

**REPORT OF THE MEETING OF THE OIE WORKING GROUP
ON WILDLIFE DISEASES
Paris, 12–14 March 2001**

The meeting of the Working Group on Wildlife Diseases was held from 12 to 14 March 2001 at the OIE Central Bureau.

Dr B. Vallat, Director General of the OIE, welcomed the participants. Dr M.H. Woodford was elected chairperson of the meeting and Drs J. Fischer and F.A. Leighton were appointed rapporteurs. The agenda and list of participants are given in [Appendices I](#) and [II](#), respectively.

1. Regional review of selected wildlife diseases

The Working Group commended OIE Member Countries that submitted reports on wildlife diseases. However, considerable gaps in the data remain encompassing substantial geographical areas and reporting of diseases in wild animals is strongly encouraged.

List A diseases

Foot and mouth disease

In South Africa, a focal outbreak of foot and mouth disease (FMD) occurred on a quarantine farm near Phalaborwa, in the FMD control area adjacent to the Kruger National Park (KNP). This farm has endemically infected adult buffalo (*Syncerus caffer*), which are used to supply newborn calves for a 'disease-free' buffalo project. The outbreak was reported to OIE as an outbreak on a quarantine premises within the FMD control zone; it was contained and controlled on the farm of origin with no further spread. The 25 surrogate Jersey cows were slaughtered, and the calves were assigned FMD infected status, and were allowed to join the endemically infected buffalo breeding herd.

The massive floods experienced in South Africa during 2000 severely damaged large sections of the KNP's electrified perimeter fence. Several incidents of vagrant buffalo escaping from the park were reported and dealt with in the adjoining communal and commercial farming areas. The net result however was that two buffalo-associated outbreaks of FMD in cattle occurred, south (SAT 1) and west (SAT 2) of the Park in November 2000 and January 2001, respectively. These are the first outbreaks of FMD in cattle adjoining Kruger for over 20 years.

In Botswana, 9/33 buffalo tested serologically for FMD were positive on virus neutralisation test.

FMD was detected in impala (*Aepyceros melampus*) in Uganda.

Peste des petits ruminants

Eleven mouflon (*Ovis orientalis*) died in a wildlife breeding centre at Faisalabad, Pakistan. Serum samples were positive for peste des petits ruminants (PPR) as determined by competitive ELISA¹. This was the first confirmed outbreak of PPR in wild sheep in Pakistan. FAO² has reported that PPR is on the increase in Pakistan, Afghanistan and Bangladesh.

Lumpy skin disease

In Namibia, lumpy skin disease (LSD) was diagnosed clinically and confirmed histologically in approximately 30 springbok (*Antidorcas marsupialis*).

In South Africa, a disease clinically and histologically indistinguishable from LSD was seen in oryx (*Oryx gazella*) in the Kimberley district. These oryx shared range with LSD-infected cattle; for a reason that cannot be explained, the oryx tested negative serologically for LSD.

Rift Valley fever

In a sero-survey, 7/31 buffalo sampled in Botswana tested positive for Rift Valley fever by ELISA.

Classical swine fever

Outbreaks of classical swine fever (CSF) in wild boar (*Sus scrofa*) in Europe were reported from Austria, Italy, Germany and the Slovak Republic. Following the outbreak of CSF in Switzerland in 1999, serological investigations demonstrated seropositive boars in the risk zone in the Ticino Canton. Younger animals from this area tested seronegative, indicating that the CSF outbreak had effectively come to an end in March 1999.

Highly pathogenic avian influenza

Serological evidence indicates that the virus occasionally circulates in wild birds in Australia.

Newcastle disease

Sampling of many hundreds of wild birds during the recent outbreaks of virulent Newcastle disease in Australia failed to find any indication of infection with the virus in any of the wild birds.

1 ELISA: Enzyme-linked immunosorbent assay

2 FAO: Food and Agriculture Organization of the United Nations

List B diseases

Anthrax

In South Africa, several focal outbreaks of anthrax have occurred. These have been characterised by isolated or small clusters of cases in traditionally endemic areas. The disease was reported in eland (*Taurotragus oryx*), bontebok (*Damaliscus dorcas*), springbok and blue wildebeest in the north-western Cape, in greater kudu (*Tragelaphus strepsiceros*) in the Northern Cape, and in wildebeest and a cheetah (*Acinonyx jubatus*) in northern Province.

In Botswana, anthrax was reported in a greater kudu.

In Zambia, anthrax was diagnosed in hippopotami in the Luangwa river.

In Namibia, anthrax was diagnosed in Burchells zebra (*Equus burchelli*), blue wildebeest, springbok, elephant (*Loxodonta africana*), black rhinoceros (*Diceros bicornus*), kudu, oryx, giraffe (*Giraffa camelopardalis*), and cheetah. Most of these cases were reported from the Etosha National Park, where zebra, wildebeest and springbok were most commonly affected.

In Zimbabwe, there were unconfirmed reports of widespread outbreaks of anthrax in both wildlife and domestic stock.

Sambar deer (*Cervus unicolor*) in the forest fringe 80 km from Mysore, Karnataka, India, have died of anthrax. Five human deaths have occurred after villagers ate an infected sambar, which had been found dead in the forest.

An unusually large number (several hundred) of American bison (*Bison bison*) died of anthrax in Wood Buffalo National Park in north-western Canada in the summer of 2000. Anthrax has occurred sporadically in this bison population over the past 60 years. There are between 1000 and 1500 bison in the park.

Echinococcosis

Echinococcus granulosus is the only species of this tapeworm parasite known to cause disease in animals and humans in Australia. The definitive hosts are dogs, dingoes and foxes. Sheep, pigs, goats, wombats and some macropods can be intermediate hosts. The disease occurs mostly in areas inhabited by wild dogs (*Canis familiaris*).

Leptospirosis

In Peru, leptospirosis was found in capybara and vicuna.

Infection with various serovars of *Leptospira* spp. is endemic in Australia in pigs, wombats, and possums. *Leptospira interrogans* infection has been reported in platypus (*Ornithorhynchus anatinus*).

Q fever

In Australia, cattle, sheep, goats, bandicoots, kangaroos and ticks are commonly infected. Infection is characteristically asymptomatic in animals, although occasionally, heavy *Coxiella burnetii* infections can cause late abortions in sheep and goats. Transmission generally occurs through inhalation of aerosols but vector transmission is common in animals.

Q fever is most commonly transmitted to humans by inhalation of aerosols from waste products of infected ruminants.

Q fever was recently reported in four Queensland Rail employees who were working near a suburban freight station and cattle yards near Brisbane, Queensland, Australia. Bandicoots, feral rodents, birds and ticks are natural reservoirs. Prior outbreaks have involved abattoir and meat workers.

Rabies

In Namibia, rabies was diagnosed mainly in black-backed jackal (*Canis mesomelas*) (10) and bat-eared foxes (*Otocyon megalotis*) (5), although solitary cases were also confirmed in eland, domestic camel, honey badger (*Mellivora capensis*) and kudu.

In Botswana, rabies was confirmed in black-backed jackal (4), spotted hyaena (1), and an unspecified mongoose.

In South Africa, wildlife rabies was diagnosed mainly in black-backed jackal (14), yellow mongoose (*Cynictis penicillata*) (36), and bat-eared fox (25). However, significant numbers of aardwolf (*Proteles cristatus*) (5), suricates (*Suricata suricata*) (4) and wild dog (*Lycan pictus*) (6) were also confirmed to be infected. Sporadic cases were also diagnosed in Cape clawless otter (*Aonyx capensis*), civet (*Civettictis civetta*), spotted hyaena, caracal (*Felis caracal*), African wildcat (*Felis lybica*), genets (*Genetta genetta*), polecats (*Mustela* spp.), Cape fox (*Vulpes chama*), ground squirrel (*Xerus anauris*) and kudu. The loss of the six wild dogs in the Madikwe National Park is cause for concern, and the remaining population has been vaccinated.

In Uganda, a case of rabies was confirmed histologically in an impala.

In South America, rabies was reported in bats in Peru and Argentina.

Terrestrial rabies is enzootic in several species of wildlife in the USA and oral rabies vaccination programmes are ongoing in parts of several states.

Terrestrial rabies is still a common disease among wildlife in Eastern and Central Europe and has been reported from several different species of carnivores, deer and wild boar (*Sus scrofa*). Eradication programmes are in progress in several countries in Western Europe and have resulted in a significant decrease and disappearance of rabies in wildlife. The total number of bat rabies cases in Western Europe in 2000 was 33 (the area from Denmark to Spain). Meanwhile, the lyssavirus strains involved in European bat rabies are genetically different from those observed in terrestrial mammals. An apparent increase in insectivorous bat cases was registered in the year 2000 on this continent. Member Countries are encouraged to submit reports of bat rabies and alert the public of the health risks associated with handling bats.

Paratuberculosis

Paratuberculosis organisms have been found as an incidental finding from kangaroos grazing in a location of high livestock density. No disease was evident.

Trichinellosis

The first case of trichinellosis in Papua New Guinea caused by a new species in the genus *Trichinella* (*T. papuae*) in a domestic pig was described. It was found that 8.8% of a wild pig population in the Western Province, adjacent to Irian Jaya, Indonesia, were infected. Infection was not found in other local and feral animals, or in domestic pigs from other parts of the country. It was concluded that eating infected wild pig meat was the cause of infection of domestic pigs.

A different species, *T. pseudospiralis*, occurs in tiger quolls (*Dasyurus maculatus*), eastern quolls (*Dasyurus viverrinus*), and Tasmanian devils (*Sarcophilus harrisi*) in Tasmania, Australia.

Brucellosis

In the KNP in South Africa, 26.4% of 178 adult buffalo cows tested were positive reactors for brucellosis. *Brucella abortus* biovar 1 was isolated from the lymph nodes of several slaughtered positive reactors, as well as from several aborted fetuses.

In Botswana, 2/58 buffalo tested reacted positive to brucellosis by the complement fixation test.

Brucellosis in wapiti (*Cervus elaphus*) and bison (*Bison bison*) in the Greater Yellowstone Area (GYA) USA, remains a significant animal health issue. A record of Decision (ROD) was reached in December 2000 by the

multiple state and federal natural resource and animal health agencies involved in the situation. The ROD contains a three-stage plan for the elimination of brucellosis from bison in the GYA.

Brucella suis occurs in a defined area in wild pigs in Australia. Weddell seals (*Leptonychotes weddellii*) in the antarctic were found by complement fixation (CF) test and competitive ELISA to have antibodies to *Brucella abortus*. This complements the results of researchers in the UK, USA and Argentina.

Bovine tuberculosis

Bovine tuberculosis (BTB) continues to be a problem in South Africa. During the reporting year, a survey of buffalo herds in the KNP detected four new infected herds in the north of the Park, an area that has previously been relatively free of the disease. The situation in the Park's lion (*Panthera leo*) population is also a cause for concern – 78% of the lions tested in the southern district of the Park (high prevalence buffalo area) reacted positively on intradermal testing. Recently, *Mycobacterium bovis* has been cultured from lesions in the mammary tissue and mammary lymph node of an infected lioness, and an endometrial lesion has also been found. Also in KNP, the first case of BTB in spotted hyaena (*Crocuta crocuta*) was diagnosed, and subsequently another five cases were confirmed in this species. Three more cases of BTB were confirmed in leopards (*Panthera pardus*), and two more cases in greater kudu. The first case of BTB in a warthog (*Phacochoerus aethiopicus*) was also diagnosed on a farm near the Kruger southern boundary.

In Hluhluwe/Umfolosi Park (HUP), four buffalo herds tested this year had BTB prevalence rates of 53%, 48%, 36% and 48%, respectively, a significant increase over the 1998 prevalence figures. In this Park, BTB is also present in a large percentage of the lions, and the last three lionesses necropsied had endometrial lesions. BTB was also diagnosed for the first time in a bush pig and a baboon (*Papio ursinus*) in this Park.

Elsewhere in Africa, BTB continues to be a problem in buffalo in Queen Elizabeth and Kidepo National Parks in Uganda, and in Lechwe on the Kafue Flats in Zambia.

Since 1994, the state of Michigan in the USA has reported a problem with BTB in wild white-tailed deer (*Odocoileus virginianus*) from a five-county area in north-eastern lower Michigan. Tuberculosis in deer has been detected in recent years in 12 Michigan counties following increased surveillance. A free-ranging elk (*Cervus elaphus*) also was diagnosed with tuberculosis during 2000. The disease has been found in black bear (*Ursus americanus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), opossum (*Didelphis virginianus*), bobcat (*Felis rufus*) as well in one herd of captive deer, a feral cat, and in 12 herds of domestic cattle.

Efforts to eradicate *M. bovis* from Michigan are continuing. Primary strategies to eliminate the disease include elimination of supplemental feeding and baiting of deer in counties in which tuberculosis has been confirmed as well as reduction in deer population density via liberalised hunting regulations.

BTB was reported in a free-living Iberian lynx (*Lynx pardinus*), an endangered feline living in Coto Donana National Park in south-western Spain. The isolate correlates by molecular characterisation with other isolates from wild ungulates in this park, strongly suggesting an epidemiological link.

In the past year, two wild elk in or near Riding Mountain National Park in south-central Canada (Province of Manitoba) were diagnosed with BTB. In the 1990s, a small group of cattle in this area was found to have the disease and strict eradication measures were carried out. The recognition of the disease in a small number of wild elk in recent years following the eradication programme in cattle has raised concerns that wild elk may act as reservoirs of the infection for some period of time. Federal and provincial authorities responsible for agriculture, wildlife and national parks, have formed a joint working group to fully evaluate epidemiological and ecological questions related to mitigating the health risks associated with tuberculosis in this population of elk.

The brush tailed possum (*Trichosurus vulpecula*) continues to be the main wildlife reservoir of *M. bovis* for domestic species in New Zealand.

Malignant catarrhal fever

A single case of sheep-associated malignant catarrhal fever was diagnosed in a 2-year old buffalo heifer in the western Cape, in South Africa.

Duck virus enteritis

In the USA, duck virus enteritis occurred in feral ducks and geese in Pennsylvania and South Carolina.

Fowl cholera

In the United States of America (USA), fowl cholera was confirmed primarily in multiple species of ducks and geese and in low numbers of other avian species in western states. In Canada, there were large outbreaks in double-crested cormorants that killed 7000 to 10,000 young of the year.

Infectious bursal disease

Hypervirulent infectious bursal disease virus (IBDV) – a type 1 IBDV – has not been found in wild birds (anywhere). However, antibodies to IBVD have been found in wild birds, for example, emperor penguins (*Aptenodytes forsteri*) and Adelie penguins (*Pygoscelis adeliae*) near Mawson Station in Antarctica. The infection was thought to have come from poultry or crustacean meal used in feed, and contamination of the environment prior to the introduction of control regulations for the disposal of poultry products in Antarctica in the 1980s.

Avian chlamydiosis

Chlamydia psittaci was diagnosed in four wild crimson rosellas (*Platycercus elegans*) in Victoria, Australia.

A study was carried out to compare polymerase chain reaction (PCR) with cell culture for detection of *C. psittaci*. The prevalence of infection in captive birds was highest where there were frequent changes in flock members or where many birds were confined in small areas. *Chlamydia psittaci* was not detected in wild psittacines or water birds in this study. PCR was found to be more sensitive than cell culture for detection of *C. psittaci*. Captive birds of the genus *Neophema* were most commonly found to be positive. Many birds were positive for avian chlamydiosis but had no clinical signs.

Lagomorph diseases

There were frequent reports from several European countries of infections with calicivirus in lagomorphs causing European Brown Hare Syndrome (EBHS) in hares and rabbit haemorrhagic disease (RHD) in rabbits. Myxomatosis is also frequently reported from several European countries.

Tularemia

A large outbreak of tularemia in humans occurred in Kosovo in the spring of 2000. Field investigations revealed the presence of the organism in water supplies and in small mammals. No cases of tularemia in lagomorphs (*Lepus* spp.) were observed in Kosovo.

Cases of tularemia in hares were reported from Austria, France and the Scandinavian countries. In Sweden tularemia is, for unknown reasons, expanding its distribution and is today observed in many counties in the southern part of the country where it did not occur previously.

Rabbit haemorrhagic disease

Rabbit haemorrhagic disease virus (RHDV) has not been seen in species other than the European rabbit (*Oryctolagus cuniculus*) in Australia. Viral Research reports on the testing of 28 different animal species for RHDV by PCR. The virus did not grow in any of these species. The only effects on wildlife have been indirect through a loss of a food source.

The latest CSIRO³ review of RHDV stated that rabbit numbers in the drier areas of Australia have been reduced by between 65% and 90% since the introduction of the disease. The report stated that virus should continue to control rabbit populations for approximately 10 years. Another study found that there have been serological

3 CSIRO: Commonwealth Scientific Industrial Research Organisation

positives in Australian rabbits to an avirulent strain of calicivirus. This similar nonpathogenic virus may be the reason for the variable effectiveness of the virus in population control in the wetter areas. Wild rabbit serum collected prior to 1995 had antibodies to an RHDV-like virus. In a challenge study it was found that 11/23 rabbits seropositive to the RHDV-like virus survived challenge with RHDV. The stress of reproduction, low temperatures or flea infestation appear to promote outbreaks of RHDV. Proximity to water and cattle also appears to promote outbreaks of RHDV. This suggests that vectors (flies and mosquitoes) may play a role in local transmission. If the disease has been present before in a particular area, spread of the disease is limited.

Wildlife list diseases

Amphibian chytridiomycosis

This recently described chytrid fungus killed free-living and captive amphibians in Australia, Central America and the USA. There is epidemiological, pathological, and experimental evidence that some amphibian populations suddenly declined due to mass mortalities caused by chytridiomycosis. Exposure of juvenile great barred frogs (*Mixophyes fasciolatus*) resulted in 100% mortality between 17 and 24°C. Four of eight animals did not die at 27°C but infection was confirmed in three of four. The disease has been found in 44 native species of frogs, and has been found in 60% of endangered frog species in Australia.

Chytridiomycosis has been found to cause mortality in wild non-native frogs (*Litoria raniformis*) in New Zealand. Chytrid fungus infection was found in a dead green and gold bell frog (*Litoria aurea*) after translocation into a newly created habitat site in Sydney. Not only is *Batrachochytrium dendrobatidis* highly virulent, but it does not depend on amphibians for its existence, and either lives saprophytically or has alternative hosts. Where amphibians are deliberately moved, infection could be initiated by release of the infected amphibian or simply by release of water containing zoospores.

Benzalkonium chloride, methylene blue, itraconazole, and fluconazole are effective against *Batrachochytrium dendrobatidis* *in vitro*. Various methods of treatment have been tried with varying degrees of success.

Amphibian iridovirus disease

Bohle iridovirus caused disease in a group of frogs in Townsville, Queensland. Antibodies to nonspecified ranaviruses are widespread in Australian cane toads (*Bufo marinus*). The virus was found by quarantine authorities in pythons that were smuggled into Australia from Singapore.

Angiostrongylosis

Three species of *Angiostrongylus* are found in the lungs of rats in South-east Asian and Pacific regions. Only *Angiostrongylus cantonensis* has been found in abnormal vertebrate hosts. *Angiostrongylus cantonensis* infection was the cause of death of a wild brushtail possum (*Trichosurus vulpecula*) in Sydney, Australia. The parasite was found in the meninges of the spinal column of a wild yellow tailed black cockatoo (*Calyptorhynchus funereus*) and has been diagnosed in a wild tawny frogmouth (*Podargus strigoides*). This is very significant, as the infection had not been seen previously in birds in Australia.

Two fatal cases of angiostrongylosis were reported in children in Australia due to the rat lungworm *Angiostrongylus cantonensis*.

Babesiosis

In the KNP, an aging zebra stallion with neurological signs was found to have clinical babesiosis, and brain smears also demonstrated parasitised red blood cells clogging the central nervous system (CNS) capillaries. The parasite was a large babesia, probably *Babesia caballi*. This same animal had generalised papular and crusty dermatitis, and *Dermatophilus congolensis* and *Malassezia* were demonstrated on skin scrapings. The animal was obviously immunologically compromised.

Another case of babesiosis in a zebra was reported from Botswana.

Haemoparasites were found in four young North Island brown kiwis (*Apteryx australis mantelli*) brought to Auckland Zoo, New Zealand. Preliminary investigations have implicated *Babesia* spp. Babesiosis is well documented in little penguins (*Eudyptula minor*) in Australia.

Botulism

In 1999, and again in 2000, loons (*Gavia immer*) and mergansers (*Merganser* spp.), perhaps over 1000 of each species, died of type E botulism in east-central Canada (Province of Ontario) and were found along the shores of Lakes Huron and Erie. This is the first time that mortality on this scale has occurred due to type E botulism in these species. The occurrence of epidemics in two consecutive years has raised concerns that type E botulism may be an emerging disease for these birds. The principal species affected, the common loon is in decline over much of its range in eastern North America, and mortality on the scale seen in 1999 and 2000 could significantly accelerate population declines of this species.

Bovine viral diarrhoea

78/90 eland, 3/15 greater kudu, 4/7 giraffe and 3/31 African buffalo were found to be serologically positive for bovine viral diarrhoea by ELISA during a serosurvey in Botswana.

Canine distemper

A single case of canine distemper was reported in a bat-eared fox from Namibia.

Fisherman have discovered approximately 50 dead baby seals (*Phoca* spp.) on the island of Shalyga, 5 km from the mouth of the Ural River on the northern coast of the Caspian Sea. Canine distemper has since been diagnosed.

Canine distemper was diagnosed in a red fox (*Vulpes vulpes*) in Australia. There was concurrent toxoplasmosis.

Chronic wasting disease

Chronic wasting disease (CWD) of cervids has been found in the USA for the first time in Nebraska in a free-ranging cervid. The positive 3-year old male mule deer (*Odocoileus hemionus*) was killed by a hunter in south-western Kimball County during the November 2000 firearms season. Kimball County is adjacent to the CWD endemic focus in wild mule deer, elk, and white-tailed deer in north-eastern Colorado and south-eastern Wyoming.

CWD of cervids is a transmissible spongiform encephalopathy (TSE) related to, but distinct from, scrapie of sheep and bovine spongiform encephalopathy. CWD was first recognised as a syndrome in cervids in the 1960s and was identified as a TSE in the 1980s. In addition to the endemic focus of CWD in wild deer and elk, CWD has been diagnosed in captive elk in Colorado, Montana, Nebraska, Oklahoma, South Dakota, and the Canadian province of Saskatchewan. Programmes to eliminate CWD from captive elk in the USA and Canada are being developed.

Some targeted surveillance and/or harvest-based surveys for CWD in free-ranging cervids has(ve) been conducted and reported in at least 30 states in recent years. In all, brainstems from over 13,750 free-ranging cervids have been examined microscopically for evidence of CWD infection in the USA, most over the past 3 years. No evidence of CWD has been detected in more than 5700 samples collected outside the endemic area (Colorado/Wyoming/Nebraska), indicating that CWD is probably not widespread among native deer and elk populations. Surveys of wild cervids for CWD in Canada are also ongoing. Thus far, CWD has not been detected in wild cervids in Canada.

Management actions have been taken to help limit spread and reduce the occurrence of CWD in free-ranging cervids. The presence of CWD has led to considerable interagency cooperation at the state and national level. Although initially perceived as solely a wildlife health issue, increasing interest in the TSEs in general, and CWD in particular, has fostered increased interagency cooperation among wildlife management, livestock health, and public health agencies, as well as representatives of cattle, sheep, and alternative livestock industries. A coordinated national approach to CWD research has been an important product of this broad-based cooperative endeavour to better understand and manage CWD in both the USA and Canada.

The public health aspects of CWD were considered by the WHO⁴ Consultation on Transmissible Spongiform Encephalopathies and Public Health. The Consultation concluded 'there is currently no evidence that CWD in cervidae is transmitted to humans', however, the following recommendations were made:

- National authorities should be vigilant and international authorities should encourage awareness and surveillance for CWD around the world.
- No part or product of any animal with evidence of CWD or other TSEs should be fed to any species (human, or any domestic or captive animal).
- Work should be continued to improve the understanding of CWD where it occurs.
- Regarding the movement of cervids (domestic or wild for repopulation purposes), precautionary measures should be taken to prevent the introduction and spread of CWD.
- In liaison with the WHO, the OIE, through its competent Commissions, must assess the priority consequences of the disease.

Die-off of Gyps spp. vultures

The Group noted with concern the continued die-off and disappearance from many areas of the Indian sub-continent of Gyps spp. vultures. Abnormally high mortality rates of vultures have been reported in Pakistan as has the disappearance of these birds from Nepal. The Royal Society for the Protection of Birds (RSPB) has alerted International Birdlife partners and all other relevant groups within potentially affected countries (South Asia, Central Asia, Middle East, North Africa and Southern Europe) to the problem and has encouraged them to set up monitoring and surveillance programmes. No causal agent responsible for this extensive die-off has been identified so far.

Update on haemorrhagic disease in deer

During 2000, 42 haemorrhagic disease virus isolations from white-tailed deer were made at the Southeastern Cooperative Wildlife Disease Study in the USA. These isolations are primarily associated with morbidity and mortality reported from Georgia, North Carolina, South Carolina, Virginia, Maryland, Kansas and Texas. Isolates include 34 viruses identified as epizootic haemorrhagic disease virus (EHDV)-2, six were identified as EHDV-1, two bluetongue virus (BTV)-17.

4 WHO: World Health Organization

Inclusion body disease of boid snakes

Inclusion body disease was confirmed by histopathology in two captured Australian pythons in a study done in 1998. Unconfirmed cases were seen in 2000 in carpet pythons (*Morelia spilota variegata*) in an avian and exotic animal veterinary practice in Sydney. The latter cases occurred in reptiles acquired from the wild in the preceding 2 to 12 months.

Morbillivirus

New Zealand fur seals (*Arctocephalus forsteri*) and New Zealand sea lions (*Phocarctos hookeri*) were seropositive for a morbillivirus antigenically similar to phocine distemper virus. The former infection was not implicated in the 1998 Auckland Islands epidemic. Fur seals may act as a reservoir of virus for sea lions.

One common dolphin (*Delphinus delphis*) from the south-west Indian Ocean, 18 long-finned pilot whales (*Globicephala melas*) from New Zealand, and 85% of pilot whales from the south-west Pacific were found to be seropositive for dolphin morbillivirus (DMV) in a study of 288 cetaceans from 1995 to 1999. DMV may therefore be presently endemic in pilot whales in the south-west Pacific. In contrast, the prevalence of the infection in Atlantic cetaceans is lower now than in previous studies, indicating that humoral immunity may be waning, and vulnerability to new epidemics may be increasing.

Multispecies die-off

A multispecies die-off is currently being investigated in the Ngorongoro crater in Tanzania.

Mycobacteriosis

An emaciated New Zealand fur seal (*Arctocephalus forsteri*) was killed on Bondi Beach. Necropsy revealed acid-fast bacilli within lymph nodes, yet culture and PCR failed to identify the mycobacterial species. *Mycobacterium bovis* and *M. tuberculosis* infection were ruled out.

Granulomas were seen in several organs in young freshwater crocodiles (*Crocodylus johnstoni*) in Australia. Infection with *Mycobacteria* spp. was confirmed by PCR, but culture was not completed.

Two isolated cases of mycobacteriosis occurred in Gilbert's potoroos (*Potorous gilbertii*) in Western Australia. One animal had a paracloacal gland abscess that contained acid-fast bacilli. Details for the second animal were not available. Cultures are pending.

Salmonellosis

Salmonella group O type B was cultured from 1 of 4 sea turtles (*Chelonia mydas*) necropsied in Western Australia. Salmonellae and other Gram-negative bacteria were considered to be the cause of death and illness in this species where there was concurrent infection with cardiovascular flukes and other parasites.

Salmonella spp. was reported to cause hepatic necrosis and death in brushtail possums (*Trichosurus vulpecula*) in New Zealand.

An outbreak of salmonellosis (*S. typhimurium* subtype DT160) occurred in sparrows in New Zealand in the South and North Islands in winter. The outbreak was associated with grain silos. Other passerines were also affected. Death was as a result of septicaemia. This uncommon phage type was first isolated from a human in 1998 in New Zealand and from animals in May 2000. The disease was considered to be a serious zoonotic risk, and to date there have been 90 human cases since the beginning of 2000.

Sarcoptic mange

In Uganda, 10 cases of sarcoptic mange were seen in gorillas (*Gorilla berengei*), and 5 cases in chimpanzees (*Pan troglodytes*).

Sporadic cases of sarcoptic mange were reported in springbok and red hartebeest in the Etosha National Park in Namibia. Sporadic cases were also seen in black-backed jackal, blue wildebeest, and leopard in the KNP, South Africa.

Mange is still a common disease among carnivores in Europe, and this disease has caused mortality in chamois (*Rupicapra rupicapra*) and ibex (*Capra ibex*).

Three cases of human scabies (infection with *Sarcoptes scabiei*) acquired from handling dead infected common wombats (*Vombatus ursinus*) were reported in Australia. Sarcoptic mange occurs at a prevalence of between 0% and 30% throughout the range of the common wombat, and at a similar prevalence in the red fox (*Vulpes vulpes*) population as well. There have been unconfirmed reports of sarcoptic mange in southern hairy nosed wombats (*Lasiornhinus latifrons*) in the Gawler ranges and on the Nullarbor plain, an area that represents this specie's entire range. The latter is significant because of the more threatened status of the southern hairy nosed wombat. This disease has the potential to threaten small remnant populations of common wombats. Humans, dogs, and koalas have developed infections after contact with infected common wombats.

Trichomonosis

Trichomonas gallinae infection was found in 46% of wild Senegal doves sampled in a study in Perth, Western Australia.

A wild endangered species of snake died from gastritis associated with large numbers of trichomonad parasites. Trichomonosis was seen in a wild powerful owl (*Ninox strenua*) and in several little penguins (*Eudyptula minor*) with stomatitis that were admitted to rehabilitation facilities.

Additional diseases

Acanthocephalan parasite infection in numbats

Acanthocephalan parasite infection caused mortality in wild translocated numbats (*Myrmecobius fasciatus*) in Western and South Australia. The infection in translocated animals was acquired through ingestion of termite intermediate hosts. This infection was only seen in animals from one reserve in the wheat belt south-east of Perth. Treatment and quarantine protocols have been recommended to inhibit the spread of this infection, and importantly, to prevent the contamination of clean habitats and food sources.

Atlantic brant mortality

Atlantic brant goose (*Branta bernicla*) mortality occurred at a National Wildlife Refuge near Atlantic City, New Jersey, USA, in November 2000 and February 2001. The cause of the mortality remains undetermined. The first mortality event began in early November 2000 when sick and dead birds were found on a shallow freshwater impoundment. Adults and juveniles were affected. The mortality ended by early December with approximately 700 cadavers collected. Sick and dead birds were primarily found on the refuge although some cadavers were found up to 15 miles away. A second brant mortality event began about 15 January 2001 when sick and dead birds were observed in several bays in the tidal marsh area near Atlantic City, New Jersey. The second mortality event lasted only a few days but over 700 cadavers were collected.

Australian bat lyssavirus

Australian bat lyssavirus (ABL) was first described in 1996 during surveillance of wildlife species for the source of Hendra virus. Initially named pteropid lyssavirus, ABL has antigenic and genetic similarities to rabies virus, and rabies vaccine and antirabies immunoglobulin have been shown to protect against ABL infection. Nonetheless, ABL is phylogenetically distinct, and has been classified as a new species (genotype 7) of lyssavirus by the International Congress for the Nomenclature of Viruses. Australia remains free of (genotype 1) rabies virus. ABL has been found in five species of bats: the black flying fox (*Pteropus alecto*), the little red flying fox (*P. scapulatus*), the grey-headed flying fox (*P. poliocephalus*), the spectacled flying fox (*P. conspicillatus*) and the yellow-bellied sheath-tailed bat (*Saccolaimus flaviventris*). In January 1999, lyssavirus was found in the

genus *Nyctophilus*, having never been seen previously in this microchiropteran. Antigen or anti-ABL antibody has also been detected in at least two species of Australian microchiroptera. Molecular studies have identified variation in the nucleotide sequence between pteropid isolates and an insectivorous bat (*Saccolaimus flaviventris*) isolate, suggesting at least two variants exist in Australian bat populations. Infection is known to cause fatal clinical disease in bats, although serologic findings indicate that not all infections are fatal. Infection has not been evident in any terrestrial animal species, and retrospective investigations of archived animal specimens have found no evidence of previous cases. Two (fatal) human cases were the result of direct exposure to bats. Public health authorities in Australia have placed emphasis on public awareness, and on pre- and post-exposure measures for at-risk groups.

Pre- and post-exposure prophylaxis, as recommended by the Advisory Committee on Immunisation Practices, is recommended for all bat workers in Australia. Discussion on vaccination of domestic pets and captive bats is ongoing.

Avian vacuolar myelinopathy

In the USA, avian vacuolar myelinopathy (AVM) was confirmed in eight bald eagles (*Haliaeetus leucocephalus*) and is suspected in another five eagles that died from mid-November through late December, 2000 at Clarks Hill Lake in eastern Georgia. The lake lies along the border with South Carolina and also is known as Lake Strom Thurmond. During the mortality event, AVM was confirmed in numerous American coots (*Fulica americana*), two Canada geese (*Branta canadensis*), two great-horned owls (*Bubo virginianus*), and a killdeer (*Charadrius vociferus*), a small wading bird, in the area surrounding the lake.

First recognised when it killed 29 bald eagles in the winter of 1994-95 in Arkansas, AVM has caused the deaths of at least 82 eagles to date in Arkansas, Georgia, North Carolina, and South Carolina. Eagles with AVM exhibit difficulty or inability to fly or walk and have extensive vacuolar lesions in the white matter of the CNS. The cause of AVM remains undetermined despite extensive diagnostic and research investigations. A natural or manmade neurotoxin is suspected because there has been no evidence of viruses, bacteria, prions, or other infectious agents and the lesion is consistent with toxicosis. AVM has also been detected in numerous American coots since 1996, and it is hypothesised that eagles are exposed to the causative agent of AVM via ingestion of affected coots.

AVM was diagnosed in ducks at Woodlake, North Carolina in late 1998 and was suspected in two Canada geese at Clarks Hill Lake in late 1999. The confirmation of AVM in geese, owls, and a killdeer this winter adds to the number of susceptible species, and the affected killdeer represents the first bird with AVM that is not regarded as waterfowl or a predator. To date, there has been no indication that mammals, including humans, are affected by AVM. However, public health and wildlife authorities recommend that as with any sick wild animal, birds suspected of having AVM should be considered unfit for consumption.

Bubonic plague

Cases of bubonic plague have been reported in marmots (*Marmota* spp.) in Mongolia. Cases have also been reported in the human hunter population, which is being vaccinated. Fat marmots infected with plague in autumn often go into hibernation without becoming clinically ill. On emerging in poor condition in the spring their infection intensifies and their fleas transmit infection to hunters. The hunters have been warned of the undesirability of hunting wild animals in the affected area.

***Campylobacter* spp. infection**

Campylobacter spp. was cultured from the faeces of captive reared kiwis (*Apteryx australis*) in New Zealand that were to be released into Tongariro Forest Conservation Area and Karioi Rahui (on the southern slopes of Mt Ruapehu) in the North Island.

In January and February 1998 there was a mass mortality event involving New Zealand sea lions (*Phocarctos hookeri*) in the Auckland Islands in New Zealand. Another study in 2000 found that a *Campylobacter*-like organism was found in at least one tissue from every diseased animal and was associated with a necrotising arteritis.

Dermatophilosis

Dermatophilus spp. infection was seen in farmed saltwater crocodiles (*Crocodylus porosus*) in Australia. One farm reported that 85% of crocodiles aged between 1 and 3 years were affected. In another report, the disease was found to be the most frequently diagnosed and the most important disease of farmed crocodiles in Australia. The same paper reports the disease in a wild crocodile, thus emphasising the ubiquitous nature of the organism, and suggesting a route for introduction into farms.

Fibropapilloma in sea turtles

A study of fibropapilloma in green turtles (*Chelonia mydas*) in Indonesia found that prevalence was 21.5%. Cardiovascular fluke infection of green sea turtles (*Chelodina mydas*) in East Java was found to be 100% prevalent.

Hendra virus (previously equine morbillivirus)

Hendra virus (family Paramyxoviridae) was first described in September 1994, in an outbreak of disease in horses in Australia. Twenty one horses and two humans were infected, with the resultant deaths of 14 horses and one human. In a further two foci (the most recent in January 1999), another three horses and one human were infected, all fatally. Human cases have been attributed to exposure to infected horses. Extensive wildlife surveillance has identified pteropid bats (flying foxes) as a natural host of Hendra virus, with infection endemic in the four mainland Australian species (*Pteropus alecto*, *P. poliocephalus*, *P. scapulatus*, and *P. conspicillatus*).

Since 1994 more than 5000 animals including wildlife have been tested for Hendra virus, and so far it has been found only in megachiropterans. Fifteen per cent of animals tested have had antibodies. Anti-Hendra virus antibodies were recently found in *Pteropus* and *Dobsonia* bat species in New Guinea.

Japanese encephalitis

The virus has been detected in Australia. Two human cases were reported in north Queensland in 1998, and one of these was acquired on the Australian mainland. Kangaroos and wallabies are unlikely to spread Japanese encephalitis should it become established in Australia. Studies completed at the Australian Animal Health Laboratory recently found that eastern grey kangaroos (*Macropus giganteus*), tammar wallabies (*Macropus eugenii*), and agile wallabies (*Macropus agilis*) do not provide a host for the virus. Sentinel pigs are used by the Australian Quarantine Inspection Service in high risk areas in the wet season and bled fortnightly. The virus has a natural cycle between birds and mosquitoes, but it multiplies rapidly in pigs then is spread by mosquitoes. Migrating birds are a potential source of entry of the virus into Australia. Murray Valley encephalitis virus and Kunjin virus are present in Australia and are similar to Japanese encephalitis. They may act as a vaccine for Japanese encephalitis.

Kangaroo blindness

Orbiviruses of the Wallal and Warrego serogroups were isolated from kangaroos affected by blindness in an epizootic in south-eastern Australia in 1994 and 1995 and extending to Western Australia in 1995 and 1996. Wallal virus antigen was detected by immunohistochemical analysis and orbiviruses were seen on electron microscope examination. Wallal virus was present in three species of midges during the outbreak. Viral chorioretinitis in kangaroos was reproduced in three of eight kangaroos inoculated with Wallal virus preparations. The conclusion was made that Wallal virus was the main virus involved in the blindness/orbivirus epidemic.

Microsporidiosis

Encephalitozoon cuniculi infection was shown to be prevalent in Australia in wild rabbits. Techniques were developed for isolation and culture of the causative agent, so that risk factors for domestic rabbits and humans could be determined. Of 81 wild rabbits, 20 had antibodies, as did 22 of 29 laboratory rabbits.

***Mucor amphibiorum* infection**

A study done in 2000 found that *Mucor amphibiorum* infection in the platypus (*Ornithorhynchus anatinus*) in Australia causes a granulomatous dermatitis that may progress to cause disseminated disease and death.

Infection with *Mucor amphibiorum* continues to be seen in Australian cane toads (*Bufo marinus*), and has also been reported in free-ranging tree frogs (*Litoria infrafrenata*).

Muspiceoidosis

Two cases of human polymyositis were reported in Australia, one life threatening. The causative agent was a new genus and species of muspiceoid nematode (*Haycocknema perplexum*). The male and female parasites live in human myofibres. This is the first report of any member of this nematode group infecting humans. Other members of the superfamily occur in rodents and cause serious disease in native marsupials in Australia (koalas, kangaroos, wallabies, hare-wallabies and tree kangaroos).

Nipah virus

Approximately 1.1 million pigs were culled to contain an outbreak of a previously unknown disease in pigs and humans between September 1998 and April 1999. Of 265 reported human cases of viral encephalitis attributed to Nipah virus infection, 105 were fatal. The majority of human cases had a direct contact with infected live pigs. Epidemiological and experimental evidence suggests that aerosol transmission is the predominant mode of transmission between pigs and from pigs to humans. No human-to-human transmission was identified. Evidence of infection has been found in dogs, cats, and horses. Preliminary wildlife surveillance found serological evidence of infection in five species of bats: *Pteropus vampyrus*, *P. hypomelanus*, *Cynopterus brachyotis*, *Eonycteris spelaea*, and *Scotophilus kulhi*, and at multiple locations in Peninsular Malaysia. No serological evidence of infection was found in 18 wild boar (*Sus scrofa*), in 16 domestic dogs (*Canis familiaris*) used to hunt wild boar, or in 25 rodents (*Rattus rattus*) trapped on case farms. The recent isolation of virus from *P. hypomelanus* strengthens the contention that pteropid bats (commonly known as flying foxes) are a natural host of Nipah virus, and that they were the probable source of infection for pigs. Infection in flying foxes appears to be asymptomatic. Nipah virus is a member of the paramyxoviridae family of viruses, and is most closely related to the recently described Hendra virus. A new genus (Henipavirus) is proposed for these two viruses. Another outbreak in pigs in Northern Perak was reported in 2000, and authorities killed 1700 pigs after a woman was confirmed to have the disease.

Ocular disease in endangered bandicoots

An occurrence of conjunctivitis, possibly caused by *Chlamydia* spp., is being investigated in wild western barred bandicoots (*Perameles bougainville*) on Bernier Island in Western Australia. Diagnosis by PCR is pending.

Papillomavirus infection

A cutaneous papillomavirus (*Papovaviridae*) was demonstrated in brushtail possums (*Trichosurus vulpecula*) in New Zealand. Typical wart-like clinical lesions were observed and, on histopathological examination, typical changes were noted. It is one of the first viruses reported in this species. Molecular techniques show that this is a new virus.

Skin disease resembling infection with papilloma-virus was found in captive Western barred bandicoots (*Perameles bougainville*) at Kanyana Wildlife Rehabilitation Centre, and in one wild animal on Bernier Island in Western Australia in 2000. Investigation into a viral aetiology is continuing.

Shearwater mortality

In the summer of 2000 there were large numbers of short-tailed shearwaters (*Puffinus tenuirostris*) found washed up along Australia's east coast. Necropsies at various institutions revealed birds in poor condition with no signs of disease. Birds were tested for avian influenza virus and Newcastle disease virus by viral culture and serology, and found to be negative. Bleeding was found in the proventriculus and the anterior duodenum, and was thought to have occurred terminally or even after death. Some theories included unusually bad weather, poor condition at

the start of the southern migration, or normal mortality but prevailing weather changes, causing more birds to be washed up and found.

***Streptococcus suis* infection**

Two French hunters died in 1999 and 2000 following contact with hunter-killed wild boar. Meningoencephalitis and septicaemia were observed and a *Streptococcus suis* strain was isolated. These are the first occurrences of such infections in hunters associated with contamination by free-ranging wild boar in France, and possibly in Europe.

Tioman virus

A new paramyxovirus was isolated from *Pteropus hypomelanus* during efforts to isolate Nipah virus from flying foxes in Australia. Tioman virus has been characterised as a member of the genus *Rubulavirus* of the family *Paramyxoviridae*.

West Nile virus epizootic update

West Nile virus (WNV) mortality occurred in wildlife in the eastern USA for the second consecutive year. WNV is an arthropod-borne virus that had never been reported in the Western Hemisphere until the autumn of 1999. Wild birds (primarily crows [*Corvus brachyrhynchos*]), horses, and humans were affected in the 1999 outbreak in the greater New York City area. In 2000, WNV activity was first detected in wild birds found dead in May in south-eastern New York area and north-eastern New Jersey. The virus continues to expand both geographically and in the number and variety of species infected. WNV has been isolated from over 60 species of birds, including 55 free-ranging species from 11 states and Washington, D.C. Wild mammal species including bats, rodents, and carnivores, in the New York area were found to be positive for WNV for the first time this year and 29 domestic horses from six states were infected with WNV. Twelve mosquito species were found to be positive for WNV including species active at dawn and dusk, species active during the day, and species that feed on avian hosts and mammalian hosts. Staten Island is considered to be the epicenter of the 2000 outbreak where 10 of the 18 confirmed human WNV cases were identified. There has been one human fatality from WNV this year.

Wild birds play a critical public health role in Western Hemisphere WNV outbreaks. Several native bird species, particularly the American crow, appear to be highly susceptible to this recently introduced arbovirus. An enhanced passive surveillance system for reporting and testing dead birds has been the leading surveillance tool used by state public health agencies to detect WNV activity. WNV-positive birds were found in most areas long before mosquitoes, horses, humans, or sentinel chickens indicated the virus was present in an area.

Surveillance of WNV was carried on in wild birds over the eastern and central parts of southern Canada in the summer and autumn of 2000. A total of 2266 birds were included in the surveillance programme. No WNV was detected in Canada, but the virus was detected in all counties of New York State (USA) along the Canadian border.

WNV was detected in horses in Camargue in southern France, but no human or wildlife cases have been reported. It is unclear if WNV is endemic or sporadically introduced by migrating birds.

WNV was reported from Indonesia.

2. Wild animals and products derived therefrom – potential hazards

2.1. Transmission of wild animal diseases to domestic species and vice versa when animals are used as animal feed

The Group noted that wild animals and their products are sometimes used as feed for domestic animals. For example, unprocessed fish and marine mammals are sometimes fed to mink or other species on commercial fur farms in northern countries, and similar practices are assumed to exist elsewhere. Domestic animals are also fed to wild animals, for example, as bait in trapping and hunting, and to supplement inadequate natural food sources. In fact, such practices form one part of a complex of interconnections, via food, that may be routes of disease transmission in either direction between wild and domestic animals.

The Group thinks that transmission of diseases between wild and domestic animals via feeding is a complex issue that deserves in-depth consideration. The potential health risks to domestic and wild animals require both general and specific evaluation, yet management actions to reduce such disease risks must fully acknowledge environmental and ecological management issues, such as conservation of predator and scavenger species. Because the dimensions of the health risks to wild and domestic species have not been evaluated and because the management of such health risks may be complex and multidisciplinary, the Group strongly recommends that the OIE evaluate the potential health risks and associated management options.

2.2. New companion animals

There is an increasing interest in wild amphibians, reptiles, birds and mammals as companion animals for private ownership. The international trade in such species is rapidly developing in Europe and North America. The Group expresses concern about the risk of disease transmission from these animals to their owners or even to the natural environment: it has been observed that such animals can escape or are deliberately released when they are no longer desired, and can survive in the wild.

The Working Group recommends that, with few exceptions, the trade in exotic vertebrates as new companion animals should not be encouraged. At all times, health risk analysis, as described in the Health Risk Analysis Guidelines prepared and published on the Internet by the Working Group, should be used to evaluate all international movement of such animals. This trade can represent a potential threat for the conservation of some species. The welfare of these animals is also frequently compromised by unsatisfactory conditions in the private owner's home. The detection of infections or parasites is often difficult as many of these species are considered to be disease reservoirs but are clinically unaffected.

3. Diagnosis of bovine tuberculosis in wildlife

The Working Group reviewed the excellent report on diagnosis of bovine tuberculosis in wildlife provided by Dr R. Gerhold and Dr J. Fischer. The report can be found at [Appendix III](#).

4. Paratuberculosis (Johne's disease) in wildlife

The Working Group reviewed the excellent report of paratuberculosis in free-ranging wildlife prepared by Dr R. Gerhold and Dr J. Fischer ([Appendix IV](#)). The Working Group encourages the submission of additional reports of paratuberculosis in wild animals.

5. Validity of diagnostic tests for wildlife diseases. Responses from OIE Reference Laboratories

It is of great importance to determine the validity of diagnostic tests for different diseases, designed for domestic animals but used in wildlife. The Working Group welcomes the initiative by the OIE Standards Commission to survey the OIE Reference Laboratories with regard to this subject. The Working Group share the opinion of the Commission that Reference Laboratories should be encouraged to validate the tests for listed diseases in wildlife species. This topic will also be covered in one paper in the forthcoming wildlife disease edition of OIE *Scientific and Technical Review*. The Working Group urges more OIE Reference Laboratories to participate in this investigation to list appropriate tests for wildlife.

6. Risk analysis for wildlife translocations

Guidelines for carrying out health risk analysis in translocations of wild animals have been completed and placed on the Internet for free access. They are accessible through the OIE Web site.

Included in these guidelines is an electronic version of the OIE/IUCN⁵ publication entitled 'Quarantine and Health Screening Protocols for Wildlife Prior to Translocation and Release into the Wild', edited by Dr

5 IUCN: World Conservation Union

Woodford. This document provides guidelines for quarantine procedures for a wide range of animal species, and is an important companion document for the guidelines.

7. Biosafety of genetically modified organisms. The Cartagena Protocol

The Group received information about the Cartagena Protocol from the OIE Central Bureau. The Working Group has expressed concerns in its reports to the International Committee in 1994 and in 1996 about deployment of genetically modified organism (GMO) for use as vaccines .

The Working Group has received information that a genetically modified virus intended to vaccinate European rabbits against myxomatosis and RHDV has been developed and that it may replicate and be infectious among rabbits if deployed. The Group is seeking clarification regarding development and deployment of this GMO.

8. Request to the International Animal Health Code Commission

The Working Group re-considered and confirmed its request to the Code Commission (report of 2000) that the definition of 'Animal' in the *International Animal Health Code* be amended or redefined to explicitly include wild animals, be they free-ranging or captive. This is requested in order to make explicit that the requirement for health risk analysis for international movements of animals also applies to wild animals and not only to domestic animals.

9. Web page details

The Working Group recommends that its Web page on the OIE Web site be expanded to include the following items:

- a) Terms of Reference of the Working Group
- b) Annual questionnaire sent to Chief Veterinary officers and others to report occurrences of wildlife diseases
- c) Names, addresses, (E-mail and postal) Web site URL of each member of the Working Group
- d) All reports of the Working Group, past years and current year
- e) Link to the on-line Guidelines to Health Risk Analysis in Wild Animal Translocations.

10. Wildlife disease questionnaire

The questionnaire was revised and will be sent to Member Countries in December 2001.

11. Other matters

11.1. Emerging diseases in amphibians

The Working Group agreed with the Fish Diseases Commission (FDC) that knowledge concerning the epidemiology and importance of infections with chytrid fungi and iridoviruses in amphibians is incomplete. Nonetheless, evidence for the implication of these infectious organisms in the decline of amphibian populations is compelling. Scientific documentation is growing rapidly. Furthermore, not only is it fully plausible that these infectious agents may be spread internationally by trade in wild or farmed amphibians, there is also evidence that iridoviruses pathogenic to amphibians may also be pathogenic to fish (wild or farmed species).

The Working Group has determined that these infectious agents and the diseases they cause in wild species will be added to its list of wildlife diseases of concern. The Group urges the FDC to monitor the growing body of scientific information on these infectious agents and, through formal health risk analysis, to determine the extent to which trade in the animals and animal products that fall within the remit of the FDC may spread these infectious agents internationally.

11.2. Foot and mouth disease: the potential role of wildlife in Europe

In Europe, Asia and South America, FMD has historically been a disease of large bovids, including domestic and wild cattle and water buffalo. Sheep and swine have also regularly been affected. In Africa, the SAT types of FMD viruses are endemically maintained in free-ranging African buffalo, with periodic 'spill over' into other cloven-hoofed wildlife and domestic livestock. FMD appears to cycle most efficiently amongst highly gregarious species, which naturally occur in large herds or are farmed intensively. In previously recorded outbreaks of FMD on several continents, there is little documentation of the role of other low density native cloven-hoofed wild mammals, such as the various cervids, wild ovines and caprines, in the disease epidemiology. It would appear that these taxa become incidentally infected, but their potential to act as maintenance hosts is limited. They may however play a significant role in the dissemination of infection during the acute clinical phase of the disease, when significant amounts of virus may be shed.

The potential importance of wild swine as viral amplifiers and shedders is also largely unknown. The current FMD outbreaks in Europe and elsewhere, demonstrate the great need for additional information regarding the role, if any, of wild animals in FMD epidemiology. Research and improved surveillance and monitoring in this area should be a high priority.

.../Appendices

MEETING OF THE OIE WORKING GROUP ON WILDLIFE DISEASES

Paris, 12–14 March 2001

Agenda

1. Regional review of selected wildlife diseases
 2. Wild animals and products derived therefrom – potential hazards
 3. Diagnosis of bovine tuberculosis in wildlife
 4. Paratuberculosis (Johne's disease) in wildlife
 5. Validity of diagnostic tests for wildlife diseases. Responses from OIE Reference Laboratories
 6. Risk analysis for wildlife translocations
 7. Biosafety of genetically modified organisms. The Cartagena Protocol
 8. Request to the International Animal Health Code Commission
 9. Web page details
 10. Wildlife disease questionnaire
 11. Other matters
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MEETING OF THE OIE WORKING GROUP ON WILDLIFE DISEASES

Paris, 12–14 March 2001

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Diagnosis of Bovine Tuberculosis in Wildlife

The current methods for diagnosing bovine tuberculosis in wildlife, primarily cervids, have presented challenges for detection of positive animals. Historically, the bovine tuberculin skin test was used. This method required handling the animal twice, as well as a delay of 60 days for retesting. Other types of tests, such as the lymphocyte stimulation test, interferon-gamma assay, and enzyme-linked immunosorbent assay (ELISA), have yielded variable success. Culture of *Mycobacterium bovis* continues to be the gold standard for definitive diagnosis. However, bacterial isolation may require 4–16 weeks. Thus, ancillary tests such as polymerase chain reaction (PCR) are being examined for potential use.

Skin tests continue to be used in multiple species with varying degrees of sensitivity and specificity. In South Africa, results of single cervical skin testing of lions using a double dose of *M. bovis* purified protein derivative (PPD) has correlated well with results of postmortem examination, histopathology, and mycobacterial culture. Unfortunately, there are no current antemortem tests available to detect bovine tuberculosis in pachyderms.

In vitro assays to measure T cell reactivity have been developed with variable success. The ELISA using *M. bovis* tuberculin purified protein derivative (PPD) has shown a sensitivity of 73.6%. The ELISA may be used as a complementary test with skin testing because it may detect animals anergic to the tuberculin test. Lymphocyte stimulation tests (LST) have been investigated using *M. bovis* PPD. The sensitivity of LST was 70% and specificity was 74% when compared with culture results. The interferon-gamma test is a rapid test (24 hours), which requires handling animals only once to obtain a blood sample and is a comparative test for avian and bovine tuberculosis. Aliquots of heparinised whole blood are incubated with avian or bovine PPD antigens for 16–24 hours allowing sensitised blood cells to produce interferon. Plasma then is removed and assayed for both bovine and avian types interferon-gamma in the enzyme immunoassay (EIA). In cattle, sensitivity of the interferon gamma assay was found to be 93.6% by testing 6264 animals from herds known to be infected with *M. bovis*, and the specificity of the interferon-gamma assay (96.3%) was determined by testing over 6000 cattle. A trial comparing the sensitivity of interferon-gamma to the single intradermal tuberculin test (SIDT) in cattle in the United States of America (USA), indicated that the caudal fold test (CFT) ranged from 80.4% to 84.4% and the interferon-gamma ranged from 55.4% to 94.7%. In another study using the CFT and interferon-gamma test in parallel, sensitivity is increased to 95% and specificity was 97%. Animals that have been tested intradermally with PPD will show increased interferon-gamma results from day 3 to day 77 post PPD injection.

A commercial bovine interferon-gamma product has been used in numerous countries, such as New Zealand and Ireland, as an adjunct to eradication programmes for bovine tuberculosis. In South Africa, a strong correlation has been found between results of the skin test and the commercial interferon-gamma test in African buffalo (*Syncerus caffer*). The commercial interferon-gamma test is being investigated for use as a tool for bovine tuberculosis diagnosis in the USA. A commercial cervid interferon-gamma product has been used with good success in red deer (*Cervus elaphus*) in New Zealand. However, results to date are not as consistent with elk (*Cervus elaphus*) in the USA, and the test has not provided accurate results when used for white-tailed deer (*Odocoileus virginianus*) in the USA.

Molecular biological approaches such as PCR and restriction fragment length polymorphism have been investigated as post-mortem diagnostic tests. Although PCR analysis has a shorter turnaround time than bacterial culture, marginal methods of extracting small numbers of bacteria from tissue result in lower PCR sensitivity compared with bacterial culture. Thus, PCR is used in tissue that histologically appears to be infected with tuberculosis and the PCR is usually confirmed with culture. Restriction fragment analysis (RFA) is useful when trying to determine the epidemiology of an outbreak of *M. bovis*. Because the RFA technique demonstrates small changes in bacterial DNA, it can be used to identify specific strains of *M. bovis* thus aiding in investigation of potential sources of an outbreak.

Post-mortem diagnostic procedures such as necropsy may be used to increase confidence in a diagnosis of a field reactor animal. A careful examination of as few as six pairs of lymph nodes, the lungs and the mesenteric lymph nodes can result in 95% of the animals with macroscopic lesions being identified. The sensitivity and specificity of gross pathology was determined to be 93% and 89%, respectively, when the presence of lesions was compatible with tuberculosis. The specificity and sensitivity of histopathological evaluation was found to be 89% and 88%, respectively when the histological lesions were compatible with tuberculosis. The highest sensitivity estimates (93–95%) and specificity estimates (94–95%) were obtained by interpreting gross pathology in parallel with histopathology. Gross and histopathological data were confirmed by culture of *M. bovis*.

The diagnosis of tuberculosis in wildlife continues to be a challenge due to technical and intrinsic qualities of the tests. The need for tests with ability to rapidly detect *M. bovis* infection in multiple species of wildlife is highly desirable. At the present time there are field tests under development that may yield results consistent with post-mortem evaluation and culture.

Paratuberculosis (Johne's disease) in Wildlife

Paratuberculosis (Johne's disease) is a chronic disease of the intestinal tract and lymphoid tissues caused by *Mycobacterium avium paratuberculosis*. The bacteria are acid-fast bacilli that are transmitted via the faecal-oral, intra-uterine, and transmammary routes from adults to juveniles. Clinical signs of paratuberculosis are weight loss, emaciation, rough hair coat, and intermittent or constant diarrhoea. Infection in cattle is generally acquired when the animal is immature, but clinical signs are not observed until the age of 2 years or older.

Gross lesions of paratuberculosis include enlarged lymphatics and lymph nodes, subserosal oedema and mucosal thickening of the jejunum and ileum. Microscopic lesions include extensive infiltrations of epithelioid macrophages, multinucleated giant cells and numerous acid-fast organisms within macrophages in the mesenteric and ileocaecal lymph nodes. The lamina propria and submucosa of the jejunum and ileum may be similarly infiltrated by macrophages.

Diagnosis of paratuberculosis is confirmed by bacterial isolation. However, the organism may require 4-16 weeks for culture. Serological tests, have been developed, which have shorter turnaround time, but may lack good sensitivity and/or specificity unless used in combination.

Paratuberculosis is often observed in domestic livestock, game farms, and zoological collections. In the United States of America (USA), regulatory programmes to control the disease in domestic stock vary from state to state and a national eradication programme is currently under consideration. Reports of paratuberculosis in wildlife are uncommon, but have been documented.

Paratuberculosis was diagnosed in eight Rocky Mountain bighorn sheep (*Ovis canadensis*) and a Rocky Mountain goat (*Oreamnos americanus*) between 1972 and 1979 in the Mount Evans region in Colorado. Six of the bighorn sheep showed clinical signs and two sheep were subclinically affected, but were diagnosed with paratuberculosis by histopathology and isolation of *M. a. paratuberculosis*. The clinical cases showed gross and histological lesions consistent with paratuberculosis, and the subclinical cases revealed mild lymphoid hyperplasia of the ileum and associated lymph nodes on histological examination. A 2.5-year-old male mountain goat was also found to be in poor condition and to have diarrhoea. Necropsy revealed lesions consistent with paratuberculosis on gross and histopathological examination.

Paratuberculosis has also been documented in free-ranging cervids. The disease has been reported in tule elk (*Cervus elaphus nannodes*) in the Point Reyes National Seashore (PRNS) in California, which was established on land previously used for dairy and beef cattle. The tule elk was introduced into PRNS in 1978. In 1980 and 1981, three clinically affected elk were diagnosed with paratuberculosis. Gross and histological lesions were consistent and *M. a. paratuberculosis* was isolated from faeces of each animal. In 1982, five more elk in PRNS were diagnosed with paratuberculosis.

In 1993 the PRNS elk herd was re-evaluated for paratuberculosis because clinical cases had not been observed since 1984. One hundred samples of fresh faeces were collected and evaluated for *M. a. paratuberculosis* using radiometric culture. Four of the samples from two separate groups were positive for *M. a. paratuberculosis* demonstrating that the organism persisted in the PRNS tule elk herd. The persistence of paratuberculosis may hinder relocation programmes as the elk population nears the maximum sustainable equilibrium of PRNS.

In the 1940s, two species of deer, the axis deer (*Axis axis*) and fallow deer (*Dama dama*) were introduced into PRNS. None of the deer showed clinical signs of paratuberculosis; however, *M. a. paratuberculosis* has been isolated from the faeces of both species. Due to federal mandates, contact between the deer and the tule elk did not occur.

Mycobacterium avium paratuberculosis was isolated from two free-ranging eastern white-tailed deer (*Odocoileus virginianus*) at a Connecticut farm with a 6-year history of bovine paratuberculosis. *Mycobacterium avium paratuberculosis* was isolated from the caecal lymph node, terminal ileum, and ileocaecal valve of a 4-year-old male deer and from a caecal lymph node of a 1.5-year-old female deer. Gross lesions were not apparent in either deer. Microscopically, mild nonspecific lesions of parasitic migration were found in the gastrointestinal tract, while lymph node examination revealed sinus histiocytosis, another nonspecific lesion. *Mycobacterium avium paratuberculosis* has been isolated from two affected members of the Key Deer race of white-tailed deer in the Key Deer National Wildlife Refuge in Florida, USA.

Other members of the cervidae family have been experimentally infected with *M. a. paratuberculosis*. Examples include the Rocky Mountain elk (*Cervus elaphus nelsoni*) and the mule deer (*Odocoileus hemionus*). Juveniles of each species were exposed to the agent following its isolation from naturally infected bighorn sheep. All exposed individuals became infected and *M. a. paratuberculosis* was isolated from both species. However, only the mule deer had clinical signs of paratuberculosis. This is important because these cervids are in contact with the naturally infected bighorn sheep in Colorado.

In Tayside, Scotland, United Kingdom, a survey of 33 wild rabbits (*Oryctolagus cuniculus*) demonstrated that 67% were infected with *M. a. paratuberculosis*. The rabbits were generally in good condition and gross pathology showed that 3/33 rabbits had gross lesions similar to ruminants and 58% had histopathological lesions similar to ruminants. Bacteriological results demonstrated that 82% of the rabbits were culture positive and 67% were positive by polymerase chain reaction. Another survey from 22 farms in Scotland showed a regional variation in paratuberculosis in rabbits with the Tayside region being significantly higher in incidences. There was an apparent correlation between a history of previous or current problems of paratuberculosis in cattle and the presence of paratuberculosis in rabbits on the farm. Genetic typing could not discriminate between rabbit and cattle isolates from the same or different farms, suggesting a single strain may be responsible for the disease in either host. However, the direction of transmission between species could not be determined from this investigation. Experimental interspecies transmission studies are necessary to confirm these observations.

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