

Dengue in Florida & Implications for Georgia

Mark S. Blackmore

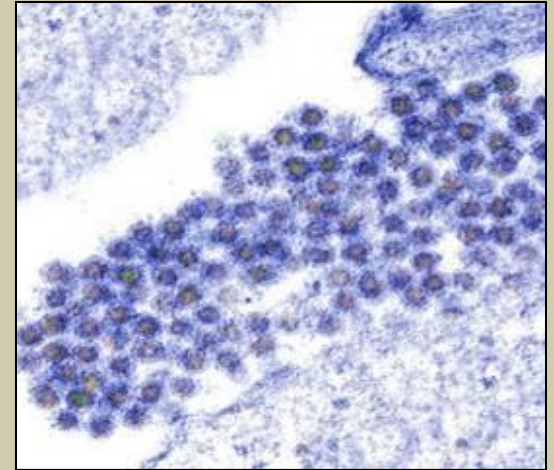
Valdosta State University

Acknowledgements

- Carina Blackmore, DVM, PhD, Dipl. ACVPM
- Monroe County Health Department
 - Jean Barber, RN
 - Robert Eadie, Administrator
 - Mark Whiteside, MD, Medical Director
- Florida Department of Health Officials (FDOH)
 - Elizabeth Radke, MPH
 - Erin Sauber-Schatz, PhD, EIS Officer for FDOH
 - Danielle Stanek, DVM
 - Lillian Stark, PhD, FDOH State Laboratory
- Centers for Disease Control & Prevention
 - Glen Gallagher, EID Fellow
 - Chris Gregory, MD EISO
 - Elizabeth Hunsperger, PhD
 - Brad Biggerstaff, PhD
- Valdosta State University, Faculty Development Grant

Dengue Virus

- Single-stranded RNA flavivirus
 - Same family as WNV, SLEV & YFV
- Four serotypes – DEN-1, 2, 3, 4
 - Infection provides lifelong immunity to the *specific serotype*
- Causes dengue and dengue hemorrhagic fever



Dengue Fever

- Often mild, non-specific
- Sudden onset of high fever
- Severe headache
- Pain behind the eyes
- Body aches and joint pains
- Nausea or vomiting
- Rash



Dengue Hemorrhagic Fever

- Severe abdominal pain
- Bleeding from the nose, mouth, and gums
- Frequent vomiting with or without blood
- Black stools
- Excessive thirst
- Pale, cold skin
- Restlessness or sleepiness

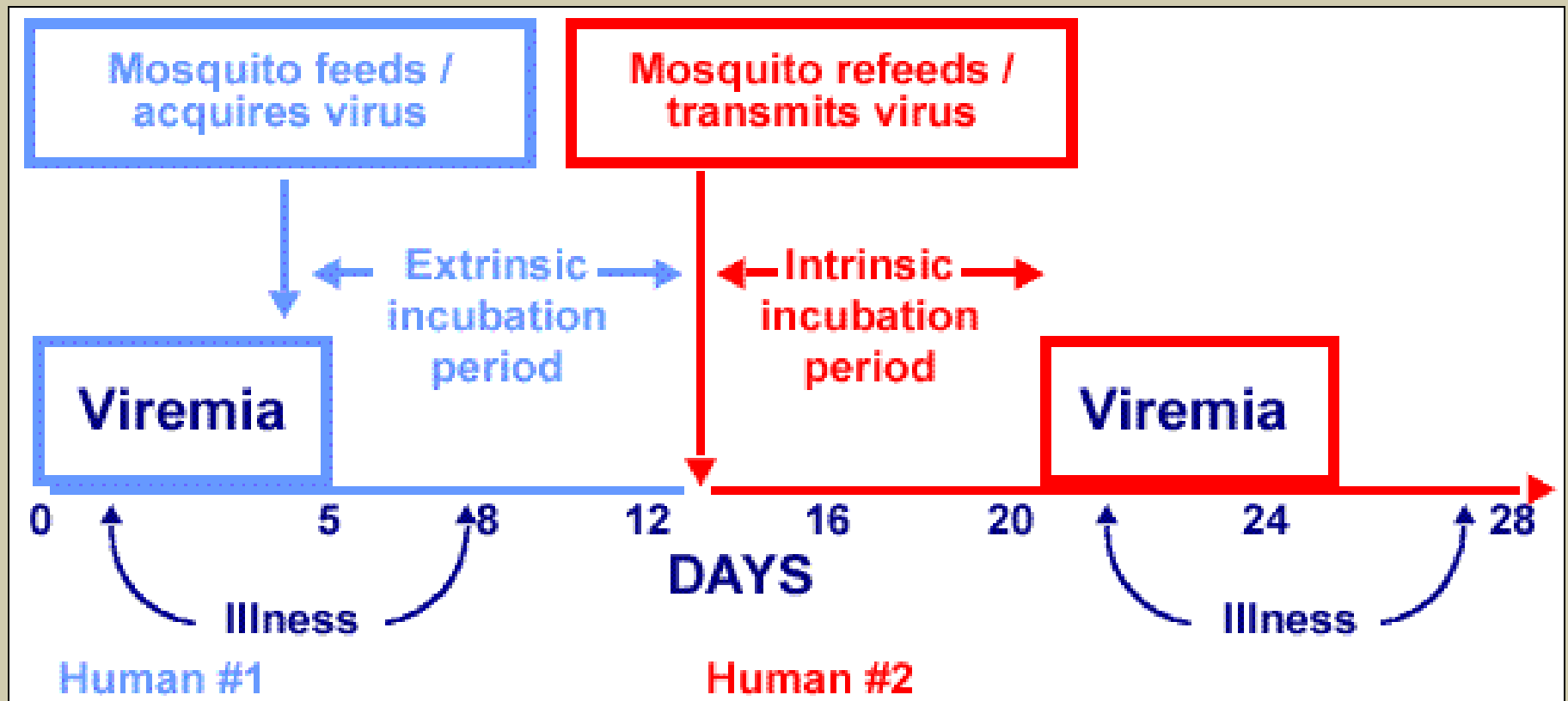


Transmission



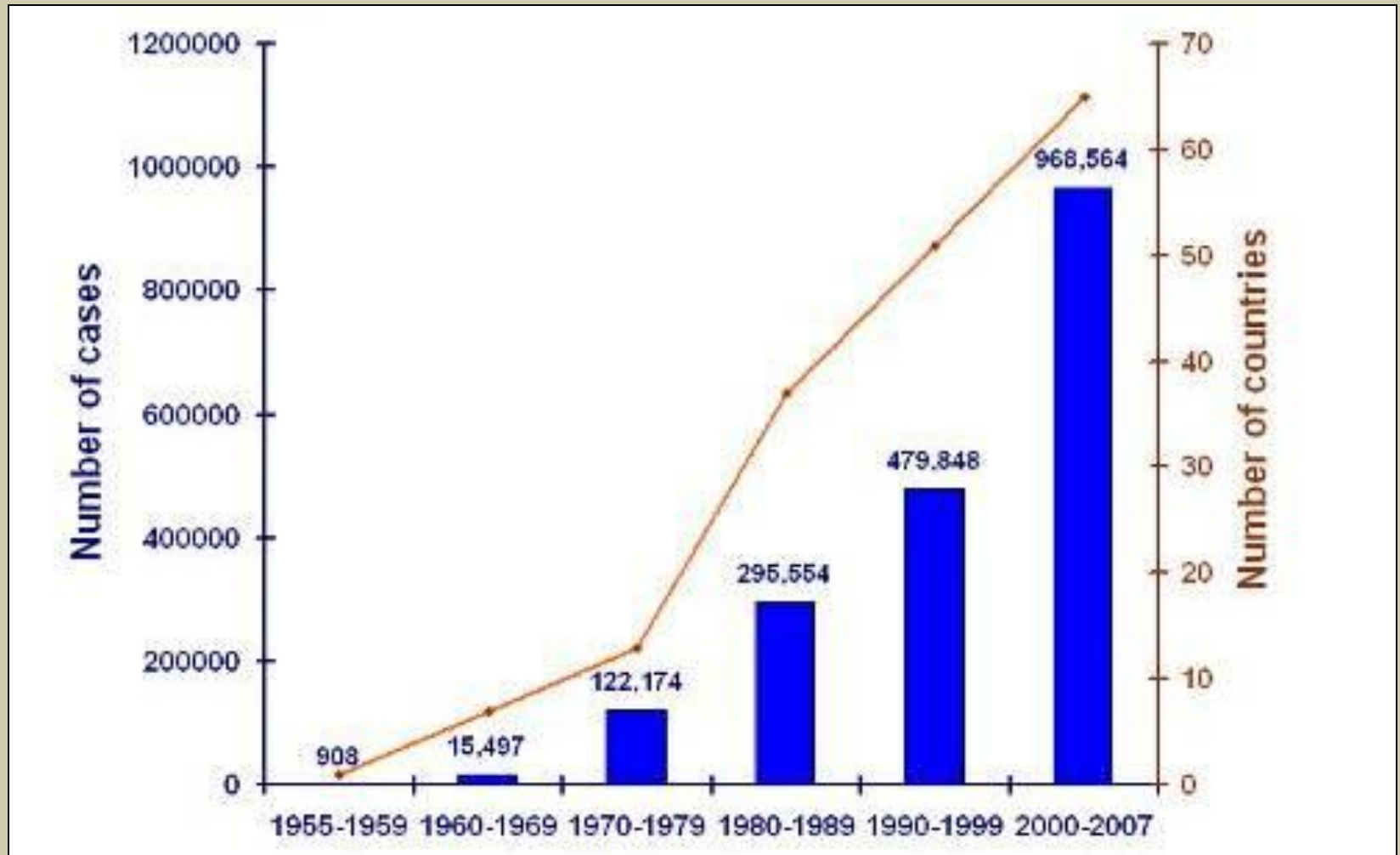
Aedes aegypti* and *Aedes albopictus

Incubation/Viremic Periods

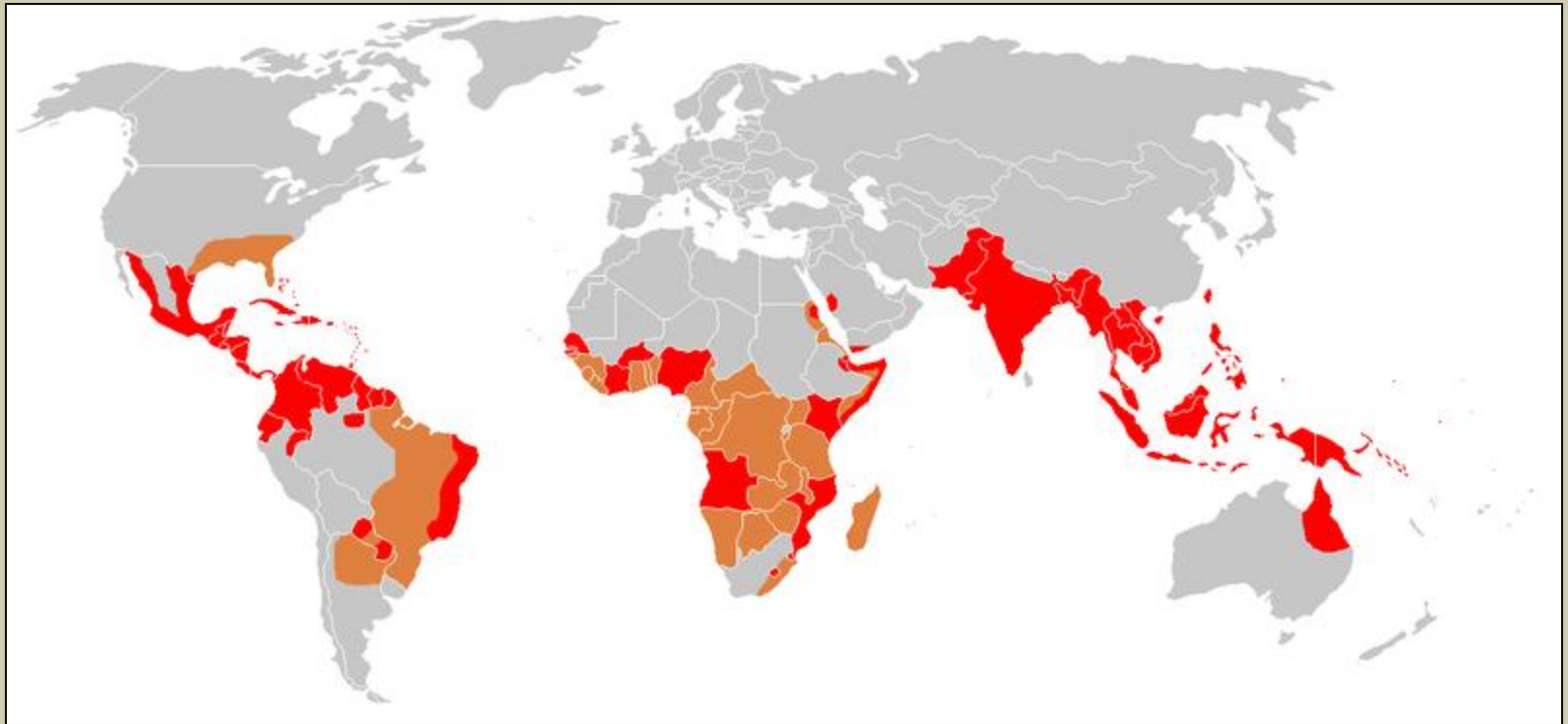


From CDC

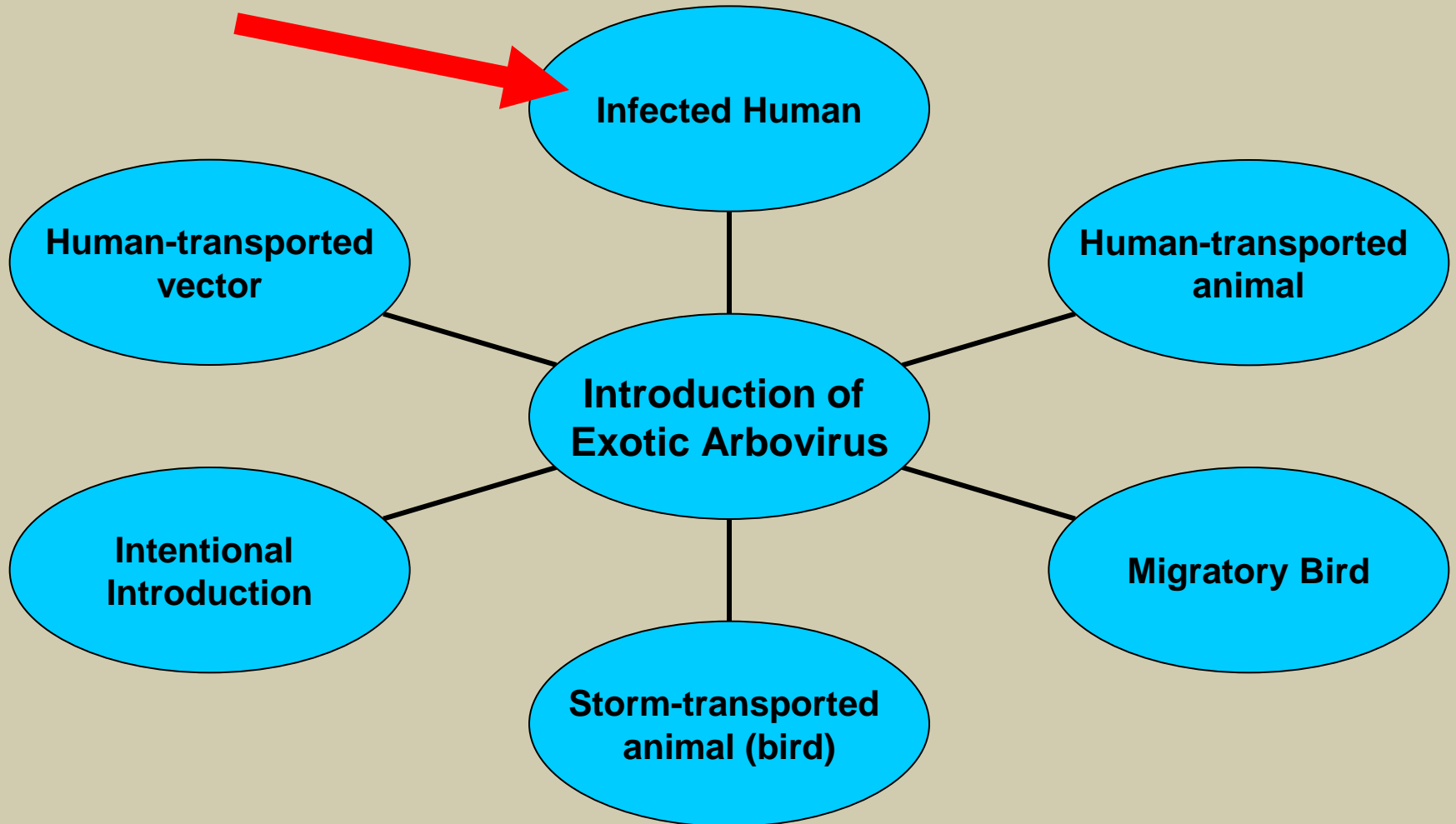
Average annual number of DF/DHF cases reported to WHO and average annual number of countries reporting



Dengue Distribution

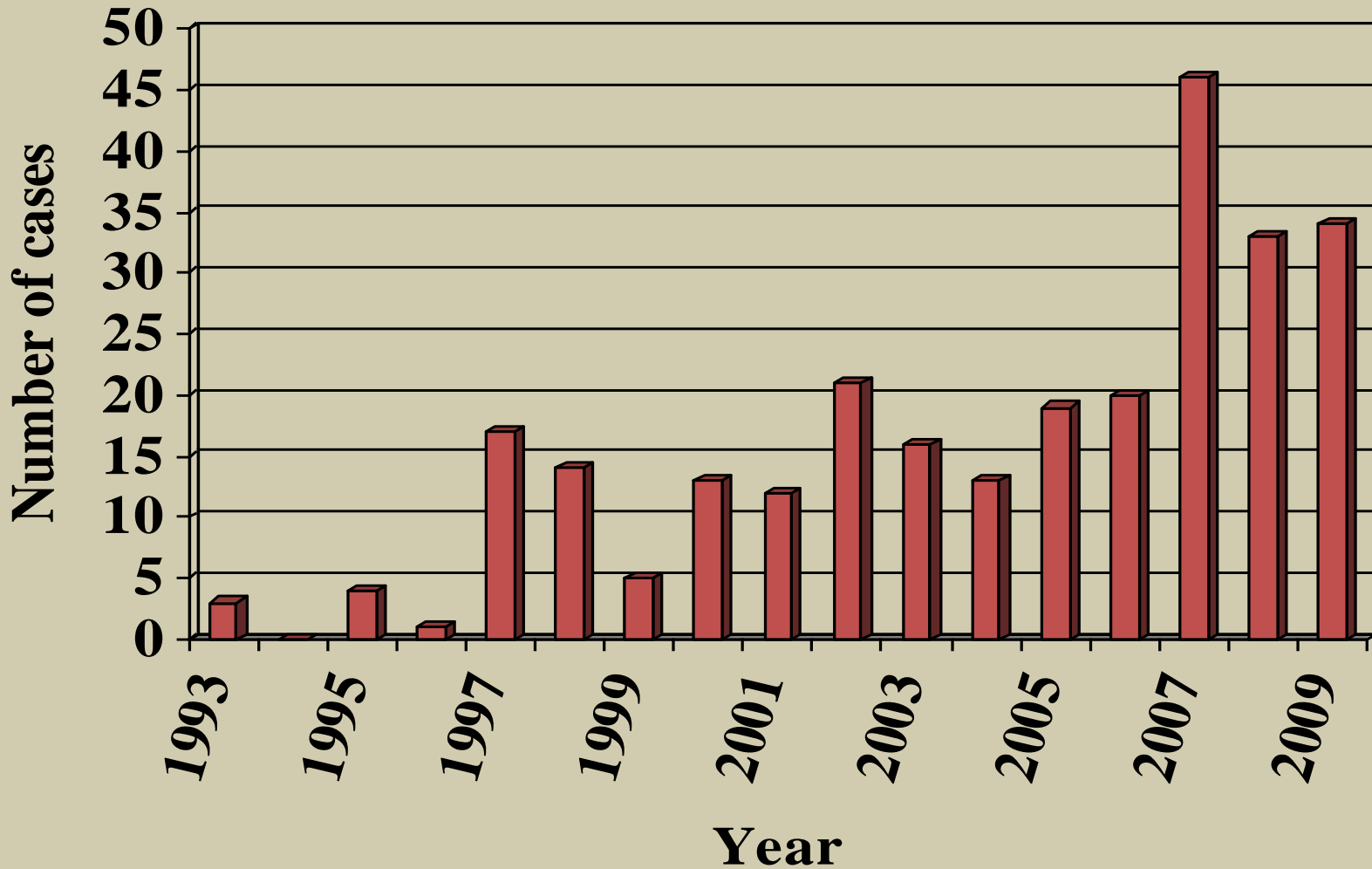


Modes of Introduction for Arboviruses



Dengue in Florida

Imported dengue in Florida, 1993-2009



Imported Dengue, Florida 2010

- Brazil
- Colombia
- Costa Rica
- Dominican Republic
- Ecuador
- El Salvador
- Grenada
- Guatemala
- Haiti
- Honduras
- Jamaica
- Martinique
- Malaysia/ Bangladesh
- Nicaragua
- Panama/ Venezuela
- Philippines
- Puerto Rico

Florida Ecology Conducive to Arboviruses



- Warm Climate
- Regular Rainfall
- Vectors present
- Suitable Hosts for Amplification
- Historical Data

Outbreak Identification

- September 1, 2009 - Monroe County Health Department notified of a New York resident diagnosed with dengue after travel to Key West
- Index case: 34 year-old female visited Key West from August 2-9, 2009
 - No recent travel to dengue-endemic country
 - Onset August 10 of fever, headache, malaise, and chills
 - Visited physician multiple times over next few days, developed arthralgia, retro-orbital pain, and petechiae
 - Anti-dengue virus IgM antibodies, DENV-1.

- Key West
 - 129 miles SW of Miami
- Population 23, 262
- > 2 million visitors annually
 - International Airport
 - Highway
 - Passenger cruise ships
- *Aedes aegypti* widespread;
Aedes albopictus absent



Old Town



More cases

- Due to public notification, self diagnosis by a 48-yr-old Key West resident with no recent travel history
- Wife became ill two weeks later, dengue infection was confirmed
 - Indicated ongoing transmission, multiple generations of mosquitoes



Dengue vs. Flu

- **Fever**
- **Severe headache**
- Pain behind the eyes
- **Body aches**
- Joint pains
- **Nausea or vomiting**
- Rash
- **Fatigue**

- **Fever**
- Cough
- Sore throat
- Runny or stuffy nose
- **Body aches**
- **Headache**
- Chills
- **Fatigue**
- **Nausea or vomiting**
- Diarrhea

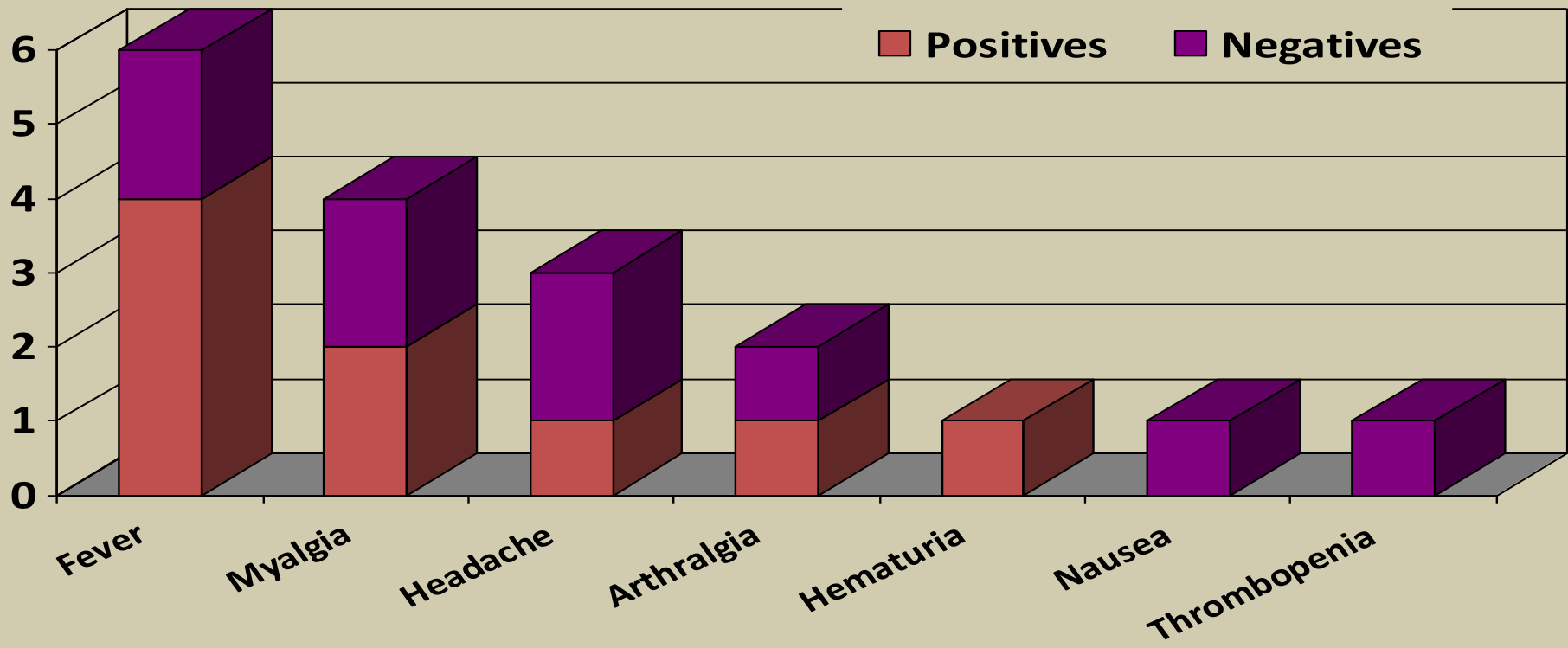
Medical record search criteria

- Dengue
- Dengue hemorrhagic fever
- Fever (persistent) +
- Infectious disease NOS
- Myalgia
- Bleeding (hemorrhage)
- Blood in urine
- Thrombocytopenia
- Rash
- Arthralgia
- Petechiae
- Leukopenia
- Generalized pain
- Eye Pain
- Exclude:
 - Influenza
 - Cough
 - Wheezing



Medical Record Search Results

- Search yielded 211 records
- Six were identified as possible cases
- Four were confirmed as dengue infections

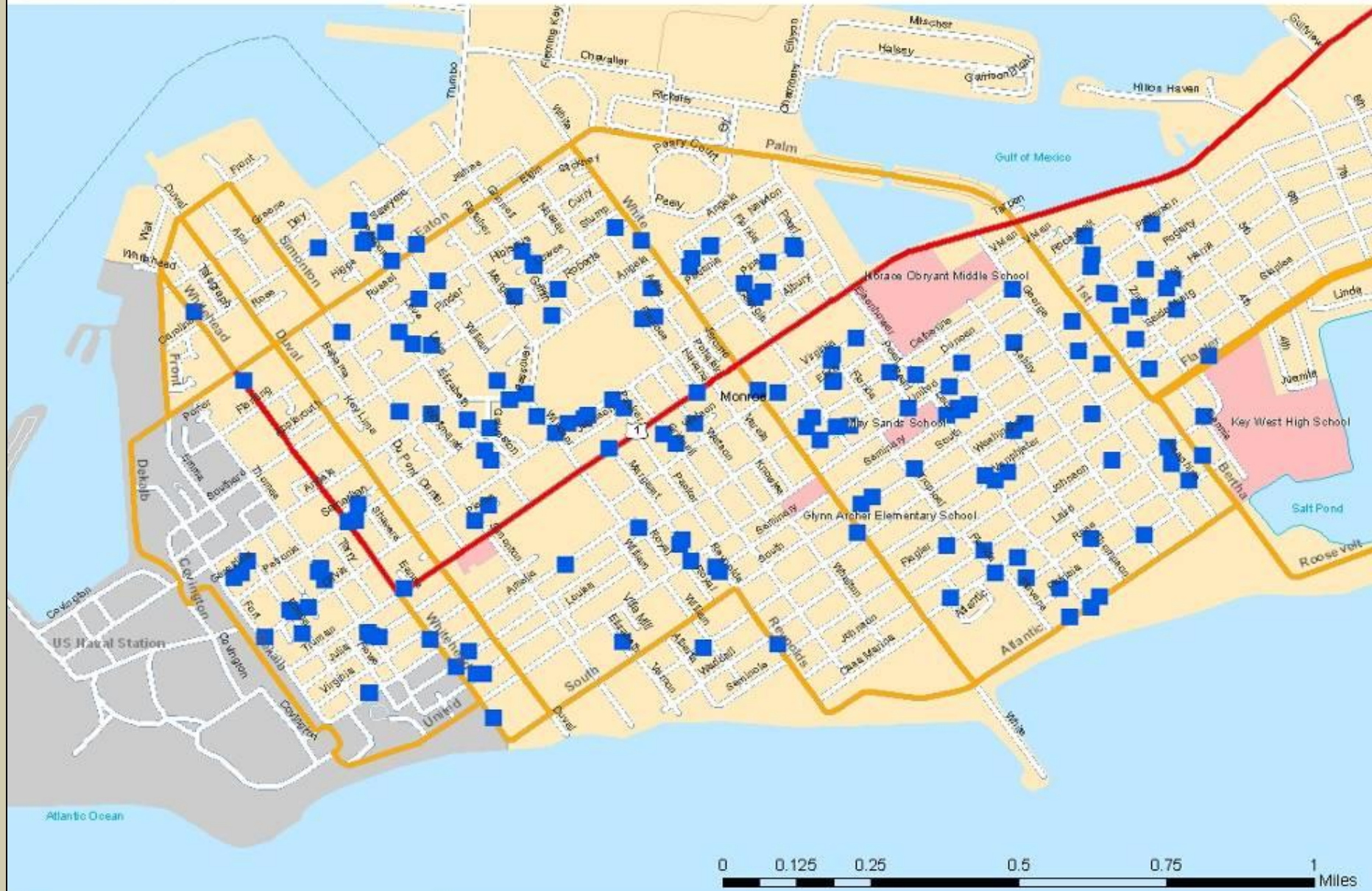


Seroprevalence Survey Objectives

- Determine the prevalence of dengue in Key West
 - Blood collection
- Identify risk factors for infection
 - Household and individual questionnaires



Households Sampled During Serosurvey in Key West



■ Sampled Households (N=170)

Questionnaire

- Demographics
- Household level risk factors
 - Screened windows, A/C
 - Standing water around the house
- Individual risk factors
 - Time outside
 - Mosquito avoidance measures
- Medical history
- Travel history



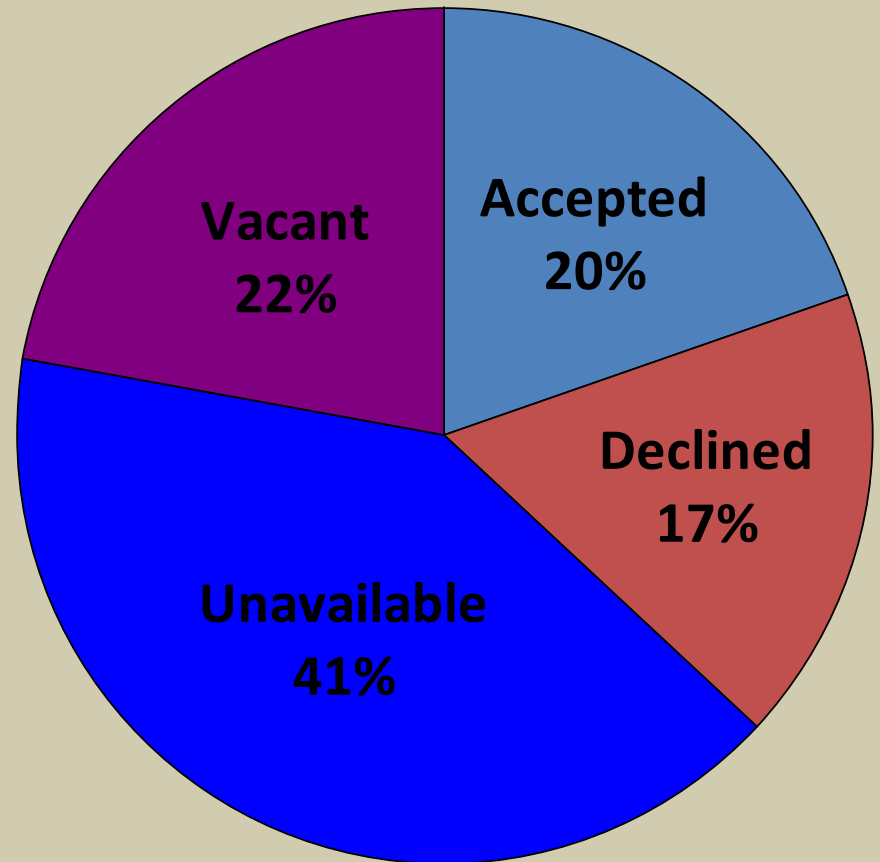
Seroprevalence Survey Methods

- 3-5 teams at a time (September 23-27)
 - Interviewer
 - Phlebotomist
 - Member of mosquito control staff
- Obtained verbal consent for questionnaire and blood collection from household members older than 5



Survey Acceptance in Key West

- Final household list=911 residences
- 53% acceptance when able to contact
- 170 participating households
- 240 total samples
- 1.4 individuals per participating house



Lab Definitions

- Laboratory positive recent infection (occurring in prior 3 months)
 - DENV detected by RT-PCR or NS1 ELISA
 - Dengue-specific IgM by ELISA
- Presumptive recent infection
 - Recent febrile dengue-like illness **and**
 - No travel to dengue-endemic country in prior 3 months **and**
 - Positive IgG ELISA and PRNT₉₀

Seroprevalence Results

- 8 laboratory positive recent infections
 - 2 acute
- 5 presumptive recent infections (IgG and PRNT+ with recent illness and no travel)
- Total=13 (5.4%) of 240 participants had evidence of recent infection
- Weighted estimate=4.9% (95% CI=1.8-7.9)

Risk Factors

Gender		p=0.099
	Male	Female
Total	139	101
Recent	9 (69%)	4
Others	130 (57%)	97

Race				p=0.0237
	White	Black	Hispanic	Asian
Total	186	19	29	5
Recent	8 (62%)	3 (23%)	1 (8%)	1 (8%)
Others	178 (78%)	16 (7%)	28 (12%)	4 (2%)

Risk Factors

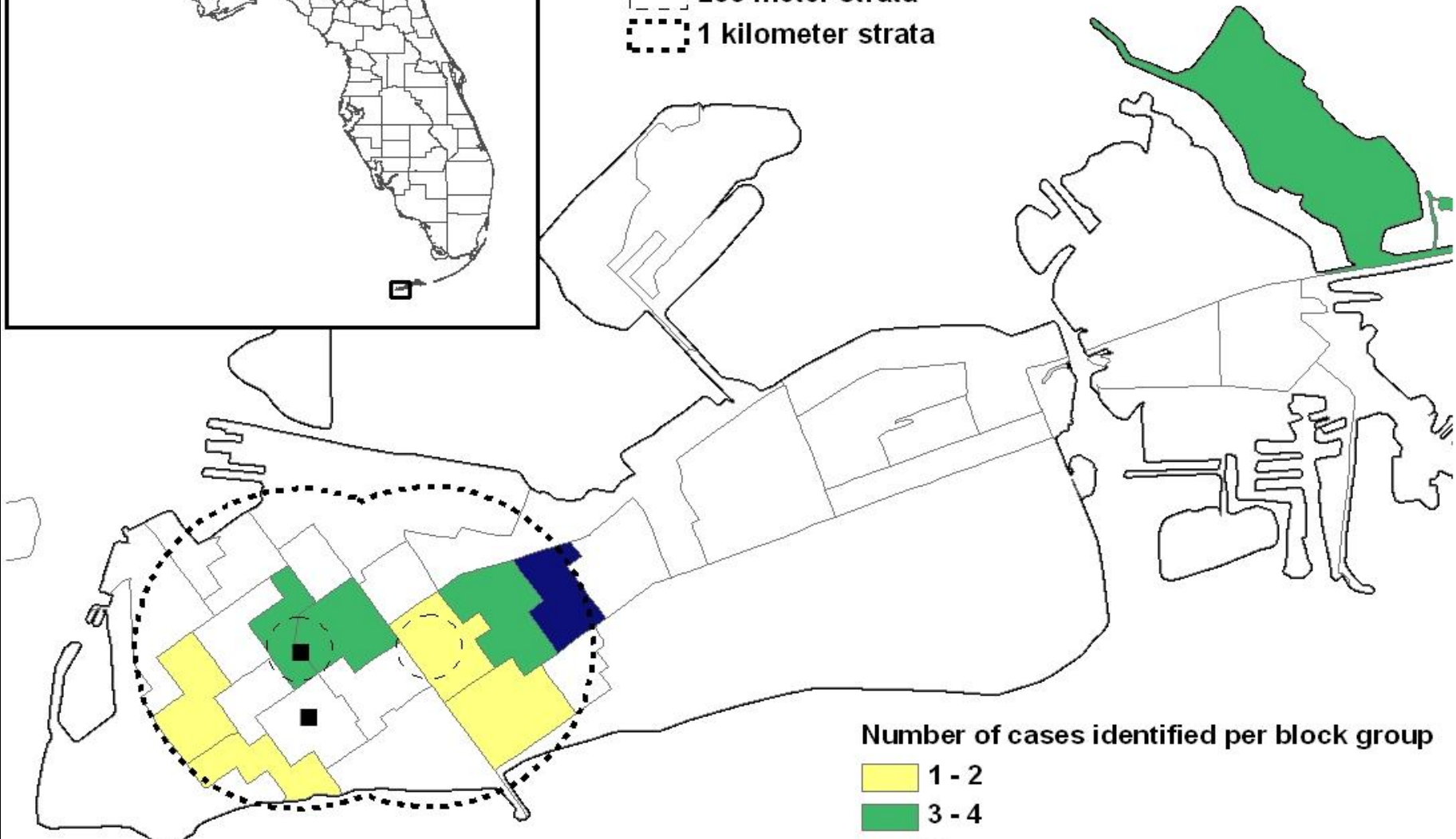
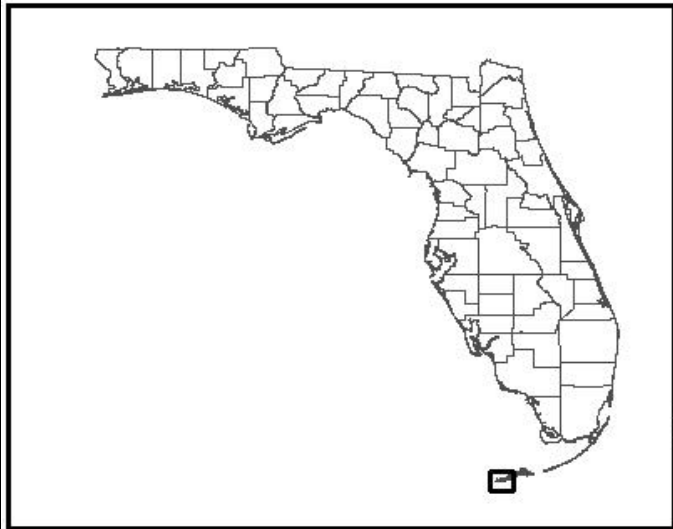
Variable	Recent Infections	Others	Crude OR	95% CI
Air conditioning >50% of time	37%	75%	0.20	0.06-0.69
Windows open >50% of time	41%	15%	3.85	0.94-15.87
Vegetation covers >50% of yard	59%	30%	3.40	0.91-12.71
Bird bath in yard	41%	11%	5.64	1.32-24.13
Empty water from containers	6%	36%	0.12	0.02-0.79
Outside in evenings	86%	67%	3.12	0.92-10.57
Bitten at work/school	32%	14%	2.95	0.97-9.02
Use bite prevention measures	26%	52%	0.32	0.13, 0.79
Use repellent with DEET	20%	41%	0.36	0.14, 0.94
Traveled outside FL in past 3 months	12%	38%	0.23	0.05-0.99

Case total

- 27 confirmed and presumptive cases
 - Index case
 - Physician and county health department submissions
 - Medical record review
 - Seroprevalence survey
- July 26 – October 19, 2009

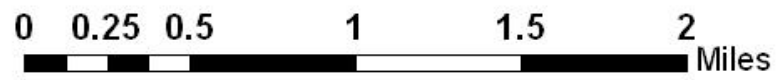
Serosurvey Investigation Area

- 200 meter strata
- 1 kilometer strata



Number of cases identified per block group

- 1 - 2
- 3 - 4
- 8
- No cases identified
- Positive mosquito pool



Viral Sequencing

- Two human samples and two mosquito pools were sequenced
- DENV-1 found to be genetically related to 2007 Mexican DENV-1
- Mexico was the top U.S. international destination in 2008

Strengths and Limitations of Surveillance

- Strengths

- Largest sample of U.S. residents for dengue serosurvey
- Conducted in a timely manner
- Multifaceted approach

- Limitations

- Large number of unoccupied households
- Census data
- Small number of cases = wide confidence intervals for risk factors
- Resistance to testing by some local physicians

CHD Response

- Public outreach via newspapers, radio, TV, public forum, and flyers
- Visitors to Key West targeted through messaging at hotels and guest houses
- Messaging for physicians through personal visits, and letters
- Developing online physician training on clinical diagnosis and management with CDC Dengue Branch
- Syndromic surveillance being used to supplement passive reporting



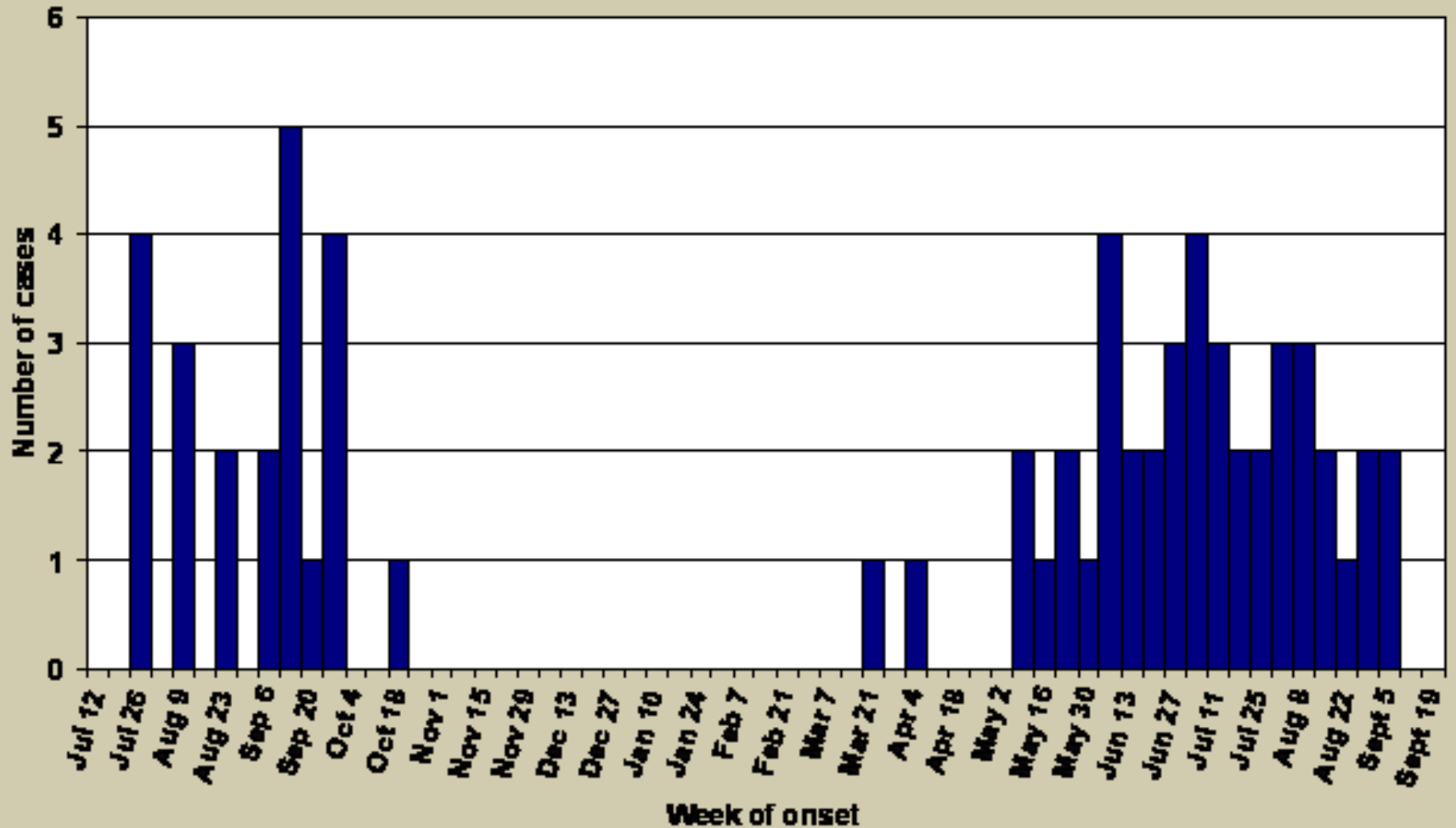
Mosquito Control Response

- Door to door environmental assessments focused on eliminating breeding sites
 - Additional inspectors hired
- Public outreach campaign
- Liquid larvicides used to treat inaccessible properties
- FKMCD attorney sends certified letters to homeowners unwilling to cooperate
- Implementing experimental lethal ovitraps

Current status

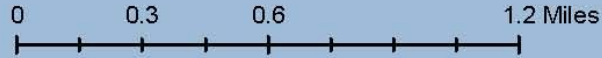
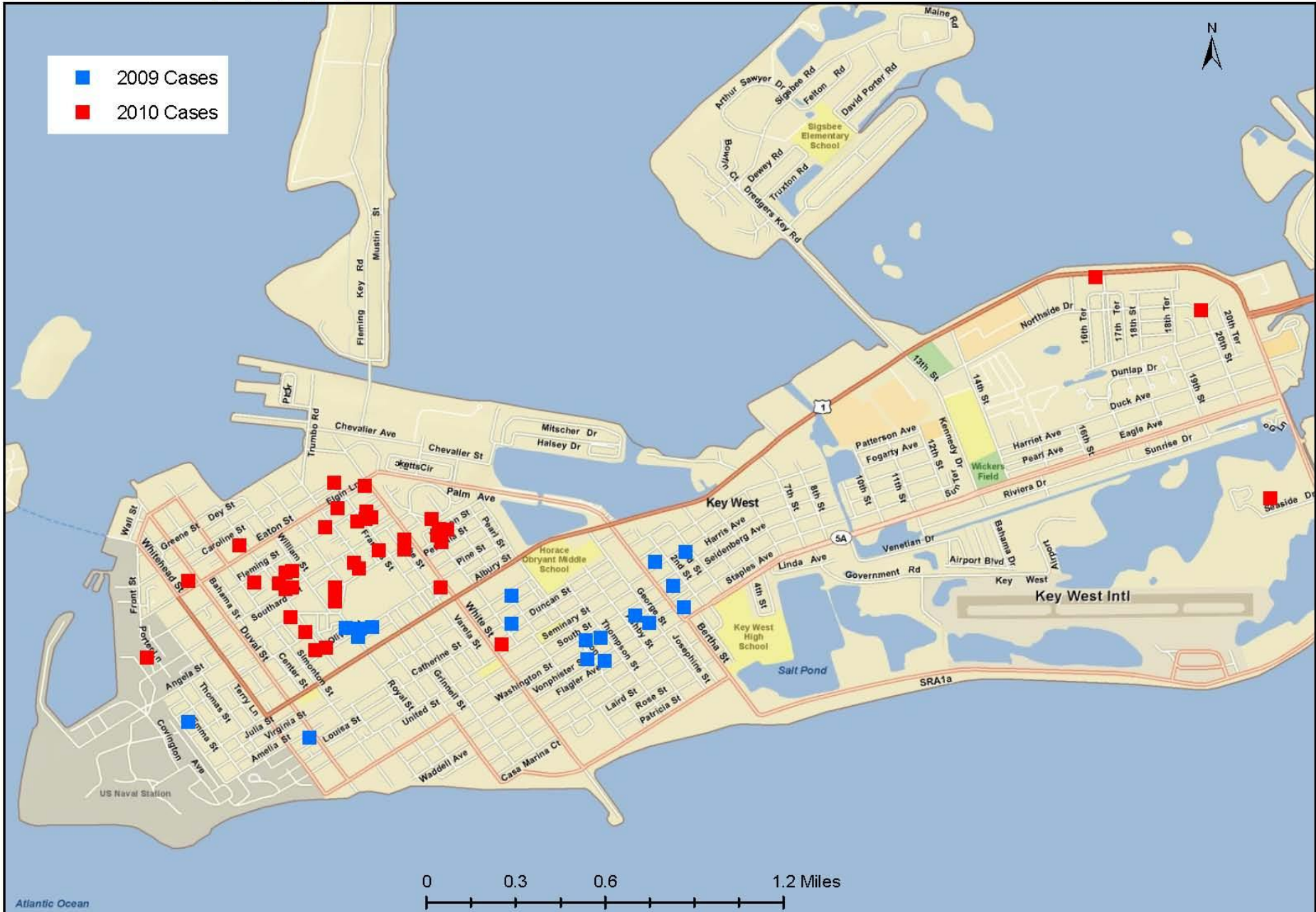
- Late 2009-early 2010, no new cases were reported
- 41-yr-old male, onset April 6, no travel history but lived in military housing
- May, multiple IgM+ results from commercial labs
- Monroe CHD and Florida Keys Mosquito Control District reinvigorated their control measures
- As of October 15,2010: 53 autochthonous cases have been identified in Florida; 52 in Key West
- Broward County case was DEN-3

Epi Curve, Dengue fever, Key West 2009-2010.



2009 and 2010 Key West Dengue Cases

- 2009 Cases
- 2010 Cases



... and what about Georgia?

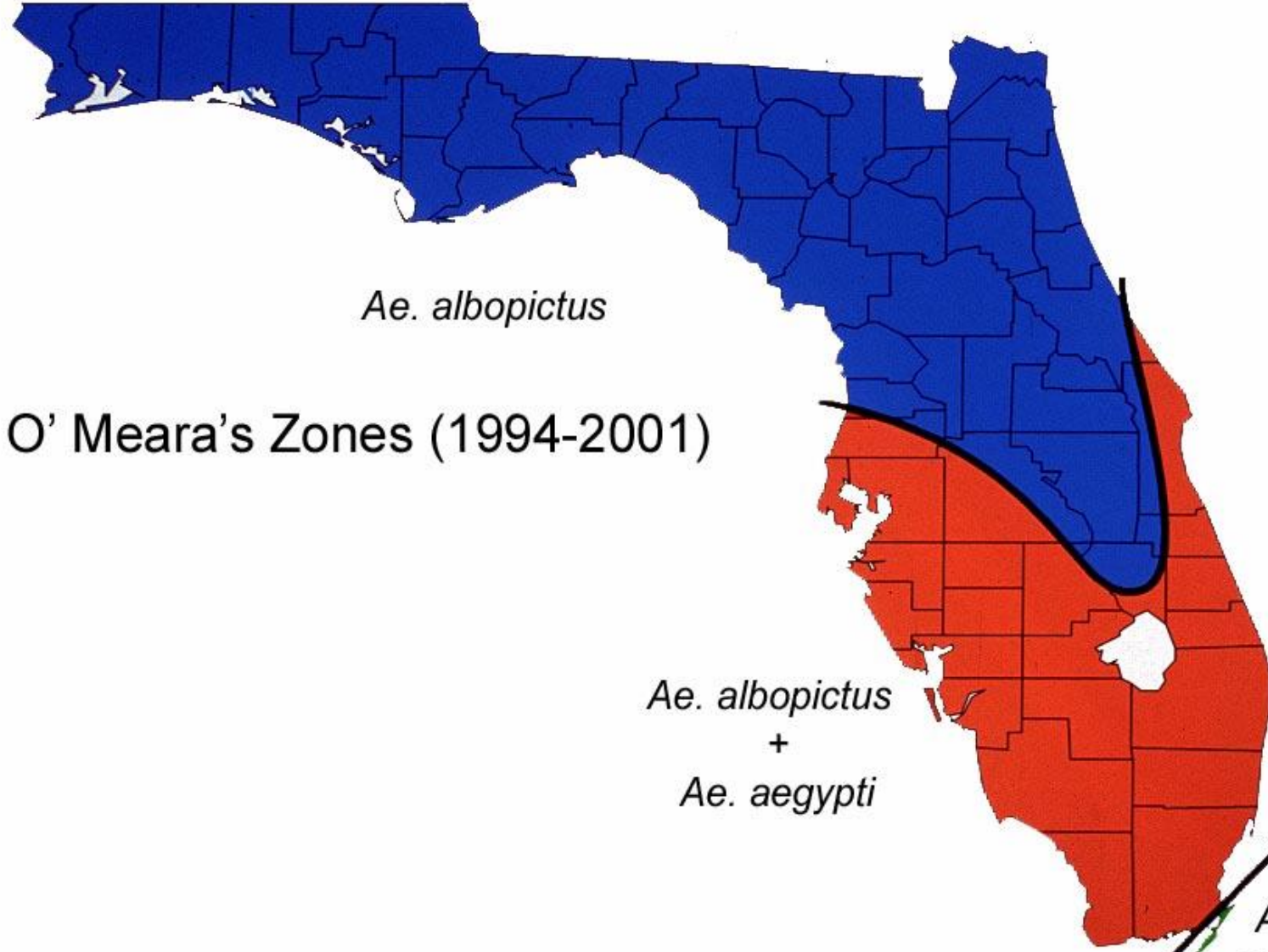
- ✓ International travel
- ✓ Suitable climate

Vectors?



Reynosa, Mexico





Ae. albopictus

O' Meara's Zones (1994-2001)

Ae. albopictus
+
Ae. aegypti

Ae.
aegypti

Vector Differences & Recent Outbreaks

- Tamaulipas, Mexico 1995
 - Cases & positives limited to *Aedes aegypti* areas
- Hawaii 2001-2002
 - Outbreak associated with *Aedes albopictus* less severe than in Society Islands (*Aedes aegypti*)
- Florida
 - Keys are the last bastion of *Aedes aegypti*



Dengue

Mark S. Blackmore
Valdosta State University