Mosquito Control

Zika Virus.

West Nile Virus. Nuisance.

bdeenihan@clarke.com

630-235-3943

Being Prepared

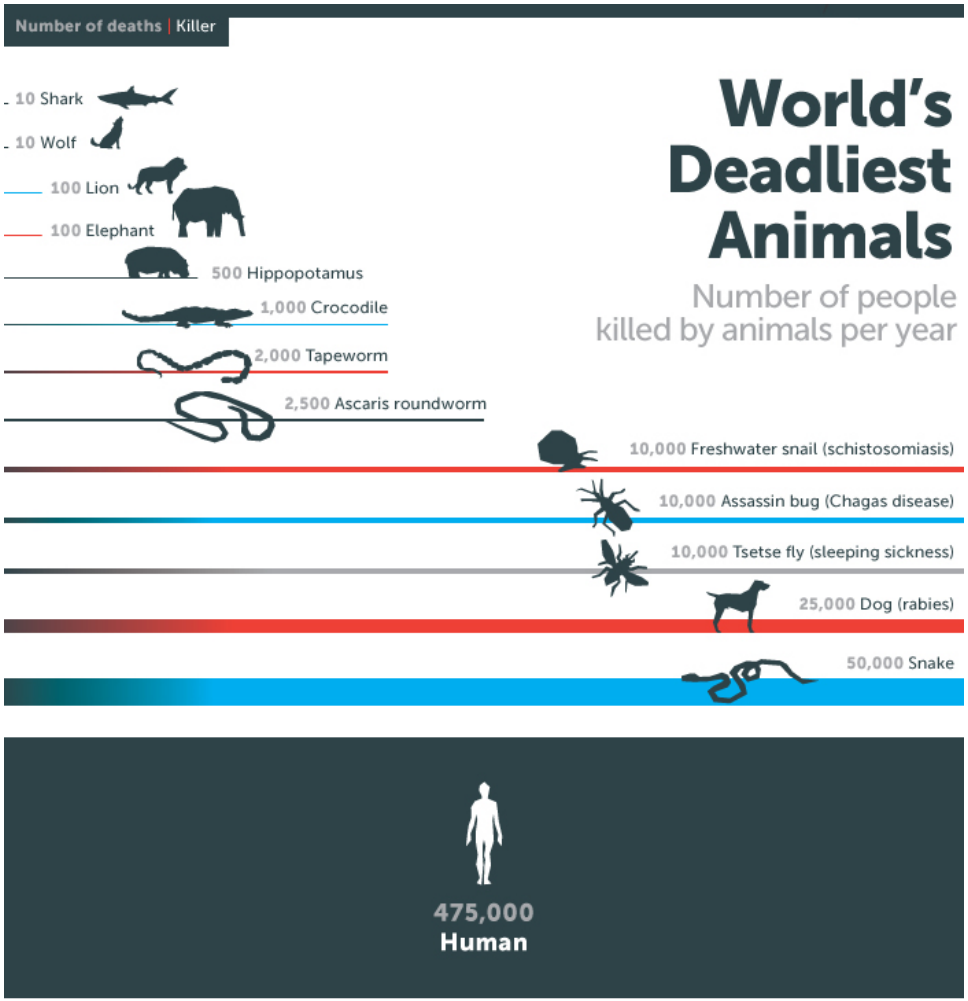
- *As we go through the workshop today,*
- How to start a program
- What is needed
- How we can help
- **West Nile Virus, nuisance**
- New ways/tools *adjust* your program to combat/prepare for Zika Virus.

Zika Virus, West Nile, etc.

- Nuisance program that can be ramped up to respond to disease
  - Not re-creating wheel
  - Change a few spokes
  - Tools in place; adult and larval
  - Different control
- West Nile Virus, Zika Virus, other
  - More adult tools
  - Traditional control

Can you provide assurance to your community that you're ready to respond to a Zika or other mosquito-borne disease outbreaks?

- 2016 taught us two things: ***mosquito-borne viruses are not going away***
- ***We have to employ new protocols for control.***
- With Zika virus entering the U.S. ***it's time to assess your mosquito control program's effectiveness***



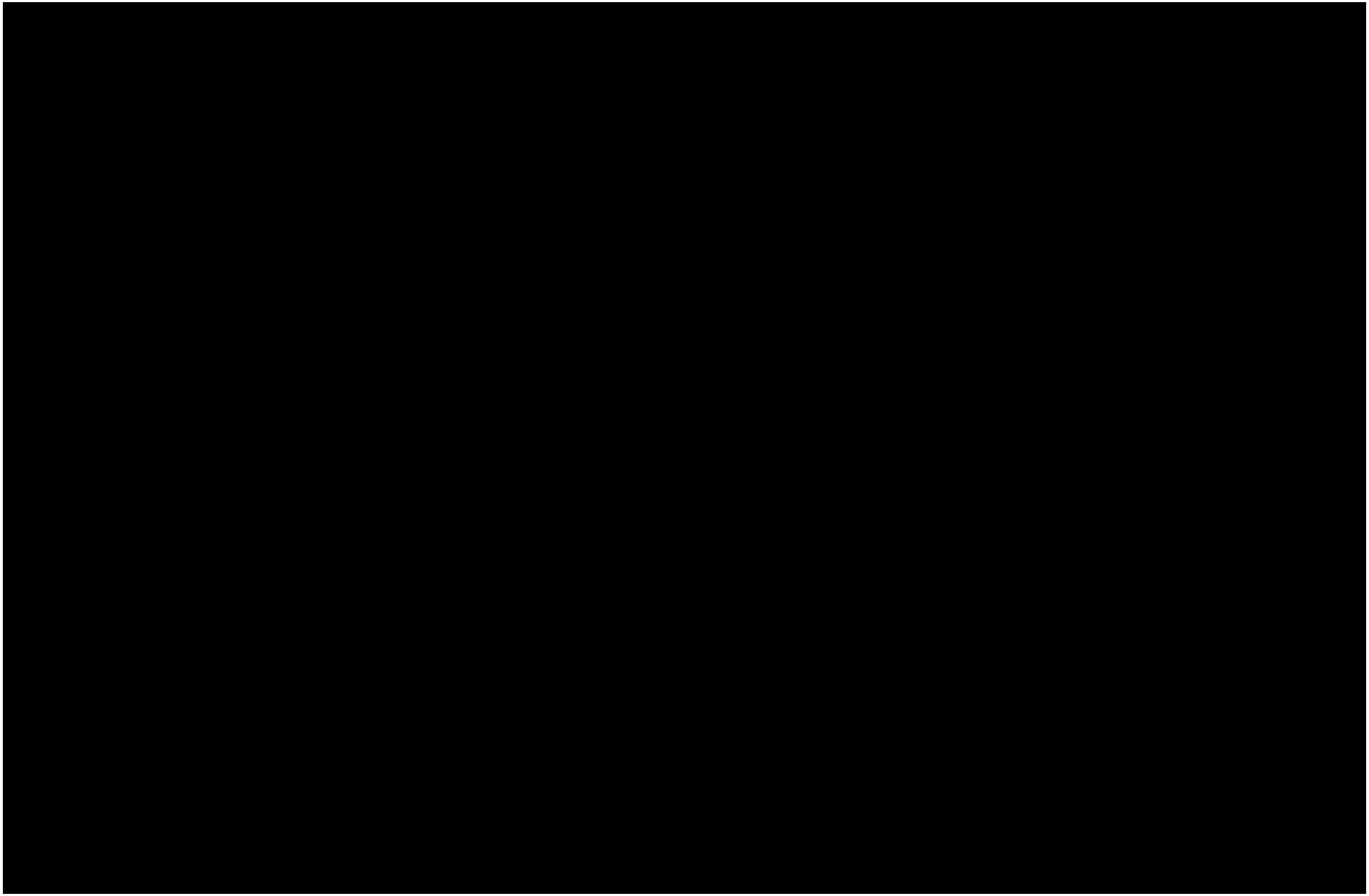
Waging a War Against Mosquitoes…

When it comes to killing humans, no animal even comes close to the mosquito.

Zika Virus

- **PPP**
- **Plan, Prepare, ~~Panic~~**
  - Plan and Prepare
  - Plan in place
  - Plan can/may change
  - Prepare to implement
  - Not Panic

Zika changed everything



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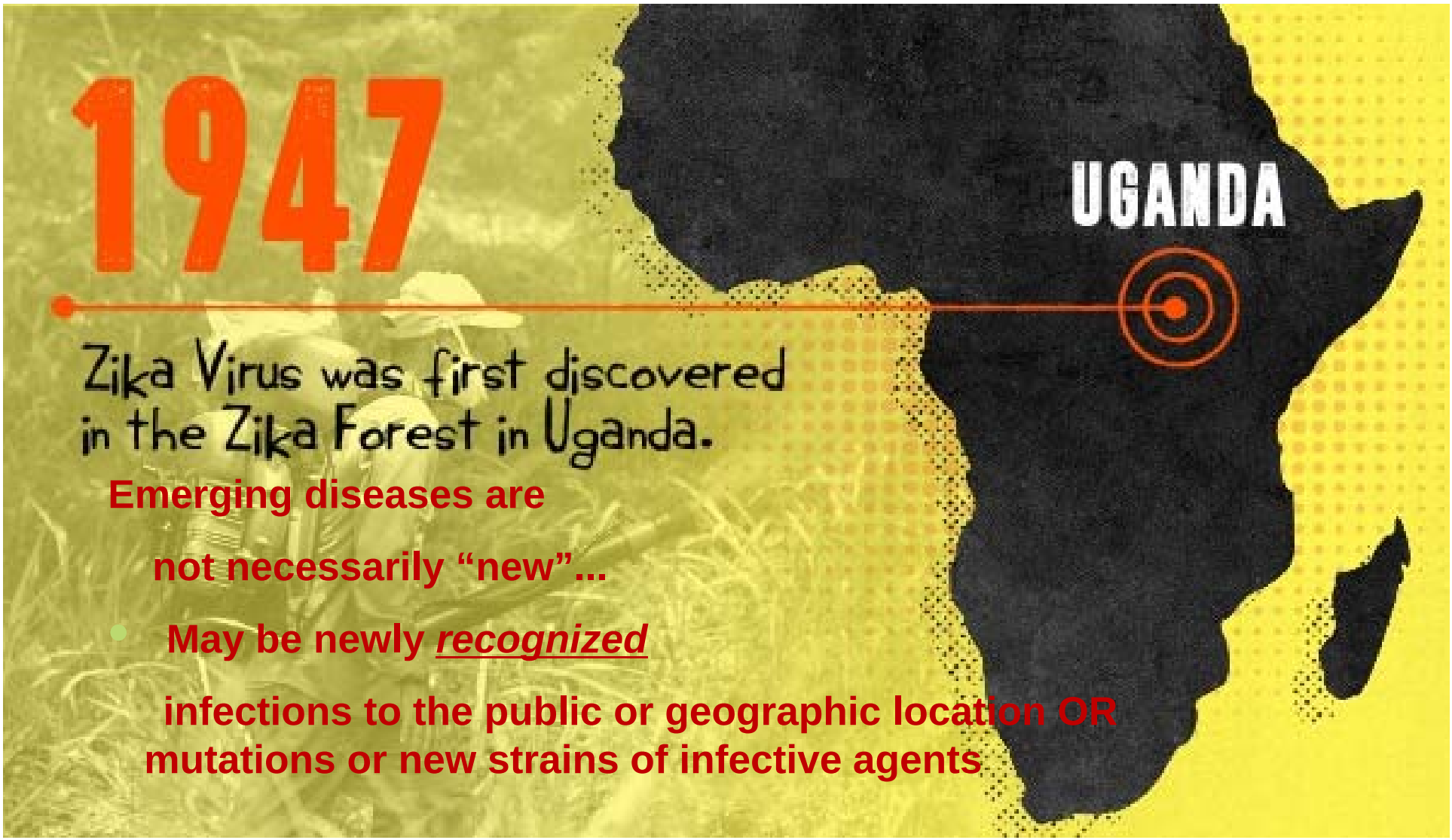
What Are “New” Emerging Diseases?



Emerging diseases are

not necessarily “new”...

- **May be newly *<u>recognized</u>***

infections to the public or geographic location OR mutations or new strains of infective agents

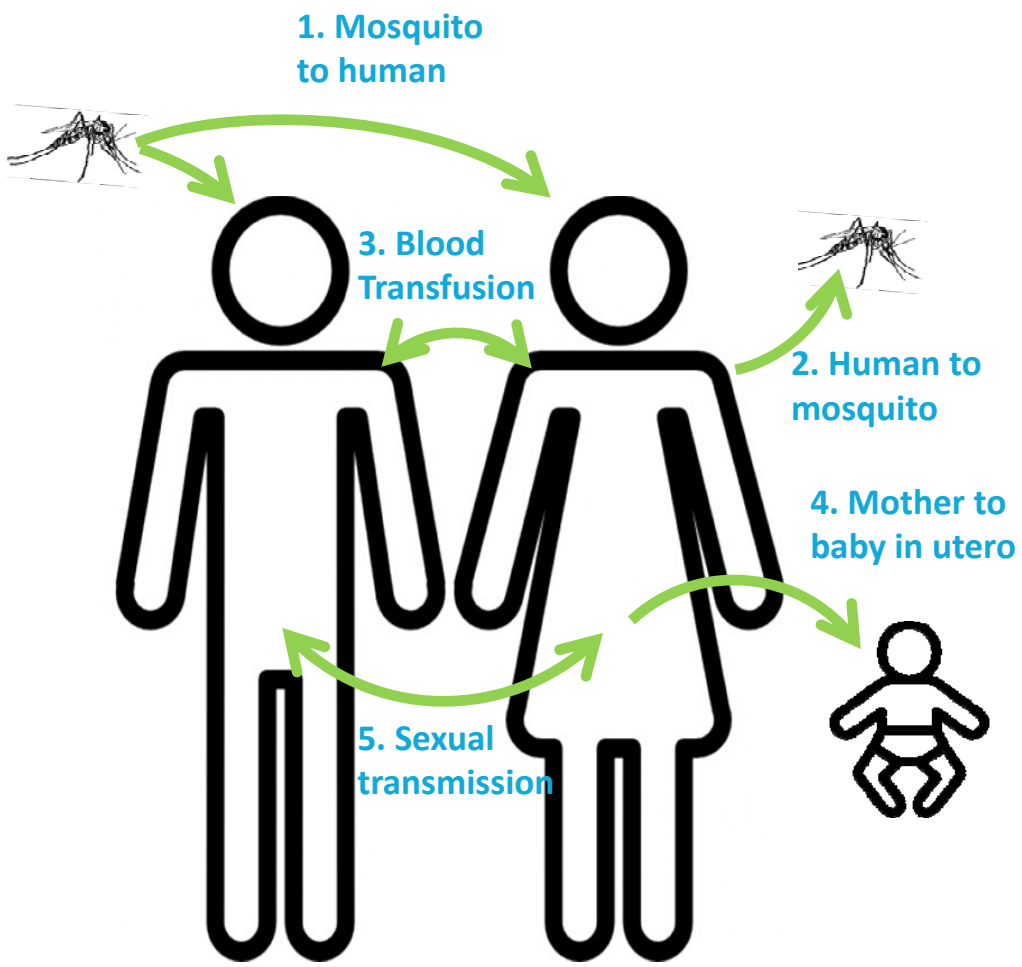
Background

Zika Cases in the U.S.

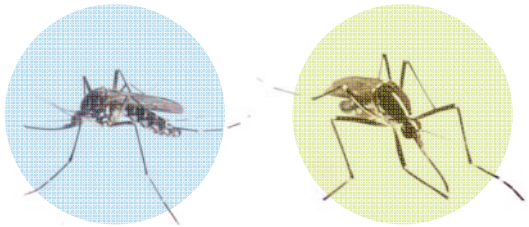
- 4,900 cases confirmed
- 217 confirmed locally acquired
- 4,682 imported/travel related
  - 1,292 pregnancy cases
    - 875 births
      - 36 with defects
      - 5 deaths

Calendar year 2016
Source: Arbonet

5 Zika Transmission Routes



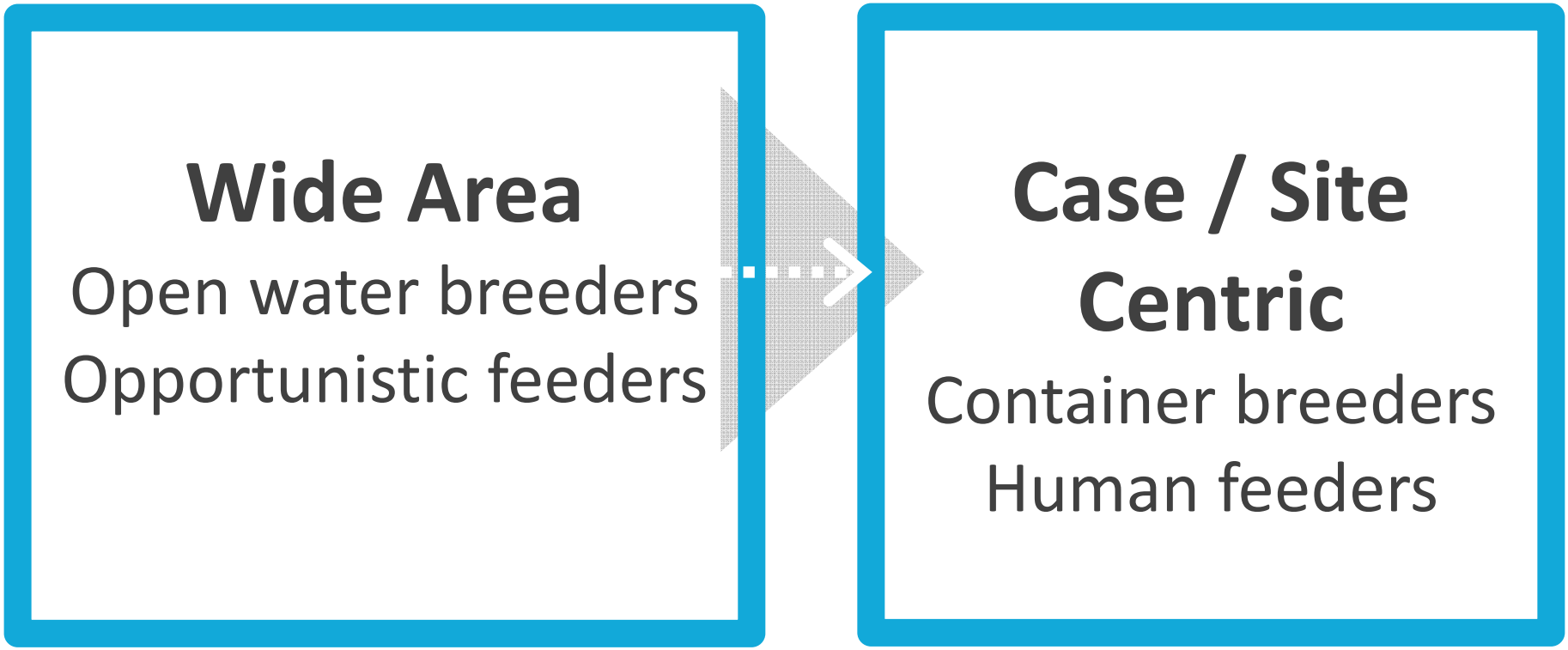
Mosquito vectors



Aedes aegypti and *Aedes albopticus*

- Lay eggs in very small amounts of water—earning the nickname ‘container breeders’
- Like to live near people and bite during the day
- Have very short flight radius
- Eggs can survive dry conditions up to six months

Mosquito Control



(Traditional)

(New)

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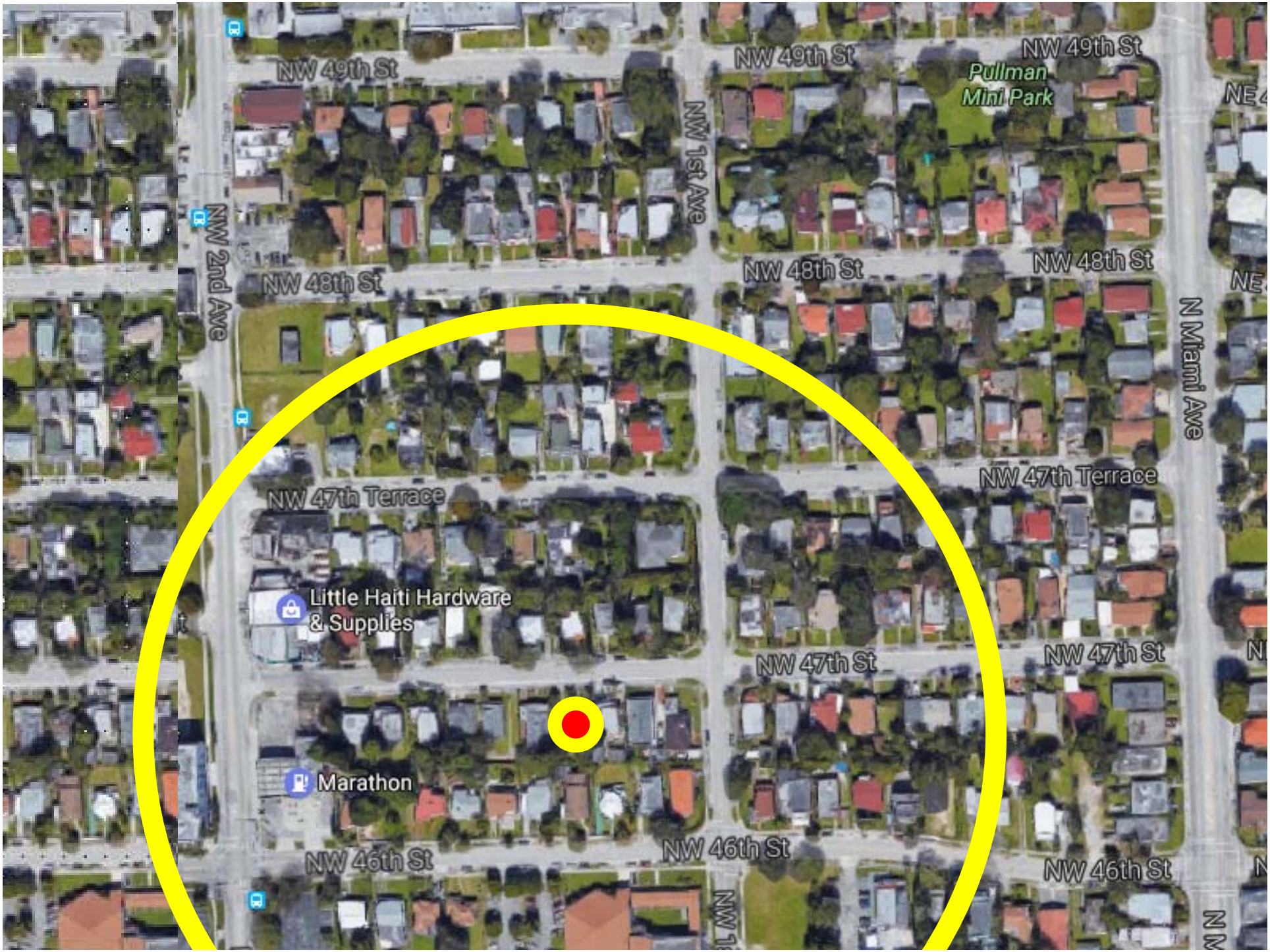
NW 49th St
NW 49th St
NW 49th St
Pullman
Mini Park
NW 1st Ave
NW 2nd Ave
NW 48th St
NW 48th St
NW 48th St
N Miami Ave
NW 47th Terrace
NW 47th Terrace
Little Haiti Hardware
& Supplies
NW 47th St
NW 47th St
Marathon
NW 46th St
NW 46th St
NW 46th St



The challenge:
Cryptic breeding sites




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New scalable services

Clarke SITE Guard™

Miami Dade SITE Guard Evolution

Hired / trained over 200 employees from inception.

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Miami Dade | Hiring Seasonal Staff

- Hired and trained over 180 seasonal employees from inception. *(12 to 173 in 42 days)*
- Pass drug testing, motor vehicle records check and background check
- Training
  - **Classroom OSHA safety**
  - **Chemical training**
  - **Public Relations /Resident Interaction Training**
  - **1 day classroom training of operation field procedures directly with Field Supervisor**
  - **Field training working with a veteran technician**

Miami-Dade | June 2016

Miami-Dade | August 2016

New control methods


IS WO
WALED
EVERYONE


LIVE

Miami-Dade | Clarke Aerial Services

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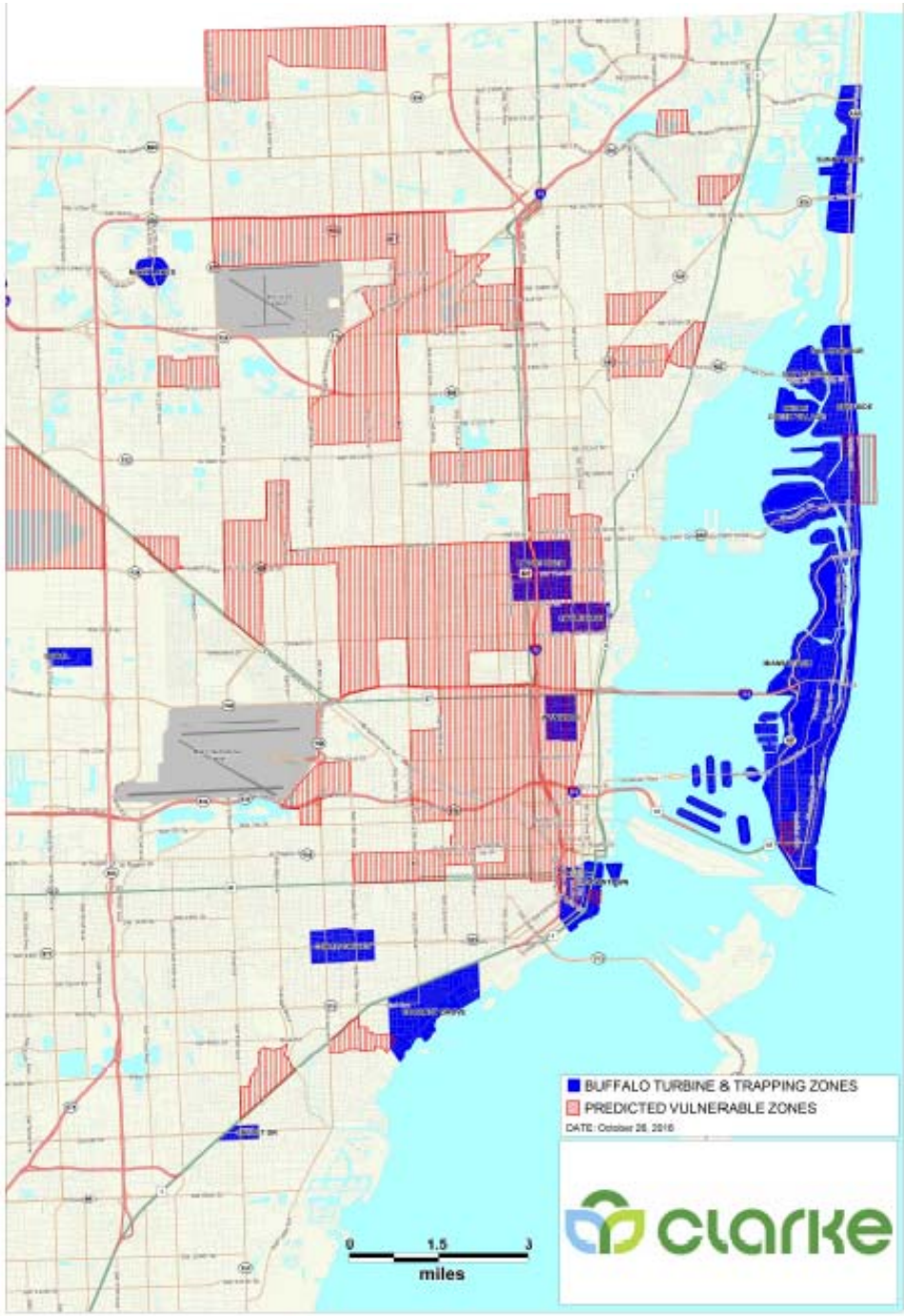
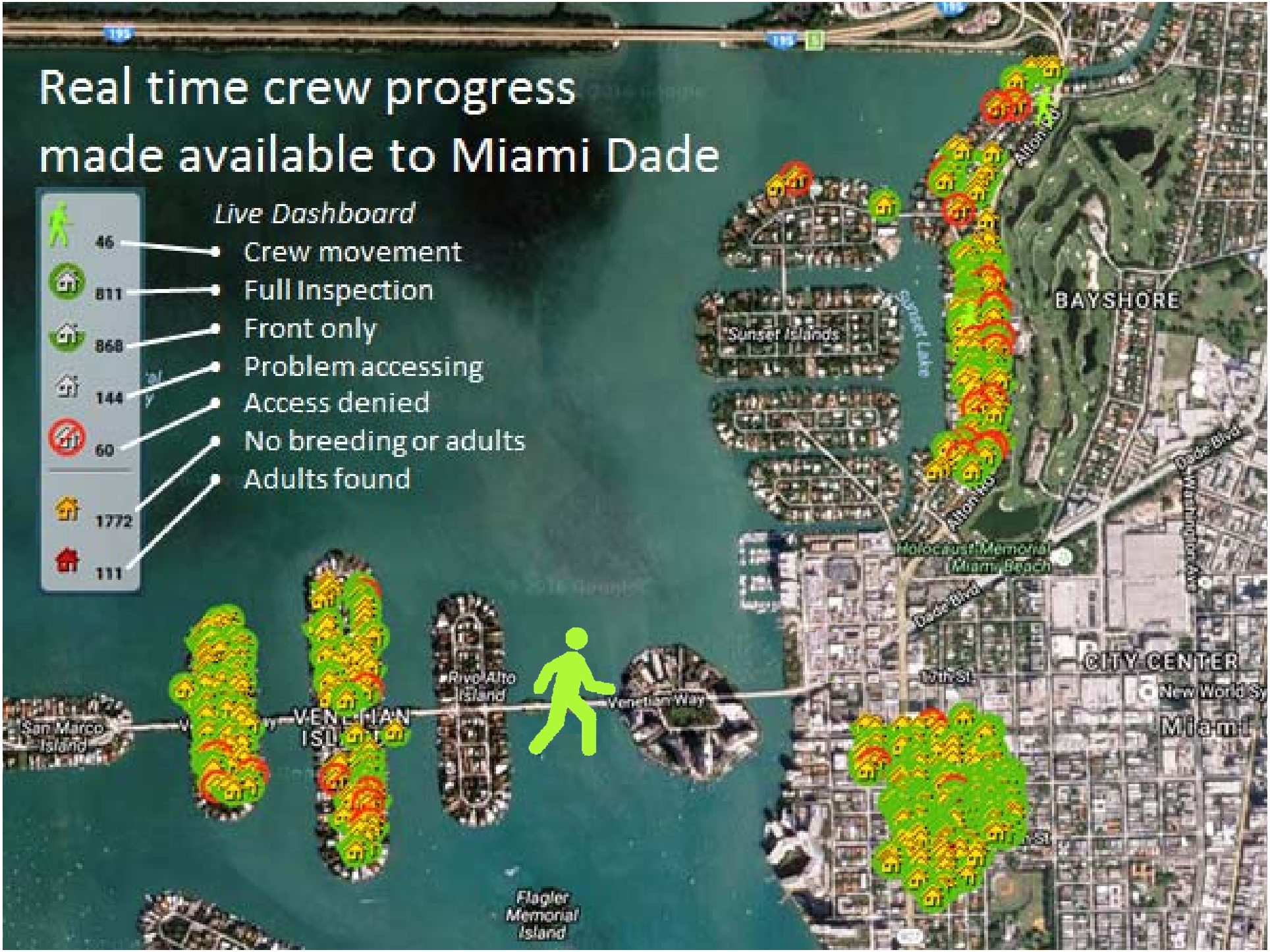
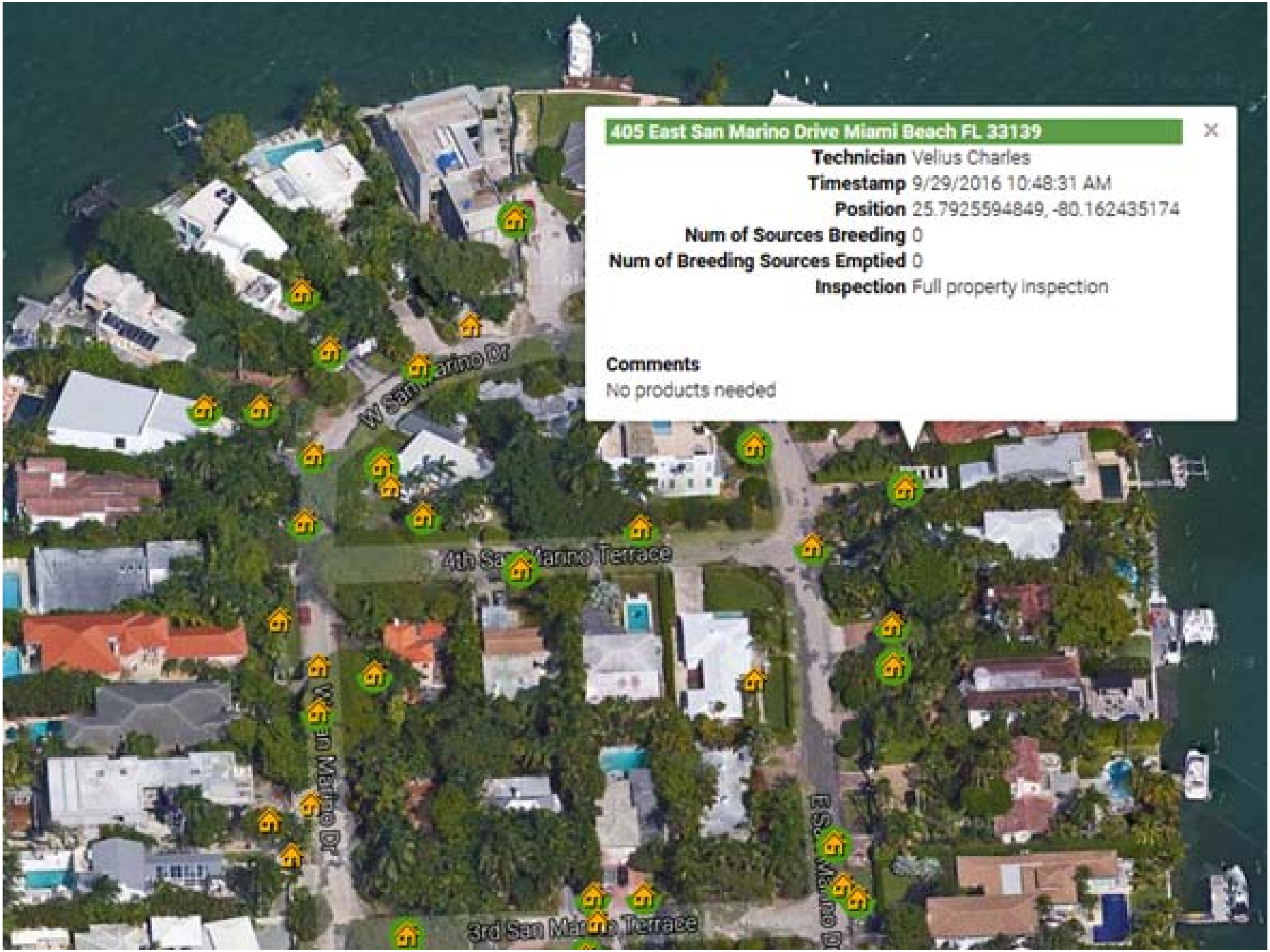
Current Buffalo Turbine & Trapping Zones



Data and Reporting


Real time crew progress made available to Miami Dade
Live Dashboard
46
Crew movement
811
Full Inspection
868
Front only
144
Problem accessing
60
Access denied
No breeding or adults
1772
Adults found
111
BAYSHORE
Sunset Islands
Sunset Lake
Alton Rd
Dade Blvd
Holocaust Memorial (Miami Beach)
CITY CENTER
10th St
Miami
Rivo Alto Island
Venetian Way
San Marco Island
Flagler Memorial Island


405 East San Marino Drive Miami Beach FL 33139
Technician Velius Charles
Timestamp 9/29/2016 10:48:31 AM
Position 25.7925594849, -80.162435174
Num of Sources Breeding 0
Num of Breeding Sources Emptied 0
Inspection Full property inspection
Comments
No products needed
W San Marino Dr
4th San Marino Terrace
W San Marino Dr
E San Marino Dr
3rd San Marino Terrace

Learnings

#1

A season-long suppression approach needs to be used for container breeder control.

Control Methods

for Container Breeders

Wide Area

- Adulticiding by truck/aerial
- Larviciding by truck/aerial

+

Site Centric

- House-to-House
- Inspect & tip
- Larviciding
- Duet ULV
- Education

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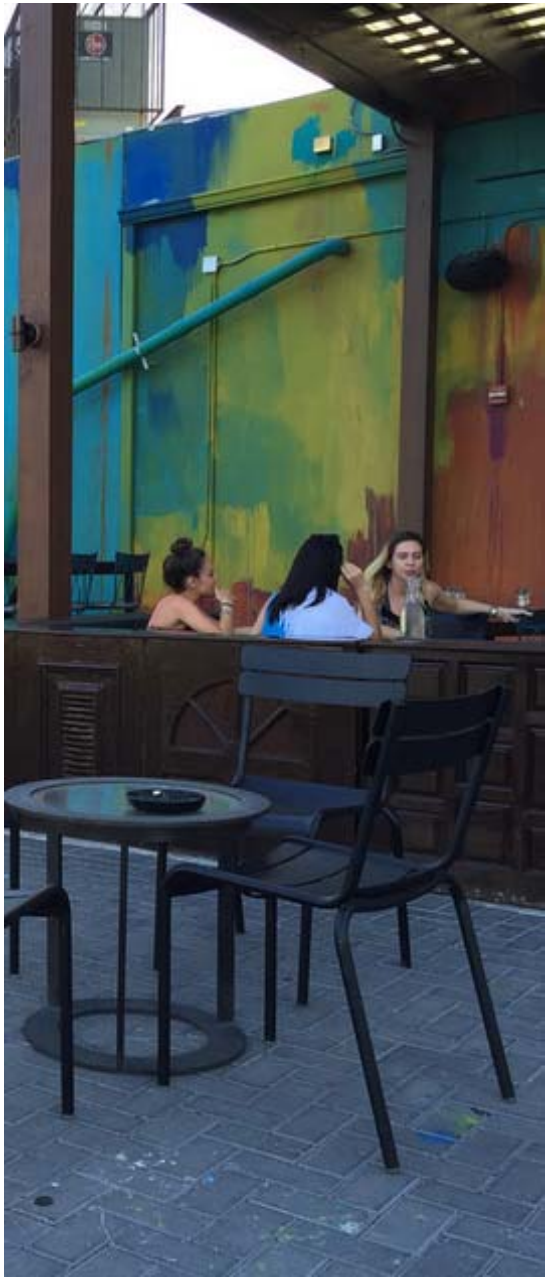
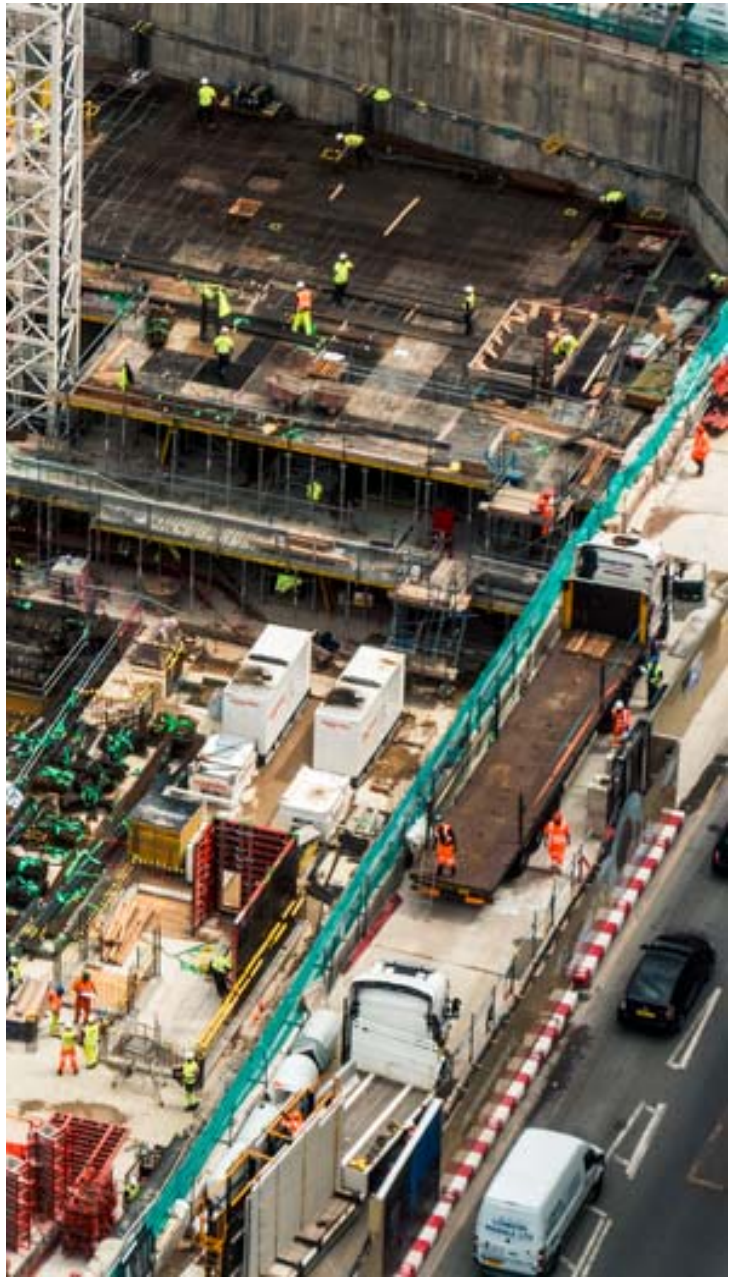
#2

Zika control requires an understanding of mosquito AND people proximity.

Dual Focus

Mosquitoes + Humans ♀♂





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#3

New wide area larviciding methods can suppress populations early.

#4

Door-to-door site inspections are a key element in controlling a human-host epidemic cycle.

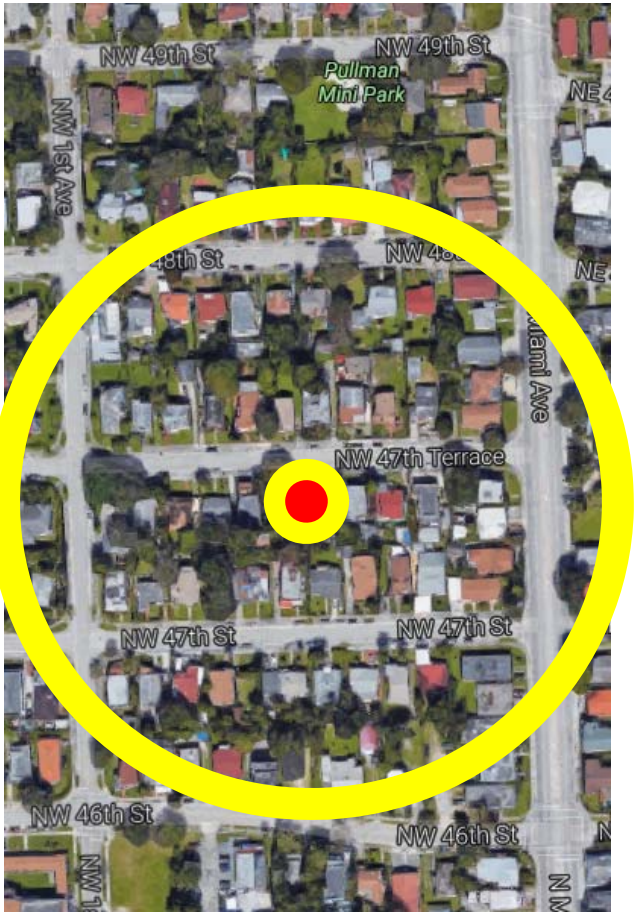
Control lessons learned?

Boots on the ground

+

Modified wide-area methods

Radius Approach



2016

Biology Block Approach

2017

Infection case

Door-to-door treatment

Wide-area treatment

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Miami-Dade | What We Have Done

Personnel: Professional Appearance

– **ID Badges**

– **Standard Uniform**

- Clarke grey shirt
- Dark blue pants
- Dark blue hat
- Miami-Dade Vest

– **Truck wrapped** to identify as Miami-Dade Contractor

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Product & equipment containment, and important safety step

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#5

Recent Zika-related innovations are relevant for any program.

Spinosad (Natular®) Larvicide

- DT

- T30

OMRI Listed Organic Materials Review Institute

OMRI Listed Organic Materials Review Institute

- G30

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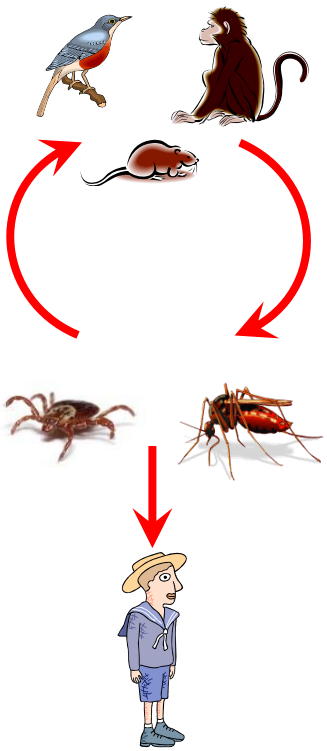
Vide
Lenox AVE

Simplified Patterns of Vector-Borne Disease Transmission

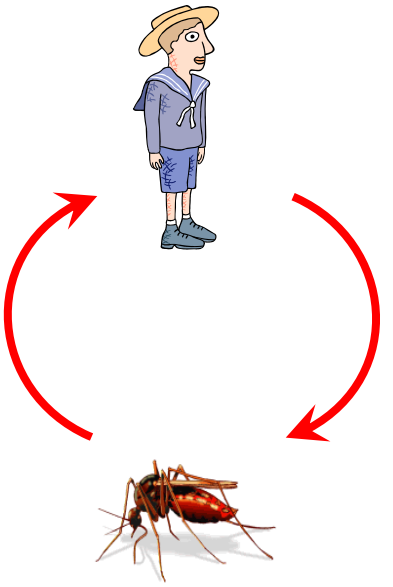
Scenario one:
People are incidental hosts



Enzootic cycle

WNV

Scenario two:
People are primary hosts



Epidemic cycle

ZIKV, DENV and CHIKV

Harry M. Savage
Division of Vector-Borne Diseases
Centers for Disease Control and Prevention

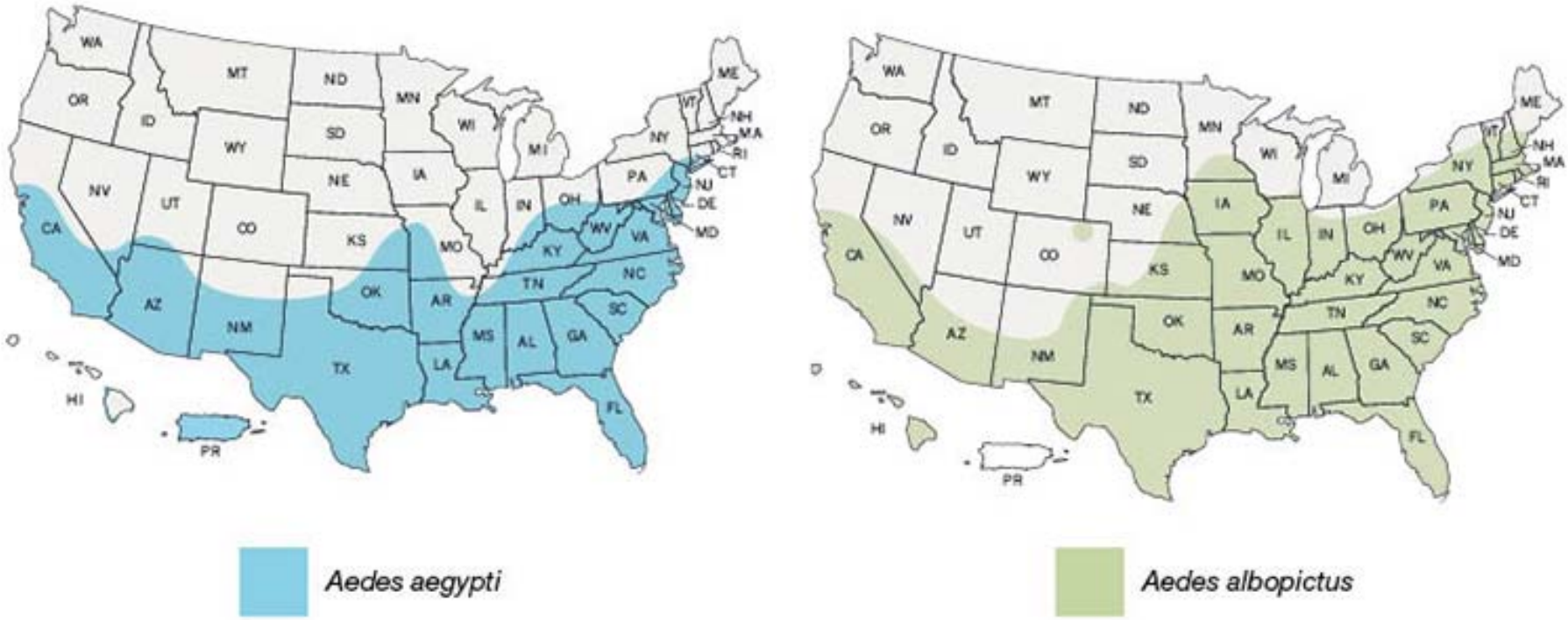
Aedes | How They Are Different

- **Both like to lay eggs in *very small* amounts of water, earning the nickname 'container breeder'.**
  - Bottle caps, flower pots, bird baths, gutters, downspout drains, rain barrels, ponds, junk piles, tires, boat covers
- **Like to live near people and bite during the day.**
  - *Opposite of night-biting mosquitoes* that can carry West Nile virus. Prefer to rest at night and have a very short flight radius. Resting spots can include garages, carports, sheds . . . In homes if you let them. Eggs can sustain dry conditions for up to 6 months!

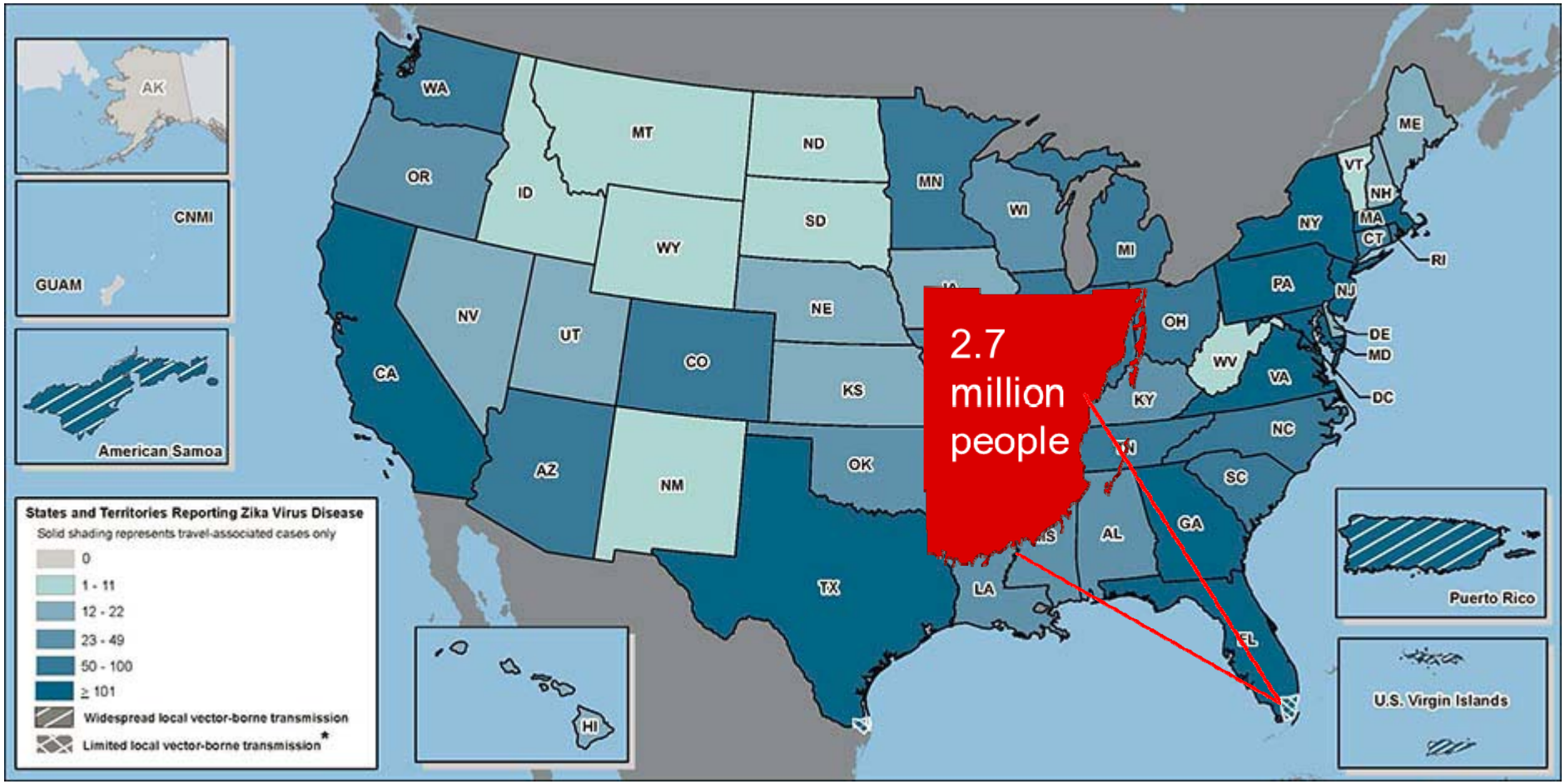
Same Time/Day Time Biters

- The mosquitoes that can transmit Zika are **biting during the same time children are out playing, people are enjoying their yards & people are working outside.**

Estimated range of Aedes albopictus and Aedes aegypti in the United States, 2016*



Zika Confirmed Reported Travel Cases in US as of 1/18/17

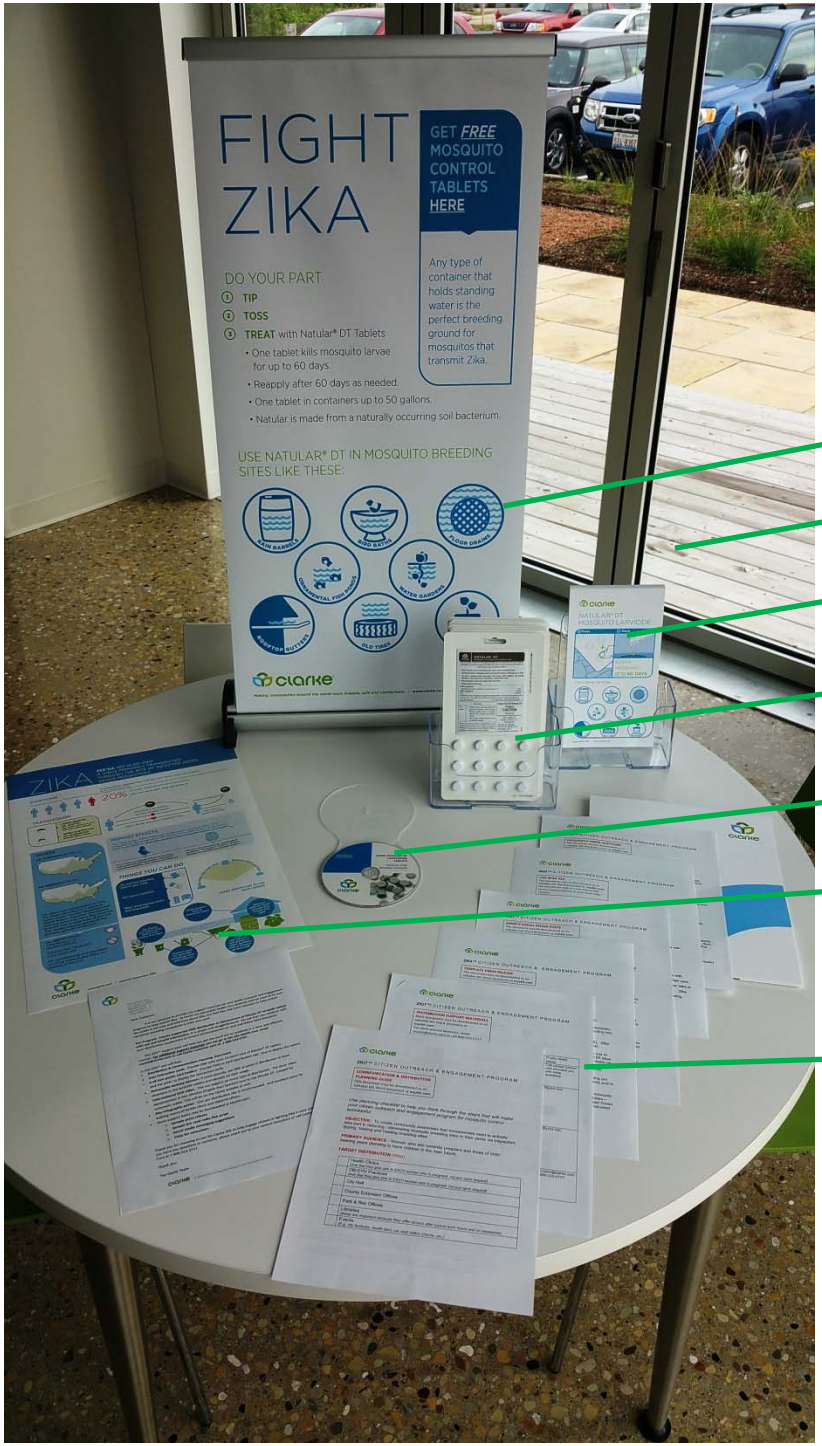


CDC

Kentucky City areas

- Greater Louisville area: 1,269,702
- Greater Lexington area: 723,849
- Greater Bowling Green area: 218,870

Education & Public Engagement



ZKit™ Community Engagement Program

- Pull-up Banner
- Acrylic holders
- Use Instructions – Bilingual
- Natular DT tablets – 12/card – Bilingual label
- Use Instruction Video - Bilingual
- Zika Infographic
- Planning Guide
- Template Press Release
- Template Social Media Messaging
- Template Live Read PSAs
- Q&As
- Support Material List / Reorder Instructions

Community Engagement Program

- 60+ days control
- Counties purchase Natular DT tablets
- Counties then distribute to residents
- Clarke provides free support tools for points of distribution

9” x 5 ¾”
50 cards / case
600 tablets / case

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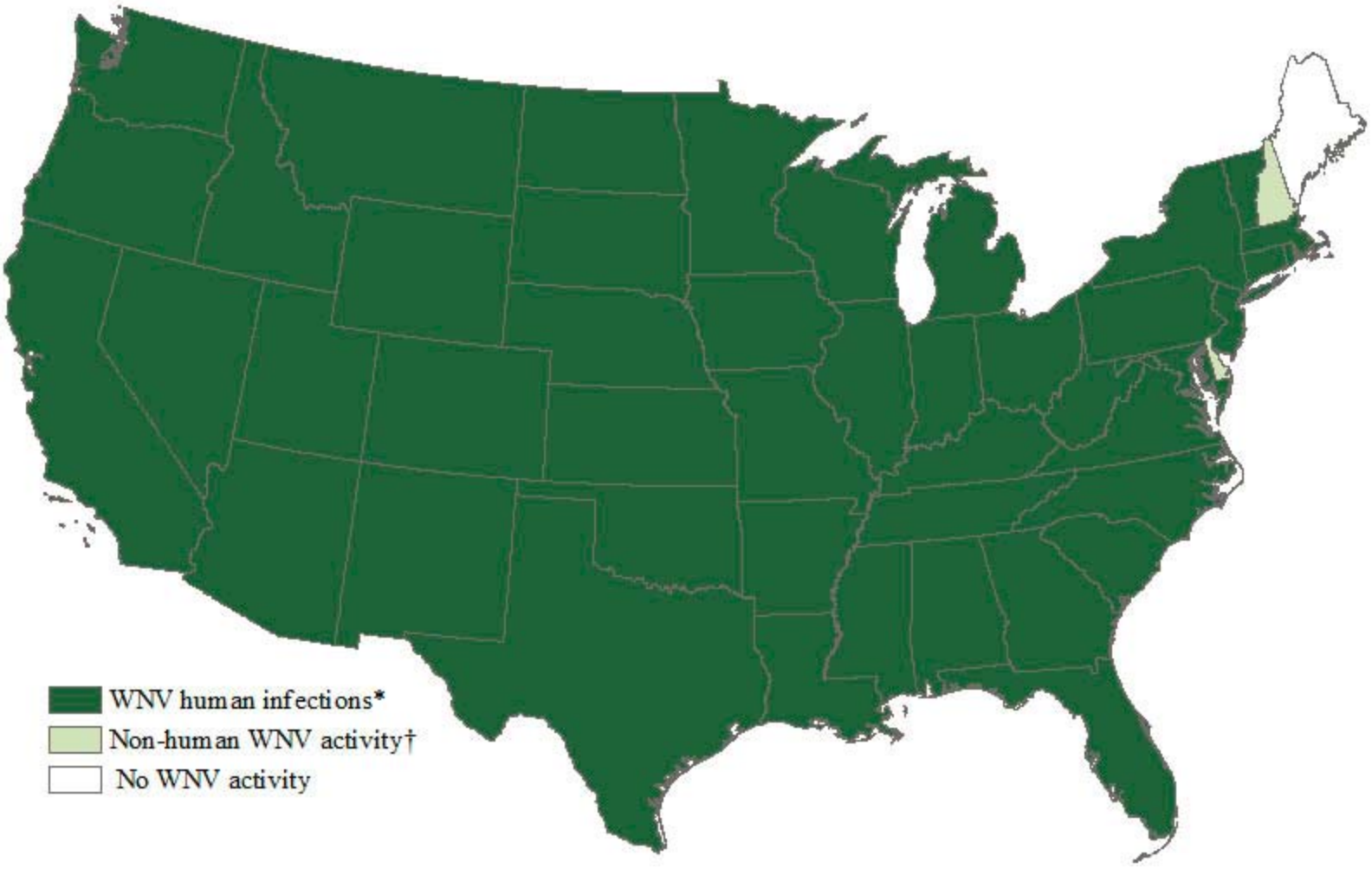
West Nile Virus

Vectors

- ***Culex*** **species are 1º vectors**
- ***Aedes albopictus*** **is a competent 2º vector**

West Nile Virus Activity by State – United States, 2016 (as of January 17, 2017)



WNV National Update

- In 2016
  - 2,038 cases – (2,060 2015)
  - 94 fatalities
- California was major WNV epicenter in 2016
  - 424 cases, 19 deaths
- Ohio 18 cases, 4 deaths
- Illinois 153 cases, 5 deaths
- Michigan 42 cases, 3 deaths
- Penn. 16 cases, 2 deaths

Malaria

Malaria

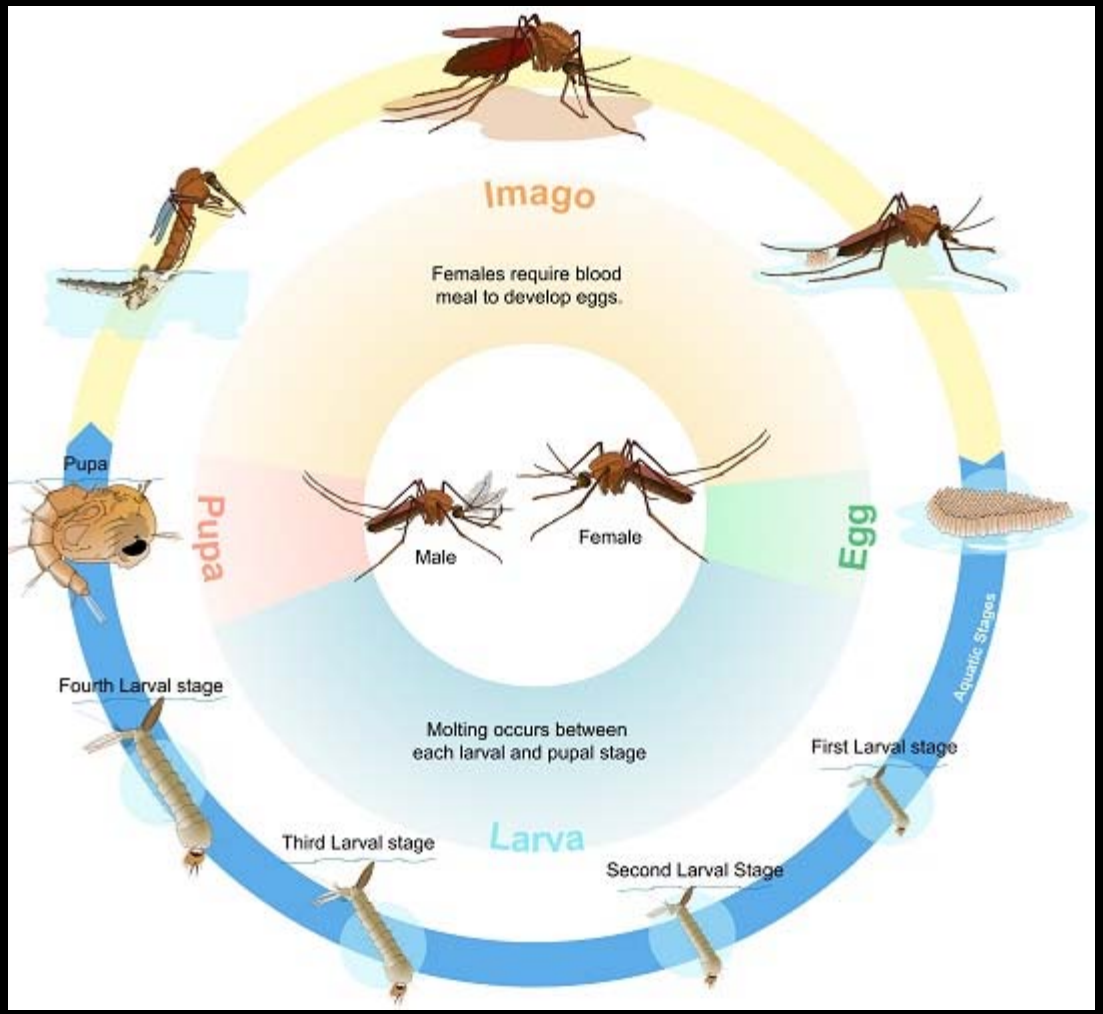
Malaria is a leading cause of death and disease worldwide, especially in developing countries.

- **Malaria risk areas**
  - Africa, Central and South America, Southeast Asia, Middle East
- **Each year**
  - 300-500 million cases
  - > 1 million deaths
- **In Africa, a child dies**

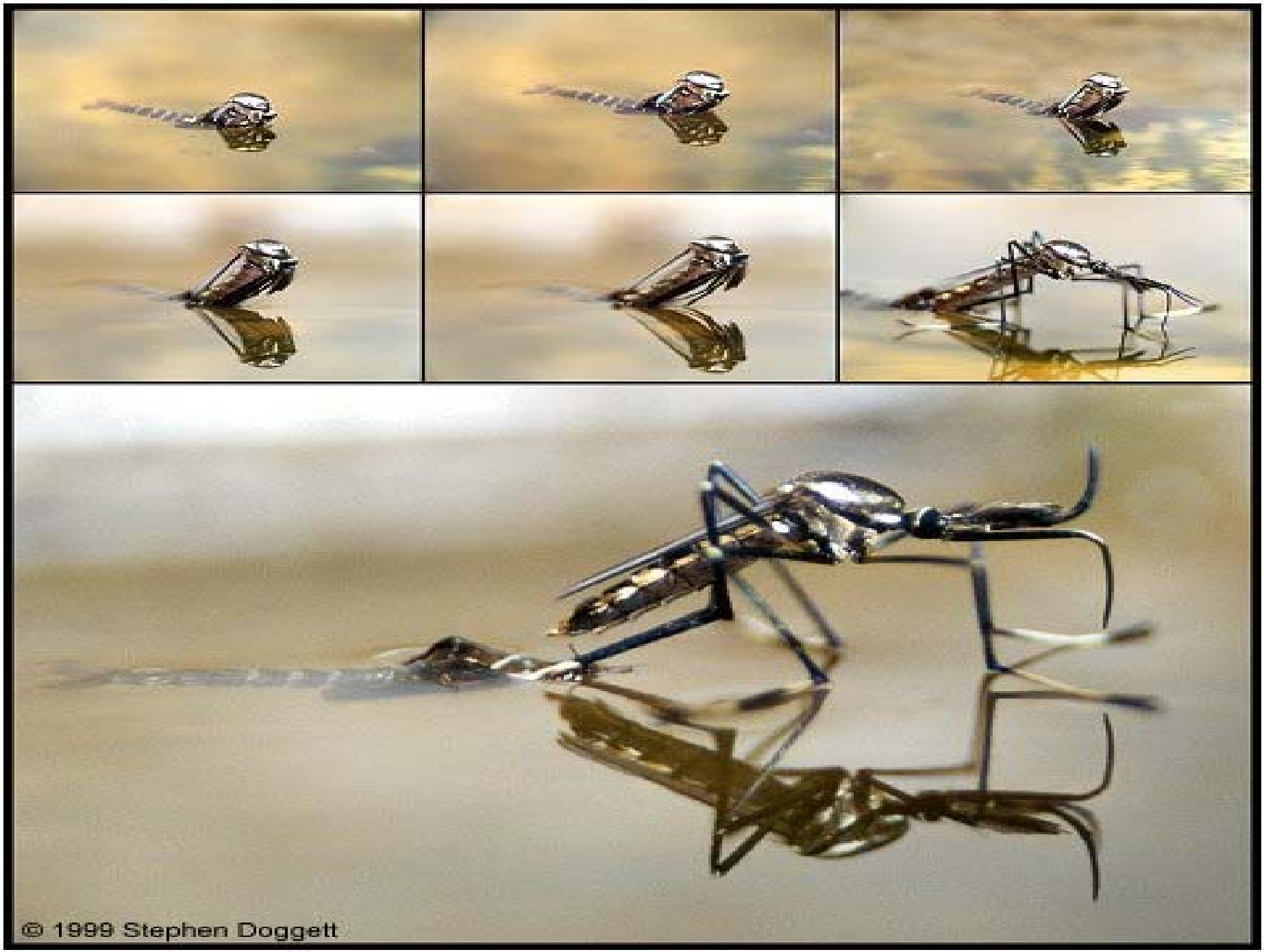
every 30 seconds

Biology, Species and Habitats

Mosquito Life Cycle




© 2002 Stephen L. Doggett


© 1999 Stephen Doggett

Flight Range

15 MILES

10 MILES

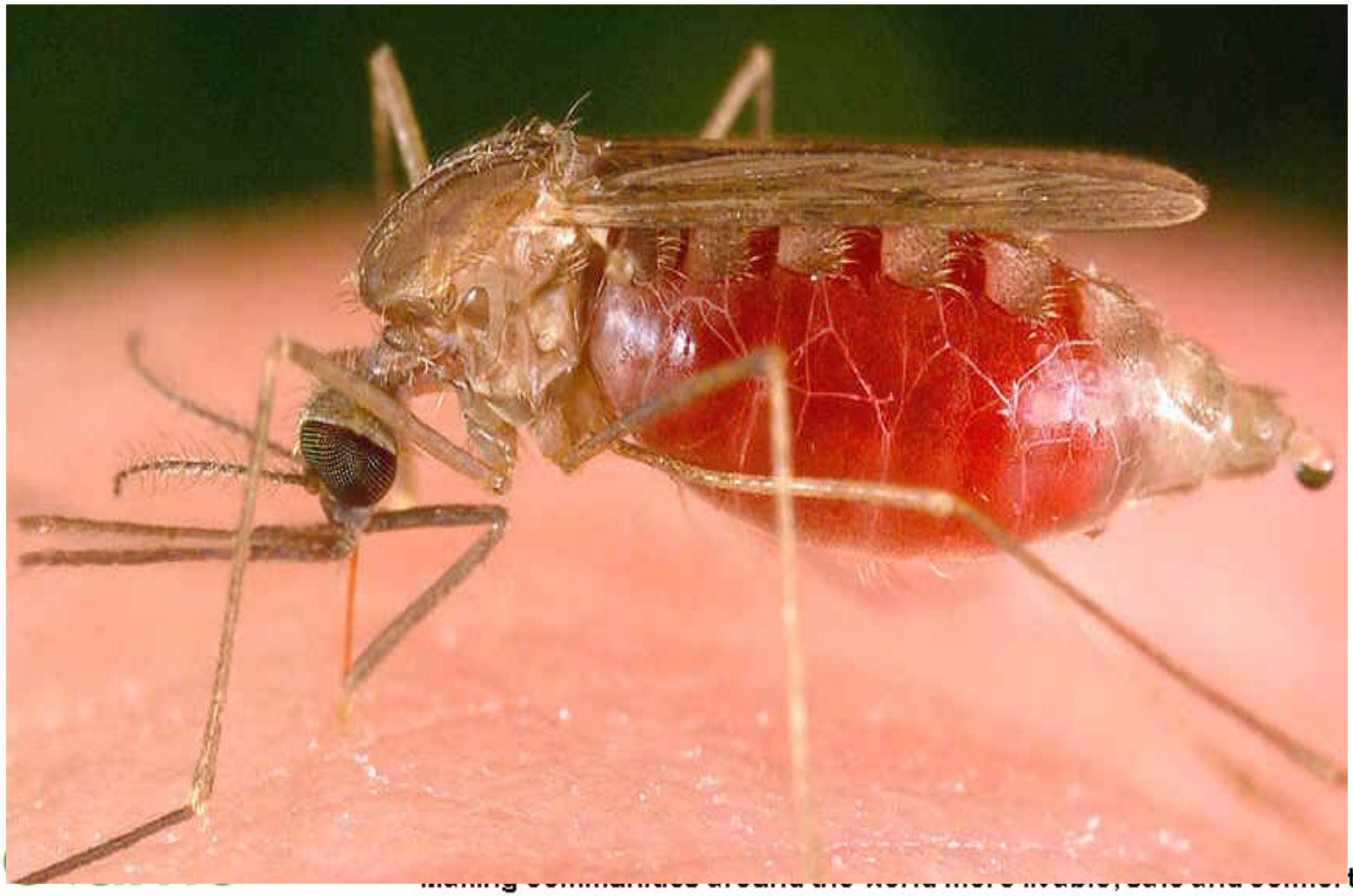
5 MILES

Hundreds of feet

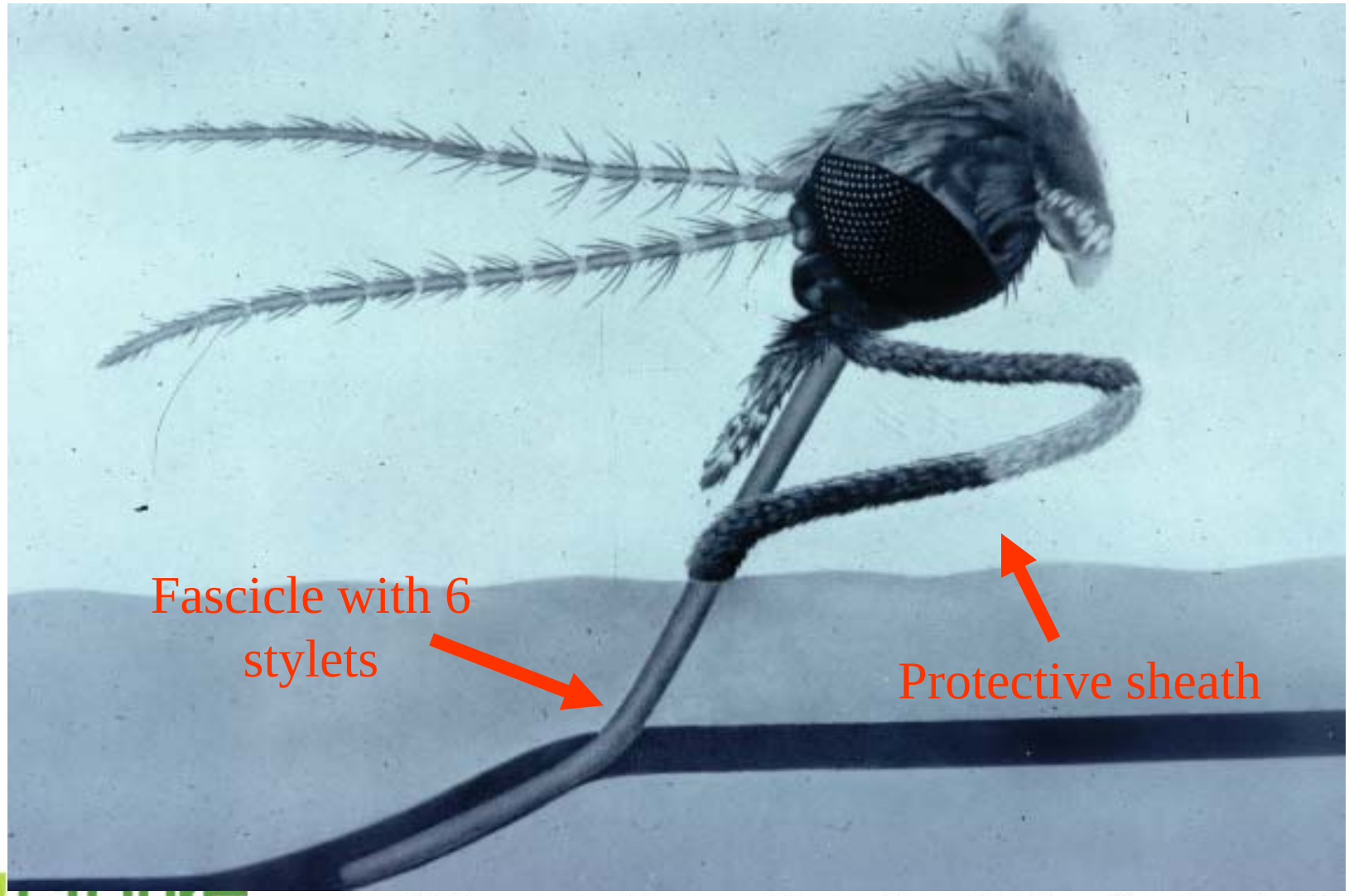
Disease Transmission

What do adult mosquitoes eat?

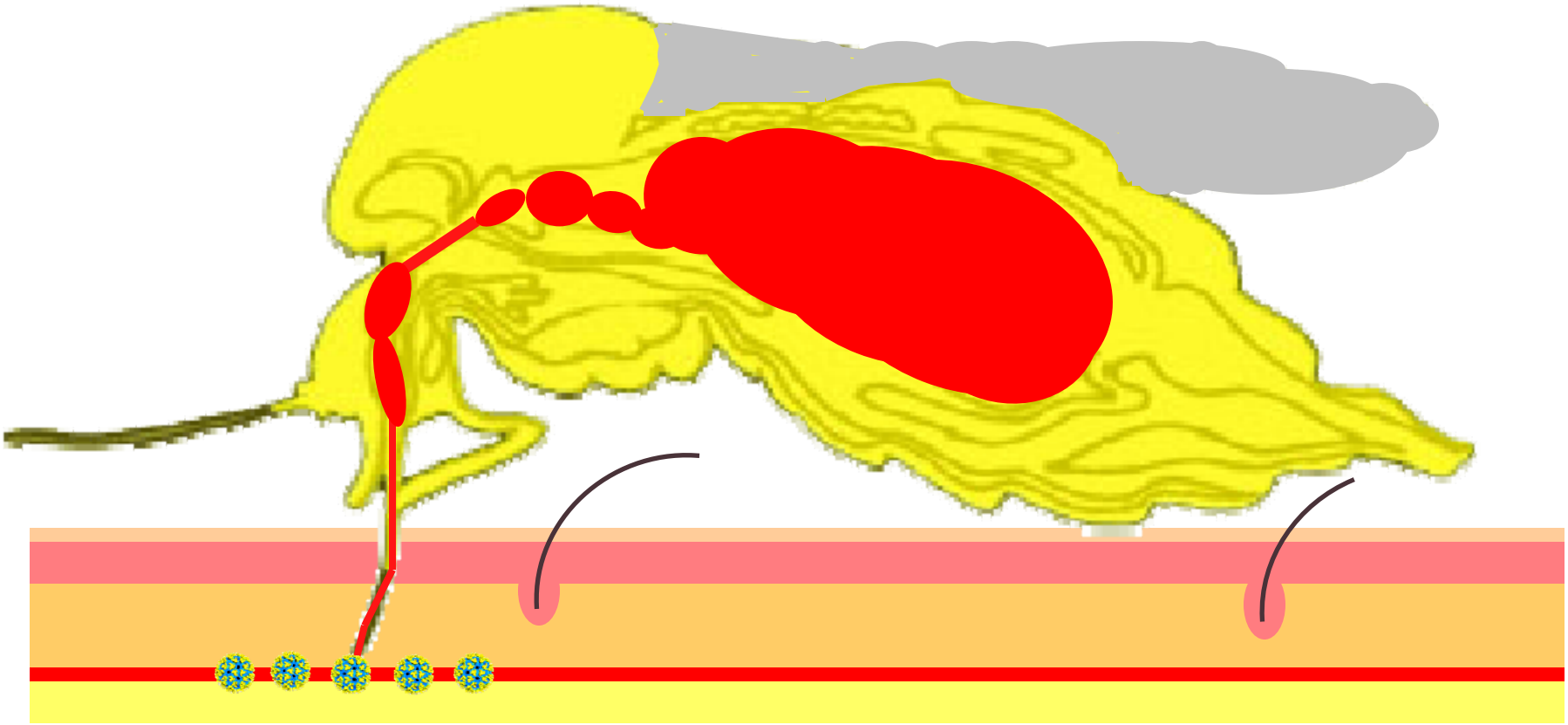
Blood



Capillary Penetration



Infection of mosquito feeding on a viremic animal



Virus particles in blood

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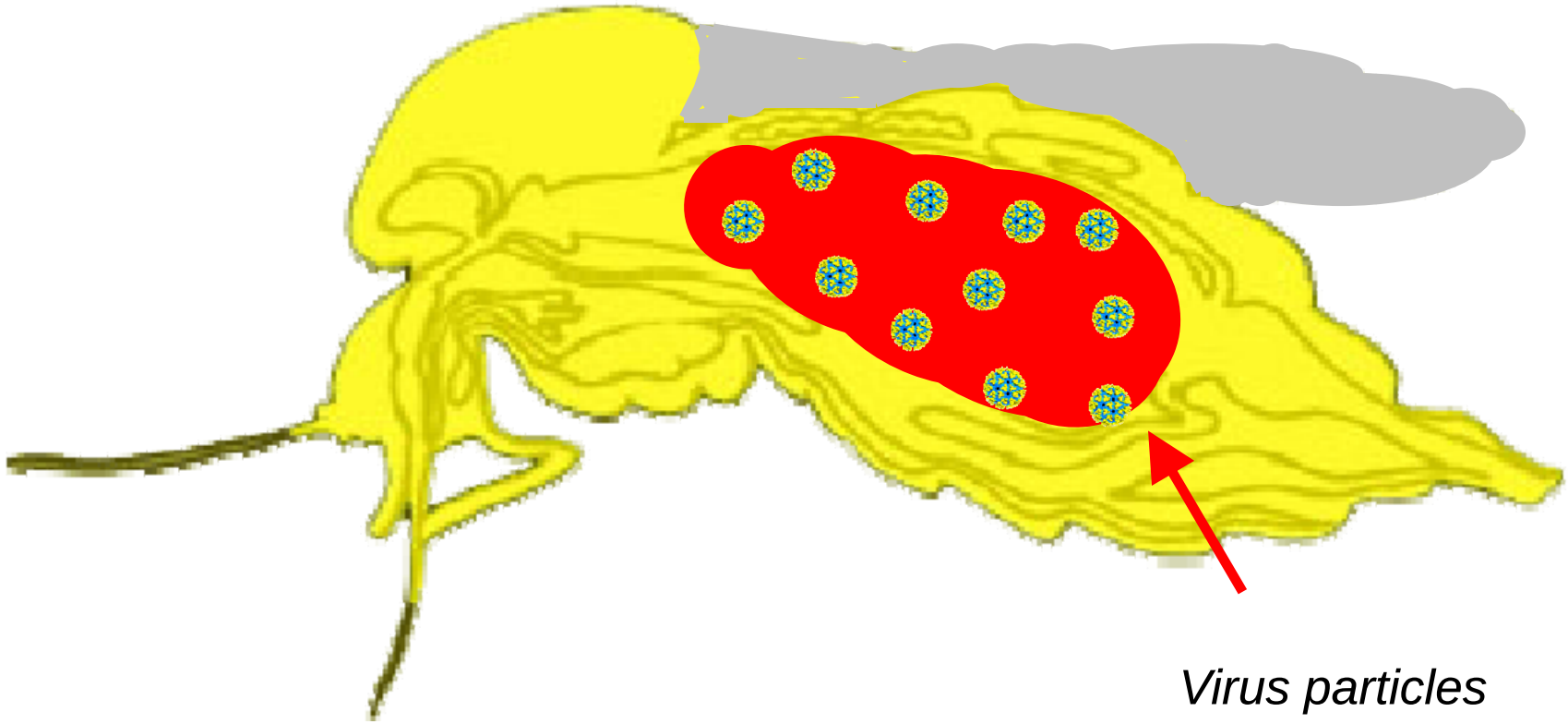
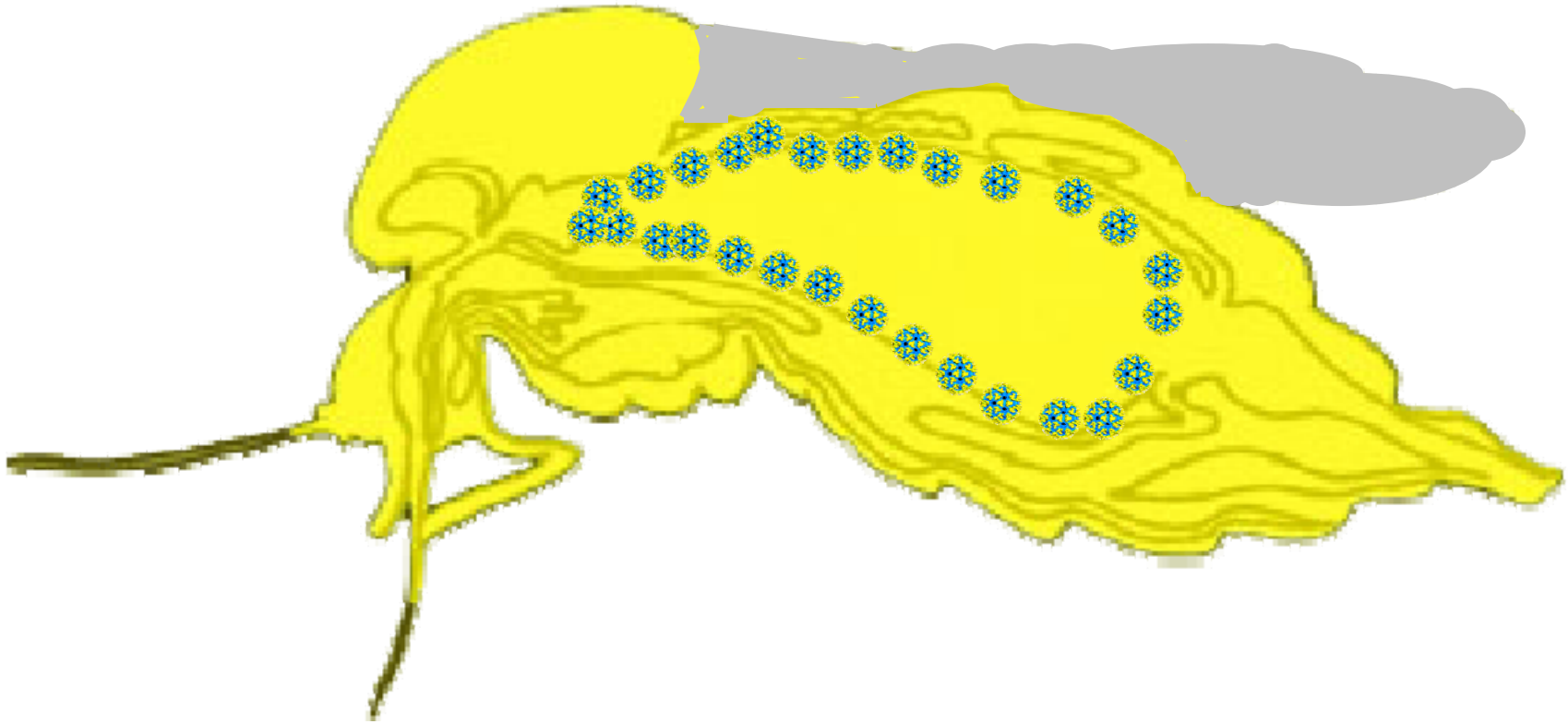
Dissemination slides courtesy of Ted Andreadis

Digestion of blood



Virus particles survive

Replication of virus within midgut



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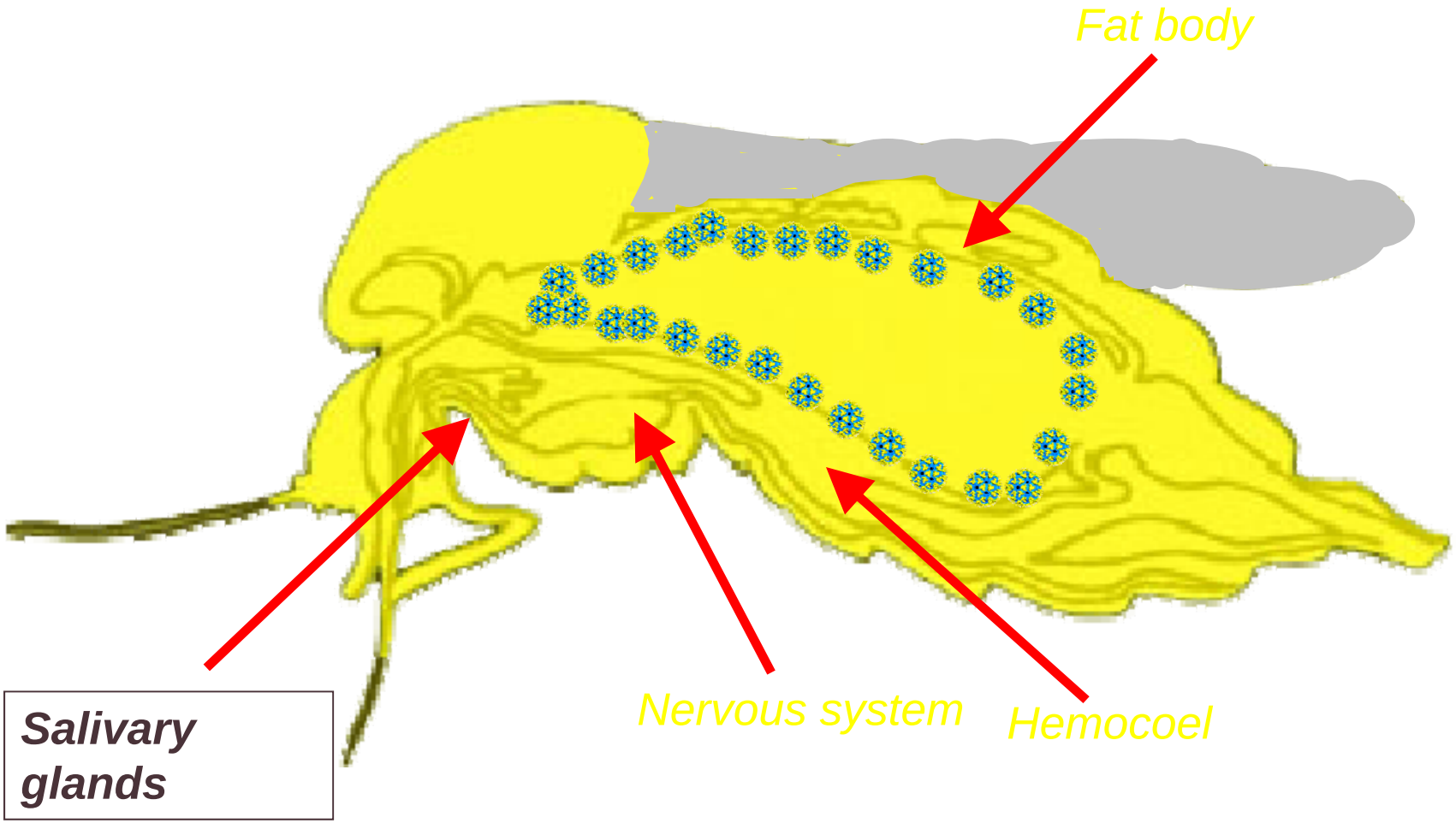
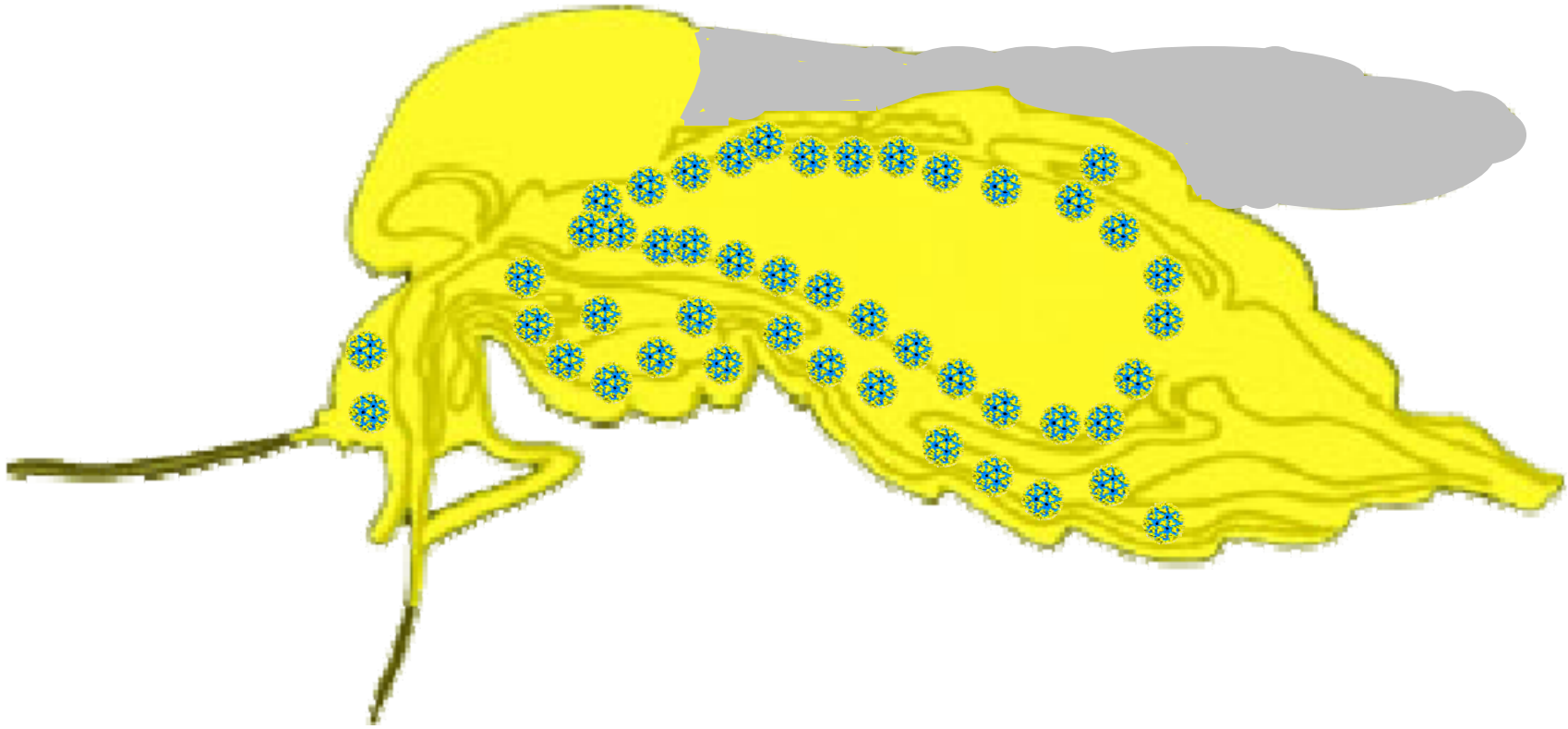
Dissemination from the midgut into mosquito tissues



Virus replication in secondary tissues in body



4-5 logs of virus
(10,000 – 100,000 PFU's)
required for transmission

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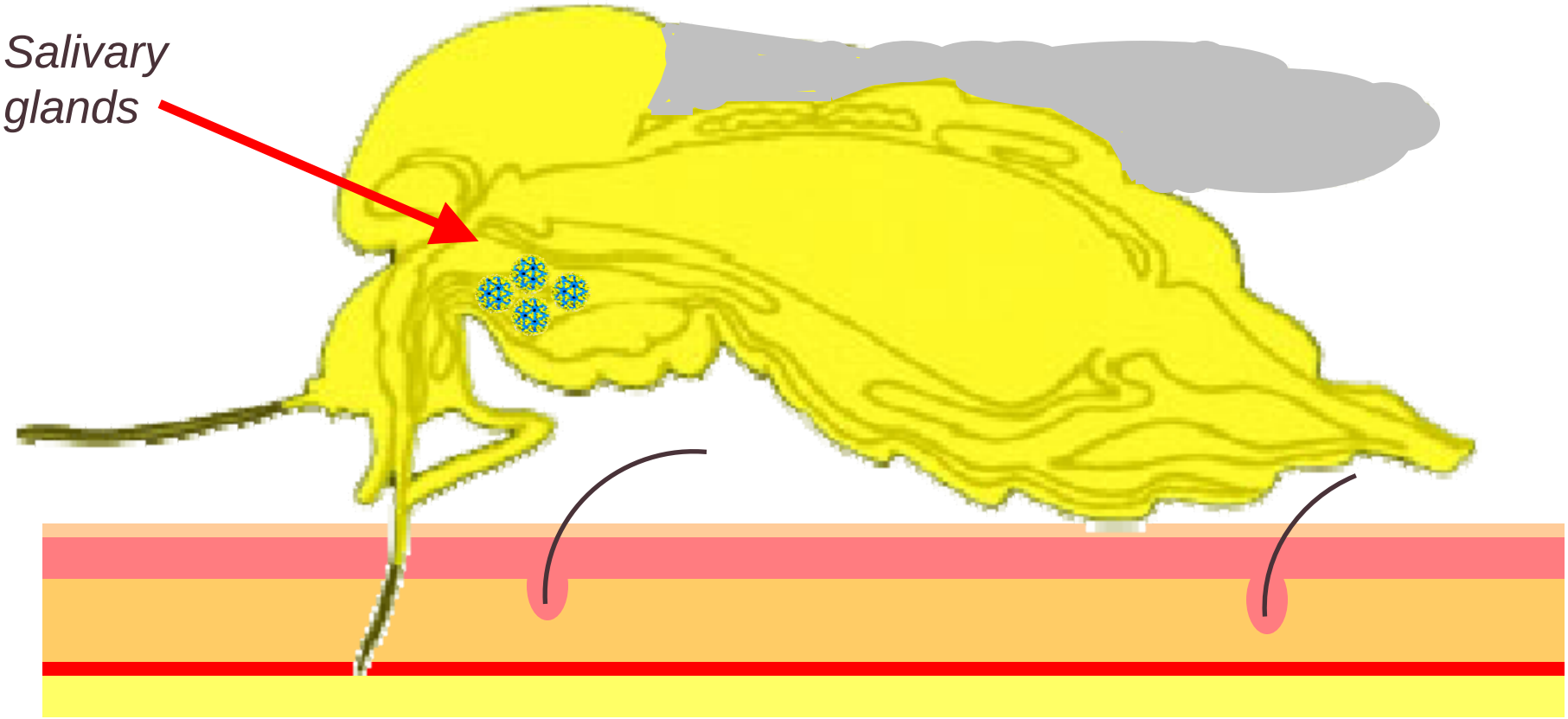
Transmission of virus from mosquito to new host



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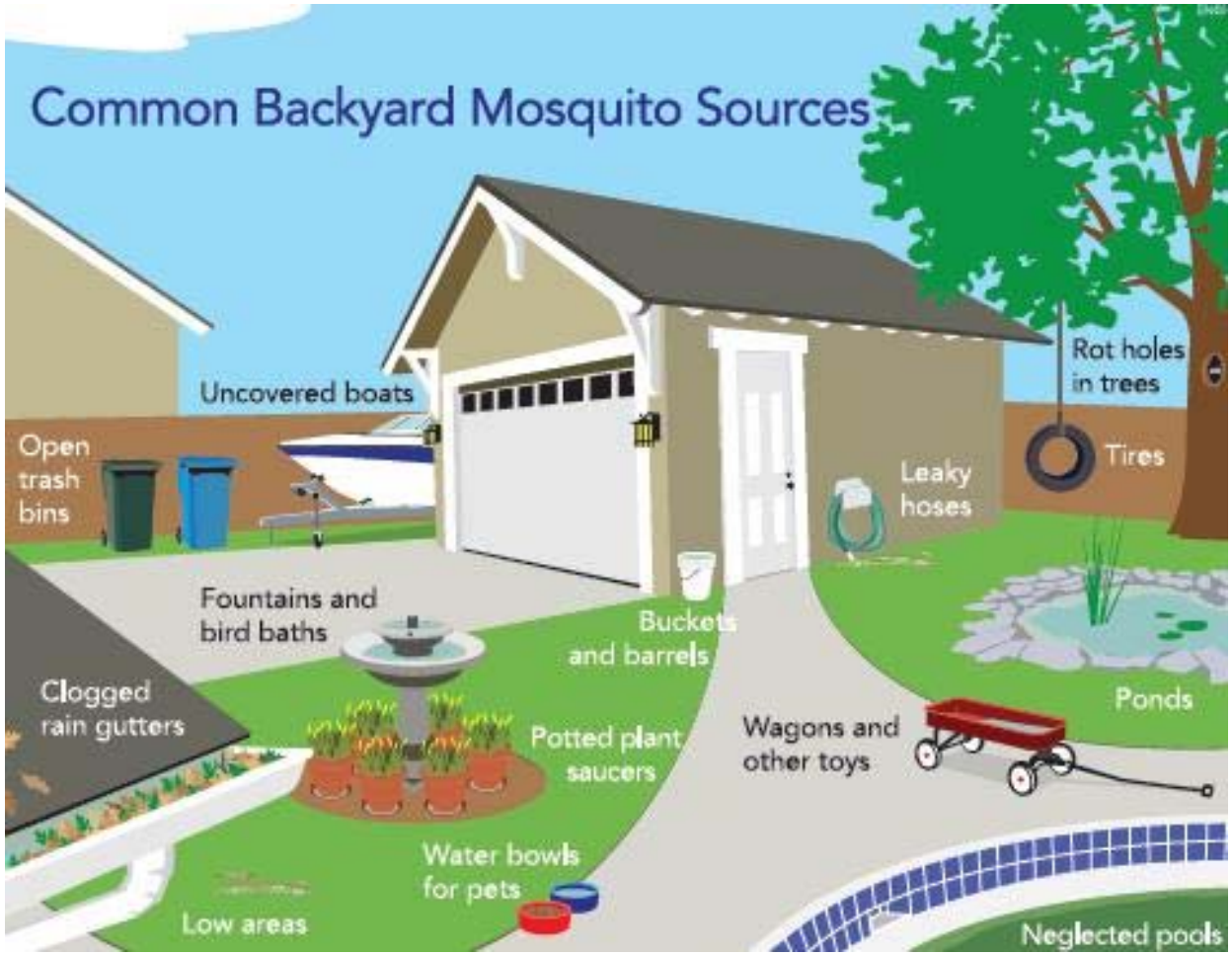
Habitats

Potential breeding sites

Potential residential breeding sites



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Potential commercial breeding sites

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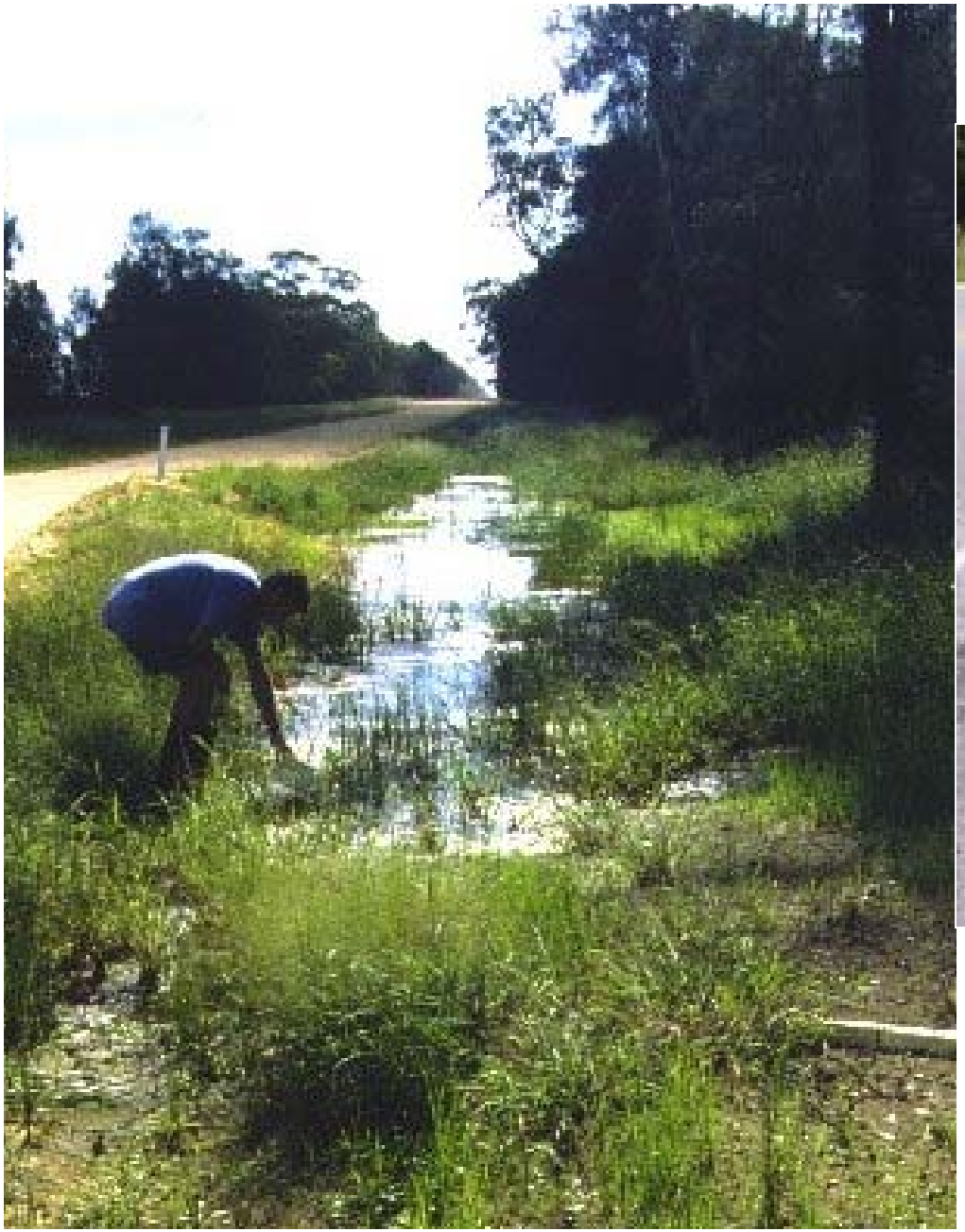
Woodland Pool

Roadside Ditch



Container Breeding

- Tire Piles
- Natural holding spots
- Containers
- Pools
- Catch basins


ActionPacker

Survey and Mapping

Survey and Mapping

- Locate and clearly define all sources
  - **Knowing where to treat - important as what to treat**
- Map sources
- Categorize and label sources
  - **Allows for thorough and efficient treatment**
- Record and measure acres or miles
- Prepare operational maps for efficient planning & record of treatment

Survey and Mapping

Mapping is more important than ever

Maps played a critical role in the Zika control program in Miami-Dade

- Crew maps were distributed daily to define treatment areas
- Maps from DOH with local transmission cases determined the 1/8 mile radius of concentrated door – door inspections.
- Mapping of all trap locations for regular surveillance and maintenance
- Maps critical for tracking, operational management, verification and reporting

After yard inspections were performed in Miami-Dade, door tags were left.

Mosquito Surveillance

Larval surveillance

- Distinguish between breeding and non-breeding habitat
- ID to determine nuisance or disease species
- Create historical database
- Utilize to make informed control decisions

Adult surveillance

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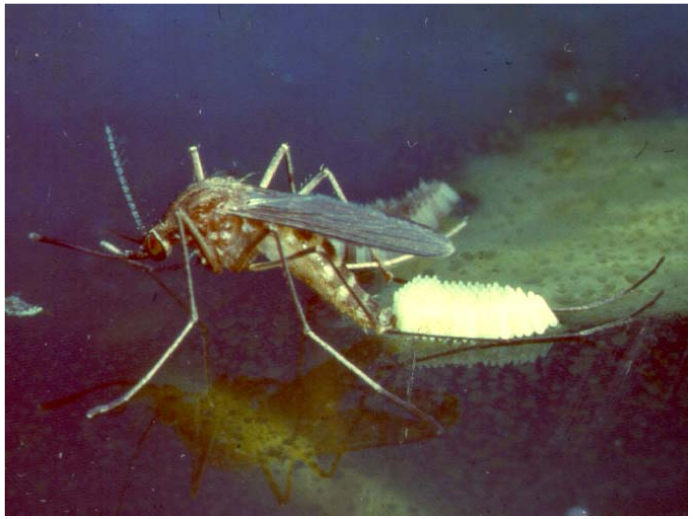
ABC Trap

- Captures greater variety of species
- Captures greater numbers
- Captures collection alive
- Battery powered
- Carbon dioxide is primary attractant; pull light and get “clean collection”

Oviposition
CDC Gravid Trap

- Refines species collection
- Excellent for Cx. pipiens
- Some success for Oc. japonicus
- Battery powered, good for surveillance in remote locations
- Captures collection alive



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BG-Sentinel Trap

- Easy, pop-up design
- Excellent for *Aedes aegypti & albos* when used with BG-Lure
- Can be used with or w/o CO_2
- Battery powered, good for surveillance in remote locations

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Mosquito Control

Arthropod-Borne Viruses "Arboviruses"

- Some pose little/no threat to public health
- Others are major killers

2 methods of prevention:

- Personal protection measures
  - 3 D's (Drain, Dress, Defend)
- Public health measures
  - Surveillance, monitoring
  - Mosquito control: Larviciding/Adulticiding

Larval Control

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Larviciding:
Timely detection & suppression of mosquito breeding

Prescription Larviciding + Rotation of actives to prevent resistance

- Natural Predators
  - Fish, *G. afffinis*
- Surfactants
  - CocoBear
- BT Products
  - Bti, *B. thuringiensis israelensis*
  - Bs, *B. sphaericus*
- IGR's
- Spinosad/Natular

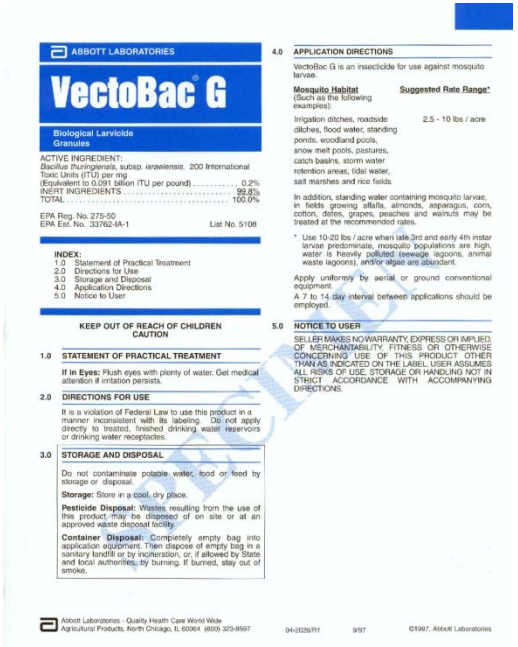
Larvicide Offerings by IRAC MOA Classification

5	7A	11A	11B	Larv Oil
Natular 6 formulations	Altosid 8 formulations	Vectolex 3 formulations	Vectobac 5formulations	CocoBear 1 formulation
OMRI LISTED For Organic Use		Vectomax 2 formulations		

Oils/surfactants

CocoBear.
Coconut oil extract, same as used in foods, candies and beverages for flavoring, as well as many cosmetics.

Bti – (VectoBac)



ABBOTT LABORATORIES

VectoBac® G

Biological Larvicide
Granules

ACTIVE INGREDIENT:
Bacillus thuringiensis, subsp. *israelensis*, 200 International Toxic Units (ITU) per mg (Equivalent to 0.091 billion ITU per pound) 0.2%
INERT INGREDIENTS 99.8%
TOTAL 100.0%

EPA Reg. No. 275-50
EPA Est. No. 33762-IA-1 List No. 5108

INDEX:
1.0 Statement of Practical Treatment
2.0 Directions for Use
3.0 Storage and Disposal
4.0 Application Directions
5.0 Notice to User

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

If in Eyes: Flush eyes with plenty of water. Get medical attention if irritation persists.

2.0 DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

3.0 STORAGE AND DISPOSAL

Do not contaminate potable water, food or feed by storage or disposal.

Storage: Store in a cool, dry place.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

4.0 APPLICATION DIRECTIONS

VectoBac G is an insecticide for use against mosquito larvae.

Mosquito Habitat (Such as the following examples)	Suggested Rate Range*
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields	2.5 - 10 lbs / acre

In addition, standing water containing mosquito larvae, in fields growing alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts may be treated at the recommended rates.

* Use 10-20 lbs / acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.

Apply uniformly by aerial or ground conventional equipment.

A 7 to 14 day interval between applications should be employed.

5.0 NOTICE TO USER

SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS OR OTHERWISE CONCERNING USE OF THIS PRODUCT OTHER THAN AS INDICATED ON THE LABEL. USER ASSUMES ALL RISKS OF USE, STORAGE OR HANDLING NOT IN STRICT ACCORDANCE WITH ACCOMPANYING DIRECTIONS.

Abbott Laboratories · Quality Health Care World Wide
Agricultural Products, North Chicago, IL 60064 (800) 323-9597 04-2026/R1 9/97 ©1997, Abbott Laboratories

VectoBac® GS

BIOLOGICAL LARVICIDE

GRANULE

ACTIVE INGREDIENT:
Bacillus thuringiensis, subspecies *israelensis*, strain AM 65-52, fermentation solids, spores, and insecticidal toxins 2.80%
OTHER INGREDIENTS 97.20%
TOTAL 100.00%

Potency: 200 International Toxic Units (ITU) per mg (Equivalent to 0.091 billion potency: ITU per pound)

The percent active ingredient does not indicate product performance and potency measurements are not Federally standardized.

EPA Reg. No. 73049-10
EPA Est. No. 33762-IA-001 List No. 05103

INDEX:
1.0 First Aid
2.0 Precautionary Statements
2.1 Hazard to Humans (and Domestic Animals)
2.2 Environmental Hazards
3.0 Directions for Use
4.0 Application Directions
5.0 Storage and Disposal
6.0 Notice to User

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 FIRST AID

If in Eyes	• Hold eyes open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes. • Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-877-315-9618 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-323-9597.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)

CAUTION

Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling.

Mixers/loaders and applicators not in enclosed cabs or aircraft must wear a dust/mist respirator meeting NIOSH standards of at least N-95, R-95 or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitization.

2.2 ENVIRONMENTAL HAZARDS

Do not contaminate water when cleaning equipment or disposing of equipment washwaters. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

4.0 APPLICATION DIRECTIONS

VectoBac GS is an insecticide for use against mosquito larvae.

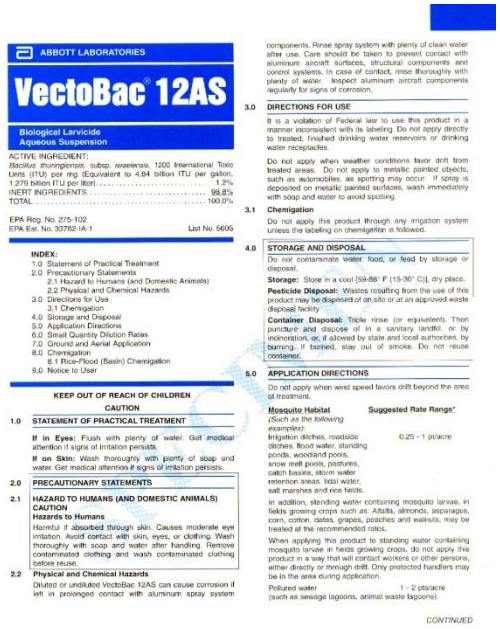
Mosquitoes Habitat (Such as the following examples)*	Suggested Range Rate*
Irrigation ditches, roadside ditches, flood water, standing ponds, livestock watering ponds and troughs, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields	2.5 - 10 lbs. / acre

In addition, standing water containing mosquito larvae, in fields growing crops such as alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches, sugar cane and walnuts may be treated at the recommended rates.

* Use 10-20 lbs. / acre when late 3rd and early 4th instar larvae predominate, mosquito populations are high, water is heavily polluted (sewage lagoons, animal waste lagoons), and/or algae are abundant.

Apply uniformly by aerial or ground conventional equipment. Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment and weather related factors determine the potential for spray drift. The applicator and the treatment coordinator are responsible for considering all of these factors when making decisions.

A 7 to 14 day interval between applications should be employed.



ABBOTT LABORATORIES

VectoBac® 12AS

Biological Larvicide
Aqueous Suspension

ACTIVE INGREDIENT:
Bacillus thuringiensis, subsp. *israelensis*, 1200 International Toxic Units (ITU) per mg (Equivalent to 4.64 billion ITU per gallon, 1.27% billion ITU per liter) 1.2%
INERT INGREDIENTS 98.8%
TOTAL 100.0%

EPA Reg. No. 275-102
EPA Est. No. 33762-IA-1 List No. 5605

INDEX:
1.0 Statement of Practical Treatment
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2.1 Hazard to Humans (and Domestic Animals)
2.2 Physical and Chemical Hazards
3.0 Directions for Use
3.1 Chemigation
4.0 Storage and Disposal
5.0 Application Directions
6.0 Small Quantity Dilution Rates
7.0 Ground and Aerial Application
8.0 Chemigation
8.1 Rice-Flood (Basin) Chemigation
9.0 Notice to User

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 STATEMENT OF PRACTICAL TREATMENT

If in Eyes: Flush with plenty of water. Get medical attention if signs of irritation persists.

If on Skin: Wash thoroughly with plenty of soap and water. Get medical attention if signs of irritation persists.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARD TO HUMANS (AND DOMESTIC ANIMALS)

CAUTION

Hazards to Humans

Harmful if absorbed through skin. Causes moderate eye irritation. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash contaminated clothing before reuse.

2.2 Physical and Chemical Hazards

Diluted or undiluted VectoBac 12AS can cause corrosion if left in prolonged contact with aluminum spray system components. Rinse spray system with plenty of clean water after use. Care should be taken to prevent contact with aluminum aircraft surfaces, structural components and control systems. In case of contact, rinse thoroughly with plenty of water. Inspect aluminum aircraft components regularly for signs of corrosion.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles.

Do not apply when weather conditions favor drift from treated areas. Do not apply to metallic painted objects, such as automobiles, as spotting may occur. If spray is deposited on metallic painted surfaces, wash immediately with soap and water to avoid spotting.

3.1 Chemigation

Do not apply this product through any irrigation system unless the labeling on chemigation is followed.

4.0 STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

Storage: Store in a cool (59-86° F (15-30° C)), dry place.

Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

Container Disposal: Triple rinse (or equivalent). Then puncture and dispose of in a sanitary landfill, or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. Do not reuse container.

5.0 APPLICATION DIRECTIONS

Do not apply when wind speed favors drift beyond the area of treatment.

Mosquito Habitat (Such as the following examples):	Suggested Rate Range*
Irrigation ditches, roadside ditches, flood water, standing ponds, woodland pools, snow melt pools, pastures, catch basins, storm water retention areas, tidal water, salt marshes and rice fields.	0.25 - 1 pt/acre

In addition, standing water containing mosquito larvae, in fields growing crops such as: Alfalfa, almonds, asparagus, corn, cotton, dates, grapes, peaches and walnuts, may be treated at the recommended rates.

When applying this product to standing water containing mosquito larvae in fields growing crops, do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

Polluted water 1 - 2 pts/acre
(such as sewage lagoons, animal waste lagoons).

CONTINUED

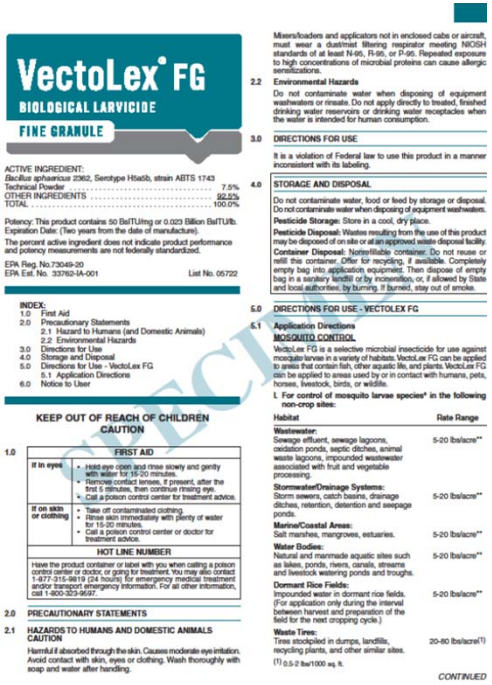
- Active ingredient is *B. thuringiensis israelensis*
- Only good for **48 hour control**, so timing is essential with Bti/(VectoBac).
- Rips out the mid-gut of the mosquito.

clarke

Making communities around the world more livable, safe and comfortable.

Bs – (VectoLex)

- Active ingredient is *B. sphaericus*
- Overcomes shortcomings of Bti
- Works better with more larvae present
- Helps promote the regeneration of the crystal and spore in the water column
- **Regeneration provides the residual control of 21 – 45 days**



VectoLex® FG

BIOLOGICAL LARVICIDE

FINE GRANULE

ACTIVE INGREDIENT:
Bacillus sphaericus 2362, Serotype H5a5b, strain ABTS 1743
Technical Powder 7.5%
OTHER INGREDIENTS 92.5%
TOTAL 100.0%

Potency: This product contains 50 BaITU/mg or 0.023 Billion BaITU/lb.
Expiration Date: (Two years from the date of manufacture).
The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

EPA Reg. No.73049-20
EPA Est. No. 33762-IA-001 List No. 05722

INDEX:

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 FIRST AID

If in eyes
- Hold eye open and rinse slowly and gently with water for 15-20 minutes.
- Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center for treatment advice.

If on skin or clothing
- Take off contaminated clothing.
- Rinse skin immediately with plenty of water for 15-20 minutes.
- Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-877-315-9619 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-323-9697.

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION
Harmful if absorbed through the skin. Causes moderate eye irritation. Avoid contact with skin, eyes or clothing. Wash thoroughly with soap and water after handling.

Mixers/loaders and applicators not in enclosed cabs or aircraft, must wear a dust/mist filtering respirator meeting NIOSH standards of at least N-95, R-95, or P-95. Repeated exposure to high concentrations of microbial proteins can cause allergic sensitizations.

2.2 Environmental Hazards
Do not contaminate water when disposing of equipment washwaters or rinsate. Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

3.0 DIRECTIONS FOR USE
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

4.0 STORAGE AND DISPOSAL
Do not contaminate water, food or feed by storage or disposal. Do not contaminate water when disposing of equipment washwaters.
Pesticide Storage: Store in a cool, dry place.
Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
Container Disposal: Nonrefillable container. Do not reuse or refill this container. Offer for recycling, if available. Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or, if allowed by State and local authorities, by burning. If burned, stay out of smoke.

5.0 DIRECTIONS FOR USE - VECTOLEX FG

5.1 Application Directions
MOSQUITO CONTROL
VectoLex FG is a selective microbial insecticide for use against mosquito larvae in a variety of habitats. VectoLex FG can be applied to areas that contain fish, other aquatic life, and plants. VectoLex FG can be applied to areas used by or in contact with humans, pets, horses, livestock, birds, or wildlife.

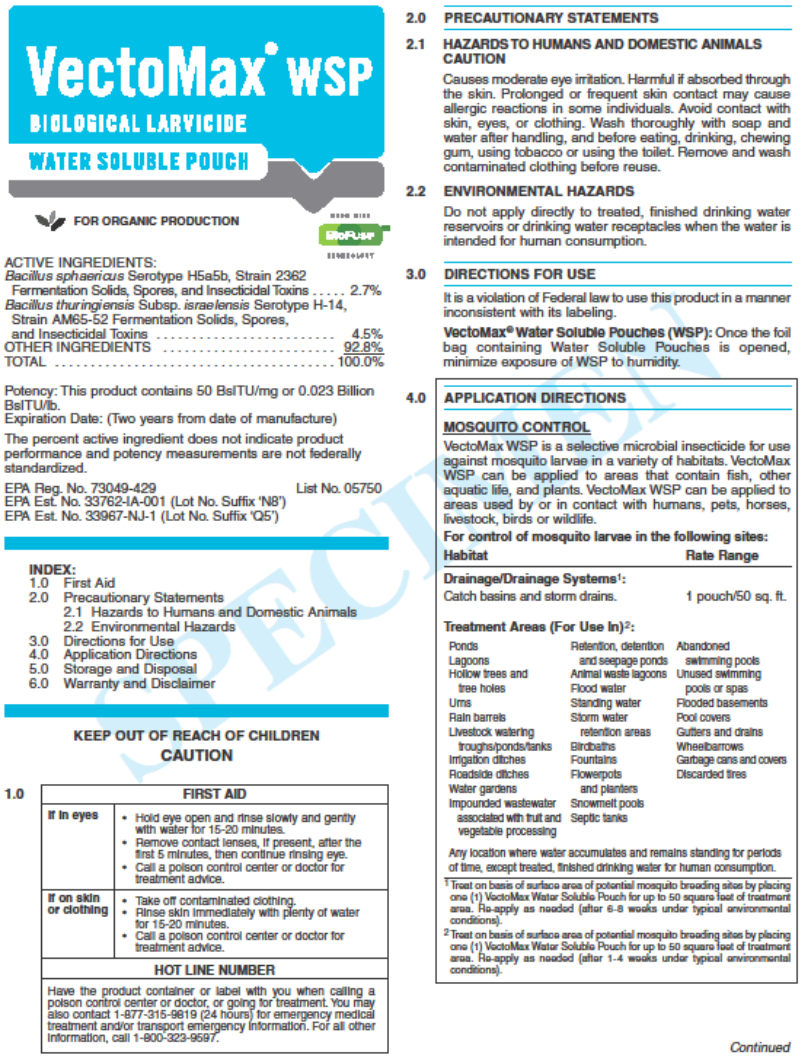
I. For control of mosquito larvae species* in the following non-crop sites:

Habitat	Rate Range
Wastewater: Sewage effluent, sewage lagoons, oxidation ponds, septic ditches, animal waste lagoons, impounded wastewater associated with fruit and vegetable processing.	5-20 lbs/acre**
Stormwater/Drainage Systems: Storm sewers, catch basins, drainage ditches, retention, detention and seepage ponds.	5-20 lbs/acre**
Marine/Coastal Areas: Salt marshes, mangrows, estuaries.	5-20 lbs/acre**
Water Bodies: Natural and manmade aquatic sites such as lakes, ponds, rivers, canals, streams and livestock watering ponds and troughs.	5-20 lbs/acre**
Dormant Rice Fields: Impounded water in dormant rice fields. (For application only during the interval between harvest and preparation of the field for the next cropping cycle.)	5-20 lbs/acre**
Waste Tires: Tires stockpiled in dumps, landfills, recycling plants, and other similar sites.	20-80 lbs/acre(1)

(1) 0.5-2 lbs/1000 sq. ft.

CONTINUED

Bti & Bs – (VectoMax)



VectoMax® WSP
BIOLOGICAL LARVICIDE
WATER SOLUBLE POUCH

FOR ORGANIC PRODUCTION

ACTIVE INGREDIENTS:
Bacillus sphaericus Serotype H5a5b, Strain 2362 Fermentation Solids, Spores, and Insecticidal Toxins 2.7%
Bacillus thuringiensis Subsp. *israelensis* Serotype H-14, Strain AM65-52 Fermentation Solids, Spores, and Insecticidal Toxins 4.5%
OTHER INGREDIENTS 92.8%
TOTAL 100.0%

Potency: This product contains 50 BsITU/mg or 0.023 Billion BsITU/lb.
Expiration Date: (Two years from date of manufacture)

The percent active ingredient does not indicate product performance and potency measurements are not federally standardized.

EPA Reg. No. 73049-429 List No. 05750
EPA Est. No. 33762-IA-001 (Lot No. Suffix 'N8')
EPA Est. No. 33967-NJ-1 (Lot No. Suffix 'Q5')

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2.1 Hazards to Humans and Domestic Animals
2.2 Environmental Hazards
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4.0 Application Directions
5.0 Storage and Disposal
6.0 Warranty and Disclaimer

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0

FIRST AID	
If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. • Call a poison control center or doctor for treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.
HOT LINE NUMBER	
Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-877-315-9819 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-323-9597.	

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION

Causes moderate eye irritation. Harmful if absorbed through the skin. Prolonged or frequent skin contact may cause allergic reactions in some individuals. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling, and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

2.2 ENVIRONMENTAL HAZARDS

Do not apply directly to treated, finished drinking water reservoirs or drinking water receptacles when the water is intended for human consumption.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

VectoMax® Water Soluble Pouches (WSP): Once the foil bag containing Water Soluble Pouches is opened, minimize exposure of WSP to humidity.

4.0 APPLICATION DIRECTIONS

MOSQUITO CONTROL

VectoMax WSP is a selective microbial insecticide for use against mosquito larvae in a variety of habitats. VectoMax WSP can be applied to areas that contain fish, other aquatic life, and plants. VectoMax WSP can be applied to areas used by or in contact with humans, pets, horses, livestock, birds or wildlife.

For control of mosquito larvae in the following sites:

Habitat	Rate Range
Drainage/Drainage Systems[1]:	
Catch basins and storm drains.	1 pouch/50 sq. ft.

Treatment Areas (For Use In)[2]:

Ponds	Retention, detention and seepage ponds	Abandoned swimming pools
Lagoons	Animal waste lagoons	Unused swimming pools or spas
Hollow trees and tree holes	Flood water	Flooded basements
Urns	Standing water	Pool covers
Rain barrels	Storm water retention areas	Gutters and drains
Livestock watering troughs/ponds/tanks	Birdbaths	Wheelbarrows
Irrigation ditches	Fountains	Garbage cans and covers
Roadside ditches	Flowerpots and planters	Discarded tires
Water gardens	Snowmelt pools	
Impounded wastewater associated with fruit and vegetable processing	Septic tanks	

Any location where water accumulates and remains standing for periods of time, except treated, finished drinking water for human consumption.

[1] Treat on basis of surface area of potential mosquito breeding sites by placing one (1) VectoMax Water Soluble Pouch for up to 50 square feet of treatment area. Re-apply as needed (after 6-8 weeks under typical environmental conditions).

[2] Treat on basis of surface area of potential mosquito breeding sites by placing one (1) VectoMax Water Soluble Pouch for up to 50 square feet of treatment area. Re-apply as needed (after 1-4 weeks under typical environmental conditions).

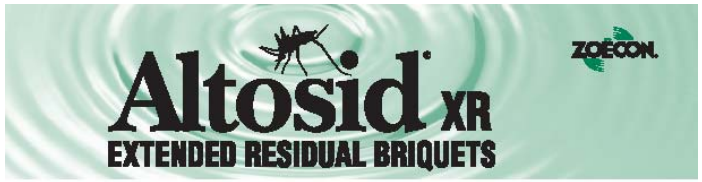
Continued

- Combines *Bs* & *Bti* for broad-spectrum and residual control

clarke

Making communities around the world more livable, safe and comfortable.

Insect Growth Regulators – (Altosid)



A SUSTAINED RELEASE PRODUCT TO PREVENT ADULT MOSQUITO EMERGENCE
(INCLUDING THOSE WHICH MAY TRANSMIT WEST NILE VIRUS)

SPECIMEN LABEL

ACTIVE INGREDIENT:
(S)-Methoprene (CAS #65733-16-6))
(Dry Weight Basis): 2.1%
OTHER INGREDIENTS: 97.9%
Total. 100.0%

EPA Reg. No. 2724-421
EPA Est. No. 2724-TX-1

KEEP OUT OF REACH OF CHILDREN
CAUTION
SEE ADDITIONAL PRECAUTIONARY STATEMENTS

INTRODUCTION

ALTOSID® XR BRIQUETS are designed to release effective levels of (S)-Methoprene insect growth regulator over a period up to 150 days in mosquito breeding sites. Release of (S)-Methoprene insect growth regulator occurs by dissolution of the briquet. Soft mud and loose sediment can cover the briquets and inhibit normal dispersion of the active ingredient. The product may not be effective in those situations where the briquet can be removed from the site by flushing action.

ALTOSID® XR BRIQUETS prevent the emergence of adult mosquitoes including: *Anopheles, Culex, Culiseta, Coquillettidia,* and *Mansonia* spp., as well as those of the floodwater mosquito complex (*Aedes, Ochlerotatus,* and *Psorophora* spp.) from treated water. Treated larvae continue to develop normally to the pupal stage where they die.

NOTE: (S)-Methoprene insect growth regulator has no effect on mosquitoes which have reached the pupal or adult stage prior to treatment.

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS - CAUTION

Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling.

FIRST AID

Call a poison control center or doctor for treatment advice.

If in eyes	•Hold eye open and rinse slowly and gently with water for 15-20 minutes. •Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
If on skin or clothing	•Take off contaminated clothing. •Rinse skin immediately with plenty of water for 15-20 minutes.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.

ENVIRONMENTAL HAZARDS

Do not contaminate water when disposing of unused product.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

A SUSTAINED RELEASE MOSQUITO GROWTH REGULATOR TO PREVENT ADULT MOSQUITO EMERGENCE *(INCLUDING THOSE WHICH MAY TRANSMIT WEST NILE VIRUS)*

SPECIMEN LABEL

ACTIVE INGREDIENT:
(S)-Methoprene (Dry Weight Basis)
(CAS #65733-16-6) 8.62%
OTHER INGREDIENTS: 91.38%
Total 100.00%

This product contains water, therefore the weight of the briquet and percent by weight of active ingredient will vary with hydration. The Ingredient Statement is expressed on a dry weight basis.

EPA Reg. No. 2724-375 EPA Est. No. 2724-TX-1

KEEP OUT OF REACH OF CHILDREN
CAUTION

PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS CAUTION

Causes moderate eye irritation. Harmful if absorbed through skin. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, or using tobacco. Remove and wash contaminated clothing before reuse.

FIRST AID

Call a poison control center or doctor for treatment advice.

If in eyes	• Hold eye open and rinse slowly and gently with water for 15-20 minutes. • Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.

FIRST AID (CONTINUED)

If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes.

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-248-7763 for emergency medical treatment information.

ENVIRONMENTAL HAZARDS

Do not contaminate water when disposing of unused product.

DIRECTIONS FOR USE

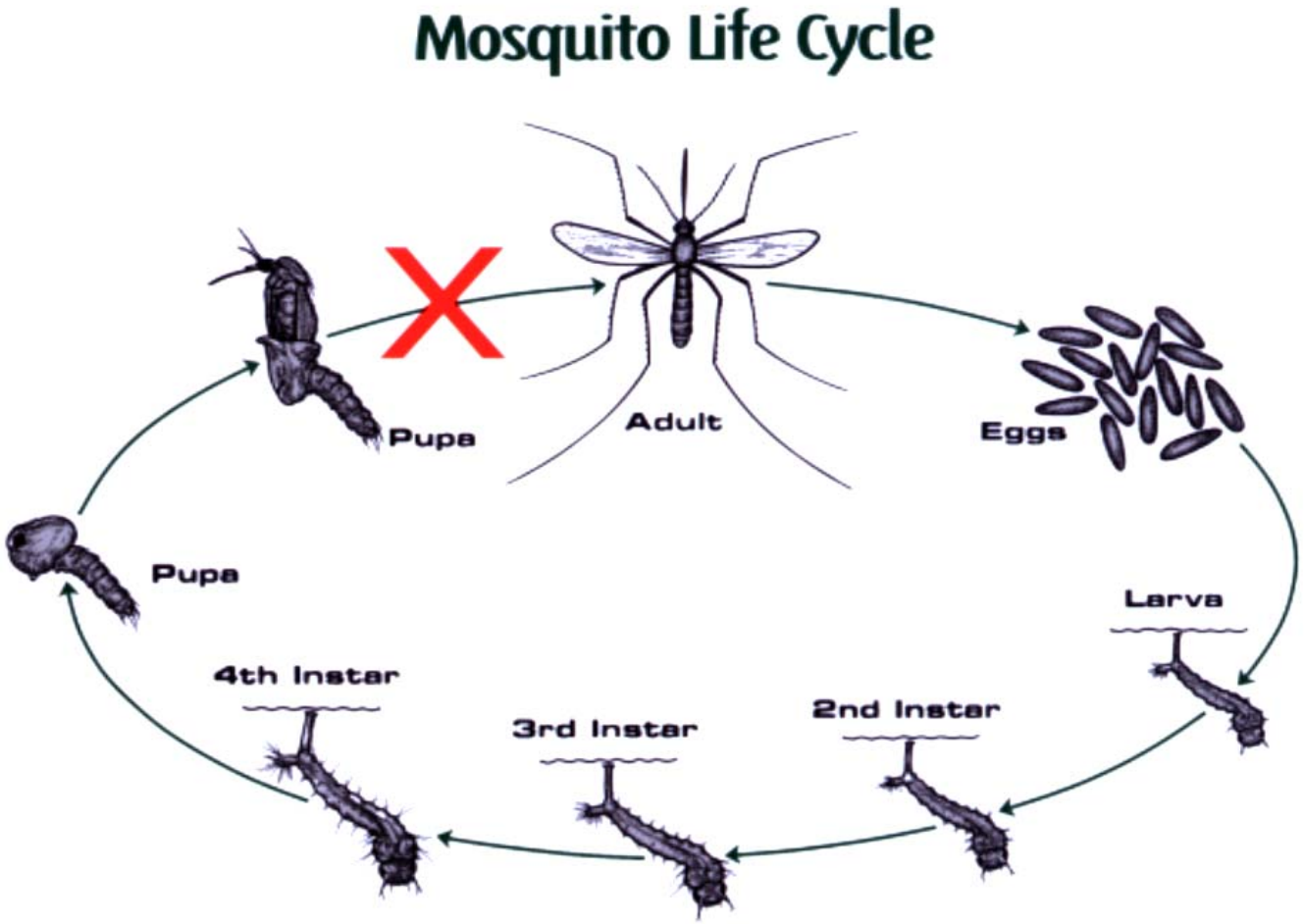
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

Note to User: Do not remove **ALTOSID® Briquets** from container except for immediate use.

Because of the unique mode of action of **ALTOSID® Briquets**, users must be familiar with special techniques for accurate evaluation of treatments. See Application Rates and Intervals section of this label or consult local Mosquito Abatement Agency. Effective use of **ALTOSID® Briquets** in sites subjected to periodic heavy flow of water requires careful attention to briquet placement and to the possible need for retreatment. Use of the product in storm drains, waste treatment and settling ponds, and similar systems should therefore be limited to experienced pesticide applicators, such as personnel of Mosquito Abatement Districts and Public Health Agencies.

Introduction: The **ALTOSID® Briquet** is a formulation designed to release effective levels of **ALTOSID®** Insect Growth Regulator up to 30 days under typical environmental conditions. Release of **ALTOSID®** Insect Growth Regulator is effected by dissolution of the **ALTOSID® Briquet**. If briquets become covered by obstructions such as debris, vegetation, and loose

Methoprene Activity



Spinosad (Natular®) Larvicide

- DT

- T30

OMRI Listed
Organic Materials Review Institute

OMRI Listed
Organic Materials Review Institute

- G30

Community Engagement Program

- 60+ days of control
- Counties/muni's purchase Natular DT tablets;
  - give to citizens
- Clarke provides free support tools for points of distribution

9" x 5 ¾"
12 tablets per card
50 cards / case
600 tablets / case

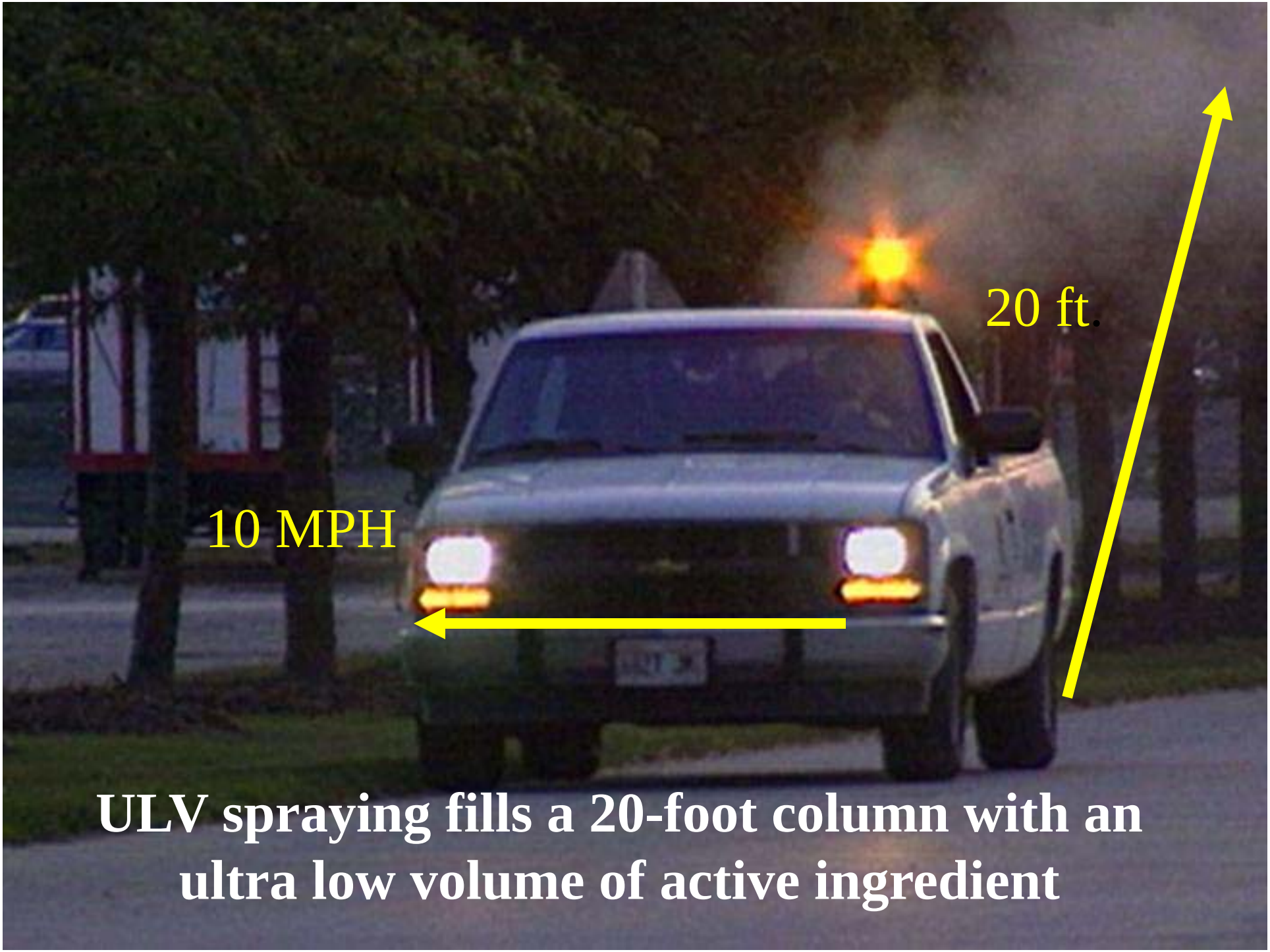
clarke®

Making communities around the world more livable, safe and comfortable.

Adult Control

Maruyama Backpack MM300

- Even distribution of liquid chemical
- Different product (residual)
- Pistol throttle control
- Standard nozzle droplet test:
- SMD = 55-64 micron
- Can also be used as a blower



ULV spraying fills a 20-foot column with an ultra low volume of active ingredient

Why Do We Adulticide

- Control large numbers of mosquitoes
- Show taxpayers we are doing something about the mosquitoes
- Emergency control of disease vectors
- FEE – Fast, Economical, Effective
- Essential political standpoint

Why Do We Adulticide

- **Adult control first and most important step in halting spread of disease – Zika, West Nile, etc.**
- **ULV unit (Ultra Low Volume)**
- ***ULV unit properly calibrated* and *particle tested***
- **Different adult control methods to fit disease**
- **Different adult control product to fit disease**
- **Different application rate (disease vs. nuisance)**
- **Nuisance control program intensified for disease control**

Guardsman - 1.6 Gal ULV Backpack Power

1. New nozzle: 6 metering restrictors for flow rates btwn 1.7 – 8.5 oz/min for true ULV adulticide droplets with oil or water-base products

2. Agitation control lever: innovative and efficient agitation system using air-flow in the bottom of the tank;

3. Super 4 discharge valve: instant interruption system, avoids agrochemical waste and environmental contamination;

4. Chemical tank with 1.6 gal capacity: innovative design, low-center of gravity, providing better balance and comfort for the operator;

5. Kawasaki engine (TK065) - the highest technology in 2 stroke engines. Providing low fuel consumption and superior performance.

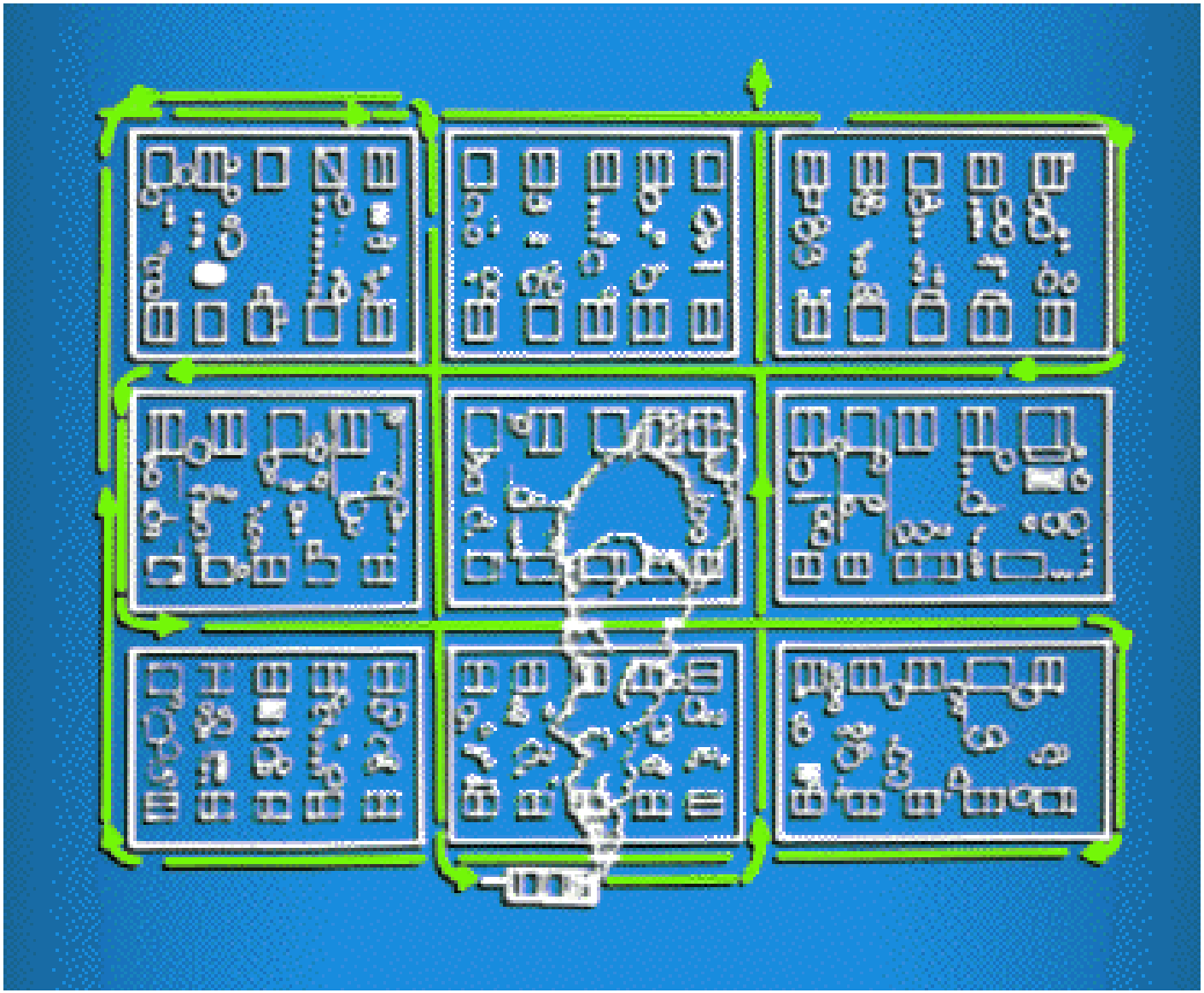
ULV Equipment: Gas or Electric right size and fit for your program

- Electric
- 8+ HP gas
- 18+ HP gas

GPS Variable Flow Record Data

- Cover more area in less time
- Save 10% - 15% product
- Total Acres Sprayed
- Total Miles sprayed
- Total pesticide sprayed
- Total time of mission
- Total time of operation of ULV machine
- Pesticide remaining in tank

Complete Control



omfortable.

Adult Control Products (Space Spray)

- **d-Phenothrin (Sumithrin) Pyrethroid (Duet & Anvil)**
- **Prallethrin (Duet)**
- **Deltamethrin Pyrethroid (DeltaGard)**
- **Etofenprox Pyrethroid (Zenivex)**
- **Permethrin Pyrethroid (Boimist, Kontrol, Permanon, etc.)**
- **Pyrethrins/Pyrethrum Pyrethroid (Merus)**
- ***Chlorpyrifos Organophosphate (Mosquitomist)***
- ***Malathion Organophosphate***
- ***Naled Organophosphate (Dibrom)***

Adulticides

- Organophosphates
- Synthetic Pyrethroids

Adulticide Offerings by IRAC MOA Classification

1B	3A
MosqitoMist 3 formulations	Anvil 3 formulations (including Aqua)
MosquitoMaster 1 formulation	AquaHalt 1 formulation
	Biomist 6 formulations
	Duet 2 formulations (including Aqua)
	Merus 1 formulation

OMRI LISTED For Organic Use

clarke

Making communities around the world more livable, safe and comfortable.

Organophosphates:
MosquitoMaster 412 and Mosquitomist

- Quick knockdown; non-corrosive
- Ready-to-use/No Mixing
- No PBO
- Ease of use for technicians
- **Best resistance fighter** (MM412)

Pyrethroids:
Anvil and Duet

- Non-carcinogen
- Ready-to-use/No Mixing
- Synergist
- Sumithrin (prallethrin)
- **Agitation = enhanced control**

West Nile Virus Control

- *Culex* mosquito
  - Nighttime feeder
  - Primarily birds, other mammals
  - Strong mosquito
  - Increased flow rate vs. nuisance control

Prallethrin Pyrethroid

Deltamethrin Pyrethroid

Permethrin Pyrethroid

Pyrethrins/Pyrethrum Pyrethroid

Malathion Organophosphate

d-Phenothrin (Sumithrin) Pyrethroid

Etofenprox Pyrethroid

Naled Organophosphate

Chlorpyrifos Organophosphate

Zika Virus Control
Difficulties Not Seen with Other Disease

- **Aggressive daytime biters**
  - Feed 1 – 4 hours before sunset
  - Feed 1 – 2 hours after sunrise
- **No inversion**
  - Product not stay ground level where mosquitoes are feeding
- **Product with agitation/flushing ability.**

Duet

Kentucky Department of Agriculture.

The most efficient adulticide available to control container breeding mosquitoes

Duet

acceptable droplet size spectra. Application equipment must be tested at least annually to confirm that pressure at the nozzle and nozzle flow rate(s) are properly calibrated.

GROUND ULV APPLICATION

To control Mosquitoes and other listed insects, apply DUET at a flow rate of 2.6 to 7.8 fluid ounces per minute at an average vehicle speed of 10 mph using a swath width of 300 feet for acreage calculations (see chart below). For best results, apply when mosquitoes are most active and meteorological conditions are conducive to keeping the spray cloud close to the ground. Certain mosquito species such as *Aedes aegypti* and *Aedes albopictus*, are most active during the day. Application in calm air conditions is to be avoided. Apply only when ground wind speed is greater than or equal to 1 mph. All types of applications should be conducted at temperatures above 50 °F. Under normal residential conditions a flow rate of 4.8 fluid ounces per minute at an average vehicle speed of 10 mph is recommended. If a different vehicle speed is used, adjust rate accordingly. These rates are equivalent to 0.00024 to 0.00072 pounds of Prallethrin and 0.0012 to 0.0036 pounds of Sumithrin® and Piperonyl Butoxide per acre. Vary flow rate according to vegetation density and mosquito population. Use higher flow rate

AI-0477

Certain mosquito species such as *Aedes aegypti* and *Aedes albopictus*, are most active during the day.

Duet. . .Puts more mosquitoes in the line of fire

If they aren't flying, they aren't dying

- An adulticide works when a droplet comes in contact with a mosquito
- **Lab research indicates that prallethrin (Duet) provokes mosquitoes out of harborage areas in a state of benign agitation**
  - Does NOT create a biting frenzy
  - Confuses the mosquito
  - Increases probability mosquitoes will come in contact with Duet

Plos ONE, November 2012, Vol. 7, Issue 11

"Effectiveness of Ultra-Low volume Nighttime Applications of an Adulticide against Diurnal Aedes albopictus, a Critical Vector of Dengue and Chikungunya Viruses"

JAMCA, December 2012, Volume 28, No. 4

"Efficacy of Duet Dual-Action Adulticide Against Caged Aedes Albopictus with the Use of an Ultra-Low Volume Cold Aerosol Sprayer"

Journal of Medical Entomology; Sept. 2013

Aedes aegypti and Aedes albopictus

Duet was the one treatment that consistently increased activity of blood-fed mosquitoes; importance being that Duet stops these blood-fed mosquitoes from reproducing the next generation and thus stopping disease transmission quicker.

Summary - Basics

- **Remember West Nile Virus**
  - –Catch basin
  - –Wide area control
- **Nuisance Control**
  - –Flood areas
  - –Complaints
  - –Weather

Summary - What Learned?

- **Zika Virus**
  - –Container breeder
  - –Live, Work, Play
  - –New, different control
  - –Boots on the ground

Summary - What Learned?

- **Larval Control - Zika**
  - –Homeowner use (Natular DT)
  - –Residual control
- **Adult Control - Zika**
  - –Daytime feeders
  - –Duet (agitation)
  - –Hand held application

Summary

- **Zika Virus**
  - **Plan and Prepare**
  - **Nuisance, West Nile, Zika, other**
  - **Change a few spokes on the wheel**
  - **Adult control unique; tools are available**
  - **Tip, Toss, Turn, (Gravity),Treat**
  - **Plans can/may change**
  - **Not Panic; Ask for Help**

Thank you.

Questions?

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