JOURNAL 48
Namibia Wissenschaftliche Gesellschaft / Namibia Scientific Society
Windhoek, Namibia 2000
ISSN: 1018 - 7677

DISEASES OF WILDLIFE AFFECTING LIVESTOCK FARMING IN NAMIBIA[1]

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SUMMARY

More than 70% of Namibia's population depends directly or indirectly on agriculture, with the emphasis on extensive livestock farming. More than 80% of the total agricultural production is of animal origin, with the export of animals and animal products accounting for more than 17% of the countries total export production. Namibia is thus totally dependent on the export of life animals and animal products such as beef and mutton and has for many years had access to sophisticated world markets, e. g. the European Union. Several diseases of wildlife pose a direct threat to the health status of Namibia's cattle and small stock population and effective preventative and control measures have been adopted to safeguard livestock farming and thus Namibia's export markets from such diseases. The most important diseases of wildlife which had a direct effect on Namibia's livestock population are foot-and-mouth disease, anthrax and rabies. Epidemiology of these diseases, their control in the Namibian context and preventive measures employed are highlighted. As wildlife ranching in combination with livestock farming on the same farm unit becomes more and more widespread, disease conditions where wildlife act as asymptomatic carriers of diseases like bovine malignant catarrhal fever, gedoelstiasis, African swine fever and Corridor disease have become of particular importance. A range of on-farm disease control measures to prevent contact and restrict movements, which have been instituted to protect domes tic livestock from these disease conditions, are briefly described. By implementing the described control measures and thus minimising the risk of disease transmission between wildlife and domestic animals, wildlife and livestock are successfully farmed with in Namibia under extensive rangeland conditions.

ZUSAMMENFASSUNG

Mehr als 70% der Bevölkerung Namibia's ist entweder direkt oder indirekt von der Landwirtschaft abhängig, mit dem Schwerpunkt auf extensiver Tierhaltung. Über 80% der gesamten Agrarproduktion ist tierischen Ursprungs, wobei die Ausfuhr von Tieren und tierischen Produkten mehr als 17% des gesamten namibischen Aussenhandels beträgt. Aus diesen Gründen ist der Export von Lebendtieren und tierischen Erzeugnissen wie Rind- und Lammfleisch für Namibia von grosser wirtschaftlicher Bedeutung und hat man sich deshalb seit vielen Jahren um Zugang zu den bedeutenden Weltmärkten, wie z. B. die Europäische Gemeinschaft, erfolgreich bemüht. Eine Vielzahl von Wildkrankheiten bedrohen unmittelbar die Gesundheit von Namibia's Rind- und Kleinviehbeständen. Vorbeugende und kontollierende Massnahmen mussten unternommen werden um die Haustierbestände und damit auch Namibia's Exportmärkte für Tiere und tierische Produkte vor solchen Krankheiten zu schützen. Die wichtigsten dieser Wildkrankheiten für Namibia's Farmtierbestände sind Maul-und-Klauenseuche, Milzbrand und Tollwut. Die Epidemiologie dieser Seuchen, ihr Kontrolle unter namibischen Umständen und vorbeugende Massnahmen werden beschrieben. Da Wildfarmerei als Ergänzung zur und zusammen mit Haustierfarmerei auf derselben Farm zunehmend an Bedeutung gewinnt, sind Tierkrankheiten wobei Wild als asymptomatische Träger auftreten, wie z. B. Bösartiges Katarrhalfieber der Rinder, Gedoelstiase, Afrikanische Schweinepest und Korridorkrankheit, von besonderer Bedeutung. Kontrollmassnahmen die dem Schutz vor solchen Krankheiten, wie u. a. Isolierung und Bewegungskontrolle, dienen und auf Farmen zum Schutz des Tierbestandes zur Anwendung kommen, werden kurz beschrieben. Die Anwendung der geschilderten Seuchenkontrollmassnahmen, und damit die Verringerung des Risikos der Krankheitsübertragung zwischen Wild und Haustieren, ermöglicht die erfolgreiche Farmerei mit Wild und Farmhaustieren unter Namibia's extensiver Weidewirtschaft.

[1] Paper delivered at the 25th Anniversary Congress of the Namibian Scientific Society, Windhoek, 3rd June 2000

INTRODUCTION

With a land surface of 823 000 square kilometres - being 2,7% of the surface area of Africa -Namibia is a country sandwiched between the Namib and the Kalahari desert and periods of drought, sometimes as long as 4 to 9 years, are a regular occurrence.

In spite of these topographical and climatic constraints Namibia is predominantly an agricultural country. Although only contributing about 10 % to the gross domestic product in recent years, **agriculture is the most important single economic activity** by providing a livelihood to **70% of the countries population** of approximately 1,8 million. Nearly 50 % of the countries job-opportunities are provided by agriculture, hereby thus being the single most important employment factor within the domestic economy. During 1996 the export value of animals/animal products amounted to nearly 13% of the total export production.

As intensive agricultural use of land and irrigation farming can only be practised on a very limited scale, **extensive livestock farming** is the backbone of Namibia's agriculture. On more than 90% of the available agricultural land, cattle ranching is practised on 48%, mixed cattle/small stock ranching on 14,5% and small stock ranching on 37,5% of the area.

TABLE 1 : LIVESTOCK and LANDUSE in NAMIBIA : Dec. 1999[2]

	Numbers	% used of total available agricultural land
CATTLE	2 279 404	
SHEEP	2 159 461	
GOATS	1 626 095	
Cattle ranching		48%
Mixed Cattle/Small stock ranching		15%
Small stock ranching		37%

[2] Division of Veterinary Services, Windhoek : Livestock Census 1999

Cattle farming

With a cattle population of some 2,3 million (1999) and a beef export value in excess of N$ 750 million per annum, **cattle ranching** is the single most important agricultural activity in Namibia and represents **73%** of the total agricultural production. Apart from beef production, stud farming supplies high-quality stud animals to local farmers and to neighbouring countries. The granting of a beef quota under the Lomé IV agreement (1990 - 2000) greatly assisted Namibia's livestock industry in diversifying its beef export market. By utilising this new export market, about 40 000 cattle (8 290 tons) of the approximately 320 000 cattle marketed in 1998, were channelled to Europe. However, it must be noted that South Africa is, and will remain for a long time, Namibia's most important market for beef. The export of cattle to the Republic of South Africa amounted to nearly 42% of the total production in 1999. [3]

Small stock farming

Small stock farming in Namibia consists primarily of sheep, but goats, numbering some 1,6 million, do play a major role in the supply of meat to the local market. Sheep farming is mainly concentrated in the arid south and west of the country, with a total of some 2,16 million sheep in 1999. Since the decline in earnings from the export of karakul pelts, more and more farmers shifted their activity to the production of mutton. As Namibia has only very limited slaughter facilities for small-stock, the bulk of slaughter sheep and -goats has to be exported live to South Africa.

In 1999 a total of 1 099 223 small stock were produced for slaughter, of which 801 244 or **73% were exported live** to the South African markets.

Game farming and venison production

Game farming plays a very important part in Namibia's tourism industry and thus as an earner of foreign exchange. Whereas the export of venison to Europe played an important role during the early to mid - eighties, only very small quantities were exported during recent years. The marketing of live game to re-stock farms for tourism and hunting is gaining in importance and the farming potential of game animals is widely recognised as a way to broaden the base of ecologically sound farming activities **Ostrich farming** has been developed during the past 10 years. Commercial farming units have been established, with over 33 000 domesticated birds kept under intensive to semi-intensive conditions, for the production of meat, skins and feathers in 1999. The tourism potential of an ostrich farm is an additional benefit. This farming activity holds promises for development, especially in the more arid southern regions.

In summary it is clear, that Namibia's agricultural economy totally depends on the maintenance and development of its export markets for animals and animal products. The countries of particular importance are South Africa, importing some 42% of the total cattle- and 73% of the total small stock-production respectively. It is thus clear, that the occurrence of livestock diseases is a continuous threat to the industry and any outbreak of a disease like **FMD** will have a disastrous impact on Namibia's livestock export markets, with serious consequences for the whole economy.

[3] Meat Board of Namibia: Monthly Statistical Bulletin Dec. 1999

Thus only the freedom of exotic diseases like Foot-and-Mouth disease and Bovine Lungsickness will ensure an export market of animals and animal products. After the severe outbreak of Foot-and-Mouth disease in 1961, with its crippling effects on the Namibian economy, a whole series of veterinary disease control measures were instituted to prevent a repetition of outbreaks and to safeguard the countries export markets.

TABLE 2 : LIVESTOCK PRODUCTION AND MARKETING 1999[4]

Species	Slaughtered by Namibian butchers *	Slaughtered at EU approved Export abattoirs	Slaughtered at other approved Export abattoirs **	Exported live to South Africa	TOTAL Production
Cattle	18 955	159 522	19 995	144 315	342 787
	5,5%	46,5%	5,8%	42,2%	
Small stock	61 060	236 919	Nil	801 244	1 099 223
	5,5%	21,5%		73%	

*** = for local consumption**

**** = Abattoirs north of the Veterinary Cordon Fence**

AFRICAN ANIMAL TRYPANOSOMIASIS (NAGANA)

The transmission of Nagana to domestic animals is entirely based on the presence of tsetse flies (*Glossina morsitans morsitans)* in Namibia. Wild animal hosts, such as kudu antelopes, bushbuck, warthog, buffalo and elephant form a major reservoir for infection of the tsetse fly. Tsetse fly occur in the area around the Kwando river in the Caprivi region. The increasing practice of ranching with game, with the concurrent translocation of game from tsetse fly infested areas to fly free areas, may cause clinical disease in game normally regarded as being " immune" to trypanosomiasis. In such cases, the mechanical transmission from game to domestic livestock is a possibility.

Control is based on various methods to control the vector. In the 1930's large scale hunting operations were undertaken in South Africa to eliminate the wild host. This was, however, never done in Namibia. Here the control of the tsetse fly is based on odour-baited, insecticide treated targets, combined with deltamethrin treatment of cattle.

ANAPLASMOSIS

In South Africa the following game species have been shown to be susceptible to experimental infection with *Anaplasma marginale*, with infection being sub-clinical:[5] Blesbok (*Damaliscus dorcas phillipsi*), duiker (*Sylvicapra grimmi grimmi*) and the white-tailed (black) wildebeest (*Connochaetes gnou*). *Anaplasma* sp. have also been found in giraffe (*Giraffa camelopardalis)*, where anaplasmosis has been found to be associated with deaths and clinical disease, sable antelope *(Hippotragus niger)* and buffalo *(Syncerus caffer)*[6]. As these antelopes, except for duiker, do not naturally occur in the farming areas of Namibia, transmission to cattle is unlikely.

[4] Meat Board of Namibia: Monthly Statistical Bulletin Dec. 1999

[5] Infectious Diseases of Livestock with special reference to Southern Africa 1994: 412

[6] Infectious Diseases of Livestock with special reference to Southern Africa 1994: 407

ANTHRAX

Unlike in domestic animals, anthrax in **game** is still of major importance, especially in the Etosha National Park. The building of roads for tourists since 1962 led to the creation of numerous gravel pits and new water- holes. Game concentrated around these watering places, leading to a higher disease incidence. Most cases occurred during the end of the rainy season, as the vleys and gravel pits dried up. Anthrax was diagnosed in many different species, being responsible for over 60% of the recorded deaths in Etosha. A survey undertaken in 1983 and 1987 in Etosha[7] showed that the soils and waters in even the areas of high anthrax incidence are not universally infected with high numbers of *Bacillus anthracis* and the earlier contention, that gravel pits are associated in a major way with the incidence of anthrax, could not be supported. During a recent study[9] positive isolations of anthrax spores were obtained from 72% of the jackal, 60% of the hyena and 50% of the vulture faeces collected around anthrax carcasses, with numbers frequently high and potentially able to produce new foci of infection.

During recent years, anthrax in game animals outside Etosha gained in importance, especially on **game farms**. In 1988 several outbreaks were experienced among oryx in the Okahandja and Otjiwarongo districts and oryx, black wildebeest, zebra, eland and hartebbest were vaccinated by using a dart gun.[7]

In 1986 a number of **cheetah** died after they had been fed with meat from a shot baboon which evidently had suffered from cutaneous anthrax.[8] In 1992 **oryx** became affected in the Diamond area near the Orange river and **elephant** died of anthrax near Sesfontein. In 1997 lion and cheetah were infected with anthrax after eating infected horse meat on a game farm in the Gobabis area. One lion died, with the others treated successfully with antibiotics.[10]

Control of the disease is based on the annual vaccination of all grazing livestock in endemic areas, vigorous disinfection procedures of possible contaminated areas, prompt and safe disposal of all dead animals and strict quarantine and isolation measures during outbreaks.

Since 1901 anthrax has been a **notifiable** disease in Namibia and since 1973 the vaccination of all cattle in Namibia has been made compulsory. All cattle, older than 3 months, have to be vaccinated annually. Very safe and effective avirulent spore vaccines, prepared from a non-pathogenic and avirulent mutant, are available from various pharmaceutical companies, including Onderstepoort, South Africa.

[7] Turnbull, P.C.B. *et al.* 1989: Further progress in understanding anthrax in the Etosha National Park. Madoqua, 16(2): 93-104
[8] Voigts, B. 1989: Anthrax in oryx and goats in Namibia. SA Vet. Med. 2(5): 179
[9] Jäger, H. 1989: Anthrax in game in SWA/Namibia. State Veterinary meeting, Div. of Vet Services, Windhoek. Unpublished.
[10] Div. of Vet. Services: Epidemiological Update Sept. 1997

TABLE 3 : Anthrax in the Etosha National Park 1964 - 1998[11,12]

Species / Year	1967-70	1971-74	1975-77	1978-82	1983-87	1988-92 [13]	1993-98 [14,15]	1964-98
Black rhino				4	3	4	3	**16**
Blue wildebeest	250	293	35	45	110	70	66	**877**
Eland	2	2				2	2	**8**
Elephant	18	7		82	28	216	45	**519**
Giraffe	1	4		1		7	2	**17**
Kudu	3	4		8		3	2	**26**
Oryx	15	3		3		6	9	**45**
Ostrich	2	3				0		**6**
Springbok	54	48	11	32	7	53	63	**296**
Zebra	380	447	33	84	139	110	164	**1 475**

[11] Schneider, H. 1977: Analyse der Tiergesundheitssituation in SWA/Namibia. Inaug. Diss. Giessen
[12] Turnbull, P.C.B. *et al.* 1986. Isolation of *Bacillus anthracis*, the agent of anthrax in the Etosha National Park. Madoqua, 14(4): 321-331 AND Turnbull. P.C.B., *et al.* 1989: Futher progress in understanding anthrax in the Etosha National Park. Madoqua, 16(2): 93-104
[13] Lindeque, P.M. and Turnbull, P.C.B. 1994: Ecology and epidemiology of anthrax in the Etosha National Park, Namibia. Onderstepoort J. vet. Res. 61:71-83
[14] Division of Veterinary Services, 2000: Personal communication
[15] Etosha Animal Disease Reports to: Director of Veterinary Services: 1993-2000

TABLE 4 : Laboratory confirmed Anthrax in game in Namibia: 10 Year Period: 1989 - 1998[16,17]

Species / Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL	% of Total
African buffalo (*Syncerus caffer*)				20							20	
Black rhino (*Diceros bicornis*)								E1 2	3	E2 1	9	
Black wildebeest (*Connochaetes gnou*)	1	5									6	
Blesbok (*Damaliscus dorcas phillipsi*)							1		2	1	4	
Blue wildebeest (*Connochaetes tauri.*)	9		13	18	E15	E6	E2 25	E193	E11	E13	134	14,4
Eland (*Taurotragus oryx*)			1	2			1			1	5	
Elephant (*Loxodonta africana*)	37	29	7	32	E10	E10	E3	E7	E2 2	E13	152	16,3
Giraffe (*Giraffa camelopardalis*)		1		5	E1 2	E1	1	11				
Hartebeest (*Alcelaphus buselaphus*)	4				E1		1 E1	E1			8	
Impala (*Aepyceros melampus*)								1			1	
Kudu (*Tragelaphus strepsiceros*)						E2		2				
Oryx (*Oryx gazella*)	6			1	E2 1	E1 5	E1 6	E2	E3		28	3,0
Roan antelope (*Hippotragus equinus*)			1			2	2	5				
Sable antelope (*Hippotragus niger*)	1						1					
Springbok (*Antidorcas marsupialis*)	8		10	14	E4 E8	E8 E6	E22	E15	4		99	10,6
Steenbok (*Raphicerus campestris*)				2				2				
Zebra (*Equus burchelli / z. hartmannae*)	16	11	27	22	E31	E25	E22 8	E28 5	E45 2	E13	255	27,3

E1= number of cases in Etosha National Park

[16] Annual Report. 1989-1998: Division of Veterinary Services, P/Bag 12022, Windhoek
[17] Etosha Animal Disease Reports to: Director of Veterinary Services: 1993-1999

TABLE 4 : Laboratory confirmed Anthrax in game in Namibia: 10 Year Period: 1989 - 1998[16,17]

Species / Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	TOTAL	% of Total
Carnivores												
Cheetah (*Acinonyx jubatus*)					E2	E1	E1	E1 5		8	18	2,0
Jackal (*Canis mesomelas*)	1	1										
Lion (*Panthera leo*)	3		3									
Domestic animals												
Bovine (Cattle)	5	1		3	4	5	8	33		12	31	102
11,0												
Sheep	9	9										
Goats			9			10		8		28	55	6,0
Pigs									2	5		
Camel									2		2	
Horse									1		1	
TOTAL No. of ALL confirmed cases												935

[16] Annual Report. 1989-1998: Division of Veterinary Services, P/Bag 12022, Windhoek
[17] Etosha Animal Disease Reports to: Director of Veterinary Services: 1993-1999

FOOT AND MOUTH DISEASE[18,19]

Since the dramatic Rinderpest epidemic at the end of the last century, no other animal disease had such profound and serious consequences for the whole economy of Namibia than Foot and mouth disease (FMD), especially the 1961 outbreak. Apart from locally confined outbreaks in the northern border districts, Namibia's commercial farming area is free from this disease since 1964.

FMD is an acute, highly contagious viral disease of domestic and wild cloven-hoofed animals, with the natural hosts being, cattle, sheep/goats, pigs, buffalo, antelope and camels. Horses are resistant, while the African buffalo acts as an asymptomatic carrier of the virus.

The role of game in FMD outbreaks in Namibia:

In all outbreaks prior to the one of 1961/62 the disease was never found in game animals. **Game, however, played a major role in the rapid spread of FMD in 1961/62 and again in 1964.** Predisposing factors in the context were:

(1) the close contact at water holes between livestock and game due to the decrease of water points because of the drought;
(2) contact between livestock and game where fodder and licks (salt, minerals and phosphate) were supplied; and
(3) the drought conditions throughout the country, which forced livestock and game into a closer than normal contact in areas where some grazing was still available

At the beginning of the epidemic FMD numerous cases were seen in game, but towards the end of the outbreak no further cases were diagnosed. This could probably have been due to the general decrease of virus material, caused by extensive vaccinations in all districts. Likewise the completed system of gameproof fences played an important role in containing the disease.

During the 1961 outbreak FMD was diagnosed in the following game species:

TABLE 5 : FMD in Game (1961 - 63)

Date	Species		Type of virus	District
August 1961	Eland	*(Taurotragus oryx)*	SAT 1	Gobabis
	Oryx	*(Oryx gazella)*	SAT 1	Windhoek
	Kudu	*(Tragelaphus strepsiceros)*	SAT 1	Windhoek
Sept. 1961	Hartebeest	*(Alcelaphus buselaphus)*	SAT 1	Windhoek
	Springbok	*(Antidorcas marsupialis)*	SAT 1	Windhoek
	Steenbok	*(Raphicerus campestris)*	SAT 1	Windhoek
August 1963	Afr. buffalo	*(Syncerus caffer)**	SAT 3	Bushmanland

* This animal showed no clinical symptoms and had probably strayed across the border from Botswana, were SAT 3 occurred at that time

[18] Schneider, H: 1994: Animal Health and Veterinary Medicine in Namibia, Agrivet
[19] Schneider, H.1977: Analyse der Tiergesundheitssituation in SWA/Namibia. Inaug. Diss. Giessen

Foot and mouth disease control measures:

FMD is a **notifiable disease** under the Animal Disease and Parasites Act of 1956 (Act 13 of 1956). This entails the compulsory notification of a suspected FMD outbreak by the owner of such an animal, prevention of access to such animals, the control of the movement of animals infected with FMD and the keeping of required registers in respect of numbers of animals on the property.

Since the 1961 outbreak a **national control programme** has been developed. The aim is:
(1) to safeguard Namibia's livestock industry against the introduction of the disease;
(2) to diagnose outbreaks as early as possible;
(3) to prevent the spread and achieve eradication by an immediate high-level control activity; and
(4) to create a reasonable immune cattle population in areas most likely to be infected from neighbouring territories by means of annual prophylactic vaccinations.

Zoo-sanitary measures employed to achieve these aims are the following:

(1) **Regular inspections of all cloven-hoofed farm animals by animal health inspectors.**
Namibia is divided into stock inspection areas, where all cloven-hoofed animals are regularly inspected.

(2) **Movement control of cloven-hoofed animals and their products:**
To control the movement of cloven-hoofed animals one property to another, either within, out or into a district, except by virtue of a permit (or licence) issued by a state veterinary official, certain districts have been declared as FMD control districts.[20]

(3) **Annual prophylactic vaccinations in the high-risk areas.**

(4) **Monitoring of game for FMD virus in the high-risk areas.**

(5) **Maintenance of a system of veterinary cordon and disease control fences:**
To prevent introduction and spread of FMD within the country, a system of strategically placed veterinary disease control fences were erected during the 1961/62 outbreak, with later additions to them. Of particular importance in this context is the **Veterinary Cordon Fence (VCF).** This northern, east-west disease control fence was started at the end of 1961, with the last part in western Damaraland being completed in 1977 and the eastern part, south of Gam, in 1982. The **VCF** is a double fence, 10 meters apart, consisting of a 2,8 m high game-proof fence on the northern/outer side and a 1,4 m high stock-proof on the southern/inner side. The total length from east to west is 2 300 km with seven permanent gates which are permanently manned by veterinary personnel trained as gate guards. The VCF thus effectively divides Namibia into a **high risk** zone to the north and a **free zone** to the south.

(6) **Border control, quarantine farms and import quarantine:**
Special veterinary guards are placed at control posts where roads traverse the VCF. For the

[20] Schneider, H: 1994: Animal Health and Veterinary Medicine in Namibia, Agrivet

purpose of exporting meat from cattle slaughtered in the high-risk zone, these animals have to undergo a 21-day quarantine period in the special veterinary quarantine farms. Beef from such animals may not be exported, unless it has been matured after slaughter and has not been frozen before a pH of not more than 6 has been reached. The importation of animals and animal products is subject to a veterinary import licence and quarantine at a veterinary quarantine station may also be required. Quarantine is compulsory if the animals originate from potentially FMD infected areas.

RABIES[21]

The chief vectors involved in the transmission of rabies in Namibia are **dogs** in the northern districts with dogs and humans as main victims, **jackal** (*Canis mesomelas*) in the central districts causing heavy losses amongst cattle and probably establishing the initial outbreak in kudu antelopes (*Tragelaphus strepsiceros*) in the kudu rabies epidemic in the late 1970's and **wild felidae** like the African wild cat (*Felis lybica*), caracal (*Felis caracal*) and **genets** (*Genetta sp.*) in the southern, more arid districts. Other than in South Africa, no natural rabies-viverridae climax has been found in Namibia. Since 1990 more and more cases are diagnosed in sheep. Rabies in dogs is particularly noticeable in areas where vaccination coverage of the canine population is insufficient.

In the following tables the incidence of rabies in different animal species is illustrated. The kudu-rabies period lasted for 10 years from 1977 to 1986 (*vide infra).* The 10 year epidemic of rabies amongst kudu antelopes (*Tragelaphus strepsiceros*), being an aberrant cycle in these animals, caused high mortalities and severely depleted the kudu population in the central districts of Namibia. High mortalities were also seen in eland (*Taurotragus oryx)* in 1982 and 1983.

TABLE 6 : Confirmed cases of rabies in different animal species, expressed as percentage of all cases for given periods 1948 - 1998[22]

Animal species	Period / Percentage of all cases					
	1948-1956	1968-1975	1976-1982	1983-1987	1988-1992	1993-1998
Cattle	64,0	49,8	35,2	36,0	45,6	45,6
Domestic dog	20,0	17,5	16,1	25,2	11,6	18,7
Jackal (*C.mesomelas*)	9,4	15,2	8,0	7,5	8,0	11,0
Kudu (*T.strepsiceros*)	0	0	30,0	17,4	0,3	0,8
Felidae	4,0	4,3	2,1	2,2	2,3	2,7
Viverridae (*incl. Genetta)*	1,3	3,5	0,6	1,4	0,5	0,3
Other dom. animals	1,3	4,2	2,7	4,4	27,4*	16,8**
Other wild animals		5,5	5,3	5,9	4,3	4,1
TOTAL	100	100	100	100	100	100

* = nearly 80% of these cases are in sheep

** = 59% in goats and 35% in sheep

[21] Schneider, H: 1994: Animal Health and Veterinary Medicine in Namibia, Agrivet

[22] Div. of Veterinary Services Namibia: Annual Reports: 1948 - 1998

TABLE 7 : All laboratory confirmed cases of rabies: 1976 - 1998 (2-year intervals)

Species	1976	1978	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998
Cattle	15	23	44	131	35	23	170	116	144	82	134	185
Dog	10	14	23	21	31	28	44	25	33	15	36	106
Kudu (*Tragelap. strepsic.*)		28	82	64	13	2	2	1	1	1	1	10
Jackal (*Canis mesomelas*)	3	8	23	18	11	4	39	16	32	13	44	27
Goat	1	2	3	2	8	4	22	15	4	23	40	30
Bat eared fox (*O. megalotis*)	2	4	3	3	3	1	41	3	1	5	7	2
Sheep	1	1	1	1		1	27	105	104	45	1	11
Equidae (Horses & donkeys)		1	1	1	3		5		4		4	6
Felidae (*Felis sp.*)	3	4		1	1	6	10	4	5	3	6	17
Honey badger (*M. capensis*)	0	2	1	3	1		1	1	3		1	3
Genetta sp.	1		1				1					
Cheetah (*Acinonyx jubatus*)		1	1	1							1	1
Leopard (*Panthera pardus*)			1								1	
Viverridae (*Cynictis/Suricata*)	2			2	2		3	1	1		1	2
Eland (*Taurotragus oryx*)			2	6	1	1	1				2	2
Aardwolf (*Proteles cristatus*)				1	2	1						2
Others					4	2	9			4		3
TOTAL (All cases)	38	88	186	255	115	73	375	287	332	191	279	407

An analysis of all laboratory confirmed rabies cases for the period 1970 - 1982 presents a clear picture with respect to the geographical distribution of **vectors** and **victims**. This situation has not substantially changed in later years.

TABLE 8 : Rabies: Vectors and victims 1970 - 1982

Affected species	Number and percentage of cases*					
	Area I		Area II		Area III	
VECTORS	Number	%	Number	%	Number	%
Dog	132	66,0%	66	33,0%	3	1,0%
Jackal *(Canis mesomelas)*	4	2,5%	148	96,0%	2	1,5%
Felidae *(Felis lybica, F.caracal)*	4	9,0%	14	33,0%	25	58,0%
Bat eared fox *(O. megalotis)*			21	70,0%	9	30,0%
Viverridae**	1	4,0%	8	32,0%	16	64,0%
Honey badger *(M. capensis)*			13	93,0%	1	7,0%
VICTIMS:						
Bovine	6	1,5%	260	97,0%	6	1,5%
Kudu			270	100%		
Eland			9	100%		
Other domestic animals***	5	15,0%	27	79,0%	2	6,0%
Other wild animals	2	13,0%	12	80,0%	1	7,0%
Humans	4	80,0%	1	20,0%		

* Percentage expressed as of the total number of cases in this species

** *Cynictis penicillata, Suricata suricata, Genetta sp.*

*** Equines, ovines and caprines

AREA I : Kaokoland, Ovambo, Okavango, Bushmanland

AREA II : Damaraland, Outjo, Tsumeb, Grootfontein, Hereroland, Otjiwarongo, Otavi, Omaruru, Karibib, Swakopmund, Okahandja, Windhoek, Rehoboth, Gobabis

AREA III : Maltahöhe, Mariental, Bethanie, Keetmanshoop, Lüderitz, Karasburg

The main vectors of rabies in Namibia (dogs, jackal, felidae, and exceptionally viverridae) transmit the disease by biting. The accidental infection of wounds or abrasions through saliva from in infected animal is a distinct possibility in humans, especially when trying to "remove the bone in the throat" of a rabid bovine.

The kudu rabies epidemic is thought to be directly linked to an increased population density brought about, *inter alia*, by changes to the ecology and natural habitat of these antelopes. Increased farming activities since the early 70's resulted in better and constant water supplies being at the water-dependant

kudu's disposal and a change from open grassland to a kudu-favoured bush- and tree-habitat occurred due to increased stocking rates and resultant overgrazing. The increased economic value of kudu due to controlled trophy hunting and the export of venison, resulted in the increased protection of these animals and the reduction of their natural enemies, large predators. Thus an over-population of kudu was reached in the mid-70's. The kudu rabies epidemic started in 1977 and lasted until 1986. It is estimated that during this 9 year epidemic up to 100 000 kudu had succumbed to the disease. Only by 1991, after some 5 years, the population density had returned back to normal.

With the occurrence of rabies in 1956, rabies control regulations were issued, providing for vaccination isolation, culling and disposal of animals and compulsory vaccination of dogs was made applicable to all dogs in certain districts. Current rabies control measures stipulate that no person may introduce any dog, cat or wild carnivore into Namibia or move it within Namibia, unless he has been issued with a permit by a state veterinarian; and each owner of a dog must have his animal vaccinated against rabies before it attains the age of 7 months, but not before it is 3 months old. This vaccination must be repeated every 3 years. Rabies prophylaxis is based on regular immunisation of domestic dogs and the **reduction or elimination of the disease in wildlife reservoirs. Vaccination of wildlife vectors, like jackal, is not practically feasible in Namibia.** The regular state veterinary immunisation cam-paign also provide for the free vaccination of cats. Cattle, especially stud animals, are vaccinated in great numbers by farmers in areas were rabies is endemic. By vaccinating a high percentage of the rural and urban dog population a satisfactory level of rabies control is achieved. **The reduction of high population densities of jackal is another important measure in rabies control.** The indis-criminately use of poisons has led to the death of a large number of non-target animals, like bat-eared foxes and vultures, and new methods like poison-collars are being investigated. The use of strychnine is strictly controlled through veterinarians, as this poison is available on prescription only.

BOVINE MALIGNANT CATARRHAL FEVER (MCF)

MCF infection in Africa is associated with contact of cattle and wildebeest (*Connochaetes taurinus*) resulting in the wildebeest-associated syndrome. There is no indication that game species other than wildebeest are able to transmit the disease under natural circumstances.[23] The virus has been identified as Alcelaphine herpes virus 1 (AHV-1), whereas the etiological agent of the sheep or non-wildebeest associated-syndrome has not yet been identified.[24] Most free-living adult wildebeest are infected with AHV-1, but probably only excrete virus in circumstances of severe stress (e.g. captivity, high temperatures). Excretion of AHV-1 is for all practical purposes limited to wildebeest calves under the age of 4 months, thus resulting in the disease during the months April - July when these calves are within the age group 3 - 5 months.

The occurrence of the disease in Namibia is intimately linked to the contact of bovines with the Blue wildebeest (*Connochaetes taurinus*) and the sheep-associated syndrome is unknown. More and more wildebeest were introduced in the early 1980's onto game farms and special disease control measures had to be implemented. To be able to control the importation into and movement within Namibia of wild animals, Regulation R 1924 of 1975 makes provision for the issuing of permits for such animals

[23] Infectious Diseases of Livestock with special reference to Southern Africa 1994:947

[24] Hoffmann, D. & Young, M.P. 1989: Malignant catarrhal fever. Austr. Vet. Journ. 66(12): 405-406

subject to conditions a state veterinarian may specify. In the case of wildebeest, permits are only issued for movement to properties where a specific camp has been designated for these animals and which is double fenced to prevent any contact with cattle on the property or on neighbouring land. As transmission can occur over distances of several hundred metres, it is essential to have cattle and wildebeest separated by at least 1 000 metres.[25]

GEDOELSTIASIS

Gedoelstiasis (" **Uitpeuloog** ") is a specific oculo-vascular myiasis of domestic animals in Namibia. The larvae of the nasal flies of particularly wildebeest *(Connochaetes taurinus)* and hartebeest *(Alcelaphus buselaphus), Gedoelstia cristata* and *Gedoelstia haessleri*, infest sheep, goats, cattle and horses if these animals are grazing in close vicinity of these antelopes. The larvae do not settle in the nasal cavity but migrate through the host's body, causing three clinically distinct disease syndromes:

- An **ocular form**: One or both eyes may be affected, showing mild to severe changes of the eye, including rupture of the eyeball with secondary infection.
- A **brain form**: Larvae migrate from the eye to the central nervous system. Seen mostly in sheep, with an incidence of 15 - 30%. Symptoms are ataxia, paresis, paralysis and muscular spasms.
- A **cardiac form**: Larvae migrate from the eye through blood vessels to the heart, commonly resulting in sudden death without any clinical symptoms. [26]

The first reports of a peculiar disease among ruminants and horses were received in 1927 from the Kalahari areas. Prominent symptoms were uni- or bilateral exopthalmus and affection of the nervous system. A similar disease, called "blouwildebeestoog", was described from the Kuruman area in South Africa.[27] With the decline of the wildebeest population in the commercial farming area and the epidemiology of the disease being known, only sporadic cases of Gedoelstiasis are reported. Outbreaks occur along the Botswana border and in 1970 an outbreak in sheep was diagnosed in the Kamanjab district, along the Etosha border, with another outbreak in sheep 1986 from the Mariental district.[28]

The disease can be controlled by the prevention of contact between these antelopes and domestic animals.

CORRIDOR DISEASE

Corridor disease is a protozoal, tick transmitted disease of cattle, caused by *Theileria parva lawrenceii*. This disease is transmitted by ticks from the African buffalo (*Syncerus caffer*) to cattle, resulting in a low morbidity but high mortality. Typical clinical symptoms are high fever and a pronounced and generalised swelling of the lymph nodes. The disease is mainly transmitted by the brown tick, *Rhipicephalus appendiculatus*, being replaced by *Rhipicephalus zambeziensis* in the more arid part of southern Africa,[29] as is the case in Namibia.

Corridor disease was for the first time diagnosed in 1978 in two outbreaks in cattle in the Grootfontein district. The diagnosis was confirmed by pathological examination and transmission was believed to have originated from contact with buffaloes from Bushmanland. No *R. appendiculatus* ticks could be found. Another single outbreak occurred in 1981, followed by two outbreaks, causing the deaths of

[25] Infectious Diseases of Livestock with special reference to Southern Africa 1994:954
[26] Basson: P.A. 1962: Studies on specific oculo-vascular myiasis of domestic animals (Uitpeuloog). Onderstepoort J. vet. Res. 29(1): 81-87 & 29(2): 203-240
[27] Fourie, J.M. & Snyman, P.S. 1942: Blouwildebeestoog. J.S.A. vet. med. Ass. 123(2): 43-47
[28] Annual Reports. 1955-1990: Division of Veterinary Services, Windhoek. Unpublished.
[29] Infectious Diseases of Livestock with special reference to Southern Africa 1994:326

nine cattle, in 1984 and a last diagnosed outbreak in 1985. All these outbreaks occurred in th Grootfontein district without any history of contact with buffalo and in 1984 the tick, *R. zambeziensis* was identified on the affected farms.

Corridor disease is after foot-and-mouth disease the most important disease transmitted from Africa buffalo to cattle and is thus a major constraint to the introduction of buffalo to game farms in the cattl farming areas of Namibia. Control is based on the prevention of contact between buffaloes and cattl through fences and the prohibition on introduction of buffaloes to game farms or game reserves withi the cattle farming area.

AFRICAN SWINE FEVER

ASF is caused by a virus totally unrelated to the virus of European swine fever. In Namibia th **warthog** (*Phacochoreus aethiopicus*) is a frequently infected, inapparent carrier of the virus. Viru has been isolated from the tissues of carrier animals for up to 3 years after infection and in commercially processed hams for up to 6 months. *Ornithodorus* sp. ticks (Tampans) have been found to be able t act as vectors of the disease.

In a serological survey amongst Namibian warthog in 1979, 97 % were sero-positive. However, viraemi is seldom in warthog and virus concentrations are low. In almost all cases antibody to ASF was only found in localities where the warthog-associated tampan occurs, thus indicating the importance o *Ornithodorus* sp. in the transmission of the disease. It has been suggested, that warthog piglets acquir the infection during the first weeks of their lives while confined to the burrows in which they wer born. [30] Transmission to domestic pigs is by the oral route, by ingesting material like infected wartho pork in garbage or possibly infected tampans as has been suggested in the 1986 Omaruru outbreak which possibly originated through the feeding of guinea fowl *(Numidia meleagridis)* crops to th domestic pigs, with guinea fowls being known as one of the major predators of the Kalahari tampa (*Ornithodorus savignyi*).

No treatment exists for ASF and in an effort to curb the spread of the disease, all animals in an infecte herd are culled, with compensation being paid. ASF is a **notifiable** disease since 1920 and since i became known that wild pigs act as carriers and transmitters of the disease, **special measures wer adopted to prevent any possible contact between wild and domestic pigs.** ASF control regulation were enforced as from 1960 in certain districts of Namibia, where ASF was known to occur. Thes districts are designated the **ASF Control Area** and all pigs in this area have to be kept in double fenced enclosures and the export of pigs or uncooked pork out of this area is subject to a veterinar permit. Pigs may only be fed with cooked swill and kitchen garbage. **Prophylaxis is thus by way o preventing any domestic pig - warthog contact and in feeding only cooked animal products. N vaccine is available.**

AFRICAN HORSESICKNESS

African Horsesickness (**AHS**) is an acute to subacute viral, insect-transmitted disease of equines

[30] FAO/CEC Expert Consultation on African Swine fever research. 1981 F3

characterised by fever, oedema of the subcutaneous tissues and the lungs, circulatory impairment and haemorrhages. The disease has been known to occur in Namibia since earliest times and is endemic in most areas of Namibia.

AHS is caused by an orbivirus of the Reovirus family, almost indistinguishable by physical-chemical means from the bluetongue virus of the same family, with 9 immunologically distinct types, without any cross-protection between them. Natural infections have been found in equines, dogs and camels. AHS is transmitted principally by blood-sucking midges of the species *Culicoides*. Susceptibility is highest in horses, somewhat lower in mules, and lowest in donkeys.

Mortality rates are ranked in the same order, with rates as high as 95% in horses and about 80% in mules, with donkeys being quite resistant to AHS. Significant antibody levels have been found in elephant and zebra and virus has been isolated from zebra, but not from elephants.[31] The possibility that elephants are reservoir hosts is, however, considered to be doubtful. No neutralising antibodies were found to both AHS and Bluetongue viruses when a large number of elephants, which showed high complement fixing titres to these viruses, were tested in an endemic AHS area in South Africa.[32] **A 1987 outbreak of AHS in Spain was attributed to the importation of zebra *(Equus burchelli)* from Namibia.**[33] Here the zebra were thought to have acted as a reservoir host, with the disease transmitted to an absolute susceptible horse population.

Thus the possibility of zebra acting as reservoir host to AHS must be considered, although no certain proof has yet been found. Due to this possibility, the export of zebra from Namibia is negatively affected.

Treatment, control and prophylaxis

Prophylaxis is through the application of a polyvalent vaccine, manufactured by the Onderstepoort Laboratories, South Africa. Immunisation should preferably be undertaken during winter or early spring. Immunisation of mares should be avoided during the first 3 months of pregnancy.

During the height of the horsesickness season, other preventative measures such as insect control by repellents and insecticides and the stabling of valuable animals during late afternoon, night and early morning should also be employed. Immunity starts to develop 2 to 3 weeks after the complete immunisation regime. Annual immunisation is recommended to give a good and stable immunity.[34] As AHS may pose a real threat to fully susceptible horse population by way of lateral spread from carrier zebras, strict testing and quarantine measures must be employed where such potential carrier animals are imported from endemic AHS areas, such as Africa.

NEWCASTLE DISEASE

Newcastle Disease (ND), mainly the velogenic and respirothropic forms, has been spreading since 1993 through the southern African region. The disease is well known amongst poultry, but has recently also been diagnosed in ostriches in Namibia (Gobabis, 1995).

[31] African Horse Sickness review. 1988: Foreign Animal Disease Report. USDA, APHIS. 16(4): 7-12
[32] Infectious Diseases of Livestock with special reference to Southern Africa 1994:463
[33] Merck Veterinary Manual. 1991: Merck & Co., Rahway, N.J., USA: 374
[34] Onderstepoort Vaccines. 1988: Veterinary Research Institute, Onderstepoort: 18

The occurrence of the disease in ostriches is of particular importance for that developing industry, a exports are severely affected. Clinically the disease manifests itself in ostriches as follows:

High mortalities are only seen in ostriches chickens, whereas adults may only develop nervou symptoms or are clinically unaffected.

Control measures

ND is a scheduled disease in Namibia and very recently (June 1995)[35] movement control for ostriche by means of a permit system and a permit system to obtain ND vaccines has been introduced. Th following control measures are enforced in the case of an ND outbreak: in Namibia.[36]

A buffer zone with a radius of 20km is established around an outbreak and a stamping-out or vaccinatio and quarantine policy is followed. Komarov ND vaccine may not be used in ostriches as it may b fatal. Other than in poultry, vaccination of ostriches is neither compulsory nor at government expens In order to either prevent the spread of ND from affected poultry to ostriches, or to prevent the sprea within both populations and a given area, various control options are used, including stamping-out o flocks, vaccination and quarantine.

Herbert Schneider grew up on a farm in the Karibib distric (Namibia) and studied veterinary medicine at the Universit of Pretoria (Onderstepoort), obtaining the degree BVSc Post-graduate qualifications include the Diploma in Stat Veterinary Medicine (Edinburgh, Scotland 1973); Dr. med. ve (Univ. of Giessen, Germany 1977) and Specialist veterinaria in Tropical Veterinary Medicine (Hessen, Germany 1981). H joined the Division of Veterinary Services of Namibia in 196 and served as State Veterinarian in Omaruru, Ondangua, Ka manjab-Opuwo and Windhoek. In 1978 he became the Directo of Veterinary Services and in 1984 Principal Secretary for Agri culture, Nature Conservation, Veterinary Services and Se Fisheries. In 1990 he established a veterinary consultancy i Windhoek, spezializing in Veterinary Public Health, Meat Hy giene and Animal Disease Control. He has served in an execu tive capacity on numerous veterinary and agricultural commis sions and committees in the Southern African region and ha recently been elected Vice-President of the World Veterinar Association.

[35] Government Notice No. 114 of 1995
[36] Circular 22/95: Director of Veterinary Services