

Using DNA Fingerprinting to Identify the Blood-Feeding Patterns of Mosquito Vectors of West Nile Virus

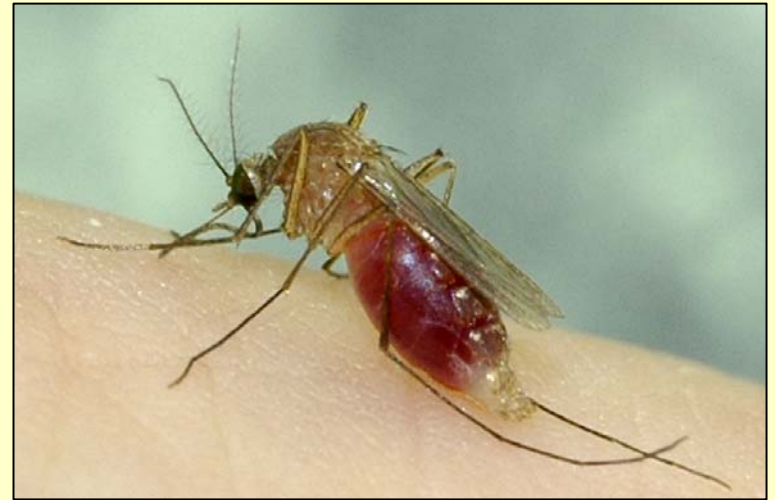
Theodore G. Andreadis

The Connecticut Agricultural
Experiment Station
New Haven, CT



Introduction

- **WNV has been detected in 18 different mosquito species in Connecticut**
- **5 species have been implicated as primary or secondary vectors**
- ***Physiologically competent***
- ***Frequently infected in nature***
- ***Closely associated with virus foci (human cases)***

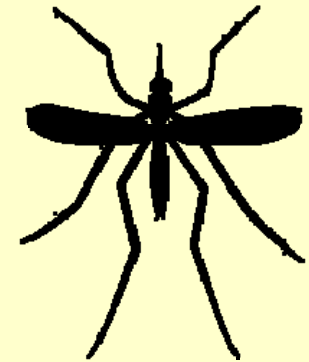


Primary Vectors

Culex pipiens

Culex restuans

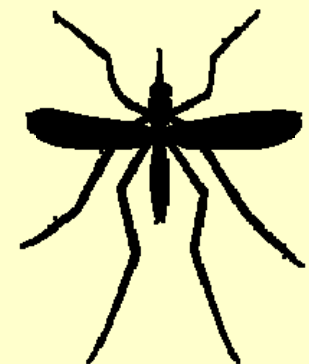
Culex salinarius



Secondary Vectors

Aedes vexans

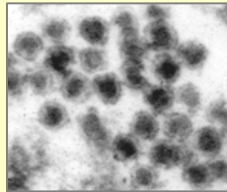
Culiseta melanura



West Nile Virus Transmission Cycle



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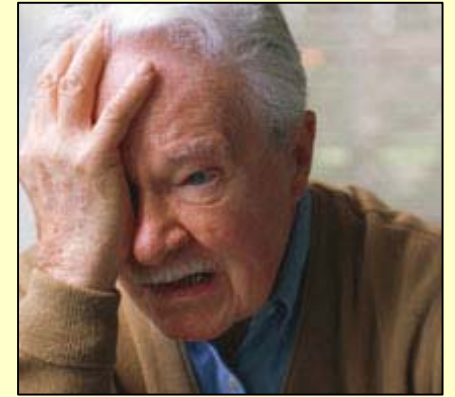
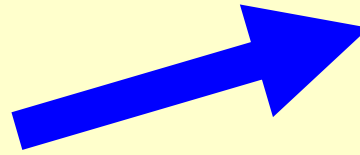
Enzootic

Cycle

?

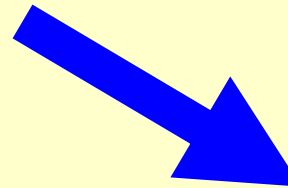


Wild Bird Reservoirs



Epidemic Transmission

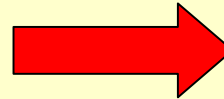
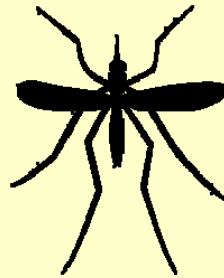
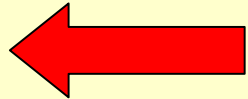
?



Mosquito Blood Feeding Study

- To examine the feeding patterns of the principal mosquito vectors of WNV in Connecticut

Birds



Mammals

- Identify specific bird and mammal hosts that mosquitoes feed on in nature
- Determine the role of these animals in the ecology of WNV in the region





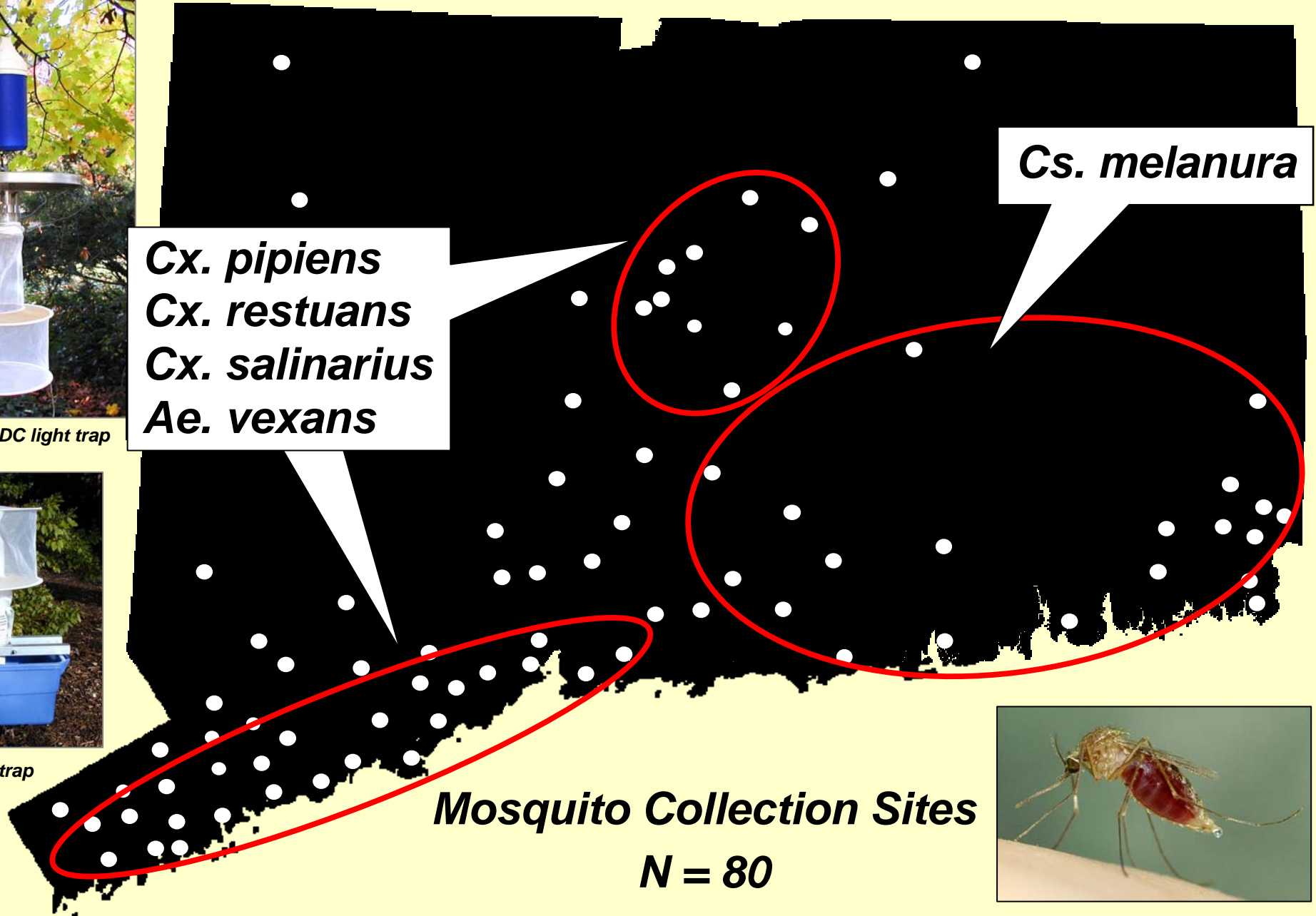
CO₂-baited CDC light trap



Gravid trap

Cx. pipiens
Cx. restuans
Cx. salinarius
Ae. vexans

Cs. melanura

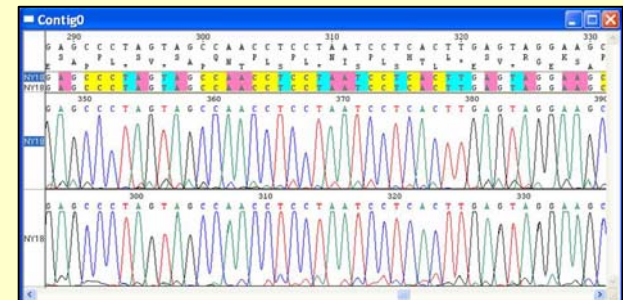
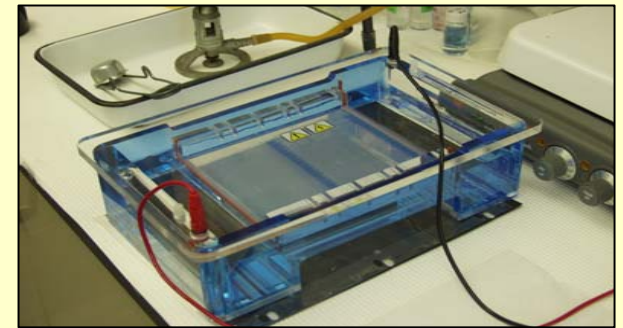


Mosquito Collection Sites
N = 80

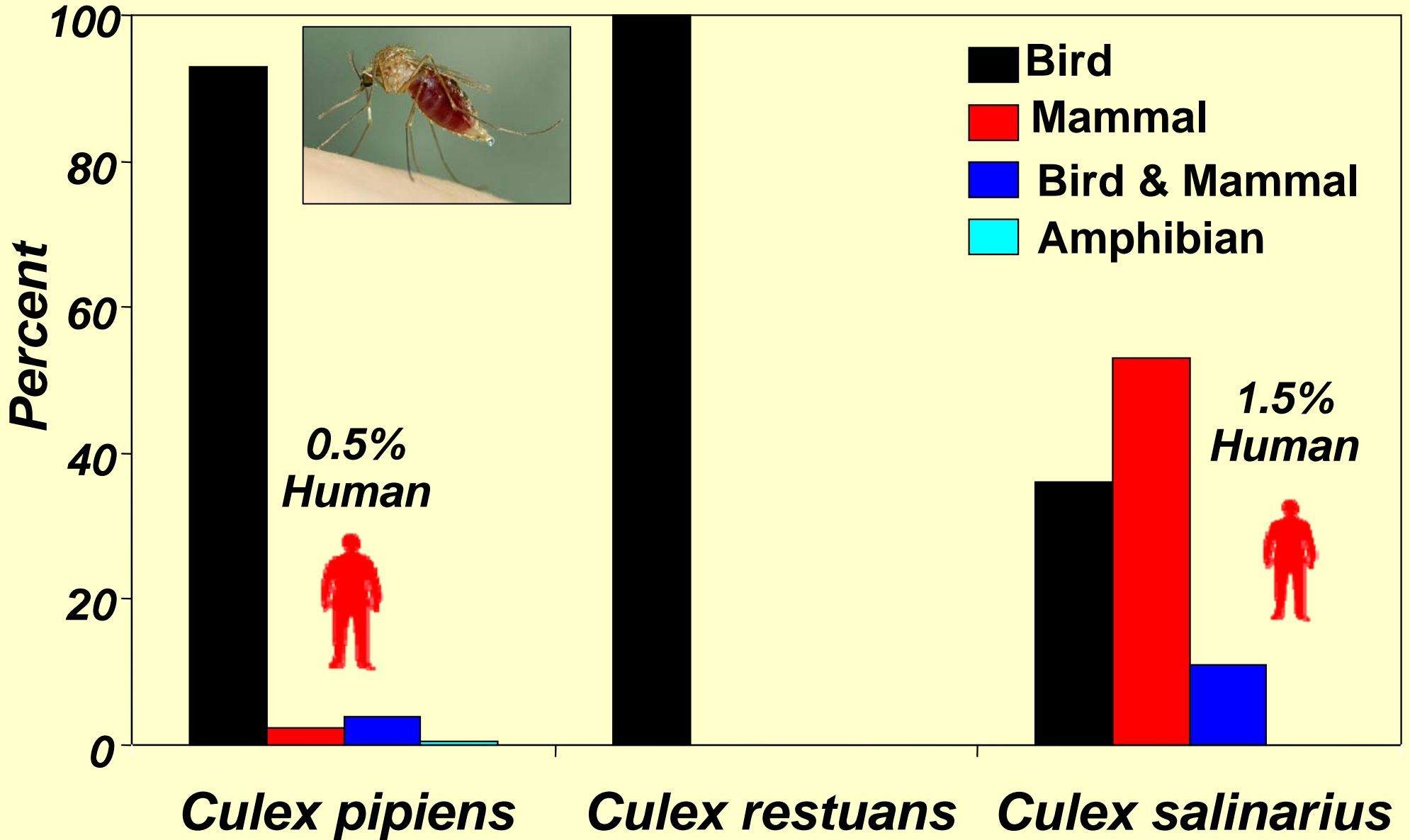


Materials and Methods

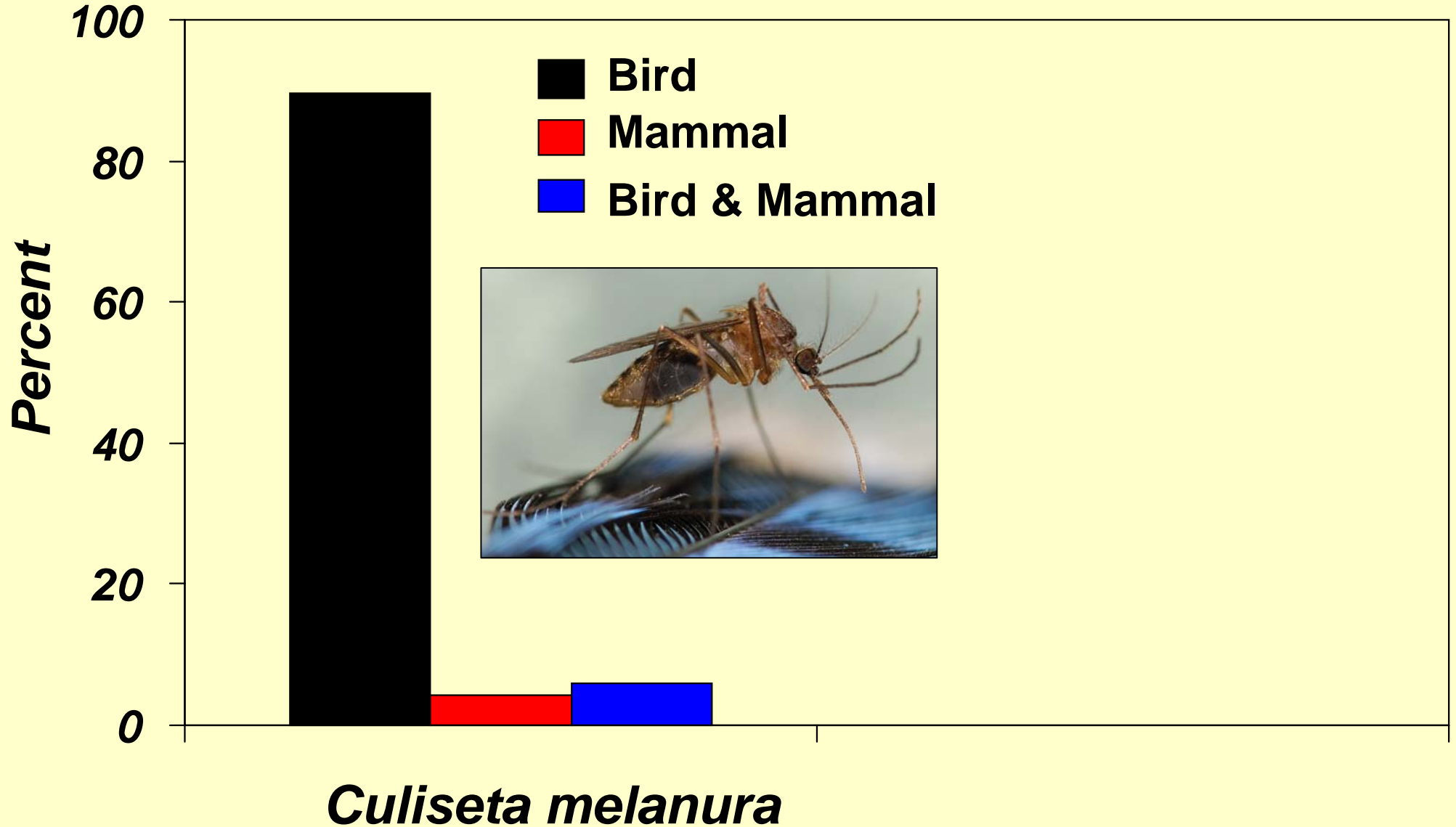
- Abdomens were removed under a dissecting microscope and DNA was isolated
- The DNA was amplified by PCR using Avian and Mammalian specific primer pairs to the *cytochrome b gene*
- The PCR amplification products were sequenced and identified to species by comparison to the Genbank® sequence data base



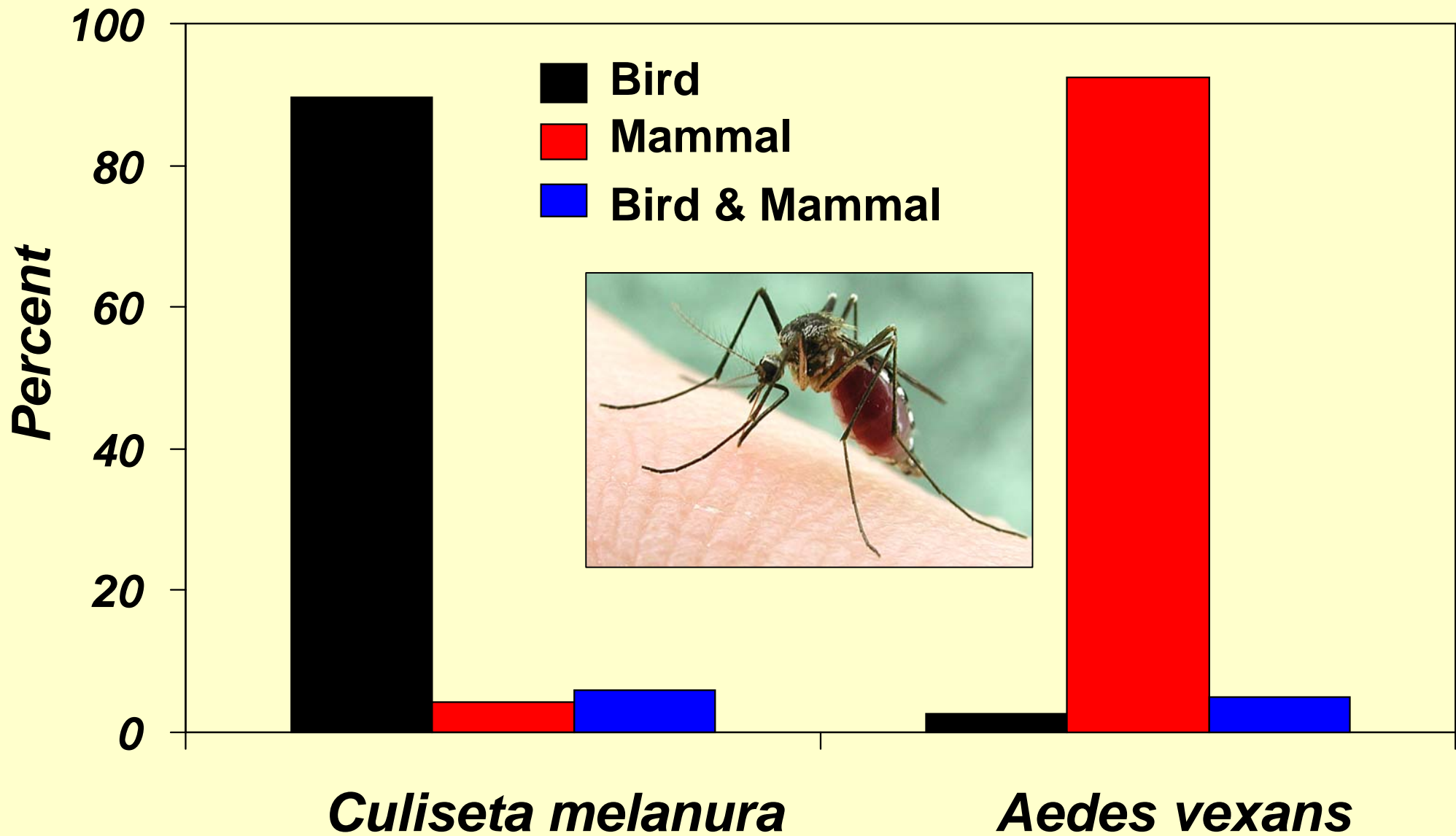
Culex Mosquitoes



Secondary Mosquito Vectors

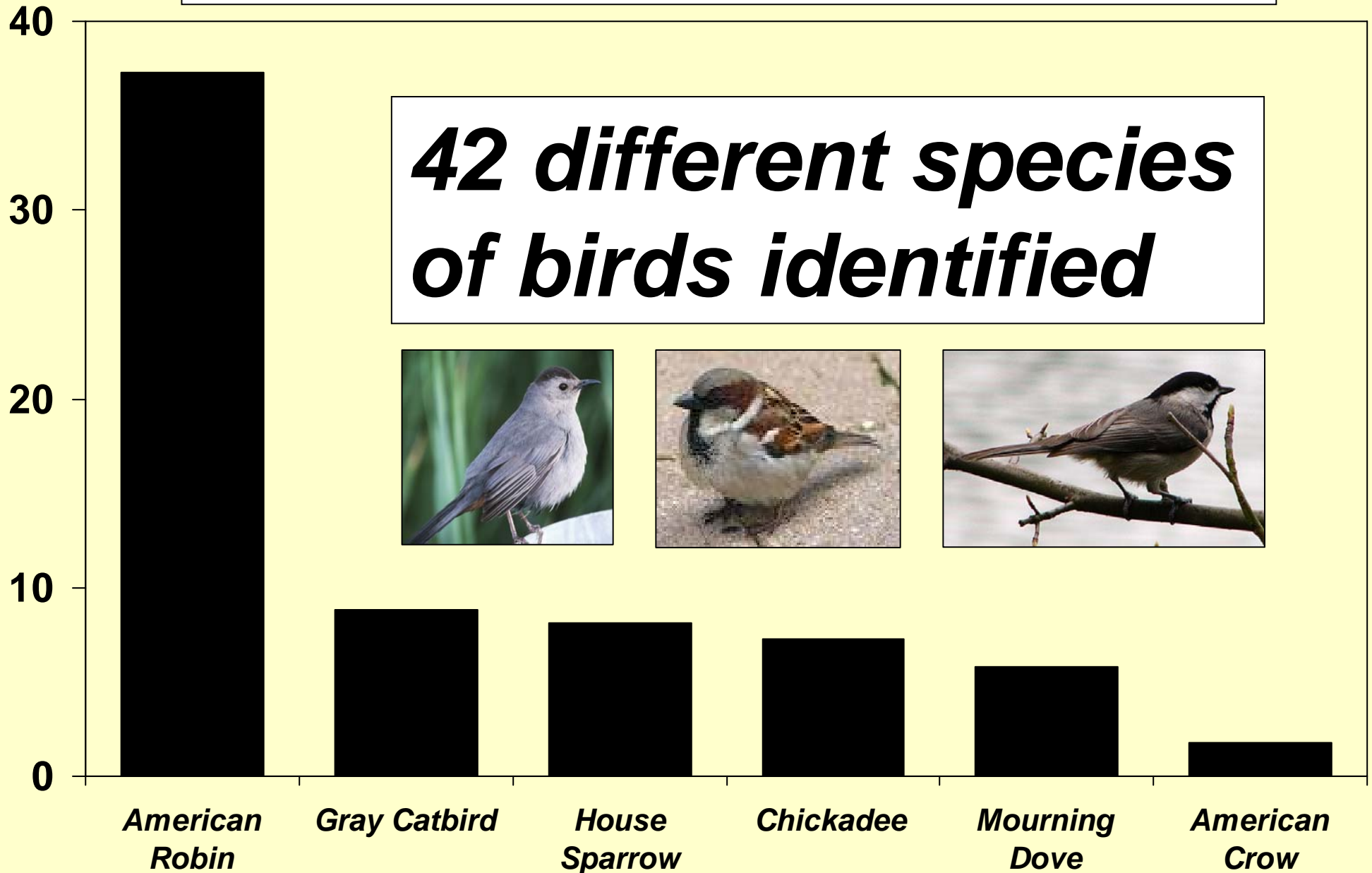


Secondary Mosquito Vectors

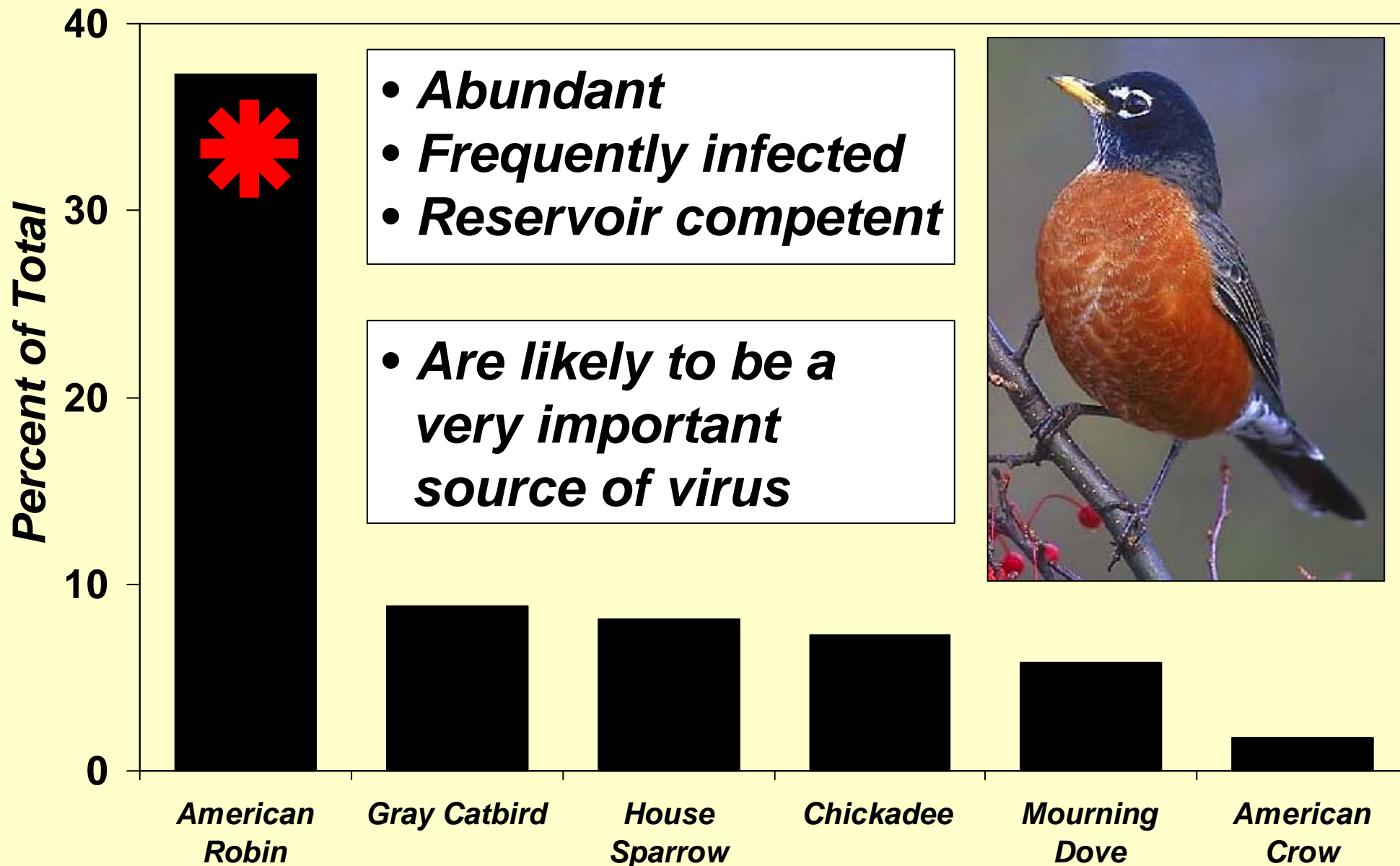


Percentage of Bird-Derived Blood Meals (n = 330)

***42 different species
of birds identified***



Percentage of Bird-Derived Blood Meals (n = 330)



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JANUARY 2006

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No part of the continental United States is safe: Robins roam throughout the country.

Mosquito-Borne West Nile Turns Up in an Unsuspected Carrier: the American Robin

EPIDEMIOLOGY—Since West Nile virus arrived in the Western Hemisphere in 1999, people have worried each summer about its spread. Although the virus, carried by mosquitoes, has been detected in more than 200 species of birds, crows have been closely monitored as the primary reservoir. This year medical entomologists at the Connecticut Agricultural Experiment Station learned that we may have been watching the wrong bird and the wrong mosquito.

By extracting blood from the stomach of engorged mosquitoes,

Theodore Andreadis and his colleagues found that 40 percent of the infected mosquitoes had feasted on the blood of the American robin, a species that can carry the virus without showing symptoms.

A more important finding questions the strategy of disease control for West Nile, which has focused on eradicating a common, easily controlled, ditch-dwelling mosquito. Andreadis found that these mosquitoes rarely bite mammals, so they are not likely to pass the virus on to people.

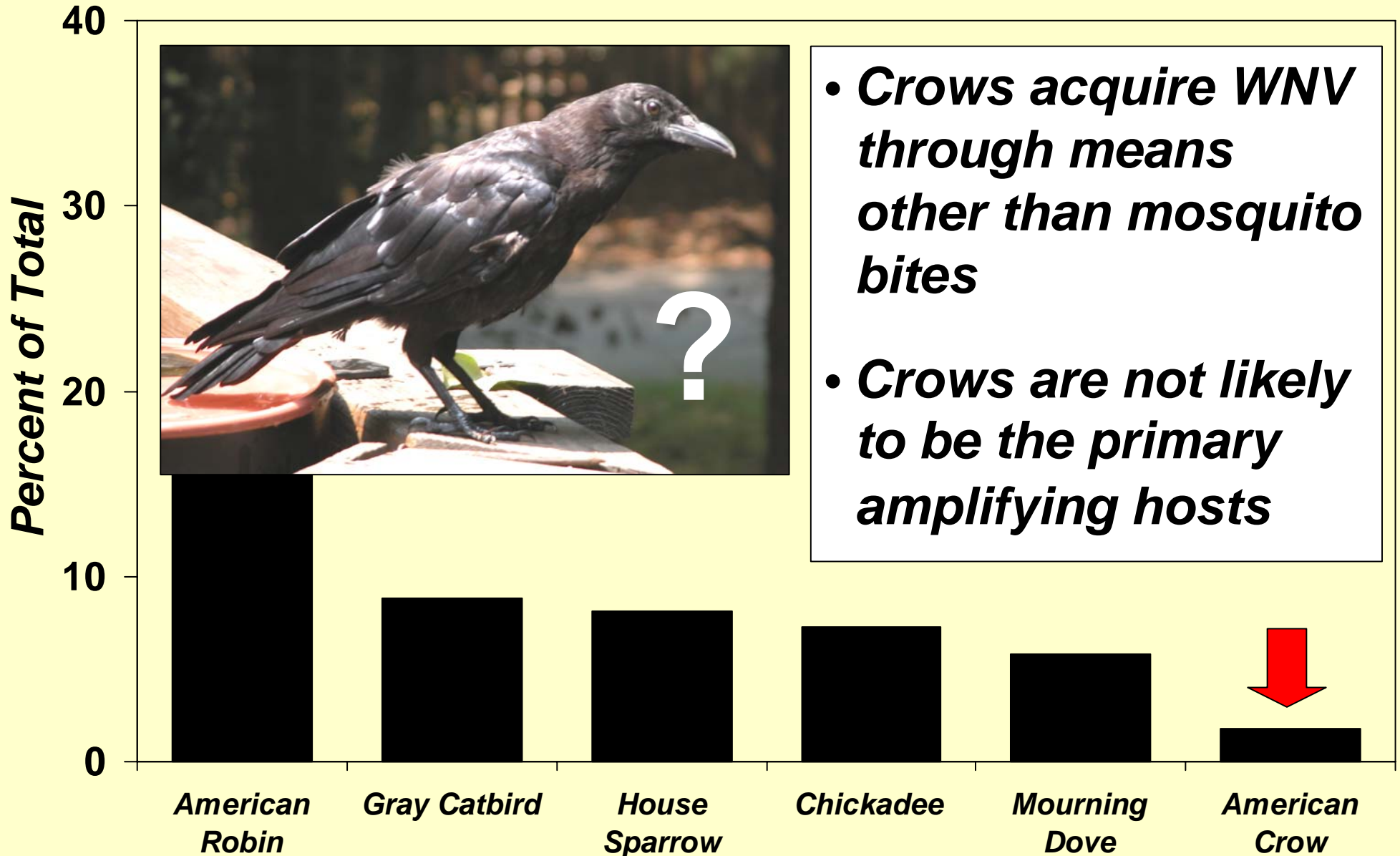
Salt marsh mosquitoes,

on the other hand, pose a greater risk of disease transmission, says Andreadis, because they feed on birds about a third of the time and on mammals more than half the time. And salt marsh mosquitoes are a challenge to control because they breed in vast stretches of pristine marshland along the coast.

Complicating study of the virus even further, a lab study found that an infected mosquito can pass the virus to nearby mosquitoes while they are feeding on an uninfected animal.

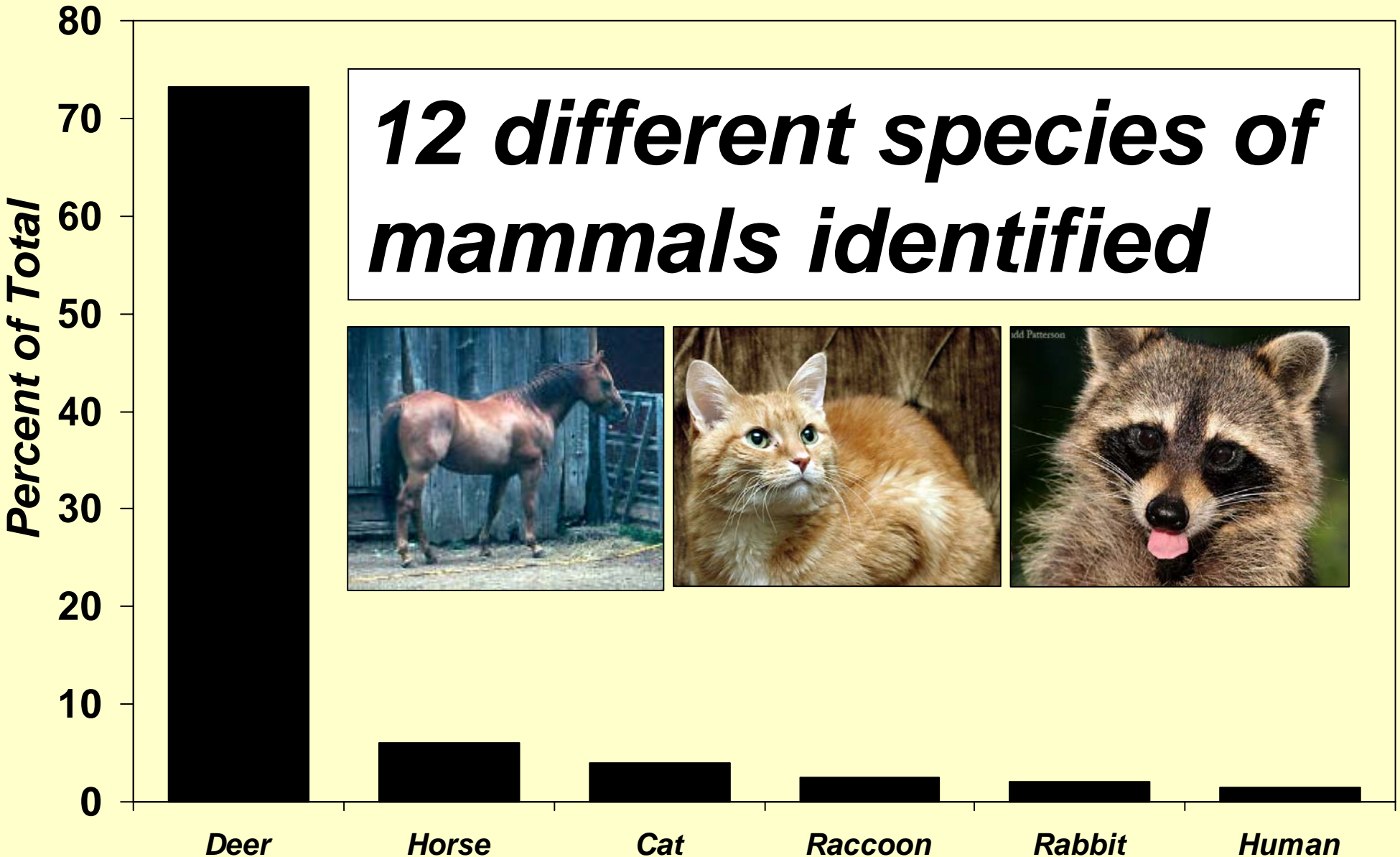
—*Jessa Forte Netting*

Percentage of Bird-Derived Blood Meals (n = 330)

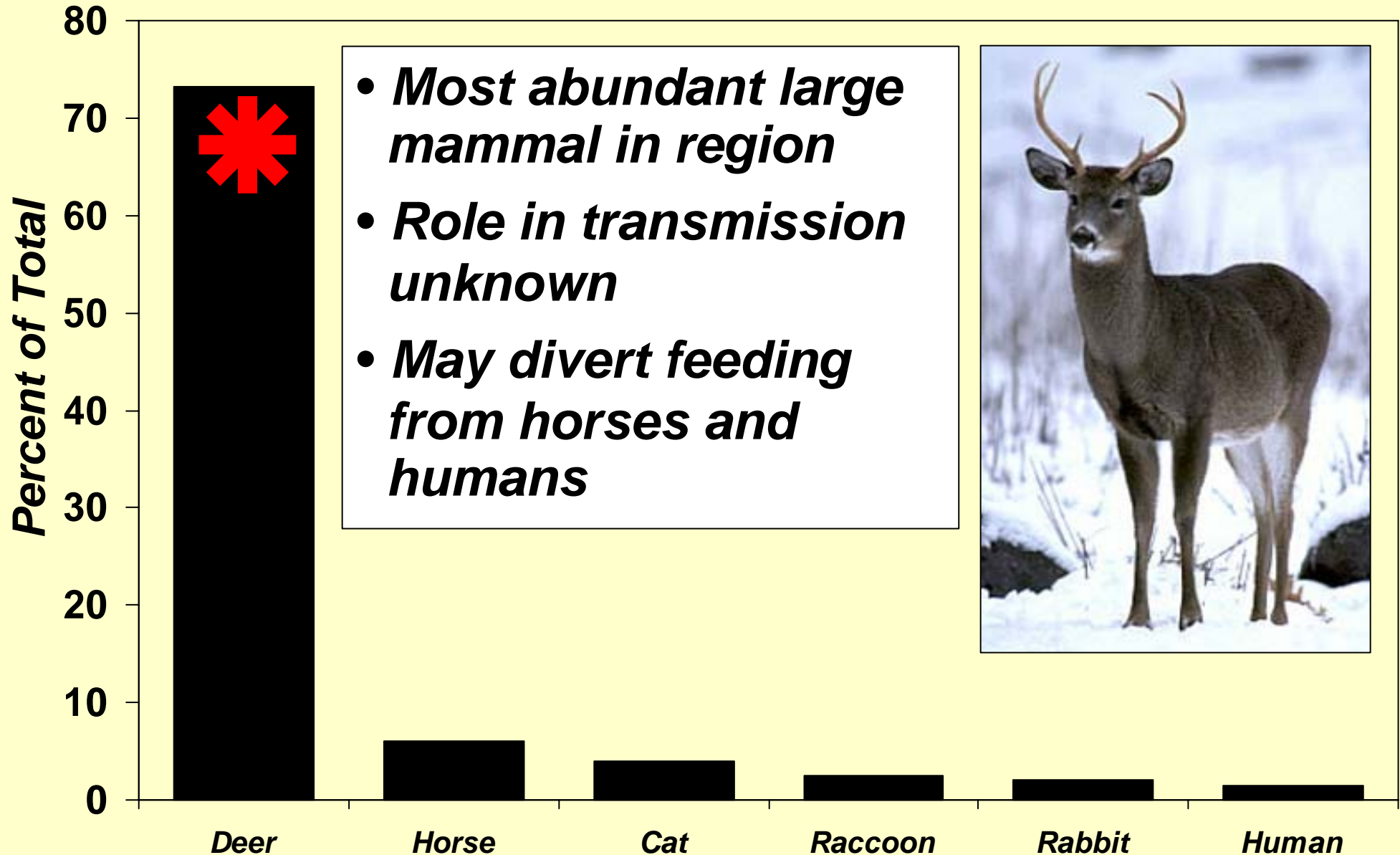


Percentage of Mammal-Derived Blood Meals (n = 198)

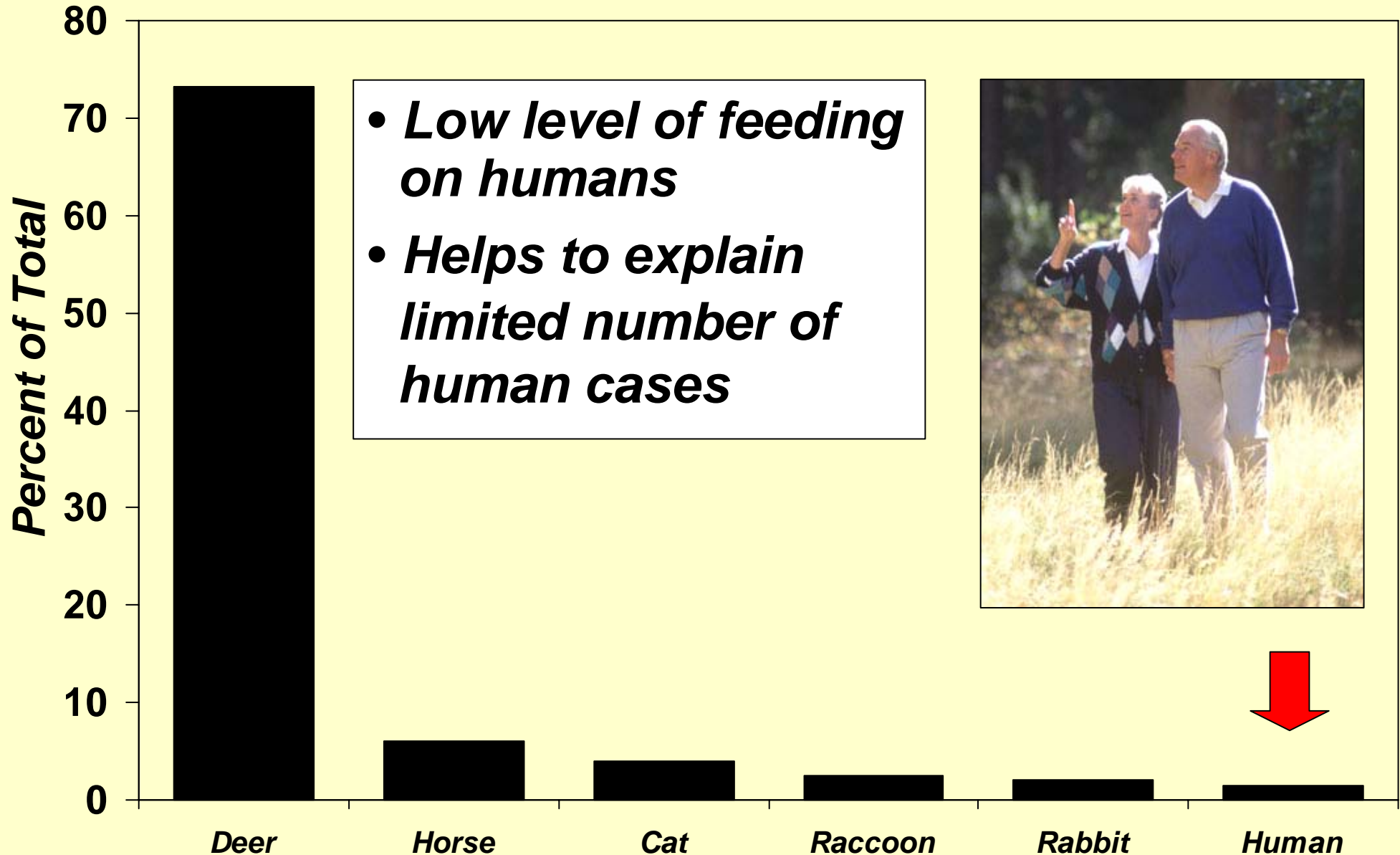
12 different species of mammals identified



Percentage of Mammal-Derived Blood Meals (n = 198)



Percentage of Mammal-Derived Blood Meals (n = 198)



Northeastern US West Nile Virus Transmission Cycle

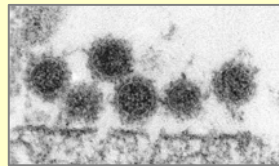


■ ■ ➔ **Overwinter**



Culex pipiens
Culex restuans
Culiseta melanura

Enzootic Cycle



Virus



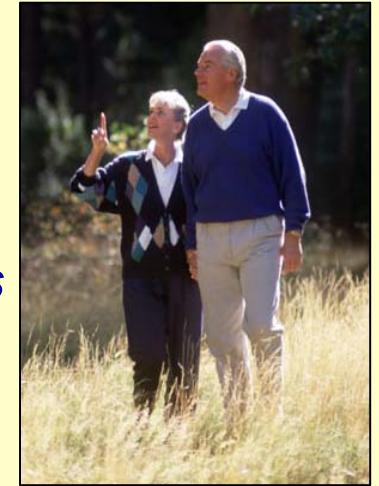
Wild Bird Reservoir and Amplifying Hosts

June to October

Epidemic Transmission



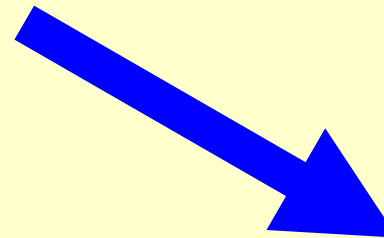
Culex salinarius
Culex pipiens
Aedes vexans



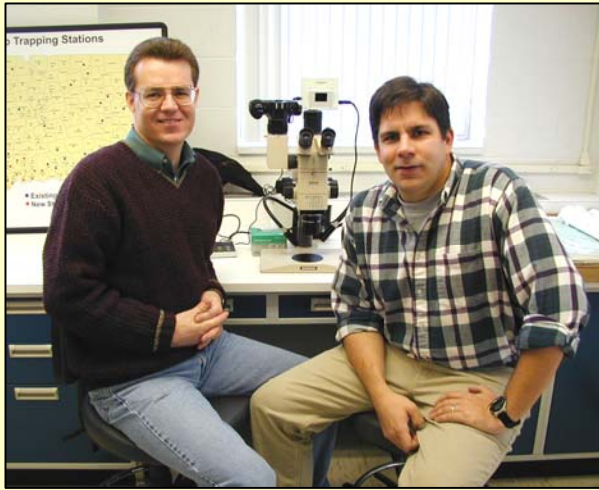
Incidental Infections



August to October



CAES Mosquito / West Nile Virus Research Group



Mosquito Identification & Trapping

John Shepard
Michael Thomas

Blood Meal Analysis

Dr. Goudarz Molaei



Virus Isolation & Identification

Dr. Philip Armstrong Shannon Finan
Dr. John Anderson
Dr. Charles Vossbrinck

