6-2004

# Michigan Bovine Tuberculosis Eradication Project: 2004 Activities Report and Conference Proceedings

# Michigan Bovine Tuberculosis Eradication Project

**2004 Activities Report and Conference Proceedings**

# Activities Report &
# Proceedings of the 2004
# Bovine Tuberculosis Conference

**June 9-10, 2004**

**The Henry Conference Center**
**East Lansing, Michigan**

STATE OF MICHIGAN

JENNIFER M. GRANHOLM, Governor

# BOVINE TB ERADICATION PROJECT

Department of Agriculture
Dan Wyant, Director

Department of Community Health
Janet D. Olszewski, Director

Department of Natural Resources
Rebecca A. Humphries, Director

On June 9 and 10, 2004, the State of Michigan and U.S. Department of Agriculture hosted the eighth annual Bovine Tuberculosis (TB) Conference, with guest speakers from Georgia, Colorado, Iowa, New York and two Canadian provinces. Our guests came together from across North America to receive policy updates and share the latest scientific data and innovative research on bovine TB.

Among other things, the speakers shared insight on: the promotion of biosecurity; the $30 million annual costs of TB eradication in New Zealand; the latest research in new and improved blood tests; and the first season results of the Michigan Department of Natural Resources pilot project to target and remove only TB positive deer from the “hot” areas in Northeast Lower Michigan.

When the Michigan Bovine TB Eradication Project began in 1996, there was no definitive information on where the disease was, and into what species it had been introduced. Since 1997, the Michigan Department of Community Health has documented 2,284 human TB cases, but only nine were caused by M. bovis, the organism that causes bovine TB. DNR fingerprinting showed that only one of these nine cases had a possible link to exposure to bovine TB infested deer or cattle herd in Lower Northern Michigan. Since testing began, the MDNR has looked at over 123,000 hunter harvested, wild white-tailed deer; and MDA, the USDA and private veterinary practitioners have tested nearly all of the state’s 1 million livestock animals on 17,000 farms. We identified the locations of bovine TB positive cattle and deer and feel confident that we know where the disease occurs.

The dedicated efforts of hunters and livestock producers have led to the long sought-after federal designation of Split State Status. This designation is the first step in acknowledgement from our trading partners that we are headed in the right direction with the ultimate goal of receiving bovine TB free status in all areas of Michigan once again.

What the project partners have learned and how we have responded to the call for bovine TB eradication is currently being measured, imitated and modeled for other disease control efforts in Michigan and in other states. We have not only reached a plateau on the spread of the disease, but are on the path to successful eradication. As we get closer to our goal, we must keep our efforts strong and focused. History shows that it can re-emerge if we don’t continue with our cooperative, science-based disease eradication strategies.

Sincerely,

Dan Wyant
MDA Director

Rebecca A. Humphries
MDNR Director

Janet D. Olszewski
MDCH Director

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## Rebecca Humphries

Director, Michigan Department of Natural Resources
Lansing, Michigan

# Welcoming remarks at June 2004 Bovine TB Conference

I have hiked the forests, fields and meadows with concerned policy makers, dedicated staff, and hunters from all walks of life. In 1994, a conscientious white-tailed deer hunter contacted the Michigan Department of Natural Resources requesting help in identifying what looked to be a diseased deer. It was bovine Tuberculosis – and our worlds' changed.

We joined forces with the Michigan Departments of Community Health and Agriculture – we brought in experts from MSU and set about establishing open communications with the U.S. Department of Agriculture. It would take a community of concerned and committed people to eradicate this disease - *and we knew it*.

With surveillance and testing, starting in 1995, we realized that we had a unique and disturbing occurrence – for the first time in North American history we found that bovine tuberculosis was endemic in a wild white-tailed deer population. Ten years after that buck was harvested, and close to $100 million state and federal dollars later, we have garnered hunter concern, assistance and desire to see a healthy deer herd, identified the boundaries of *"hot"* areas - where we need to focus our resources, stopped a potential epidemic by bringing the white-tailed deer population down to a level where disease cannot spread out of control and ***most importantly*** we have remained steadfast in our efforts to preserve the hunting tradition in the area, thus preserving the economic viability of the business owners that depend on hunting for their livelihoods.

This hasn't been the easiest course for our dedicated staff - people who understand the experiences of other countries and want more than anything for Michigan not to become a statistic. I have the privilege of knowing and being advised by *the* most dedicated, intelligent and trustworthy individuals in state government. They have put their hearts and souls into understanding how TB spreads in wildlife, they have compared other countries' wildlife TB eradication strategies and they have helped me appreciate the policies - and the unmeasured consequences and impact of these policies on hunters, businesses and economies.

DNR staff worked long hours of overtime to develop, establish and implement rules and regulations to prevent the spread of bovine TB. But disease eradication can't be accomplished (at least in a democracy) by edict. The DNR's ecosystem management approach integrates biological, social, and economic factors - it is a comprehensive strategy that must protect and enhance sustainability and productivity of Michigan's natural resources – and in this case - Northeast Michigan's natural resources.

With a cautious and controlled approach we have managed to cut the disease prevalence rate in half - we valued the active role of Michigan's hunters in achieving our goals – and they stepped up to the challenge. We used ecosystem management to approach disease eradication (often to the chagrin of others)– as a result we still have a viable natural resource.

We now find ourselves at a crossroads in this program. We have done everything possible to keep the disease in check. Now we must bring bovine TB down to an undetectable level. Doing so will take first and foremost endorsement from our staff and then education of our constituency. We will need open and honest communication with the public and finally – once again ***perseverance.***

I am proud be a part of this effort and honored to have the trust and confidence of the Natural Resources Commission to do this job. MDA Director Dan Wyant has a strong track record when it comes to TB eradication efforts on the livestock side. I believe you will see consistency in the bovine TB eradication program and I know you will see continued support on the part of my Department to do what is right, so that bovine TB is a brief footnote in Michigan's natural history.

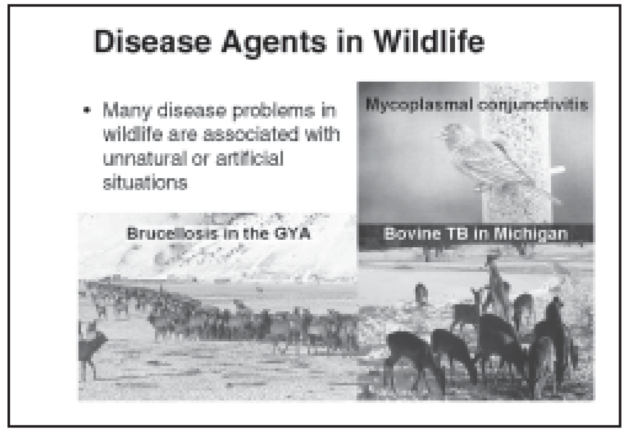
We will be judged many years from now on how we handle the difficult jobs. At the DNR, we are committed to the conservation, protection, management, use and enjoyment of the State's natural resources for current and *future* generations. It is for future generations that we take on the difficult tasks and *that* is why it is important to eradicate bovine TB from our wild white-tailed deer.

## John R. Fischer

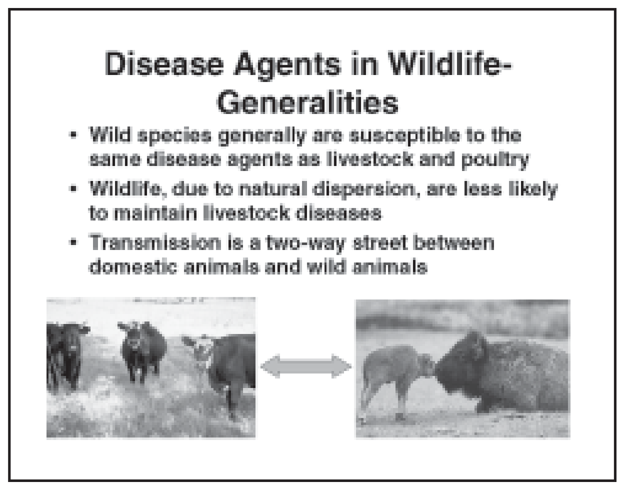
Southeastern Cooperative Wildlife Disease Study
College of Veterinary Medicine, The University of Georgia, Athens, Georgia


# Assessment and Management of Disease Risks in Wildlife

Agriculture and wildlife groups are concerned about the impact of infectious disease on their animals, and each group has apprehension about possible disease introduction from the other's animals. Wild animals generally are susceptible to infection by the same bacteria, viruses, and parasites that infect domestic animals, and transmission of disease agents between wildlife and livestock can occur in either direction. Thus, measures taken to prevent disease transmission in either direction can benefit both wildlife and livestock and are far more efficient than the efforts necessary to eliminate an established disease from domestic or wild animals.

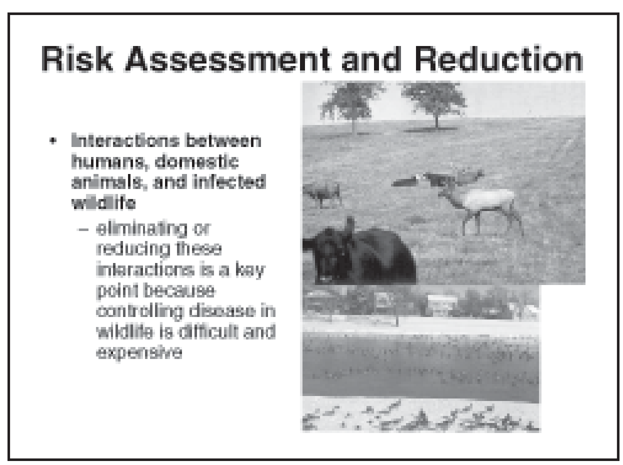



The role of wildlife in the epidemiology of domestic animal and human diseases varies greatly, depending on disease agent and host species. Infected wild animals can represent a true risk factor, or they may harbor significant pathogens while posing little or no threat to other species. Consequently, the level of risk must be evaluated to determine whether control programs are necessary or worthwhile.




Strategies to assess and reduce risk must be based upon thorough knowledge of the epidemiology of the disease agent in wildlife, humans, and domestic animals; specific information regarding the local situation; and other factors. Risk evaluation and management efforts will involve organizations with differing expertise, and cooperation will be essential between wildlife management, public health, and domestic animal health agencies. Risk reduction strategies, when deemed necessary or feasible, may be based upon manipulation of the disease agent, the host, the environment, and/or human activities.

Management of human activity, particularly the promotion of biosecurity, may be most efficient strategy because manipulations of the disease agent, host, or environment are more difficult and expensive. The science of risk assessment and disease management in wildlife is growing and evolving as new situations arise and as new methods are developed to meet the needs of wildlife resource, animal agriculture and public health interest groups.

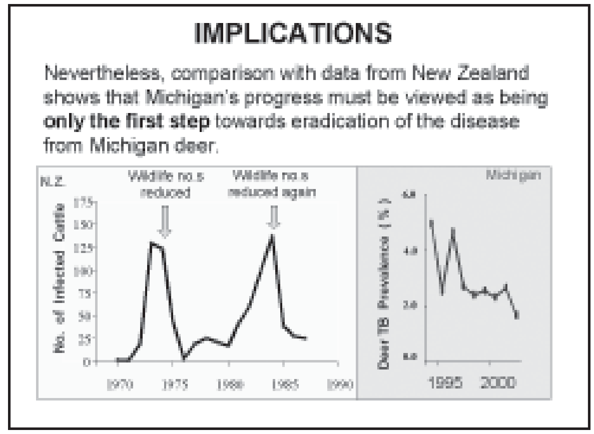


## Graham J. Hickling

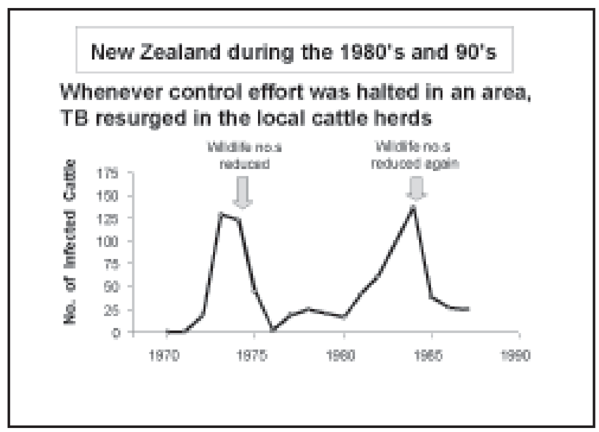
Department of Fisheries and Wildlife and Department of Large Animal Clinical Science, Michigan State University, East Lansing, Michigan


# Eradication of Bovine Tuberculosis from Wildlife Populations: Success Can Turn to Failure if Momentum is Lost

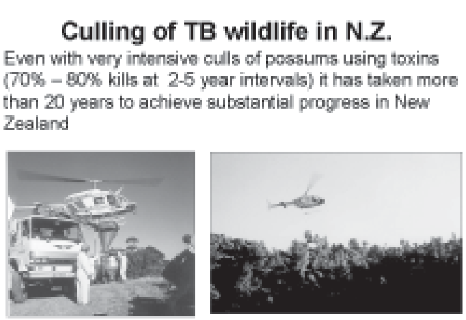
Many countries have been able to declare official freedom from bovine Tuberculosis (TB) through test-and-slaughter and movement control of livestock. However, in countries where bovine TB has spread to wildlife populations, action to reduce infected wildlife populations is also required. In New Zealand, the key wildlife reservoir is the introduced Australian possum, so herd management there is supplemented with culling of infected possum populations.

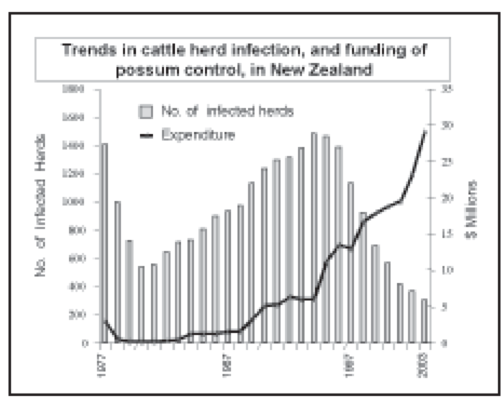



During the 1970s, a modest expenditure on possum control (~ $2 million a year) achieved good reductions in the number of TB-infected cattle herds in New Zealand, so that by 1978 there was a growing assumption that "the battle was nearly won". Control expenditure consequently dropped to near zero from 1978 to 1983. Unfortunately, the number of cattle herds infected began to increase during this period of reduced control effort. Faced with a deteriorating situation, New Zealand resumed expenditure on TB control in the mid-1990s and implemented a much more aggressive attack on the problem. Success in reversing the trend in herd infection was achieved by 1995, but this success came at great cost. New Zealand had only 600 infected herds in 1980, but it was another 21 years before the number was ever that low again. Meanwhile, the annual cost of wildlife control skyrocketed to $30 million.




The New Zealand experience demonstrates that there are great risks in reducing TB control efforts prematurely. Active management of Michigan's TB-infected livestock and wildlife has only been underway since the late 1990s. A highly significant reduction in the prevalence of TB infection among deer in the problem area has already been achieved. Nevertheless, comparison with the New Zealand situation strongly suggests that Michigan has made only the first step towards eradication of this disease. It would be a grave mistake to assume that Michigan's battle with bovine TB is close to being won.

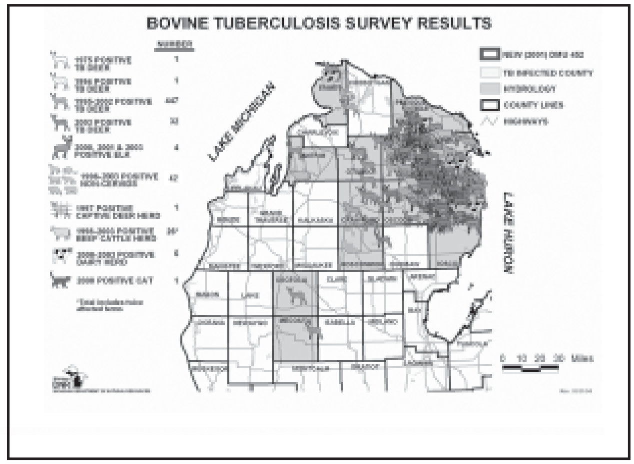


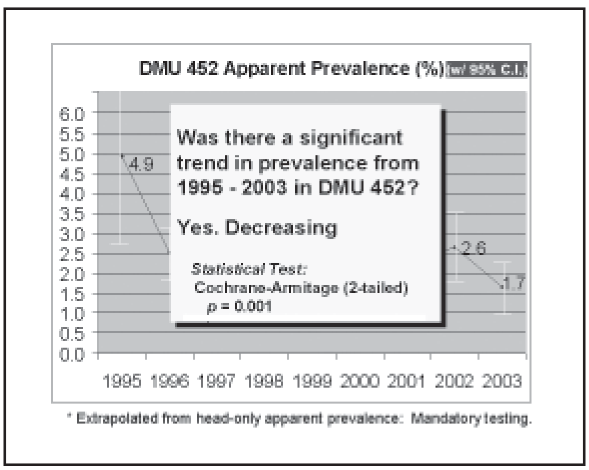
## Stephen Schmitt

Rose Lake Wildlife Research Center
Michigan Department of Natural Resources, Bath, Michigan

### Bovine TB Survillance in White-tailed Deer




Since there are no effective vaccines for disease prevention and no effective medications for treatment of bovine TB in wild deer, a combination of wildlife disease surveys and deer management strategies are being used to eliminate the disease in wild deer. The wildlife surveys monitor the spread and occurrence of the disease, while hunters are asked to examine their deer from all areas of the state, and to submit their deer heads for free TB testing from 33 counties in the northern half of the Lower Peninsula (Alcona, Alpena, Antrim, Arenac, Bay, Benzie, Charlevoix, Cheboygan, Clare, Crawford, Emmet, Gladwin, Grand Traverse, Iosco, Isabella, Kalkaska, Lake, Leelanau, Manistee, Mason, Mecosta, Midland, Missaukee, Montmorency, Newaygo, Oceana, Ogemaw, Osceola, Oscoda, Otsego, Presque Isle, Roscommon and Wexford). Deer with any signs of illness will also be examined by the lab.




Scientists, biologists, epidemiologists, and veterinarians have determined that the likely cause of bovine TB infection in Michigan's wild white-tailed deer is from congregating in artificially high numbers at feed sites. The gathering of groups of deer for prolonged periods of time enhances the potential for spreading the disease among the deer. The goal is to stop feeding and baiting in an area large enough to prevent infected deer from coming into close contact with healthy deer.

By halting feeding and baiting, and reducing the overall deer population in the area where tuberculosis is found, deer concentrations will be lowered, which should reduce the risk of transmitting bovine TB among animals. It is thought that over a period of years, these measures will eliminate bovine TB from Michigan's wild deer and make this a short footnote in the history of the wild deer population.

**MICHIGAN WHITE-TAILED DEER**
**1994 - 2003**

| Year | # Positive Deer | Total Deer Tested |
|---|---|---|
| 1994 | 1 | 1 |
| 1995 | 18 | 403 |
| 1996 | 56 | 4,967 |
| 1997 | 88 | 3,720 |
| 1998 | 84 | 9,057 |
| 1999 | 60 | 19,500 |
| 2000 | 58 | 25,858 |
| 2001 | 60 | 24,278 |
| 2002 | 54 | 18,100 |
| 2003 | 32 (preliminary) | 17,258(preliminary) |
| Total | 511 | 123,142 |

The goal of the TB Eradication Strategy is to eradicate the disease. Our success will be measured by the monitoring prevalence rate (total number of TB positive deer divided by the total number of deer tested) in the DMU 452. The prevalence rates for hunter harvested deer 1.5 years and older in the DMU 452 were 1996 - 2.5%; 1997 - 4.4%; 1998 - 2.7%; 1999 - 2.3%; 2000 - 2.6%; 2001 - 2.3%; 2002- 2.8%; and 2003 - 1.7%.

# Elaine Carlson

Biologist
Michigan Department of Natural Resources, Mio, Michigan

## Review of Surveillance for Winter Deer Feeding

Summary of Feed Flights, 1997 – 2004, in portions of 5 counties in NE Lower MI

| Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|---|---|---|---|---|---|---|---|
| # Active Sites | 235 | 350 | 94* | 74 | 81 | 71 | 63 | 72** |
| Total # of sites checked | 235 | 443 | 420* | 536 | 574 | 622 | 656 | 367** |

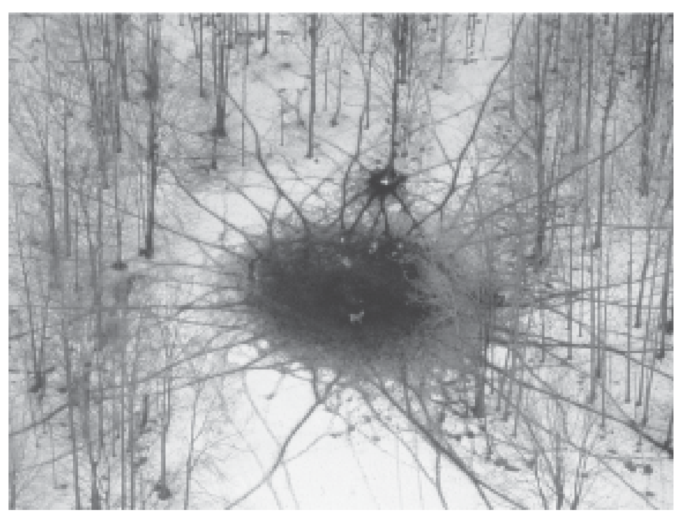
* Due to Weather, about 82% of previous sites were checked
** Only two counties and a portion of another were completed by June presentation

Comparison of active feed sites in Alcona and Alpena Counties, 2003 and 2004

| County | Alcona | | Alpena | |
|---|---|---|---|---|
| | 2003 | 2004 | 2003 | 2004 |
| # of Active Sites | 24 | 47 | 10 | 21 |

2003 livestock feeding


While it is illegal bait deer in the TB endemic area of Michigan, it is not illegal to sell it.



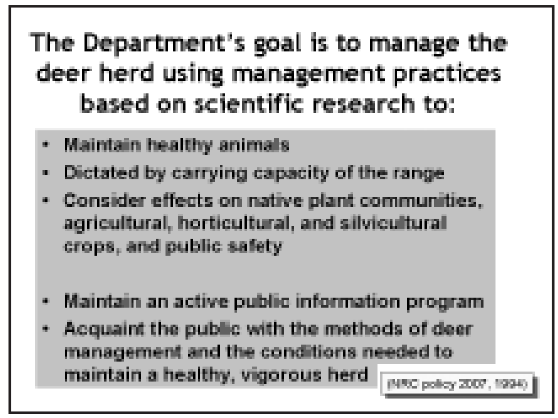
1997 deer feed site

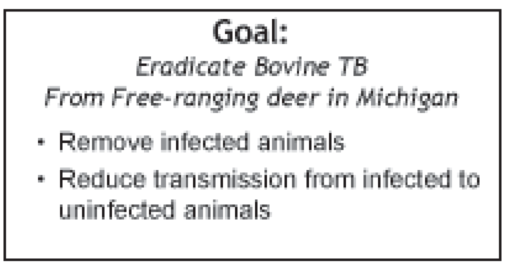
## Brent Rudolph

Wildlife Research Biologist
MDNR – Wildlife Division
PO Box 30444, Lansing, MI

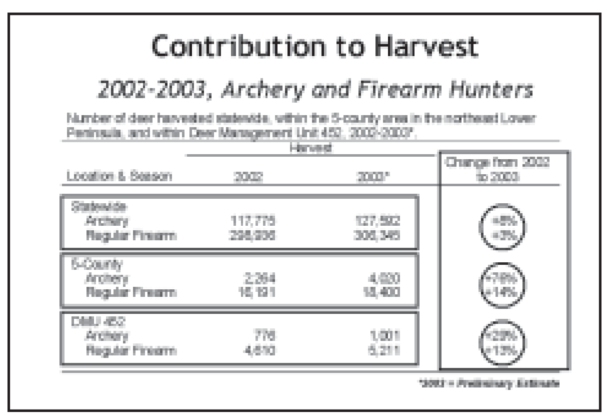

# White-tailed Deer Population and Harvest Trends in the 5-county Area of Northeast Michigan

Eradication of bovine tuberculosis (TB) from free-ranging white-tailed deer in Michigan will require removal of infected animals and reduction in TB transmission from infected to uninfected animals. Management strategies to achieve these goals include (1) removing conditions that enhance concentration of deer by eliminating baiting and feeding, and (2) increasing the harvest of deer to maintain a reduced population with a younger age structure (thus preventing older animals, more likely to have been exposed to TB, from persisting on the landscape). Information on surveillance of TB in deer and of winter feeding of deer have been addressed by other conference presenters. This presentation reviews factors used to evaluate success of the second management strategy. Trends within the 5-County area (Alcona, Alpena, Montmorency, Oscoda, and Presque Isle) are generally used to index factors of importance for managing TB, although data specific to Deer Management Unit (DMU) 452 are also reviewed. In general, hunting participation has declined in the 5-County area, although declines have been similar to or less than those observed at the statewide level. Following decreases in both archery and firearm season harvest in the 5-County area from 2001 to 2002, preliminary data suggest harvest from both seasons increased from 2002 to 2003. Firearm harvest (the primary season for deer population management) in DMU 452 appears to have increased each of the past two years. Preliminary data also suggest that the harvest of antlerless deer once again exceeded antlered deer harvest in the 5-County area, making 2002 the only year since 1997 in which this was not the case. These factors have apparently contributed to the observed trends in population estimates; deer density in the 5-County area was reduced from high levels in the mid-1990's, but has been relatively stable since 1999. Fluctuations in harvest levels probably led to a slight increase in deer age structure, a trend that may have been interrupted by the apparently increased 2003 harvest levels. Given declines in hunting participation, the relatively stable condition of the northeast Michigan deer population may be interpreted as a somewhat positive outcome, although maintaining or further reducing deer densities will likely be critical to accomplishing TB eradication.







# Michael VanderKlok

Bovine TB Eradication Livestock Coordinator, Animal Industry Division
Michigan Department of Agriculture

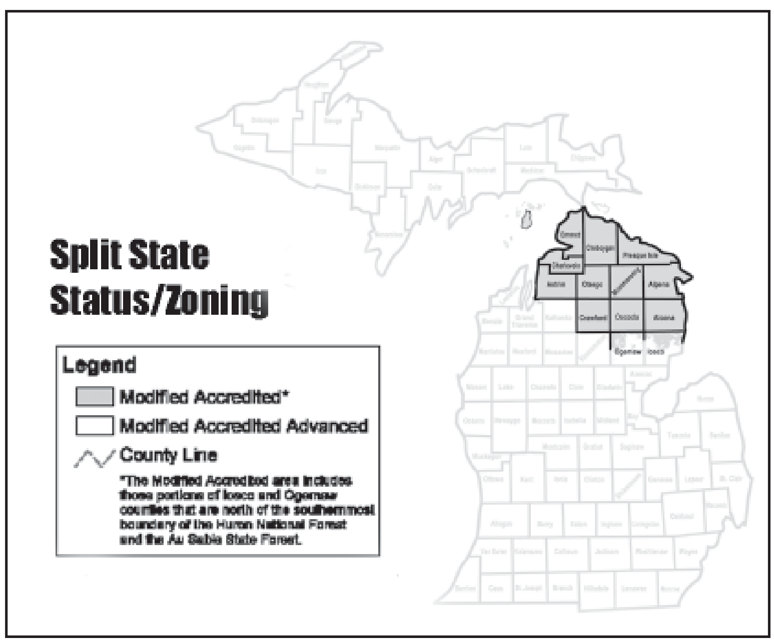
## MDA TB Program Update

The Michigan Department of Agriculture (MDA) became involved in the national bovine Tuberculosis eradication program in the early 1900s and obtained bovine Tuberculosis accredited free state status in 1979. In the fall of 1994, a hunter in northeastern lower Michigan harvested a free-ranging white-tailed deer that was diagnosed as infected with bovine tuberculosis. Further testing in wildlife throughout Michigan has revealed a low level of tuberculosis in multiple species in the northern area of the Lower Peninsula.

In response to this finding, MDA, in conjunction with the United States Department of Agriculture (USDA) Veterinary Services, instituted an area testing program that expanded in response to progressive surveillance efforts. With the finding of bovine Tuberculosis in one privately owned cervid herd and one bovine herd in northeastern lower Michigan, and the lowering of Michigan's status to modified accredited, MDA and USDA began working on updating the tuberculosis eradication program to include the new concept of regional or area boundaries for disease control. This has culminated in the granting of bovine Tuberculosis Split State Status for Michigan on April 19, 2004. This Split State Status advances the majority of Michigan, including the entirety of the Upper Peninsula, to Modified Accredited Advanced status and reduces the Modified Accredited area to include an 11-county area of northern lower Michigan, and portions of two additional counties.

This designation allows Michigan to focus available resources on the area of Michigan that has the presence of bovine Tuberculosis, and continue the statistically based random surveillance program in the remainder of the state. To further eradication efforts, MDA and USDA have implemented an electronic identification and movement permit and tracking system for all cattle in the Modified Accredited area that has proven invaluable in tracing and enforcement activities. In addition, annual herd surveillance testing and individual animal movement testing requirements have been instituted for all cattle in this area, through implementation of a bovine Tuberculosis zoning order by the Director of MDA effective June 1, 2004.

Since January, 2000, over 950,000 cattle on 17,000 farms have been tested for bovine Tuberculosis with no presence of the disease found in any other herds outside the 33 herds (32 cattle and one privately owned cervid) identified in the modified accredited area. This split state designation will allow expansion of eradication activities to include on-farm control activities to reduce the risk of tuberculosis transmission from wildlife, and has fostered partnerships with USDA Wildlife Services in tuberculosis control and research activities in Michigan. With the institution of livestock movement monitoring at the Mackinac Bridge, and movement control point between the Upper and Lower Peninsula's, submission of an application for bovine tuberculosis Accredited Free Status for the Upper Peninsula is anticipated.



## Kevin Kirk

Animal Industry Division
Michigan Department of Agriculture

# Animal ID and the USDA Radio Frequency Identification System

The electronic livestock identification pilot project was launched in Michigan in November of 2001, as part of the state's bovine tuberculosis (TB) eradication plan. Beef and dairy producers in the Modified Accredited area have incorporated this tracking and records keeping system as part of the State of Michigan's agreement for Split State Status.

**Electronic ID Represents the future of the animal agriculture industry.**

- Accuracy (electronic versus paper)
- Speed
- Cattle handling
- Producer acceptance (confidentiality)
- Lost market

It has been common for livestock to have metal tags, tattoos or plastic bangles for individual animal identification (ID). Electronic ID is unique in that it incorporates the latest technology, a tag imbedded with a radio frequency device and marked with an individual number that will not be duplicated on any other animal worldwide. This tag is then linked to a database that includes information specific to that animal, including date of birth, sex, and type/species. This electronic tag dramatically speeds up the location and tracing of livestock – from farm to market – and ensures the most accurate and up-to-date information.

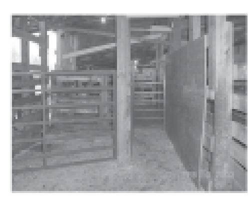
This type of technology and capability is increasingly important in a global economy and represents the future of the animal agriculture industry. Electronic ID will play a critical role in protecting the health of Michigan livestock, ensuring the safety of the food supply, maintaining consumer confidence in Michigan food and agricultural products, managing animal diseases and assisting farmers with carcass data for genetic improvement of their herds.

This project makes tags available to producers at no charge in the Northeast Lower Peninsula or those with accredited herds. To date, 1,547 herds, representing 83,350 individual animals, have been TB tested and tagged with electronic ID. Hand-held computers read the electronic tags and accompanying information, and allow additional data to be entered electronically, including disease testing information. Additionally, electronic tag readers have been installed in 12 of Michigan's major livestock markets and in six packing plants where Michigan producers send their cattle.

USDA Veterinary Services granted the state $1.3 million to develop and implement the identification program. Currently, only a handful of other states, Canada, and a few European countries are utilizing electronic ID on a regular basis.

The program is tied into the nationwide National Farm Identification Records Program maintained by the Holstein Association USA, Inc., and the USDA's Generic Database system to ensure accurate individual animal identification and tracking and coordination of TB test results and herd status.

**EID Summary as of June 1st, 2004**



| | |
|---|---|
| Premise in database | 14,600 |
| Premise in database with visible ID's (verified) | 7,528 |
| Premise with RFID | 1,547 |
| Animals ID'd with RFID | 83,350 |
| RFID's issued and not ID'd | 80,249 |
| Total Tags | 163,599 |

# Michael Dutcher

Bovine TB Program Coordinator
USDA, East Lansing, Michigan


## National Program Perspectives & Strategic Plan Update, National Uniform Methods and Rules Update, Michigan VS's TB program

The purpose of this presentation is to: describe the current status of bovine TB in the United States, with special reference to Michigan; detail current slaughter surveillance efforts; update ongoing rule making; and describe upcoming changes in the TB Uniform Methods and Rules.

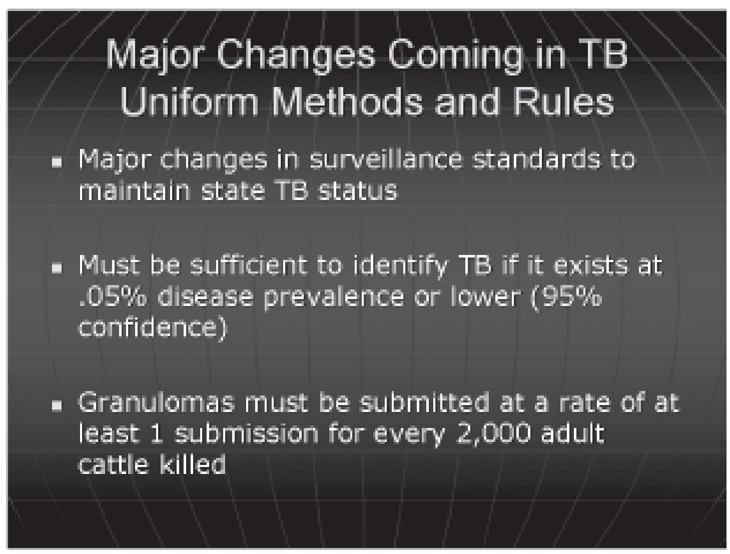
Currently, there are 46 states in the U.S. that are Accredited Free, three that are Modified Accredited Advanced (California, New Mexico, and Texas), and one state with Split State Status (Michigan - Modified Accredited Advanced and Modified Accredited). To date, for fiscal year 2004, five TB infected herds have been identified (two in Michigan), and for 2003-2004, eight herds have been depopulated and four have been quarantined. One bovine TB infected captive elk herd was identified in Kansas and depopulated.

Bovine TB has been identified by slaughter surveillance in 17 cases to date. Gross lesions have been identified in very young cattle. Seven of the infected animals were identified with Mexican ear tags; seven others are being investigated; one Holstein steer originated from a New Mexico (NM) calf raising facility, and two adult cattle are under investigation in NM and Kansas. Finding gross lesions in immature cattle from Mexico has led to an effort to strengthen import requirements for roping steers and the prohibition of Holstein cross steers and spayed heifers from entry into the U.S., effective April 1, 2004.

*Ongoing rule changes include:*

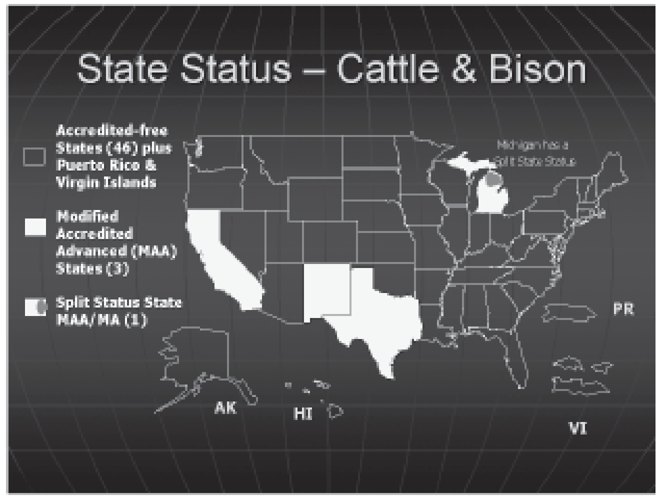
I. Granting of Split State Status to Michigan on April 19, 2004 (upgrading the status of 23 states in the Cervid TB Program is on hold until more current data is collected and surveillance requirements can be better defined).

II. The Bovine TB Uniform Methods & Rules (UM&R) are being updated to incorporate program changes, including: making major changes in surveillance standards to maintain state TB status; establishing a system for monitoring accredited veterinarian tuberculin test response rates and taking corrective action; and implementing a plan to collect critical surveillance data and document plant visits.




USDA/APHIS/VS has contributed over $23 million to Michigan for the five years beginning in 1998, and has budgeted $3.6 million for 2003 and $3.4 million for 2004. In addition, cooperative agreements and sister grant support provide funds for the development of an electronic ID system in Michigan, as well as research support, testing development (gamma interferon), wildlife surveillance, and risk communication brochures. Current, Veterinary Services TB staff includes two supervisory veterinarians, one herd accreditation veterinarian, 11 field veterinarians, 23 animal health technicians, two epidemiologists and 10 support staff. Material support includes a fleet of four-wheel drive trucks; 50 portable cattle chutes; and 48 sets of portable corral gates; laptop computers and cell phones for all personnel, and maintenance of all equipment.

In Michigan, there are now 85 to90 herds in the Bovine TB Herd Accreditation Program. Over 300 herds have accreditation in review or are pending. Prior to 1997, there were less than 10 herds in Michigan's Accreditation Program. Because of the upcoming changes in the UM&R, we are planning to make presentations for producers and veterinarians statewide.




Other ongoing VS activities include: continued TB testing and surveillance; implementation of the gamma interferon comparative test; epidemiologic tracing in and out of bovine TB infected herds; assisting with annual hunter-harvested deer samples for TB surveillance; and integration of state and federal computer databases.

Future plans include: full integration of gamma interferon testing into the bovine TB eradication program; establishment of a field laboratory for initial handling of gamma samples; development of the Accreditation Program to encompass changes to the UM&R; and continued support for research into the eradication of bovine TB.


Photo: Kaisercattle.com

# Lawrence Judge

Michigan Bovine TB Epidemiologist, USDA, East Lansing, MIchigan


## Epidemiology of Infected Herds

Two of the 33 TB positive cattle herds in the TB endemic area of Michigan were identified via slaughter surveillance; one was a trace-out. The Antrim County herd was likely a trace-out from the endemic area even though the animal was caudal fold negative 68 days before the sale. However, there was one TB positive deer harvested from the other end of the county. Several beef herds have been linked through cattle movement, but test results were unable to establish an index herd.

**Summary of gross and histologic examination and mycobacterial culture of tuberculosis bTB cases in cattle and captive deer in Michigan 1996 - 2004.**

| Herd Count | County | Herd Type | Herd Size | # CF Positive | # CC Suspects | # CC Reactors | # Gross Lesions | # Histo Lesions | PCR Tb Complex | M. bovis Cultured | Date Diagnose Positive[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Presque Isle | Deer | 262 | nt | nt | nt | 9[b] | 9 | nt | 14 | 10/27/97 |
| 1 | Alpena | Beef | 20 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 06/16/98 |
| 2 | Alcona | Beef | 13 | 7 | 2 | 1 | 2 | 3 | 3 | 2 | 12/28/98 |
| 3 | Alcona | Beef | 153 | 10 | 0 | 1 | 4 | 4 | 2 | 3 | 10/19/98 |
| 4 | Presque Isle | Beef | 249 | 8 | 0 | 5 | 6 | 6 | 4 | 6 | 11/10/99 |
| 5 | Presque Isle | Dairy | 157 | 8 | 0 | 1 | 1 | 1[c] | 1 | 1 | 02/04/00 |
| 6 | Alpena | Beef | 50 | 3 | 1 | 0 | 1 | 1 | 1 | 0 | 03/29/00 |
| 7 | Alcona | Beef | 29 | 4 | 0 | 1 | 1 | 1 | 1 | 1 | 06/20/00 |
| 8 | Alcona | Beef | 263 | 19 | 1 | 2 | 1 | 1 | 1 | 1 | 06/23/00 |
| 9 | Alcona | Beef | 271 | 17 | 1 | 3 | 3 | 3 | 3 | 1 | 09/07/00 |
| 10 | Montmorency | Dairy | 110 | 10 | 2 | 2 | 0 | 1[c] | 1 | 0 | 09/19/00 |
| 11 | Alcona | Beef | 34 | nt | nt | nt | 1 | 1[c] | 1 | 1 | 09/21/00 |
| 12 | Alpena | Beef | 52 | nt | nt | nt | 3 | 3 | 3 | 2 | 02/02/01 |
| 13 | Alpena | Beef | 38 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 02/28/01 |
| 14 | Alpena | Beef | 108 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 04/10/01 |
| 15 | Alpena | Beef | 88 | 33 | 3 | 28 | 32 | 30 | 24 | 28 | 05/07/01 |
| 16 | Alcona | Beef | 60 | 1[d] | 0 | 1 | 2 | 2 | 2 | 1 | 05/16/01 |
| 17 | Alpena | Beef | 66 | 5 | 0 | 2 | 2 | 2 | 1 | 2 | 09/06/01 |
| 18 | Alcona | Beef | 14 | 1[e] | 0 | 1 | 2 | 2 | 2 | 2 | 09/19/01 |
| 19 | Alcona | Beef | 6 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 12/07/01 |
| 20 | Oscoda | Beef | 21 | 1[f] | 0 | 0 | 1 | 1 | 1 | 1 | 04/10/02 |
| 21 | Alpena | Beef | 39 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 05/24/02 |
| 22* | Alpena | Beef | 40 | 8 | 0 | 5 | 4 | 3 | 3 | 2 | 06/12/02 |
| 23* | Alpena | Beef | 37 | 8 | 0 | 0 | 2[g] | 2 | 2 | 2 | 06/28/02 |
| 24 | Emmet | Beef | 33 | 3 | 0 | 3 | 1 | 1 | 1 | 1 | 07/17/02 |
| 25 | Emmet | Dairy | 79 | 10 | 0 | 1 | 1 | 1 | 1 | 1 | 07/17/02 |
| 26 | Alcona | Dairy | 350 | 12 | 1 | 0 | 0 | 0[c] | 0 | 1 | 11/22/02 |
| 27 | Alcona | Beef | 45 | 4 | 1 | 0 | 0 | 1 | 1 | 1 | 01/21/03 |
| 28 | Oscoda | Beef | 19 | 2 | 0 | 2 | 2 | 2 | 2 | 1 | 01/27/03 |
| 29 | Alpena | Dairy | 35 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 03/60/03 |
| 30 | Antrim | Beef | 70 | 4 | 0 | 1 | 1 | 1 | 1 | 1 | 05/23/03 |
| 31 | Alpena | Beef | 23 | 5 | 0 | 1 | 1 | 1 | 1 | 1 | 11/10/03 |
| 32 | Alpena | Dairy | 68 | 3 | 1 | 0 | 1 | 1 | 1 | 1 | 12/23/03 |
| 33* | Montmorency | Dairy | 148 | 7 | 1[h] | 0 | 1 | 1 | 1 | P | 07/15/04 |
| Totals | | 2986 | 208 | 15 | 67 | 86 | 93 | 69 | 85 | | |

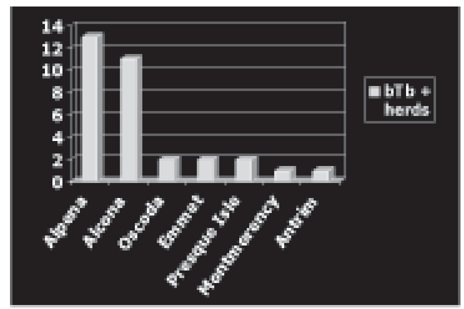
nt = not tested, [a] Date first diagnosed by PCR or culture, [d] Only 22 tested, [g] slaughter positive, * = 2X-infected premises
[b] Only 116 necropsied, [e] Only 13 tested, [h] Gamma Int. positive, P = pending, [c] Herd not yet depopulated, [f] DSSC test reactor

Note: Table updated after conference

## **Changes to the Bovine TB Accredited Free Herds Program** (cont)**:**

Management issues that likely affect the risk of bovine TB introduction into domestic livestock mainly revolve around two issues: 1) how cattle are housed (inside barns, in open (pasture) areas, or a combination of these two methods); and 2) how cattle are fed, including where feed is stored and where it is presented to the animals. Central to both issues is whether deer and/or other wildlife known to harbor *M. bovis* can freely enter the same areas occupied by livestock, and if these wildlife species can access feed either while it is being stored or after it has been presented to livestock. When feed is presented either inside housing or very close to animal housing areas, the likelihood of feed contamination via bovine TB infected wildlife should be reduced as compared to providing feed to cattle in close proximity to where wildlife reside (i.e., cover exists for wildlife and/or is some distance away from farm buildings/human dwellings). Because the risk of bovine TB transmission associated with feed source likely varies by geographic region (because of differing bovine TB prevalence in wildlife among these areas), the requirements for mitigating this risk can be reasonably expected to vary as well.

**TB Infected Cattle Herds by County**




## Peter H. Butchko

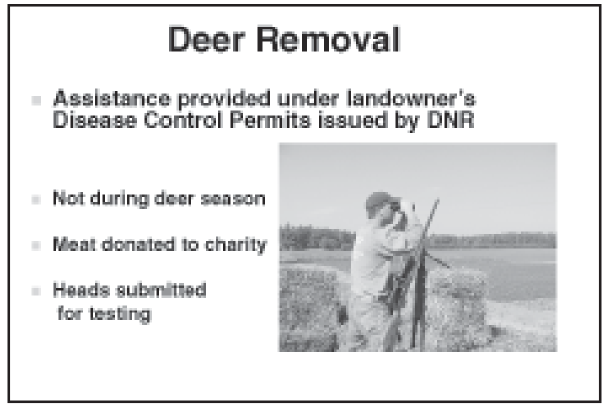
Director, Wildlife Services
USDA, Okemos, Michigan

### USDA – Wildlife Services
### Michigan TB Program Update

USDA – Wildlife Services (WS) has contributed to the eradication of bovine TB in Michigan.

1) WS employees have assisted producers by removing deer under disease control permits issued by MDNR.

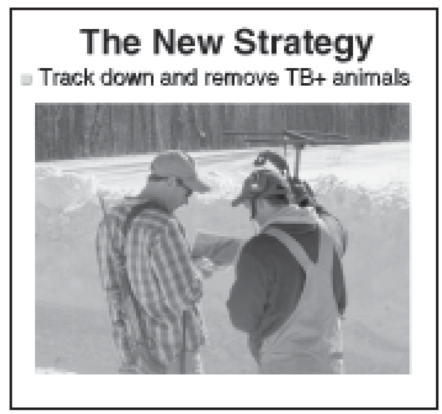
2) WS has provided fencing to producers to prevent deer from feeding at feed storage areas as a means to prevent transmission. To date, 22 fences have been erected and 19 others are pending. Observations of existing fences have not indicated that any deer have penetrated the barriers.

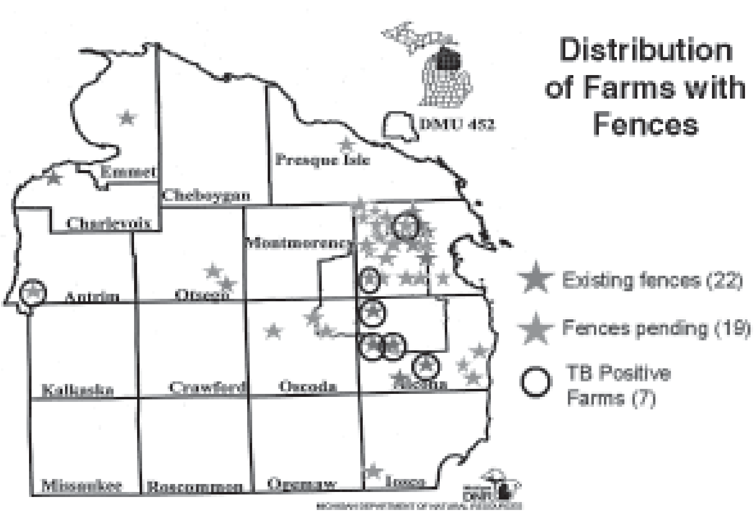



3) WS employees continue to make observations of wildlife patterns on TB positive farms. With the assistance of MDA and USDA-VS, WS staff is getting onto farms before the livestock are removed in order to get a more realistic and complete picture of wildlife activity.

4) WS participated in MDNR's test-and-remove strategy by assisting with trapping and removing deer that have tested positive.

5) WS employees provided considerable assistance to WS researchers.




**Wildlife Observations on TB+ Farms**

- Cooperative effort with MDA, USDA VS facilitates earlier access on TB+ farms
  - Earlier access (prior to depopulation) provides more realistic picture of wildlife activity on farm
- More intensive sampling – small mammals and deer

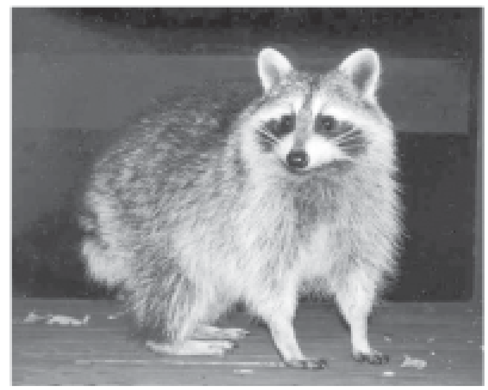
## Thomas DeLiberto

National Wildlife Disease Coordinator
United States Department of Agriculture,Wildlife Services


# The Ecology of *Mycobacterium bovis* in Michigan

T.J. DeLiberto, K.C. Vercauteren, and G.W. Witmer. USDA/APHIS Wildlife Services, National Wildlife Research Center, Fort Collins, CO

In support of bovine TB control in Michigan, USDA/APHIS/WS National Wildlife Research Center has been conducting research to clarify the role of wildlife in the ecology of *M. bovis* in Michigan, identify methods to improve surveillance and develop methods to decrease potential transmission between livestock and wildlife. A study is under way to determine if wildlife other than white-tailed deer could serve as reservoirs or vectors of *M. bovis*. As of December 31, 2003, samples from 858 animals of 32 species have been processed and submitted to the MSU diagnostic laboratory and results of 723 cultured samples have been analyzed. The overall prevalence rate of submissions (10 positive and 4 suspect animals of 723 lab results) is 1.94%. Raccoons had a prevalence rate of 8.1% (5 of 62). The prevalence rate in opossums was 5.7% (4 of 70).

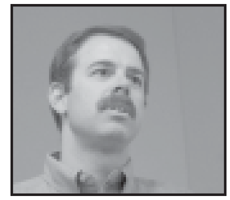


A study examining the potential of coyotes as a sentinel species of TB in white-tailed deer has been documenting the home range and dispersal patterns of coyotes. Home ranges of coyotes ranged from 5 to 16 square miles. We are currently estimating the prevalence rate of bovine TB in coyotes. Preliminary results suggest a prevalence of 30% in coyotes within the core area. These data suggest that coyotes would serve as a good sentinel species for TB.

Research to document interactions among white-tailed deer and other potentially infected wildlife has been completed. After 2 years and over 1,700 hours of observations on 212 farms, only one direct deer-cattle interaction (<15 ft) was observed. However, 273 incidences of deer (949 individuals) using cattle pasture and feed were documented. Numerous direct and indirect interactions were observed among cattle and other animals (e.g., turkey, coyote, rabbit, opossum, raccoon, domestic cat). These results suggest that direct interaction between cattle and deer is rare and interspecies transmission of *M. bovis* is more likely to occur through indirect routes.

Studies that involve psychological, physical and biological barriers are being evaluated to minimize interactions between white-tailed deer and livestock to reduce interspecific transmission of TB. Evaluations of electric eartags, propane cannons, electronic guards, a commercially available deer activated siren, and red laser light found that these devices did not reduce deer use of areas. However, a deer activated acoustic and visual effigy was effective at protecting food resources from deer. We completed research that evaluated the effectiveness of electrobraid fencing to prevent deer from using food resources. The value of this fencing ranged from marginal to very effective depending on the configuration.

# Kurt C. VerCauteren



USDA/APHIS/Wildlife Services/National Wildlife Research Center, 4101 LaPorte Avenue, Fort Collins, CO


## Use Of Dogs For Limiting Deer Contact With Cattle

Bovine tuberculosis (*Myobacterium bovis*) is established in wild white-tailed deer (*Odocoileus virginianus*) in northeastern lower Michigan. To minimize direct and indirect contact between cattle and potentially disease-infected deer, methods to limit deer use of pastures and interactions with cattle are being sought. Livestock protection dogs have been used successfully for thousands of years to reduce predation on livestock, primarily sheep. Dogs socially bonded with cattle could minimize direct contact between deer and cattle, as well as deer use of pastures. To evaluate this, we conducted a study at captive white-tailed deer operations where the opportunity for deer/cattle interactions were greatly increased due to high deer densities. Protected pastures contained 4 cows and 1 dog and unprotected pastures contained just 4 cows. Dogs were contained by Invisible Fences® and cattle were contained with two-strand electrified poly-rope fences. Data on deer use of pastures and interactions among deer, cows, and dogs were collected via direct observation, animal-activated video systems at feed sites, and trail monitors and track plots along pasture perimeters. The dogs performed well; deer were about 75 times more likely to feed on cattle feed in pastures without dogs. In addition, deer were about 40 times more likely to contact cattle directly in pastures without dogs.

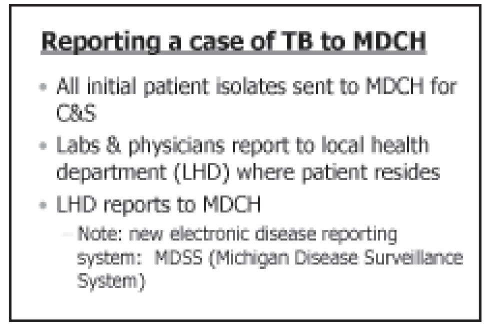
A second phase of this effort has been initiated and the dogs are now on working farms. We are presently evaluating if the dogs are effective with more cows in larger pastures, if they can be effective over a several year period, if they can integrate into existing operations, and if landowners will like them and perceive them to be an asset. The dogs are working well and the landowners feel they are doing their job, which is keeping deer and other wildlife, including coyotes, out of pastures and away from cows.

# Mary Grace Stobierski

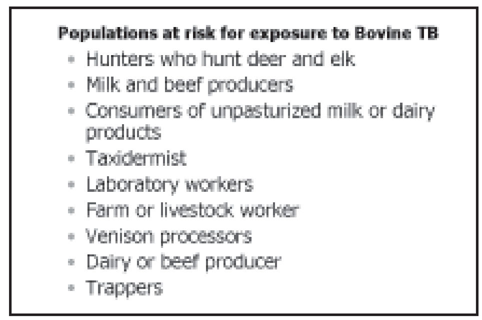
Bureau of Epidemiology
Michigan Department of Community Health


## Human TB Epidemiology

In the late 19th century, TB killed one out of every seven people living in the United States and Europe. Today, TB continues to remain a threat to the health and well being of people around the world. Among infectious diseases, TB remains the second leading killer of adults in the world, with more than 2 million TB-related deaths each year. The global incidence rate of TB is growing at approximately 0.4% per year, but much faster in sub-Saharan Africa and in countries of the former Soviet Union.




Michigan, along with 21 other states, is considered a "low-incidence" state with case rates of active tuberculosis below 3.5/100,000 in the population. The number of reported cases has been slowly declining since 1993, although this decline has not been of equal benefit for all racial and ethnic groups. Between 20 and 30 residents die each year in the state as a result of TB.

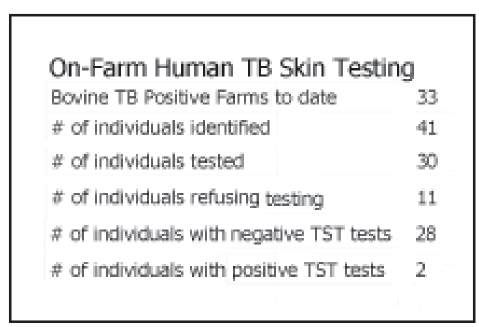



One of the major trends in TB in Michigan has been a gradual decline in the number of cases reported. In 2003, TB Control Program reported 243 TB cases and a case rate of 2.4 per 100,000 population. This represents a 22.9% decrease in the number of cases reported in 2002. TB cases in Michigan have decreased by 36.9% over the six-year period from 1998 - 2003.

*M. tuberculosis* complex consists of three mycobacterial species: *M. tuberculosis, M. bovis* and *M africanum*. All three organisms are transmitted in the same manner and cause similar clinical disease and all are reported to the Centers for Disease Control (CDC) as a case of tuberculosis

Since 1997, in Michigan, only one of the nine human cases of bovine TB has been associated with the strain of bacterium found in the cattle and wild-white-tailed deer population of Northern Lower Michigan. This Alpena County resident was U.S. born, elderly and died of unrelated causes in 2002. This person had a family that hunted and may have consumed unpasteurized milk as a child. The other TB positive individuals were either elderly and grew up on farms in Michigan or were foreign born.

MDCH works with the local health department to offer skin tests to farm families with TB positive cattle. To date, there have been 33 TB positive farms, with 41 at risk individuals identified. Of those identified, 30 have been skin tested and 11 have refused. Twenty-eight individuals were tuberculosis skin test (TST) negative and two were TST positive. Individual that respond to the TST are referred to their physicians for follow up diagnosis. Just as in testing for disease in cattle and deer – a positive skin test does not necessarily mean that the individual has tuberculosis disease.



On-Farm Human TB Skin Testing

| | |
|---|---|
| Bovine TB Positive Farms to date | 33 |
| # of individuals identified | 41 |
| # of individuals tested | 30 |
| # of individuals refusing testing | 11 |
| # of individuals with negative TST tests | 28 |
| # of individuals with positive TST tests | 2 |

## Dale Berry

Bureau of Laboratories
Michigan Department of Community Health

## MDCH's Participation in the Resolution of Michigan's Bovine Tuberculosis Problem by Assisting with Diagnosis, Research and Assistance Services

The MDCH TB/Mycology Laboratory provides services to health partners in Michigan to assist in the diagnosis of disease caused by *Mycobacterium spp.* and fungal micro-organisms. Services are provided primarily for Michigan's human public health but also for diagnosis of disease in animals.
The laboratory tests approximately 8,000 clinical specimens and 2,000 referred culture isolates annually, using a variety of methods including acid fast slide examination, rapid culture isolation, genetic probe, chromatographic profiling, biochemical identifications, susceptibility testing and DNA fingerprinting.

Approximately 250 new human cases of TB are diagnosed annually in Michigan. The vast majority of human cases are due to *Mycobacterium tuberculosis*, not *Mycobacterium bovis*, which is responsible for bovine TB primarily found in Michigan's deer and cattle. The ability of the MDCH TB laboratory to quickly and accurately diagnose TB infection and to specifically determine the type of TB is not only important for patient care and public health, but also important in the efforts to eradicate bovine TB from Michigan's animal populations.

**Michigan's Human Tuberculosis Cases**

| Year | Human TB Cases *(M.tb.)* | Human TB Cases *(M.bovis)* |
|---|---|---|
| 1997 | 373 | 3 |
| 1998 | 385 | 2 |
| 1999 | 351 | 0 |
| 2000 | 287 | 1 |
| 2001 | 330 | 0 |
| 2002 | 315 | 1* |
| 2003 | 243 | 2 |

*Same strain found in deer and cattle in Michigan.

***M.bovis* Testing at MDCH**

| Year | # Humans Tested | # Human *M. bovis* | # Deer Tested | # Deer *M.bovis* |
|---|---|---|---|---|
| 1994 | 7637 | 0 | 1 | 1 |
| 1995 | 8902 | 1 | 51 | 18 |
| 1996 | 7756 | 0 | 94 | 56 |
| 1997 | 7303 | 3 | 131 | 88 |
| 1998 | 7426 | 2 | 116 | 84 |
| 1999 | 7873 | 0 | 127 | 60 |
| 2000 | 7296 | 1 | 119 | 58 |
| 2001 | 7681 | 0 | 604 | 60 |
| 2002 | 7116 | 1 | 386 | 54 |
| 2003 | 6143 | 1 | 73 | 32 |

## Stephen Schmitt

Rose Lake Wildlife Research Center
Michigan Department of Natural Resources, Bath, Michigan

# Free-ranging White-tailed Deer Test and Remove Pilot Project

**Pilot studies to investigate a new strategy for control of bovine tuberculosis in Michigan white-tailed deer**

Since 1995, when the DNR recognized that bovine Tuberculosis (TB) was established in the white-tailed deer of northeastern Lower Michigan, the two principal management strategies have been to reduce deer densities in the affected area and restrict baiting and supplemental feeding of deer. With the cooperation of Michigan hunters, the strategies have been effective in stopping further build-up of TB and in lowering the percentage of the herd that is infected. Currently, about 1.7% of the deer in the core area are infected. The DNR is not content to rely solely on its principal management strategies and is always looking for new ways to help in the effort to eradicate bovine TB in its free-ranging deer herd. Any new strategy, besides being efficacious in lowering TB prevalence, must also be acceptable to the landowners and the public.

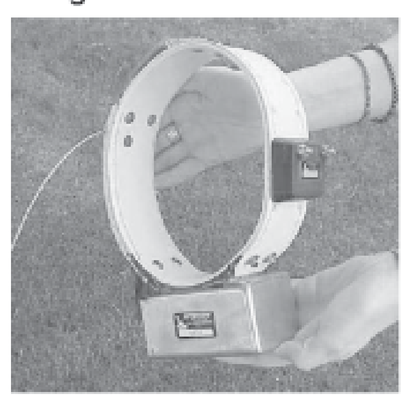
Most of the people who hunt or own property in TB-affected areas are strongly opposed to killing a lot more deer. The refinement of a blood test for TB raises the possibility of a management approach that may enable targeting TB-positive deer without having to kill off many healthy deer to get the small percentage of the herd that is infected.

Biologists from the DNR, New Zealand, and Michigan State University proposed an experimental TB control strategy. It calls for two field trials or “pilot” studies in the core TB area, the first to see if the plan can be carried out under field conditions, and the second to see if the strategy will actually reduce the percentage of the wild deer herd that is infected with TB.

**Field Trial 1:**
**Is it feasible to blood-test and selectively kill TB positive deer?**

- Deer were live-trapped January through March in a part of the TB core area that has a relatively high percentage of infected deer.
- Deer had a blood sample drawn, were fitted with ear tags and radio collars, and then be released.
- Blood samples were tested for TB at Michigan State University.
- TB-positive deer were located by their unique radiocollar signal and shot. The carcasses of all deer killed were tested for TB to check the accuracy of the blood test.
- TB-negative deer were left alone—the radiocollars were self-releasing, and fell off the deer after a preset time period, and were recovered for reuse.
- The target number of yearling and adult deer to be caught and tested will be about 100. About five of those deer are expected to be TB positive.
- Based on the outcome of this feasibility trial, we will decide whether or not to proceed with the second pilot study.

Programmable Radio-collar



**Field Trial 2: Is the test-and-kill strategy an effective way to reduce TB?**

- Deer will be live-trapped, radio-collared, TB tested and released as above, but in a larger geographic area and over two winters. The study area chosen will have a relatively high percentage of TB-infected deer based on DNR testing of hunter-harvested deer.
- The goal will be to reduce the number of TB-positive deer by 10% each year for two years in a row.
- The data will be analyzed statistically to determine if the strategy succeeded in significantly reducing the percentage of TB positive deer.

We expect this work to be difficult to carry out and it will not work without landowner cooperation. But, if it does work, it will keep Michigan moving toward elimination of TB from wildlife, while preserving as many uninfected deer as possible.


## Patrick Rousseau

Riding Mountain National Park
Wasagaming Manitoba, Canada



## Doug Bergeson

Riding Mountain National Park
Wasagaming Manitoba, Canada


### Bovine Tuberculosis In The Riding Mountain National Park Region

Bovine tuberculosis (*Mycobacterium bovis*) re-appeared in the Riding Mountain National Park (RMNP) Region in domestic cattle in1991 and in wild elk (*Cervus elaphus*) in 1992. In 2000, a multi-agency task force team, consisting of members of Parks Canada (RMNP representatives), the Canadian Food Inspection Agency (CFIA), Manitoba Conservation, and Manitoba Agriculture and Food and Rural Initiatives, was established to deal with the ongoing management complexities of agriculture/wildlife bovine TB issue.

The Task Force Team has focused on four main areas: (1) disease surveillance, which consists of examining hunter killed samples of cervids (2,385 elk heads with nine being confirmed positive for bovine TB, and 1,925 white-tailed deer [*Odocoileus virginianus*] heads with two being confirmed positive for bovine TB), and testing of domestic cattle in the region (over 50,000); (2) disease prevention, which includes barrier fences (100, 8-foot high cervid proof fences) being installed around cattle producers hay yards, and regulations and enforcement of baiting and feeding of cervids; (3) research, which has focused on understanding elk movement patterns, habitat use of elk, and predator prey relationships of wolves and elk; and (4) disease control, which includes tagging cattle and tracing of cattle in the region.

One program that transcends several of the management areas is the blood testing and removal of elk in RMNP. Since 2002, 305 elk have been captured using a helicopter and net gun technique, had blood samples taken and radio collars or ear transmitters attached. The blood is transported to the CFIA lab in Napean, Ontario, for analysis. Tests done on the blood are the lymphocyte stimulation test (LST), the fluorescence polarization assay (FPA), and the polymerase chain reaction test (PCR). Elk that are determined to be suspect as per the blood tests are then tracked down, blood samples taken, euthanized and complete post mortems conducted. Out of the 305 elk screened using the blood tests, 63 elk have been removed as suspect and 11 have been confirmed with bovine TB (results pending for 26 elk).

The presence of bovine TB in the elk and white-tailed deer populations in and around RMNP represents a significant threat to the region’s cattle industry. Dealing with such a complex issue will require an adaptive management approach that incorporates new information as it becomes available through research and science.

## Ryan Brook

Ph.D. Student, University of Manitoba

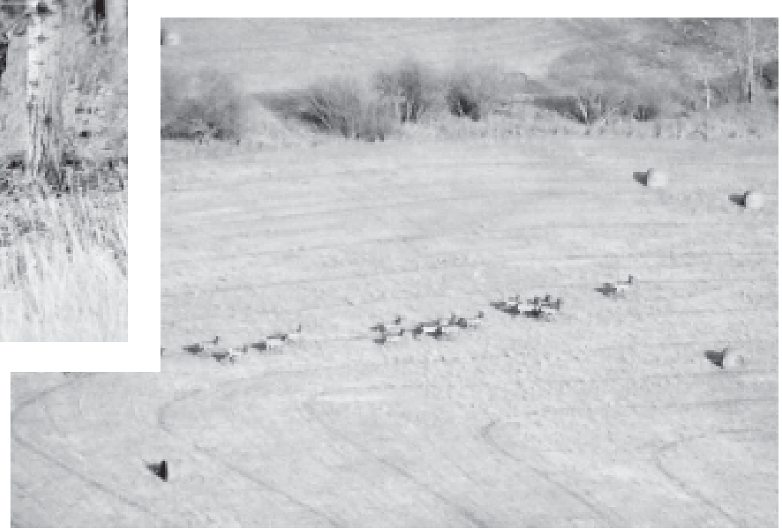
### Elk-Agriculture Interactions around Riding Mountain National Park

R.K. Brook[1], McLachlan, S.M.[1]. [1]Faculty of Environment, University of Manitoba

Elk within the Greater Riding Mountain Ecosystem of Manitoba are not restricted to National or Provincial park "islands". Movements of elk out of protected areas into the surrounding agriculture-dominated landscape can result in disease transmission. The purpose of this study is to determine the relative importance of environmental and farm management practices that influence elk movements out of Riding Mountain National Park (RMNP) and assess farmers' perceptions of risk associated with wildlife interactions.

In order to document farmers' concerns, a mail survey was sent to all 4,220 farms in the region in April 2002. Attitudes toward elk, deer and moose are largely positive, while attitudes toward wolves are more negative. The number of farms reporting indirect contact between deer and cattle (65%) was twice the number of farms with indirect contact between elk and cattle (27%). However, the level of concern regarding TB in deer was similar to that for TB in elk. Despite the high level of concern over disease transmission, few farm operators reported making changes to their farming practices to reduce their personal risk.

During the winters of 2002 to 2004, 139 elk were captured in and around RMNP using a net-gun fired from a helicopter and fitted with either a GPS satellite collar or VHF collar or ear transmitter. Relocations were collected on VHF collared elk one to six times per week and on GPS collars once every one or two hours. Preliminary data indicates that 38% of the collared elk moved outside of RMNP at some point in the year. The proportion of each elk's locations that were outside of RMNP ranged from 0% to 83%. Long distance movements (>25 km) and dispersal events have been documented, including three bull elk moving from RMNP to Duck Mountain Provincial Forest to the north. Home range size (100% Minimum Convex Polygons) ranged from 13 $km^2$ to 533 $km^2$.



## Om Surujballi

Mycobacterial Diseases Centre of Expertise
Canadian Food Inspection Agency

## Use of Antemortem Blood Tests

Bovine Tuberculosis (TB) has recently been identified in cattle and in free-ranging cervids in the area of Riding Mountain National Park (RMNP), Manitoba, Canada. Between 1991 and 2002, the causative organism of bovine TB, *Mycobacterium bovis,* has been isolated from a number of cattle herds, from hunter/predator/road-killed elk and from at least one white-tailed deer in this region.

In January 2003, a TB management zone was created in the area of RMNP. This zone has been classified as TB Accredited Advanced in relation to the rest of Manitoba and to the other provinces and territories of Canada which are classified as TB-free. The Canadian Food Inspection Agency (CFIA), Parks Canada Agency, and the province of Manitoba have taken steps to reduce the incidence of bovine TB in this area. Among the measures instituted are enhanced TB surveillance of cattle in the zone; barrier fencing of hay storage yards to prevent access by free-ranging cervids; and the targeted removal of elk from the herd that resides within the Park.

Beginning in 2002, the CFIA and Parks Canada have been conducting a joint research project to examine the efficacy of ante-mortem blood tests as a means of diagnosing tuberculosis in elk resident in RMNP. The tests being investigated include the lymphocyte stimulation test (LST), the polymerase chain reaction (PCR) and the fluorescence polarization assay (FPA). The presentation will discuss the results that we have obtained to date in the application of these three technologies for diagnosing bovine tuberculosis in free-ranging elk in Riding Mountain National Park.

### Experimental Design

- Blood tests interpreted in parallel
- Animals scored positive by 1 or more of the 3 blood tests were re-captured and necropsied (2003 and 2004)
- Tissue samples submitted for histopatholgy and culture

### Results

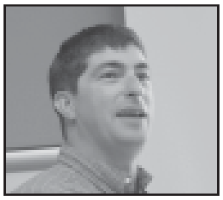
- **2002** 40 elk captured and tested. (1 animal scored positive on LST) No recapture of animals during 2002
- **2003 (January)** 115 elk captured and tested with LST, FPA, PCR
- LST 28 animals +ve (4/28 FPA +ve, 5/28 PCR +ve)
- FPA 9 animals +ve (4/9 LST +ve, 2/9 PCR +ve)
- PCR 14 animals +ve (5/14 LST+ve, 2/14 FPA +ve)
- Total of 40 elk positive on at least 1 test

### 2004

- **150 Elk tested**
- **29 positive/suspicious on at least 1 test**
  - **12 LST +ve (bovis)**
  - **6 LST mycobacteriosis suspect**
  - **13 FPA +ve**
  - **3 PCR +ve**
- **26 animals were recaptured and necropsied (histo and culture in progress)**

### Summary

- From 2002 to 2004 a total of 305 elk were tested by LST, PCR and FPA
- 70 elk were positive on at least 1 test
- 63/70 positive elk were necropsied and tissues submitted for histopathology and culture of *M. bovis*
- So far, 11/37 blood test-positive animals are positive by culture/PCR (PEFF) [histo and culture incomplete for 26 elk]



## Ray Waters

United States Department of Agriculture,
Agricultural Research Service,
National Animal Disease Center,
Bacterial Diseases of Livestock Research Unit, Ames, Iowa

## Mitchell V. Palmer

United States Department of Agriculture,
Agricultural Research Service,
National Animal Disease Center,
Bacterial Diseases of Livestock Research Unit, Ames, Iowa

### Blood-based Assays for Detection of *Mycobacterium bovis* Infections in Cervidae

White-tailed deer (*Odocoileus virginianus*) have emerged as reservoirs of bovine Tuberculosis (TB) in Northern America. Additionally, captive deer (including reindeer, *Rangifer tarandus*) are routinely TB tested for interstate shipment and herd accreditation. For TB surveillance of deer, blood-based assays are particularly attractive because deer are handled only once. Both cell-mediated and humoral responses are elicited upon infection of deer with *Mycobacterium bovis*.

In addition to skin testing, cell-mediated sensitization may be detected by evaluation of lymphocyte blastogenic, interferon (IFN)-$\gamma$ (i.e., Cervigam™), or nitric oxide (NO) responses to mycobacterial antigens. Serologic assays for the detection of infected deer include enzyme linked immunosorbent assays (ELISA), fluorescence polarization assays (FPA), immunoblot, and multi-antigen print immunoassay (MAPIA). Antigens used for these assays include complex antigens such as purified protein derivatives (PPD), whole cell sonicates (WCS), culture filtrates (CF), and lipoarabinomannan-enriched (LAM) antigens as well as specific antigens such as the early secretory antigenic target-6 kDa protein (ESA˚T-6), culture filtrate protein 10 (CFP-10), MPB70, MPB83, MPB64, MPB59 and many others.

> **Suggestions**
>
> **Use of combination assays:**
>
> **Complex antigens for sensitivity and *M. tb complex*-specific antigens for specificity**
>
> **Cellular- and antibody-based tests**

In studies with experimentally infected white-tailed deer, cell-mediated responses are detected as early as 90 days after challenge. Use of specific antigen (i.e., rESAT6:CFP10 fusion protein) enhances the specificity of IFN-$\gamma$ - based tests for detection of tuberculous reindeer. Indeed, *M. avium*- and *M. avium* subsp*. paratuberculosis*-infected cattle with robust IFN-$\gamma$ responses to *M. avium* and *M. bovis* WCS and PPD do not respond to rESAT6:CFP10 whereas *M. bovis*-infected calves do respond to rESAT6:CFP10.

While specific NO responses are elicited by experimental infection, the assay is not practical for field use in its current state as isolated mononuclear cells are required. However, IFN-$\gamma$ -based and lymphocyte blastogenic tests are adaptable to a whole blood format; thus, they are more adaptable to field applications. Antibody-based assays are particularly attractive because immediate processing of the sample is not required. ELISA and immunoblot assays using complex antigens are highly sensitive yet poorly specific as many of the antigens in PPD, WCS, and CF are shared with other mycobacterial species. Utilization of specific antigens (e.g., MPB83 and MPB70) with either immunoblot or FPA enhances the specificity of the test, however, results in decreased sensitivity. Tests that utilize multiple specific antigens (e.g., MAPIA) are more sensitive than are single antigen assays. Ultimately, tests that incorporate multiple specific and complex antigens will likely provide the greatest sensitivity and specificity. Further studies using samples from experimentally and naturally infected deer will be required to develop improved tests for detection of tuberculous deer. Additionally, direct comparisons of each of the tests (i.e., cellular- and humoral-based assays) using samples from the same deer will provide a more accurate assessment of the sensitivity and specificity of the tests.

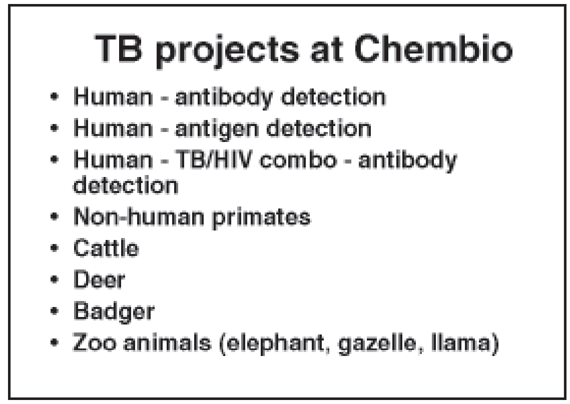
### Conclusions

- Responses to complex antigens are easily detected yet often lack specificity
- Use of rESAT6:CFP10 enhances the specificity of cellular-based tests
- Use of rMPB83, and other antigens, enhances the specificity of antibody-based tests
- Both antibody- and cellular-based assays are useful for TB diagnosis

## Konstantin Lyashchenko

Chembio Diagnostic Systems, Inc., Medford, NY

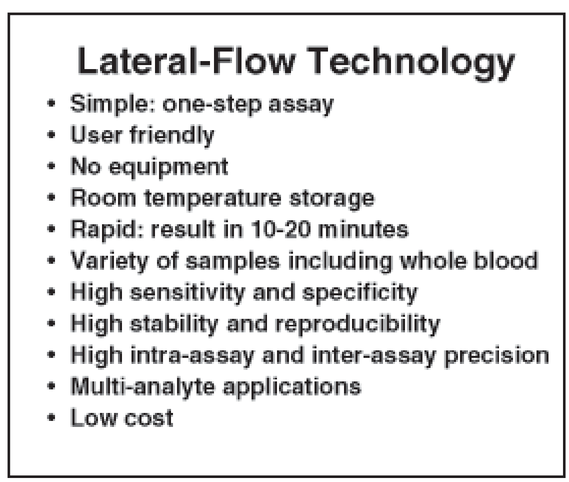

### Novel Immunoassay Technologies for Serological Detection of Bovine Tuberculosis




Deer have recently emerged as wildlife reservoirs of *Mycobacterium bovis* infection of cattle in the United Kingdom and Northern America. To improve control of bovine Tuberculosis, new diagnostics for *M. bovis* infection are needed. Novel serological methods, such as MAPIA (MultiAntigen Print ImmunoAssay) developed at Chembio (Lyashchenko, et al., 2000) and the lateral-flow technology, were proposed for rapid antibody detection during experimental *M. bovis* infection in white-tailed deer. In addition, tuberculosis serology data obtained in cattle and badgers as well as a case study on antibody responses in an elephant with human tuberculosis were presented. The relationships between the humoral and cell-mediated immune responses in the infected animals were analyzed.

In the deer study, serum samples from 25 animals infected with *M. bovis* by various routes (intratonsilarly, by aerosol, or by exposure to infected deer) and three animals infected with *M. paratuberculosis* were collected sequentially during infection. Serological markers of diagnostic importance were identified by MAPIA using 12 recombinant antigens. It was found that irrespective of the route of *M. bovis* infection, variable levels of serum IgG antibodies against multiple antigens could be detected as early as four weeks post-infection in white-tailed deer. The immunodominance of the MPB83 protein was demonstrated. None of the *M. bovis*-specific antigens reacted with pre-infection samples or with sera from deer experimentally infected with *M. paratuberculosis.*

The MAPIA results demonstrated the heterogeneity of antigen recognition by serum antibodies in *M. bovis* infection. To cover this animal-to-animal variation, a cocktail of multiple antigens was required for an accurate serodiagnostic assay for bovine tuberculosis. A lateral-flow test was developed using selected seroreactive proteins. In a pilot study, the rapid test sensitivity was 80% and the specificity was 94%. Most of the positive results were obtained within several minutes. This test could detect antibodies in sera from tuberculous cattle, badgers, and elephants. It is suggested that the proposed serological approach has the potential to improve the control of bovine tuberculosis in the livestock and wildlife animals by employing the concept of multi-host-species immunoassays.



## Scott D. Fitzgerald

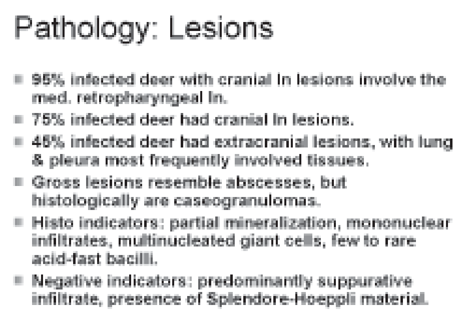
Scott D. Fitzgerald, DVM, PhD, Kathy-Anne Clarke, DVM, Katie Boland, Sarah Fox
Diagnostic Center for Population and Animal Health, Michigan State University, East Lansing, MI

## Update on Bovine Tuberculosis Activities at DCPAH, MSU


The goal of this presentation is to summarize the bovine TB activities at MSU's Diagnostic Center for Population and Animal Health (DCPAH) over the past decade. Bovine TB activities at the DCPAH can be divided into three main categories: surveillance and prevalence studies, pathology and other diagnostic testing, and experimental studies.

The primary surveillance effort by the surveillance team (DCPAH, Michigan Departments of Natural Resources [DNR], Agriculture [MDA] and Community Health [MDCH] and the National Veterinary Services Laboratory [NVSL], U.S. Department of Agriculture [USDA]) is the Deer TB Survey, which began in 1995 and is ongoing. Surveillance screening involves mainly cranial lymph nodes and only deer with gross lesions from hunter harvested deer. From this surveillance, prevalence appears to have reached a plateau at a level between 1.8 per cent to 2.8 percent disease prevalence, and there appeared to be significant down turn in disease prevalence in 2003.

In collaboration with DNR and MDCH, six high prevalence townships were selected and a "true prevalence" study conducted. Pathologic and diagnostic studies focused on location of lesions, gross and histologic pathology, and identification of TB organism, including the use of genetic probes, biochemical assays and HPLC.




Experimental studies have examined the role of a variety of animals and birds as possible wildlife reservoirs/models for bovine TB. Data from the Virginia Opossum suggests that although the animal is a susceptible host, it is not likely to serve as a significant wildlife reservoir. Additional studies have examined the role of rodents and birds in the spread of bovine TB. Voles and mice, but not rats, are likely to contribute to reinfection of TB cattle herds following repopulation, unless significant rodent control methods are practiced. Although not classically considered hosts for *M. bovis*, wild birds pose a significant bio-security risk due to small size, high numbers, flight over long distances, ability to bypass many barriers used in agricultural settings. Our studies indicate that pigeons are most likely to be a "real world" problem.

Future studies involve examining the efficacy of a new *M. bovis* subunit vaccine. After vaccination with either BCG or the *M. bovis* subunit vaccine, mice will be intranasally challenged with *M. bovis*. Antibody response, body weight, mortality, fecal shedding, *M. bovis* counts in lungs and spleens and pathology of multiple tissues will be measured and compared between the BCG, the subunit vaccine, and unvaccinated controls.

Publications Resulting from Surveillance:

Schmitt SM, et al: Bovine Tb in Free-ranging White-tailed Deer in MI. J Wildl Dis 33:749-758, 1997.
Bruning-Fann, et al: *M. bovis* in Coyotes from MI. J Wildl Dis 34: 632-636, 1998.
Bruning-Fann, et al: Bovine Tb in Free-ranging Carnivores from MI. J Wildl Dis 37:58-64, 2001.
O'Brien DJ, et al: Epidemiologic Aspects of M. bovis in Free-ranging White-tailed Deer, MI, 1995-2000. Prevent Vet Med 54:47-63, 2002.

Publications Relating to Prevalence Studies:

*O'Brien DJ, et al: Estimating the True Prevalence of M. bovis in Hunter-harvested MI white-tailed Deer. J Wildl Dis 40:42-52, 2004.*

Publications Relating to Pathology & other Diagnostic Testing

Fitzgerald SD, et al: Comparison of Post-mortem Techniques for Detection of *M. bovis* in White-tailed Deer. J Vet Diagn Invest 12:322-327, 2000.

O'Brien DJ: Tuberculosis Lesions in Free-ranging White-tailed Deer in MI. J Wildl Dis 37:608-613.

Palmer MV, et al: Tonsillar Lesions in White-tailed Deer Naturally Infected with *M. bovis*. Vet Rec 151:149-150, 2002.

Publications from Experimental Studies:

Butler KL, et al: Exp. Inoculation of European Starlings & American Crows with *M. bovis*. Avian Dis 45:709-718, 2001.

Diegel, KL, et al: Exp. Inoculation of NA Opossums with *M. bovis*. J Wildl Dis 38:275-281, 2002.

Fitzgerald SD, et al: Exp. Aerosol Inoculation of *M. bovis* into NA Opossums. J Wildl Dis 39:418-423, 2003.

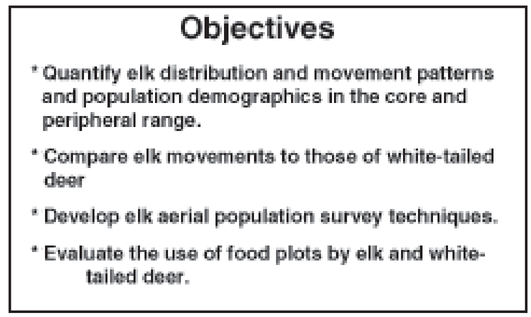
Fitzgerald SD, et al: Exp. Inoculation of Pigeons with *M. bovis*. Avian Dis 47:470-475, 2003.

# Henry (Rique) Campa, III

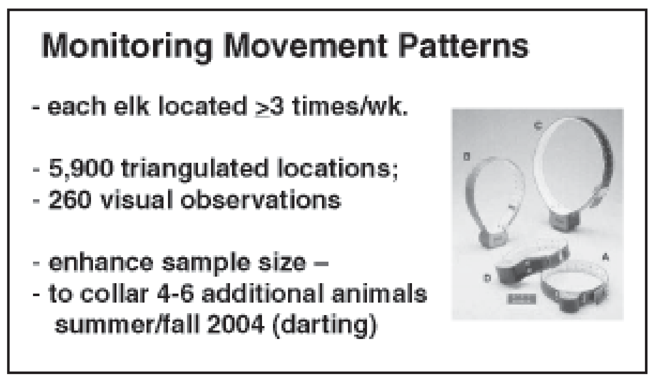
Professor
Department of Fisheries and Wildlife
Michigan State University, East Lansing, MI


## Quantifying Elk Movement Patterns, Interactions with White-tailed Deer, and Estimating the Population Size and Demographics in Michigan

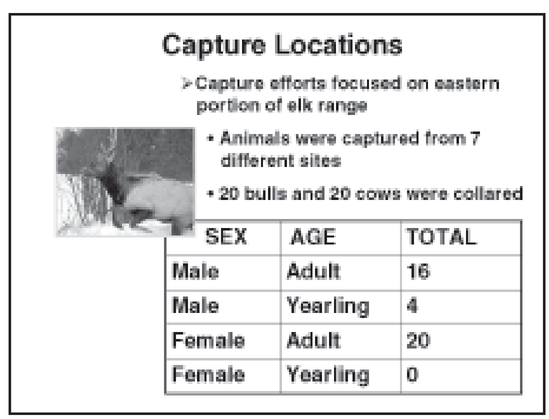
This study is a cooperative effort by Scott Winterstein and Dan Walsh, Michigan State University-Department of Fisheries and Wildlife (MSU); Dean Beyer, Jr., Michigan Department of Natural Resources-Wildlife Division (MDNR); and the Rocky Mountain Elk Foundation (RMEF). The project was initiated in February, 2003 and will continue through 2006.




There are two primary objectives of this project. First is the development of a new technique for surveying and monitoring the size of the elk herd throughout their Michigan range. Currently, MDNR monitors elk through the use of a combined aerial and ground search methodology; however, they have no means to correct counts for unseen animals. Therefore, MDNR population estimates are based on an index (i.e. the number of elk seen), and does not allow for testing of the precision of such counts. We plan to develop an estimation technique based on radio-marked individuals that will provide a means for adjusting counts for unseen animals and allow for testing of the precision of generated estimates of population size. In addition, elk range is believed to have increased by over 50% over the last 10 years (Dr. D. E. Beyer, Jr., MDNR, personal communication) creating a need for the development of an estimation technique that incorporates these range expansions. Our second primary objective is quantification of elk movement patterns to examine the amount of home range overlap between white-tailed deer and elk, with a focus on the implications for bovine tuberculosis (TB) transmission from infected animals between species.

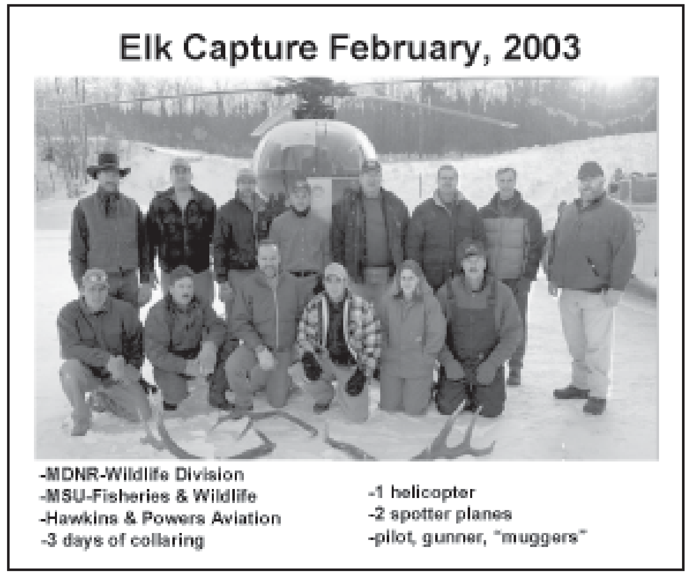



Hawkins and Powers Aviation Co. (Greybull, Wyoming, USA) were contracted to conduct all captures. MDNR personnel assisted in spotter planes by locating groups of animals and in restraining the captured animals, attaching radio collars and obtaining all necessary biological samples. Animals were captured using net-gunning techniques from a helicopter. In addition to radio-collaring animals, hair, blood and fecal samples were obtained from most individuals to measure pregnancy and general health, and for conducting genetic investigations of each elk. We began the capture operations on February 9, 2003. All animals were captured by February 12. It took a total of three days to capture the desired sample size with oneday of inclement weather that prevented flying. A total of 40 animals, 20 bulls and 20 cows, were captured over the three days.

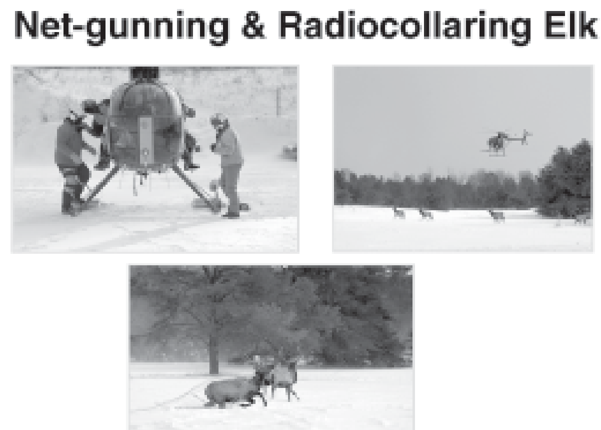



| SEX | AGE | TOTAL |
|---|---|---|
| Male | Adult | 16 |
| Male | Yearling | 4 |
| Female | Adult | 20 |
| Female | Yearling | 0 |

We monitored the survival of all animals intensely for the first seven to ten days after capture. We paid particular attention to those animals which were noted to have high body temperatures during handling, or, in the case of the bulls, those whose antlers were removed (i.e., three individuals had antlers removed because of net entanglement). These individuals were considered most at risk of succumbing to the stress associated with capture or to infection. However, no capture related mortality occurred. Currently, we are continuing to gather location data for each individual a minimum of three times a week using triangulation techniques. We also are obtaining a visual observation by homing in on at least two radio-marked elk per week. To date, we have acquired 2,270 triangulated locations and 121 visual observations. This location data will be subsequently analyzed and used to generate home range estimates for each of the radio-collared elk.




During the winter, elk remained in large herds and were relatively sedentary in their wintering areas. With the arrival of spring and the resulting resurgence in vegetation growth, the radio-collared animals exhibited a great deal of movement throughout the range with animals moving miles in short periods of time. In addition, group size decreased considerably. However, since early June most animals have exhibited only minor movements with a fidelity to general summering areas.




Most radio-collared elk dispersed (with the maximum being about 15 miles) from their general capture sites by late spring; however, to date, 15% of the elk, mainly bulls, are still in close vicinity to their capture locations and have demonstrated minimal movements from these locales.

We will continue to monitor and collect data on the movements and locations of radio-marked elk in order to provide precise, unbiased home range estimates and determine the annual variability in elk movements. We have also started developing a new elk population estimation technique.

This project fills a void in research relating to Michigan's elk resource, which has received little attention from researchers in the last decade. It is hoped that this project will provide useful tools and timely information to managers as they strive to meet the ever-increasing demands of various stakeholders interested in utilizing Michigan's elk resource. It is also hoped that this project will be a model for future partnering among public agencies and institutions and private organizations for the benefit of Michigan's natural resources.

## Amanda Fine

Department of Fisheries and Wildlife and, the Department of Large Animal Clinical Sciences at Michigan State University, East Lansing, Michigan

## Detection of *Mycobacterium bovis* in Environmental Substrates.

The potential for indirect transmission of bovine Tuberculosis (*M. bovis*) among and between cattle and white-tailed deer through the contamination of environmental substrates in northeast Lower Michigan has attracted great concern. The objective of this study was to develop and evaluate techniques for processing environmental samples (water, soil, and feed/plant material) for bacteriologic culture-based *M. bovis* detection. A series of experiments were designed in which typical environmental substrates were inoculated with *M. bovis*. Sample processing techniques were evaluated based on the subsequent ability to culture *M. bovis* from the inoculated samples. The primary comparison was between standard NaOH-based techniques and C(18)-carboxypropylbetaine (Integrated Research Technologies, LLC) sample processing methods. The perfected sample processing protocols were then applied to field collected environmental samples. Environmental samples first autoclaved and then inoculated with *M. bovis* showed equivalent detection rates using both the NaOH and CB-18 methods; however, overgrowth with non-mycobacterial agents was 50% greater in samples processed with the NaOH method. The increased “contamination” rates in the NaOH method led to a 25% decrease in *M. bovis* detection rates. The CB-18-based methods also proved superior when applied to processing field collected environmental samples by significantly reducing the occurrence of overgrowth with non-mycobacterial agents. To date, environmental samples have been collected from 11 cattle farms affected by bovine TB, and five areas identified as wildlife TB transmission sites in northeast Lower Michigan. Although mycobacteria have been isolated from these samples none of the organisms have been identified as *M. bovis*. The fact that *M. bovis* has not been detected in environmental samples collected from targeted “TB hot spot” sampling sites in northern Lower Michigan thus far indicates that the bacteria is not uniformly or widely distributed across the landscape. Future and on-going studies are focused on the collection of a larger number of samples from each sampling site for *M. bovis* detection and an investigation focused on determining the period of survival of *M. bovis* in various substrates under varying weather and environmental conditions.

## Presenters

**Doug Bergeson, MS**
Doug Bergeson is a conservation biologist with Riding Mountain National Park. Doug has worked for Parks Canada since 1988, spending time in Prince Albert, and Wood Buffalo National Parks before Riding Mountain. Bergeson was involved with the bison research program at Wood Buffalo, making him one of the few fortunate people to have worked in both Canadian National Parks that have bovine TB.

**Dale Berry**
Dale Berry has served as the manager of the Mycobacteriology/Mycology Laboratory with the Michigan Department of Community Health for the past 23 years. Mr. Berry has 30 years of experience as a microbiologist with MDCH. He received his B.S. from Michigan Technological University in 1972.

**Ryan K. Brook, MS**
Ryan Brook is a Ph.D. student at the University of Manitoba currently working on a 5-year study of elk-agriculture interactions around Riding Mountain National Park. His work includes both ecological and social analysis, incorporating elk movements and farmer knowledge to better understand the bovine tuberculosis problem in the region.

**Peter H. Butchko**
Pete Butchko is the State Director of USDA Wildlife Services in Michigan. Butchko directs the state's wildlife services programs, including wolf management activities, projects to reduce wildlife hazards to aviation, projects to reduce starling damage at dairies, and contributing to the eradication of bovine TB in wildlife. Before coming to Michigan in 1998, Butchko worked for Wildlife Services in Ohio, California and Mississippi.

**Henry (Rique) Campa, III, PhD**
Dr. Henry (Rique) Campa, III, is a professor in the Department of Fisheries and Wildlife at Michigan State University (MSU). Campa's research interests are in the areas of wildlife-habitat relationships, ecosystem management, and wildlife nutrition and he has conducted research throughout the U.S. as well as projects in Kenya and Nepal. Before coming to MSU, Rique worked for the U.S. Fish and Wildlife Service as a Wildlife Biologist and the Michigan Department of Natural Resources as a Wildlife Research Biologist.

**Elaine Carlson, MS**
Elaine Carlson is a Wildlife Biologist in the Michigan Department of Natural Resources. Carlson is involved in: coordinating the Deer Range Improvement Program; assisting with elk and black bear research; field coordination of bovine TB eradication efforts for the Wildlife Division; and is the area field biologist, responsible for habitat development for a variety of wildlife species and harvest recommendations for game species.

**Thomas DeLiberto, DVM, PhD**
Dr. Thomas DeLiberto served as the Wildlife Disease Project Leader for the USDA/APHIS Wildlife Services' National Wildlife Research Center from 2001-2003. As project leader he developed, coordinated and directed the Wildlife Services' bovine tuberculosis research in Michigan. In 2003, DeLiberto was selected as the National Wildlife Disease Coordinator for Wildlife Services. His duties include coordinating research and management of wildlife diseases, and developing a wildlife disease surveillance and emergency response system.

**Michael Dutcher, DVM**
Dr. Michael Dutcher has served as the Assistant AVIC for USDA-APHIS-VS, managing USDA's side of the Bovine TB Eradication Program since June of 2003. Dr. Dutcher spent approximately two years in a residency at the Chicago-based Zoo Pathology Program for the University of Illinois. He was in private practice before returning to Michigan as a TB field veterinarian for USDA-APHIS-VS. Dutcher was also Import-Export Veterinarian at the VS Area Office in Lansing.

**Amanda Fine, DVM**
Dr. Amanda Fine is an instructor in the Fisheries and Wildlife Department of the College of Agriculture and Natural Resources and the Department of Large Animal Clinical Sciences in the College of Veterinary Medicine at Michigan State University (MSU). She is currently pursuing a Ph.D. degree at MSU. Her research is focused on the epidemiology of bovine tuberculosis (TB) in northeast Lower Michigan and she is investigating the potential for in-direct transmission of TB among and between white-tailed deer and cattle populations. Amanda is interested in disease transmission at the wildlife/livestock interface, veterinary public health and international veterinary medicine.

**John R. Fischer, DVM, PhD**
Dr. John Fischer is Director of the Southeastern Cooperative Wildlife Disease Study (SCWDS), which was founded in 1957 at the University of Georgia's College of Veterinary Medicine. As SCWDS Director, he works with the wildlife management agencies of 16 states, the USDA, and the U.S. Department of Interior, to identify and determine the significance of diseases in wildlife populations, and to delineate the role of wildlife in the epidemiology of human and domestic animal diseases. John is a Minnesota native and has degrees and experience in Wildlife Biology, Veterinary Medicine, and Veterinary Pathology.

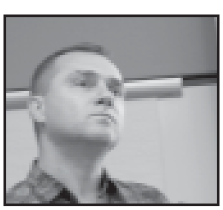
**Scott D. Fitzgerald, DVM, PhD**
Dr. Scott Fitzgerald is a professor with the Department of Pathology, and Veterinary Pathologist with the Diagnostic Center for Population and Animal Health at Michigan State University. Fitzgerald conducts research into pathogenesis of *M. bovis* in mammals and birds. He is a diplomat of the American College of Veterinary Pathologists and American College of Poultry Veterinarians, and the 1996 recipient of the Bayer-Snoeyenbos New Investigator Award from the American Association of Avian Pathologists.

**Graham Hickling, PhD**
Dr Graham Hickling is a New Zealander with a Ph.D. in Zoology from the University of Western Ontario. From 1981 to 1992, he worked as a research scientist for the New Zealand Forest Service and later the N.Z. Government's Landcare Research Institute, where he managed a multidisciplinary research program focusing on wildlife reservoirs of bovine tuberculosis. In 2001, Hickling spent a 6-month sabbatical at the Michigan DNR's Rose Lake Wildlife Disease Laboratory, where he assisted MDNR researchers with a technical review of the dynamics of bovine tuberculosis in Michigan's white-tailed deer. In August 2002, Hickling was appointed as Associate Professor at Michigan State University, to help develop a graduate specialization program in wildlife disease ecology and management, offered jointly by the Colleges of Agriculture and Natural Resources and Veterinary Medicine.

**Rebecca A. Humphries**
Director Humphries a Michigan State University graduate who began her career in the DNR in 1978 as a property specialist in the real estate division. Her background includes experience in four department divisions. She has extensive field management experience and her duties in the agency have ranged from area field wildlife biologist to acting resource management deputy , where she directed and coordinated the work of several divisions. Humphries worked as a wildlife biologist and became chief of the DNR Wildlife Division in 1997, with 186 employees and a $24 million dollar annual budget . On June 1, 2004, she began her role as Director of the Michigan Department of Natural Resources, with 1,600 employees and a $250 million annual budget.

**Lawrence Judge, DVM**
Dr. Larry Judge graduated from veterinary school in 1987 and worked in private practice with dairy producers for seven years. He worked for the Michigan Department of Agriculture, Animal Industry Division on pseudorabies surveillance and in the bovine TB program. Judge is the USDA Veterinary Services as Area Epidemiologist in Charge of bovine TB.

**Kevin Kirk, MS**
Kevin works with the State Veterinarian and species veterinarians in the Animal Industry Division to disseminate information about Michigan Department of Agriculture's (MDA) disease control and animal health strategies. He helps the department better serve the industry by gathering information about current or needed departmental animal health programs.



**Konstantin Lyashchenko, PhD**
Dr. Konstatin Lyashchenko was then Senior Research Scientist, in the Department of Molecular Immunology at the Institute of Biochemistry, National Academy of Sciences in Kiev until 1995. He came to the U.S. in 1995 and worked as Research Associate, at the Public Health Research Institute in New York City until 2001. He is presently Research Director at Chembio Diagnostic Systems, Inc., in Medford, New York.

**Mitchell V. Palmer, DVM, PhD**
Dr. Mitchell Palmer serves as the Lead Scientist of the Bovine Tuberculosis Research Group at the USDA's National Animal Disease Center in Ames, Iowa, where he has been a Veterinary Medical Officer since 1992. He has published several articles on diseases at the interface of domestic livestock and wildlife such as tuberculosis, brucellosis, paratuberculosis, West Nile virus and cryptosporidiosis.

**Brent Rudolph, MS**
Brent Rudolph is a research biologist with the Michigan Department of Natural Resources, where he coordinates the Wildlife Division's deer research program. He has conducted research on white-tailed deer in suburban, agricultural, and forested settings, and his professional interests focus on addressing the biological and sociological challenges to managing wildlife on increasingly human-dominated landscapes.

**Patrick Rousseau**
Patrick Rousseau is the Aquatics and Wildlife Management Coordinator for the Resource Conservation Section of Riding Mountain National Park in Onanole, Manitoba, Canada. His duties include water quality, fisheries, bear, bison, ungulate and beaver management, and he serves as community liaison for the overall ecosystem.

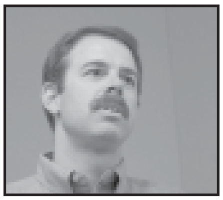
**Stephen Schmitt, DVM**
Dr. Stephen Schmitt has served as the Veterinarian-in-Charge at the Michigan Department of Natural Resources' Rose Lake Wildlife Disease Laboratory for 18 years. He is responsible for overall operation and function of the laboratory, including investigation, monitoring and research of diseases and other factors that affect the health and survival of wildlife of Michigan. Dr. Schmitt has been working with bovine tuberculosis in free-ranging deer since its discovery in 1994, and has authored several conference papers and journals on bovine tuberculosis in wildlife.

**Mary Grace Stobierski, DVM, MPH**
Dr. Mary Grace Stobierski is Chief of the Infectious Disease Epidemiology Section, and State Public Health Veterinarian for the Michigan Department of Community Health. She has been with MDCH for 14 years, and has an adjunct appointment at the MSU College of Veterinary Medicine.

**Om Surujballi, PhD**
Dr. Om Surujballi is a research scientist in the Mycobacterial Diseases Centre of Expertise, Canadian Food Inspection Agency. Surujballi joined the Food Production and Inspection Branch of Agriculture Canada as a post-doctoral fellow and worked on cloning and expression of diagnostically important antigens of *Brucella abortus*. Research interests include development and validation of diagnostic assays for *Mycobacterium bovis* and *Mycobacterium avium* subspecies *paratuberculosis*.

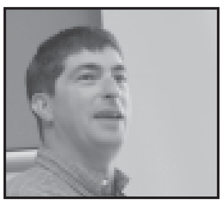
**Michael VanderKlok, DVM**

Since 1995, Dr. VanderKlok has been active in the Michigan Bovine Tuberculosis Eradication Program as an on-farm testing veterinarian, regional manager, and is currently the leader for the eradication program for livestock in Michigan. In addition to these activities he has been actively involved with state and national veterinary and animal health organizations, represents Michigan veterinarians as the delegate to the American Veterinary Medical Association, and is a member of many United States Animal Health Association and National Institute for Animal Agriculture committees.



**Kurt VerCauteren, PhD**

Dr. Kurt VerCauteren is the Chronic Wasting Disease Project Leader for the National Wildlife Research Center of USDA APHIS Wildlife Services, and a member of the Bovine Tuberculosis Project. Some of his current research involves devising means to manage and reduce transmission among and between wild and captive cervids. VerCauteren works at the wildlife-livestock interface to develop strategies to reduce contact and interaction.



**Ray Waters, DVM, PhD**

Dr. Ray Waters is a Veterinary Immunologist within the Bacterial Diseases of Livestock Research Unit at the National Animal Disease Center, Ames, Iowa. His research interests are immune responses of cattle and wildlife to *Mycobacterium bovis* infection, vaccine strategies to prevent *M. bovis* infection, and immune responses of wildlife to intracellular pathogens.

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MDA
Jeanne Lipe
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MDCH
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MDNR
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**Bovine TB interagency programs committee**
Dr. Michael VanderKlok, MDA
Dr. Kimberly Signs, MDCH
Dr. Steve Schmitt, MDNR
Dr. Michael Dutcher, USDA VS
Director Pete Butchko, USDA WS

Michigan Bovine TB Eradication Project Coordinator
Bridget Kavanagh-Patrick
Michigan Department of Community Health
North Complex - BOW Room 309
Lansing, MI 48909
patrickb@michigan.gov
(517) 335-9970
Fax (517) 335-8263

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*Editor and publisher:*
*Jeanne Lipe*

*Graphic Design:*
*Curtis Remington*

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