

# Enemies At The Gate

**Mosquito Control Is More Important  
Than Ever**

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# Travel & Disease Transmission

- **>1 Billion Cross Boundaries on Airplanes**
- **Working in Other Countries**
  - 1970 - 84 million, 2.3% of world's population
  - 2015 – 244 million, 3.3% of world's population
  - 54 million in US
  - 740 million worldwide internal migration to cities



# Mosquito Migrants

- *Aedes aegypti* larvae, *Aedes albopictus* adults in Windsor, Ontario
- *Aedes albopictus* eggs collected in traps in Kent, UK
- *Aedes aegypti* adults trapped in Netherlands
- *Aedes aegypti* larvae in traps in New Zealand
- *Introduced species*



– *Aedeomyia squamipennis* (Gamboa virus)

– *Culex panocossa* (Venezuelan Equine Encephalitis)

# Vector-borne Diseases US & Territories, 2004–2016

Dengue	41,680
Zika virus	31,919
West Nile virus	20,167
Malaria	9,081
Chikungunya virus	1,063
California serogroup	133
St. Louis encephalitis	106
EEE	1
Yellow fever virus	<u>150,842 Total</u>



# The Enemies At The Gate

- Zika
- Dengue
- Chikungunya
- Rift Valley
- Mayaro
- VEE
- Sindbis
- Ross River
- Murray Valley
- Yellow Fever
- USUTU
- Malaria



# Zika

## As of 1 August 2018

- 532,000+ suspected cases world wide
- United States & DC  
5,176
- US Territories  
37,262



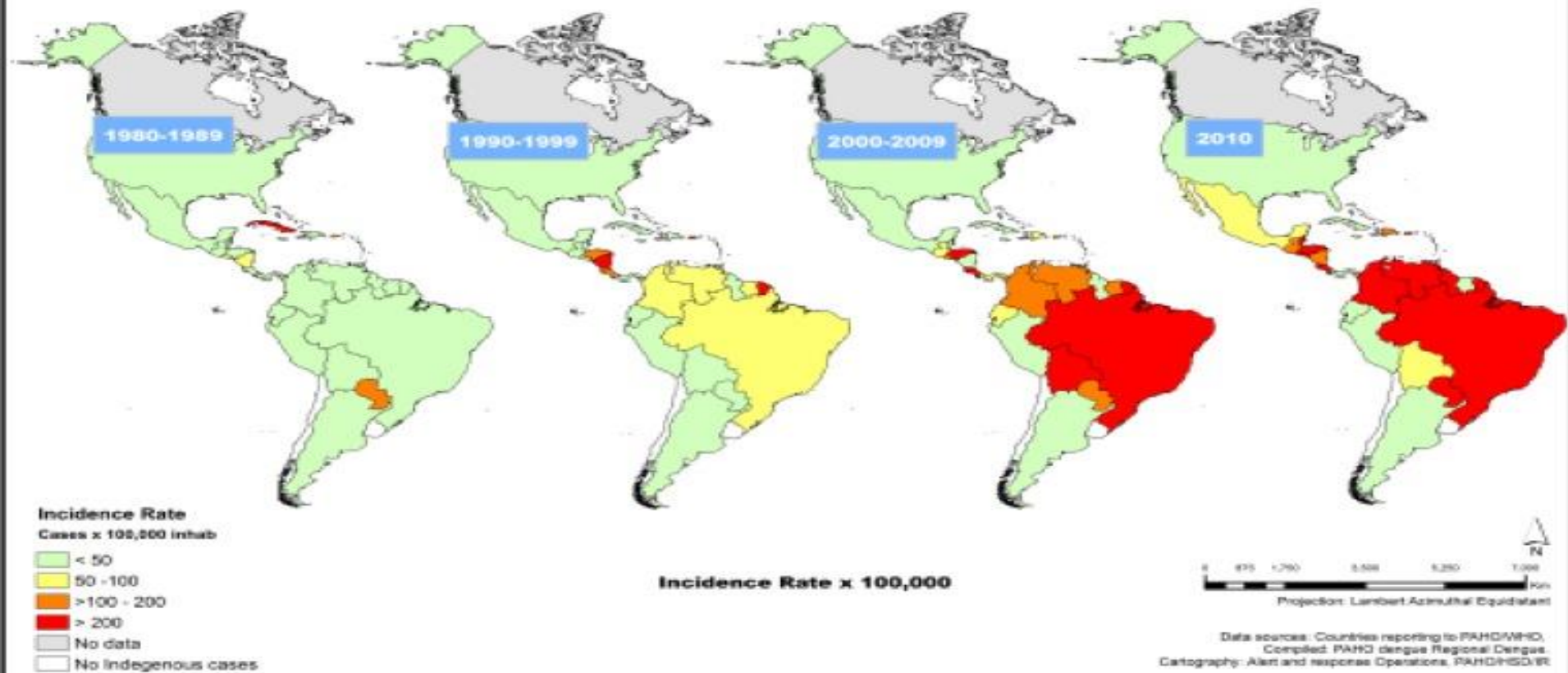
# Dengue

**WHO estimates 390 million dengue infections annually**

- **3.9 billion in 120 countries at risk**
- **Prior to 1970, only 9 countries experienced dengue epidemics**
- **Now endemic in 100+ countries**



## Dengue Incidence in the Americas, 1980- 2010





# Chikungunya US & Territories

	<u>US States</u>	<u>Territories</u>
• 2014	2,811	4,710
• 2015	896	237
• 2016	248	181
• 2017	156	39
• 2018	26	0
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	4,137	5,167
	Total = 9,304	



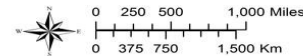
# Rift Valley Fever

- **South Africa 2010/2011**
  - 250 cases, 25 fatal
- **Mauritania 2010-2015**
  - 128 cases, 38 fatal
- **France imported case from Mali in 2015**
- **Niger 2016**
  - 348 cases with 33 fatal
- **Uganda 2016**
  - 5 cases



**Rift Valley Fever Distribution Map**

Legend:  
Blue: Countries reporting endemic disease and substantial outbreaks of RVF  
Green: Countries reporting few cases, periodic isolation of virus, or serologic evidence of RVF infection  
Tan: RVF status unknown



E. Erwin, CDC/ASBP, 2006

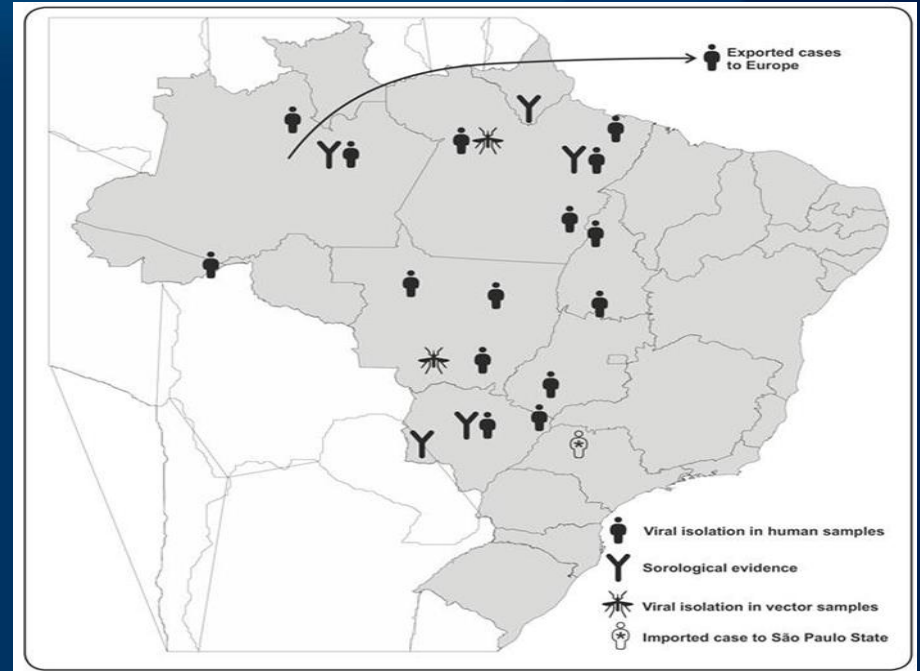
# Rift Valley Fever

## Dambo



# Mayaro

- 1954 Trinidad isolation
- Dengue like illness - rash
- Transmission cycles appear to be the same as YF, CHIKV, etc...
- *Mansonia, Haemagogus*
- Reservoirs - Non-human primates, birds and reptiles
- 2011 - 33 cases in Manaus, Brazil
  - First outbreak in an urban setting



# Venezuelan Equine Encephalitis

Fever, intense headache, myalgia,  
arthralgia

Amplified by mosquitoes/equines

Vectors

*Psorophora columbiae*,

*Psorophora confinnis*

*Aedes sollicitans*

*Aedes taeniorhynchus*



# Sindbis

Related to ChikV

1952 *Culex univittatus*  
in Egypt

*Culex and Culiseta spp.*

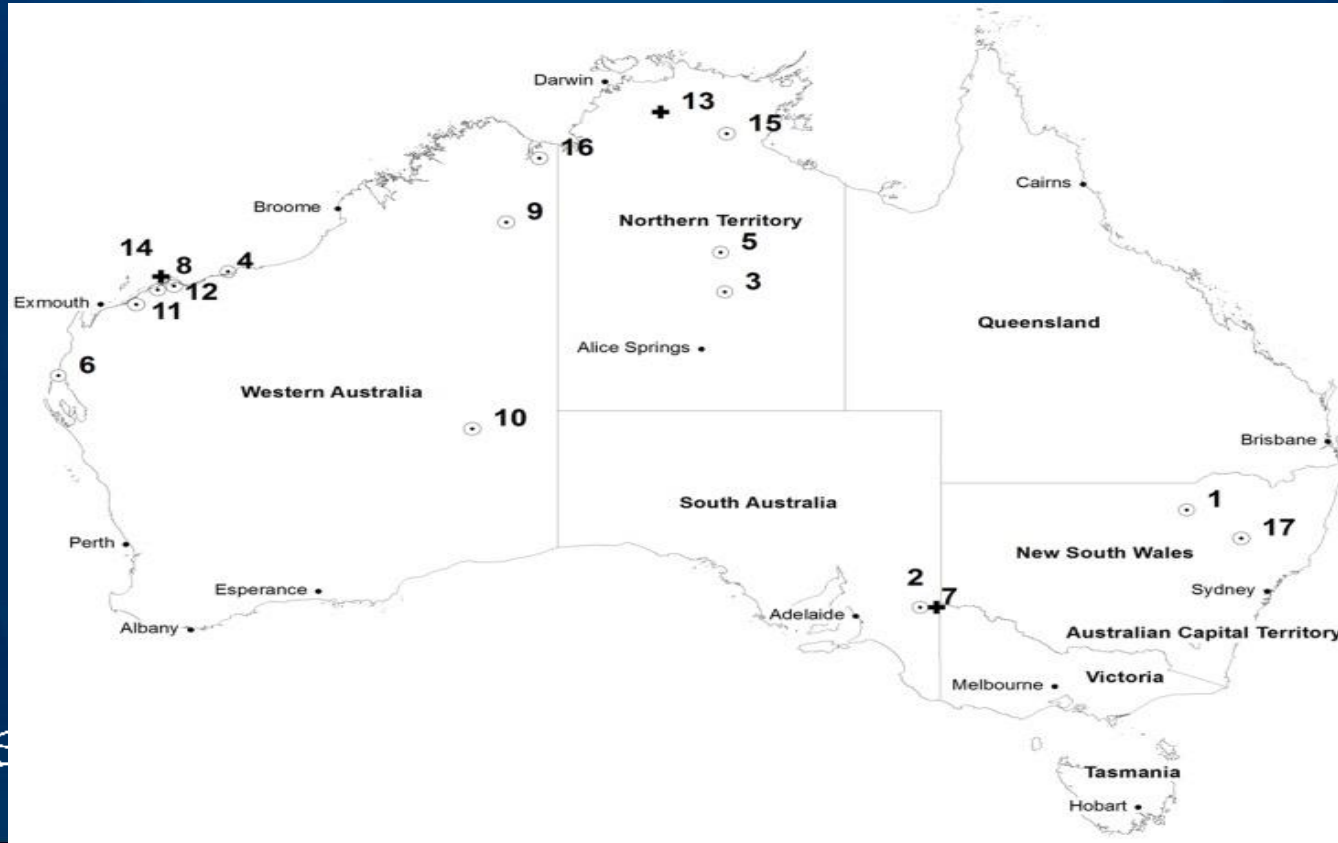
Avian reservoir

1980 epidemic:  
Pogosta disease - Finland  
Ockelbo disease - Sweden  
Karelian fever - Russia





# Murray Valley Encephalitis

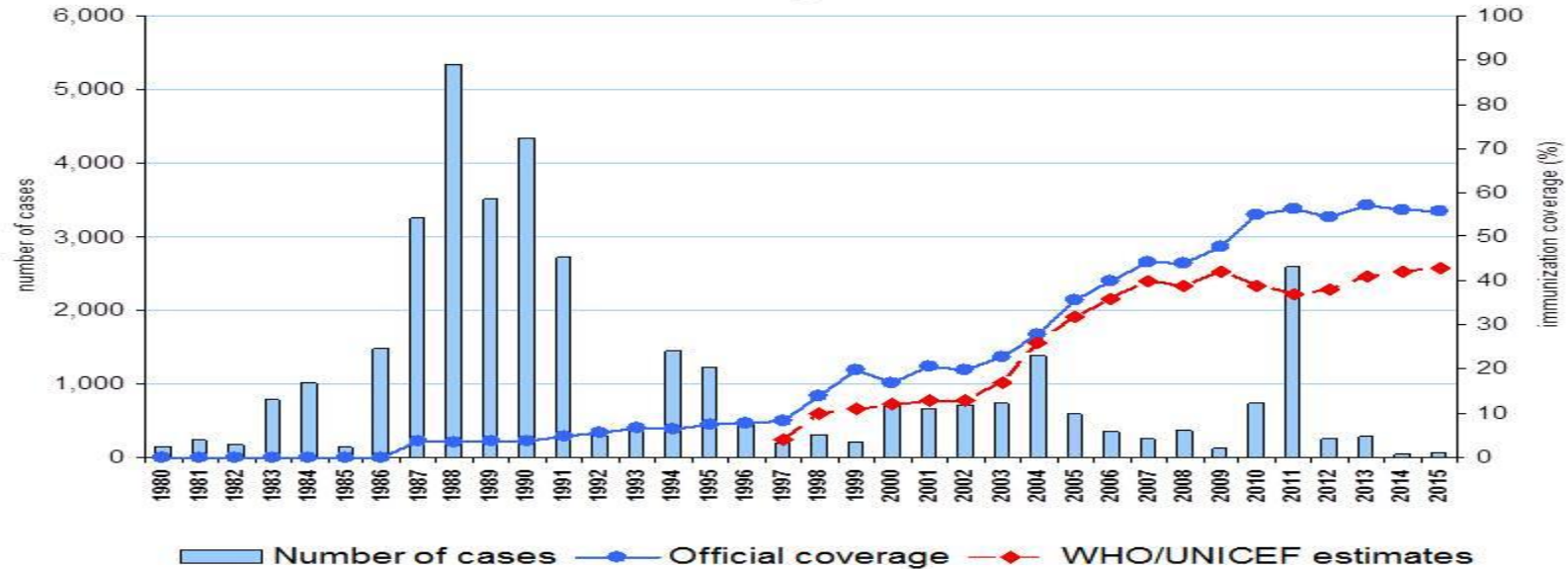




# Yellow Fever

Date of chart: 09 July 2016

## Yellow fever global annual reported cases and YFV coverage, 1980-2015



# Animal Health Impacts Yellow Fever

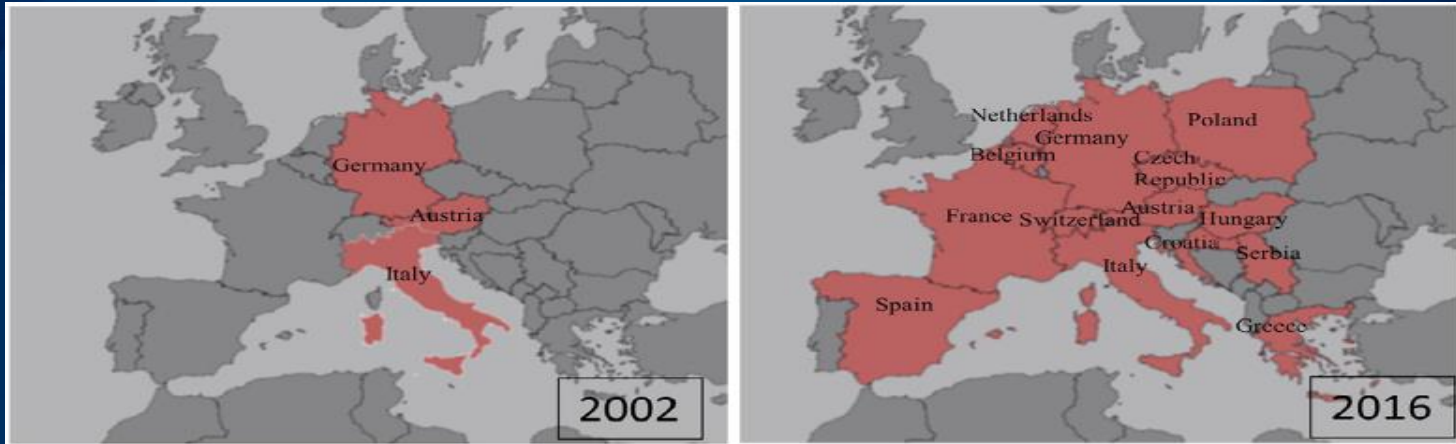
2008/9 – 2,500 monkey fatalities

2017 – 4,575 monkey fatalities

11 of 15 species of monkeys affected  
are endangered



# Usutu Virus

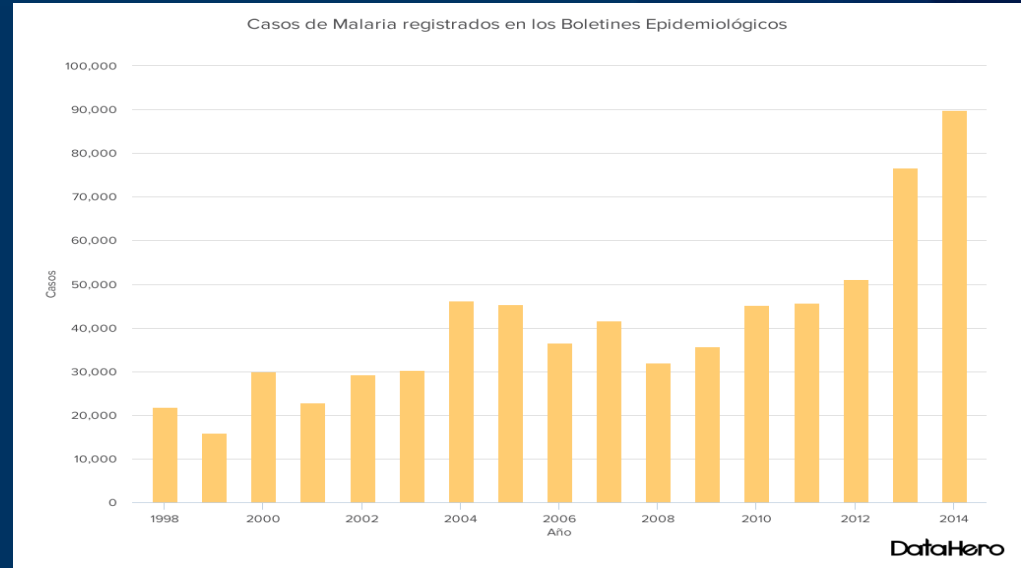


- **Discovered in South Africa 1959**
- **28 Human fatalities**
- **Primary Vector - *Culex pipiens***
- **Secondary Vector - *Aedes albopictus***
- **Reservoirs - Magpies, Crows and Jays**



# Malaria Resurgence

- **Venezuela**
  - **115,313** new local cases in 2015
  - **199,902** new local cases in 2016
  - **Record high in 75 years of reliable records**



# Other Potential Invaders

- O'nyong-nyong
- Bwamba
- Semliki Forest
- Rocio
- Ilheus
- Barmah Forest
- Spondweni



# We Must Maintain Mosquito Control Capability

- **Challenge misinformation**
  - Ensure it's science-based
  - Invite groups to visit district
  - Support science education
- **Personalize the issue in public**
  - Enlist help from mothers
  - Put a human face on disease control



# 1. The Threat From Exotic Mosquito-borne Diseases Is Increasing.

**“No country can shield itself from the invasion by a pathogen incubating in an airline passenger or a mosquito hiding in a cargo hold. Infectious diseases are now spreading geographically much faster than at any time in history”**

**Margaret Chan, MD**

**WHO Director-General 2012-2017**



## **2. These Diseases Are Serious And Mostly Incurable**

**“These survivors struggle with memory loss,  
where a fiancé is heartbroken when her  
intended really does not remember her,  
or the promise that they shared.”**



**Wendy Station**  
*Encephalitis Global*



### 3. We Have The Means To Prevent/Control Them With Minimal Risk To Human Health And The Environment.

#### Pesticide Effects: WNV Control 1999-2002

- Exposed population – 118 million
  - 106 possible
  - 26 probable
  - 2 definitive
    - 1 severe
    - History of COPD
  - *During the same period...*
- 4300 WNV cases
  - 3000 neuroinvasive
  - 300 fatalities



**MIGHT AS WELL STAY AND  
HAVE ONE MORE**

A green praying mantis is shown in profile, holding a glass of beer with its front legs. The mantis is looking towards the glass. The background is a blurred green and blue.

**WIFE'S GOING TO CHEW MY HEAD  
OFF WHEN I GET HOME ANYWAY**