



Surveillance for bovine tuberculosis in U.S. Livestock

Tuberculosis Eradication Program
Ruminant Health Programs
February 15, 2008

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Overview

- ❑ **Slaughter surveillance**
 - ❑ Slaughter inspection
 - ❑ Granuloma lesions submitted for histopathology

- ❑ **Mexico origin cases**

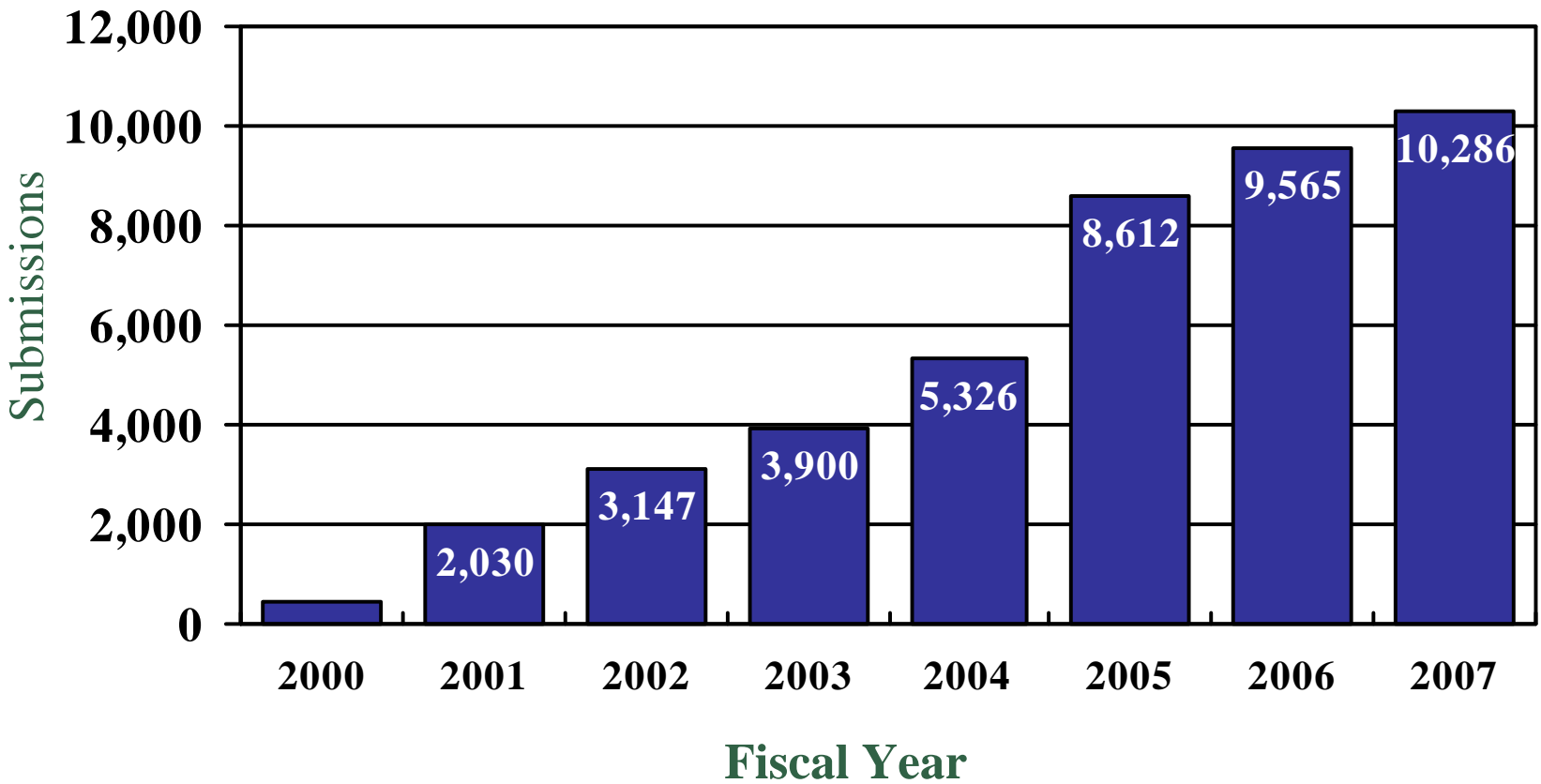
- ❑ **Live animal surveillance**
 - ❑ Tuberculin skin testing
 - ❑ Gamma interferon test

- ❑ ***M. bovis* in swine, Molokai Island, Hawaii**



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Granuloma submissions from US Slaughter Plants, 2000-2007



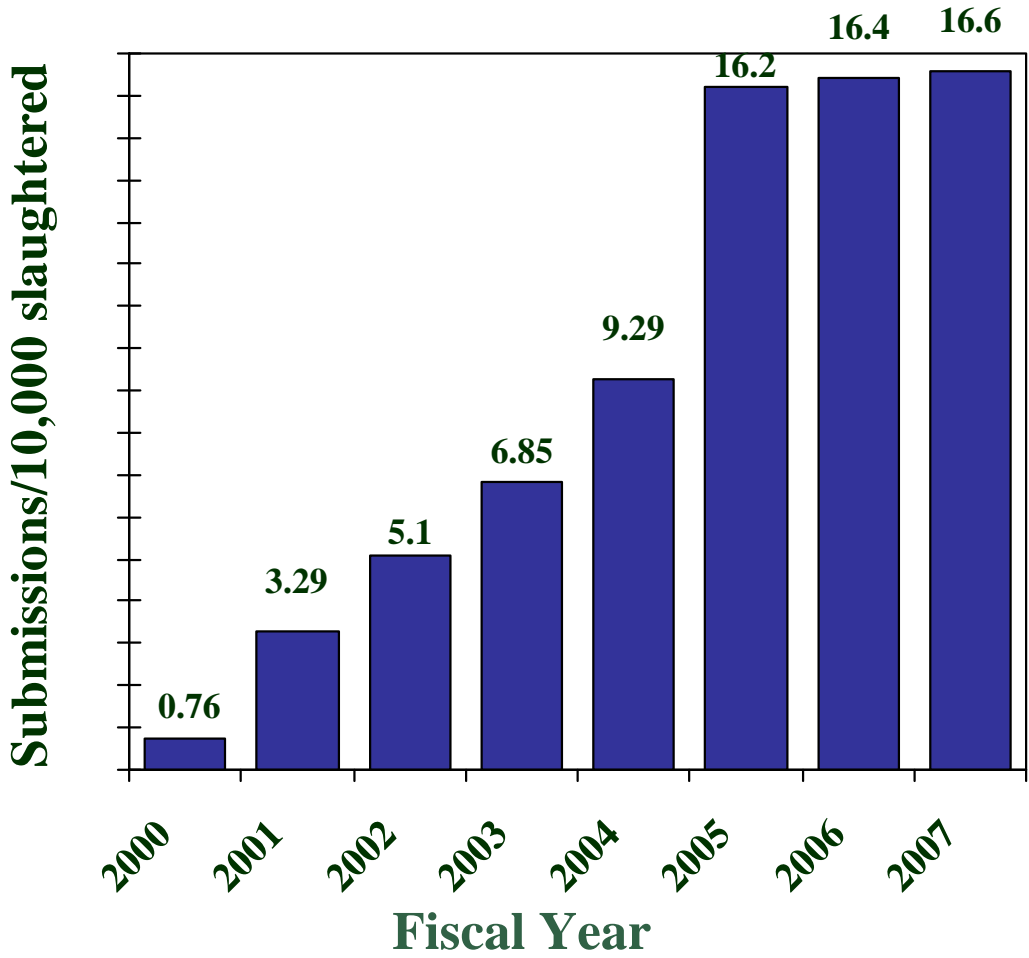
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Granuloma submission rates for slaughtered adult cattle, 2000–2007

Submissions
continue to
exceed target!

Target:
5/10,000 adult
cattle
slaughtered



← Target
Rate

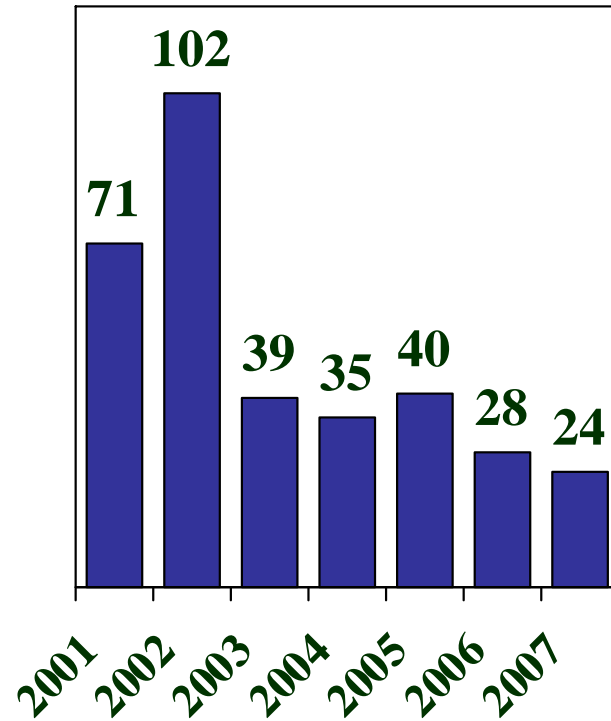
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M. bovis positive cattle from slaughter tissue sample submissions, 2001 – 2007



Number of TB cases found
at slaughter, fiscal year



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Granuloma submissions from slaughter cattle histologically compatible for *M. bovis*

October 1, 2006 – September 30, 2007

- ❑ 33 cattle positive by histology (presumptive)
- ❑ Of these 33 cases....
 - ❑ 24 - confirmed *M. bovis* (PCR or culture)
 - ❑ 9 - other Mycobacterium or negative by PCR and culture
 - ❑ 7 - *M. avium*, *M. kansasii*, *M. interjectum*, *M. gastri*, *M. intracellulare*, *M. fortuitum*, acid fast bacteria (1 each)
 - ❑ 2 - negative, no isolation made

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Confirmed cases of *M. bovis* from slaughter sample submissions

October 1, 2006 – September 30, 2007

- ❑ 24 confirmed cases (PCR or culture)
 - ❑ 6 (26%) adult cattle – US origin
 - ❑ 18 fed cattle
 - ❑ 17/18 (94%) Mexican origin
 - ❑ 5 – Aguascalientes, Chihuahua, Coahuila, Jalisco, Sonora (1 each)
 - ❑ 5 – Nuevo Leon
 - ❑ 4 – Campeche, Tamaulipas (2 each)
 - ❑ 3 – State not yet known
- ❑ **One affected herd found twice!**
 - ❑ 1 fed, 1 adult case (Oklahoma)



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Confirmed cases of *M. bovis* from slaughter sample submissions

October 1, 2007 – February 15, 2008

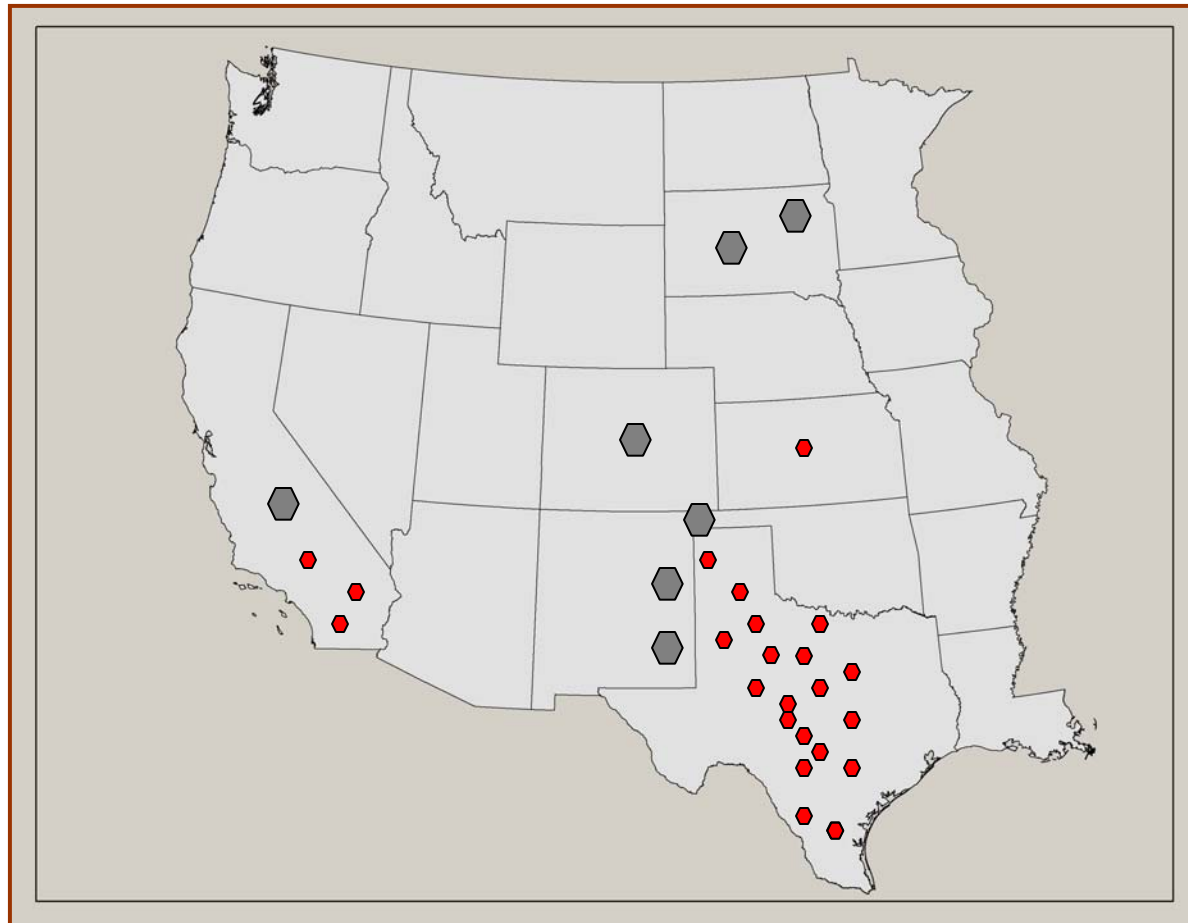
- ❑ 8 cattle positive by histology (presumptive)
- ❑ Of these 8 cases
 - ❑ 6 – confirmed *M. bovis* (PCR or culture)
 - ❑ 1 – other Mycobacterium
 - ❑ 1 – PCR negative, culture pending
- ❑ Of the 6 confirmed positive cases
 - ❑ 1 adult case (California)
 - ❑ 5 cases in fed cattle
 - ❑ Of these, 4/5 (80%) of Mexican origin
 - 1 – Chihuahua
 - 1 – Coahuila
 - 2 – Tamaulipas
 - 1 – No eartags

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Location of 30 cattle positive for *M. bovis* detected at slaughter

October 1, 2006 – February 15, 2008

-  23 fed / engorda
-  7 adult / adulto



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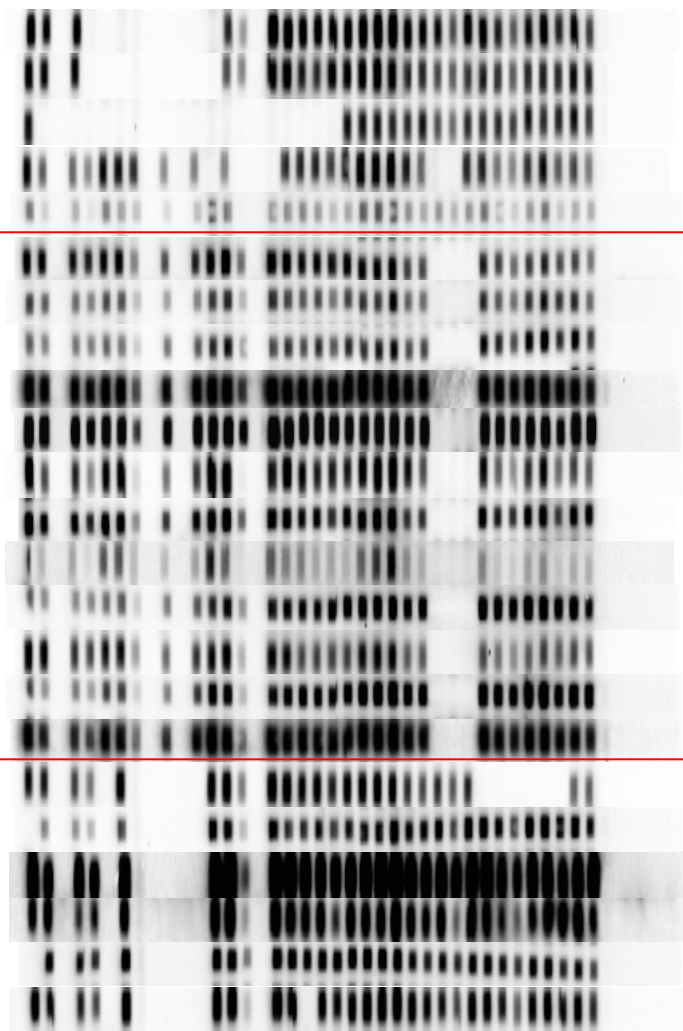
Genotyping to assist in epidemiologic investigations

- ❑ Genotyping – Analysis of differences in nucleic acid sequences between strains of same species
- ❑ Spoligotyping
 - ❑ Fast but lacks discriminatory ability
- ❑ RFLP – IS6110, PGRS (two types)
 - ❑ High discrimination, technically demanding, pattern comparison difficult when many strains
- ❑ Mycobacteria Laboratory, NVSL is routinely genotyping *M. bovis* strains to assist investigations

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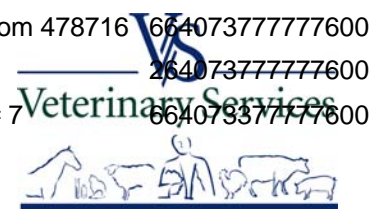


Spoligotyping

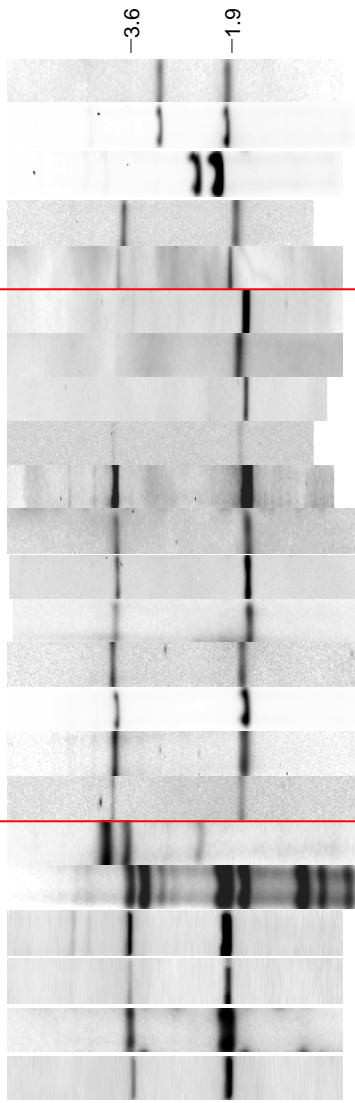


SD	adult cow	64003377777600
MI	MI herd # 37	64003377777600
SD	adult cow	40000007777600
TX	NL/VEN, MX	676521777177600
TX	MX origin	67656377777600
CA		676573777077600
TX	DUN, MX	676573777077600
TX	AGS, MX	676573777077600
TX	AGS, MX	676573777077600
OK	new herd - OK	676573777077600
OK	Index case	676573777077600
TX	NL, MX	676573777077600
NE	adult cow	654563777077600
MO	DUS, MX	676573777077600
TX	pending	676573777077600
KS	CHI, MX	676573777077600
TX	DUN, MX	676573777077600
SD	untraceable	664073777700600
NE	CHI, MX	26407377777600
CO	adult bull	66407377777600
CO	traceout from 478716	66407377777600
NE	CHI, MX	26407377777600
MN	MN herd # 7	66407377777600

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IS6110 RFLP

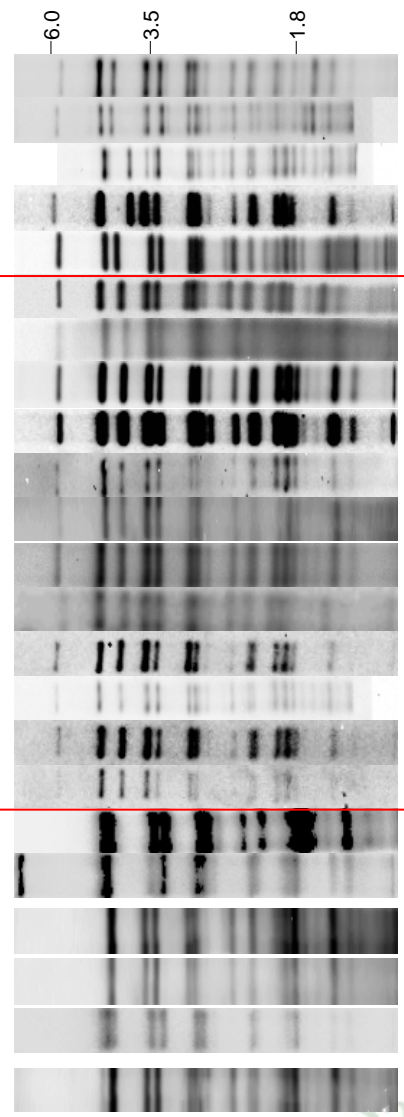


SD	adult cow	2.95, 1.92
MI	MI infected herd # 37	2.95, 1.92
SD	adult cow	2.31, 1.99
TX	NL/VEN, MX	3.79, 1.82
TX	MX origin	3.93, 1.88
CA		1.69
TX	DUN, MX	1.77
TX	AGS, MX	1.69
TX	AGS, MX	4.05, 1.75
OK	new herd - OK	3.97, 1.73
OK	index case	3.99, 1.68
TX	NL, MX	3.96, 1.68
NE	adult cow	4.02, 1.68
MO	DUS, MX	4.08, 1.73
TX	pending	3.97, 1.69
KS	CHI, MX	4.01, 1.71
TX	DUN, MX	4.07, 1.74
SD	untraceable	4.22, 3.68, 2.19
NE	CHI, MX	3.6, 3.2, 2.9, 1.9, 1.75, 1.2
CO	adult bull	3.63, 1.91
CO	traceout from 478716	3.63, 1.91
NE	CHI, MX	3.6, 1.91
MN	MN herd # 7	3.55, 1.9

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PGRS RFLP



SD	adult cow
MI	MI infected herd # 37
SD	adult cow
TX	NL/VEN, MX
TX	MX origin
CA	
TX	DUN, MX
TX	AGS, MX
TX	AGS, MX
OK	new herd - OK
OK	index case
TX	NL, MX
NE	adult cow
MO	DUS, MX
TX	pending
KS	CHI, MX
TX	DUN, MX
SD	untraceable
NE	CHI, MX
CO	adult bull
CO	traceout from 478716
NE	CHI, MX
MN	MN herd # 7

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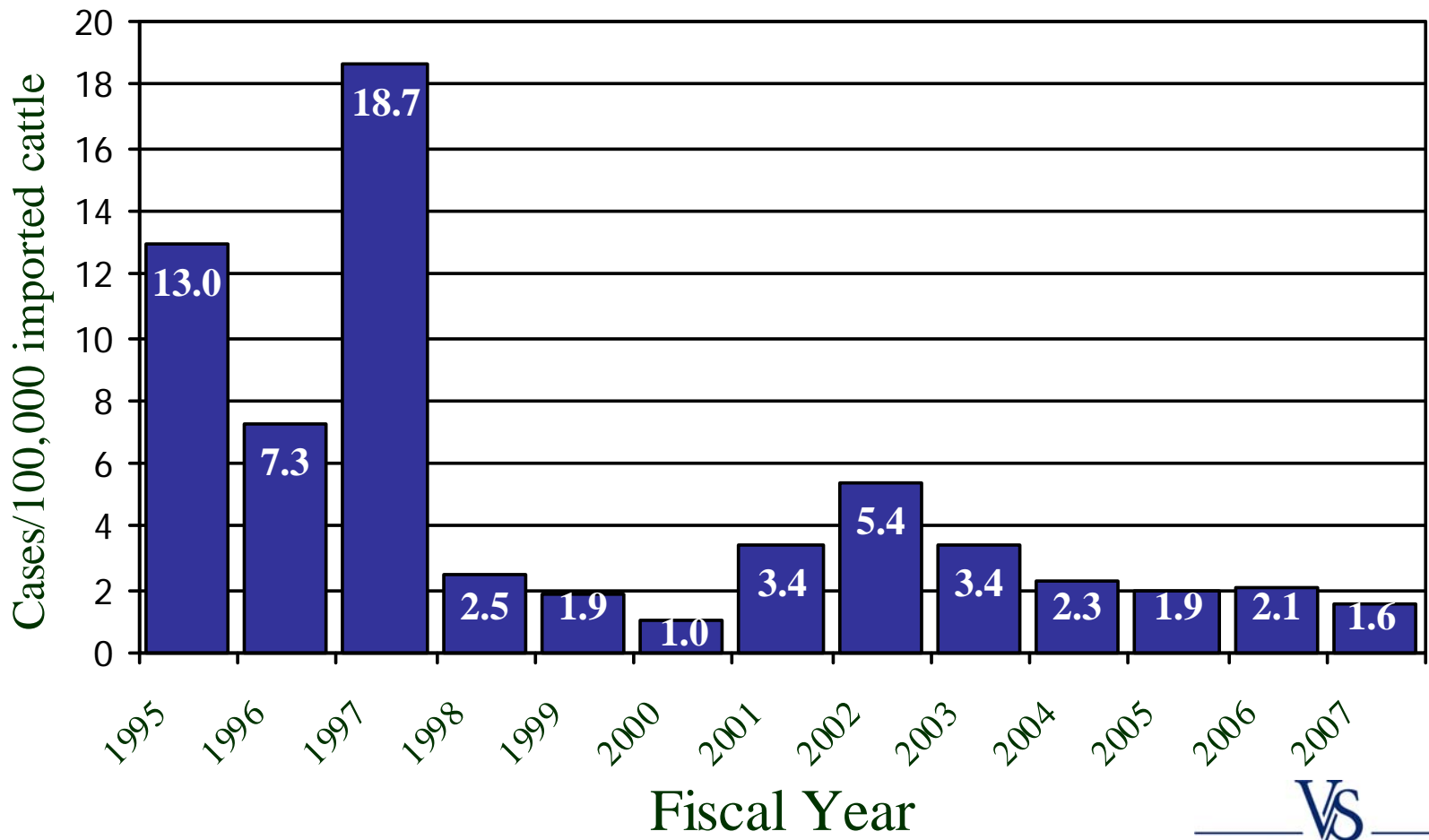


Genotyping to assist in epidemiologic investigations

- ❑ Oklahoma
 - ❑ Confirmed identical strains between animals
 - ❑ Uncommon strain, matched 10 others in database
 - ❑ Ruled out link to other recent adult cattle cases
- ❑ Roping steer isolates comparison
 - ❑ Multiple patterns observed
 - ❑ Similar to distribution of patterns from slaughter cases

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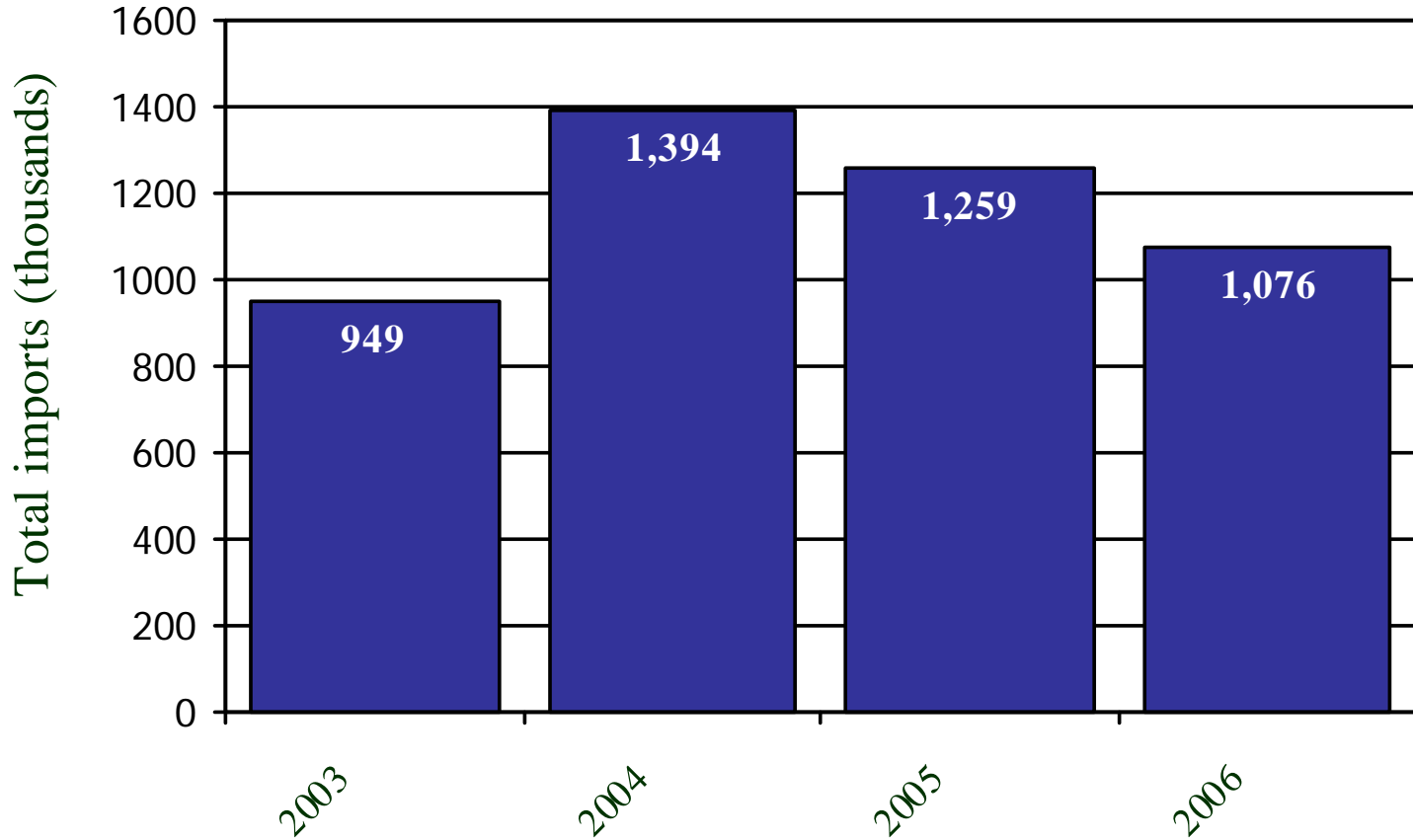
TB cases per 100,000 cattle imported from Mexico, 1995-2007



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Cattle imports from Mexico Mexico fiscal years 2003-2006



Mexico federal fiscal year ending August 30; data source: SAGARPA

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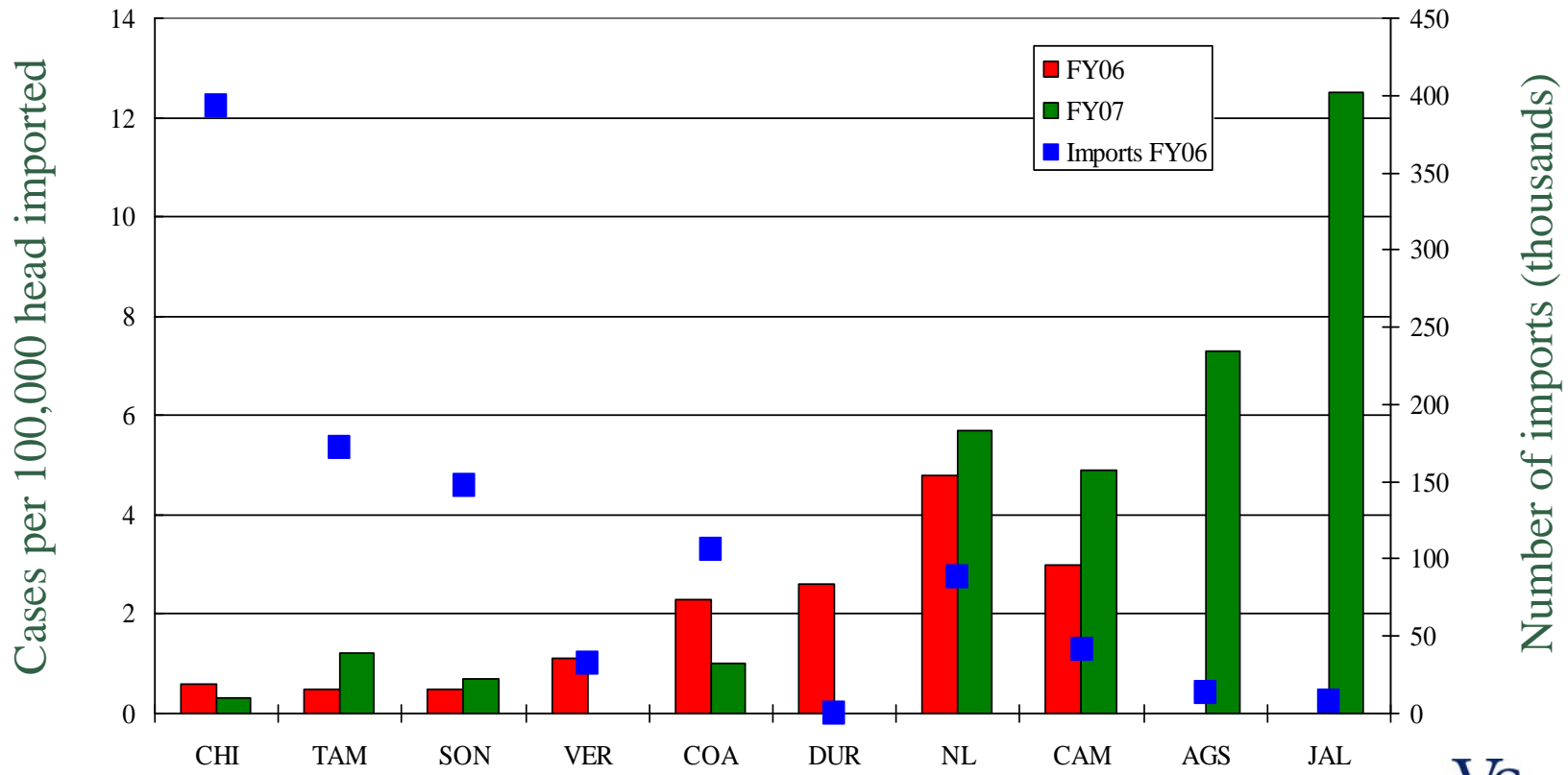


Origin of 14 TB cases with Mexican eartags

October 1, 2006 – September 30, 2007



TB cases per 100,000 cattle imported from Mexico, by Mexican state, US Fiscal Years 2006-2007*



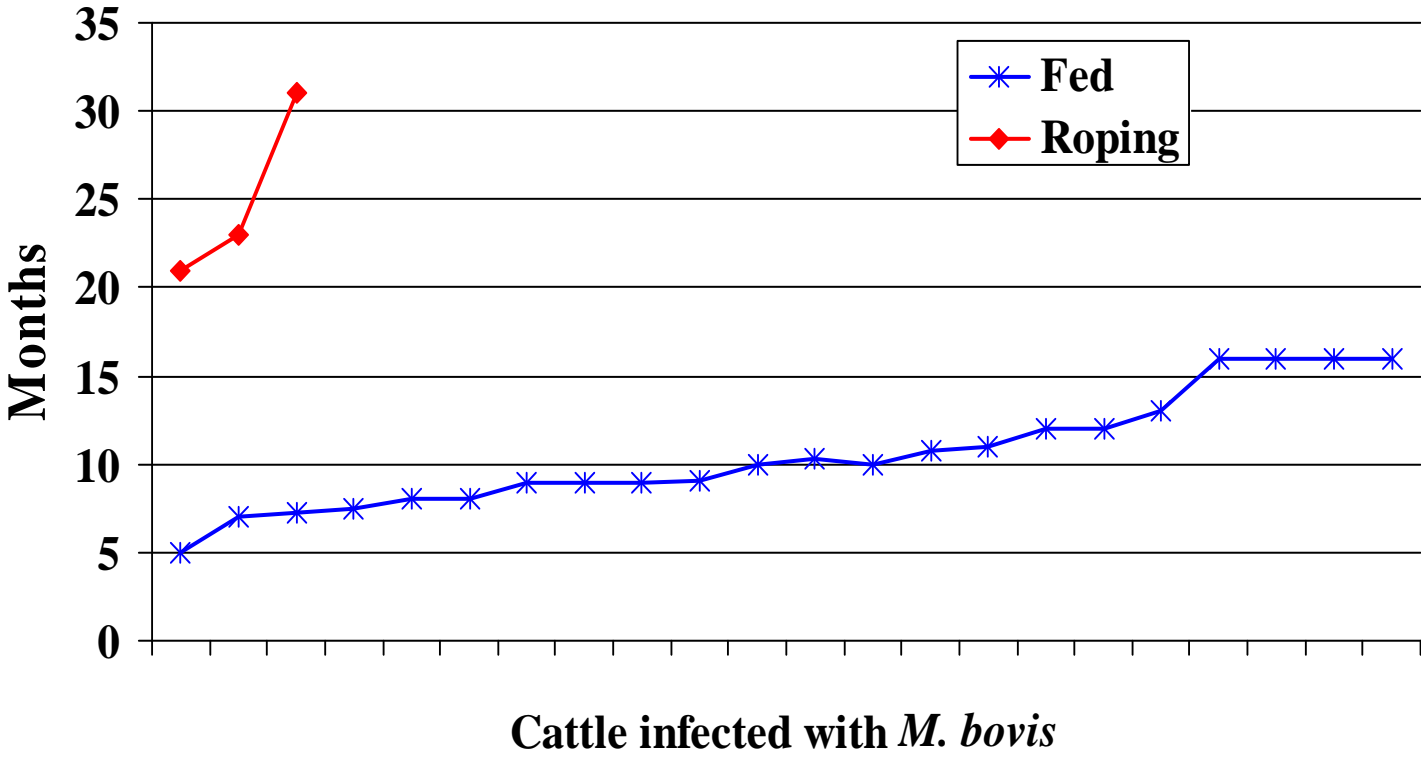
*FY 06 rate for Aguascalientes = 71.7

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Time spent in US

TB cattle cases of Mexican origin



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Caudal fold test performance, cattle and bison FY 2006 - 2007

	FY2006*	FY2007**
Total tests	1,106,669	962,940
Number of responders	10,916	12,514
Percentage, overall	1.0 %	1.3 %
Percentage, by state (≥ 290 tests)	0.00 – 3.3 %	0.00 – 4.3 %
Number of states $\geq 1\%$	11	16
Number of states $\leq 0.25\%$	11	12

*FY2006 – 50 states and Puerto Rico, approved and unapproved reports

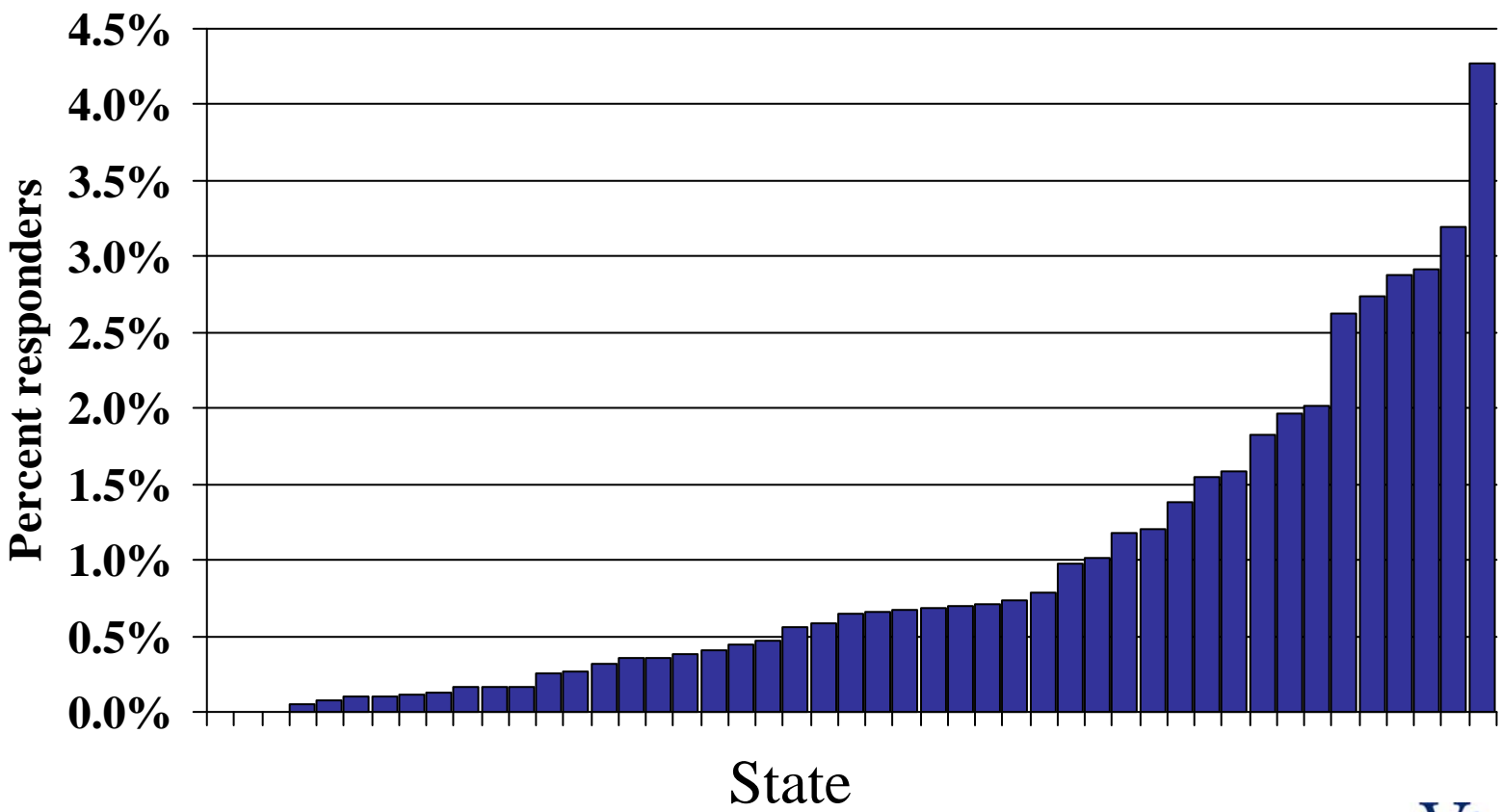
**FY2007 – 46 states and Puerto Rico, as of 10/16/07, approved reports
and states

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Caudal fold test results in cattle, by state*

October 1, 2006 – September 30, 2007



*46 states and Puerto Rico, as of 10/16/07

Source: AWBDS and states

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CFT testing data: US government veterinarians

State	Cattle type	Number tested	Number suspects	% responders
California	Dairy	790,617	12,510	1.6%
	Beef	837	8	1.0%
Michigan	Dairy	719	73	10.2%
	Beef	2,090	54	2.6%
Texas	Dairy	13,043	580	4.4%
	Beef	8,128	140	1.7%

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CFT testing data: Accredited veterinarians

State	Cattle type	Number tested	Number suspects	% responders	% non-compliant
Georgia	Dairy	18,067	326	1.8%	2 of 51 = 4%
	Beef	7,321	36	0.5%	1 of 102 = 1%
California	Dairy	40,976	26	0.1%	23 of 96 = 24%
	Beef	11,552	3	0.03%	8 of 79 = 10%
Michigan	Dairy	355,673	14,710	4.1%	4 of 441 = 1%
	Beef	97,792	1,934	2.0%	11 of 514 = 2%
Texas	Dairy	146,644	3,895	2.7%	5 of 78 = 6%
	Beef	38,711	724	1.9%	6 of 109 = 5%

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Tuberculin testing of cervids

FY 2006 - 2007

	FY 2006	FY 2007
Total cervids tested	25,421	10,353
SCT Suspects	374	231
Response rate	1.5%	2.2%

Source: AWBDS, approved reports, October 10, 2007

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Bovine gamma interferon testing Fiscal year 2007

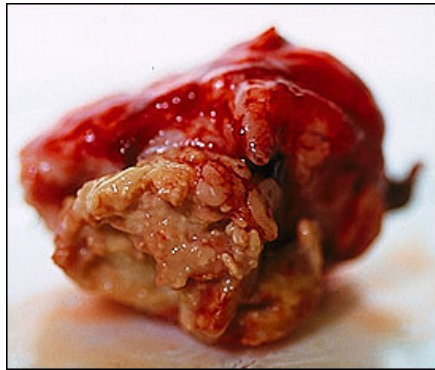
- ❑ 14,618 tests in FY2007
 - ❑ Completed in TX, MI, CA laboratories
 - ❑ 95% increase from 7,484 tests in FY2006
- ❑ 97% of completed tests
 - ❑ Colorado, Michigan, New Mexico (66%), Texas
- ❑ Approved labs: Texas, Michigan, California, NVSL
- ❑ Memo 552.5 – lab approval guidelines

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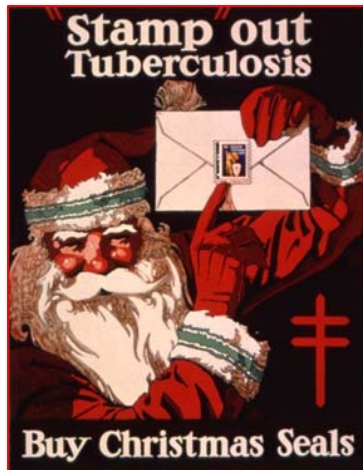
Surveillance for *M. bovis* in feral swine, Molokai Island, Hawaii, FY2007

- ❑ 8 feral swine compatible for Mycobacteriosis by histology
- ❑ Of these, 6 positive for *Mycobacterium bovis* by PCR or culture
 - ❑ 1 case, PCR not done, sample quality
- ❑ Cooperative agreement, Hawaii area office

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Lymph node, culture
positive for *M. bovis*



Thank you
Questions or comments?



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