

International Conference on Emerging Infectious Diseases: Zoonotic Diseases

Preventing human diseases by altering pathogen transmission in animal reservoirs (AKA “...taking it to the streets...”)

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ZOONOSIS PREVENTION & CONTROL

RATIONALE FOR TARGETING SUSPECTED RESERVOIRS:

Basic goals (prevention, control, elimination, eradication, etc.?)

Status (exotic, enzootic, epizootic, etc.?)

Species (domestic, wild, 'pests', 'charismatic megafauna', etc.?)

Disease ecology (deemed simple or complex; pathogenesis, etc.?)

Methods (practical, feasible, temporal dynamics, etc.?)

Economics (start-up costs, short term benefits, etc.?)

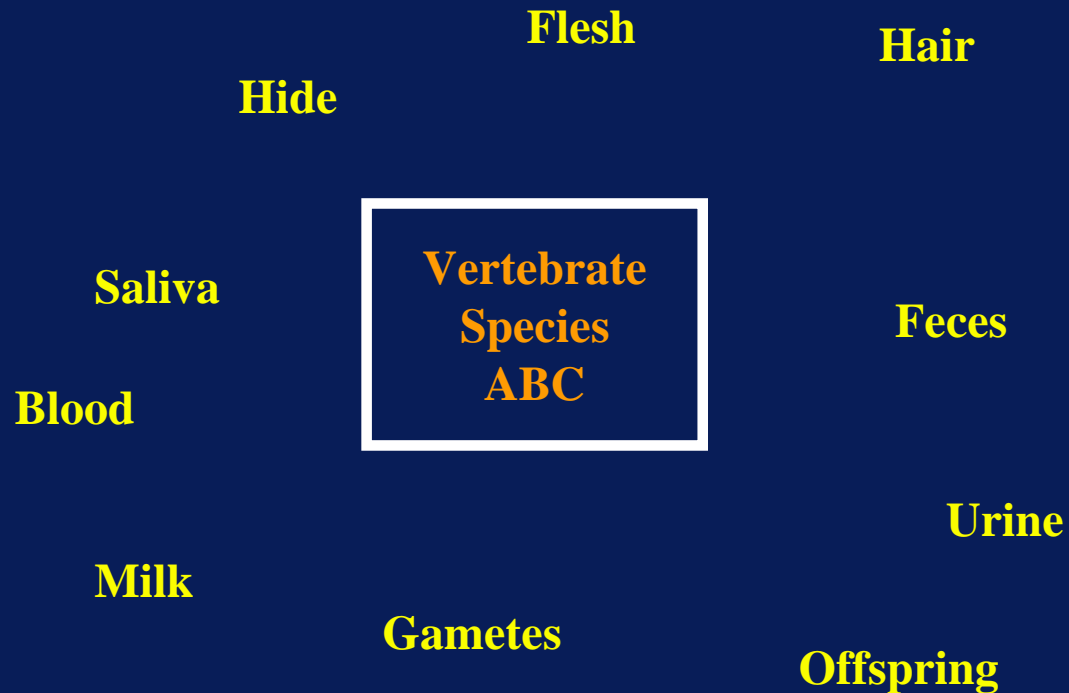
Infrastructure (inter-sectoral cooperation, diagnostics, etc.)

Society (culture, traditions, religious beliefs, education, community participation, etc.?)

ZOONOSIS PREVENTION & CONTROL

QUALITATIVE CONCERNS: VEHICLES* OF TRANSMISSION

*(more than 1 may apply)



وَعَسَىٰ أَنْ يَكُونَ مِنْهُمْ مَنْ يَهْتَدِي مِنَ النُّورِ وَمِنْهُمْ مَنْ يَسْتَلْزِمُهُ
 وَمِنْهُمْ مَنْ يَبِيعُ مِثْلَ الْكَلْبِ وَيَعْضُرُ مِنْ أَمْرِ يَمُنُّهُ قُصْبُهُ
 تَلْكَ أَيْضًا وَقَدْ ذَكَرْنَا أَنْ نَعْمُرَ رَأْسًا وَأَوَّاسًا وَأَنْتَ عَضًا فَأَنْقَلَبْنَا

صورة طير طيب
 وعض انسانا.



وَأَنْ أَوْدَعُوا رَأْسًا لِي هَذِهِ الْآقَهُ وَمَسْتَوْتٌ وَإِنْ أَحَدٌ مَّا عَضُرَ وَكَانَ
 بِهَذَا الْبَلِيَّةِ وَخَلَصَ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ
 وَأَمَّا الْآخَرُ فَكَانَ السَّامِعُ صَدِيقًا لِفَخْرٍ الْمَا فَلَادِمَانَ

ZOONOSIS PREVENTION & CONTROL

ORIGINS FOR TARGETING SUSPECTED RESERVOIRS?

Oral/Written History

Religious or Cultural Traditions

Legends: Mythology, Fables, Fairy Tales, Folklore

Common Sense

'Organized' Medicine

Modern theory

ZOONOSIS PREVENTION & CONTROL

Gradual rise in the belief about “germs” and their effects in animal populations

- ❑ **By the mid-to late 19th century, many professional veterinarians throughout Europe were beginning to accept the notion that epizootics were contagions caused by the spread of disease-matter (‘materies morbi’), unlike the majority of their other biomedical colleagues...**
- ❑ **Institution of quarantines, and destruction of obviously ill animals, could serve to impede disease spread.**

ZOONOSIS PREVENTION & CONTROL

Professional acceptance of killing vs. healing in large animal veterinary medicine (economy over sentimentality)

- ❑ Replacement costs often more timely, less costly than repairs**
- ❑ More expedient to harvest, before animal values fell further**
- ❑ Increasing sensibility of slaughter choices in reducing risks**
- ❑ Appreciation of individual carcass rendering, compared to enmasse disposal during large outbreaks**

ZOONOSIS PREVENTION & CONTROL

“Something in the air tonight...”

- Despite their historical distance from so-called “horse doctors” and “veterinary quacks”, many prominent 19th century European physicians held to the conviction that certain diseases were endemic and sporadic, relating to a generalized belief in ‘miasmas’ (‘poisoned airs’), and that overall environmental improvements would gradually prevent the generation and diffusion of such poisons in animal and human populations...**

ZOONOSIS PREVENTION & CONTROL

Support for 'anti-contagionism' and global markets

- ❑ **Coupled with the ideals of 'miasmas', many supporters of free trade viewed methods such as quarantine, exclusion, import inspection, taxes, slaughtering practices, etc. as an intrusion, nothing more than a nationalistic means of economic protectionism, rather than a prohibition against the potential introduction and exchange of animal pathogens.**
- ❑ **Obviously, history held no monopoly on corruption or incompetence...**

ZOOONOSIS PREVENTION & CONTROL

SPATIO-TEMPORAL & RESOURCE ISSUES

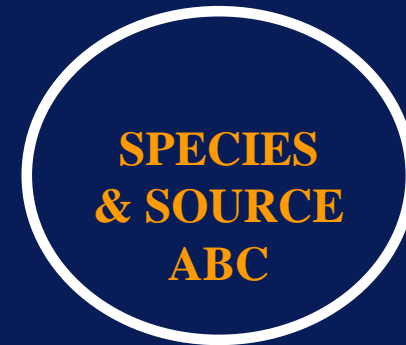


ZOONOSIS PREVENTION & CONTROL

GROSS ENTRY RESTRICTIONS: COARSE-GRAINED



X



ZOONOSIS PREVENTION & CONTROL

SITE RESTRICTIONS: MEDIUM-GRAINED

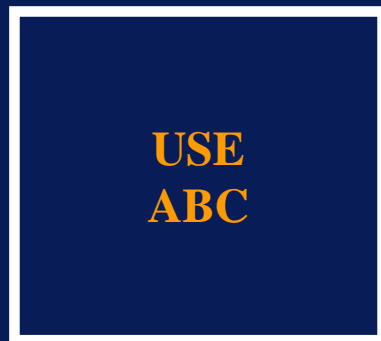
**SINK
ABC**
(e.g. government,
university, zoo,
private, etc.)

X

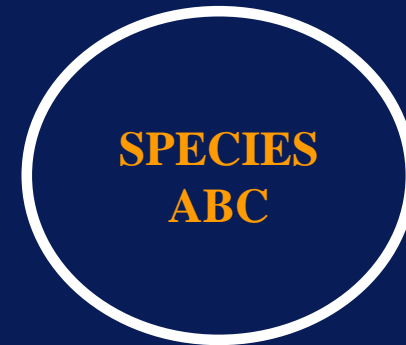
**SPECIES
ABC**

ZOONOSIS PREVENTION & CONTROL

UTILIZATION RESTRICTIONS: MORE FINE-GRAINED

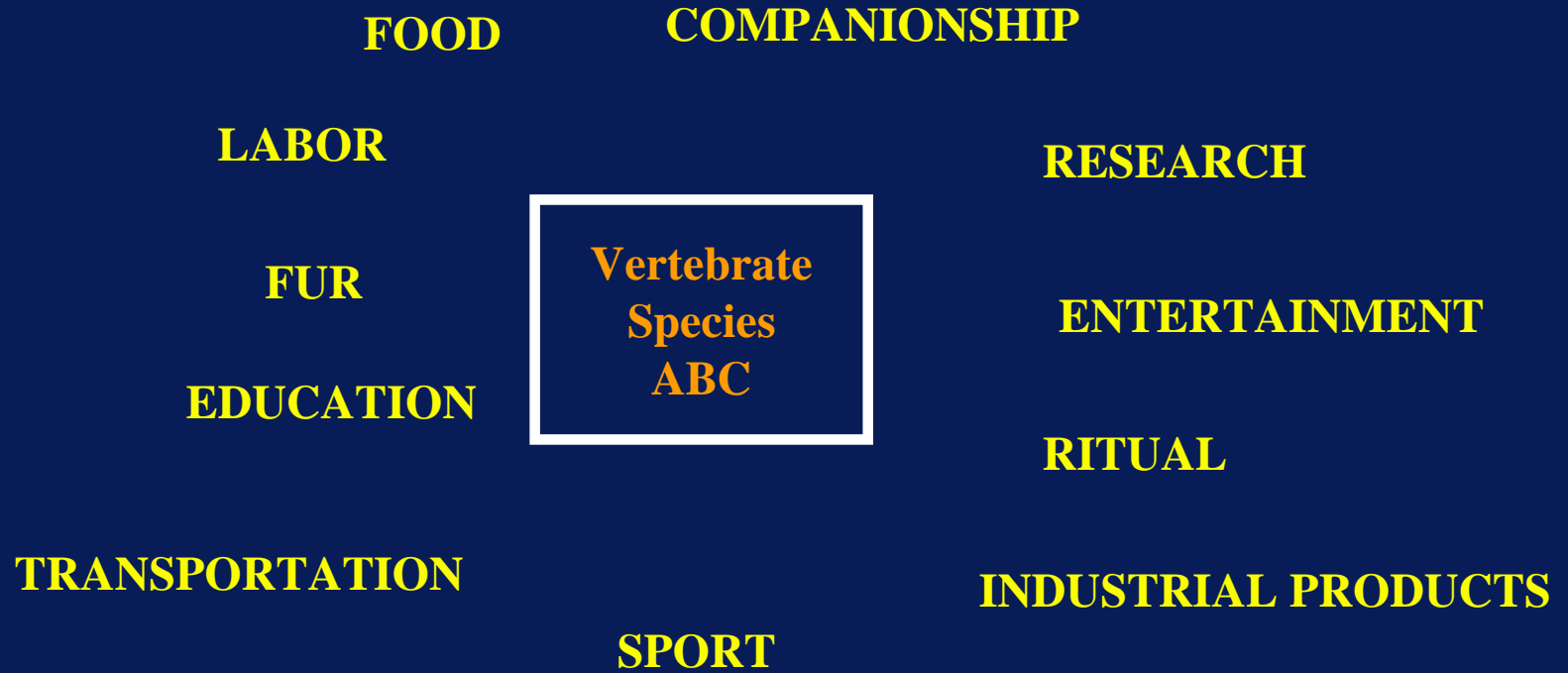


X



ZOOONOSIS PREVENTION & CONTROL

SELECTED EXAMPLES OF REGULATED ANIMAL USE



ZOONOSIS PREVENTION & CONTROL

COMING TO TERMS WITH LETHALITY: “FATAL DISTRACTIONS”

EUTHANASIA

POPULATION REDUCTION

SELECTED CULLING

TEST/SLAUGHTER

PREDATOR CONTROL

Vertebrate
Species
ABC

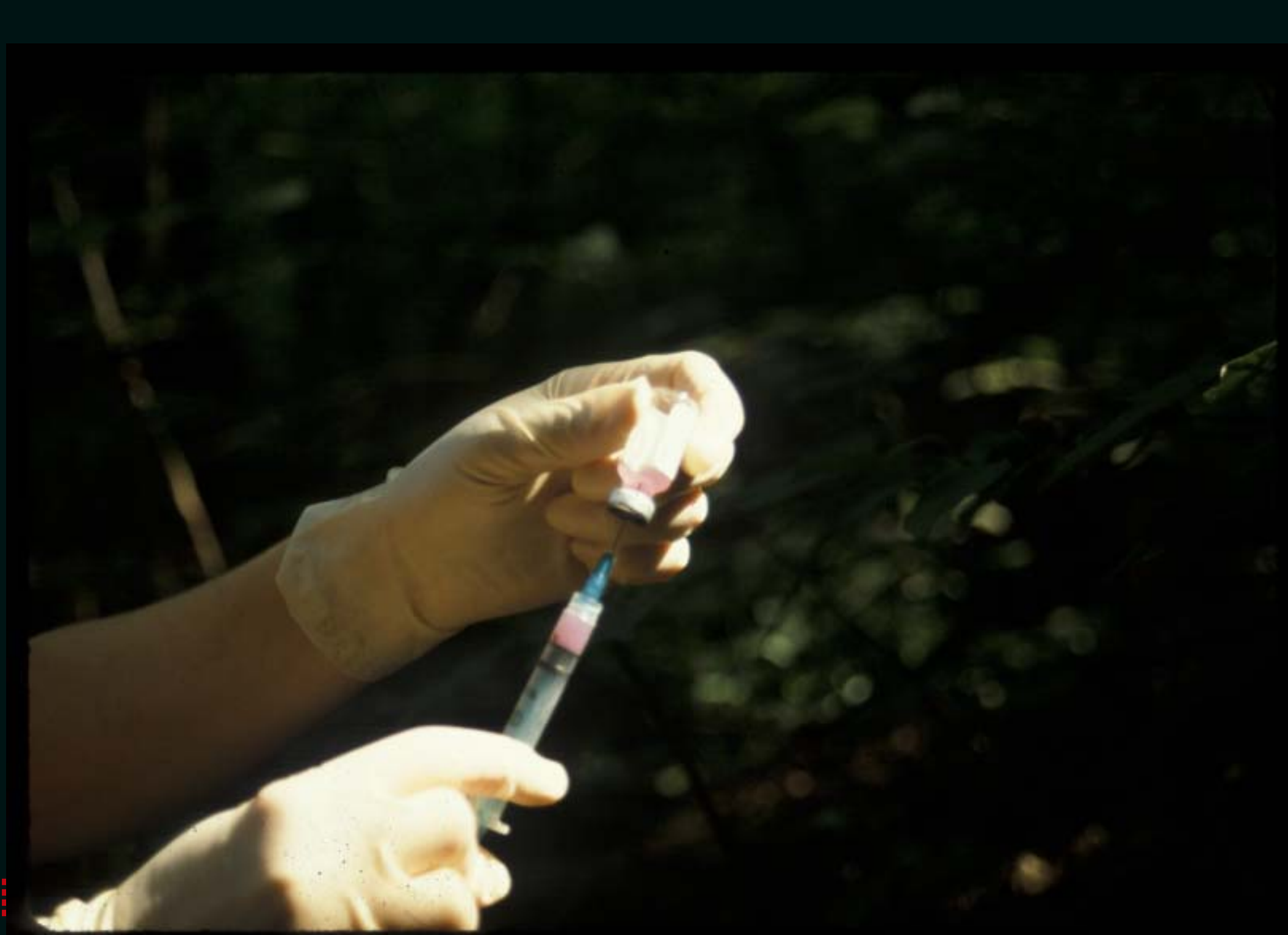
OPEN SEASONS

SANCTIONED BOUNTIES

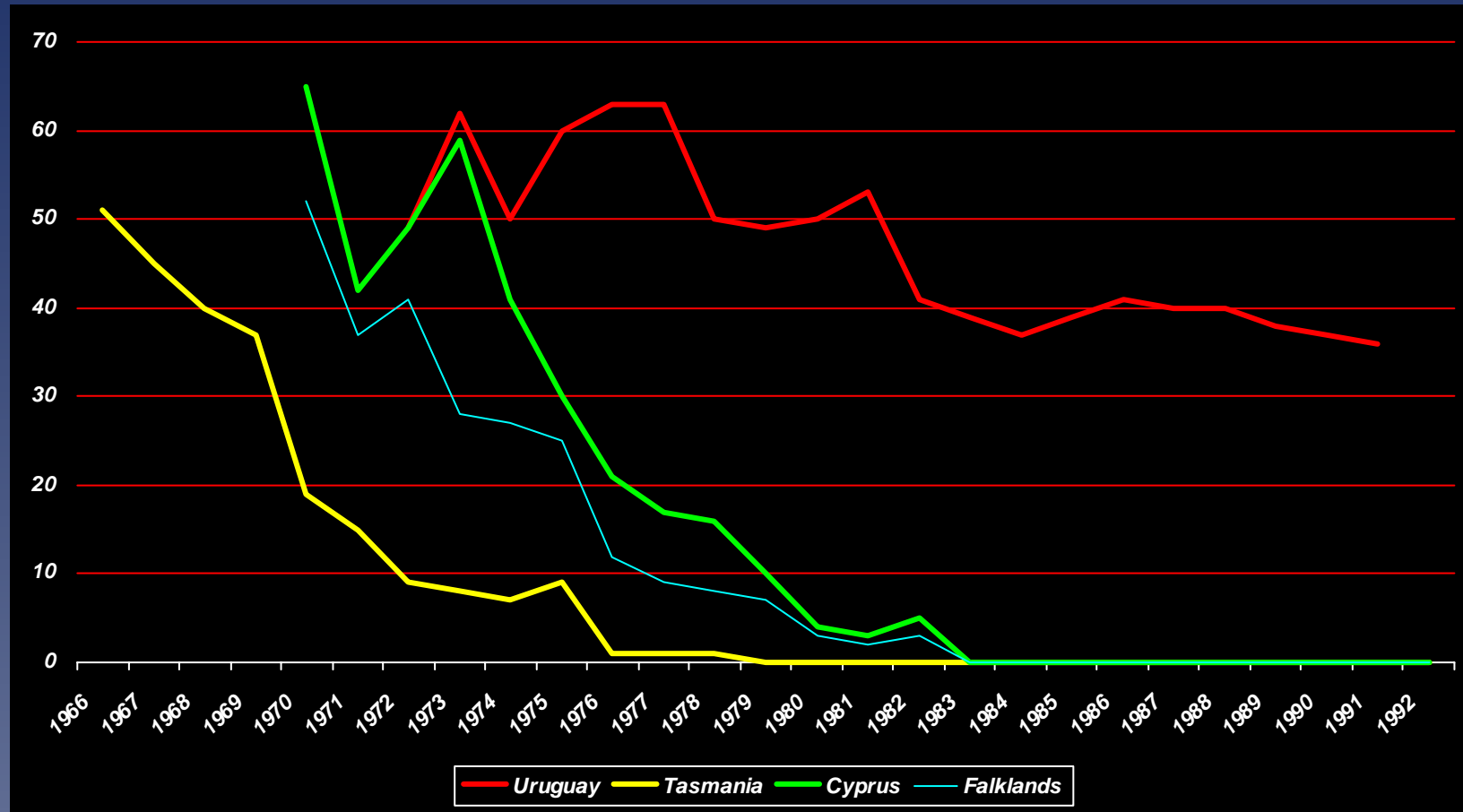
HABITAT DESTRUCTION

‘VERMIN’ REGULATION, ALA SNAKE ROUND-UPS, SHARK HUNTING REDUX’ ‘JAWS’

INTENTIONAL EXTIRPATION



Helminth control: Prevalence of *Echinococcus granulosus* (Gemmell & Roberts, 1998)

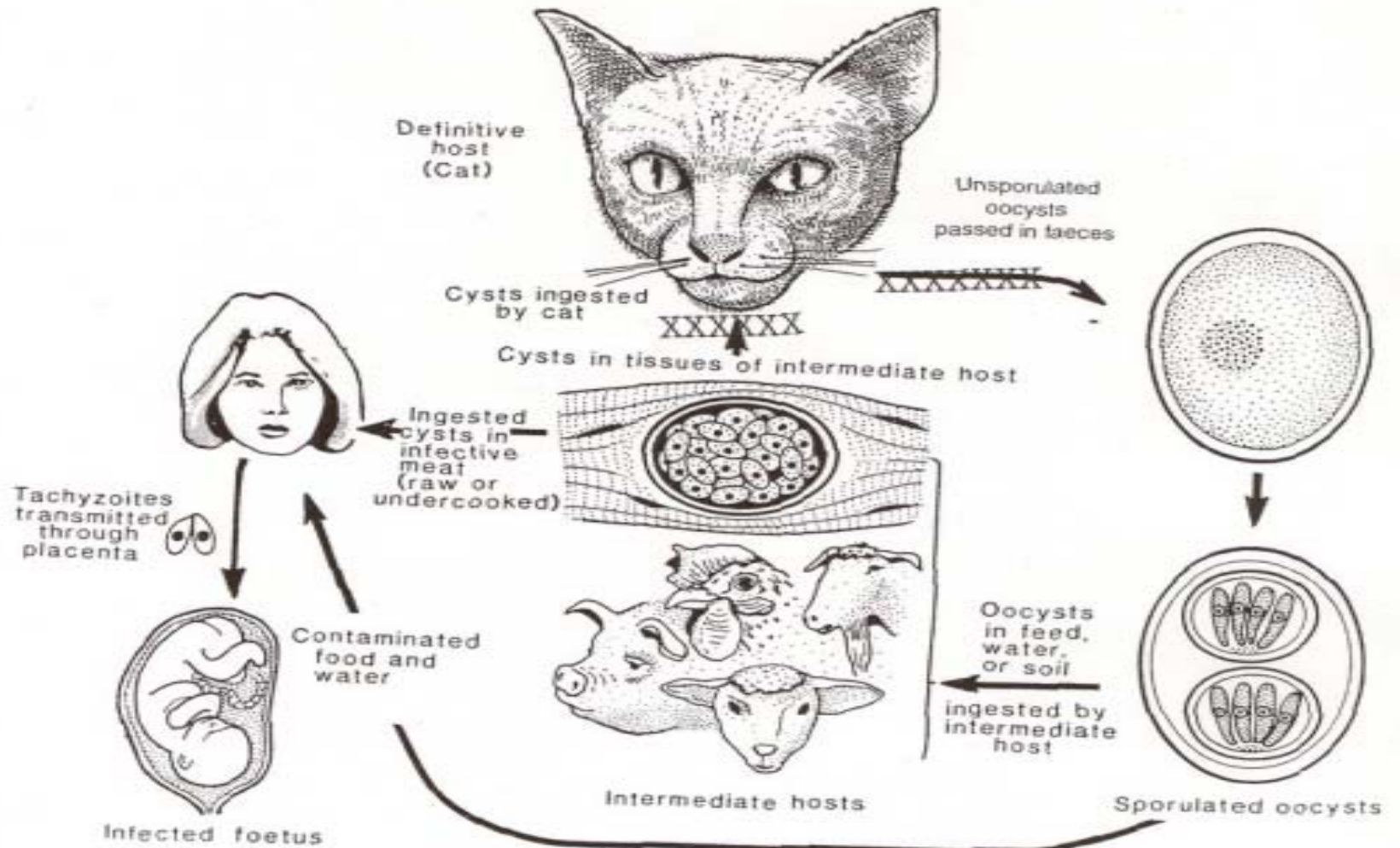


ZOONOSIS PREVENTION & CONTROL

Baylisascaris, raccoon latrines, and the great outdoors...

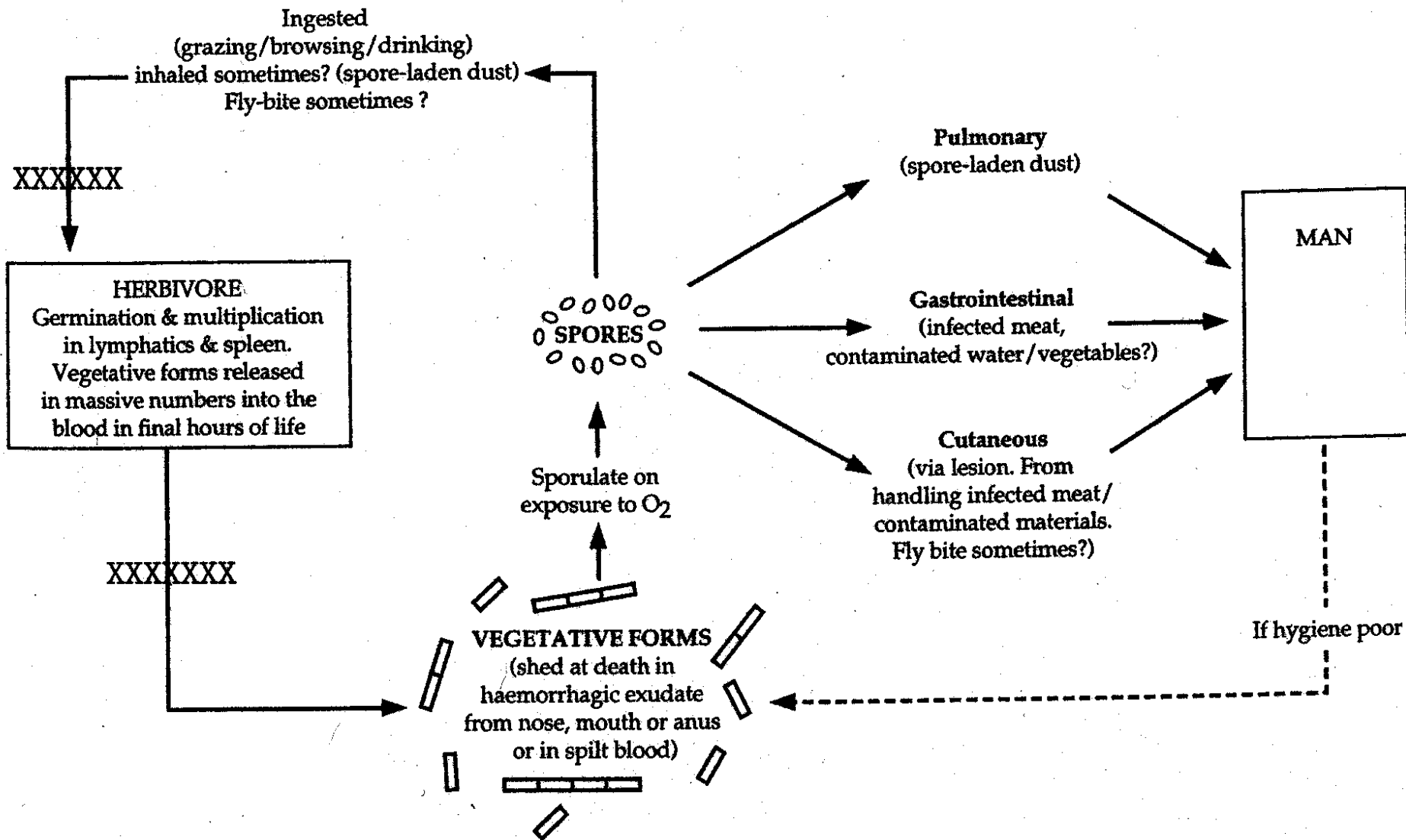


TOXOPLASMOSIS



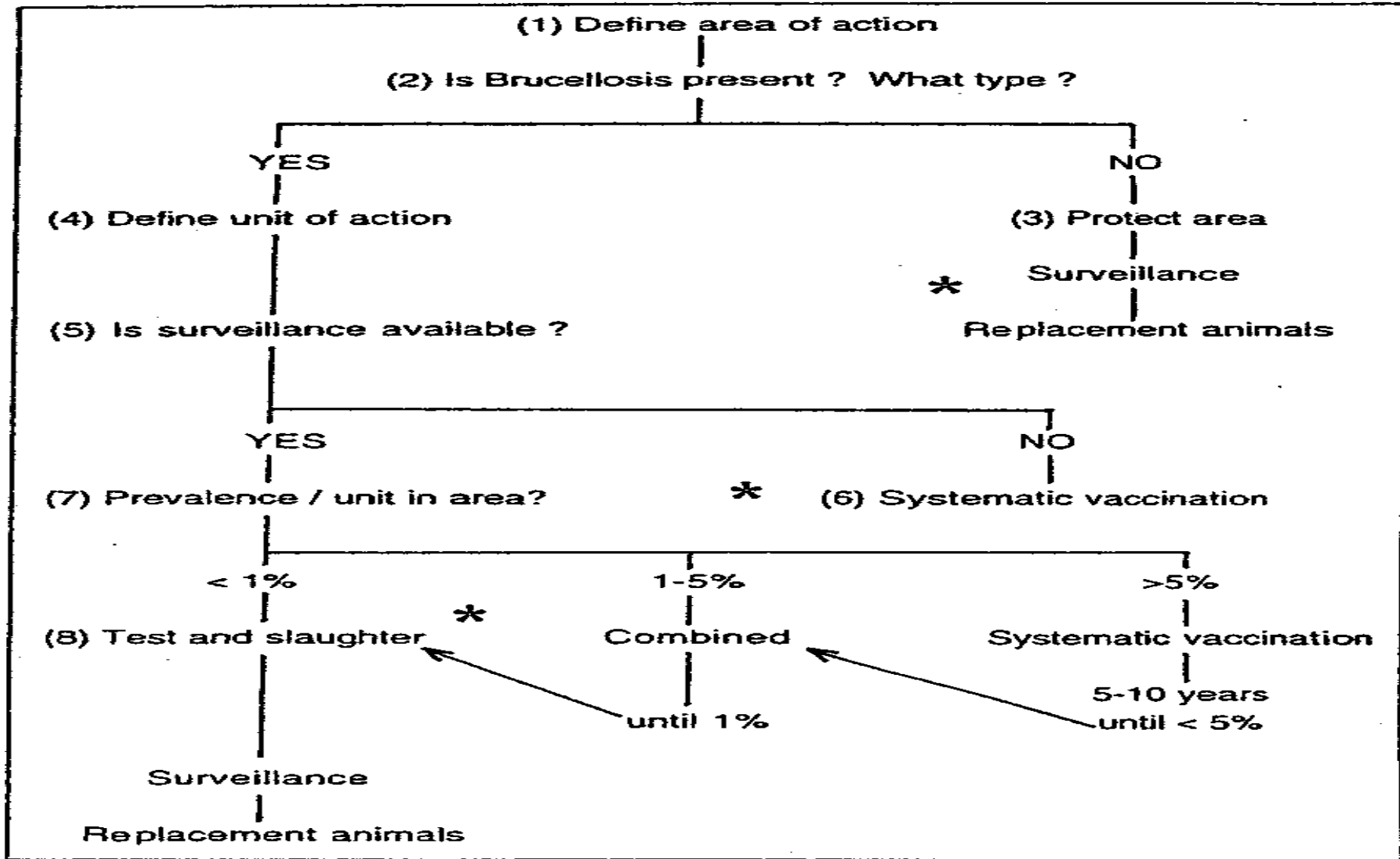
DUBEY, 1998

ANTHRAX



TURNBULL, 1998

BOVINE BRUCELLOSIS



PLOMMET et al., 1998

ZOONOSIS PREVENTION & CONTROL

Cat Scratch Disease

- ❑ **Source/breed/temperament**
- ❑ **Selection of older cats**
- ❑ **Claw trimming**
- ❑ **Bite/scratch behavior modification**
- ❑ **Flea control**
- ❑ **Vaccination??**

ZOONOSIS PREVENTION & CONTROL

Total Feral Cat Colony Management For a Potpourri of Problems

- Restricted additional members**
- Resource control**
- Vaccination**
- Drug treatment**
- Spay/Neuter**
- Surgery**
- Euthanasia**

ZOONOSIS PREVENTION & CONTROL

Rodents & HFRS viruses

- ❑ **Rodenticides**
- ❑ **Household exclusion**
- ❑ **Habitat modification**
- ❑ **Refuse removal**
- ❑ **Predator promotion**
- ❑ **Pathogen introduction**

ZOONOSIS PREVENTION & CONTROL

Defining the problem: the Filovirus reservoir(s)?

WHO

WHAT

WHERE

----- **WHY?**

WHEN

HOW

ZOONOSIS PREVENTION & CONTROL

Examining the issues: possible zoonosis 'wannabes'

- ❑ **Borna disease is a condition of horses and other vertebrates caused by a negative-stranded RNA virus**
- ❑ **Touted as an emerging zoonosis in human affective disorders**
- ❑ **Objective interpretations of serology and pcr data appear related in part to cross-reactivity and contamination**
- ❑ **Any implied methodology to target reservoirs for specific control would be impractical when information in toto suggests alternative explanations...**

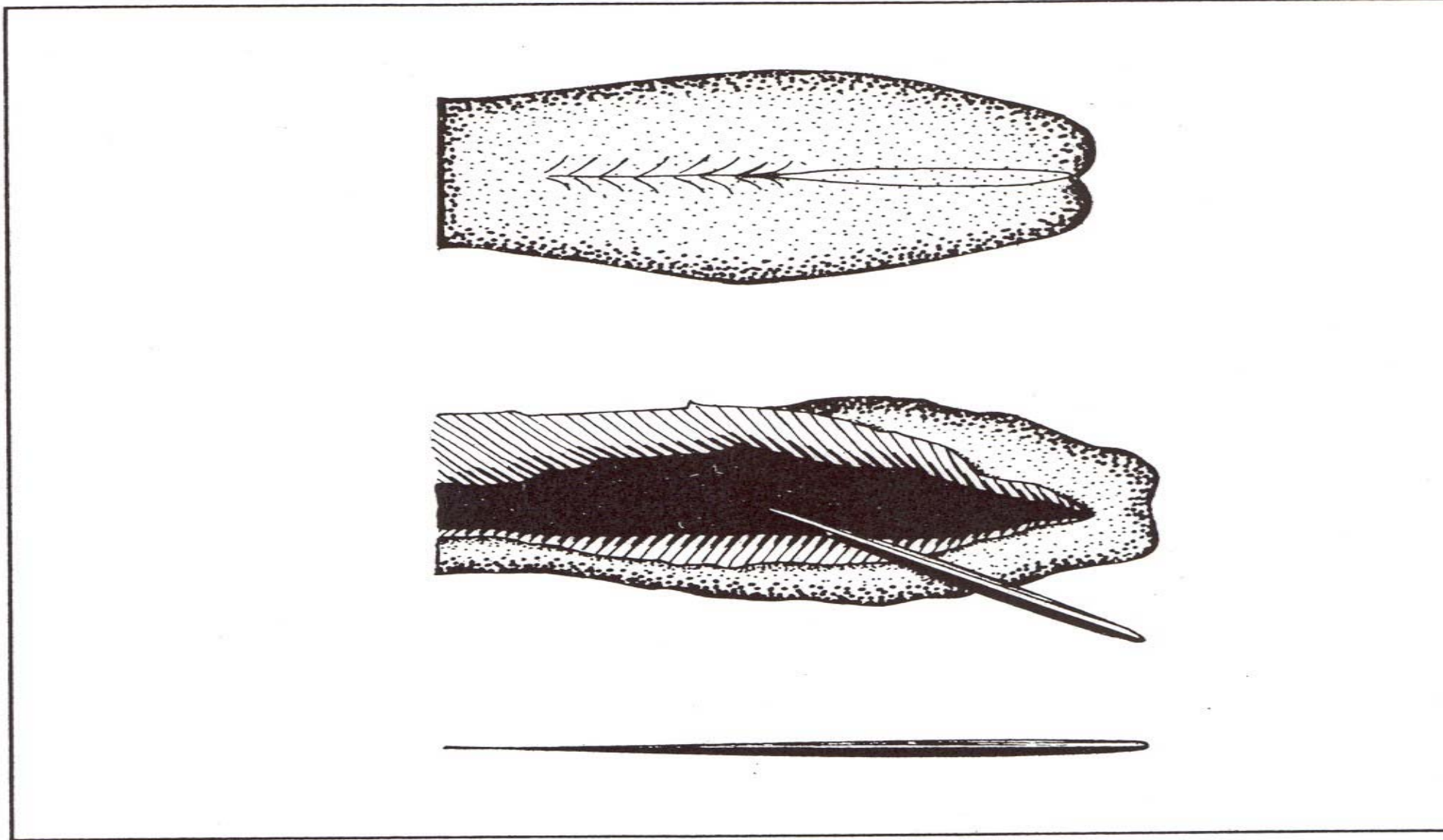
ZOONOSIS PREVENTION & CONTROL

Xenotransplantation issues

- ❑ **Rather than focus solely on a short laundry list of known pathogens to screen, proper and rigorous health promotion at the captive animal population level (closed herd, flock, school, etc.) is perhaps the better route...**

QUINTESSENTIAL RABIES CONTROL IN ANIMALS

- ❑ **Quarantine/Restricted Entry**
- ❑ **Population Reduction**
- ❑ **Movement Restriction**
- ❑ **Habitat Modification**
- ❑ **Parenteral Vaccination**
- ❑ **Oral Immunization**



This illustration from Daniel's Rural Sports (1807) details operation for removal of "worm" (lyssa) from the tongue, thought for centuries to prevent rabies. At top, line indicates site of incision. At center, mucous membrane is reflected and lyssa dissected away. At bottom is extracted "worm."

10 February 1831.



A

B I L L

To prevent the spreading of Canine Madness.

Note.—The Words printed in *Italics* are proposed to be inserted in the Committee.

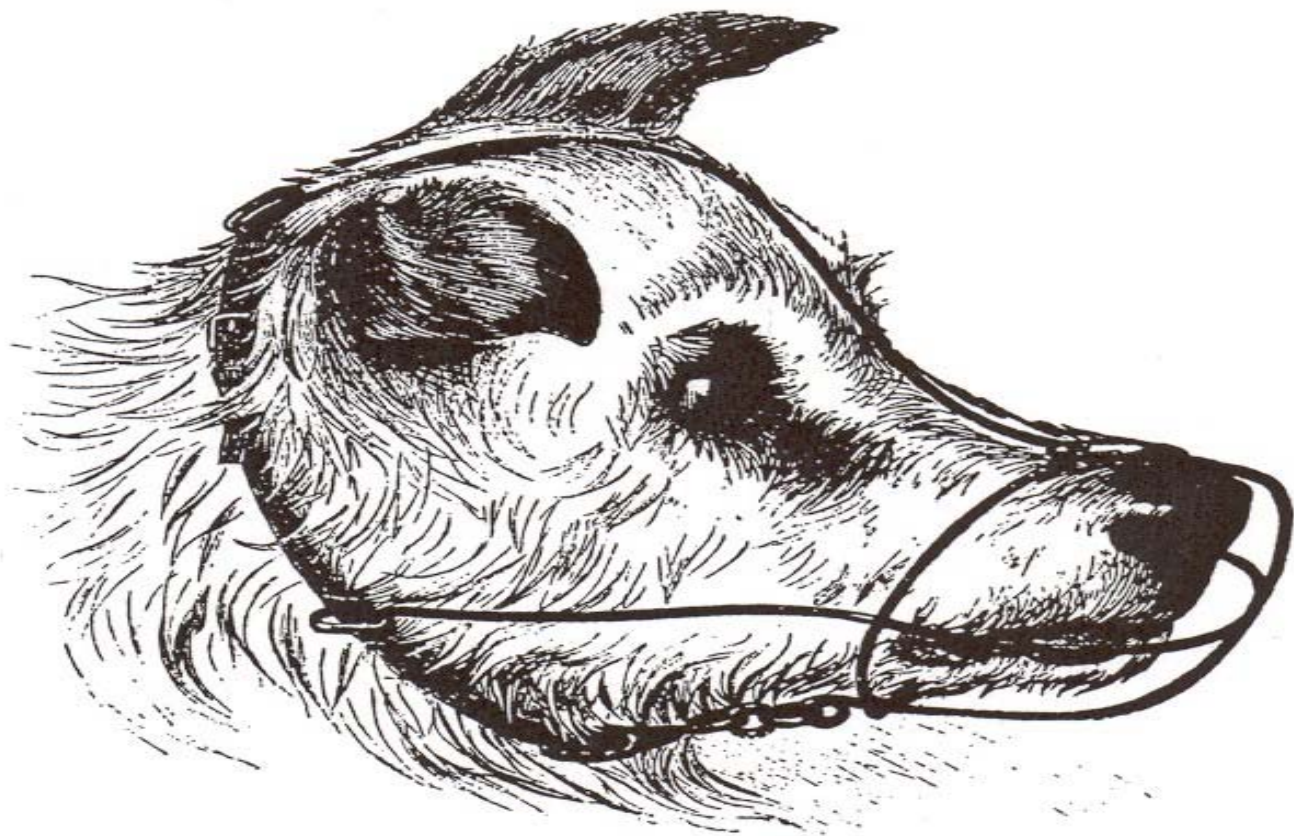
WH **H**EREA**S** many of His Majesty's Subjects have suffered from the disease occasioned by the bite of Dogs in a rabid state, and in such cases death hath ensued: And whereas in cases where parties suffer from the bite of Dogs no summary compensation can be had by them for the same, and it is expedient to provide such summary compensation: And whereas mischief to other Animals in which His Majesty's subjects have a property, hath also often ensued from the bite of Dogs: And whereas no summary compensation for such mischief can be had by the owners of such Animals; and it is therefore
10 expedient at all times, when Canine Madness is known to be prevalent, to prevent Dogs from going at large, and to empower Justices of the Peace and others to fine the owners, and if necessary, to cause any Dogs to be destroyed, and also and at all times to make summary compensation to the parties injured by the bite of Dogs, or to the owners
15 of Animals so injured; **B**C it therefore **C**hacted, by The KING's most Excellent MAJESTY, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the Authority of the same, **T**HAT from and after the *passing of this Act*, it shall be lawful for any Justice of the Peace,
20 or Chief Magistrate, on information or suspicion of the existence of Canine Madness, to issue a public Notice, requiring all Dogs within any parish, wapentake, division, city, borough, liberty, township, market town, franchise, hamlet, tithing, precinct and chapelry, mentioned in such notice, to be kept confined during the time therein stated;

Preamble.

Magistrates, upon information of Canine Madness, empowered to issue Notices, ordering all Dogs to be confined.

England Muzzling Law, 1831.

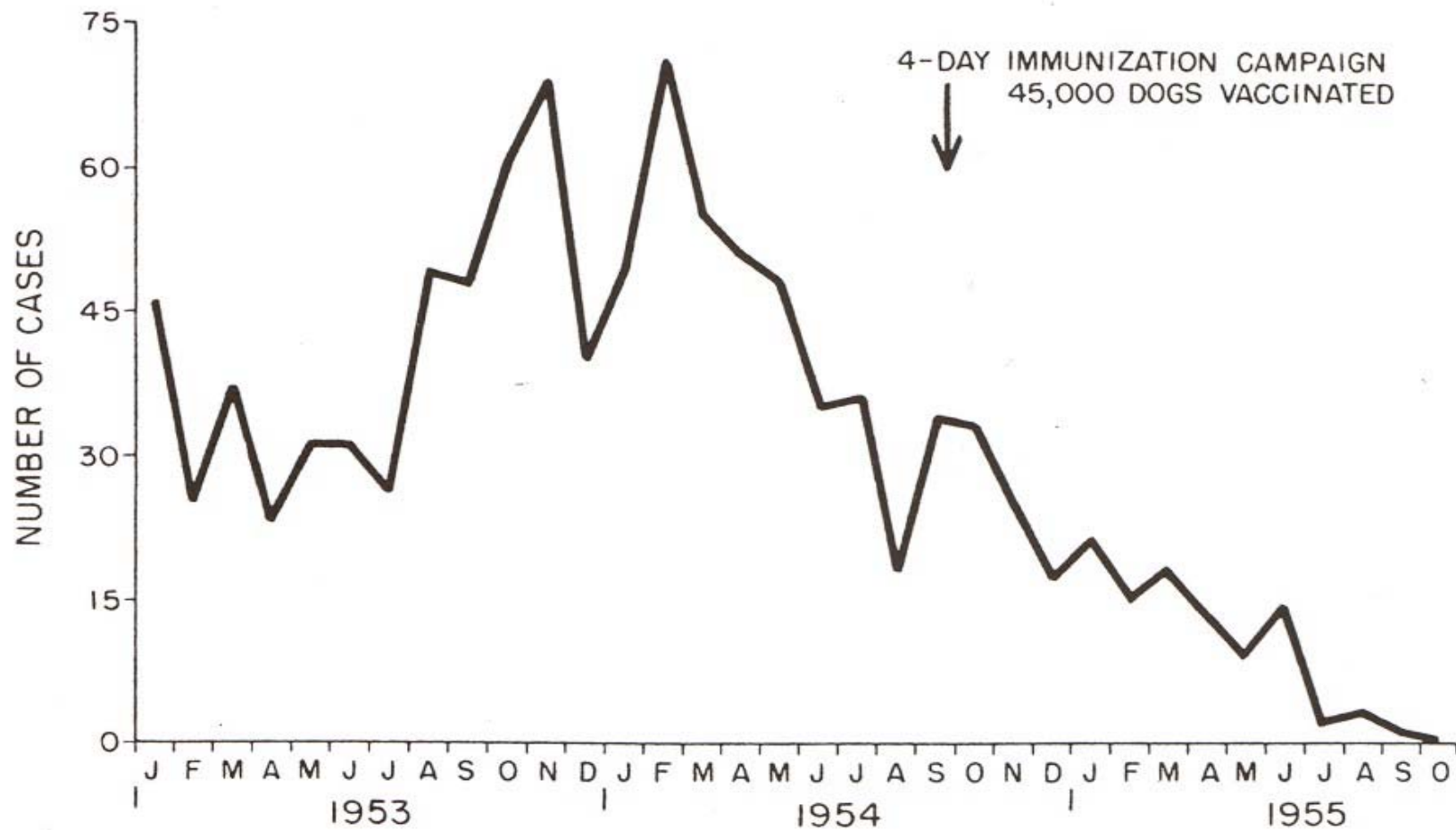
BAER et al., 1996



FLEMING, 1872

VACINE SEU CÃO CONTRA RAIVA



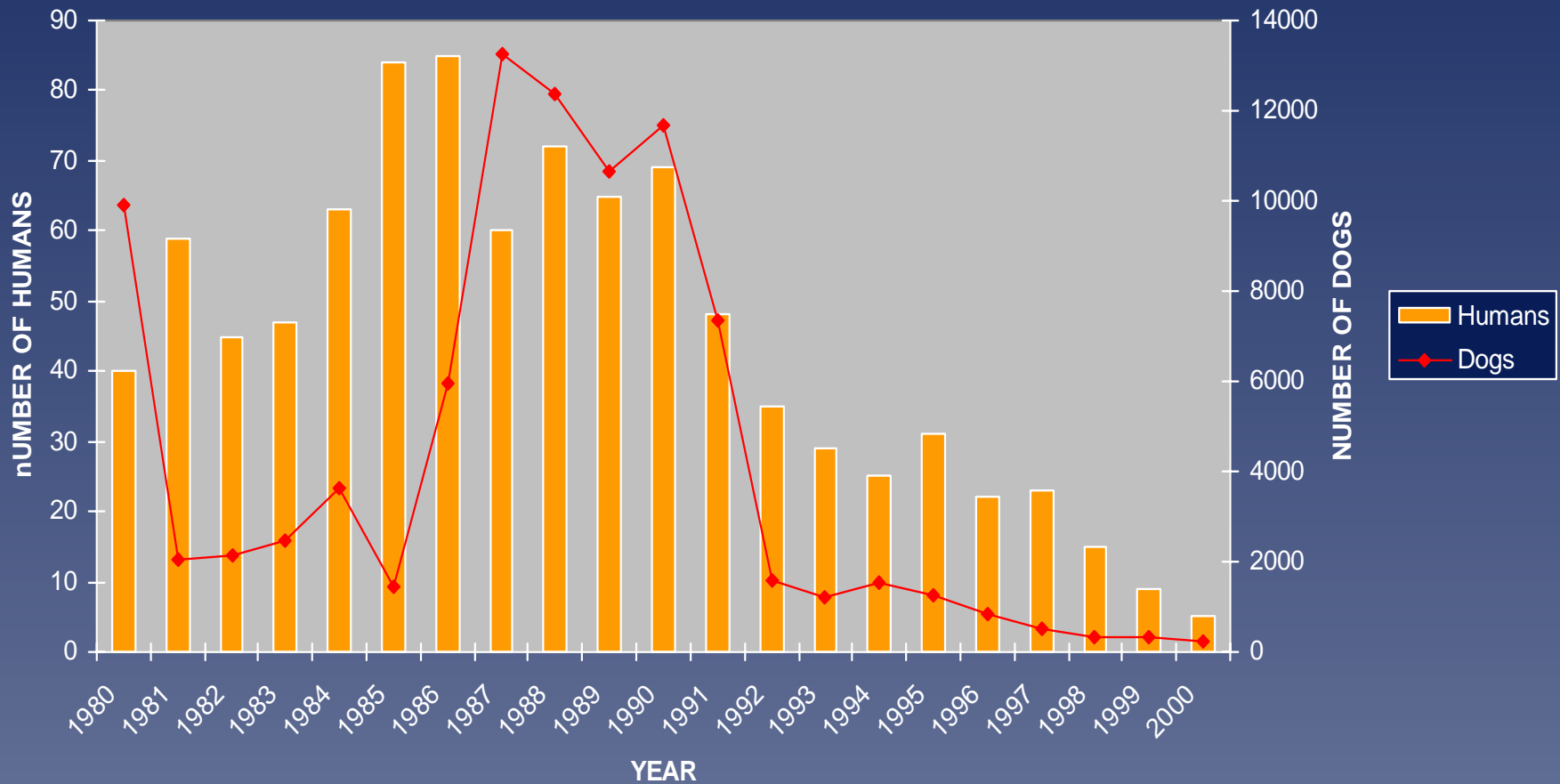


Monthly incidence of animal rabies, Houston-Harris County, Texas, January 1953 to October 1955 (Tierkel, 1956).

SELECTED EXAMPLES OF CANINE RABIES ELIMINATION

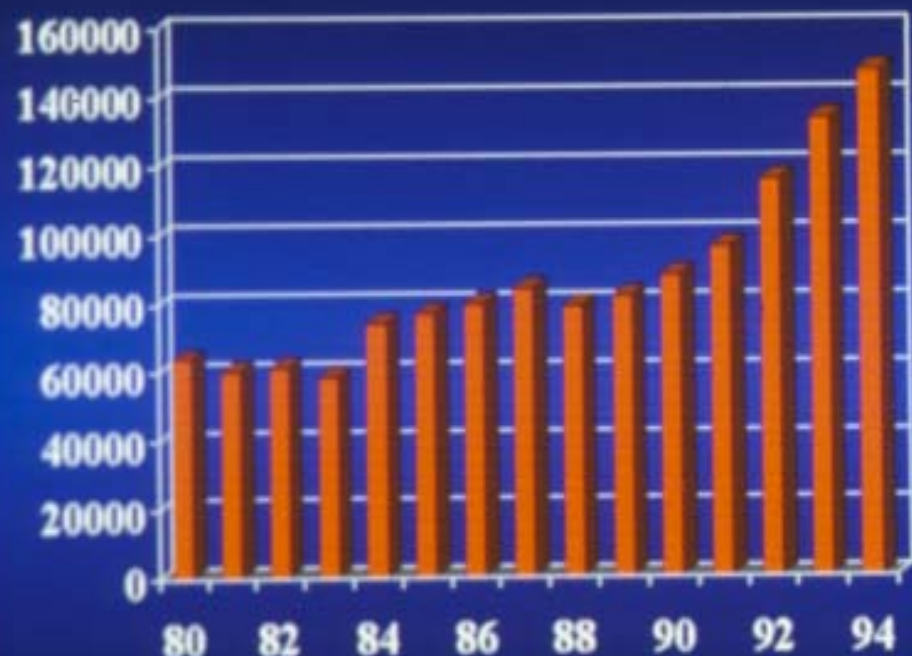
- ❑ **United Kingdom, 1922**
- ❑ **Malaysia, 1955**
- ❑ **Japan, 1956**
- ❑ **Taiwan, 1961**
- ❑ **Portugal, 1961**
- ❑ **Uruguay, 1983**

Canine & Human Rabies: Mexico

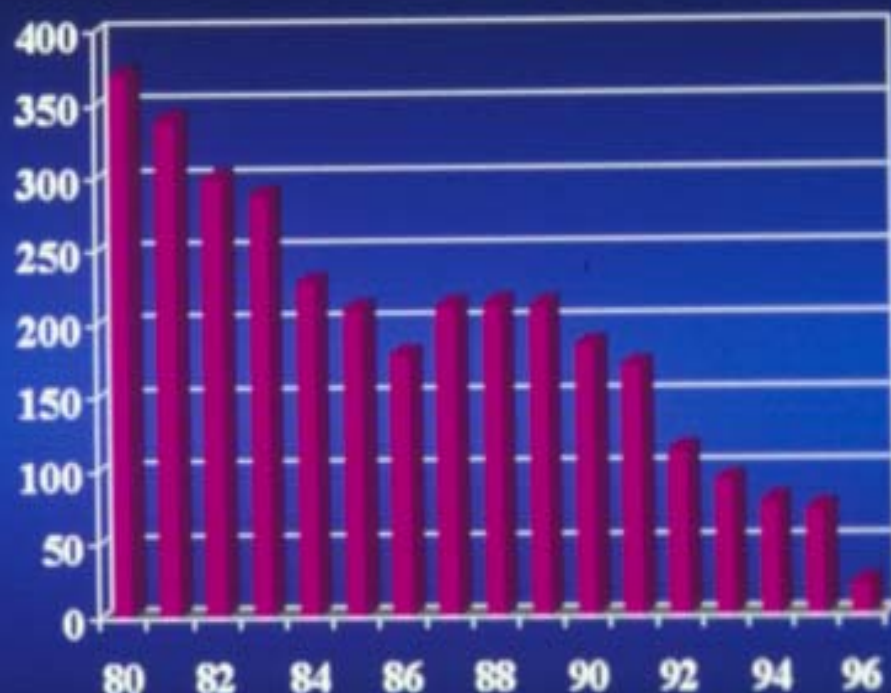


Thailand

Rabies PET



Rabies death



- ◆ about 2.6 mill dogs annually vaccinated
- ◆ annual costs US\$ 6.5 mill

WHO/EMC









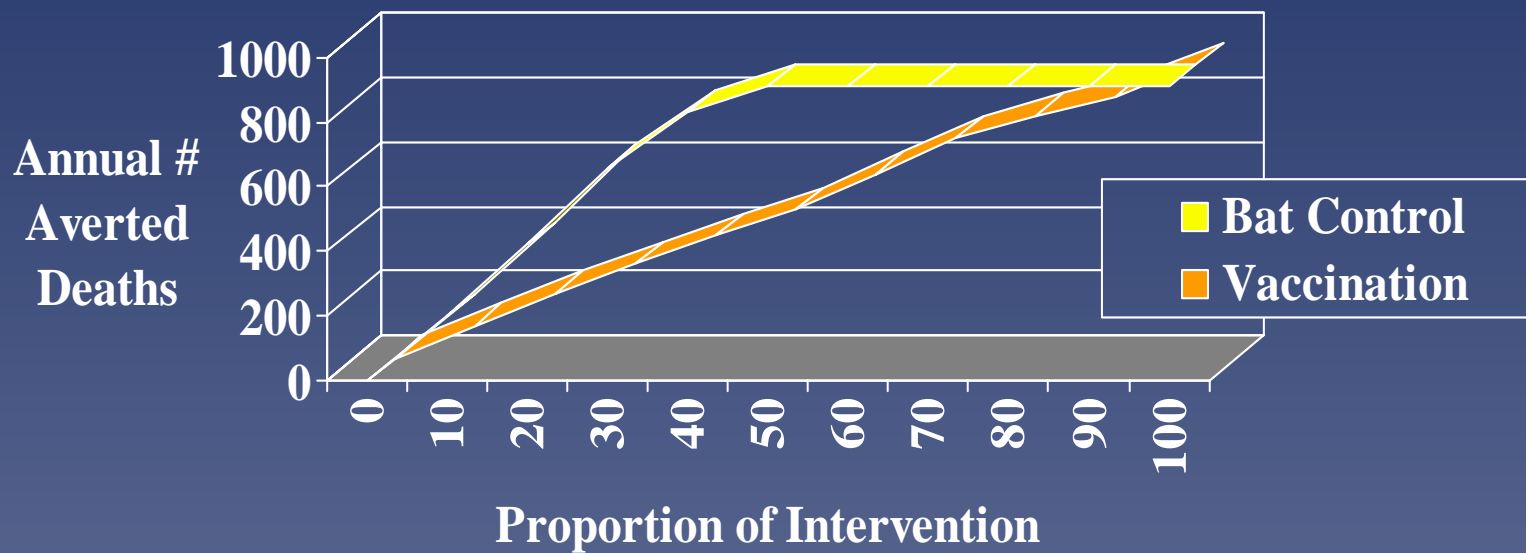
INSTITUTO VENEZOLANO DE INVESTIGACIONES CIENTÍFICAS
SERVICIO DE INVESTIGACIONES ZOOLOGICAS
SERVICIO DE INVESTIGACIONES DE REPTILES Y ANFIBIOS
CALLE JOSE MARACAY ENRIQUETA
CAROLINA, VENEZUELA



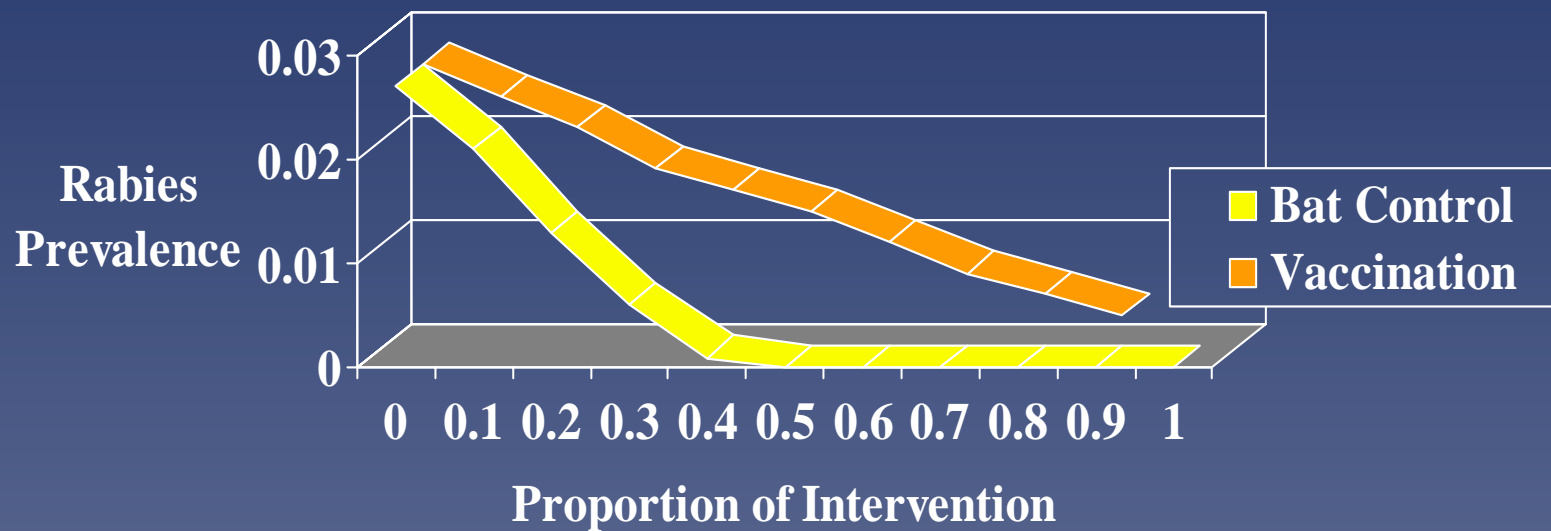
VAMPIRE BAT POPULATION REDUCTION: ANTI-COAGULANT USE

| METHOD | PLACE | BITE REDUCTION | REFERENCE |
|--------------------------------|------------------------------------|--------------------------|---|
| Systemic Tx. Cattle | Mexico (ir) Mexico (im) | 90-98% 88-97% | Thompson et al. 1972 Flores-Crespo et al. 1979 |
| Topical Tx. Bites | Mexico | 81-95% | Flores-Crespo et al. 1991 |
| Topical Tx. Bats | Mexico Brazil | 96% 91-100% | Flores-Crespo et al. 1991 Kverno et al. 1976 |

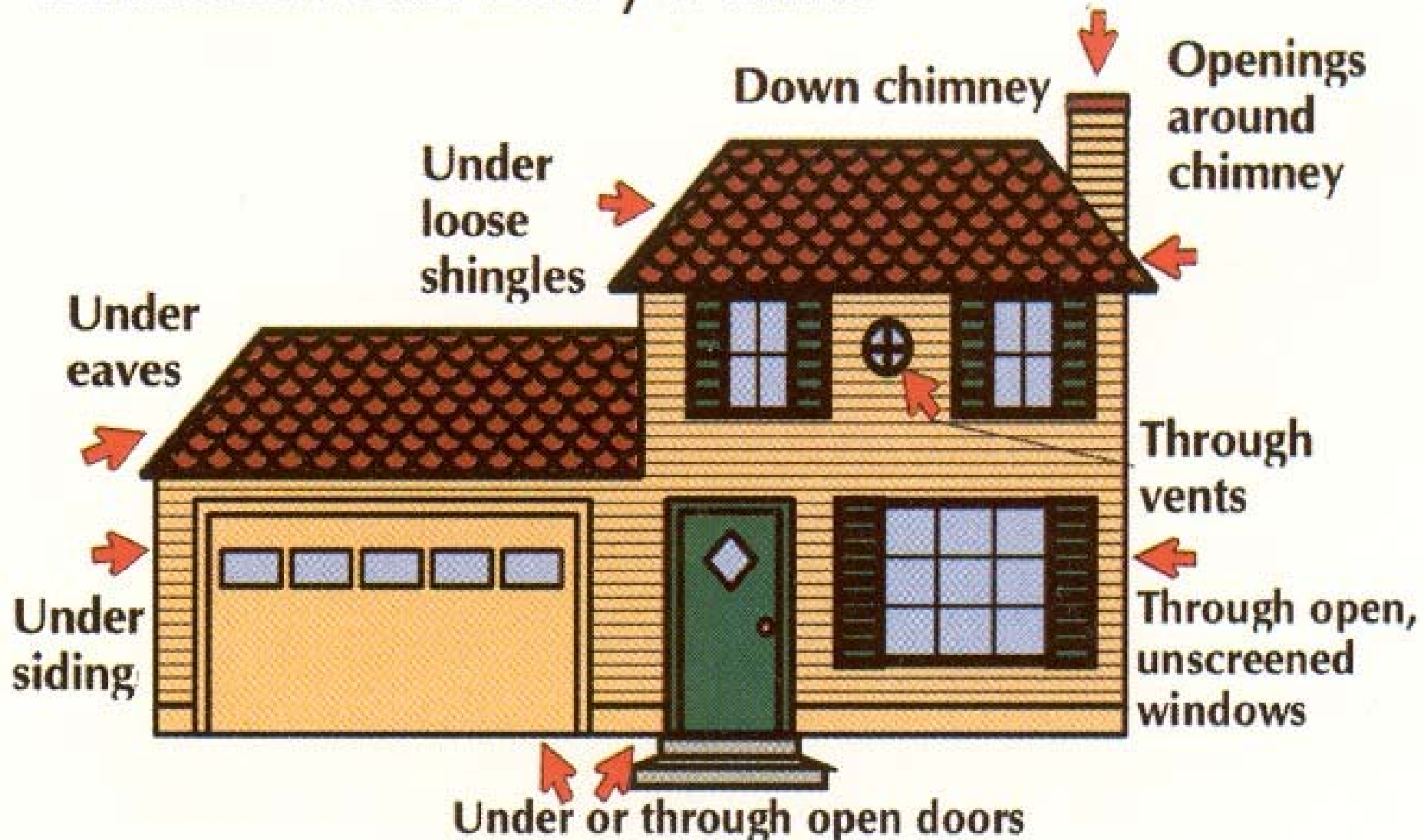
A MODEL OF VAMPIRE BAT CONTROL (Massad et al. 2001)



A MODEL OF VAMPIRE BAT CONTROL (Massad et al. 2001)



Common Bat Entry Points



POPULATION REDUCTION: Alberta, Canada 1952-56 (strychnine baits)

| <u>Taxa</u> | <u>Number Poisoned</u> |
|------------------|------------------------|
| Fox | 55,889 |
| Coyote | 53,364 |
| Lynx | 10,044 |
| Wolf | 5,461 |
| Bear | 4,130 |
| Skunk | 664 |
| Cougar | 69 |
| Fisher | 18 |
| Badger | 4 |
| Wolverine | 1 |

Ballantyne, 1958

ISL
(rabies free)

NOR
(rabies free)

FIN
(rabies free)

SWE
(rabies free)

Rabies Cases Europe
1st Quarter 1984
750 cases reported

DEN
(rabies free)

IRE
(rabies free)

GBR
(rabies free)

NET
(42)

(2002)

POL
(302)

BEL
(28)

FED
(197)

CZE
(202)

FRA
(1000)

AUT
(400)

HUN
(125)

SWI
(270)

RUM
(50)

ITA
(128)

YUG
(100)

POR
(rabies free)

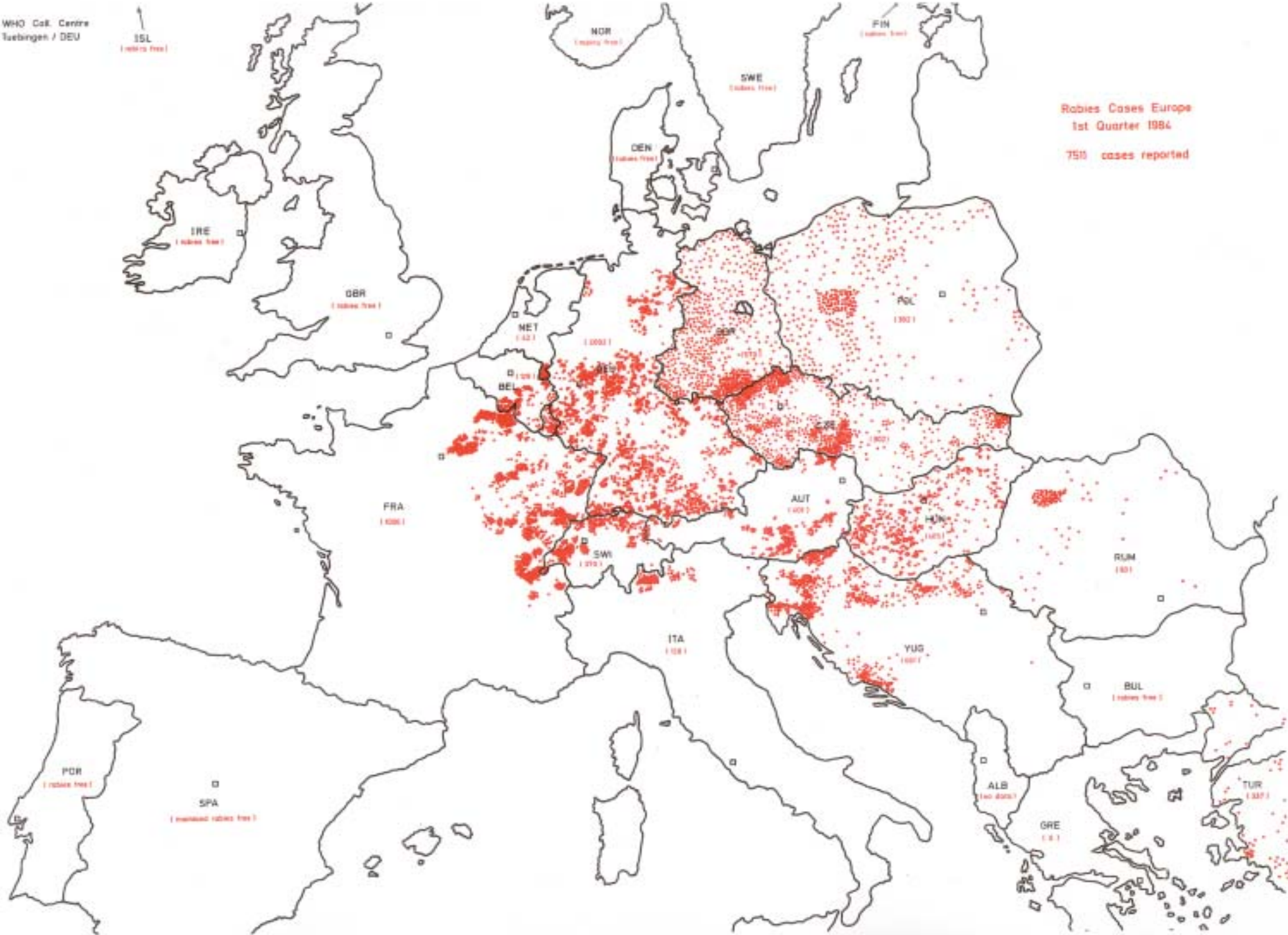
SPA
(reintroduced rabies free)

BUL
(rabies free)

ALB
(no cases)

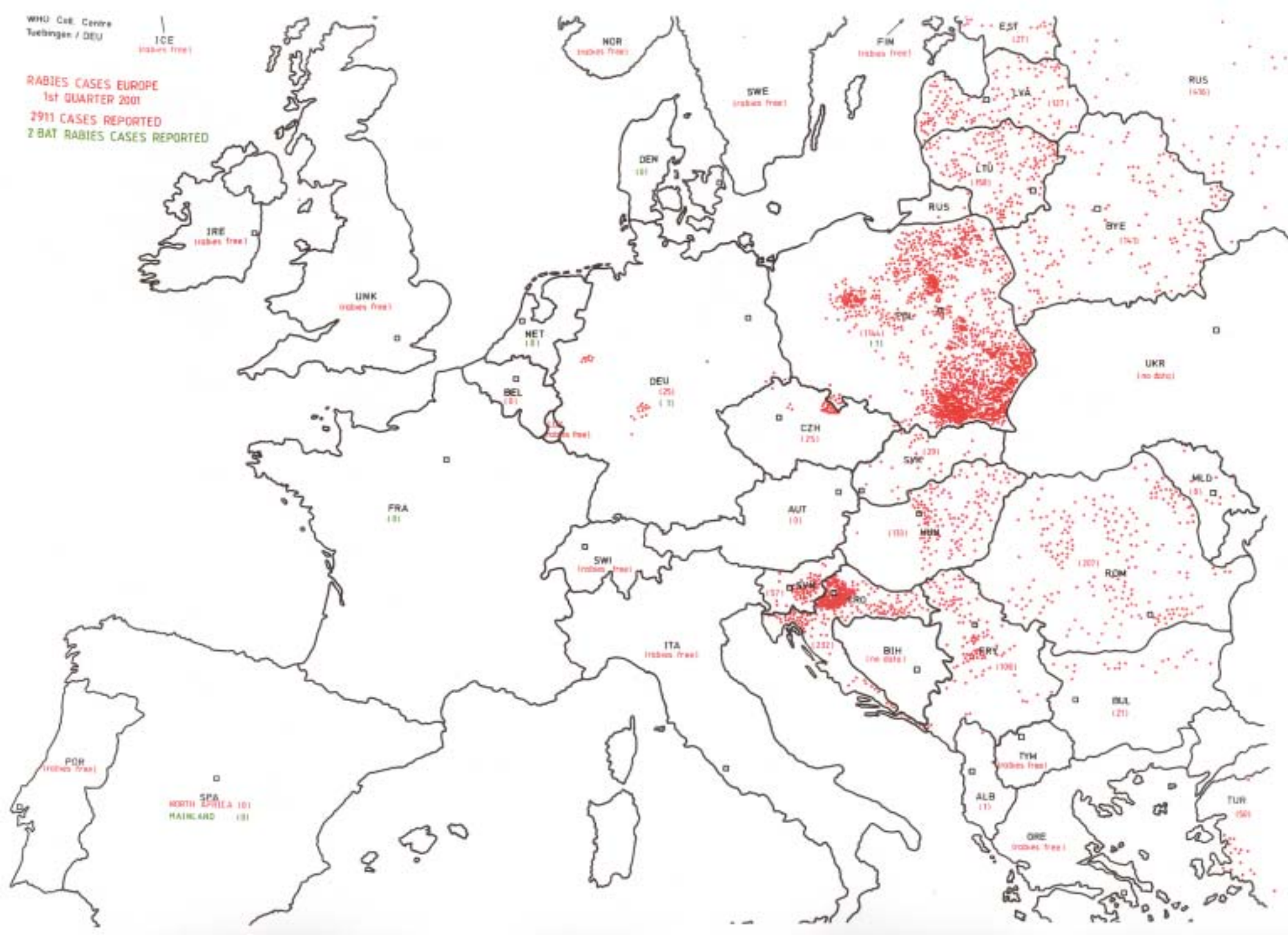
GRE
(8)

TUR
(327)



WHO Coll. Centre
Tuebingen / DEU
ICE
(rabies free)

RABIES CASES EUROPE
1st QUARTER 2001
2911 CASES REPORTED
2 BAT RABIES CASES REPORTED



ZOONOSIS PREVENTION & CONTROL

A FOCUS ON THE RESERVOIR(S) OR A QUESTION OF BALANCE?

- ❑ Dairy/beef & bovine tuberculosis?
- ❑ Small ruminants & brucellosis?
- ❑ Poultry practices & influenza?
- ❑ Cannibalistic hooved stock and TSEs?
- ❑ Modern swine production & Nipah?
- ❑ Etc.