

Epidemiology of Rabies in Bats in Texas (2001-2010)

Bonny Mayes, MA

Zoonosis Control Branch

Texas Department of State
Health Services

Epidemiology of Rabies in Bats in Texas (2001-2010)

Co-authors:

Pamela J. Wilson, MEd - Department of State Health Services, Austin, TX

Ernest (“Skip”) H. Oertli, DVM, PhD, DACVPM – retired

Patrick R. Hunt, BS - Department of State Health Services, Austin, TX

Rodney E. Rohde, PhD, MS - Texas State University, San Marcos, TX



Bat Rabies in Texas (2001-2010)

- 94% of lab-confirmed cases occurred in wildlife species
- Skunks and bats most commonly affected during study period (bats #1 from 2006-2010)
- Texas #1 for bat species and lab confirmed cases* of rabies in bats
- Average of 3,107 bats/year tested
- 3,333 tested positive for RABV
- 11% positivity rate

**Annual US Rabies Surveillance Reports*



Photo compliments of Bat World Sanctuary

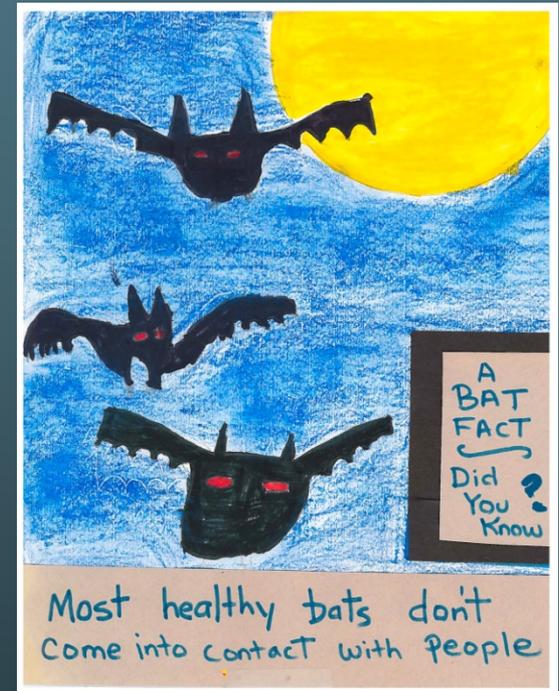
Public Health Implications of Bat Rabies

- In US, bat rabies cases documented in 49 states
- Bat rabies variants responsible for ~2-3 cases in humans per year in US
 - <http://www.dshs.state.tx.us/idcu/disease/rabies/information/bats/>
- In most bat-associated rabies cases, bat bites were either undetected or unreported
- Rabies awareness and prevention campaigns can be useful in reducing exposures / educating public about need for testing



Study Objectives

- To obtain epidemiological information on rabies in bats in Texas and their impact on humans and animals
 - Prevalence of rabies in bats
 - Monthly variations
 - Bat species
 - Bat Rabies Virus (RABV) variants
 - Bat RABV spillover
 - Domestic animal exposures
 - Human exposures
- This information is relevant to veterinarians and physicians in clinical practice when discussing rabies prevention guideline with their clients



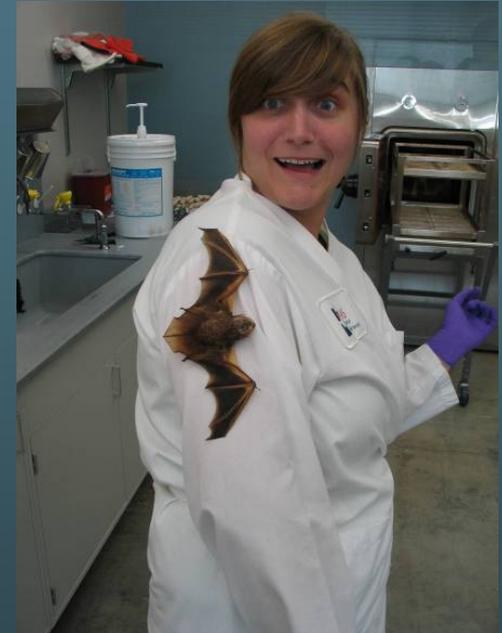
Laboratory Testing & Data Analysis

Fluorescent Antibody (FA) testing for RABV performed by labs associated with:

- Texas Department of State Health Services (DSHS), Austin
- El Paso City-County HD
- Houston Department of Health and Human Services
- San Antonio Metropolitan Health District
- Department of Defense Veterinary Food Analysis and Diagnostic Laboratory at Fort Sam Houston

Lab reports → rabies case investigations performed by DSHS regional zoonosis staff, local health departments or local rabies control authorities

We analyzed the bat rabies data in Rabies Incident Reports (RIR) and National Electronic Disease Surveillance System (NEDSS)



Andrea Musarra and
“Gertrude”

Bat Identification & RABV typing

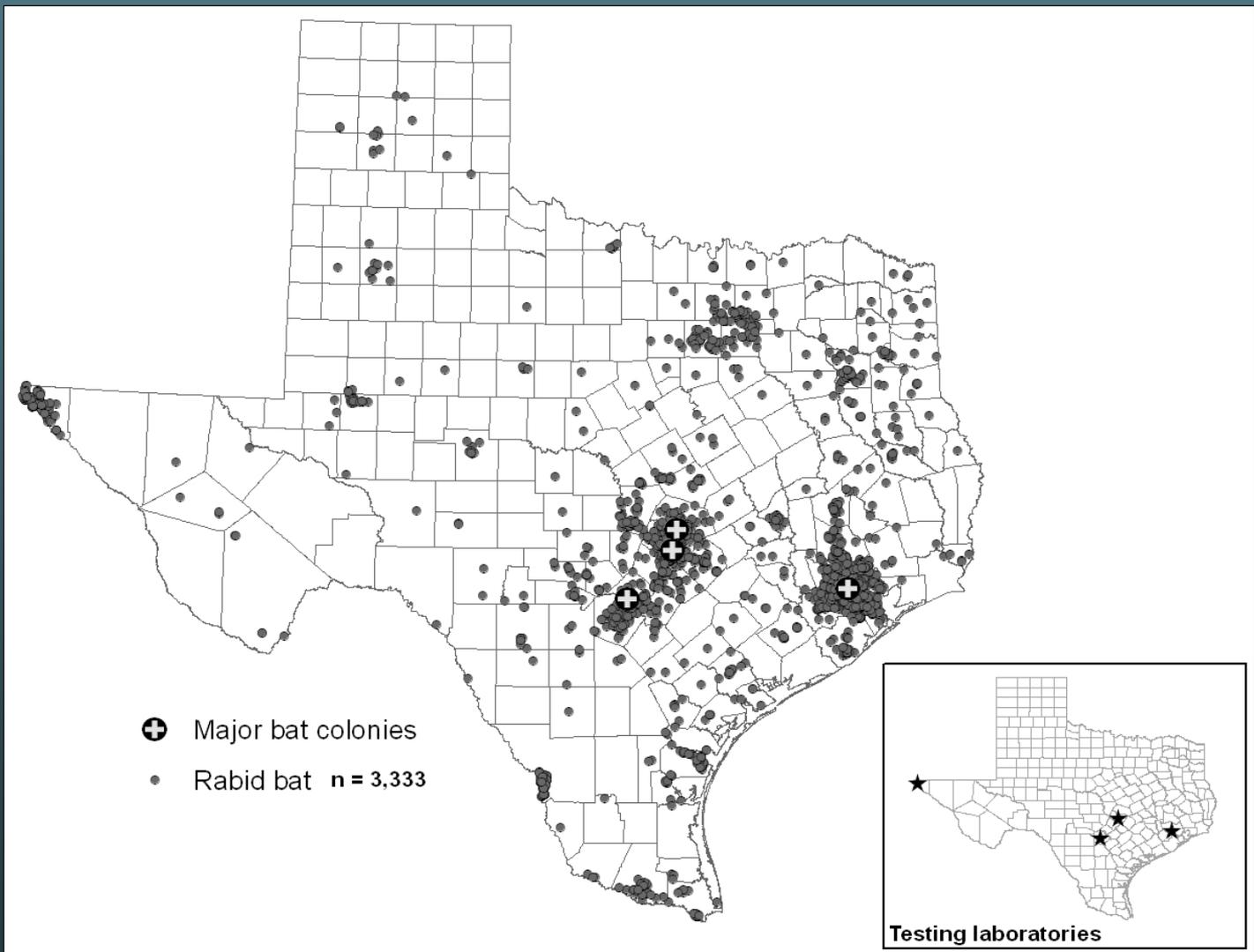
DSHS Rabies Lab:

- Identifies all bats received for testing and records bat species information
- Bat specimens sent to Angelo State University for ID confirmation
- Monoclonal antibody (MAb) typing performed on all rabies positive specimens, including bats, to determine RABV variant



Molecular typing (RT-PCR, nucleotide sequencing) performed as needed

Map of Texas depicting laboratory-confirmed rabies cases in bats (2001 to 2010), major bat colonies, and rabies testing laboratories in Texas.



Bat Colonies

Austin, TX

Congress Ave Bridge

Largest urban bat colony
~1.5 million



Houston, TX

Waugh Bridge

~300,000 bats

June 6 - Photo Credit - Odie Asscherick, Houston Bat Team



<http://inky.50megs.com/photoalbums/brackencave.html>

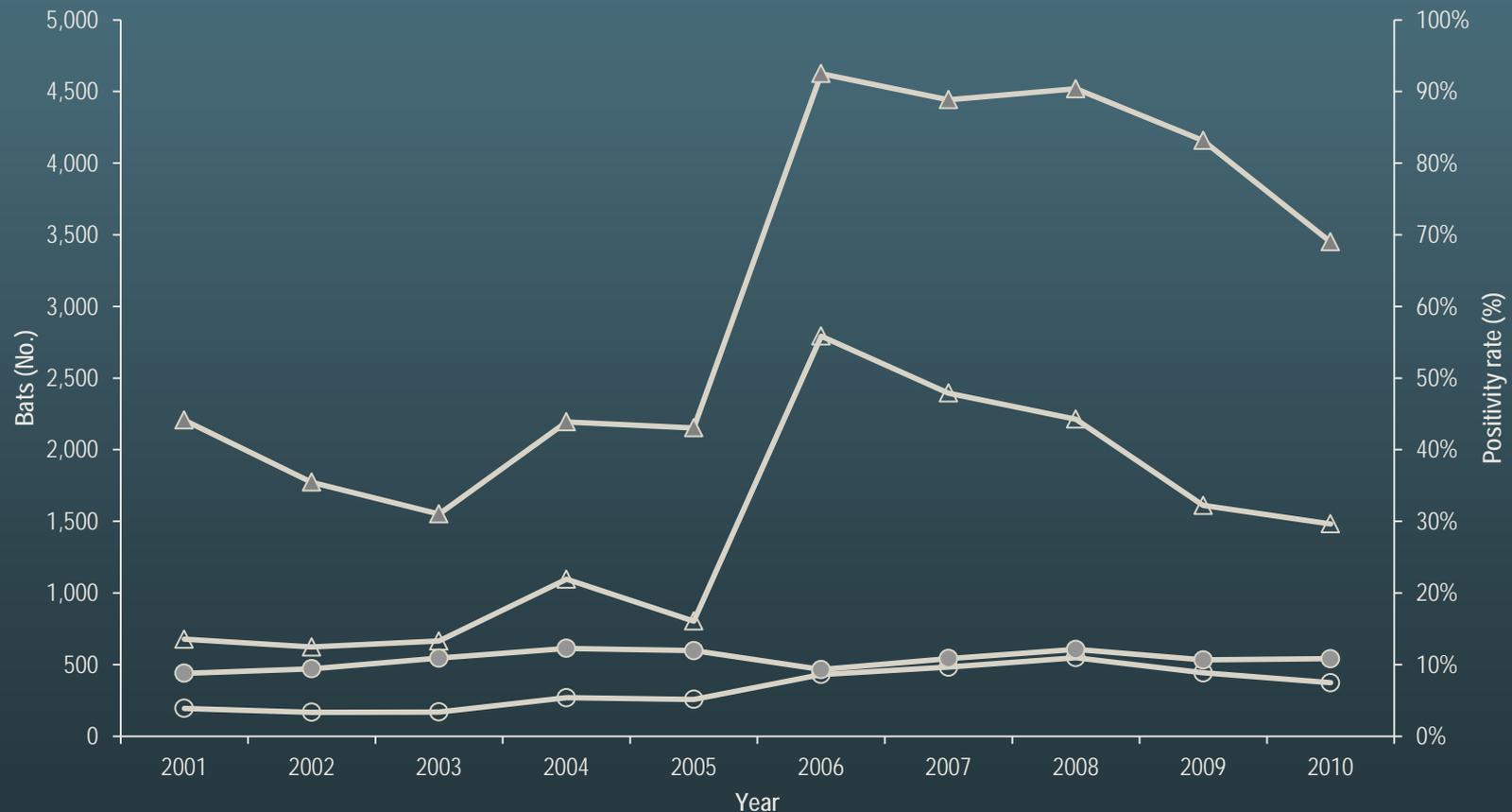


Bracken Cave

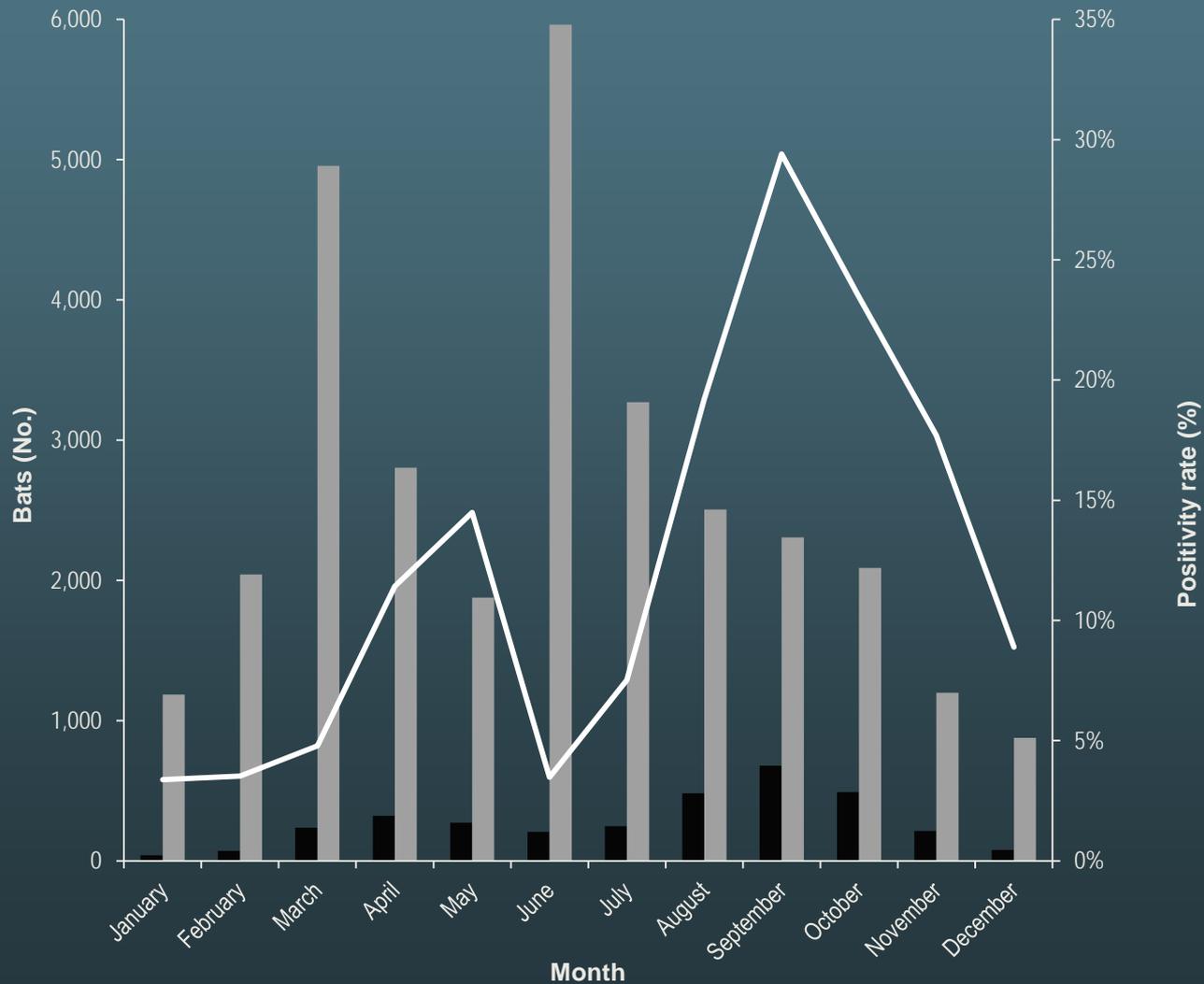
~20 miles NE of **San Antonio, TX**

Largest known bat colony
~20-40 million

Number of bats submitted for rabies testing at the Houston Department of Health and Human Services (open triangles) and for all of Texas (closed triangles) from 2001 through 2010. During these years, the number of bats that tested positive for rabies (open circles) and positivity rate of bats (closed circles) are depicted.



Monthly distribution of total number of bats submitted for rabies testing (gray bars), number of rabid bats (black bars), and positivity rate of bats (line) in Texas from 2001 through 2010.



Seasonal Variation in Submissions and Positivity Rate

- Bats in US most active during summer and early fall
 - swarming, preparation for hibernation or migration, young bats weaning & starting to fly
- ↑ % of rabid bats in late summer % early fall
- Slight increase in rabid bats in spring – large influx of Tb bats to summer maternity colonies from winter hibernacula



photography.nationalgeographic.com

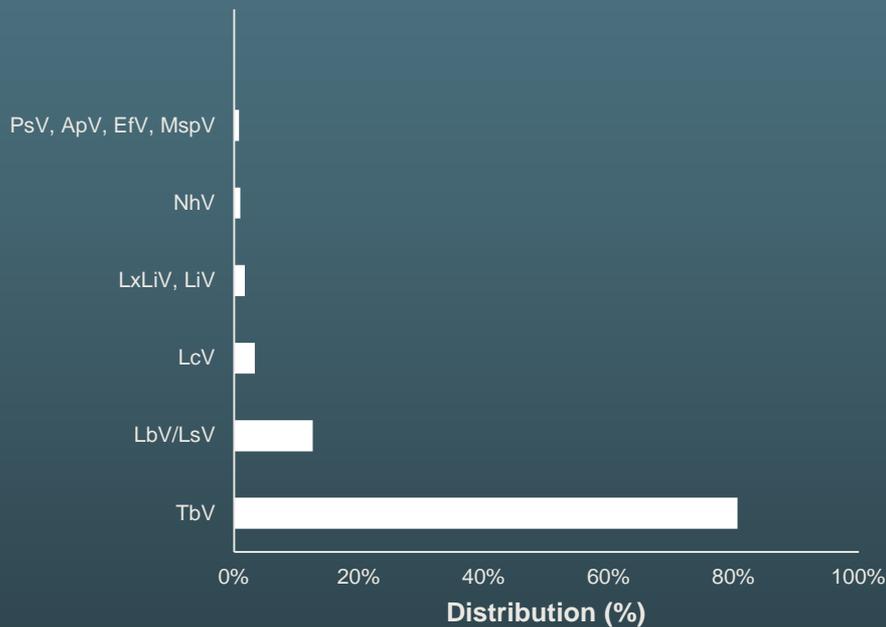
Species of rabid bats (2001-2010)

DSHS lab submissions only

- 46% of bats rec'd for testing (14,340 of 31,072) were identified
- 23 bat species received for testing and 12 bat species had at least one bat that tested positive for RABV
- Of 1,940 RABV positive bats:
 - 80% → Brazilian free-tailed bats
 - 11% → eastern red bats
- Highest positivity rates:
 - 41% → hoary bats
 - 18% → Brazilian free-tailed bats



Distribution (%) of rabies virus variants confirmed in 1,922 rabid bats identified in Texas from 2001 through 2010



ApV = *Antrozous pallidus* (pallid bat)

EfV = *Eptesicus fuscus* (big brown bat)

LbV = *Lasiurus borealis* (red bat)

LcV = *Lasiurus cinereus* (hoary bat)

LiV = *Lasiurus intermedius* (N. yellow bat)

LsV = *Lasiurus seminolus* (seminole bat)

LxLiV = *Lasiurus xanthinus* and *Lasiurus intermedius* (western & N. yellow bats)

MspV = Associated with various *Myotis* spp.

NhV = *Nycticeius humeralis* (evening bat)

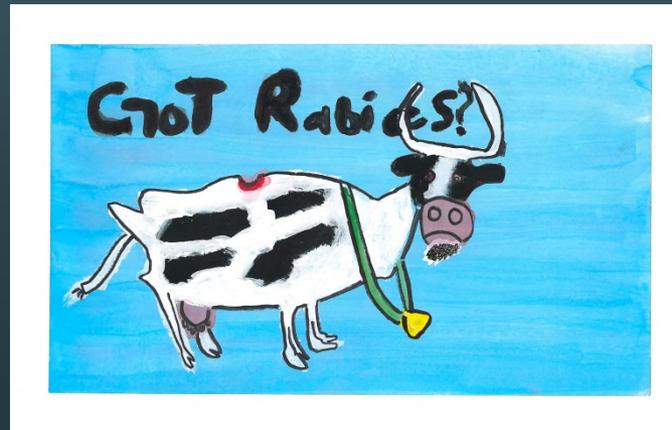
PsV = *Perimyotis subflavus* (American perimyotis)

TbV = *Tadarida brasiliensis* (brazilian free-tail)

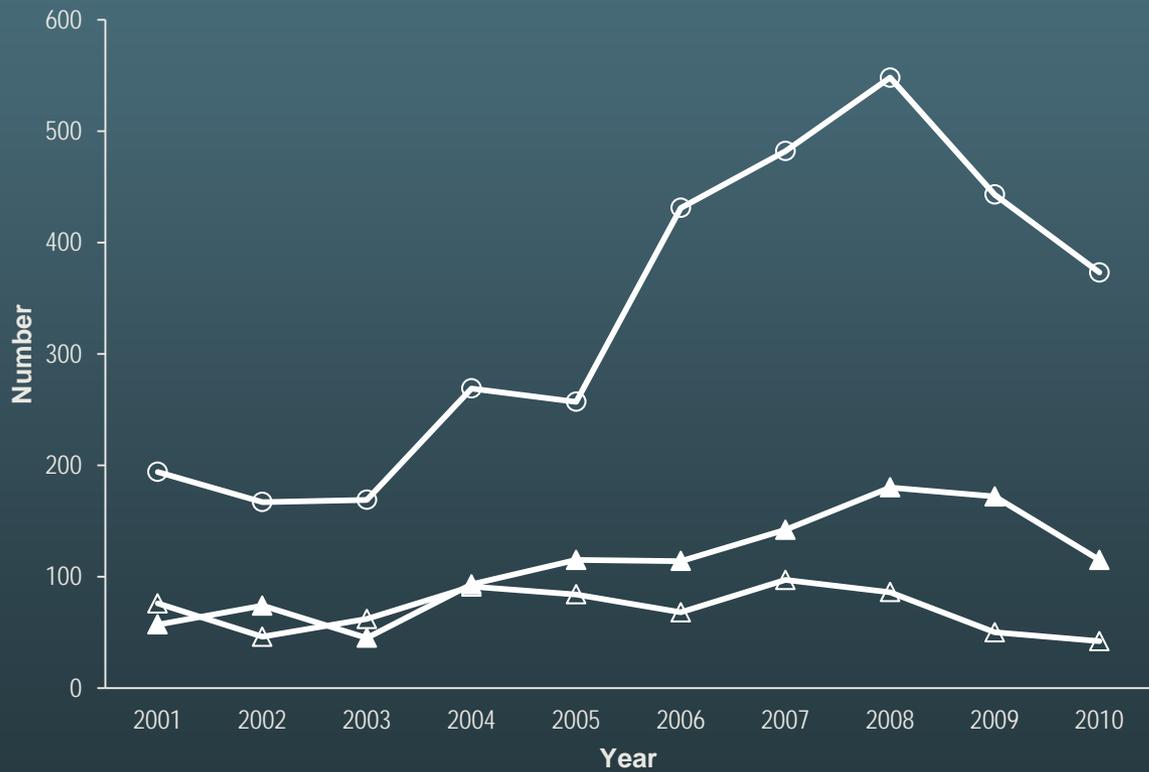
- 98% of bats had “expected” RABVV
- 2% “spillover” primarily in evening bats (mainly *Lasiurus* sp. variants)

Terrestrial Mammals with Bat RABV variants (2001-2010)

- Bat RABV variants were responsible for 13 of 5,798 (0.2%) terrestrial mammal rabies cases
 - 5 cats (four with *Tb* RABV variant & one with *Ps* RABV)
 - 4 bovids (three with imported vampire bat RABV variants & one with *Lb/Ls* RABV variant)
 - 2 dogs (*Tb* RABV variant)
 - 2 ringtail cats (one *Tb* RABV variant & one “bat rabies”)
- The animals involved had no documented vaccination history



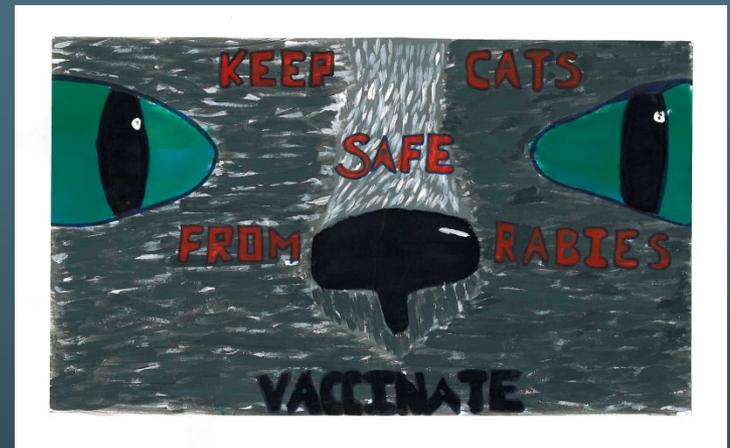
Numbers of exposed humans (open triangles; n = 702) and domestic animals (closed triangles; n = 1,107) and number of rabid bats (open circles; n = 3,333) in Texas from 2001 through 2010



Exposure of domestic animals to rabid bats

A total of 1,107 domestic animals had known exposures to rabid bats during the study period

- Complete data available for 1,080 cases
 - 776 dogs (72%)
 - 546 current on vaccination (70%)
 - 303 Cats (28%)
 - 167 current on vaccination (55%)
 - 1 horse (current on vaccination)
- Of those current on vaccinations (n=714), 99% received PEP and 1% were euthanized
- Of those that were not current on vaccinations (n=366), 73% received PEP and 27 % were euthanized



Texas State Law requires that dogs and cats be vaccinated against rabies

According to the Texas Administrative Code, domestic animals exposed to a rabid animal must either be euthanized or provided PEP

PEP for domestic animals exposed to rabid animals

Texas Administrative Code, Sections 169.22 – 169.34,
Rabies Control and Eradication

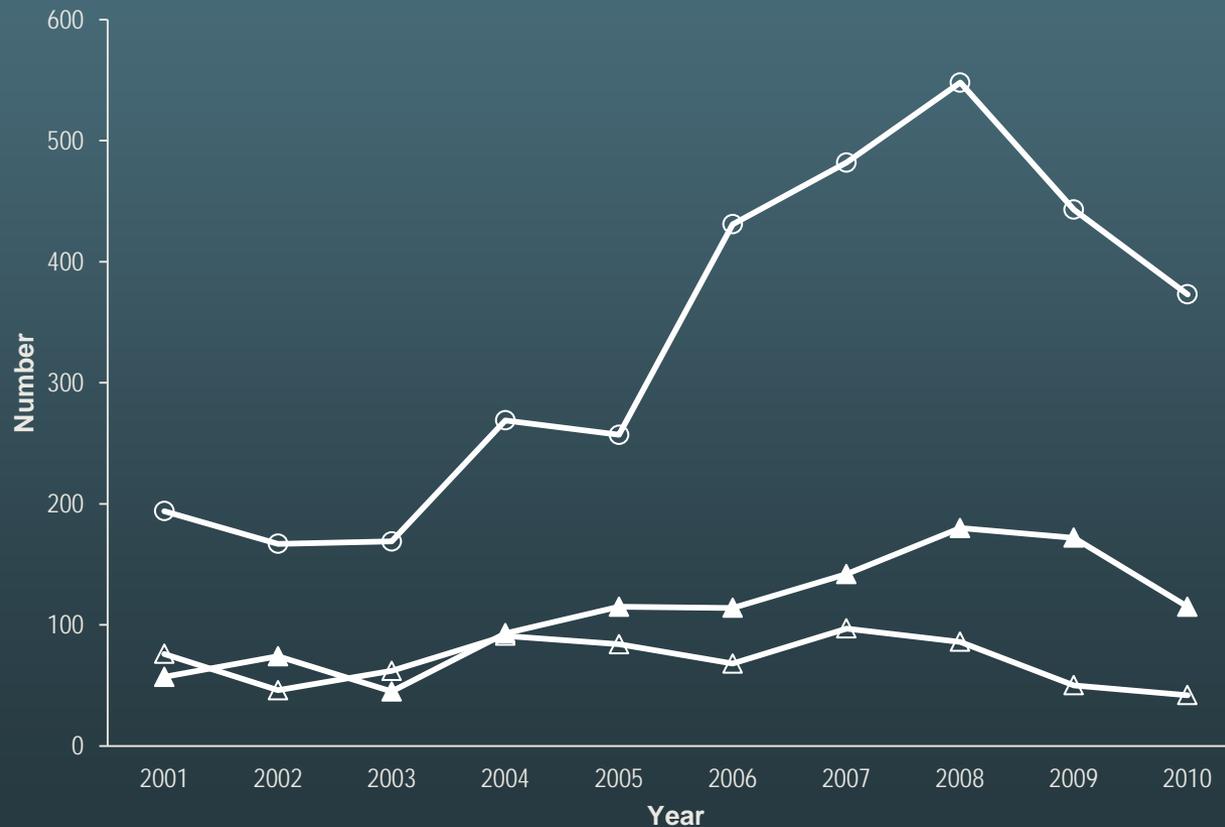
- Not currently vaccinated:
 - must be euthanized **or** vaccinated against rabies immediately, placed in confinement for 90 days, and given booster vaccinations during the third and eighth weeks of isolation
- Currently vaccinated
 - must be euthanized **or** vaccinated immediately and placed in confinement for 45 days



“Not currently vaccinated” – documentation of vaccination is not available, initial immunization was given less than 30 days previously, or animal is overdue for booster vaccination

The above recommendations apply only to animals for which there is a USDA-licensed vaccine

Numbers of exposed humans (open triangles; $n = 702$) and domestic animals (closed triangles; $n = 1,107$) and number of rabid bats (open circles; $n = 3,333$) in Texas from 2001 through 2010.



Humans exposed to rabid bats (2001-2010)

- 702 individuals exposed to 421 bats (1/3rd of incidents involved multiple people)
 - 57% males / 43 % females
- Of the rabid bats associated with human exposures, 47% were located in four counties:
 - Travis, Williamson, Harris and Bexar
- Exposures:
 - Handling (41%)
 - Uncertain if exposure occurred (32%)
 - Known or possible bite (21%)
 - Other or undocumented (5%)



Humans exposed to rabid bats (2001-2010)

- Where rabid bats were encountered:
 - 62% outside
 - 29% inside
 - 8% were transported into the home environment by a pet
- Physical state of bat when exposure occurred
 - 14% were flying
 - 58% were down and appeared to be sick or injured
 - 18% were dead
- Treatment:
 - 88% received PEP
 - 8% did not receive PEP
- During this time period, 208 additional humans were exposed to bats that were unsatisfactory for testing and 66% received PEP





Unique PEP Recommendations for Humans Potentially Exposed to Rabid Bats

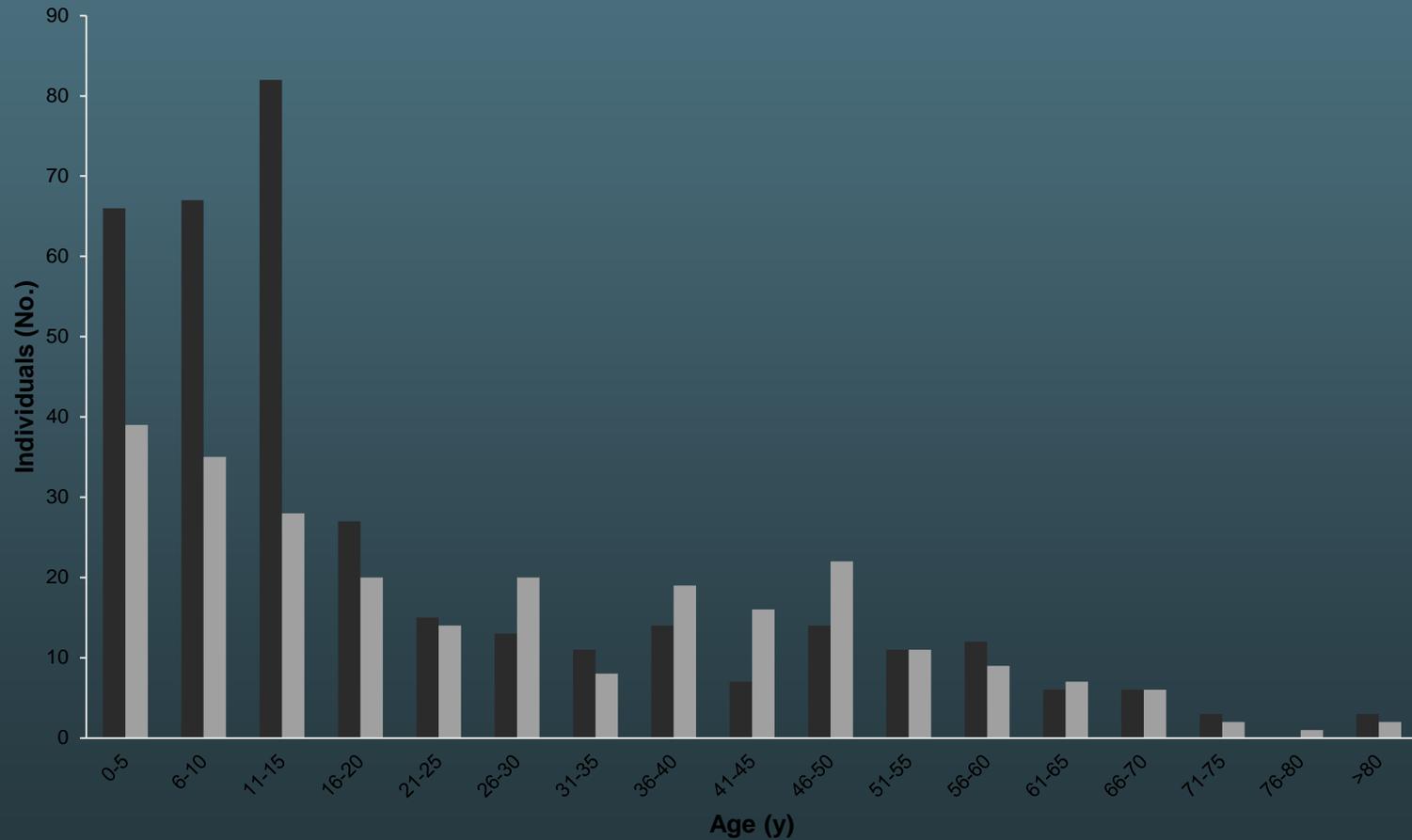
In incidents involving **bats**, PEP may be appropriate even in the absence of demonstrable bite, scratch, or mucous membrane exposure in situations in which there is reasonable probability that such exposure may have occurred (e.g., sleeping individual awakes to find a bat in the room, a person witnesses a bat in the room with a previously unattended child, mentally challenged person, intoxicated individual, etc.)

➤ 1997 → 71 year old male, Houston, TX

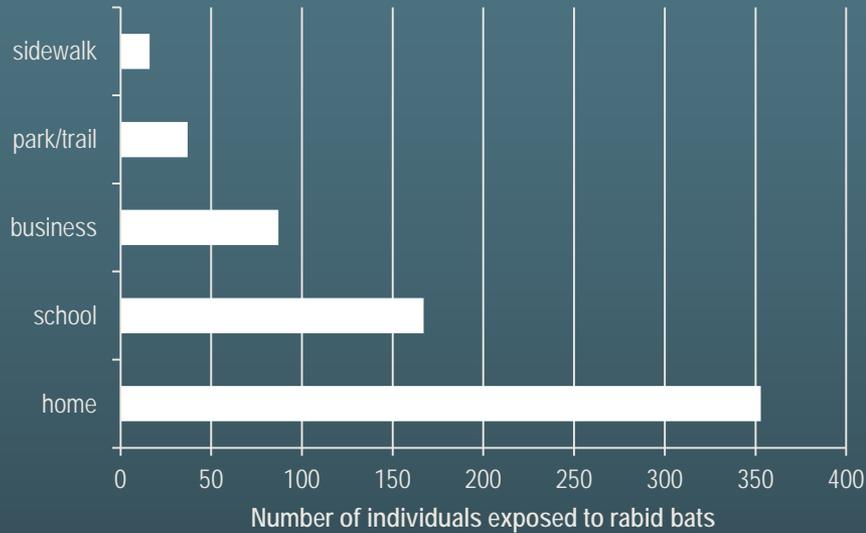
❖ exposure history:

- awoke with bat on shoulder (NE TX motel)
- removed and disposed of bat
- wife examined him and did not find bite marks
- died of silver-haired bat rabies two months later

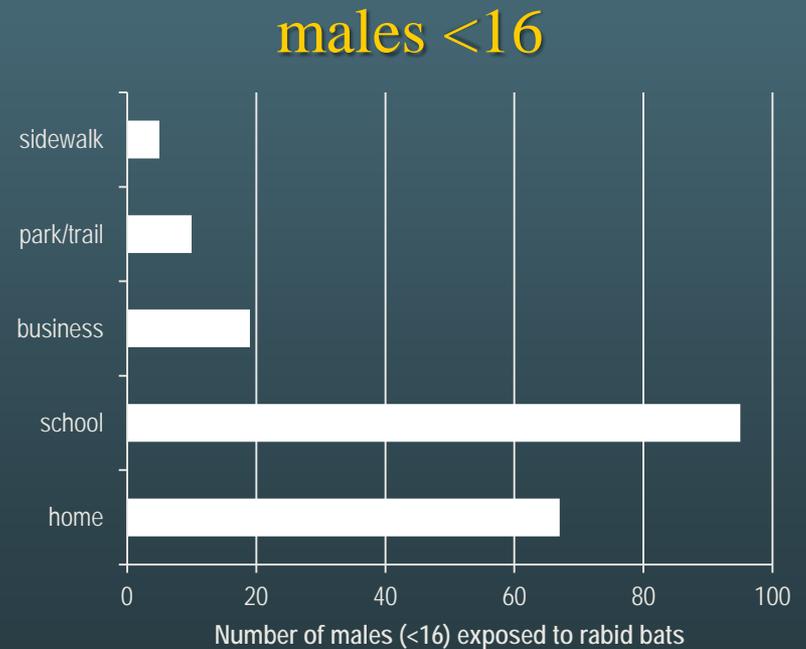
Age and gender (males, black bars; females, gray bars) distribution of 616 humans exposed to rabid bats in Texas from 2001 through 2010.



Locations where human exposure to rabid bats occurred in Texas from 2001 through 2010



all individuals



Rabies Awareness & Prevention Poster Contest

- Annual statewide contest for school kids in K-8th grade
- <http://www.dshs.state.tx.us/idcu/disease/rabies/information/contest/>
 - School staff Information Sheet
 - Teacher Contest Instructions and Entry Form
 - Student Information and Instructions
- Prizes provided by The Zach Jones Memorial Fund
<http://www.zachjonesmemorial.org/>





Zach Jones, age 16, of Humble, TX, died of rabies on Friday, May 12, 2006.

Exposure history: “bat flew in bedroom window and brushed victim on face; bat was captured and released”

Mission

The Zach Jones Memorial Fund strives to raise funds in order to assist with educational awareness, early detection, and ultimately the cure for rabies.



Conclusions

- Human PEP is expensive and can be traumatic, especially for children - “public health interventions that promote the reduction of exposure to potentially rabid animals are more cost effective than treatment!”
- Bats that have exposed (or potentially exposed) a pet or human to rabies need to be submitted for rabies testing ASAP
 - PEP can generally be delayed until testing is completed
 - Badly decomposed bats may not be satisfactory for rabies testing (but should be submitted anyhow!)
- Pets need to be kept current on their rabies vaccinations!
 - 27% of domestic animals not current on shots were euthanized versus 1% of those that were current
 - Terrestrial animals that died of bat rabies during this time period had no history of vaccination

Acknowledgements

Photos

- Barbara French
- Andrea Musarra, DSHS Rabies lab, for posing with “Gertrude” the stuffed red bat
- Dr. James Wright, bat bite photos

Human exposure data

- Regional Zoonosis Control Staff

Rabies Testing, MAb Typing and Bat Identification

- DSHS Rabies Identification Team, especially Letha Zuckero, Danielle Smith, Andrea Musarra, La'Toya Bigelow

Bat Species Confirmation

- Loren Ammerman, Angelo State University
- Robert Baker, Texas Tech University

Support

- Dr. Tom Sidwa – ZCB Manager & Dr. Skip Oertli