



# Mosquito Vectors of Zika Virus and Their Control

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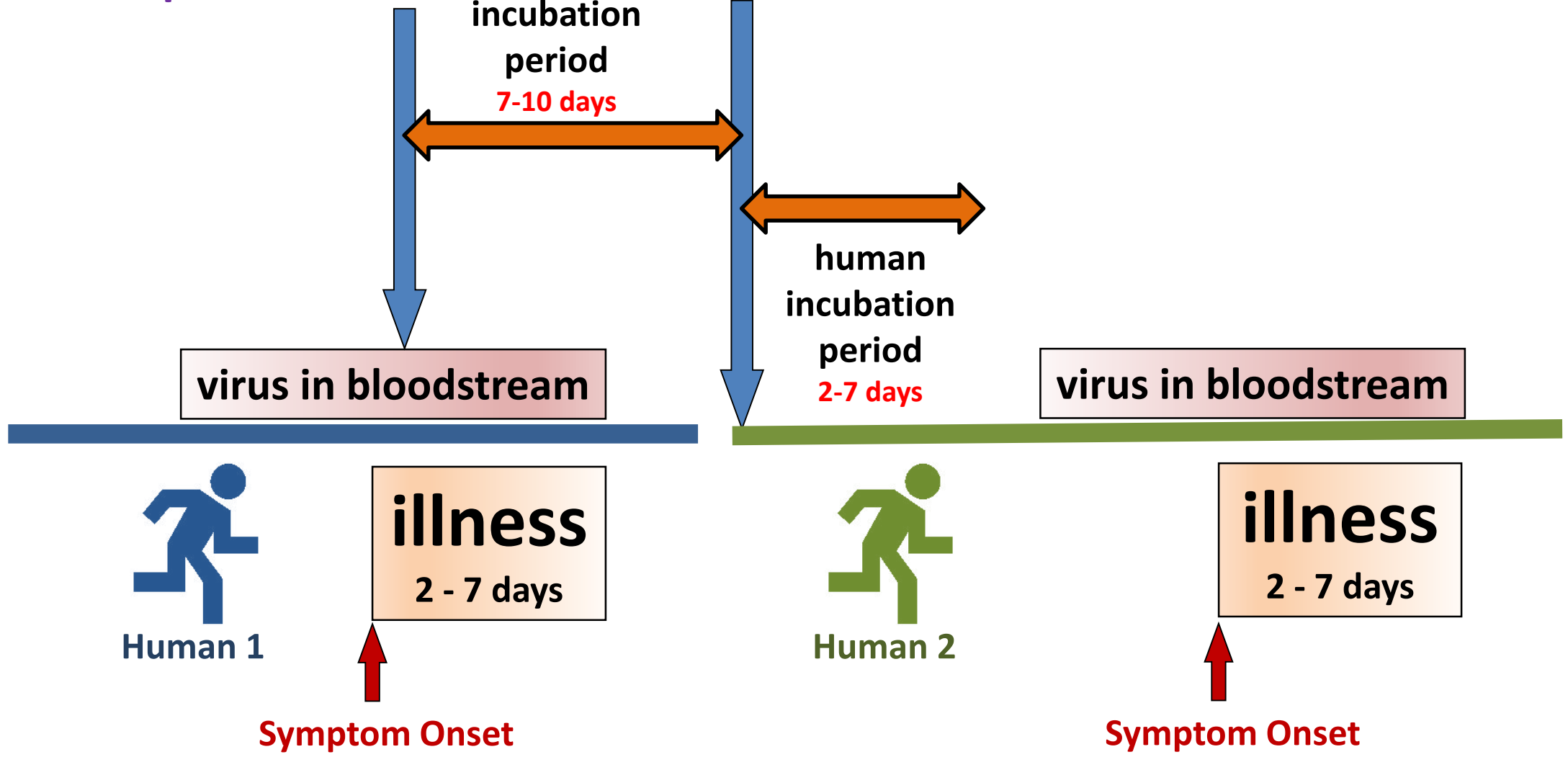
*Promoting and Protecting the Health of the Public and the Environment*



Acquires virus

mosquito  
incubation  
period  
7-10 days

Transmits virus



virus in bloodstream

virus in bloodstream



Human 1

illness  
2 - 7 days

Symptom Onset



Human 2

illness  
2 - 7 days

Symptom Onset

# Mosquito Vectors of Zika Virus

## Ten *Aedes* Species in Africa & the South Pacific

- *Stegomyia* group
  - *Ae. aegypti*, *Ae. africanus*, *Ae. albopictus*, *Ae. apicoargenteus*, *Ae. hensilli*, *Ae. luteocephalus*, and *Ae. polynesiensis*
- *Aedimorphus* group
  - *Ae. vittatus*
- *Diceromyia* group
  - *Ae. furcifer*, *Ae. taylori*



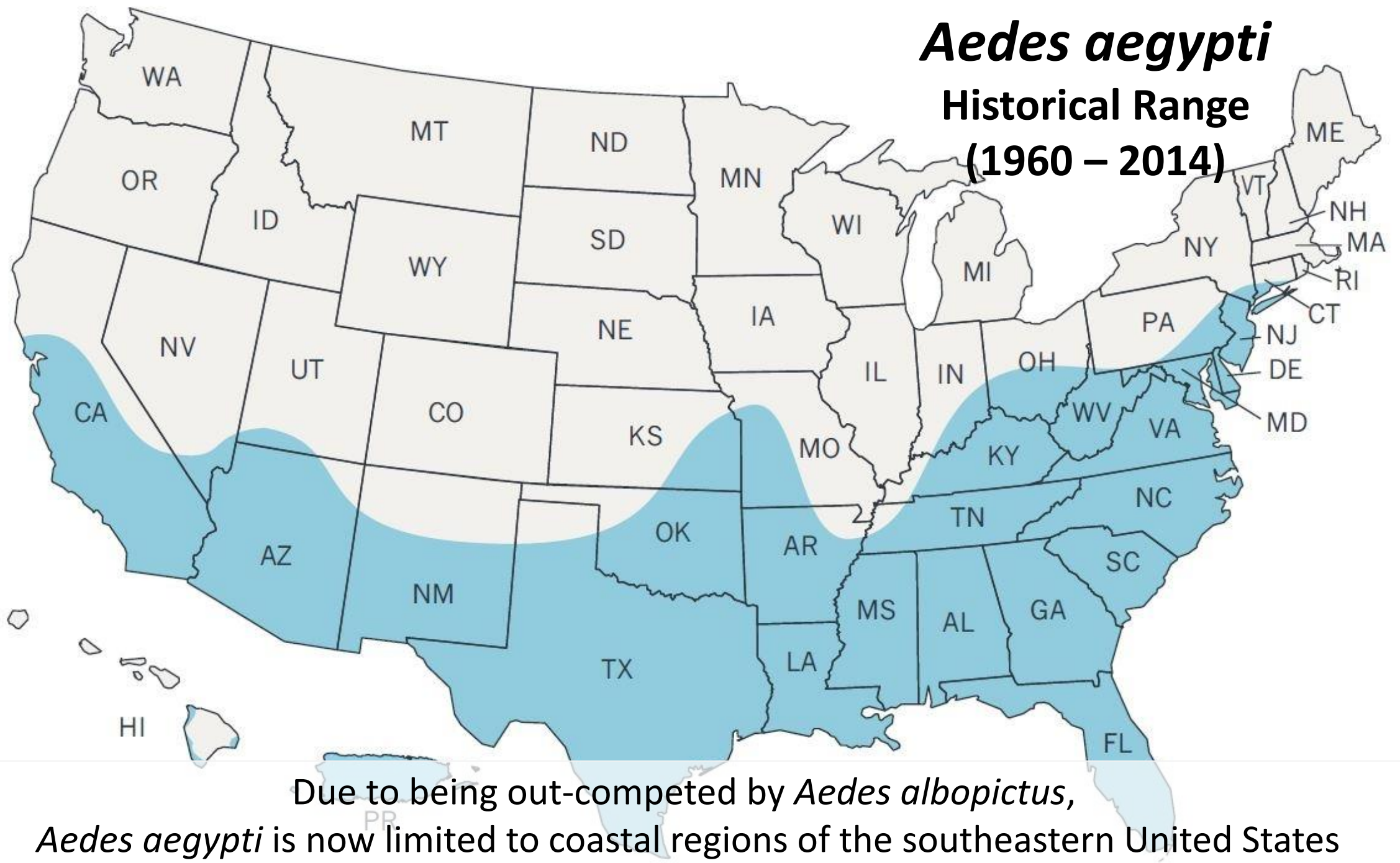


*Aedes aegypti*  
Yellow Fever Mosquito



Feeds almost exclusively on people  
Breeds and rests indoors and outdoors  
Near human habitation

# *Aedes aegypti* Historical Range (1960 – 2014)



Due to being out-competed by *Aedes albopictus*,  
*Aedes aegypti* is now limited to coastal regions of the southeastern United States



# *Aedes aegypti* Outdoor Breeding Urban Areas Near Human Habitation



Cemetery Vase



Water Storage



Waste Containers



Bird Baths



Discarded Tires



# *Aedes aegypti* Indoor Breeding



Sik, Malaysia

Bathroom Container



Sik, Malaysia

Water Fountain



*Aedes albopictus*  
Asian Tiger Mosquito



Opportunistic blood feeder, mostly mammals  
Breeds and rests outdoors  
Near human habitation or rural, wooded areas



*Aedes albopictus*  
U.S. Range





# *Aedes albopictus* Outdoor Breeding Sites Urban or Rural Areas

- Containers
  - Metal, glass, stone, earthenware, plastic, wood, or rubber
- Natural containers
  - Treeholes
  - Leaf axils (not common)
- Human-made containers
  - Flower pots
  - Cans
  - Buckets
  - Ornamental ponds
  - Birdbaths
  - Old tires
  - Cemetery vases
  - Clogged rain gutters
  - Pet watering dishes





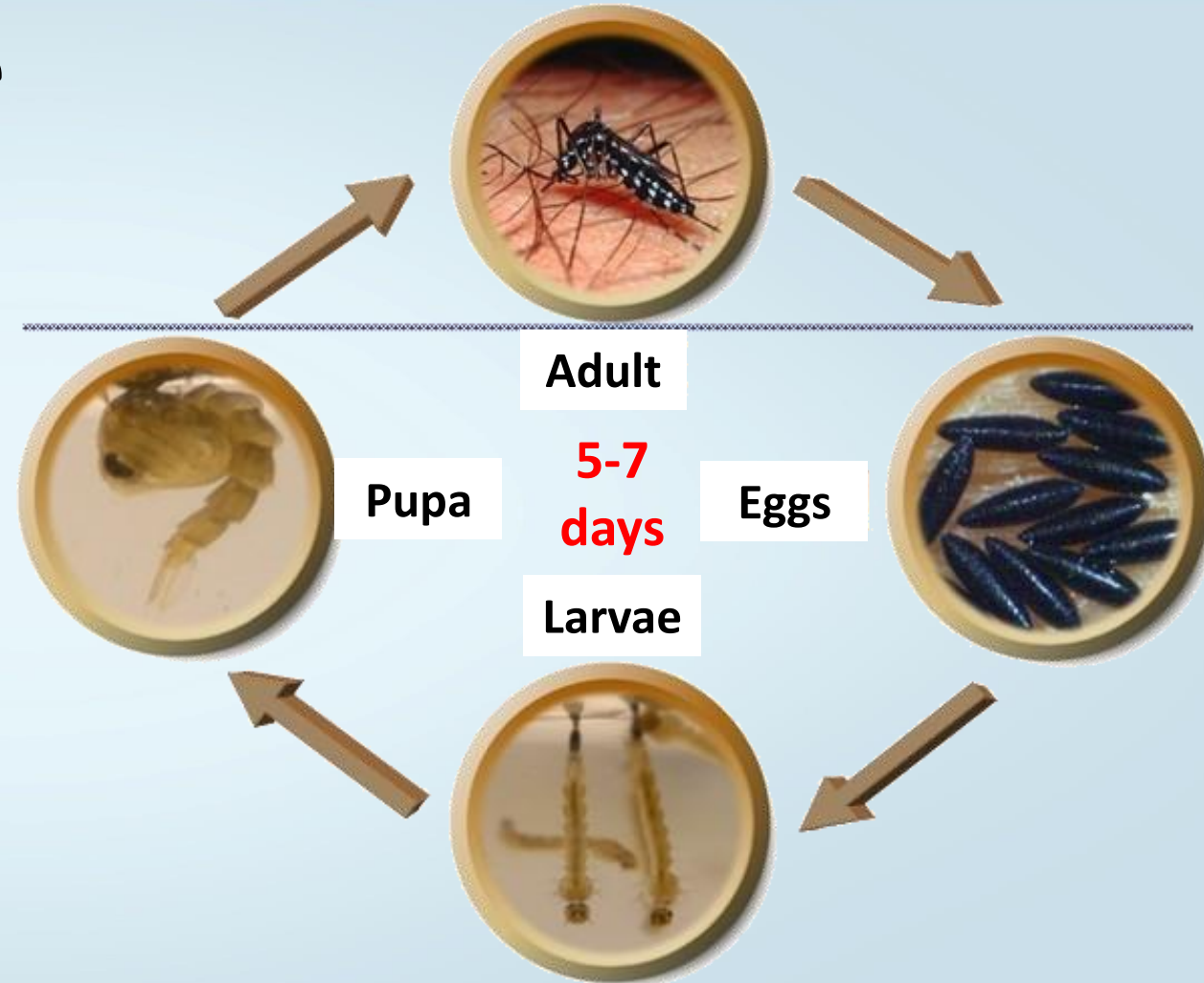
A close-up photograph of mosquito larvae and pupae in a shallow layer of water. The larvae are light-colored, segmented, and covered in fine hairs. They are positioned vertically, with their heads near the water surface. The pupae are larger, more rounded, and also covered in hairs. The water is clear, and the background is a light, neutral color.

**Eliminate Mosquito Vectors  
and Avoid Exposure**

# Controlling Mosquito Larvae

## *Main Focus of Mosquito Control*

- Mosquito larvae are
  - Confined to water and are easier to treat than adults
  - More vulnerable to control measures than the adults





# Source Reduction

Removing sources of water that breed mosquitoes





## Natural Containers

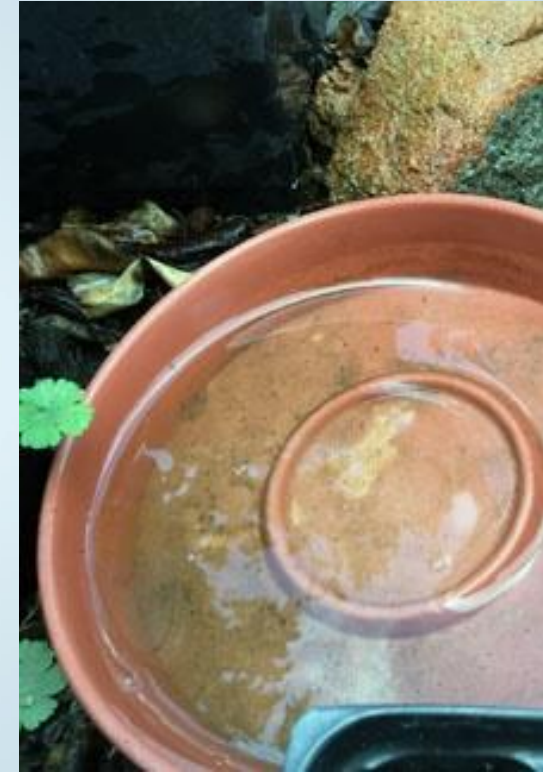


**Tree Holes**



**Cut Bamboo**

## Artificial Containers



**Plastic**



## Think Tall



## Think Small



## Recycling Waste Tires



Eliminates the need to use expensive EPA-registered insecticides



# Community Involvement in Source Reduction

“Man breeds his own *Aedes aegypti* and sits back either in ignorance or in the hope that someone else will do the tidying up.”

J.D. Gillett



## Educational Challenges

- Link larvae – “wrigglers” – with adult mosquitoes that might cause illness
- Stop dependence on government or other institutions to sustain source reduction activities



## Larviciding

Process of killing mosquitoes by applying natural agents or commercial products to control larvae and pupae





# Mosquito Control At Home



*Bacillus thuringiensis israelensis* – Bti

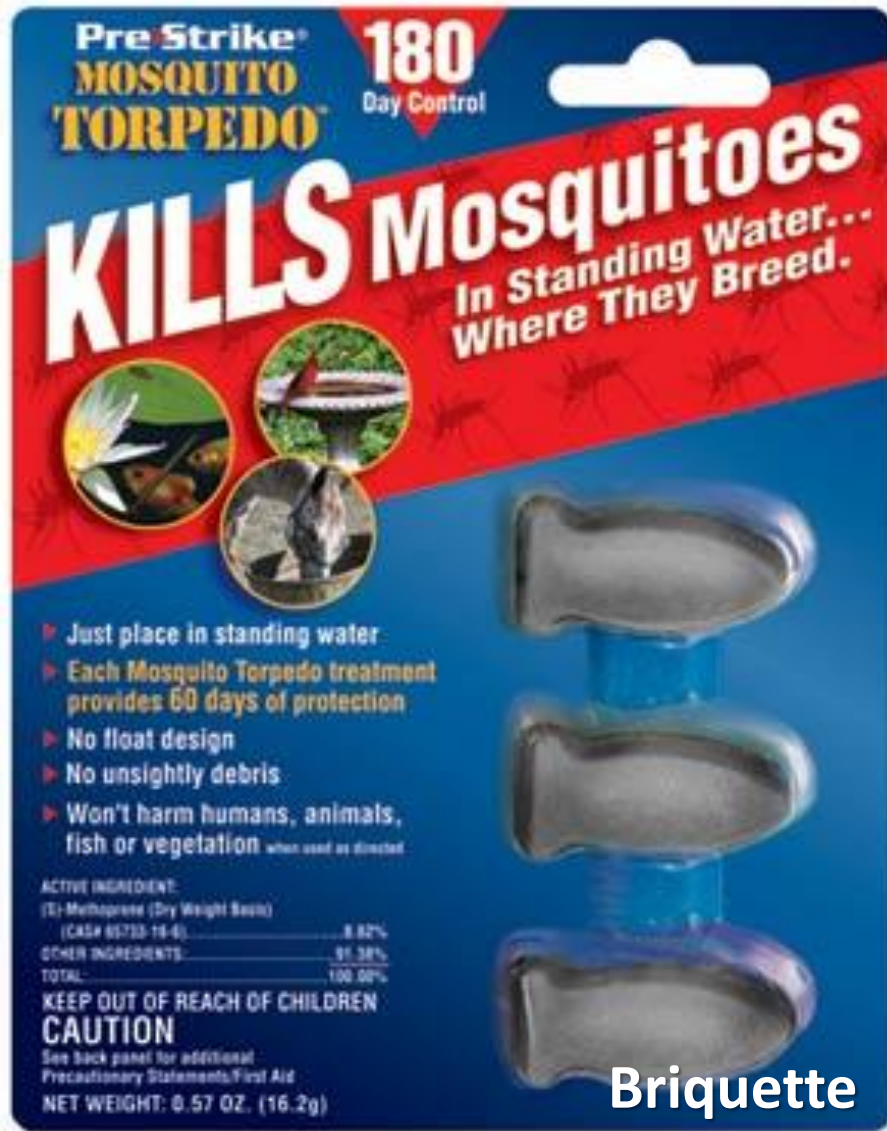
Bacterial toxins paralyzes the midgut of mosquito larvae





# Mosquito Control at Home

Methoprene, an Insect Growth Regulator



Briquette

Methoprene, an Insect Growth Regulator  
Mimics juvenile hormone &  
prevents larvae from molting into pupae



Granules



# Mosquito Repellents



## EPA-Registered Active Ingredients

- DEET
- Picaridin
- IR3535
- Oil of Lemon Eucalyptus

## Adult Mosquito Control – Adulthooding

- Source reduction or larviciding fails to control mosquitoes OR
- Outbreak already in progress





# Ultra-Low Volume (ULV) Spraying

## Use of nozzles to atomize the insecticide



# Thermal Fogging

## Use of heat to atomize the insecticide



**Vehicle-mounted, Handheld, or Backpack versions available**



Hand-held thermal fogger



# Barrier Spray

## Residual Insecticides on External Walls of Houses & Vegetation





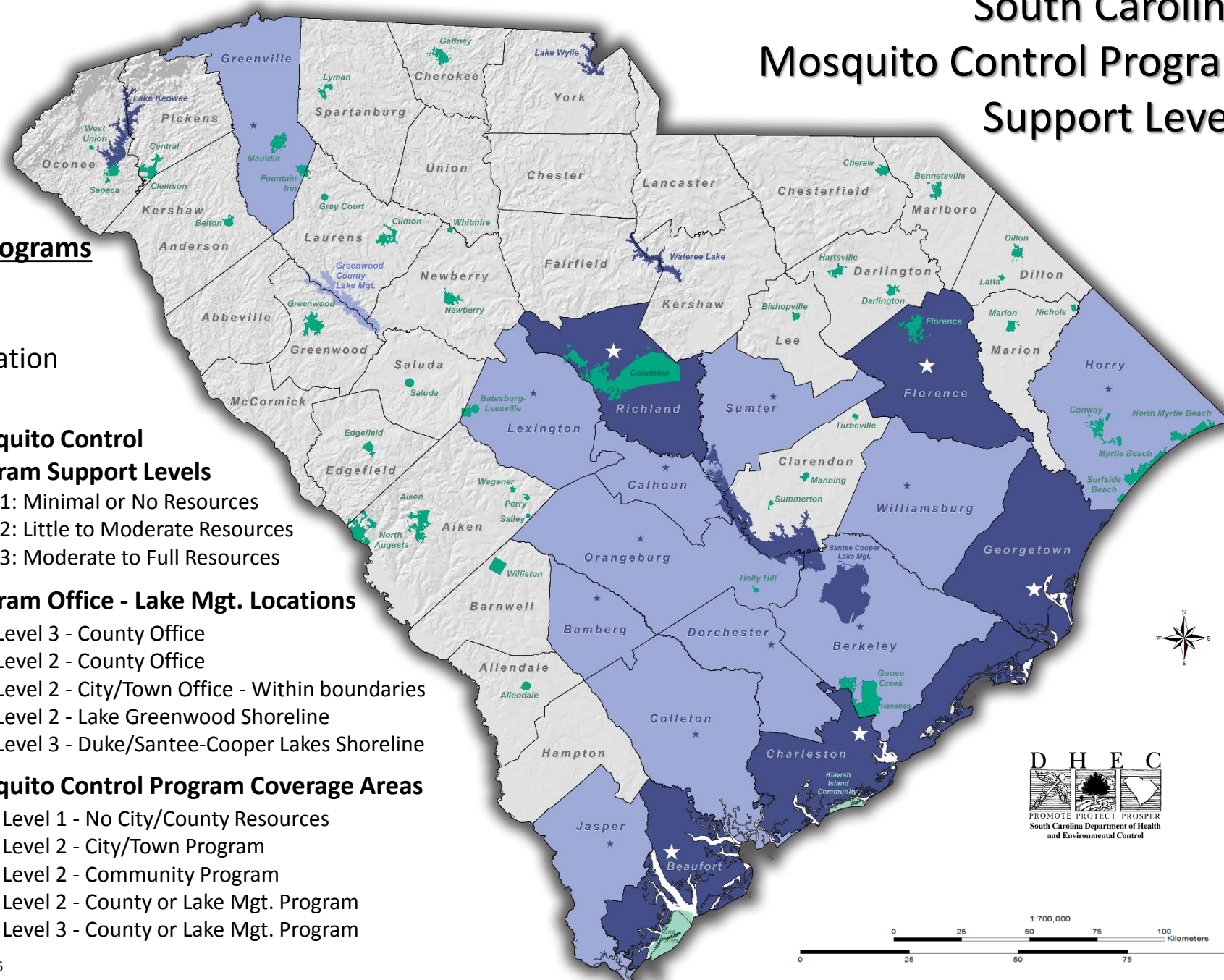
# Establishing a Mosquito Control Program

## *ASTHO's Recommendations*

- **Level 1 (Minimal)**
  - *Minimal or no resources.* Emphasize education, community participation, and personal responsibility.
- **Level 2 (Intermediate)**
  - *Little to moderate resources.* Combine resources with other jurisdiction. Add increased source reduction and adulticide. Map habitats. Monitor larval & adult populations.
- **Level 3 (Comprehensive)**
  - *Moderate to full resources.* Procure equipment and insecticides. Expand data collection. Build risk maps and assign priorities to areas.



# South Carolina Mosquito Control Program Support Levels



## 66 Mosquito Control Programs

- 16 County Level
- 45 City/Town Level
- 2 Home Owner's Association
- 3 Lake Shorelines

### Mosquito Control Program Support Levels

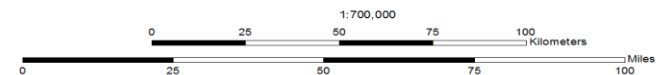
- Level 1: Minimal or No Resources
- Level 2: Little to Moderate Resources
- Level 3: Moderate to Full Resources

### Program Office - Lake Mgt. Locations

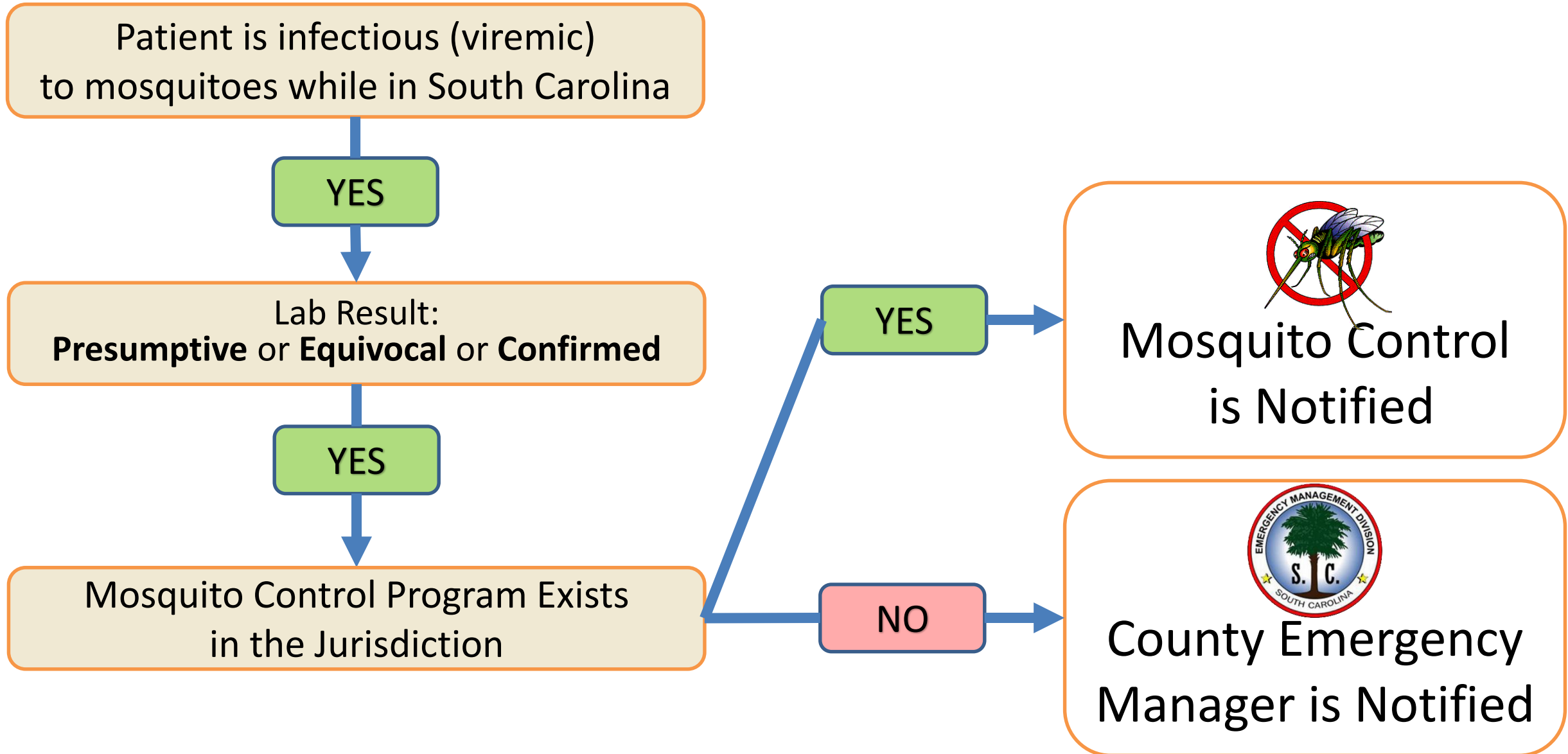
- ☆ Level 3 - County Office
- ★ Level 2 - County Office
- 🟢 Level 2 - City/Town Office - Within boundaries
- 🟡 Level 2 - Lake Greenwood Shoreline
- 🟠 Level 3 - Duke/Santee-Cooper Lakes Shoreline

### Mosquito Control Program Coverage Areas

- 🟡 Level 1 - No City/County Resources
- 🟢 Level 2 - City/Town Program
- 🟠 Level 2 - Community Program
- 🟡 Level 2 - County or Lake Mgt. Program
- 🟠 Level 3 - County or Lake Mgt. Program



# When to Notify Mosquito Control Programs of Zika-Virus Positive Events







**South Carolina Department of Health and Environmental Control**  
*Promoting and Protecting the Health of the Public and the Environment*

# CONTACT US

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