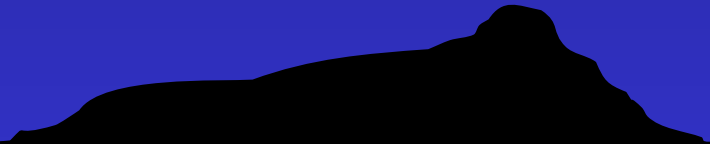
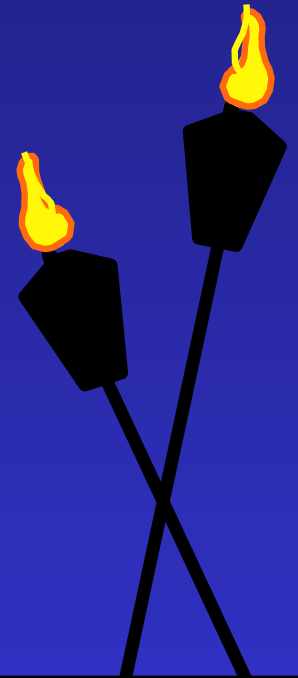
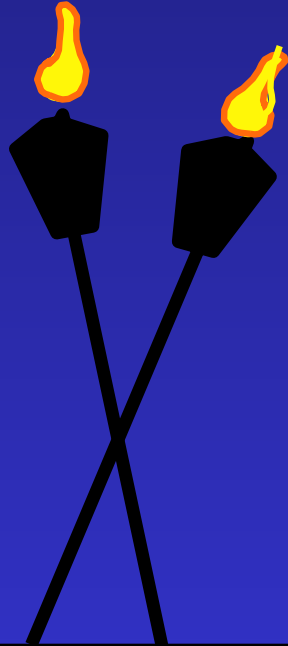


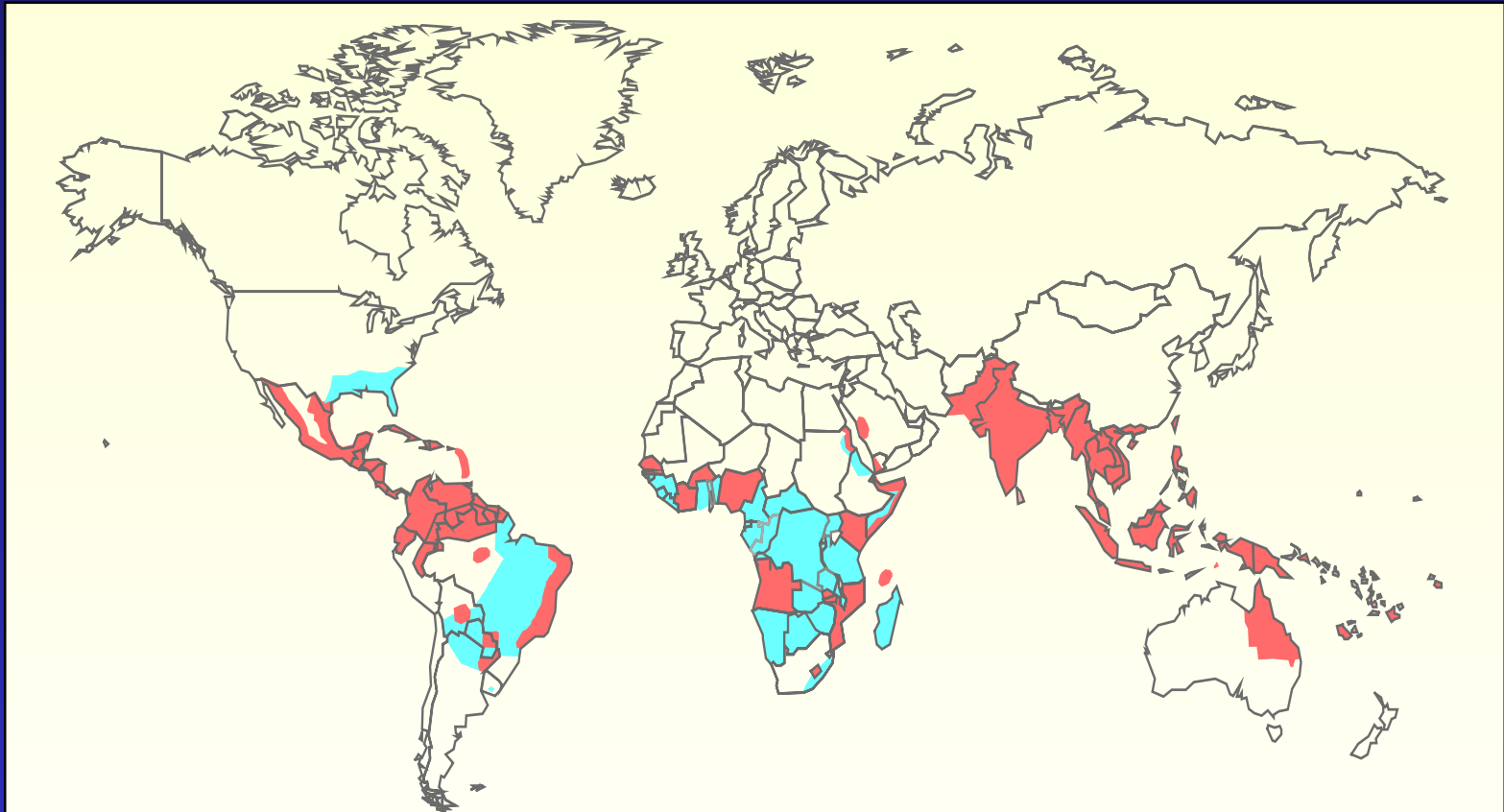
DENGUE FEVER  
OUTBREAK  
N  
HAWAII



# Dengue Virus

- Is an arbovirus
- Has 4 serotypes (DEN-1, 2, 3, 4)
- Transmitted by infected *Aedes* mosquitoes
  - daytime feeder
- Causes dengue fever, dengue hemorrhagic fever, and dengue shock syndrome

# World Distribution of Dengue 2000



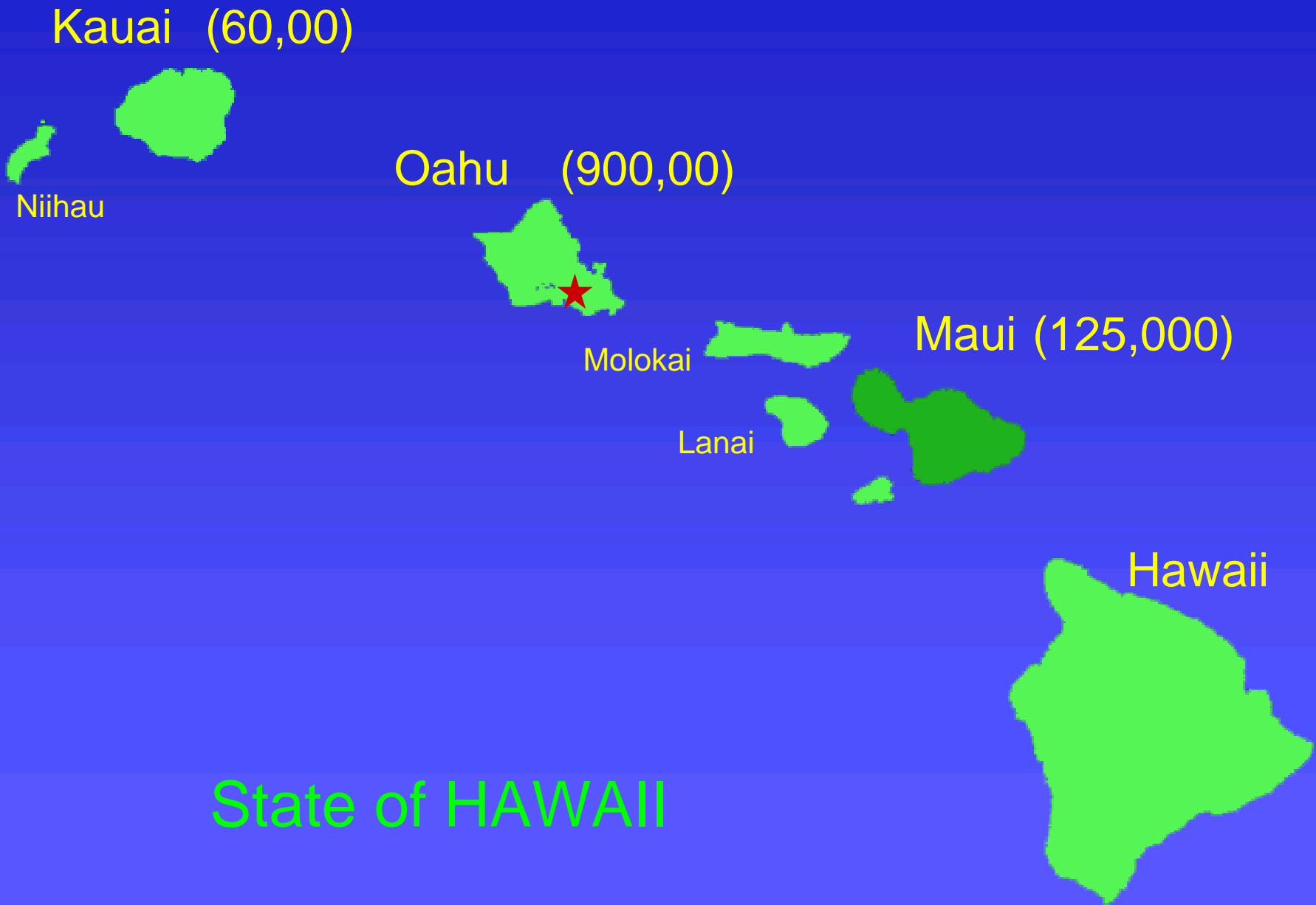
■ Areas infested with *Aedes aegypti*

■ Areas with *Aedes aegypti* and recent epidemic dengue

# Past Dengue in Hawaii

- Epidemics in 1852, 1856, 1903
- Last endemic dengue transmission during 1943 DEN-1 epidemic
- A total of 18 confirmed cases of imported dengue between 1992 and 2000  
(mean=2, range 0-8)





State of HAWAII



Lahaina

Kihei

Nahiku

Hana

**MAUI**





# Timeline of Events in 2001

**July**

Increased  
imported  
cases (12)



**Aug 3**

Statewide  
Doctor  
Alert



**Sep 12**

Maui DOH  
called  
about  
illness













# Timeline of Events in 2001

**July**

Increased imported cases (12)

**Aug 3**

Statewide Doctor Alert

**Sep 12**

Maui DOH called about illness

**Sep 21**

**CDC confirms dengue**

**Sep 24**

**Enhanced surveillance operational**



# Surveillance for Dengue

Physicians requested to test persons with *clinically compatible illness*:

Fever (or chills) *and 2 or more of the following symptoms*:

- Headache
- Eye or retro-orbital pain
- Myalgia
- Arthralgia
- Rash
- Any hemorrhagic manifestation



# Surveillance for Dengue II

## Case Definition :

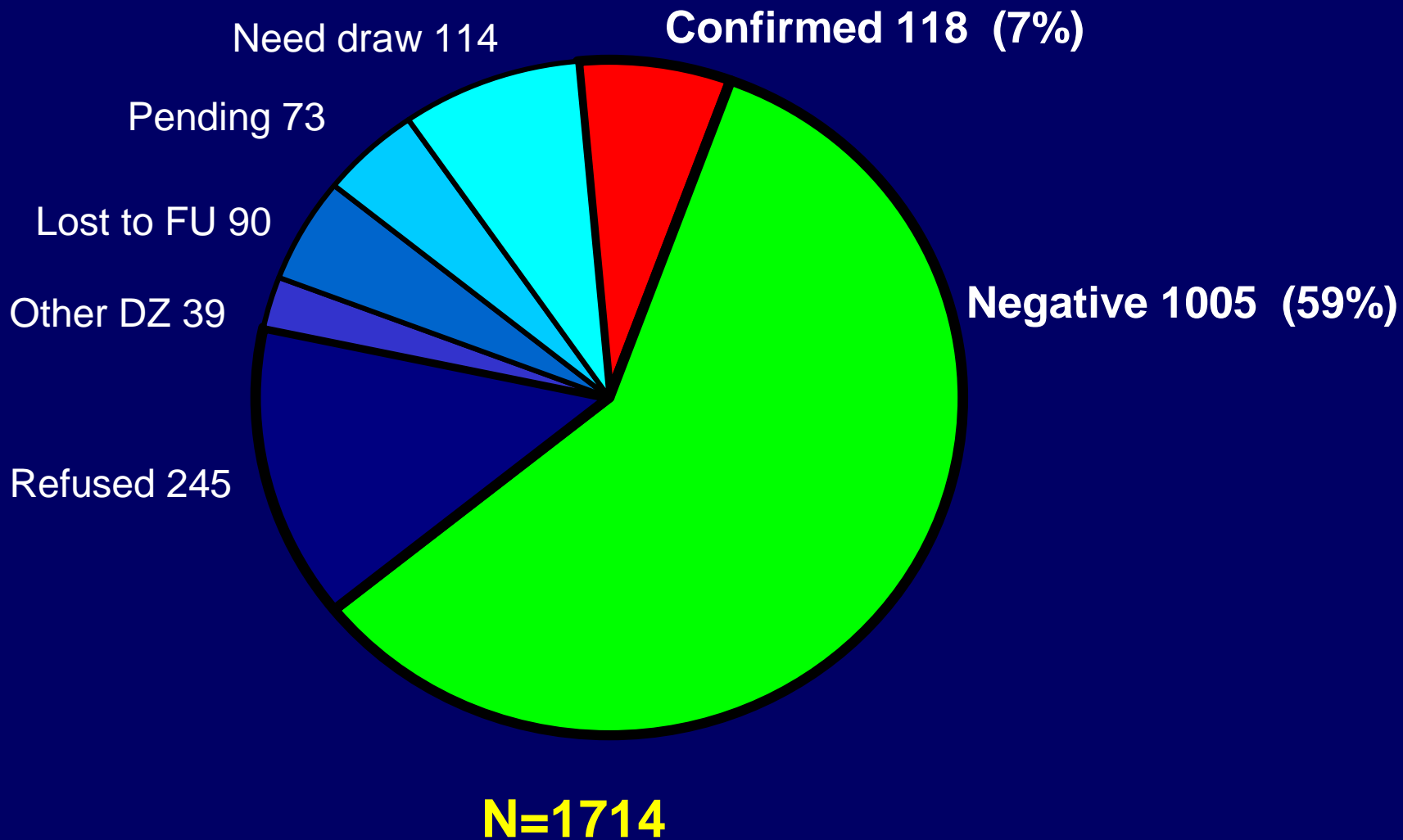
- **Culture positive for dengue virus (13%)**
- **IgM antibody positive (83%)**
- **IgG antibody positive in a person tested >2 months post onset of clinically compatible illness and linked to another IgM/culture positive case (4%)**

# Results

Between Sep 12, 2001 and Mar 15, 2002:

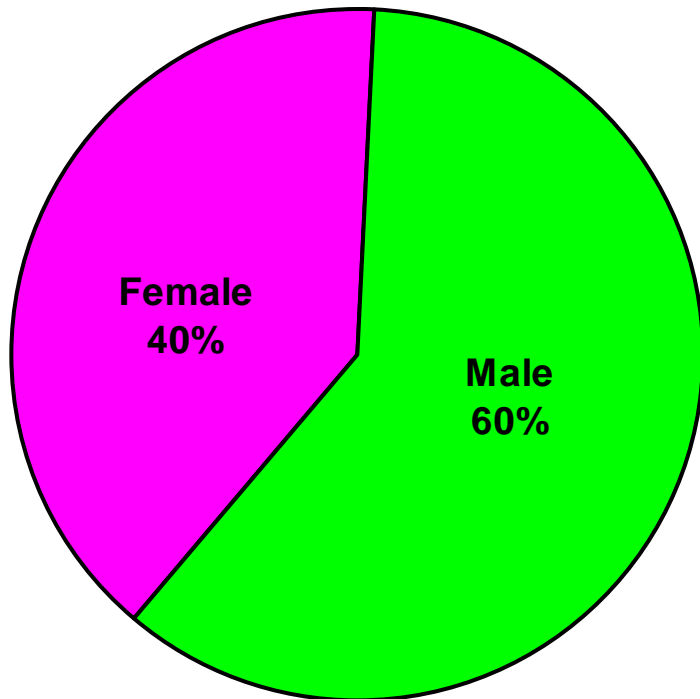
- >1700 reported “suspected” cases investigated
- 76% of these individuals met clinically compatible illness criteria

# Dengue Testing in Hawaii 3/15/02

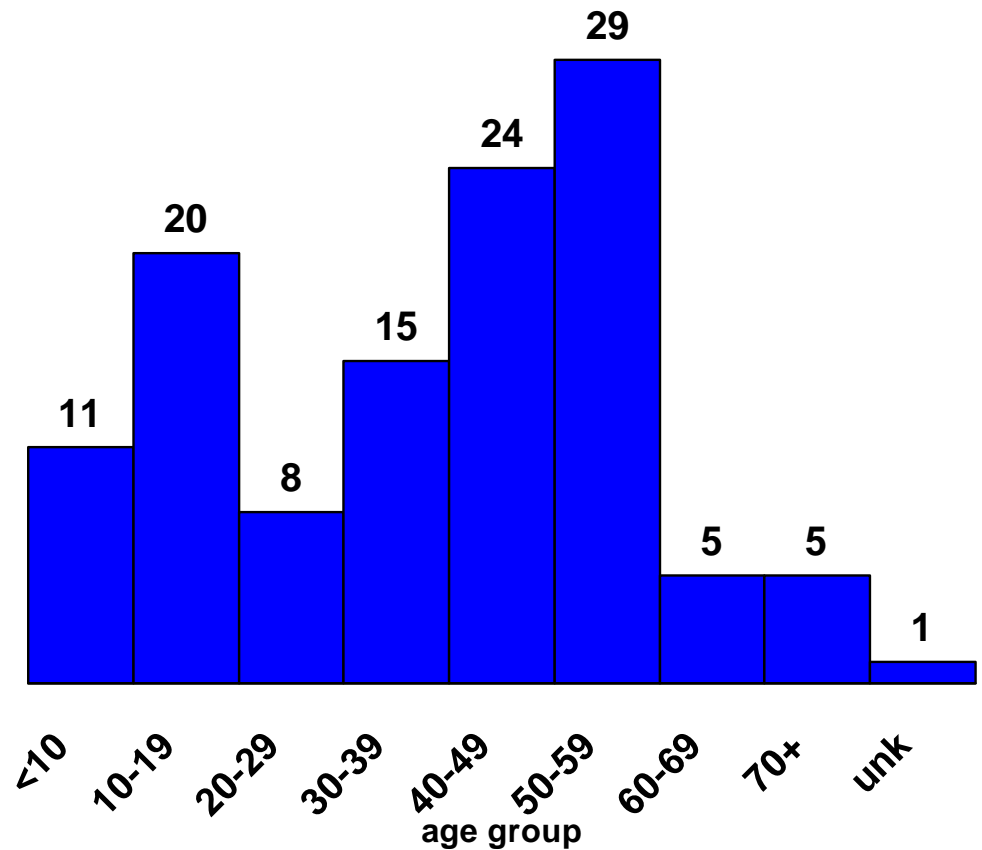


# Confirmed Dengue Cases 3/15/02

## Gender



## Age group



# Symptoms – Confirmed Infections

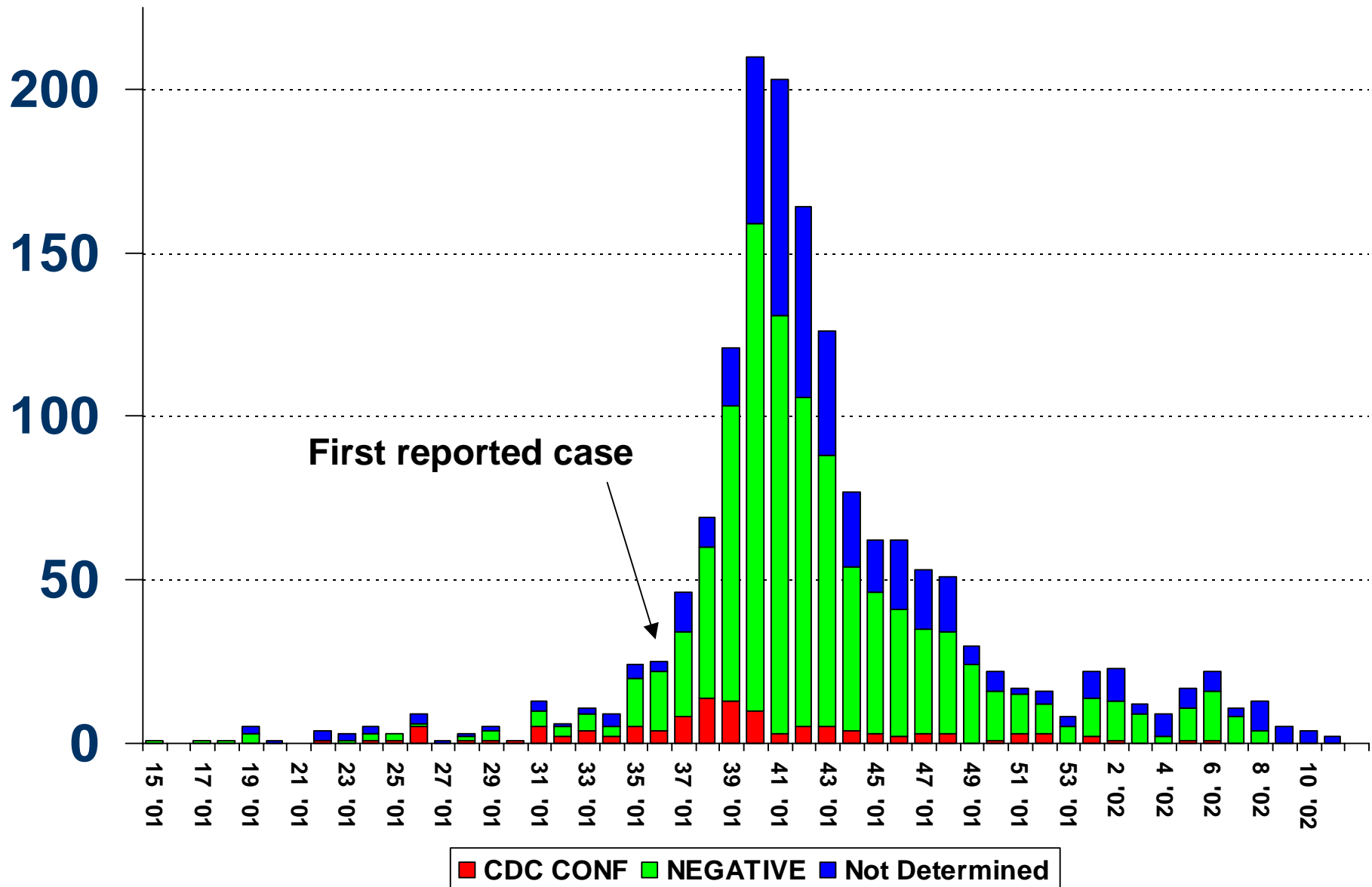
• Fever	95 % (range: 100-104 F, m: 102 F)
• Myalgia	92 %
• Headache	89 %
• Chills	85 %
• Arthralgia	73 %
• Rash	66 %
• Eye pain	58 %
<hr/>	
• N / V	48 %
• Diarrhea	36 %
• Sore throat	25 %
• Nasal congestion	23 %
• Cough	21 %

# Symptoms – Confirmed Infections

40 (34%) reported at least one hemorrhagic manifestation:

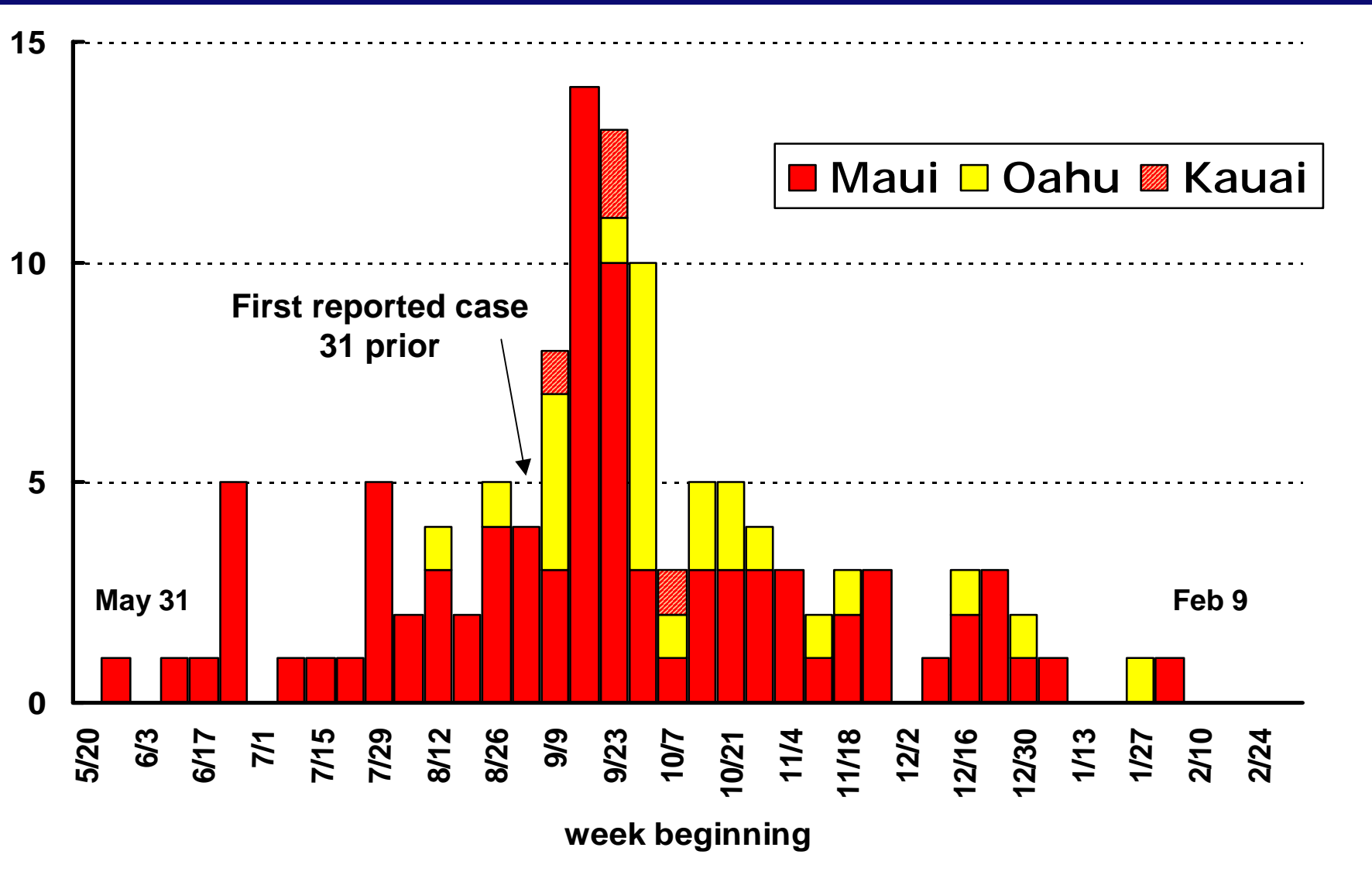
- Petechiae 24 %
- Heavy menses 19 % (females)
- Bleeding gums 8 %
- Epistaxis 8 %
- Melena 4 %
- Purpura 1 %
- Hematuria 1 %
- Hematemesis 1 %

# Dengue Testing in Hawaii by Week of Illness Onset



# Confirmed Dengue Cases by Illness Onset Week

-updated 3/15/02





# MAUI

★ confirmed dengue cases  
(n = 89)

Lahaina

Wailuku

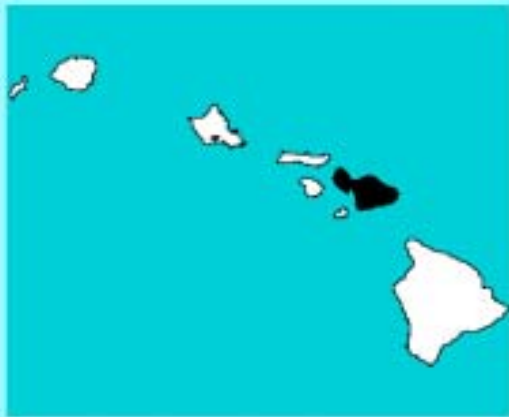
Paia Haiku

Pukalani Makawao

Kula

Kihei

73 (62%)



updated 3/15/02



Source: HDOH/Epidemiology Branch

# OAHU

★ confirmed dengue cases  
(n = 25)



9 (8%)

Laie  
Hauula

Haleiwa

Kaneohe

Aiea

11 (9%)

Kailua

Honolulu



updated 3/15/02



Source: HDOH/Epidemiology Branch

# KAUAI

★ confirmed dengue cases  
(n = 4)



updated 3/15/02



0 10 20 Miles

Source: HDOH/Epidemiology Branch

# Mosquito Observations

- *Aedes albopictus* high densities in Nahiku and elsewhere



- *Aedes aegypti* not present in outbreak foci on Maui, Kauai, and Oahu

# Household Serological Survey - Preliminary data

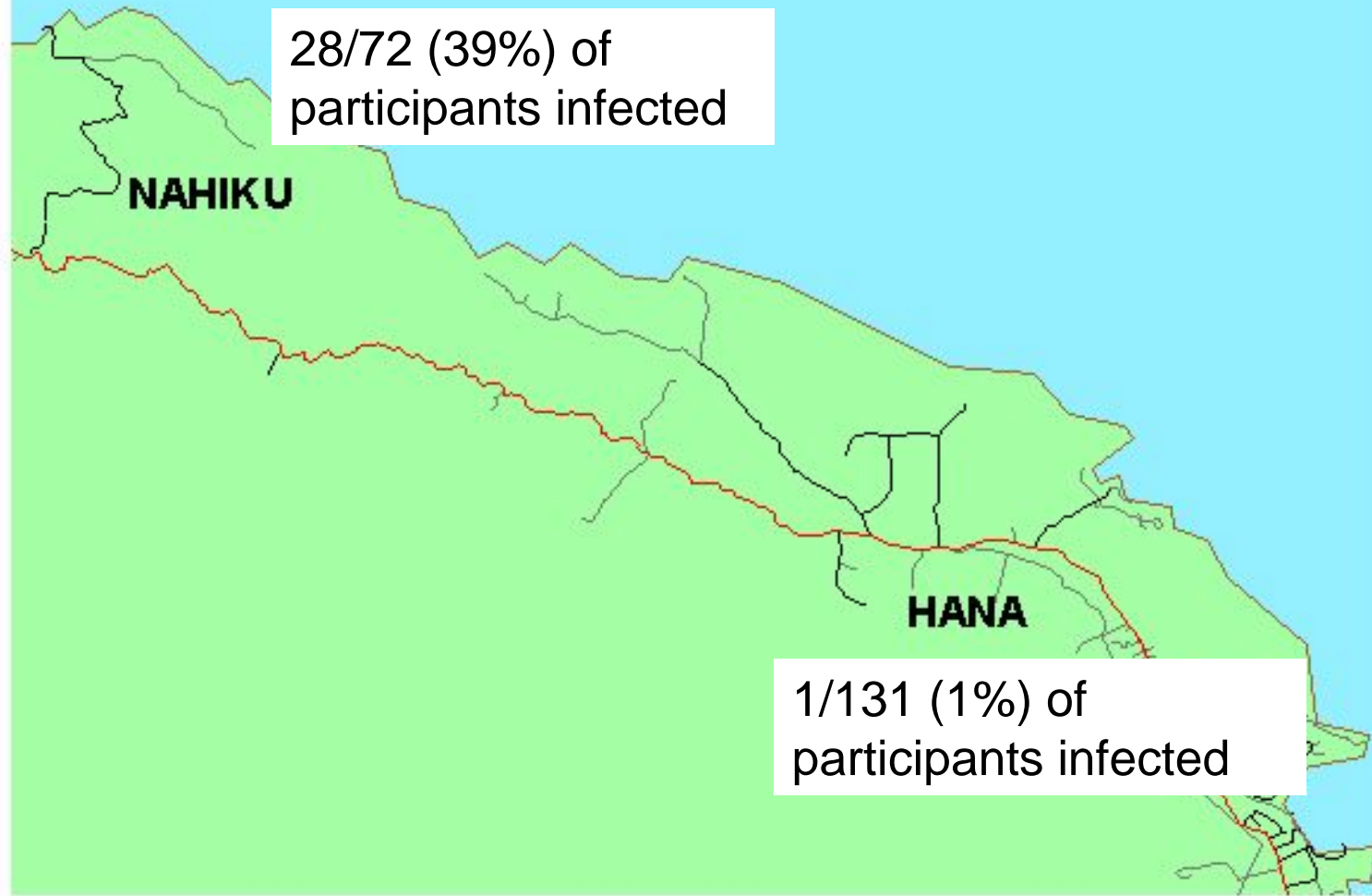
Late October 28, 2001

28/72 (39%) of  
participants infected

**NAHIKU**

**HANA**

1/131 (1%) of  
participants infected



# Origin of the Outbreak?

One outbreak with local spread

VS.

Simultaneous but separate outbreaks  
of dengue on three islands

# Epidemiologic Findings -

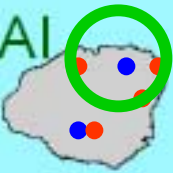
- 73 (62%) of all confirmed infections from Hana area
- 4 of 10 Maui infections outside Hana area were linked to Hana area
- 1 of 4 Kauai infections linked to exposure in Hana area
- 0 of Oahu infections linked to Kauai or Maui

KAUAI

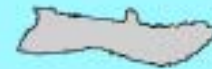
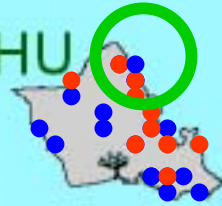
# 2001 Dengue cases

● imported case

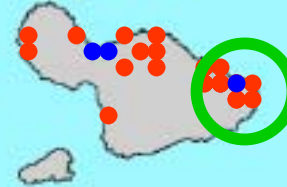
● indigenous case



OAHU



MAUI



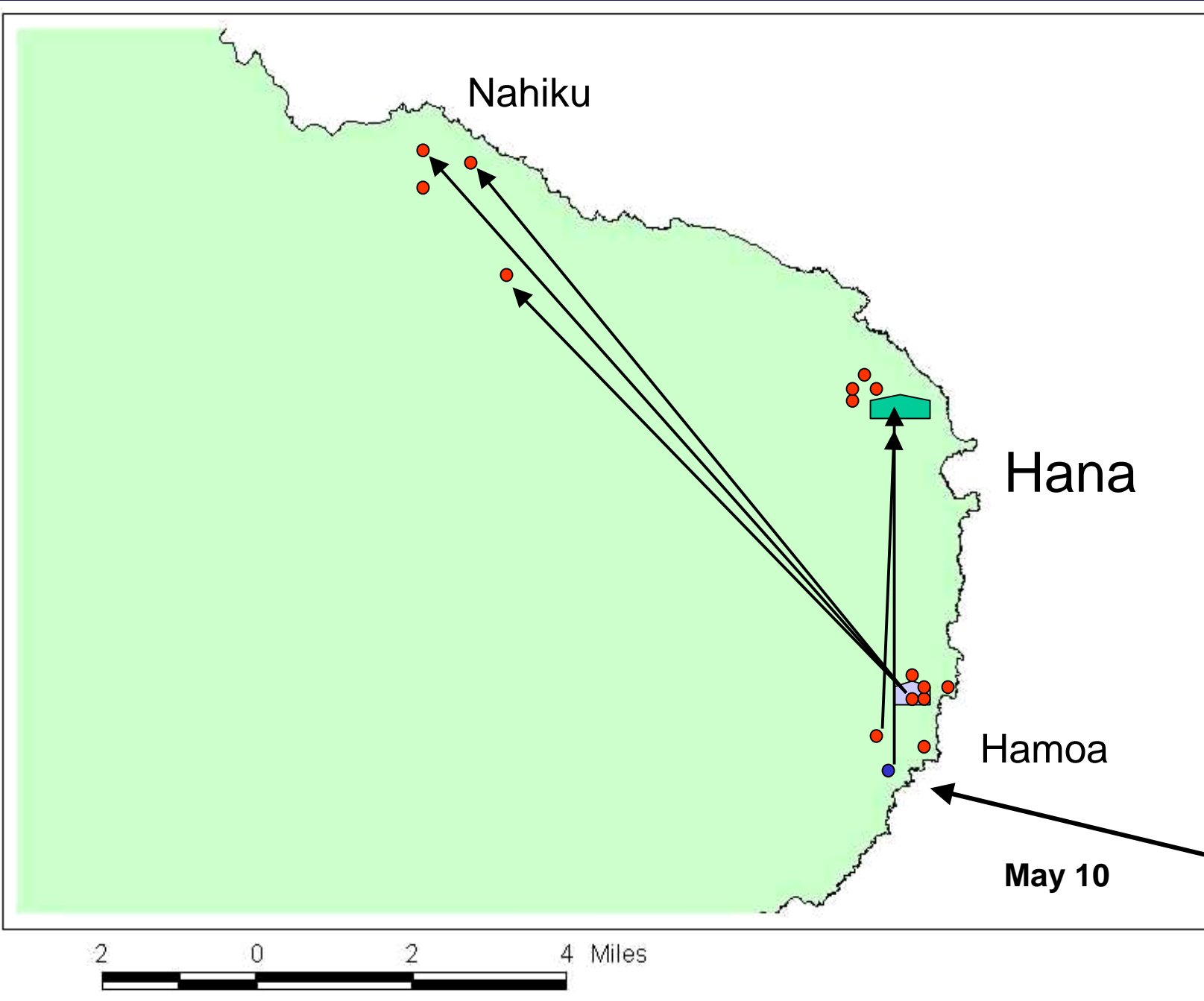
HAWAII

0 100 Miles

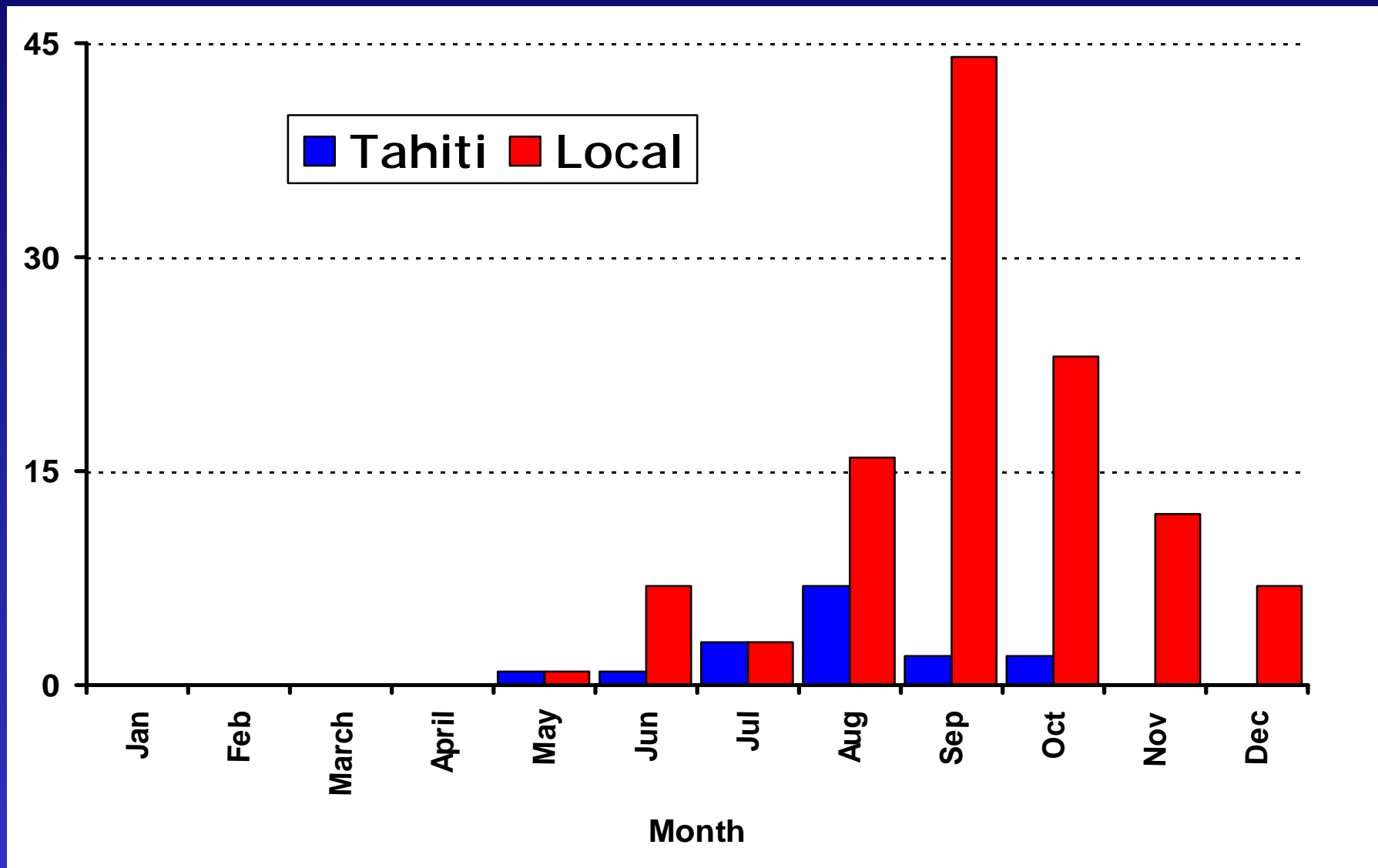


Source: HDOH/Epidemiology Branch



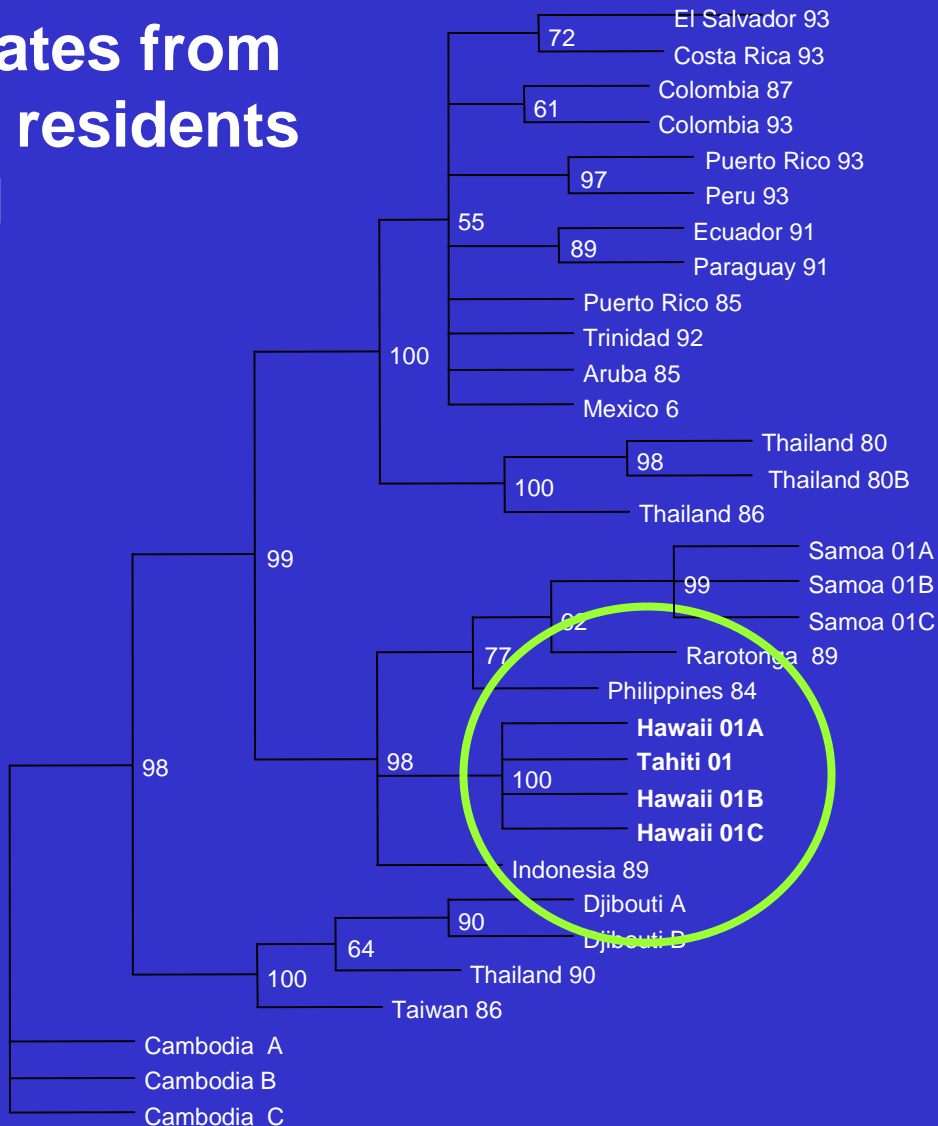


# Imported and Local Dengue Cases by Month 2001



# Dengue 1 Phylogeny

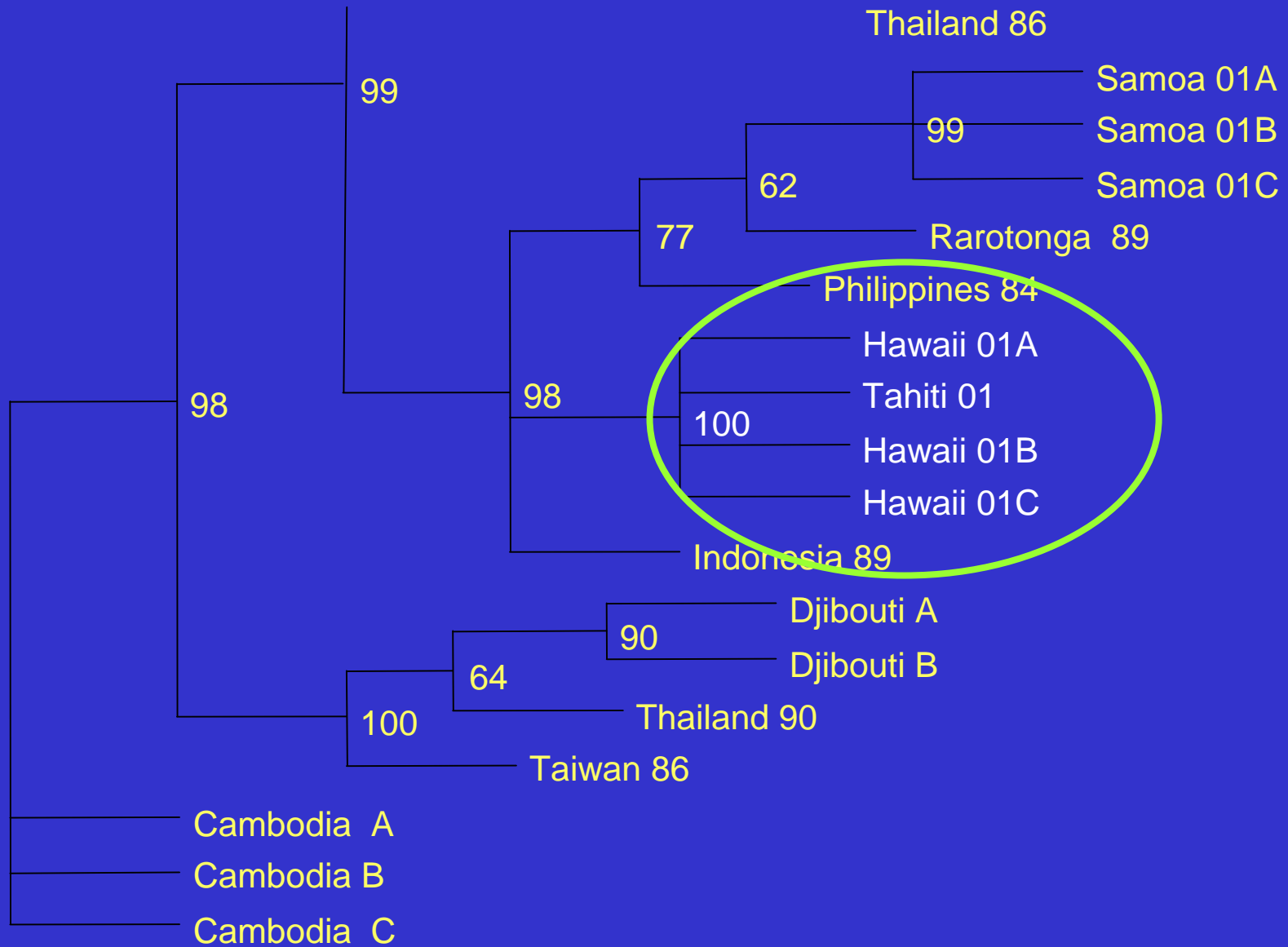
15 isolates from  
Hawaii residents  
- Den-1



American  
Genotype

Pacific  
Genotype

# Dengue 1 Phylogeny II



# Public Health Education

Intensive public health outreach on primary dengue prevention and mosquito control

- **Town meetings** by DOH and DOE educators
- Distribution of >600,000 dengue **brochures**
- Dengue **website** ([www.hawaii.gov/doh/dengue](http://www.hawaii.gov/doh/dengue))
- **Medical alerts** to physicians
- **Press releases**, public service announcements – TV, radio
- **Fliers** to Maui rental car agencies and hotels
- **Checkpoints** along Hana highway – distribution of fliers, repellent
- **Lectures** on dengue at medical centers
- **CDC video tapes** for physicians

# Public Health Action

- Mosquito inspection and treatment of over 2,500 residences
- Aggressive mosquito control statewide (spraying, source reduction)
- On-site education on mosquito control and disease prevention
- County solid waste clean-up with on-site trash pickup
- Closure of camping grounds and off-roads in Hana









# Conclusions

- DEN-1 virus responsible for current outbreak in Hawaii
- Virus transmitted locally by *Aedes albopictus*
- Local transmission likely the result of recent importation of dengue virus from endemic countries
- No DHF/DSS or fatal dengue infections identified to date

# Future Plans

- Continue surveillance for dengue fever, DHS, DSS
- Enhance laboratory capacity to confirm dengue with serological and culture - consider NAATs
- Continue public education and awareness of dengue
- Continue promotion and implementation of mosquito control measures

# Future Plans

- Conclude survey of visitors to better assess risk
- Conduct formal mosquito surveys on all islands to assess for presence of *Aedes aegypti*
- Closely monitor future dengue activity in the Pacific and Asia

# Acknowledgements

- Vector Borne Diseases Division, Dengue Branch, Centers for Disease Control and Prevention
- Department of Education
- Hawaii Visitors and Convention Bureau
- Department of Health
- Maui District Health Office
- Kauai District Health Office
- Hawaii District Health Office

*Mahalo!*

