

# **International Conference on Emerging Infectious Diseases: Zoonotic Diseases**

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

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**Viral & Rickettsial Zoonoses Branch**

# 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.?)

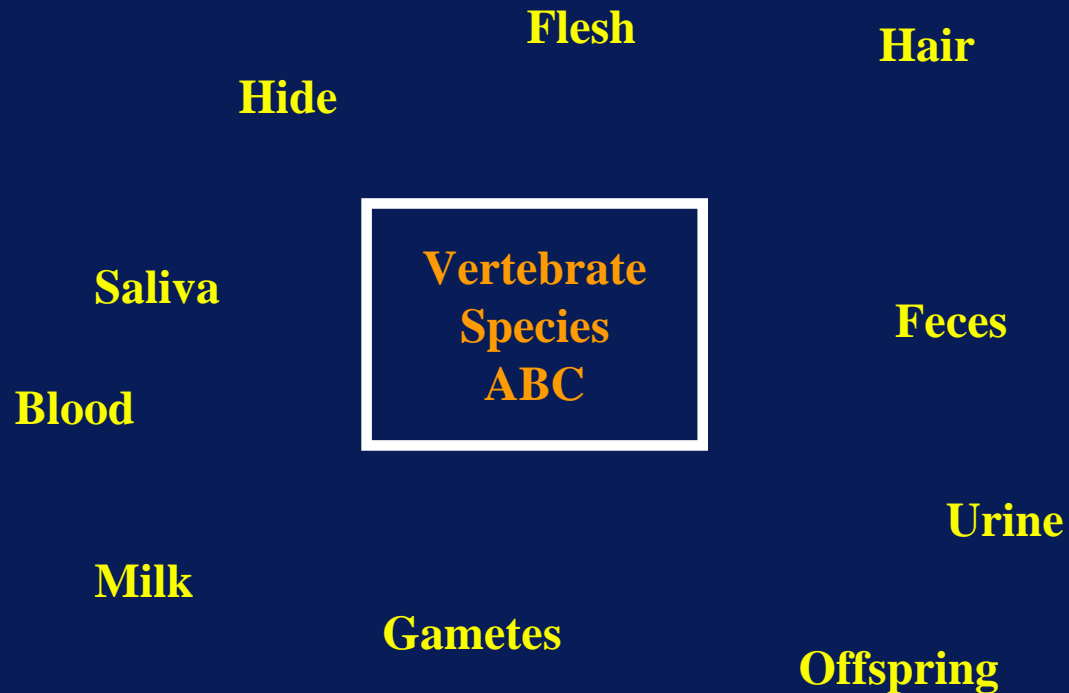
Infrastructure (inter-sectoral cooperation, diagnostics, etc.)

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

# ZOONOSIS PREVENTION & CONTROL

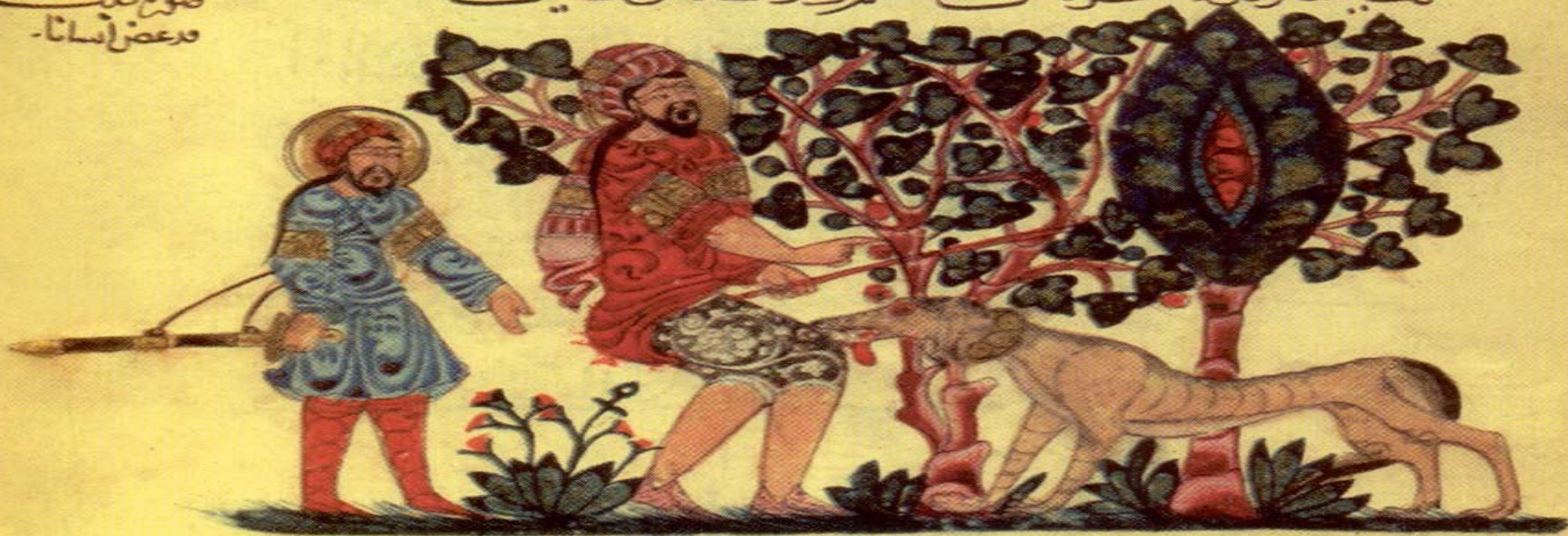
## QUALITATIVE CONCERNS: VEHICLES\* OF TRANSMISSION

\*(more than 1 may apply)



وَعَسَىٰ أَنْ يَكُونَ مِنْهُمْ مَنْ يَهْتَدِي مِنَ النُّورِ وَمِنْهُمْ مَنْ تُضَلُّهُ  
 وَمِنْهُمْ مَنْ يَبِيعُ مِثْلَ الْكَلْبِ وَيَعْضُرُ مِنْ أُمَّرِيَّتِهِ قُصْبَةً  
 تَلْكُ أَيْضًا وَقَدْ ذَكَرْنَا أَنْتُمْ رَأْسَ الْإِنْسَانِ وَأَنْسَانًا وَأَنْسَانًا فَانْقَلَبْنَا

صورة طير طير  
 وعضر انسانا.



وَأَنْ أَوْدَعُوا رَأْسَ الْإِنْسَانِ فِي هَذِهِ الْآقَةِ وَمَنْ سَوَّوْنَا وَإِنْ أَحَدٌ مَّا عَضُرَ وَكَانَ  
 بِهَذَا الْبَلِيَّةِ وَخَلَصَ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ مَعَهُ  
 وَأَمَّا الْآخَرُ فَكَانَ السَّمْعُ صَدِيْقًا لِفَخْرٍ الْمَا فَلَادِمَانَ

# ZOONOSIS PREVENTION & CONTROL

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## 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

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**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

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**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

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**“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

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## 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...**

# ZOONOSIS PREVENTION & CONTROL

## SPATIO-TEMPORAL & RESOURCE ISSUES



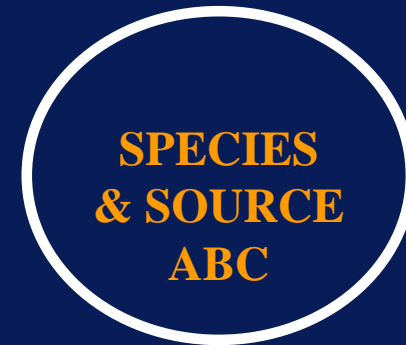
# ZOONOSIS PREVENTION & CONTROL

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## GROSS ENTRY RESTRICTIONS: COARSE-GRAINED



X



# ZOONOSIS PREVENTION & CONTROL

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## SITE RESTRICTIONS: MEDIUM-GRAINED

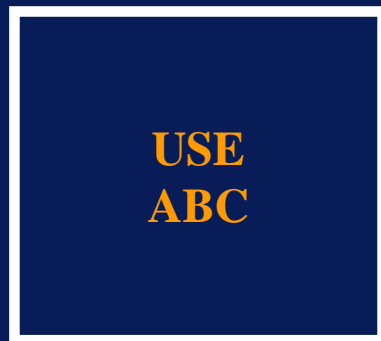
**SINK  
ABC**  
(e.g. government,  
university, zoo,  
private, etc.)

**X**

**SPECIES  
ABC**

# ZOONOSIS PREVENTION & CONTROL

## UTILIZATION RESTRICTIONS: MORE FINE-GRAINED

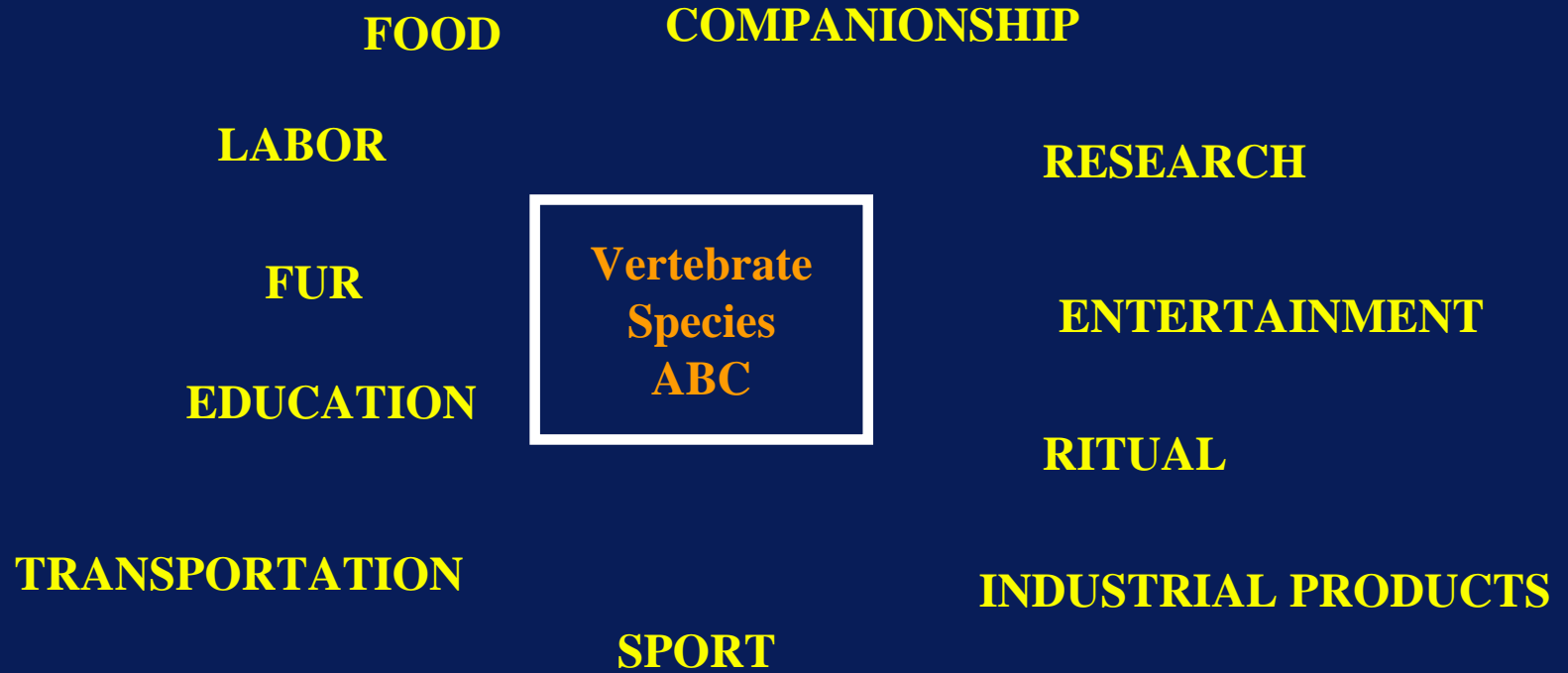


X



# ZOOONOSIS PREVENTION & CONTROL

## SELECTED EXAMPLES OF REGULATED ANIMAL USE



# ZOOONOSIS PREVENTION & CONTROL

## COMING TO TERMS WITH LETHALITY: "FATAL DISTRACTIONS"

EUTHANASIA

POPULATION REDUCTION

SELECTED CULLING

TEST/SLAUGHTER

PREDATOR CONTROL

Vertebrate  
Species  
ABC

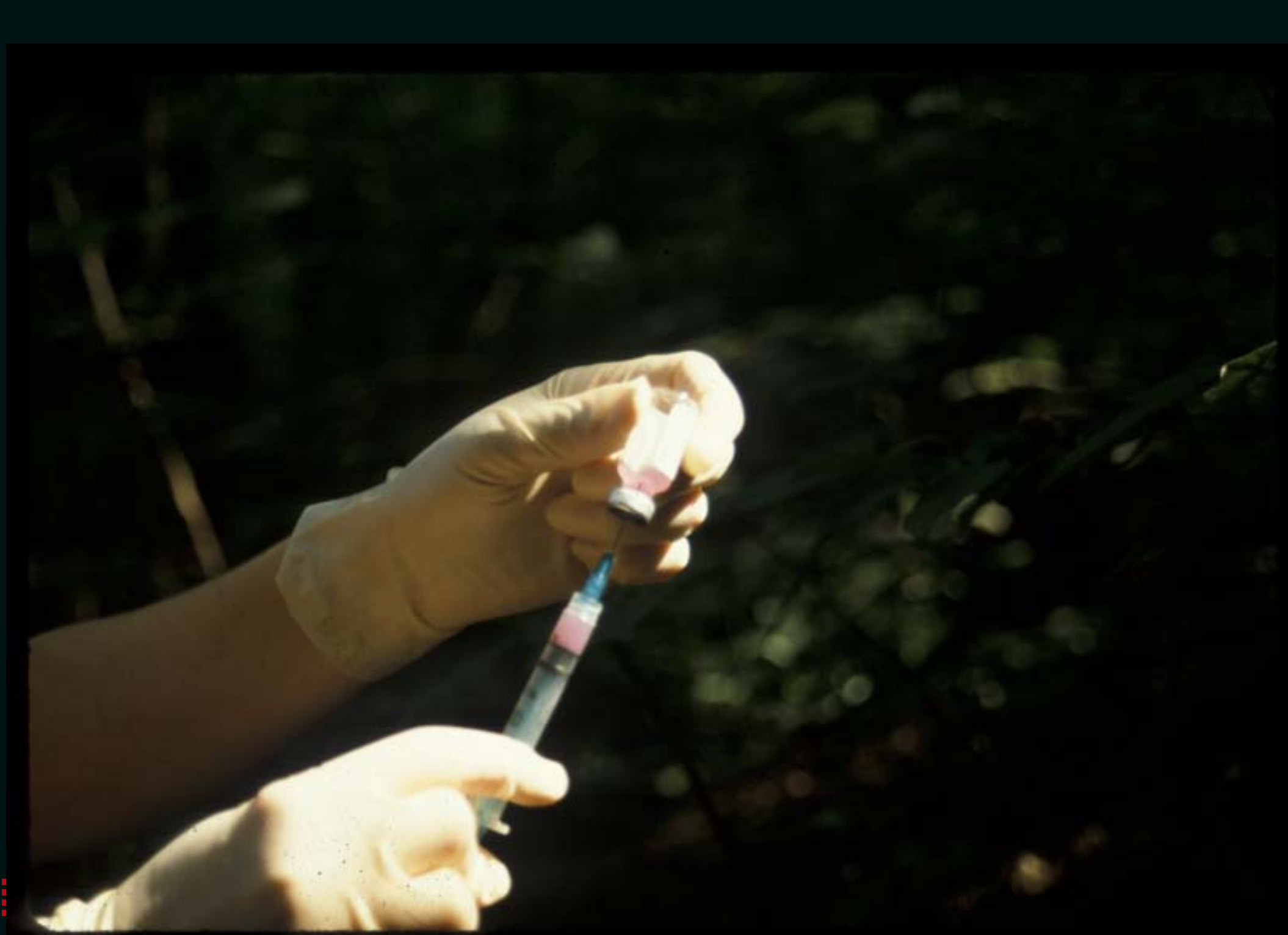
OPEN SEASONS

SANCTIONED BOUNTIES

HABITAT DESTRUCTION

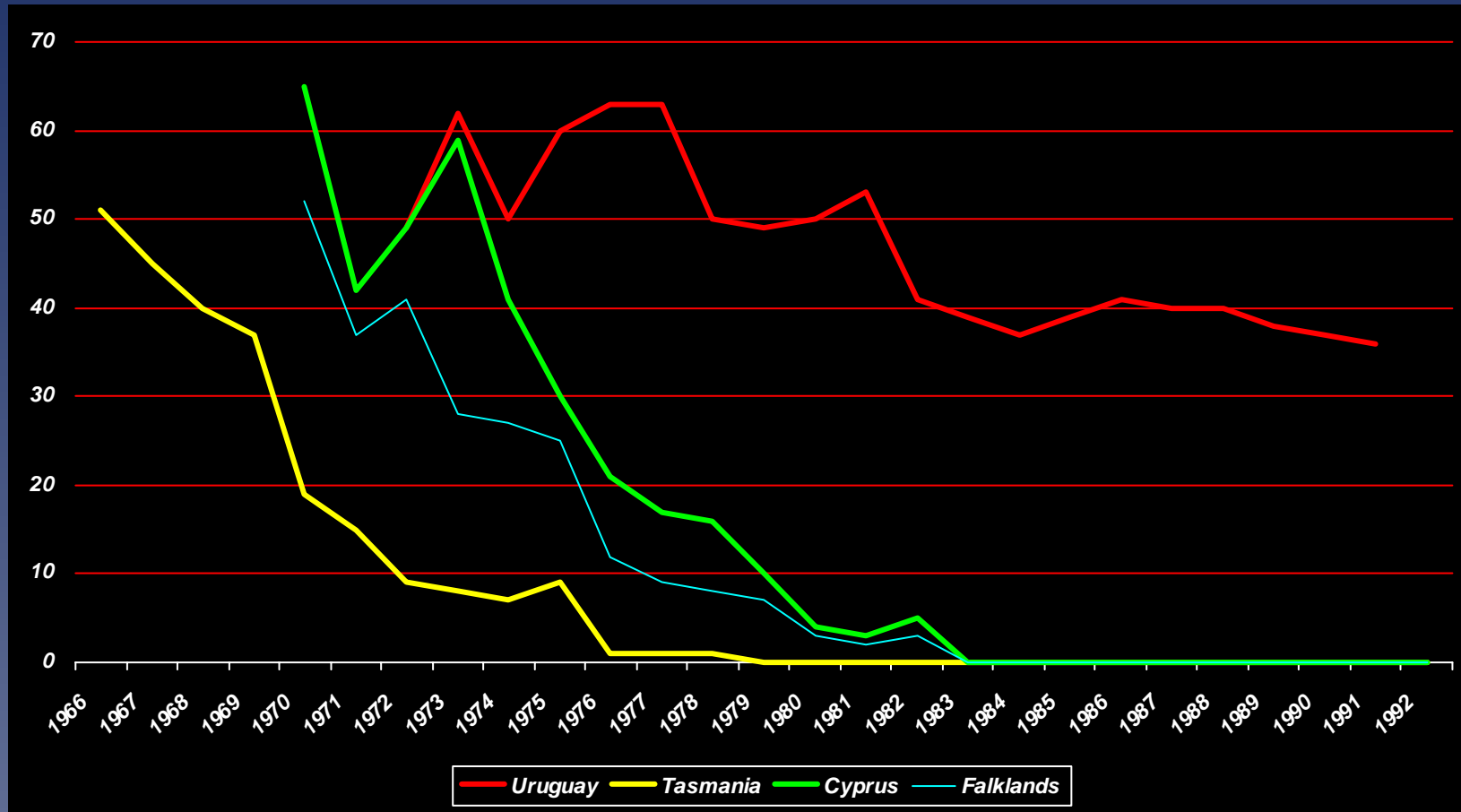
'VERMIN' REGULATION, ALA SNAKE ROUND-UPS, SHARK HUNTING REDUX' 'JAWS'

INTENTIONAL EXTIRPATION





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



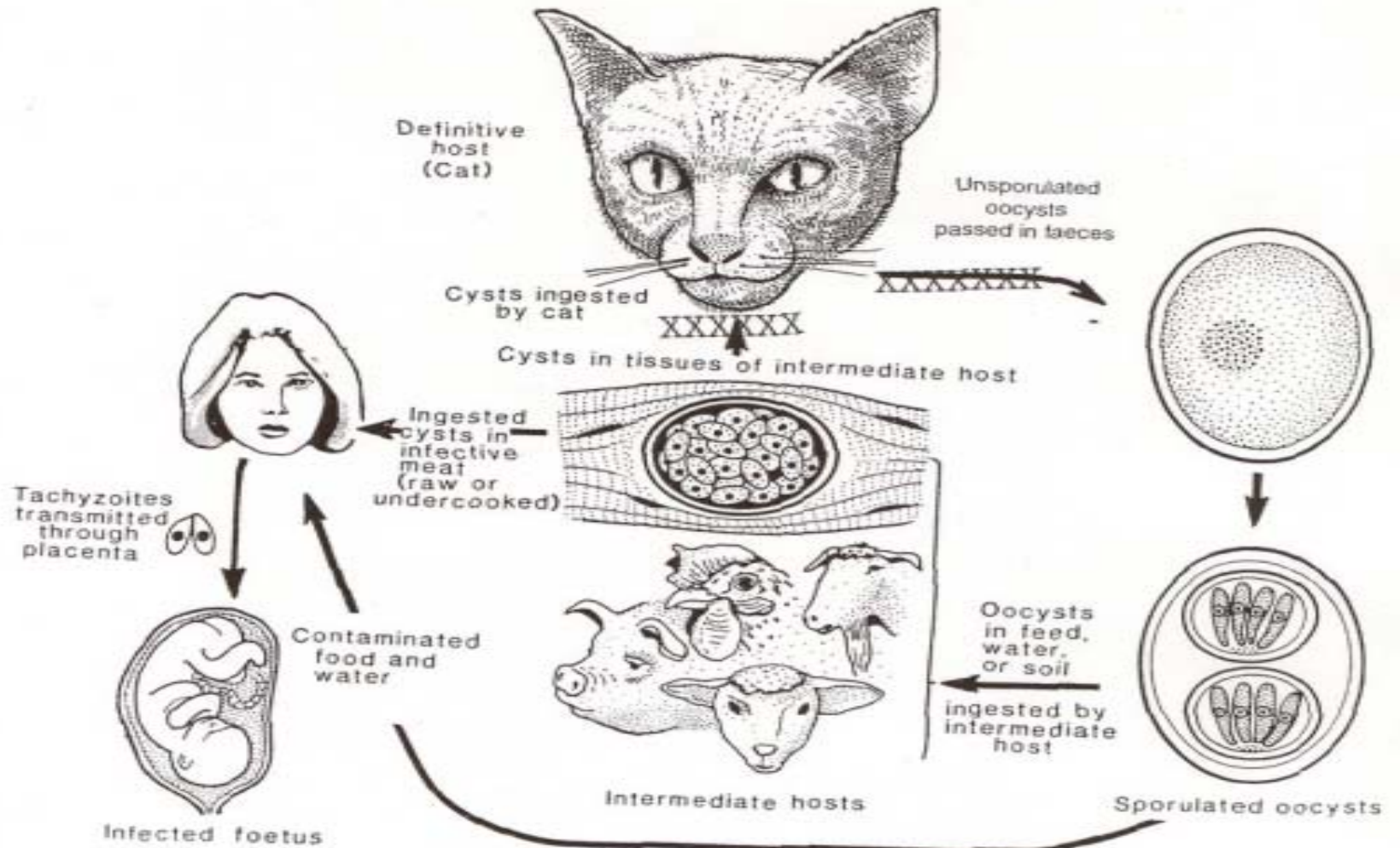
# ZOONOSIS PREVENTION & CONTROL

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

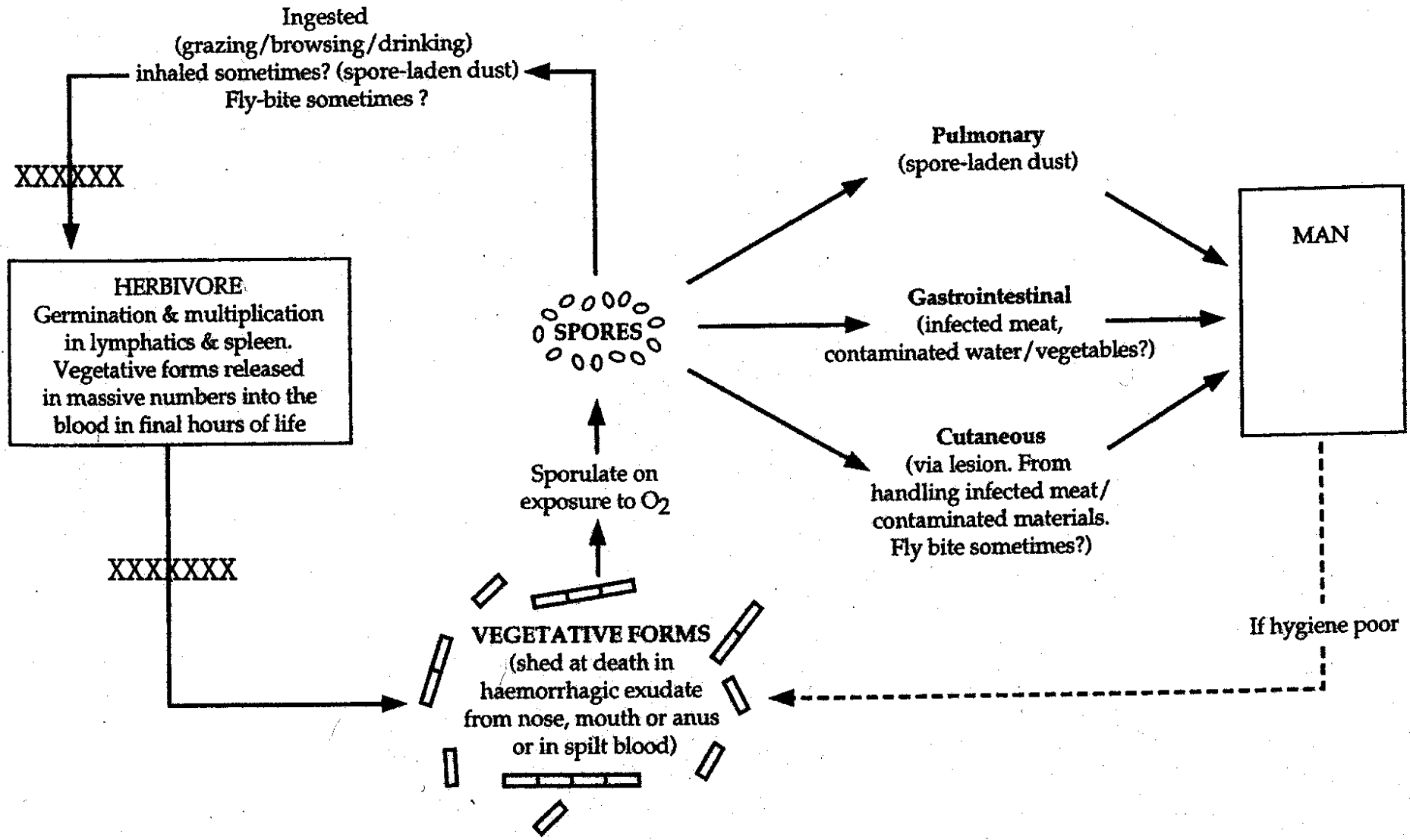


# TOXOPLASMOSIS



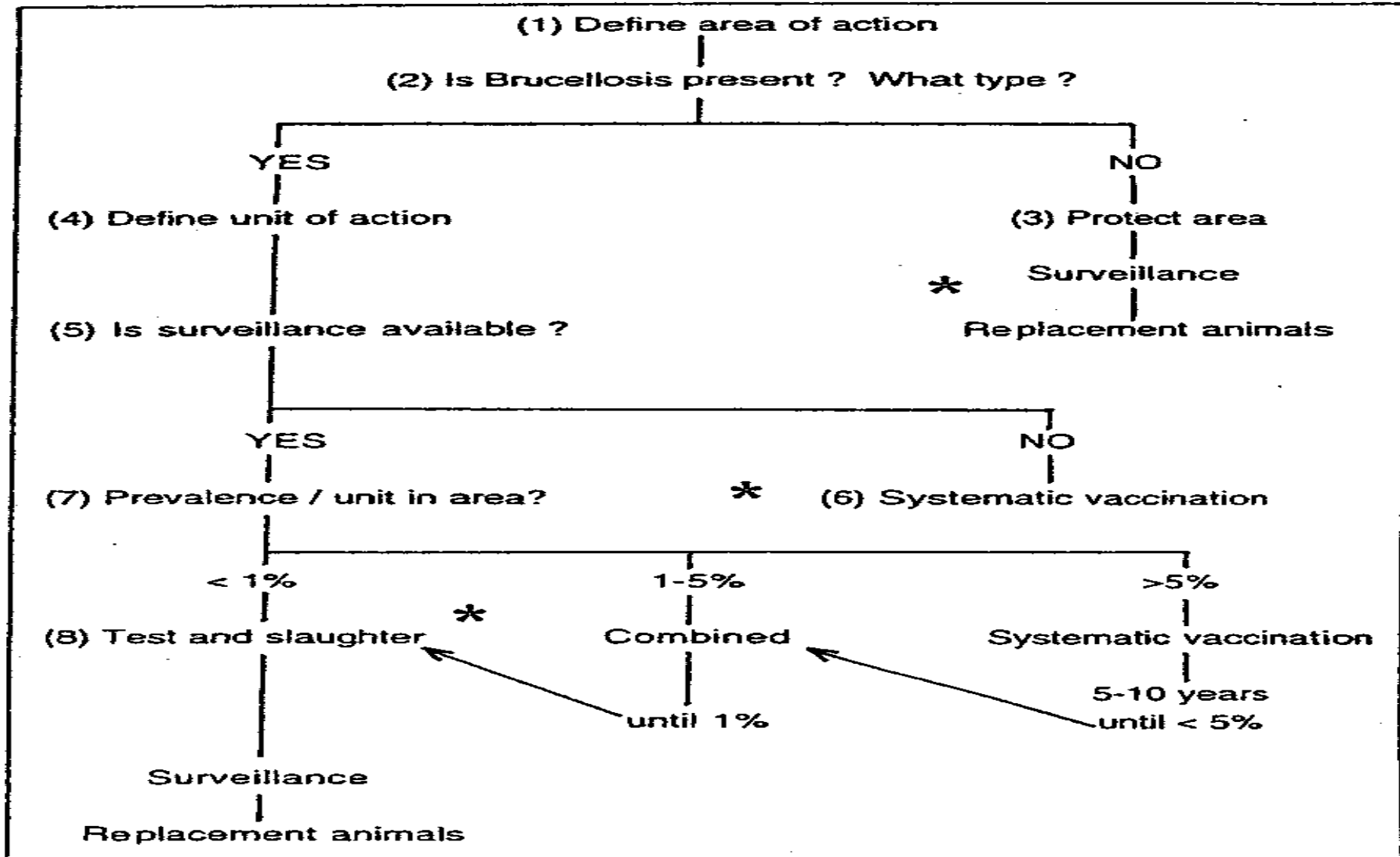
DUBEY, 1998

# ANTHRAX



TURNBULL, 1998

# BOVINE BRUCELLOSIS



PLOMMET et al., 1998

# ZOONOSIS PREVENTION & CONTROL

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## Cat Scratch Disease

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

# ZOONOSIS PREVENTION & CONTROL

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## 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

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## Rodents & HFRS viruses

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



# ZOONOSIS PREVENTION & CONTROL

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Defining the problem: the Filovirus reservoir(s)?

**WHO**

**WHAT**

**WHERE**

----- **WHY?**

**WHEN**

**HOW**

# ZOONOSIS PREVENTION & CONTROL

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## 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

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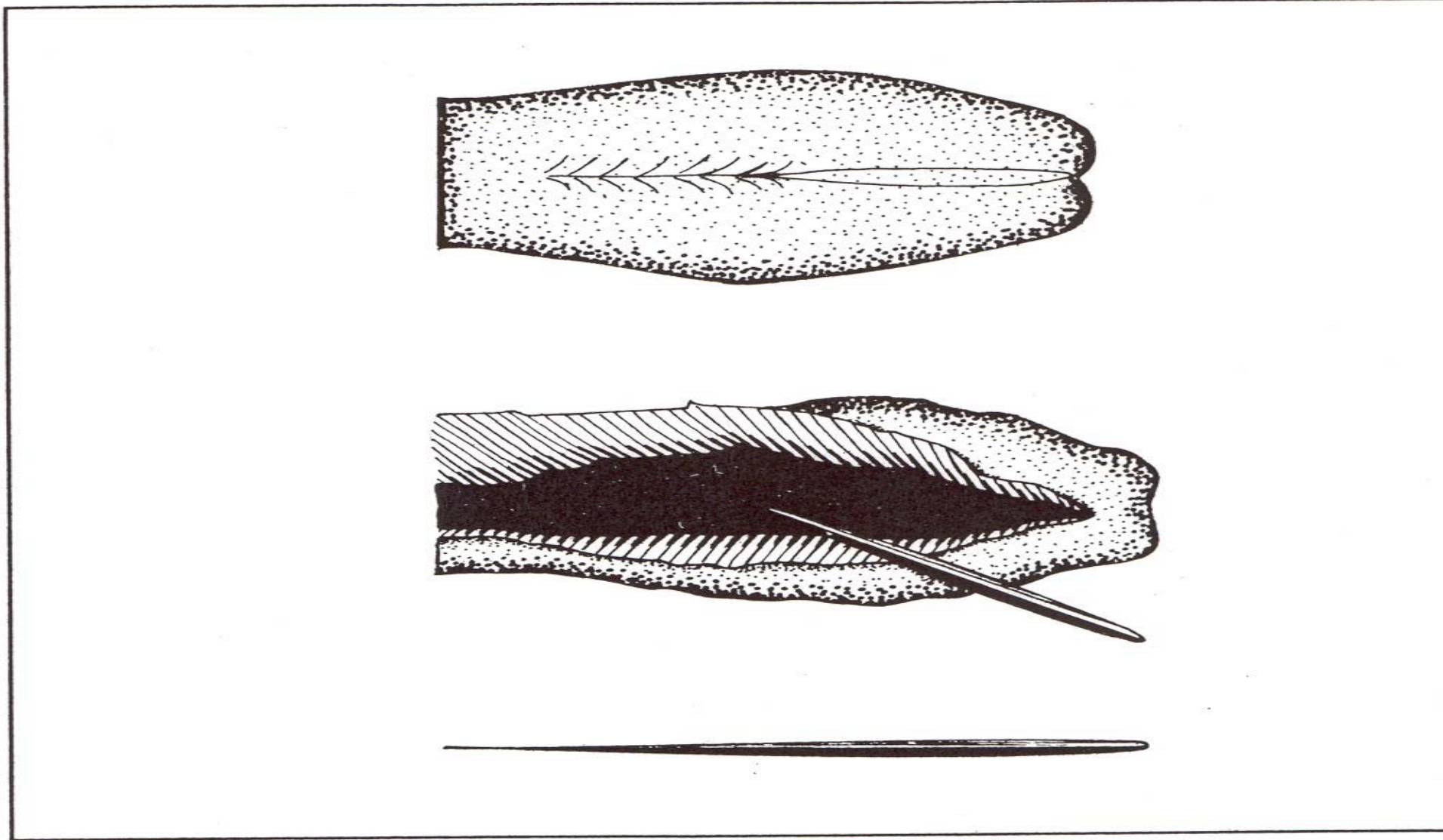
## Xenotransplantation issues

- ❑ **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

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- ❑ **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.

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

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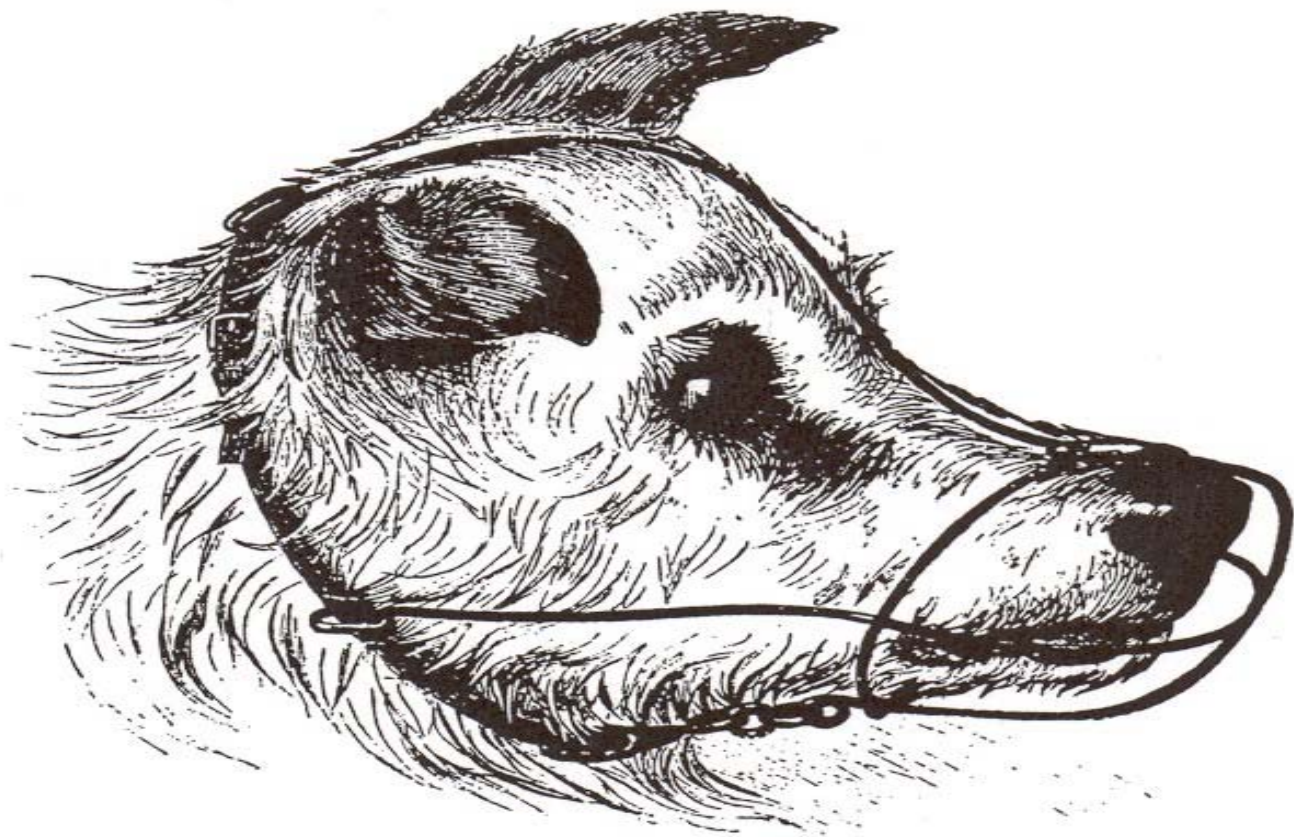
**W**H **H**EREA**S** many of His Majesty's Subjects have suffered from the disease occasioned by the bite of Dogs in a rabid state, and in such cases death hath ensued: And whereas in cases where parties suffer from the bite of Dogs no summary compensation can be had by them for the same, and it is 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  
15 compensation to the parties injured by the bite of Dogs, or to the owners 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  
20 the *passing of this Act*, it shall be lawful for any Justice of the Peace, 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

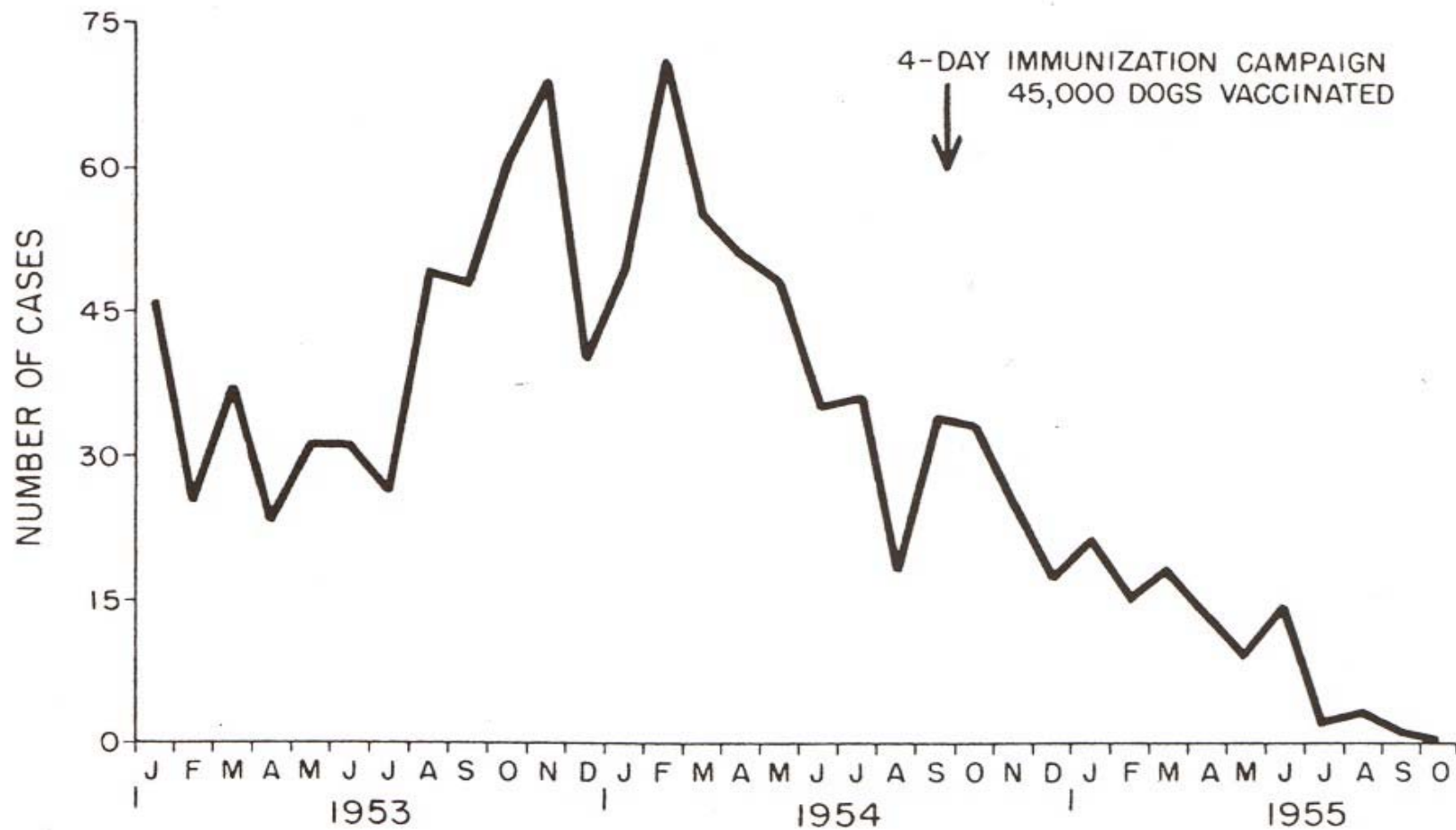


FLEMING, 1872

# VACINE SEU CÃO CONTRA RAIVA







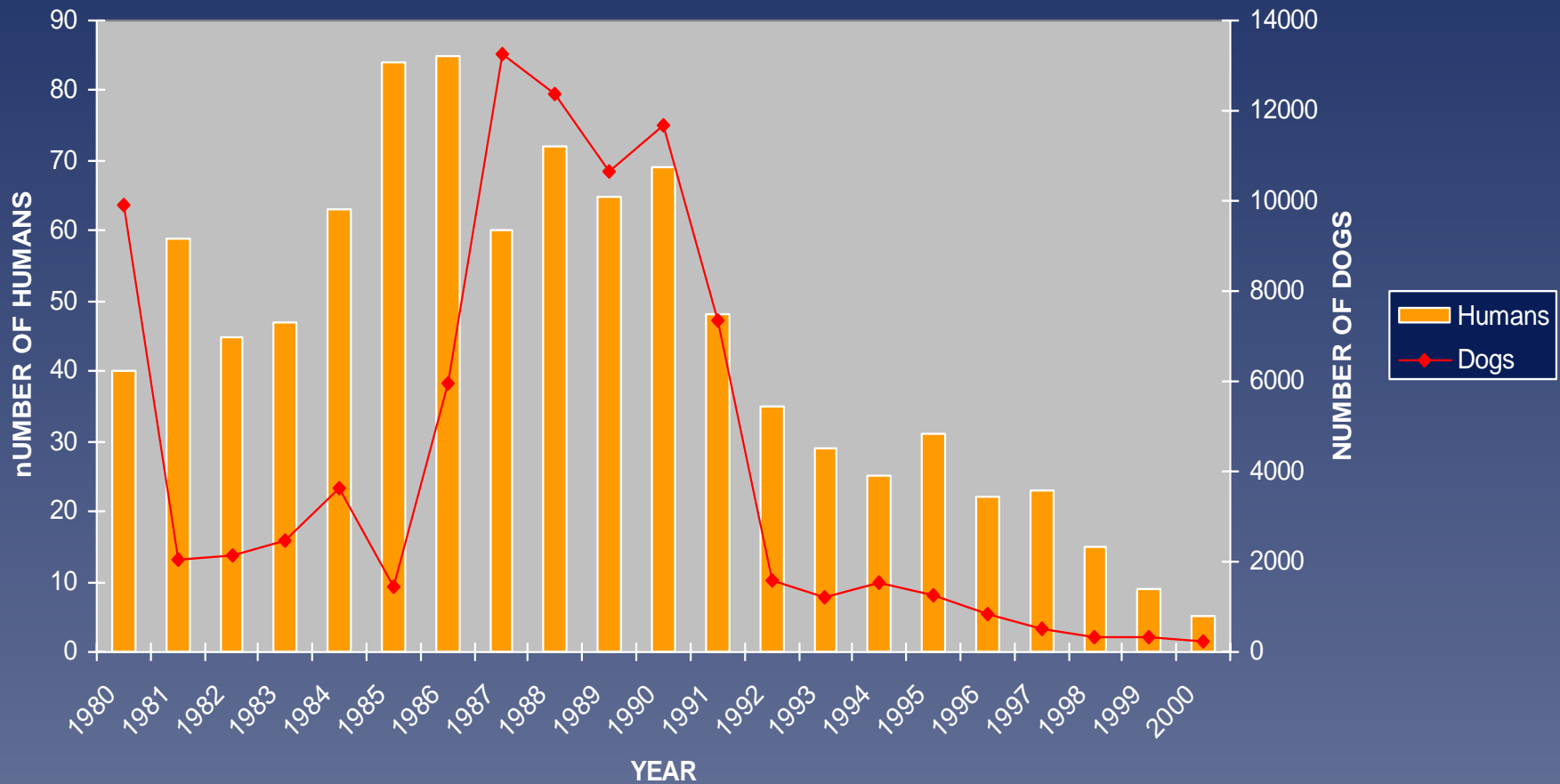
Monthly incidence of animal rabies, Houston-Harris County, Texas, January 1953 to October 1955 (Tierkel, 1956).

# SELECTED EXAMPLES OF CANINE RABIES ELIMINATION

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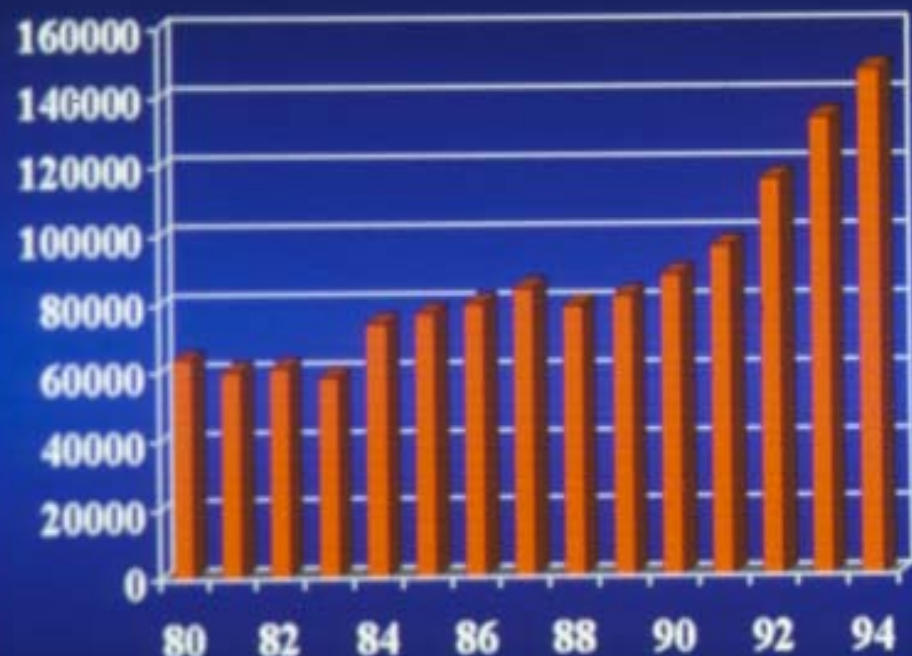
- ❑ **United Kingdom, 1922**
- ❑ **Malaysia, 1955**
- ❑ **Japan, 1956**
- ❑ **Taiwan, 1961**
- ❑ **Portugal, 1961**
- ❑ **Uruguay, 1983**

# Canine & Human Rabies: Mexico

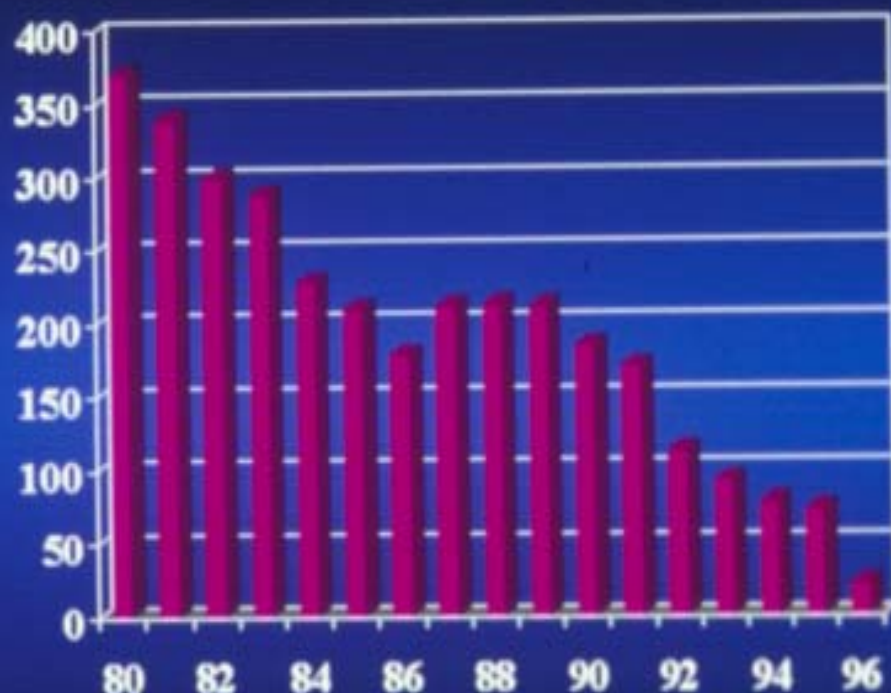


# Thailand

## Rabies PET



## Rabies death



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

WHO/EMC









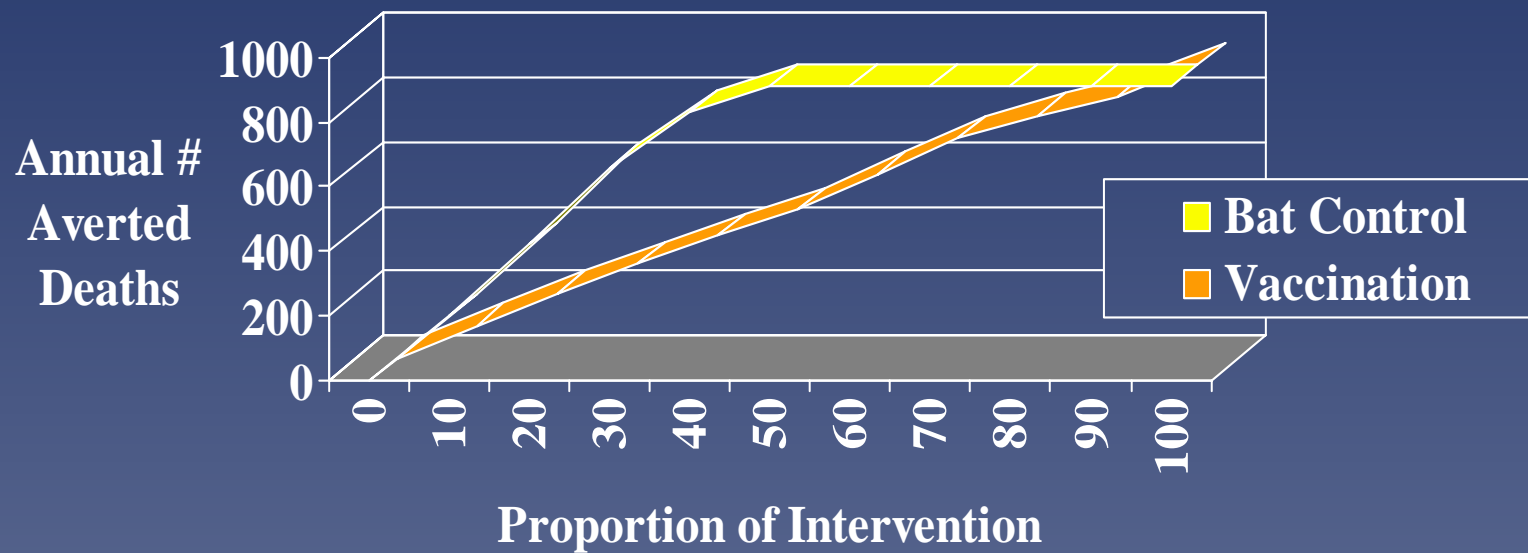




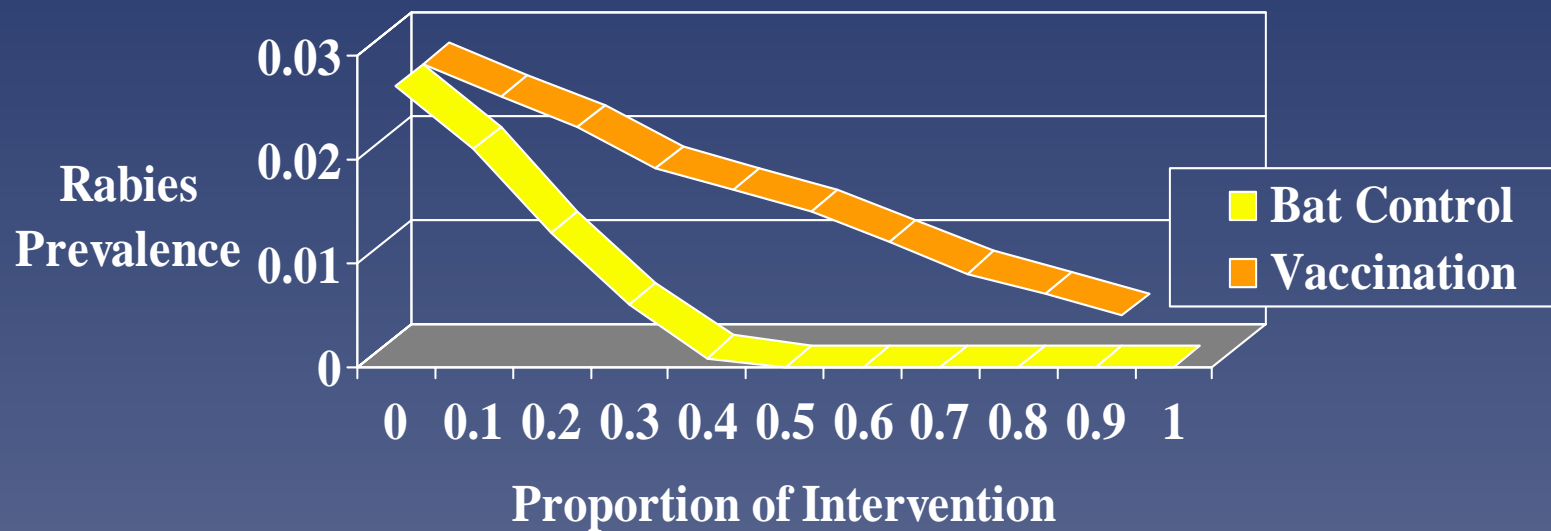
# VAMPIRE BAT POPULATION REDUCTION: ANTI-COAGULANT USE

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

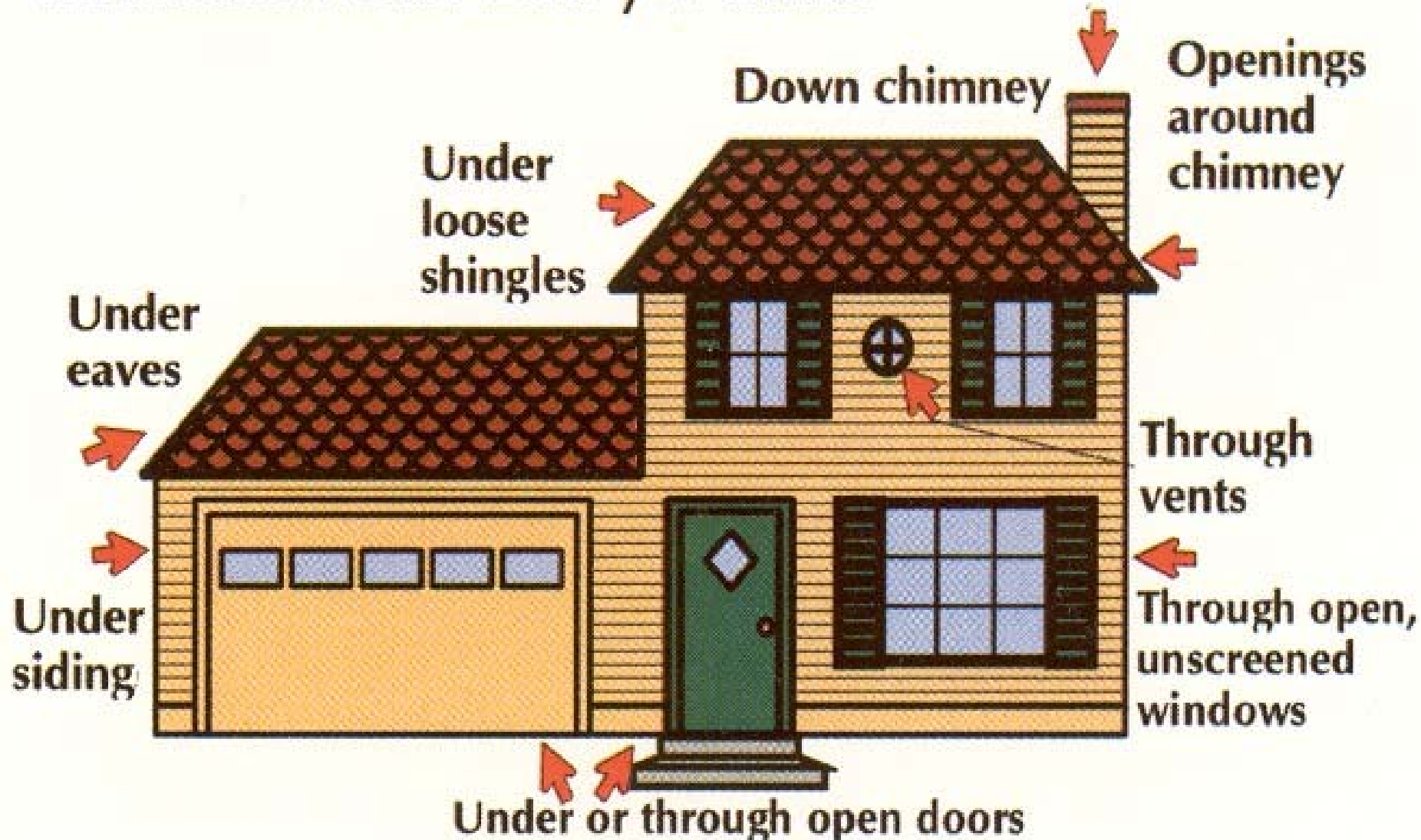
# A MODEL OF VAMPIRE BAT CONTROL (Massad et al. 2001)



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



# Common Bat Entry Points

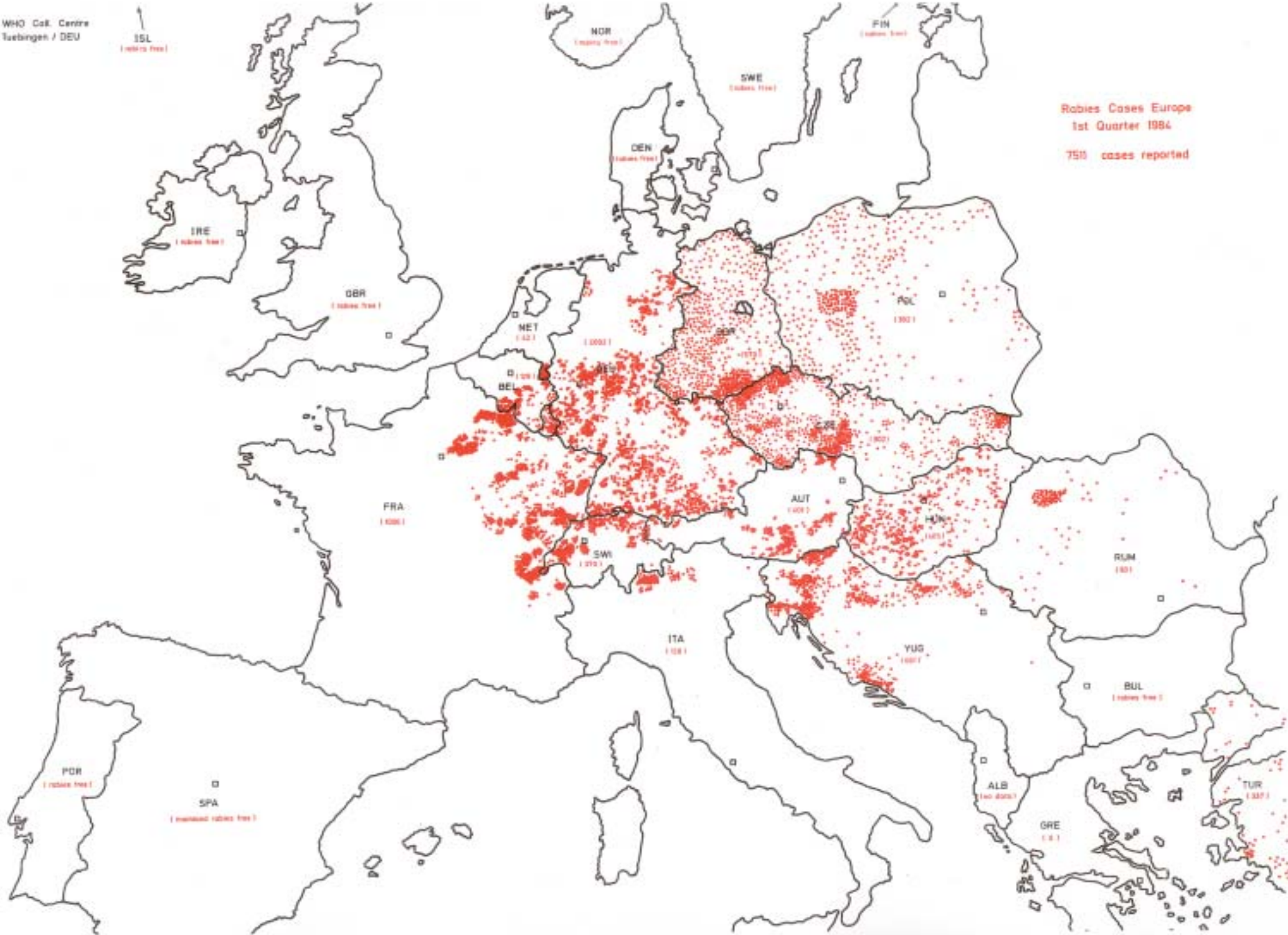


# POPULATION REDUCTION: Alberta, Canada 1952-56 (strychnine baits)

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

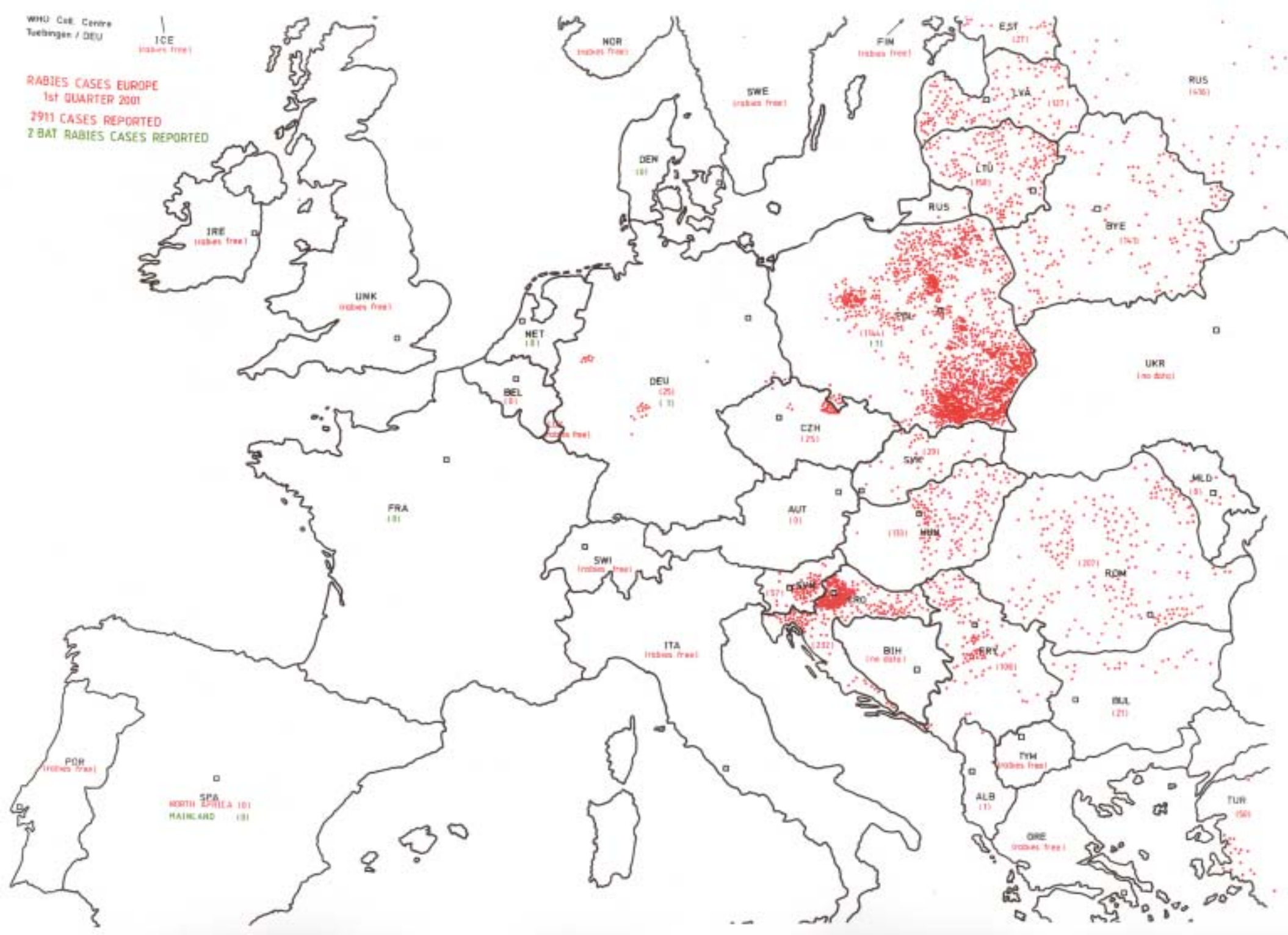
**Ballantyne, 1958**



Rabies Cases Europe  
1st Quarter 1984  
750 cases reported

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

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## 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.