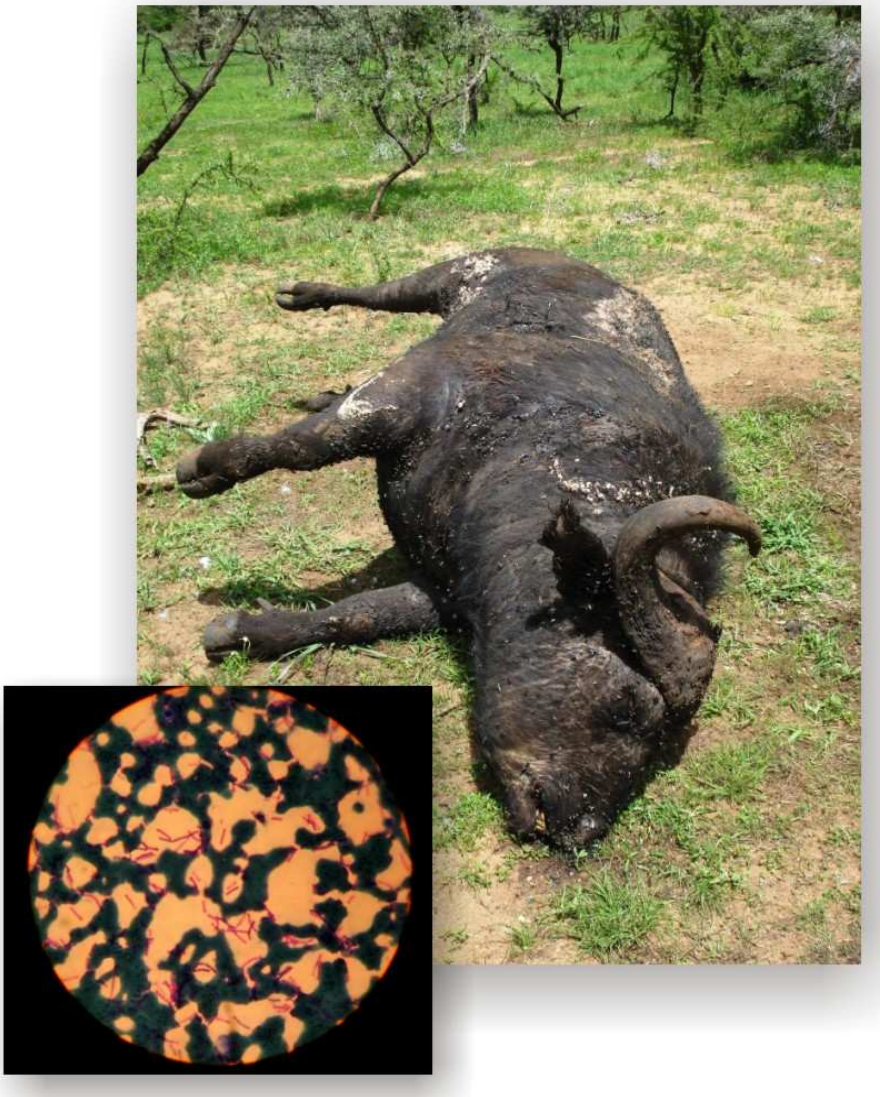
# ANTHRAX OUTBREAKS IN WILDLIFE IN TANZANIA

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**2010**

**<u>Cover Picture</u>: A dead buffalo in an anthrax outbreak in Maswa Game Reserve, 2009. More than eighty buffalo may have died in a three to four week period in the late dry season. Low numbers of other species also died: giraffe, warthog and duiker. Microscopically the infection is diagnosed by characteristic red brick-shaped organisms in the blood.**

## A SUMMARY OF ANTHRAX IN THE WILD

### What is anthrax?

Anthrax is a disease caused by a bacterium called *Bacillus anthracis*. The disease has featured in records since ancient times and still occurs in both animals and humans in many parts of the world, including most countries of sub-Saharan Africa. The anthrax organism exists in two life-cycle forms: the bacterium itself (the 'vegetative form') occurring in the infected animal, and a very resistant 'spore form' which may remain viable in the soil for decades or even centuries (De Vos, 1994). Anthrax bacteria develop into spores after exposure to oxygen, which is why the opening of an infected carcass is the cause of environmental contamination.

Although most warm-blooded species can contract it, anthrax is primarily a disease of grazing or browsing mammals. Among wildlife, it is most commonly reported in zebra, greater and lesser kudu, waterbuck, roan antelope, wildebeest, springbok, buffalo, elephant, impala, oryx and giraffe. Geographic differences determine the species most affected in any one locality. In livestock, it is most commonly reported in cattle, sheep, goats, donkeys and horses, while it is rarer in pigs. Carnivores are generally not readily affected but can succumb to very high challenge and it is not a disease of poultry. Unexpected sudden death is characteristic of anthrax in animals. External bleeding from the nose, mouth and anus is common but not invariable. The history of the area may give vital clues because recurrent anthrax is associated with certain defined soil types (Bessell *et al* 2010). One should establish whether anthrax has occurred in the local area in the past, or in an adjacent area recently.

### Anthrax risk to humans

Humans are regarded as fairly resistant to infection. Anthrax does not penetrate intact skin; it is only a danger to those eating undercooked meat from dead animals or working for some time with contaminated material of animal origin (hides, wool, bones, bone meal, etc.). Thus humans usually contract anthrax from a domestic animal situation – through 'occupational exposure'. As disease incubation is often very short (6-24hrs), any healthy animal hunted will not present a risk to people (i.e. no organism can kill you without first killing the animal). Anthrax that was used maliciously in the USA was super-concentrated in a laboratory into a form able to be inhaled, and is thus very far removed from what we are dealing with in the wild in Africa. The infection is easily treated with antibiotics and in cases of diagnosed human disease only about 1% of cases have been fatal.

### How do wild animals get infected with anthrax?

It is not always clear how an animal has contracted anthrax. It is assumed that, in the case of sporadic cases, grazing animals generally acquire the disease by ingesting spores when grazing over sites where previous victims of the disease died and deposited the spores after death. Licking of bones (pica or osteophagia) from animals that died of anthrax may result in cases or outbreaks. In Africa, the most accepted theory for browsers (giraffe, kudu, etc) is that blowflies feeding off the carcasses move to rest on the leaves of nearby trees and shrubs and deposit anthrax spores there. Browsing animals become infected when eating these leaves (De Vos,1994). Biting flies are

suspected of transmitting anthrax amongst wild animals and of playing important roles in epidemics.

The extent to which wind and water spread anthrax spores is still poorly defined, but these are thought to be generally of little consequence. Both natural and man-made water sources have been found to become contaminated by vultures drinking and bathing after feeding on anthrax carcasses. Thus winged scavengers may play an important role in spreading the disease in certain ecosystems over long distances. Apart from cases of carnivores scavenging on anthrax carcasses and occasionally succumbing to the disease, animal-to-animal transmission is not a common occurrence.

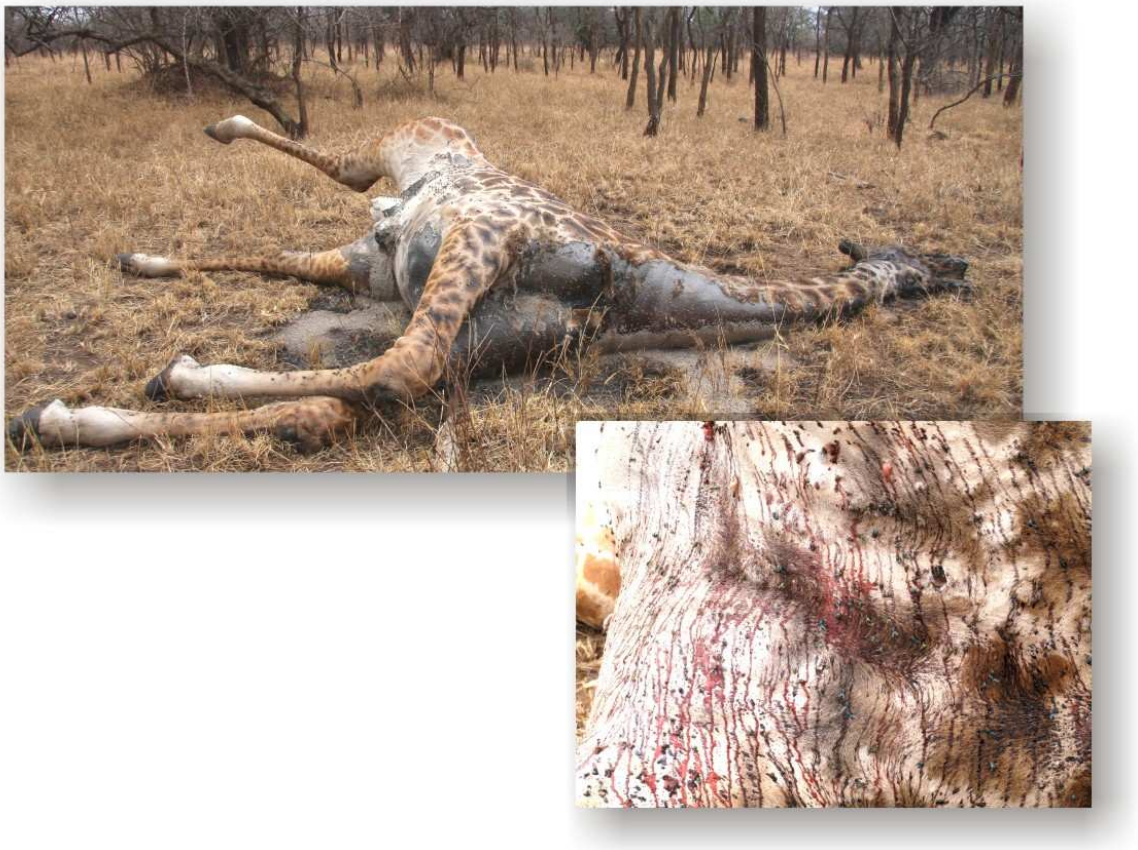

**Figure 1: Carcass of a large male giraffe that died acutely of anthrax in Maswa Game Reserve, showing unusual haemorrhaging through intact skin.**

**What are the risk factors?**

These range from the obvious, such as a past history of anthrax in the region or the occurrence of cases in adjacent livestock areas, to the less obvious, which include conducive soils and topography (e.g., alkaline, calcium rich soil) and the occurrence of a typical rain/drought pattern. The latter is common feature in the Serengeti ecosystem exacerbated by the abundance of especially prone species and the presence of some areas with habitat degeneration. If anthrax cases are not detected and rapid carcass disposal not achieved, the likelihood and frequency of subsequent outbreaks may increase. Breakdown of livestock vaccination programs in enzootic areas is a risk factor for both livestock and wildlife.

**How long is an outbreak likely to last?**

This depends on circumstances such as the abundance and densities of the most susceptible species, types of water sources and soil types. In a worst case scenario an outbreak can last for many weeks, severely depleting susceptible populations – as was seen historically, and in Maswa Game Reserve in 2009. Control actions can help reduce duration, but as it is not always easy to understand how the infection is being spread, the effectiveness of such actions cannot be readily predicted. For example, if flies are heavily involved in the spread, control is very difficult; but if by contrast man-made water sources are incriminated, control may be easier. In a natural situation the onset of heavy rains may bring the outbreak to a halt quite quickly (as in the case of Maswa in 2009). Limited data indicate that increasing herd immunity may play a part in both stopping epidemics and in lessening outbreaks in the ensuing year or two years.

**Can the outbreak re-kindle after it has been stopped?**

An outbreak can subside and flare up again if highly susceptible animals remain in the area. Anthrax is often a seasonal disease, and one should be alert for the possibility of a new outbreak in the next and successive 'anthrax seasons'. In general, though, when outbreaks do occur the following year, for example, they generally seem to be smaller and of shorter duration. They may not occur at all if your actions during and after the first outbreak have effectively reduced or eliminated environmental contamination. If susceptible populations re-build to high densities beyond what the ecosystem can maintain over a period of years, another large outbreak then becomes a high possibility again. Epidemics tend to strike when populations of certain key species reach high densities.

**How to get a diagnosis**

Since anthrax bacteria can been seen under a microscope (see cover picture) confirmation is not so difficult from a fresh carcass (within 3 days). The best samples are: a drop of blood from a freshly dead animal smeared on a glass microscope slide; and/or a swab dipped into any blood coming out of any orifice and placed in a clean container. Failing these, a small piece of tissue from the ear or eyelid should be collected into a clean container. Glass slides should be wrapped in tissue paper while swab and tissue containers should be kept cold. All samples should be sent without delay for laboratory examination. It becomes harder to collect a suitable sample as the carcass gets older. If the carcass has been opened or is over three days old, then a blood smear or tissue should be taken from extremities like the coronet region (skin just above the hooves) or the ear. Once the carcass becomes putrefied or largely consumed by scavengers, diagnosis requires the ability to culture the bacterium. Soil samples where the soil has absorbed spilled blood or fluids may also yield *Bacillus anthracis* on culture, but this is a slow and difficult procedure. Your local veterinary laboratory may not be able to do this but should know where to send the samples - for example the nearest larger regional veterinary investigation centre (VIC).

**How to take samples with proper precautions**

Remember that while humans are fairly resistant to contracting anthrax, careless handling of suspect material must be avoided. Where a laboratory-trained person is unavailable, take the following precautions when collecting samples

- Use an apron or coverall if you anticipate extensive handling of the carcass. Anthrax does NOT penetrate intact skin but dress cuts or abrasions on exposed areas, especially on the hands and arms.

- Wear disposable gloves or disposable covers for your hands, and if possible cover your shoes with disposable material. Everted plastic bags can be used.

- Insert the hand that will touch the carcass into an everted plastic sample bag, then grasp tissue to be sampled and cut it off with the other hand; reverse the bag over the sample or swab.

- Seal and label the sample bag. Use strong bleach to wipe down the ***outside*** of any container to be sent to the laboratory.

- Insert any tools that have come in contact with the animal's blood or fluids into another strong plastic bag or container for transport to where they can be disinfected (strong bleach for 1 hour) or sterilized (boiled for 30 min or pressure cooked for 15-20 min). Ensure that sharp tools do not pierce through containers. Tool containers themselves should be disinfected or sterilized as above, or incinerated. Incinerate unwanted disposable bags. Wash hands thoroughly afterwards with soap and water.

- If human exposure is suspected, seek medical advice. Anthrax can be treated relatively easily with penicillins.

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**Figure 2: A young male buffalo was left behind by a departing herd during the Maswa Game Reserve outbreak in 2009. This animal showed lethargy, bloodshot eyes and nasal bleeding. It was euthanazed and tested positive for anthrax. Because death from anthrax is often acute, it is very rare to see a clinical case of the disease in a live animal.**

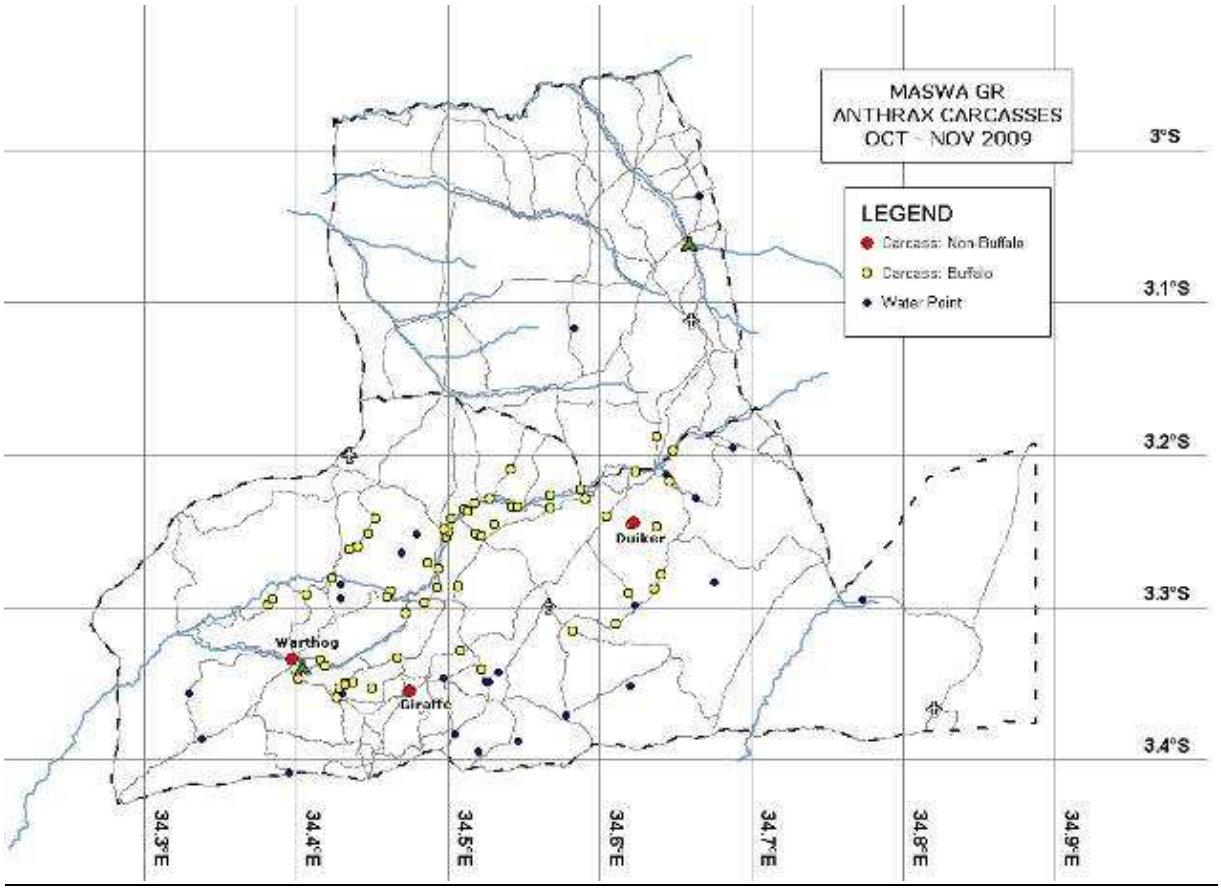


**Figure 3: Map of southern Maswa Game Reserve (Mbono and Kimali sections) showing location of carcasses concentrated around the Semu River system**

## Chronology of investigating the Maswa outbreak

The wildlife veterinary programme visited Mbono and Kimali, Maswa Game Reserve on October 3rd 2009.

Anthrax was confirmed in the two animals examined, one giraffe and one buffalo. It was particularly fortuitous and very interesting to see and sample a sick animal (Fig. 2).

The following day Dr Robert Fyumagwa informed the Maswa Game Reserve Project Manager and TAWIRI Headquarters and advised on the practicality of control measures.

After the visit the veterinary programme sent glass slides and detailed instructions on how to make blood smears to the manager of the safari operation (Tanzania Gametrackers Safaris -TGT) in Maswa. Two weeks later anthrax was confirmed in slides sent to our laboratory from another buffalo carcass.

TGT Safaris organized for an aerial survey shortly after the outbreak. A micro-light aircraft was used to plot the distribution of recent carcasses (Fig.3). All deaths were not far from water points or pools in the Semu River (Bessel *et al* 2010).

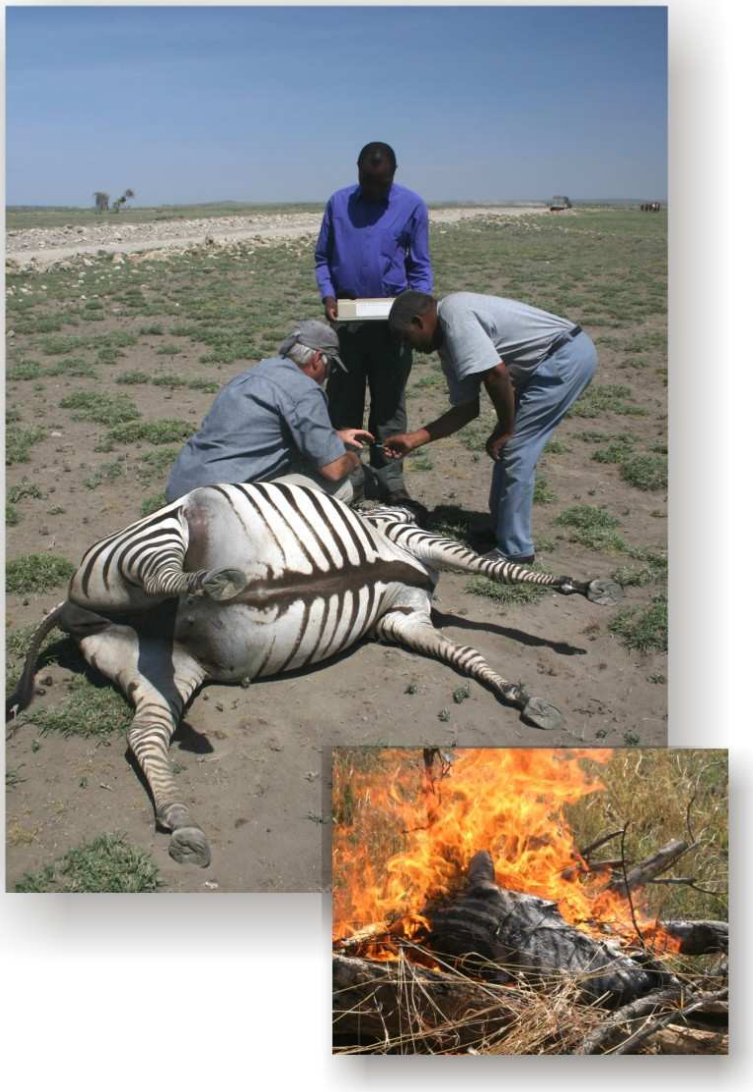

**Figure 4: Anthrax carcasses often show rapid bloating. In the wild disposal by fire is seldom practical in an outbreak but can be done on a limited basis for aesthetic reasons, for example near safari camps**

**What is the best way to dispose of a carcass?**

In the literature you will always read that the preferred method of disposal of an anthrax carcass is by burning. But with burning, it is important to ensure that soil under an opened carcass is truly scorched also, in order to kill the spores.

Where burning is not possible, burial is the less satisfactory alternative. But beware – history has many examples of new outbreaks following disturbance of old burial sites. The recommendation that the carcasses be buried at a depth of two metres with lime or quicklime (CaO) is often given. In either case (burning or burial) consideration may be given to spraying the carcasses and surrounding ground with 5-10 % formalin to reduce the number of spores which may survive to cause future cases. However, for many reasons the burning and chemical disinfection of carcasses and soil is very problematic. It is especially impractical in the wild and really only applicable to isolated domestic animal cases under intensively managed conditions.

**CONTROL MEASURES IN THE WILD**

Effective control measures in the wild are very limited but some can be carried out if the ecology

(epidemiology) of the disease is considered. Anthrax bacteria develop into spores after exposure to oxygen and these spores then infect the local environment for long periods. So **at all costs avoid opening a suspect anthrax carcass**. In a usual wildlife scenario, carcass burning is seldom effective for a number of reasons. The first is a very important consideration that **vegetative form bacteria will lose their viability after about three days** if an unopened carcass is allowed to decompose in the naturally high temperatures generally encountered in African environments. Many wild carcasses have either (i) not been discovered within three days or (ii) been scavenged anyway – so burning them after spore formation has occurred (with scarce fuel resources, the danger of spreading bush fires, and the unlikelihood of achieving soil sterilization anyway) is thus pointless. Carcass burning on a limited basis near inhabited or sensitive areas can be done for aesthetic reasons. Any way that fresh carcasses can be **protected from initial scavenging** thus might help (in the Serengeti ecosystem we have noticed that anthrax carcasses are scavenged very slowly, but cannot as yet explain this). Any anthrax **carcass in a small body of water** will greatly increase environmental infection load so should be pulled out onto dry land and burned. In South Africa wildlife veterinarians are experimenting with covering fresh suspected anthrax carcasses in black plastic sheeting, so as to (i) discourage scavenging and (ii) speed up decomposition. Fortunately, the classic late dry season **outbreak usually abates rapidly with the onset of rains**, as game dispersal and dilution of infective load in 'hotspots' occurs.

If there are resources to do **an aerial count** and thus locate carcasses during or after an outbreak (as in Fig 2), these data are very useful. Enquiries about **concurrent suspicious livestock deaths** in populated regions adjoining wildlife areas are also very informative. The most effective control measure is to **use anthrax vaccine in domestic livestock areas**. The livestock vaccine is available in Tanzania and Kenya. It should be kept in a cold chain, and to maintain solid immunity annual revaccination is recommended.

**Figure 5: There is no need to be afraid of anthrax – it is a natural phenomenon. Interestingly anthrax is the oldest disease known to humankind, with the earliest records considered to be from ancient Egypt around 1500 BC; it was also the first disease shown to be caused by a micro-organism (in 1823), and the first against which a vaccine was attempted (in 1881). If anthrax is suspected use gloves and do not open the carcass (only a blood slide was taken from this zebra). Humans do not contract anthrax very easily – usually only through eating infected undercooked meat or processing hides. Anthrax used maliciously in the USA in 2001/2 was a highly-concentrated laboratory strain that would never be encountered in a domestic or wild animal situation. The most effective control measure is the regular use of anthrax vaccine in livestock.**

**Acknowledgements**

The very professional assistance of many staff at Tanzania Gametrackers Safaris and Friedkin Conservation Fund in Arusha is gratefully acknowledged, especially Keith Roberts and Quentin Rochat who provided valuable data from the outbreak in Maswa Game Reserve in 2009.

Dr Roy Bengis of the state veterinary service in South Africa gave helpful comments and advice on anthrax.

Photographs in this report are by TGT staff and Sian Brown and Sian Brown is thanked for the photographic design.

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