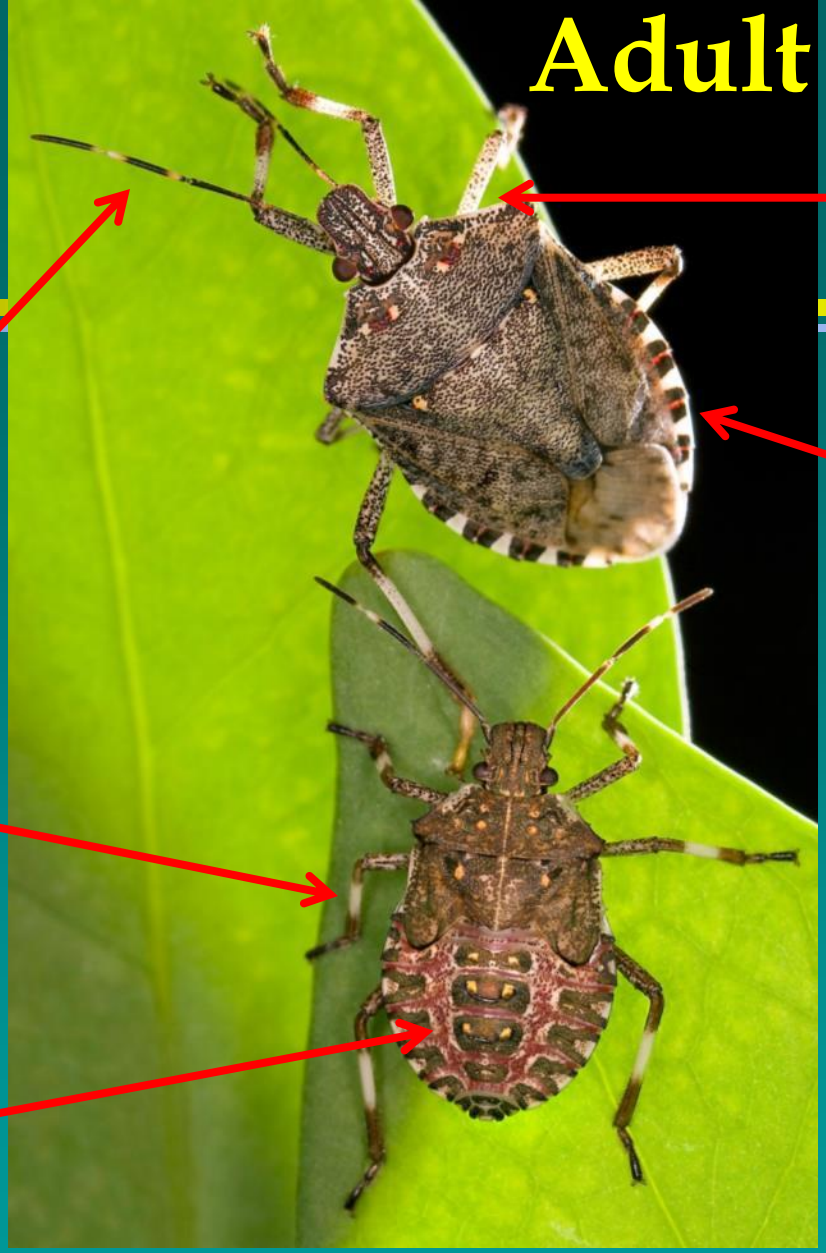
Brown Marmorated Stink Bug (*Halyomorpha halys*)

Photos: Baldo Villegas

Brown Marmorated Stink Bug (*Halyomorpha halys*)

- Native to East Asia (China, Japan, Korea, Taiwan)
- A crop pest in its native range and here
- Found in Allentown, PA 1996, ID'd 2001
- Household nuisance pest in fall, winter
- Host list currently 170 spp., likely to rise

Actual adult size
1/2 to 5/8 inch



Smooth
"shoulder" edges

Two white bands
on antennae

Banded
abdominal edge
extending
beyond wings

Banded legs

Mature nymph
(5th instar)

Rust color with
broad brown
markings

Photo: UC IPM

20-30 eggs (often 28)

Nymph (3rd of 5)

Adult

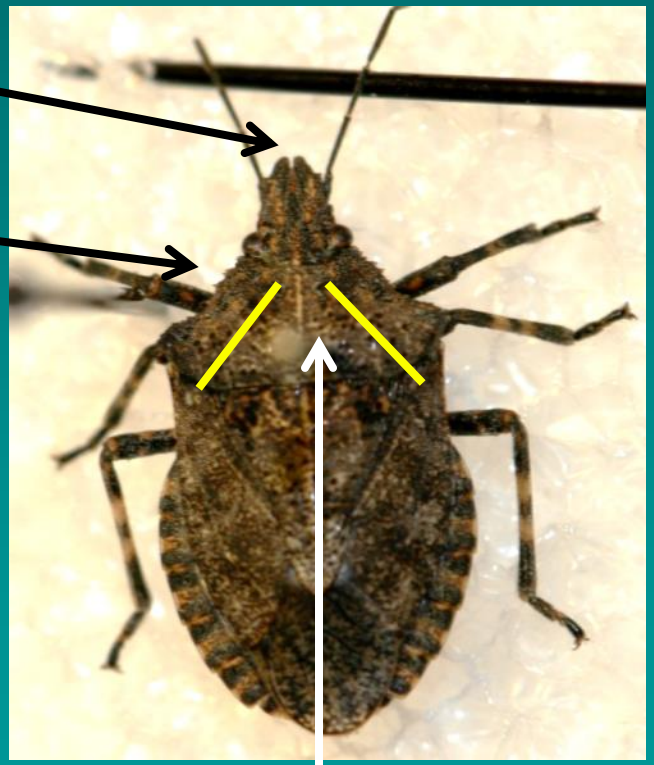
Rough Stink Bug vs. BMSB

Rough stink bug

BMSB

Rough Stink Bug vs. BMSB

Rough stink bug



BMSB

Consperse Stink Bug vs. BMSB

Consperse stink bug

Solid brown

1/2 inch

BMSB

Marble color

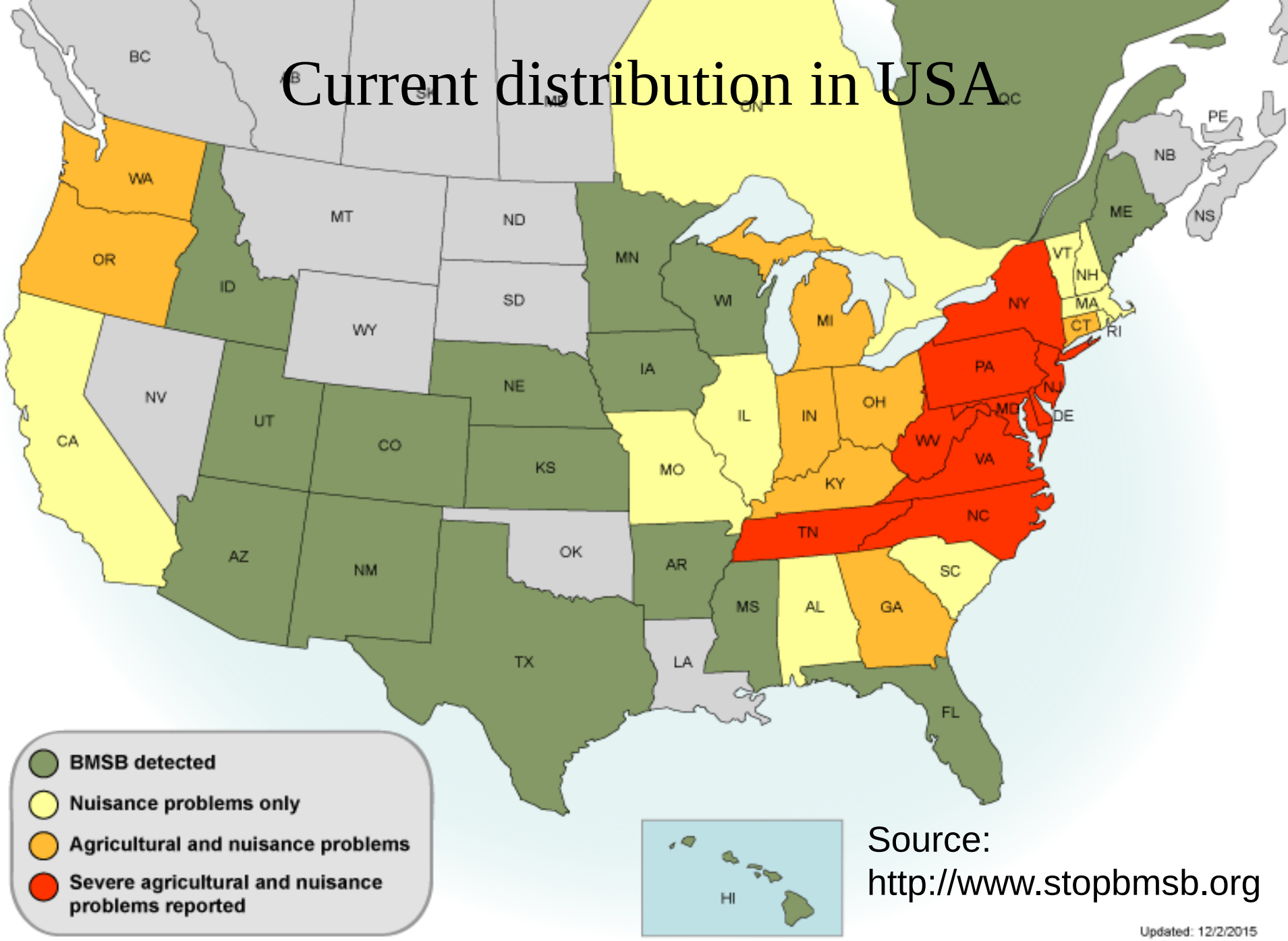
5/8 inch

Photos: StopBMSB.org

5 Nymphal Instars Male Female

- Overwinters as adult in sheltered areas
  - Tree crevices and homes, barns, other structures
- Each adult lives 6-8 months
- Female lays about 250 eggs, mates multiple times
  - ➢Each female can lay up to 9 egg clusters
- 1-2 generations in Mid-Atlantic states

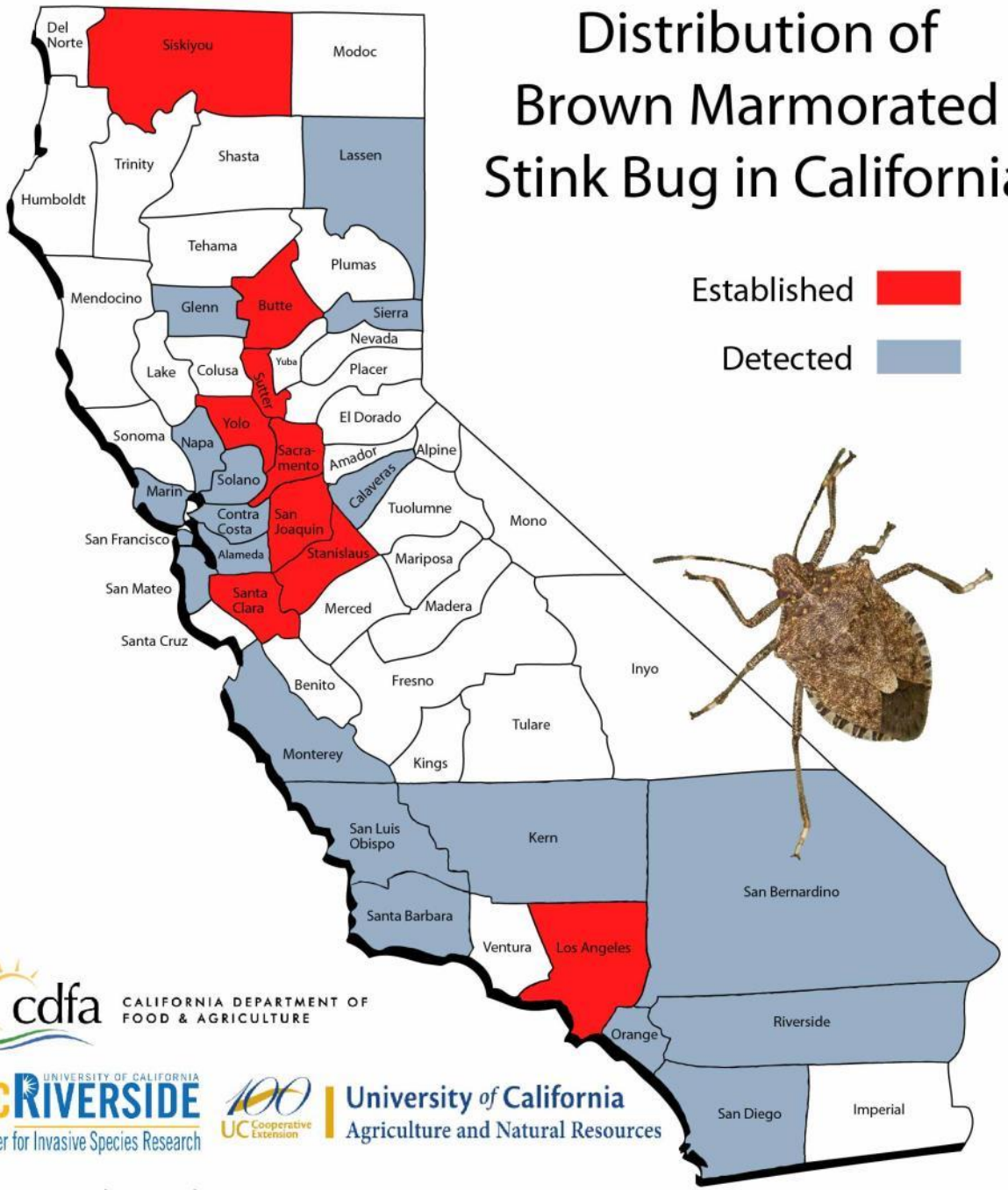
Current distribution in USA



Source: http://www.stopbmsb.org

Updated: 12/2/2015

Distribution of Brown Marmorated Stink Bug in California



cdfa CALIFORNIA DEPARTMENT OF FOOD & AGRICULTURE

UC RIVERSIDE UNIVERSITY OF CALIFORNIA Center for Invasive Species Research

UC Cooperative Extension

University of California Agriculture and Natural Resources

Prepared December 2015

One Method of Dispersal

Farmers' Markets

Infestations Around Sacramento

13th & P

14th & H

Fair Oaks Blvd. & Howe

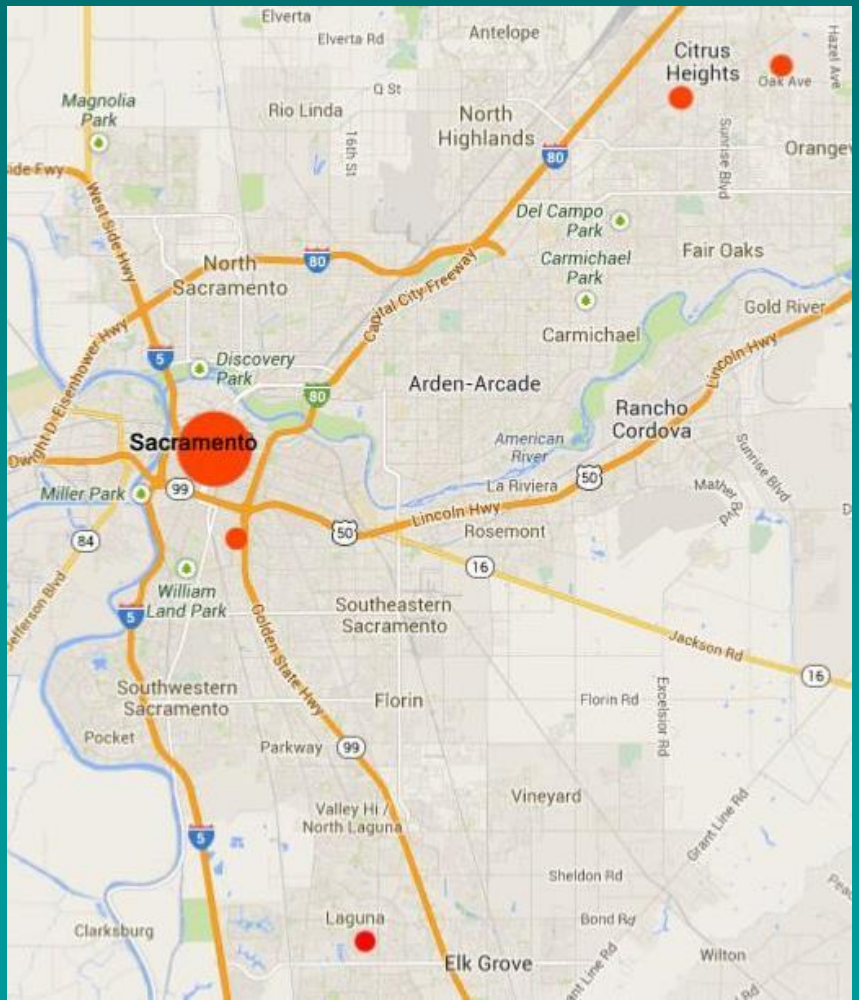
Infestations Around Sacramento

8th & G

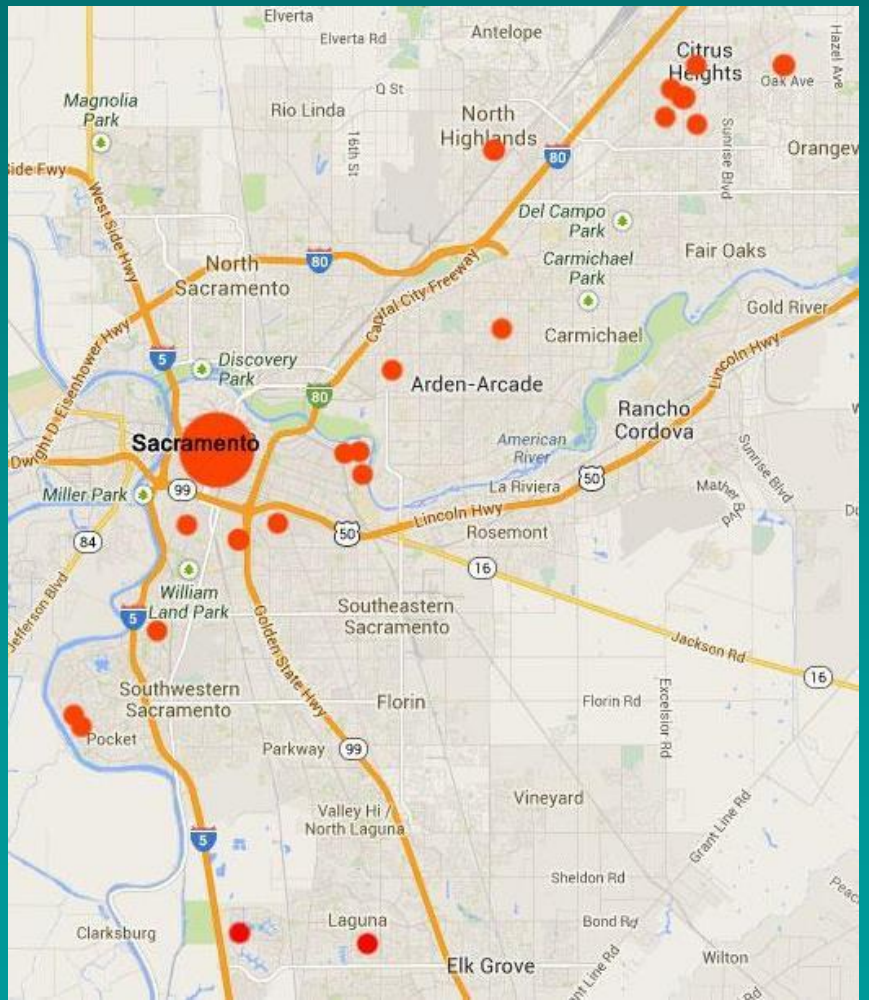
BMSB Finds

Sacramento County

Jan. 1, 2014

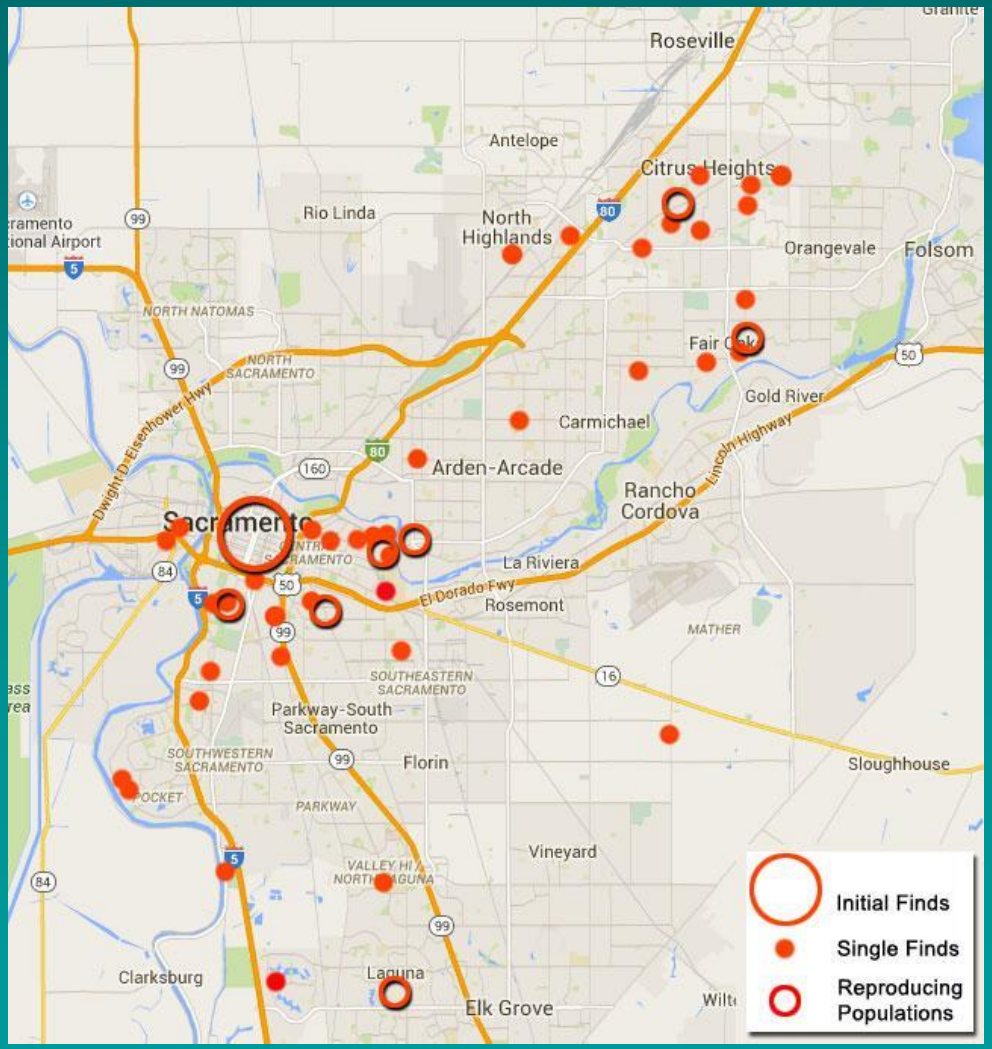


Jan. 1, 2015



BMSB Finds

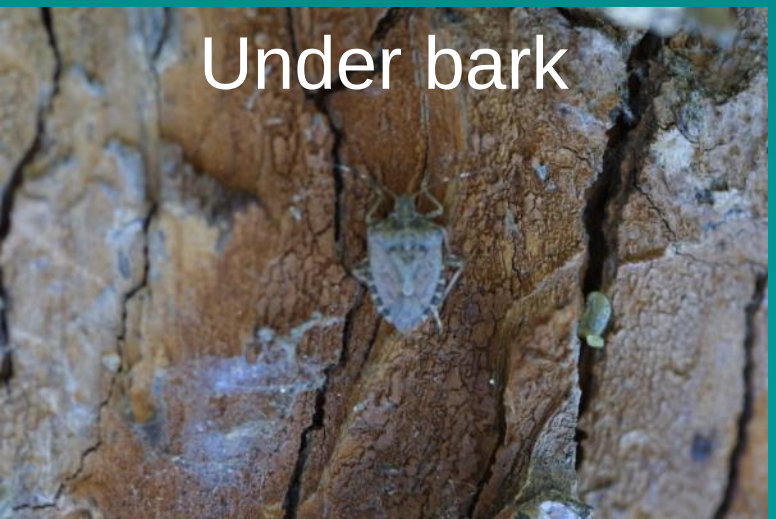
Sacramento County – Jan. 1, 2016



BMSB
An Arboreal Species

Sacramento
March 2014

Downspout



Host Plants
Crops

- Stone fruits (esp. peach), pome fruits
- Berries
- Grapes (not a major host)
- Eggplant, tomato, okra, pepper, corn, beans, sunflower

Major Host Plants
Selected Ornamentals

- Butterfly bush
- Catalpa
- Chinese pistache
- Fruiting mulberry
- Holly
- Maple
- Princess tree (*Paulownia*)
- Redbud
- Tree of heaven
- Waxleaf privet
- Zelkova

Trident Maple

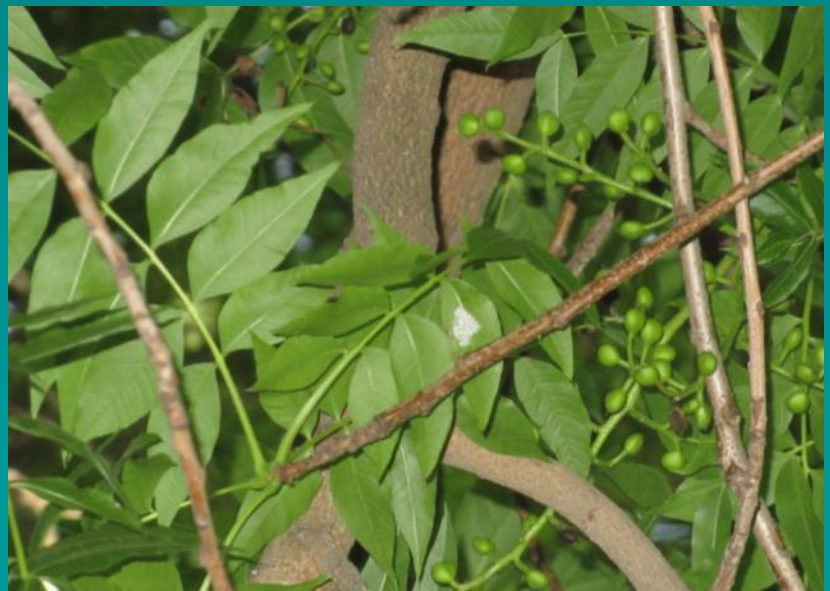
Acer buergerianum

Waxleaf Privet

Ligustrum japonicum

Chinese Pistache

Pistachia chinensis



Tree of Heaven

Ailanthus altissima

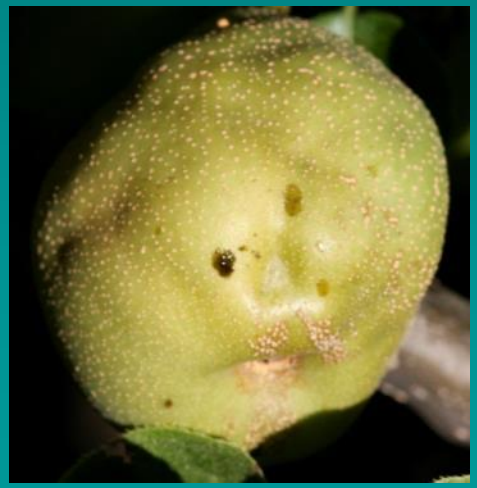
Stink Bug Feeding

BMSB Damage
2014

Peach, 5/22

Apricot 6/23

Nectarine, 6/3



Asian pear, 7/2

Fig

Plum – no damage

On Persimmons

Sept. 2015

On Apples

Sept. 2015

Trunk Feeding and Damage

Cherry
Sept. 2015

Trunk Feeding and Damage

Orange
Sept. 2015

Photo: C. Pickett

Trunk Feeding and Damage

Shamel ash
Sept. 2015

Crape myrtle
Sept. 2015

On Zelkova

BMSB in Orchards

- Fruit crops are major hosts
- Overwinter in dead trees, homes, sheds, bins, stacked logs & boards, etc.
- All stages found in orchard by mid-season
- Greatest damage on edges bordering forests and adjacent susceptible crops
- Harvest of nearby crops may force migration to other crops
- Late season crops = most potential damage

BMSB Damage

Pennsylvania 2010

BMSB in Grape
Early September 2010

Photos courtesy of Doug Pfeiffer and Dean Polk

BMSB in Vineyards
Avenues of Potential Economic Impact

- Direct injury to grapes
  - Introduction of rots, other pathogens
  - » Aborted berries, necrosis
- Contamination of wine at crush
- Nuisance in wine tasting rooms

Will BMSB be Problematic in Calif. Vineyards?

- Grapes not a preferred host
- Mainly edge effect
- Where they may be worse:
  - » Small blocks (large area/edge ratio)
  - » Bordered by forest or susceptible crops/species
  - » Harvest of nearby infested crops
  - » Later varieties (esp. late Sept. on)
  - » Mechanical harvest worse than hand picked

BMSB in Wine

- All instars have a distinct odor that can taint wine
- Smells like fresh cilantro
  - » Other descriptors: “skunky,” “citrusy”, “piney”

Aggregation Season, Pennsylvania

Photos:
Tracy Leskey

Aggregation Behavior

Entrance into Buildings

Entry Through Windows

Inside the Home

Attic

BMSB Pest Management in Structures

Different than other overwintering pests

- Enter earlier, leave later than other pests
- Active throughout entire winter
- Get into clothes, sheets, drawers, papers, etc.
- Active at night, attracted to lights
- Problematic in sensitive environments
  - » Hospitals, restaurants, regulated facilities, etc.
- But indoors they don't bite, feed, lay eggs, etc.

Insecticide Screening Study

Tom Kuhar, Virginia Tech

Insecticide Screening Study

Tom Kuhar, Virginia Tech

Some Insecticides Being Used by Pest Management Professionals

- lambda cyhalothrin
- thiamethoxam + lambda cyhalothrin
- betacyfluthrin
- imidacloprid + cyfluthrin
- esfenvalerate
- fipronil
- imidacloprid
- dinotefuran
- indoxacarb

Insecticide Screening Study

Tom Kuhar, Virginia Tech

- 9 Insecticides labeled for pest management professionals to apply
- Exposed to ambient conditions
- Mortality assessed after 48h of continuous exposure

Insecticide Screening Study

Tom Kuhar, Virginia Tech

- Screen application appeared to be an effective delivery method
- Best residual activity:
  - Lambda cyhalothrin (Demand)
    >50%>44 days
  - Cyfluthrin (Tempo)
    ~44 days residual, but low activity past 22 days
  - Cyfluthrin + imidacloprid (Temprid)
    >50%~29 days

Slides Courtesy of Dave Burgess, Cooper Pest Solutions

- Presentation at BMSB Working Group Meeting, June 2015

Entry point Treatment areas

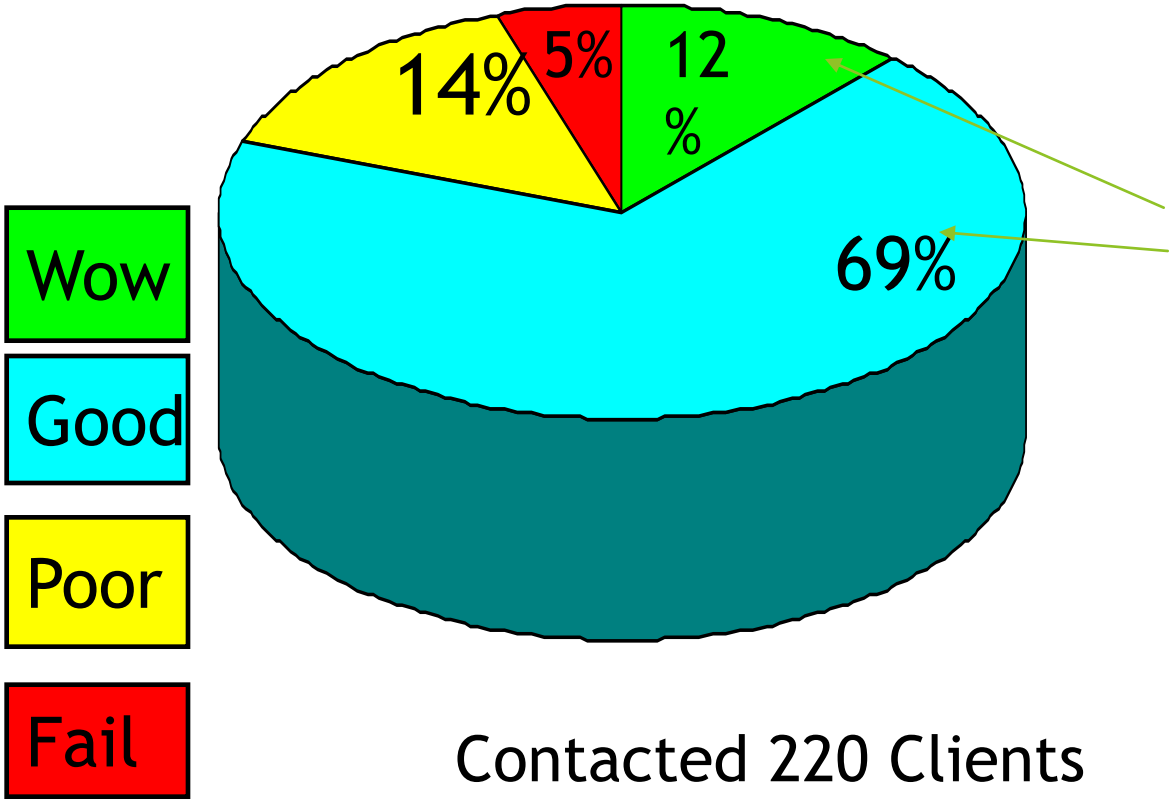
Interior services limited to attic

What are we treating with?

- Liquid Pyrethroids
  - Lambdacyhalothrin (Demand)
  - Deltamethrin (suspend)
- Indoxacarb (Arilon)
- Silica gel, pyrethrins, PPB (Tri-die)
- Pyrethrin, PPB, dicarboximide (residual fogger)

COOPER Pest Solutions®

2010 – 2011 survey results



81% Pleased With Results

Contacted 220 Clients
123 responded to survey

COOPER Pest Solutions

2014 service calls

- August 15th to September 30th – 315 jobs
- September 1st to May 30th – 11 service calls on 9 locations (2 locations had 2 service calls)

Timing issue = labor issue

- We have 45 days <u>at most</u> to get work done
  - August 15th – September 30th
- Going up and down ladders is tiring.
  - Ladders + Tired = Injuries

COOPER Pest Solutions®

Pyrethroid label changes

- All outdoor applications limited to spot or crack & crevice treatments only except for the following permitted uses
- 1. Treatment of soil of vegetation around the structure
- 2. Applications to lawn turf and other vegetation
- 3. Applications to building foundations, up to 3’

Indoor Stink Bug Traps

Research: Best Indoor Trapping Method

Virginia Tech

Light shining into soapy water

Sacramento County Supervisor Office

Dec. 2014

Co. Supervisor Office
Dec. 2014

It worked!

BMSB Traps

Dead-Inn Traps (AgBio, Inc.)

Grower
48” tall, $30

Professional
24” tall, $20

Homeowner
16” tall, $17

BMSB Traps
Rocket Trap (Rescue)

$17

Understanding BMSB Pheromones

Two Main Lure Types

1. Pheromone lures (USDA #10 and #20)
   - » Harlequin bug pheromone – nearly identical
2. "Synergist" = methyl decatrienoate (MDT)

- Best used in combination

Current BMSB Lures - Constantly Evolving

- AgBio Combo, includes other bugs

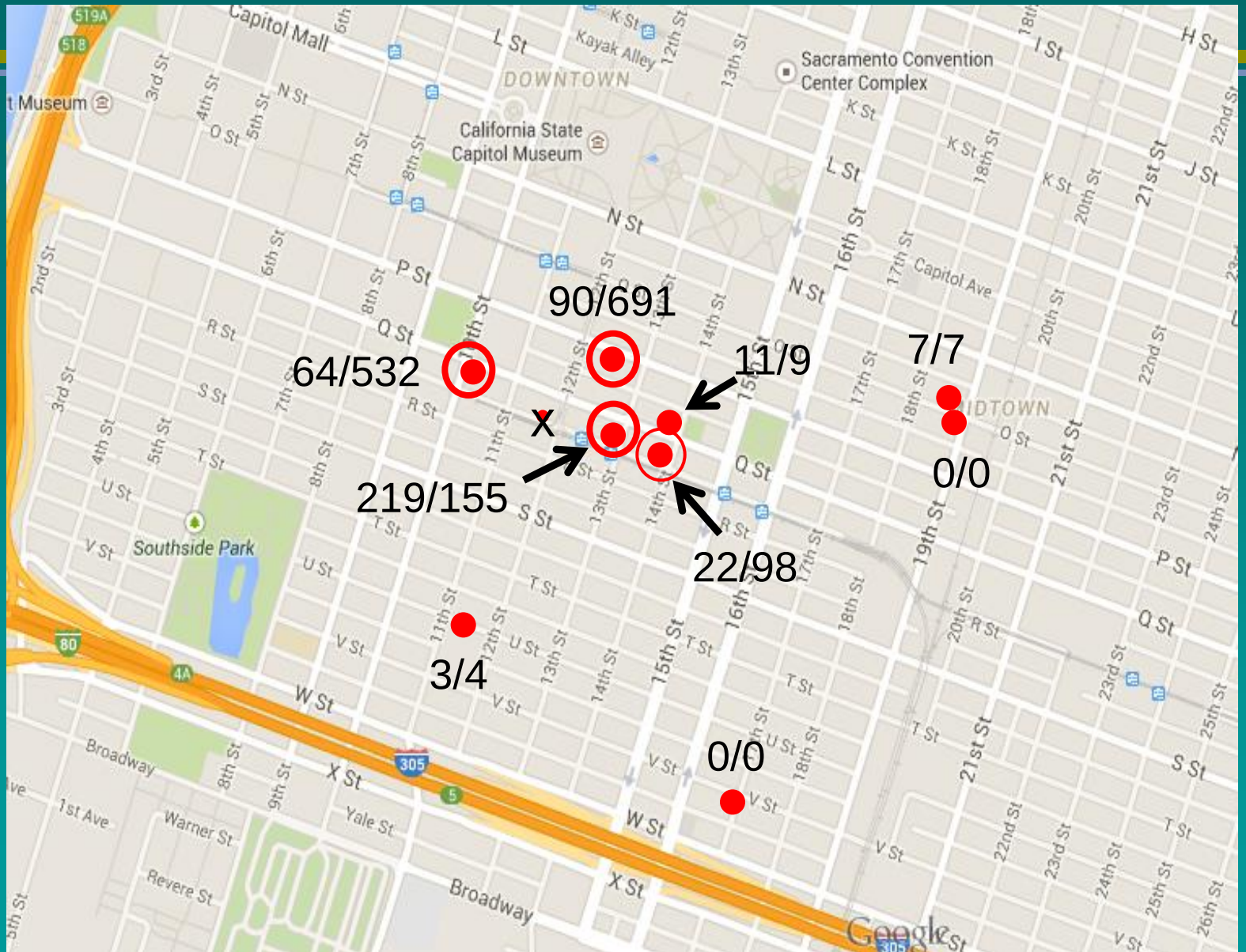
- Rescue

- Trece – 1 combined lure

High BMSB Populations

2014 Trap Locations & Counts

Adults/Nymphs



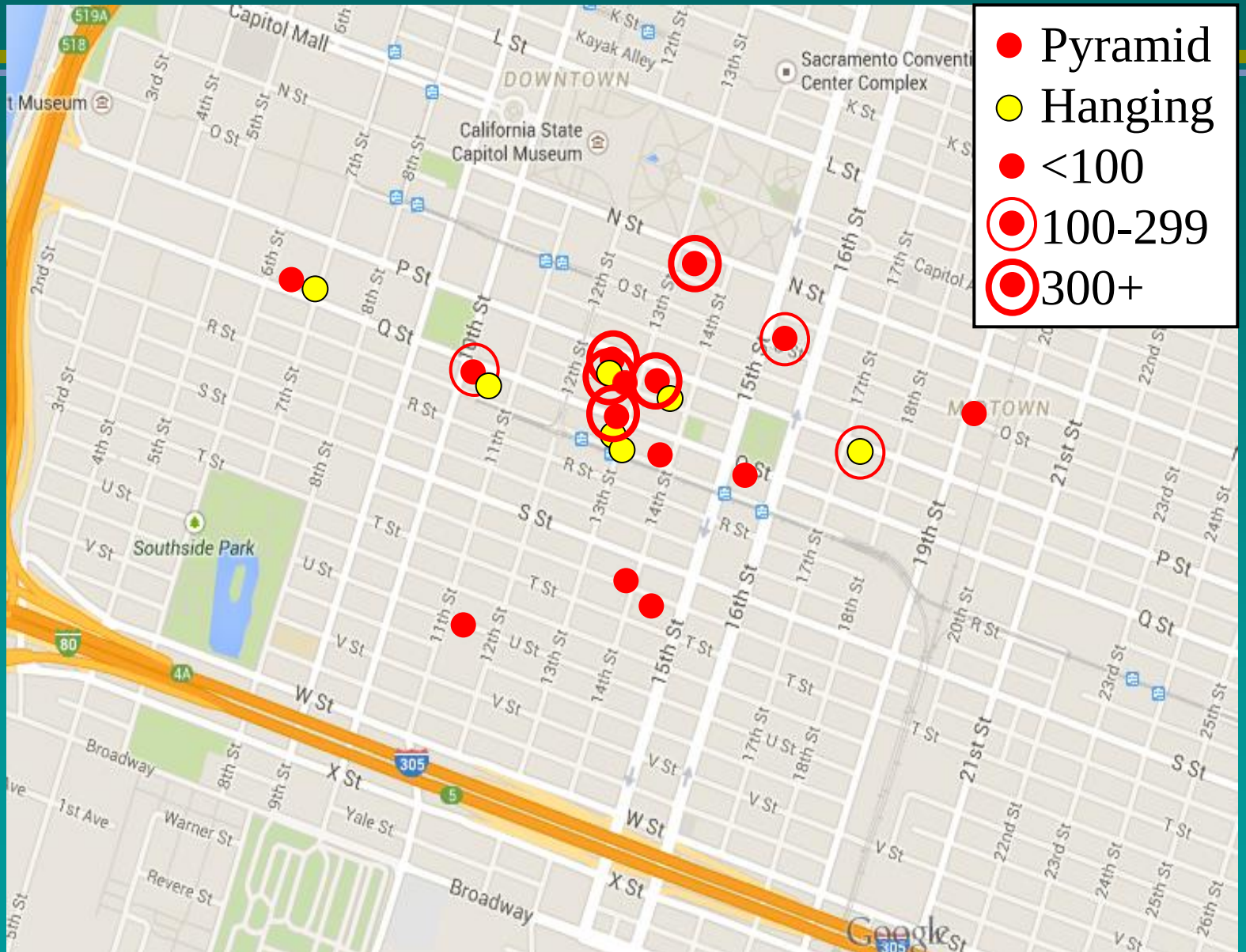
Traps Used in Sacramento Monitoring 2015

AgBio
Pyramid Trap

Double Cone
(1-gal.)

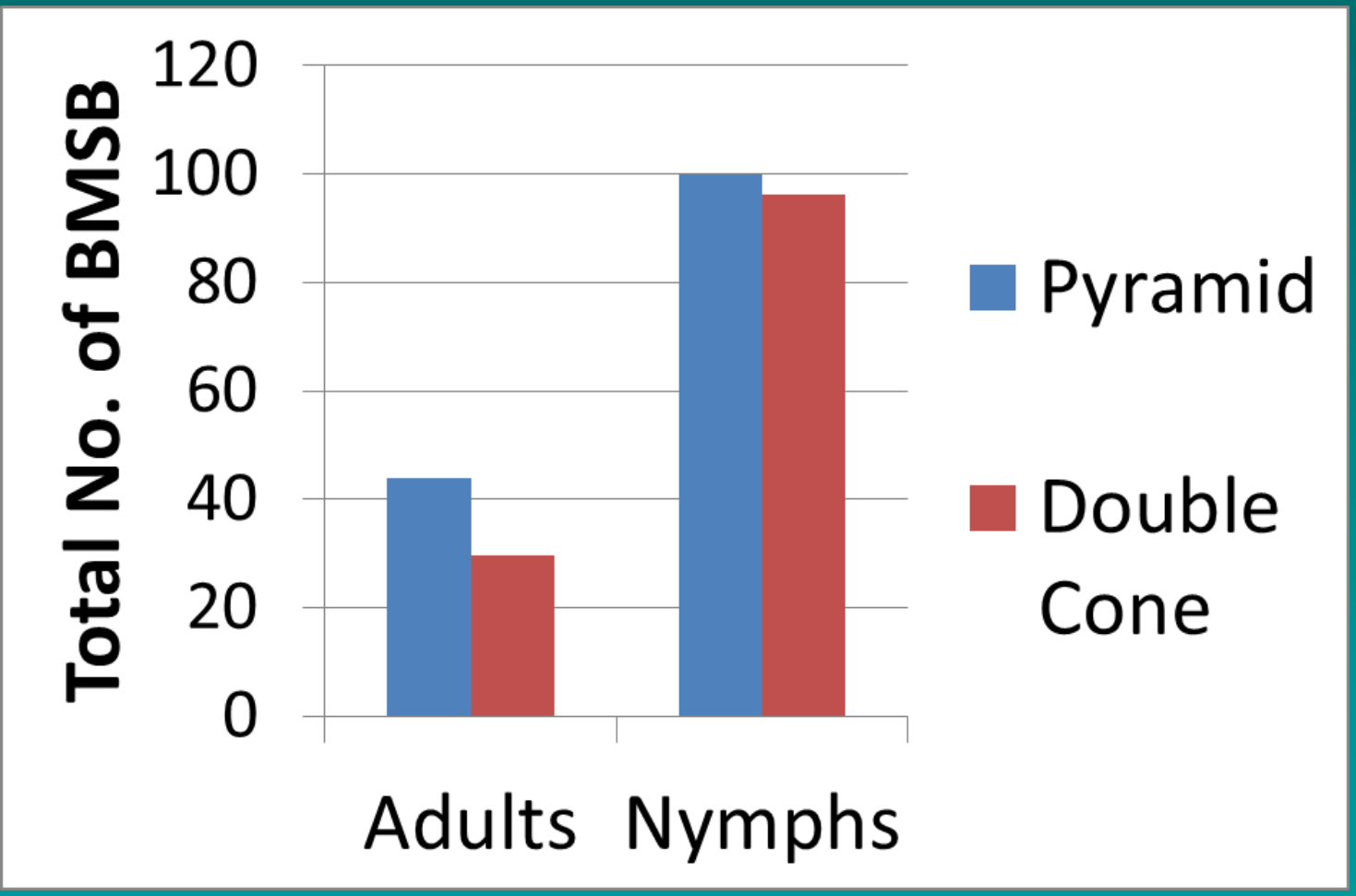
2015 Trap Locations & Counts

Adults/Nymphs



2015 Avg. Seasonal Trap Counts

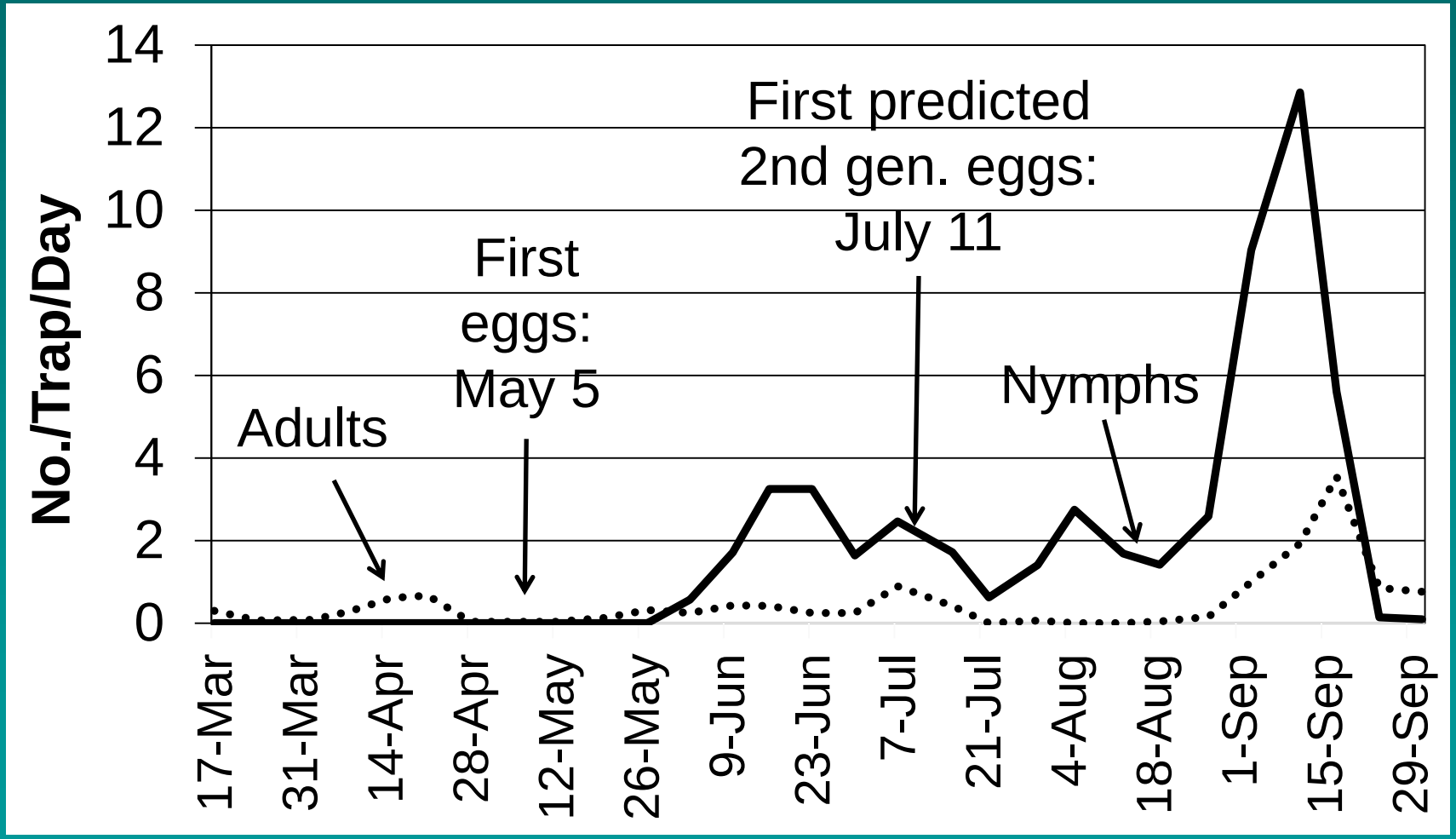
Pyramid vs. Double Cone



Overall:
14% more in pyramid traps

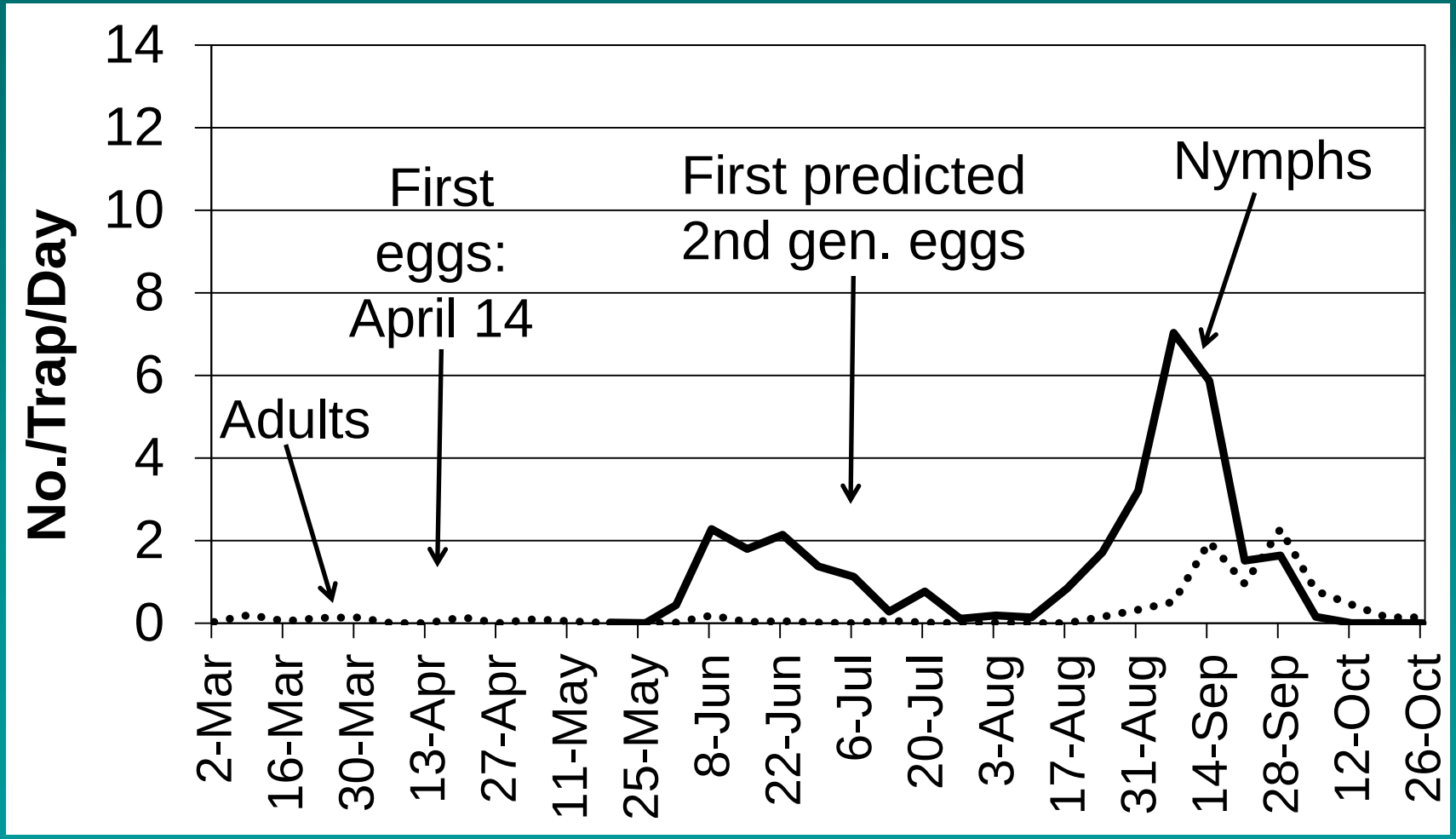
Adults and Nymphs Trapped

Avg. of 4 traps, **2014**



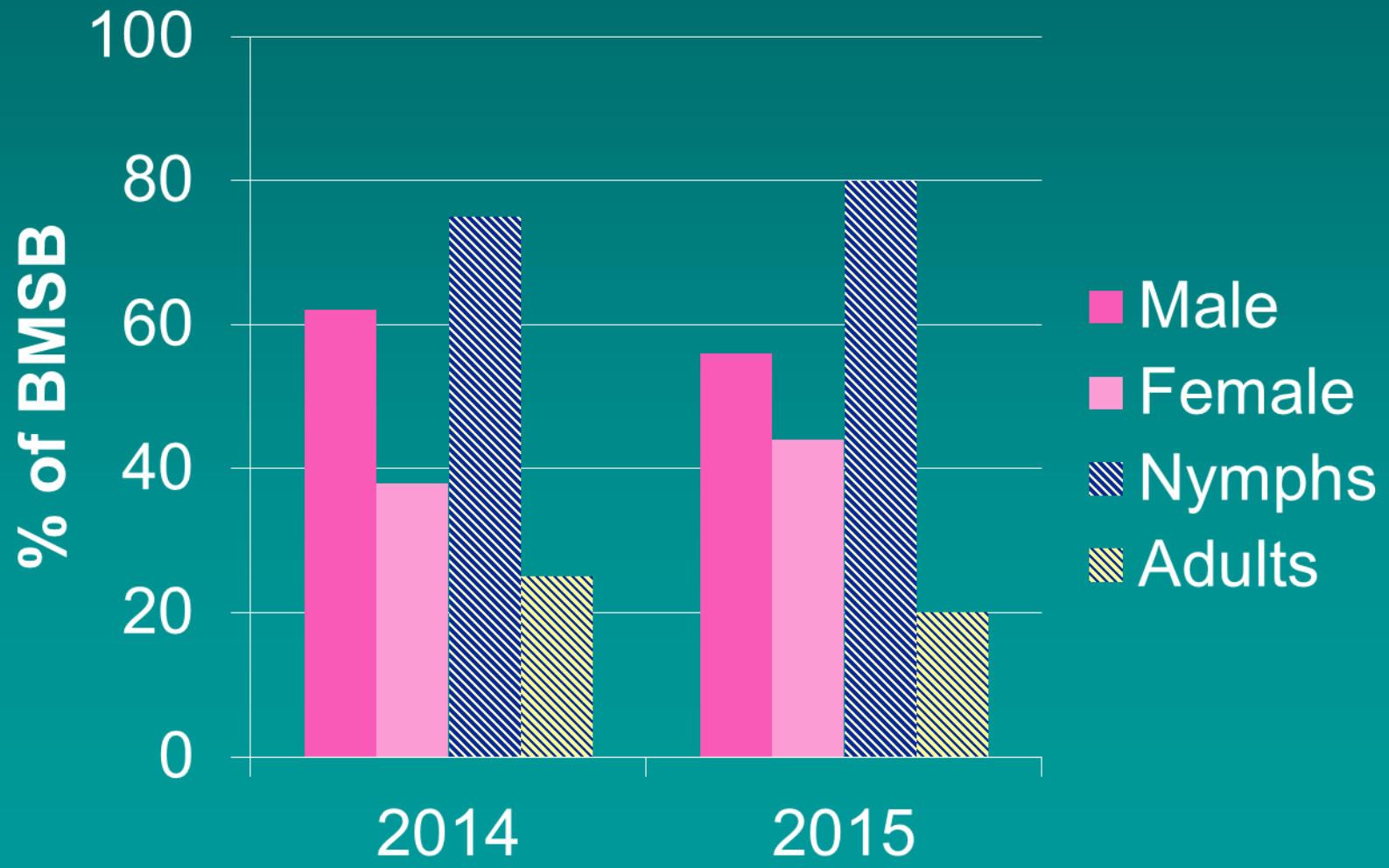
Adults and Nymphs Trapped

Avg. of 7 traps with 100+ for season, **2015**



Ratios of Trapped BMSB

Male/Female and Nymphs/Adults



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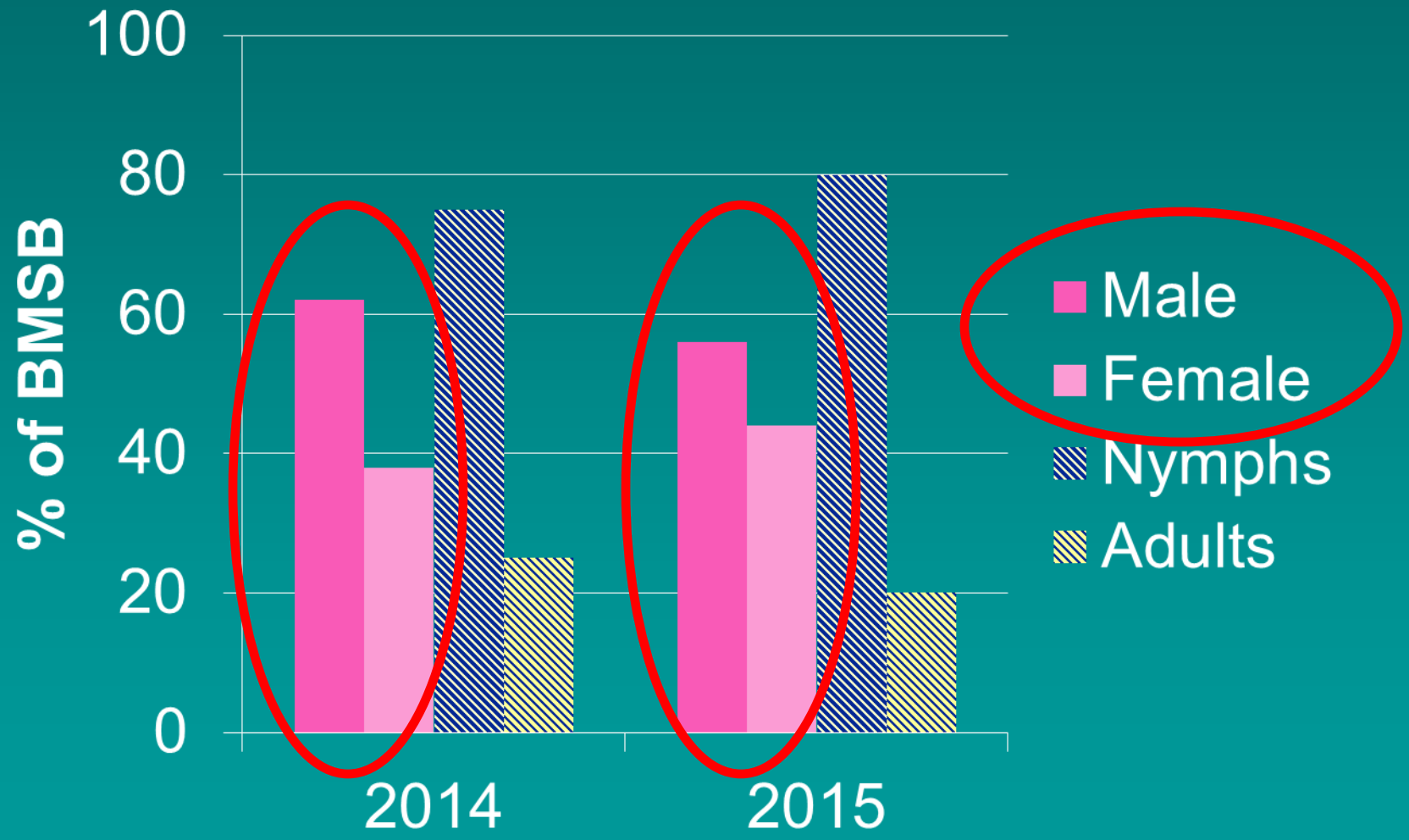

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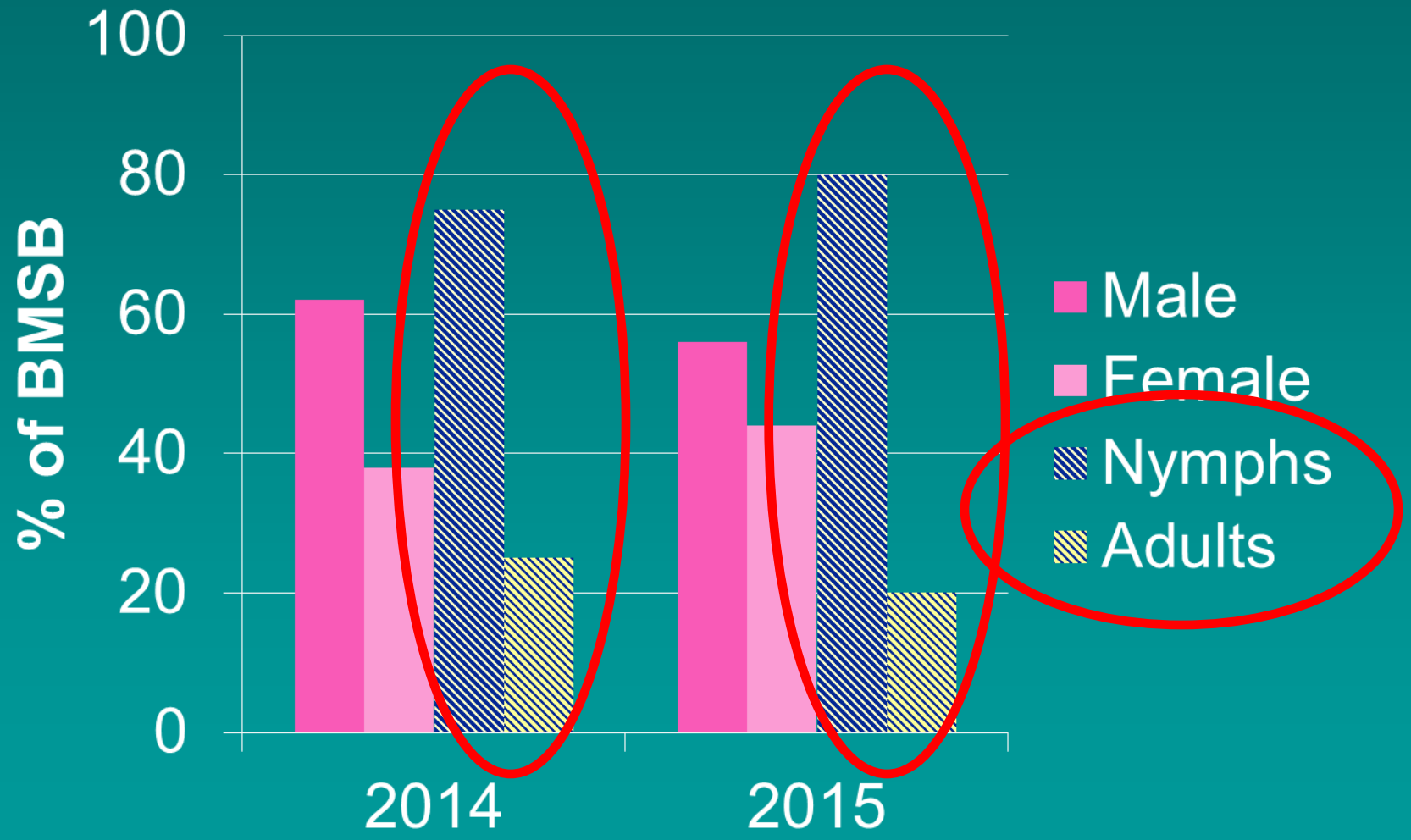
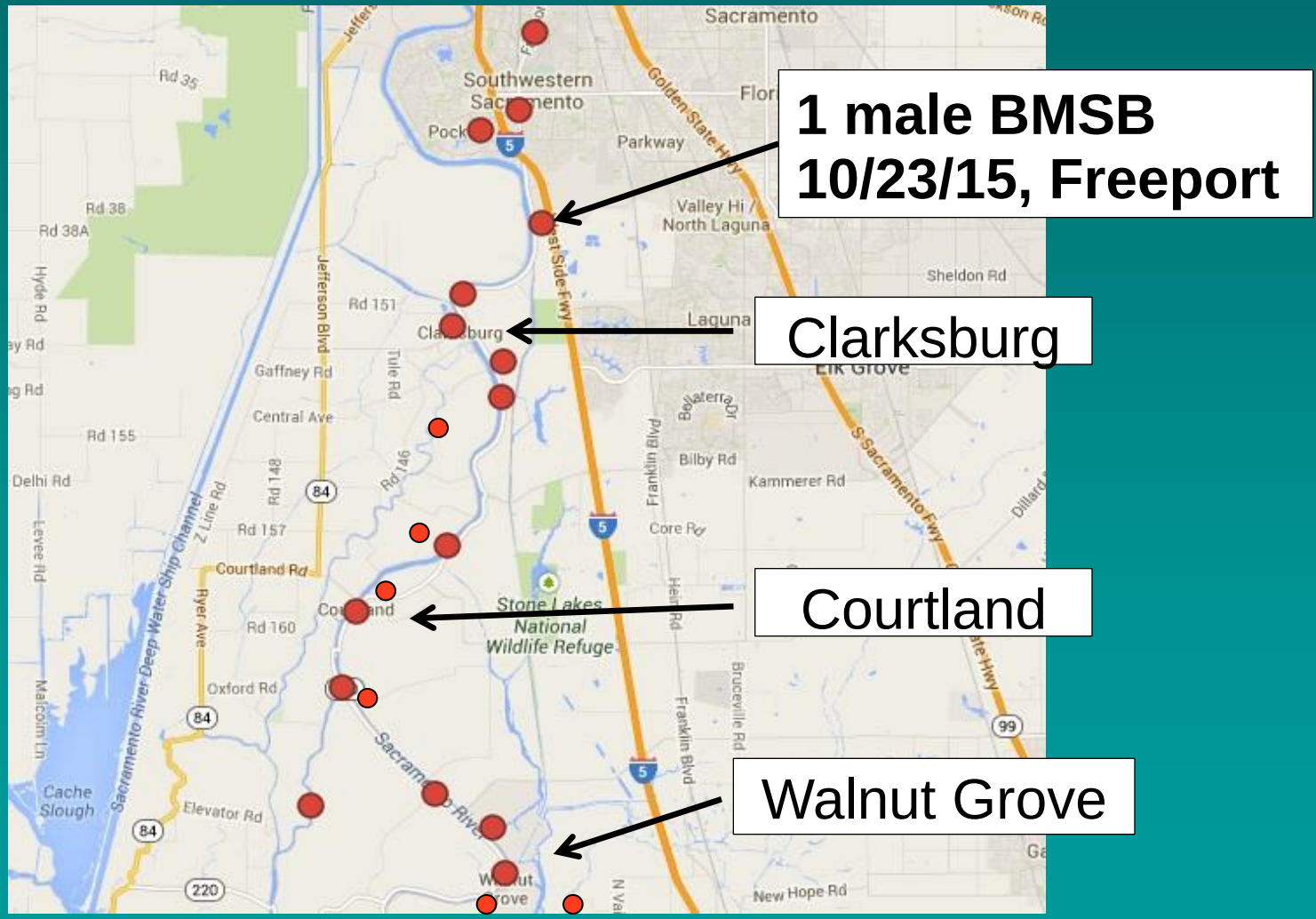


Trap Placement Locations (21)

Sacramento River Pear District, 2015



Sunflower
Trap Crop Study 2015

- Sunflower & sorghum seeds planted in ring around three 10’x20’ garden plots on 4/14
- Large numbers of BMSB found on sunflowers, far fewer on sorghum
- BMSB are easy to see on sunflower, can be easily killed

Trap Crop Study
2015

May

June

Trap Crop Study
2015

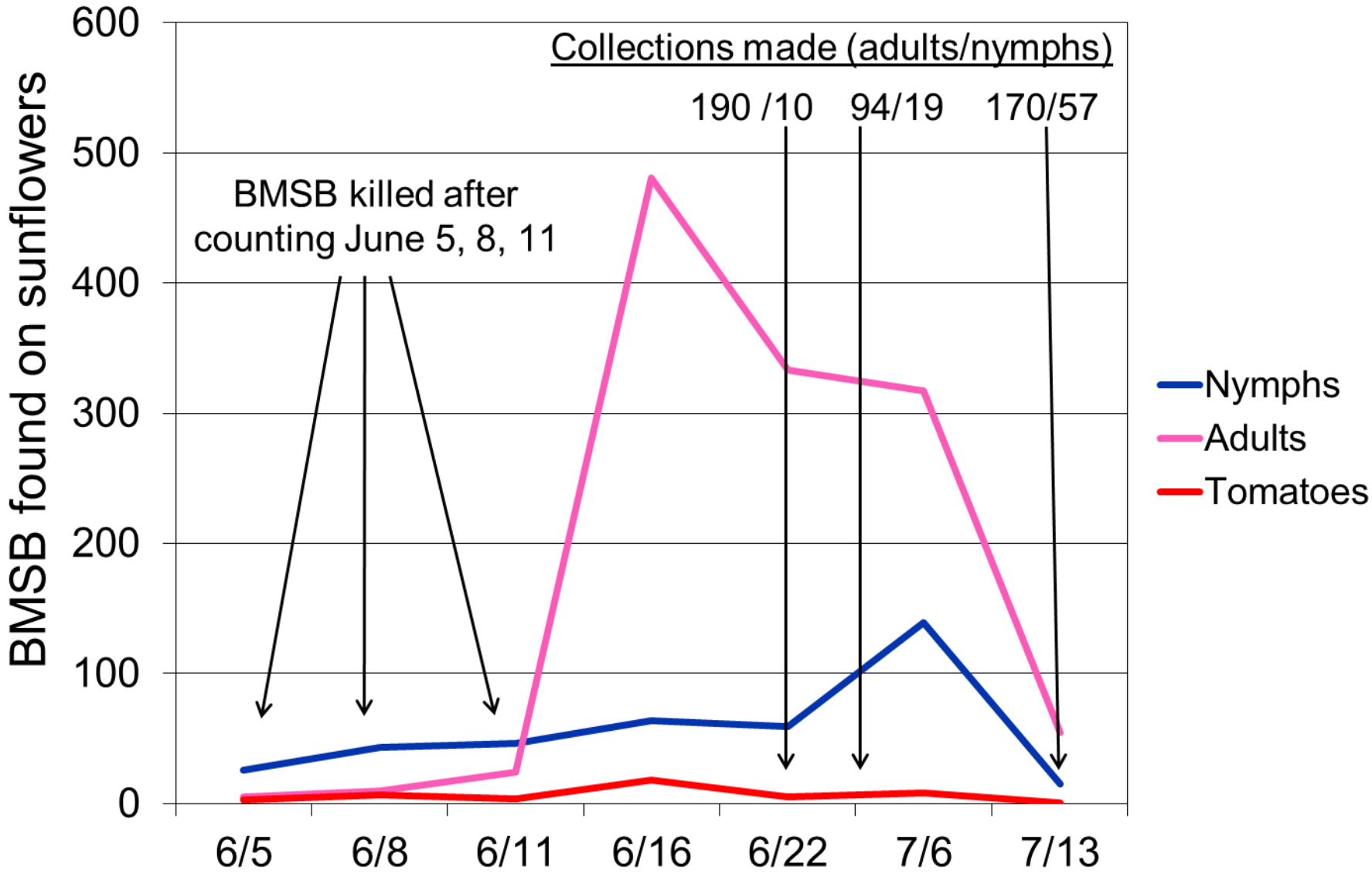
Tall sunflowers:
Large numbers

Dwarf Sunflowers:
None

June
2015

Sept. 2015

BMSB Found on Planted Sunflowers (mostly) and Sorghum



Problems Related to Chemical Control

- Lack of efficacy in field
- Moribundity – Drop & recover
- Movement into & out of orchards
- Buildup of secondary pests
  - » Mites, leafhoppers, etc.

Insecticide Bioassay Results

- BMSB “lethality index” (immediate mortality with little or no recovery)
  - » 4.5 hrs. exposure to dry residue, glass containers
  - » Field efficacy may differ

Active Ingredient	Lethality Index	Active Ingredient	Lethality Index
Dimethoate	93.3	Cyfluthrin	49.0
Malathion	92.5	Oxamyl	46.8
Bifenthrin	91.5	Esfenvalerate	43.3
Methidathion	90.4	Imidacloprid	40.0
Endosulfan	90.4	Tolfenpyrad (SC)	36.5
Methomyl	90.1	Tolfenpyrad (EC)	33.3
Chlorpyrifos	89.0	Pyrifluquinazon	28.3
Acephate	87.5	Kaolin Clay	23.1
Fenpropathrin	78.3	Diazinon	20.4
Permethrin	77.1	Phosmet	20.0
Azinphosmethyl	71.3	Acetamiprid	18.8
Dinotefuran	67.3	Thiacloprid	18.3
Kaolin Clay + Thiamethoxam	66.7	Abamectin	16.3
Formetanate HCl	63.5	Indoxacarb	11.3
Gamma-cyhalothrin	59.0	Spirotetramat	9.8
Thiamethoxam	56.3	Carbaryl	9.2
Clothianidin	55.6	Flonicamid	7.7
Beta-cyfluthrin	54.8	Water (Control)	5.8
Lambda-cyhalothrin	52.9	Cyantraniliprole	1.7
Zeta-cypermethrin	52.1		

Tracy Leskey. 2011. The Challenges Posed by the Invasive Brown Marmorated Stink Bug, *Halyomorpha halys* (Stal), to U.S. Agriculture. USDA-ARS Appalachian Fruit Research Station, Kearneysville, WV

Insecticide Bioassay Results – Top 10

Active Ingredient	Trade Name (Example)	Insecticide Class	Lethality Index
Dimethoate	Dimethoate	OP	93.3
Malathion	Malathion	OP	92.5
Bifenthrin	Brigade	Pyrethroid	91.5
Methidathion	Supracide	OP	90.4
Endosulfan	Thiodan	Organochlor.	90.4
Methomyl	Lannate	Carbamate	90.1
Chlorpyrifos	Lorsban	OP	89.0
Acephate	Orthene	OP	87.5
Fenpropathrin	Danitol	Pyrethroid	78.3
Permethrin	Pounce	Pyrethroid	77.1

Pesticide Efficacy
Field Study (Leskey et al., 2013)

- High mortality on day of application: Endosulfan (e.g., Thiodan), methomyl (Lannate), thiamethoxam (Actara), and bifenthrin (e.g., Brigade)
- Fenpropathrin (Danitol) and dinetofuran (Venom): not mortality, but strong anti-feeding effect for 7+ days
- Peaches in Mid-Atlantic: 10-12 weekly applications, alternate-row, late May-harvest using pyrethroids and neonicotinoids
- Effective insecticides in lab: only 60% average mortality in the field when applied late early July, 40% in Aug., and 20% in September

2014 Orchard Spray Recommendations
VA, WV, and MD Coop. Extension

- Products that have shown good effectiveness against BMSB include:
  - Pyrethroids: Baythroid XL (B-cyfluthrin), Danitol (fenpropathrin), Warrior II (Beta-cyfluthrin), products containing permethrin (e.g. Pounce)
  - Neonicotinoid: Belay (clothianidin)
  - Carbamate: Lannate (methomyl)
  - Premixtures: Endigo ZC (Beta-cyfluthrin + thiamethoxam) and Leverage 360 (imidacloprid + cyfluthrin)

Alternative BMSB Management

Penn. State Univ., Rutgers Univ.

- Border applications
  - Use strong residual products
- Treat surrounding vegetation, if feasible
- Trap cropping
  - e.g., beans, sunflowers
  - Spray trap crops

Organically Acceptable Insecticides

Partial to fairly good control of nymphs only:

- Pyrethrum
- Azadirachtin
- Spinosad
- Sabadilla
- Insecticidal soap
- Combinations

Natural Enemies Found in Traps

Jumping spider
(Salticidae family)

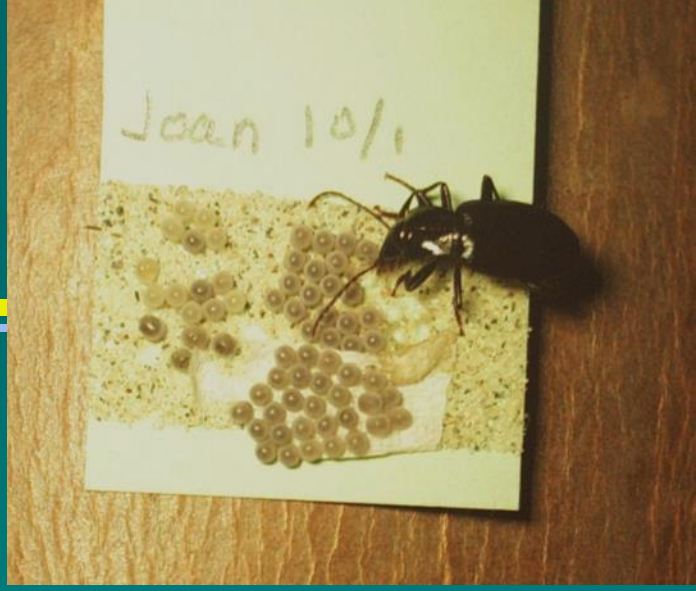
Euclytia flava
(Tachinidae)

Photo: Ryan Fernandez

Digger wasp
(*Astata occidentalis*)
(predatory wasp)

Predators

Assassin bug



Carabid beetle

(C. Pickett)

Astata sp.

(R. Henderson)

Biological Control?

- Foreign exploration done by USDA
- Egg parasitoids - *Trissolcus* spp.
- Testing at 4 sites, incl. UCR
- Possible release in Calif. in 2017

Questions?

Important Web Sites

StopBMSB.org

ucipm.ucdavis.edu

cesacramento.ucanr.edu