Chapter 11

# Disease Challenges Concerning the Utilization of the Kafue Lechwe (*Kobus leche kafuensis*) in Zambia[1]

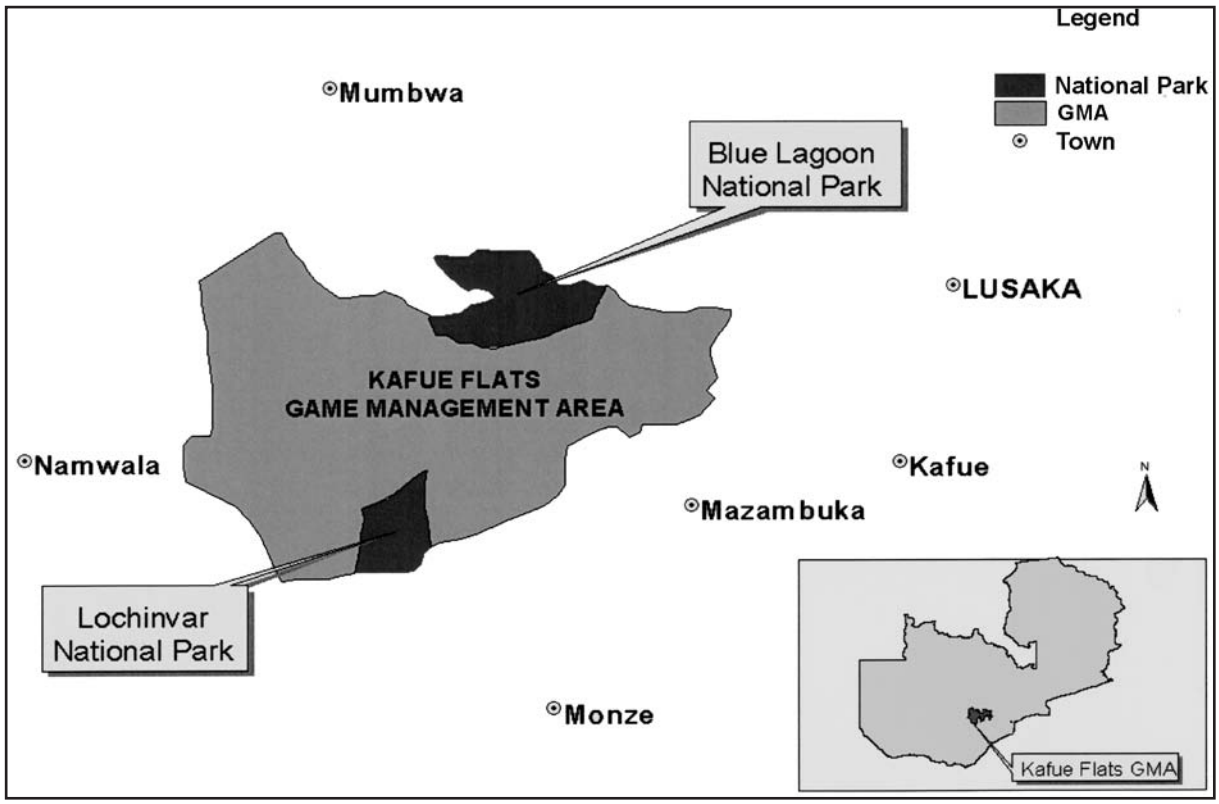
*V.M. Siamudaala[2], J.B. Muma[3], H.M. Munang'andu[4] and M. Mulumba[5]*

## Introduction

The Kafue lechwe *(Kobus leche kafuensis)* is a medium-sized, semi-aquatic antelope that is endemic to the Kafue Flats of Zambia. The Flats are a floodplain of about 6,000km$^2$ (Sheppe 1985) and comprise Lochinvar National Park (NP) (410km$^2$), Blue Lagoon NP (420km$^2$), and the Kafue Flats game management area (5,175km$^2$) (Mwima 1995) (Fig. 1). The Kafue lechwe is the predominant wildlife species of the Kafue Flats (Sheppe 1985) and is confined to a relatively small area, particularly in and around Lochinvar and Blue Lagoon NPs.

About 700 Kafue lechwes have been translocated from the Lochinvar NP to game ranches. The Kafue lechwe population on the Flats has steadily declined over the years from an estimated 80,000 in 1975 to 41,000 in 1982. Poaching, infectious diseases, and grazing pressures are the major factors responsible for the decline (Kapungwe 1993). Other contributing factors include traditional hunting practices, human presence in the area, and small-scale agricultural practices (Sheppe 1985).

**Fig. 1. Kafue Flats Game Management Area, and Lochinvar and Blue Lagoon National Parks**




[1]See abstract on p.xxv.

[2]Zambia Wildlife Authority, Chilanga, Zambia

[3]School of Veterinary Medicine, University of Zambia, Lusaka, Zambia

[4]Central Veterinary Research Institute, Lusaka, Zambia

[5]Centre for Ticks and Tick-Borne Diseases, Malawi

A number of diseases have been isolated in the Kafue lechwe. Some of these diseases, particularly brucellosis and tuberculosis (BTB), pose serious conservation and public health challenges. The actual impact of these diseases on the animal population has not, however, been investigated. Studies on animal diseases in Zambia are generally limited to diagnosis. Little is known, therefore, of the diseases in the context of the ecosystem and the prevailing land-use practices.

# Ecological and socioeconomic importance of the Kafue lechwe

## Ecological importance

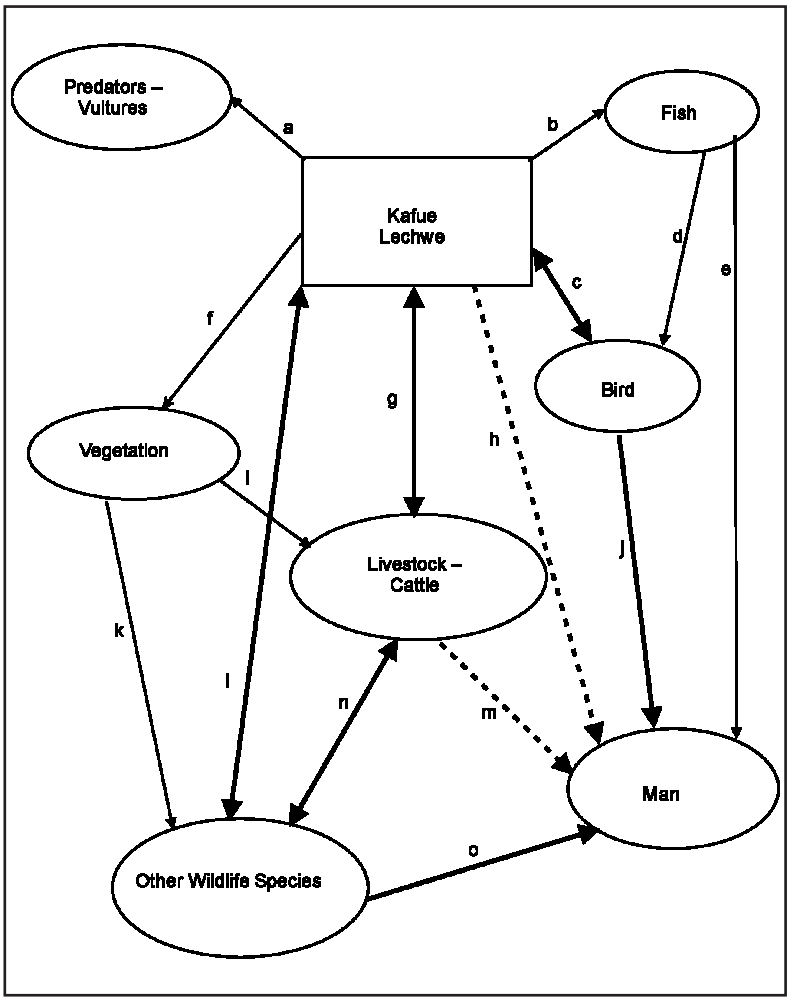
In the food chain, the lechwe is a major source of manure-food for fish; the fish in turn are the major food for aquatic birds (Fig. 2). Hence, the lechwe contributes significantly to the ecological balance of the Kafue Flats. Fish species in the area include cichlids (*Sartherodon* spp. and others), barbels (*Clarias* spp.) and *Tilapia* species, especially *T. niloticus.* The Flats support over 400 species of birds, including about 125 waterbirds. The Kafue Flats host the world's largest population of wattled cranes (*Grus carunculatus*). Other notable birds are a large variety of ducks, geese, herons, egrets, shorebirds, pelicans, storks, ibises, and cranes. Others are fish eagles (*Haliaeetus vocifer*), darters (*Anhinga rufa*), and jacanas (*Actophilornis africanus*) (Sheppe 1985).

## Socioeconomic importance

### Consumptive utilisation of the Kafue lechwe

The lechwe is hunted for meat, trophies, and hides and is a valued tourist attraction. Previously, the local communities adjacent to the area hunted hundreds of lechwes, mostly for meat, during traditional hunts called the *Chila*. This practice was discontinued in 1957, as it was unsustainable. Between 1995 and 1999, a total of 4,679 lechwe carcasses were legally harvested according to official figures. Of the total, 4,353 (93%) lechwe were hunted for game meat and 326 (7%) were taken on safari hunts, giving an average annual harvesting rate of 936 animals (Table 1). The average quantity of lechwe meat produced annually is estimated at 47.7 tons. The number of people who consume the meat annually is about 39,780

**Fig. 2. Ecological role of the Kafue lechwe on the Kafue Flats (bold arrows indicate hypothesized routes of TB and brucellosis transmission)**




**(a)** Kafue lechwe carcasses available in the field;
**(b)** manure from the lechwe;
**(c)** possible TB (avium type) transmission;
**(d)** food for aquatic birds;
**(e)** source of protein and income;
**(f)** manure fertilising the pasture;
**(g)** BTB transmission between the lechwe and cattle;
**(h)** source of protein and income, and BTB transmission from lechwe to people;
**(i)** pasture for livestock;
**(j)** source of protein and income and possible TB transmission (avium types);
**(k)** pasture for other wildlife species resulting in enhanced species diversity;
**(l)** BTB transmission between the lechwe and other wildlife species;
**(m)** source of protein and income, and BTB and brucellosis transmission from livestock to people;
**(n)** BTB transmission between cattle and other wildlife species; and
**(o)** source of protein and income, and BTB and brucellosis transmission from wildlife to people.

**Table 1. Number of Kafue lechwe hunted on the official quota between 1995 and 1999**

| Year | No. animals hunted | | | No. animals hunted as % of total carcasses | | Meat production and consumption | |
|---|---|---|---|---|---|---|---|
| | National hunting | Safari hunting | Total | National hunting | Safari hunting | Meat production in kg (tons)[a] | No. people consuming the meat[b] |
| 1995 | 1,363 | 74 | 1,437 | 94.9 | 5.1 | 73,287 (73.3) | 50,894 |
| 1996 | 457 | 66 | 523 | 87.4 | 12.6 | 26,673 (26.7) | 22,228 |
| 1997 | 1,040 | 75 | 1,115 | 93.3 | 6.7 | 56,865 (56.9) | 47,388 |
| 1998 | 668 | 54 | 722 | 92.5 | 7.5 | 36,822 (36.8) | 30,685 |
| 1999 | 825 | 57 | 882 | 93.5 | 6.5 | 44,982 (45.0) | 37,485 |
| **Total** | 4,353 | 326 | 4,679 | 93.0 | 7.0 | 238,629 (238.6) | 198,858 |
| **Annual average** | 871 | 65 | 936 | 93.1 | 6.9 | 47,736 (47.7) | 39,780 |

[a] *Mean dressing weight of 51.0 kg (Stafford* et al. *1992)*

[b] *Annual average consumption of game meat per person of 1.2 kg (Chardonnet* et al. *2002)*

(Table 1). These figures reflect the official data of the national wildlife agency (Zambia Wildlife Authority); the actual numbers of carcasses consumed and people who eat Kafue lechwe meat in Zambia are likely higher. The Kafue lechwe has come under heavy persecution for its meat for the illegal bushmeat trade. Poaching levels specific to the Kafue lechwe are speculated to be 50% of the official annual hunting quota. The main consumption centres for both legal and illegal lechwe meat are Lusaka City and Mumbwa, Monze, Kafue, Namwala, Mazabuka, and Itehi-tezhi districts (Fig. 1). The revenue generated annually from national (citizen) and safari hunting is US $47,459 and US $60,315, respectively. The average income generated per animal from national and safari hunting during said period was US $55 and US $925, respectively (Table 2), making safari hunting more lucrative per animal harvested, although the beneficiaries of various forms of utilization may, of course, differ.

## Other enterprises

The ecological function of the Kafue lechwe is important for the survival of fish and birds on the Flats. The Flats support a large fishery that, in turn, supports many people as a source of both protein and income. The birds of the Kafue Flats are also a source of protein and income for many Zambians. In addition, the Flats are an important tourist destination for bird watchers.

**Table 2. Official data on the economic value of the utilization of the Kafue lechwe between 1995 and 1999**

| Year | National hunting | | | Safari hunting | | |
|---|---|---|---|---|---|---|
| | No. animals hunted | Income, ZMK (US$) | Average income/animal, ZMK (US$) | No. animals hunted | Income, US$ | Average income/ animal, US$ |
| 1995 | 1,363 | 64,950,000 (72,858) | 47,652 (53) | 74 | 56,625 | 765 |
| 1996 | 457 | 52,900,000 (43,908) | 115,755 (96) | 66 | 62,700 | 950 |
| 1997 | 1,040 | 78,037,500 (58,936) | 75,036 (57) | 75 | 71,250 | 950 |
| 1998 | 668 | 60,120,000 (31,319) | 90,000 (47) | 54 | 54,000 | 1,000 |
| 1999 | 825 | 74,250,000 (30,275) | 90,000 (37) | 57 | 57,000 | 1,000 |
| **Total** | 4,353 | 330,257,500 (237,296) | 75,869 (55) | 326 | 301,575 | 925 |
| **Average** | 871 | (47,459) | **per year** (58) | 65 | 60,315 | **per year** 932 |

## Diseases of the Kafue lechwe of conservation and utilization importance

The diseases isolated in wild Kafue lechwe include BTB, dermatophilosis (cutaneous streptothricosis), brucellosis, blue tongue, infectious bovine rhinotracheitis, heartwater, *Coxiella burnetti*, and *Chlamydia psittaci* (Pandey 1998, Pandey *et al*. 1994, Pandey *et al*. 1992, Stafford 1991, Kraus *et al*. 1986, Clancey 1977). Stafford (1991) reported a wide variety of parasites in the Kafue lechwe, including *Schistosoma* and *Fasciola* spp. In contrast, it should be pointed out that few studies have been done on the health status of lechwe on game ranches. Diseases diagnosed so far in Kafue lechwe on game ranches include heartwater, BTB (Zieger *et al*. 1998, Pandey *et al*. 1992) and brucellosis. A summary of BTB and brucellosis, which have been widely reported in the Kafue lechwe, is given below.

### Tuberculosis

The history of BTB in the lechwe dates as far back as 1954. Unpublished records at the Department of Veterinary Services indicate that BTB was introduced into the Monze District by infected cattle in the 1940s. It was diagnosed in lechwe for the first time in 1954 in Lochinvar NP (Rottcher 1976). The actual source of BTB in the lechwe is not definitively known, but it is speculated that the disease came from cattle, because the area that became Lochinvar NP in 1971 was previously a cattle ranch. Kafue lechwe coming into contact with cattle that are brought to the Flats during the dry season for grazing pasture and drinking water is not a new phenomenon.

In the early 1960s, the prevalence of BTB in lechwe in the NP was 14%. About 25% of the cattle from the Flats were found to have tubercular lesions during routine meat inspection (Anon. 1965). Rottcher (1976) estimated that about 40% of the cattle were infected with BTB. Most recent studies by Pandey (1998) show a prevalence of 19.2% in the 177 lechwe carcasses examined. Both *Mycobacterium bovis* and *M. avium* have been isolated in lechwe. BTB has also been reported in lechwes on game ranches. Interestingly, the initial stock of lechwes on the ranches originated from the Kafue Flats, Lochinvar NP in particular. The translocation was authorised in the absence of a disease-risk analysis. The lechwe is a gregarious animal that lives in large herds, which creates a favourable environment for the transmission of BTB. Pandey (1998) postulated that BTB could also be transmitted through contamination of the pastures and soils as reported via badgers in the United Kingdom and opossums in New Zealand. In short, BTB is considered to be endemic in cattle that are moved to the Kafue Flats and that share pasture and water with affected Kafue lechwe.

### Brucellosis

Brucellosis has been reported in the Kafue lechwe, wildebeest (*Connochaetes taurinus*), and zebra (*Equus burchelli*) (Suzuki *et al*. 1995, Rottcher 1978). Unlike that of BTB, the history of brucellosis is not well documented. The actual prevalence of brucellosis is not well known. Rottcher (1978) found 6.5% reactors of 152 lechwes that were tested for brucellosis. Pandey (1998) reported finding evidence of brucellosis among hunted male animals. Brucellosis has also been reported in lechwe on a game ranch (Matsukawa *et al*. 1995) and, for the first time, in Blue Lagoon NP (Pandey 1998). The lechwe on the ranch were translocated from the Kafue Flats about four years before brucellosis was isolated. Brucellosis has also been isolated in cattle that have been moved to the Flats (Muyoyeta 1997, Ghirotti *et al.* 1991).

## Disease challenges related to human consumption of Kafue lechwe

BTB and brucellosis are of serious conservation and public health importance. The impact of BTB and brucellosis on lechwe is through mortality, morbidity, and decreased reproductive performance. Gallagher *et al*. (1972) estimated that BTB was responsible for the deaths of at least 20% of the lechwe annually on the southern bank of the Kafue Flats, i.e., the Lochinvar area. At this rate, BTB was considered the major contributing factor to the decline of the lechwe population. The public health risk from BTB is thought to be low by some, because lesions in the cases reported to date have been localized in the lungs of the lechwe. However, the affected lungs enter the food chain due to lack of meat inspection and pose a serious public health hazard. In addition, it is not known at what stage BTB may become generalized. The lack of predators allows debilitated animals to be readily harvested, as they tend to lag behind when being pursued by hunters. The hunting policy in Zambia restricts hunters to harvesting mature male animals. Because BTB is a progressive disease, it is suspected that more BTB-affected males are hunted, as they cannot run far away when pursued by hunters. Consumption of raw milk and uncertified meat from infected cattle is likely another route of BTB transmission to people. Consumption of game meat from both legal and illegal sources is likely the most direct route of BTB transmission to people. It is estimated that about 80% of lechwe carcasses hunted for meat could be infected with BTB (Krauss *et al*. 1986, Dillman 1976, MacAdam *et al*. 1974).

Brucellosis infection is characterized by abortions and orchitis, leading to poor reproductive performance and a negative impact on an animal population's growth rate. Brucellosis can be transmitted to people through the handling of wildlife carcasses. Wildlife officials and hunters are the high-risk groups. Cattle provide an indirect route of transmitting brucellosis to people, presumptively but not necessarily due to their interaction with diseased lechwe on grazing pasture and at water sources. It should be noted that un-

published data in the Ministry of Agriculture show that brucellosis is endemic in cattle in the area. The contamination of pastures and soils with urine from infected animals places other animals at risk of contracting brucellosis.

The lechwe is considered the sylvatic host for BTB and brucellosis, thereby complicating disease control in livestock that share their grazing and watering areas on the Kafue Flats, and in cattle on the farms adjacent to game ranches stocking the Kafue lechwe.

The translocation of the Kafue lechwe to other areas such as game ranches without screening for diseases increases opportunities for transferring the diseases to uninfected areas. Consequently, other species on the game ranches (and livestock on adjacent cattle farms) are at risk of infection. Similarly, translocation of other wildlife species from other areas into the Kafue Flats for purposes of restocking the area would expose potentially naive animals to the diseases found on the Flats. The newly introduced animals could also act as a vehicle for the introduction of new diseases on the Flats. Therefore, translocation of wildlife into and outside the Kafue Flats should be subjected to disease-risk analysis, including strict quarantine measures and screening tests. Again, both BTB and brucellosis have been diagnosed in lechwes on game ranches.

It is suggested that over time BTB and brucellosis will negatively affect income generated from consumptive utilization of the lechwe. This will have a direct impact on community-based wildlife management programmes, as they largely depend on hunting revenue. On a related note, the hippo-culling quota of 1988 was reduced following the 1987 anthrax outbreak in Luangwa Valley, Zambia (Lewis *et al*. 1990). Consequently, the revenue allocated to community management programmes in the Lupande study area declined by 31% from Zambian kwacha (ZMK) 212,067 in 1987 to ZMK 146,000 in 1988.

## Discussion

To minimize the risk of spreading diseases to other areas, veterinary certification of animals and animal products originating from the Kafue Flats should be introduced immediately. Meat inspection should be reintroduced as a matter of urgency to minimize the public health risk associated with consuming and handling uncertified animal products. The current practice, whereby meat is consumed without veterinary certification, places the general public at a greater risk of contracting zoonotic diseases. To further reduce the public health hazard, it is recommended that the Zambia Wildlife Authority embark on public awareness campaigns to educate people about the dangers of consuming game meat from the illegal bushmeat trade. Uncontrolled poaching, in addition to its detrimental impact on the wildlife resource, will continue to place the unsuspecting public at risk of contracting zoonotic diseases. Given Zambia's HIV/AIDS pandemic, protecting the general public from zoonotic diseases must be given serious attention. TB in people has generally been associated with HIV/AIDS.

To improve the conservation of lechwe on the Kafue Flats, innovative disease-control methods should be introduced. Testing and elimination of infected herds as suggested by MacAdam (1973) would perhaps be the most effective control method but is economically prohibitive given the large herd sizes. Eliminating or reducing contact between the lechwe and cattle has been suggested (Rottcher 1976). This would be feasible only with the cooperation and support of the local community. People would need to perceive benefits to discontinuing the transhumant grazing system. This cooperation is most unlikely, however, given that the local communities have no alternative areas in which to graze or water their animals. Fencing off the Kafue Flats would be ecologically and politically inappropriate. The translocation of clean herds of lechwe to uninfected areas that are well secure and have suitable habitat would enhance the survival of the species in the country. To improve the conservation of the species, the authors recommend that Zambian wildlife authorities create a "clean" herd of the Kafue lechwe suitable for translocation to new areas under strict quarantine and disease screening procedures. Eliminating contact between the lechwe and cattle in the new areas would further improve the survival of the species. To further enhance the conservation of the species, plans for translocations of animals into such new areas should be subjected to disease-risk analysis and include precautionary measures such as strict disease screening and quarantine protocols.

To protect the livestock that interact with the Kafue lechwe on grazing pasture and at water points, the National Veterinary Authority should improve the veterinary care delivery system for livestock in the area. Results from improved disease surveillance and monitoring in livestock could potentially serve as a proxy reflection of the situation in the wildlife in the area. Strict screening of livestock being moved into the area is also critical, as infected cattle could transmit diseases to wildlife when they come into contact.

To fully understand the ecological and socioeconomic implications of diseases in wildlife, future veterinary studies should be designed within the context of the ecosystem and the prevailing land-use practices. The need to investigate the possible spread of BTB and brucellosis to other wildlife species in the area is urgent.

## Conclusions

Without animal disease investigations that address the whole ecosystem and the prevailing land-use practices, the full extent of the ecological impacts and socioeconomic implications of wildlife diseases remains largely speculative. The actual contribution of BTB and brucellosis to the reduction of the lechwe population in the area cannot be readily quantified. Further data and more comprehensive models are needed. Available disease information is difficult to interpret in the context of the overall general management plan for the protected area, or to translate into practical management decisions. A more integrative, multidisciplinary approach to problem-solving at the wildlife/livestock interface is needed.

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