

Importation of psittacine birds into Australia

Technical Issues Paper

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Abbreviations and Acronyms

AQIS	Australian Quarantine and Inspection Service
AQPM	Animal Quarantine Policy Memorandum
IRA	Import Risk Analysis
RAP	Risk Assessment Panel
ND	Newcastle disease
IPD	Internal papillomatous disease
PPDS	Psittacine proventricular dilatation syndrome
PD	Pacheco's disease
WNV	West Nile Virus

Executive Summary

This issues paper discusses the exotic diseases of birds which are considered likely to be introduced into Australia with imported psittacine birds or their eggs. The diseases of major economic concern include those OIE List A and List B and FAO List C diseases of commercial poultry which are likely to be found in psittacine birds, and which are exotic to Australia. Of these listed diseases, only highly pathogenic avian influenza, Newcastle disease, fowl typhoid and Pullorum disease are considered to pose a risk of introduction and establishment, as a result of importation of psittacine birds.

In addition to these listed diseases, there are a number of exotic diseases specific to psittacine birds, which may potentially pose a risk to Australia's large and unique psittacine population. Many of these diseases are poorly understood at the moment. In particular, internal papillomatous disease and psittacine proventricular dilatation syndrome are of unknown aetiology, and appropriate testing methods are not available.

The list of diseases which are considered to be of concern, and which should be considered further in the import risk analysis paper, includes:

- Highly pathogenic avian influenza
- Newcastle disease
- Avian mycobacteriosis
- Fowl typhoid (*Salmonella Gallinarum*)
- Pullorum disease (*Salmonella Pullorum*)
- Psittacosis (*Chlamydia psittaci*)
- Pacheco's disease
- Amazon tracheitis
- Poxvirus infection in parrots
- Internal papillomatous disease
- Psittacine proventricular dilatation syndrome.
- West Nile virus

1. Introduction

Animal Quarantine Policy Memorandum (AQPM) 98/79 advised stakeholders that AQIS intends to undertake an import risk analysis (IRA) of the import of live psittacine birds and their eggs. AQPM 99/08 confirmed the non-routine approach to the IRA, and the membership of the Risk Assessment Panel (RAP). AQPM 99/32 advised that the Secretary had dismissed an appeal against the membership of the panel, and that the IRA process was to continue. This issues paper, which discusses the disease issues associated with importations of psittacine birds, was produced by the RAP. It represents the next step in the consultative process for this IRA.

Following the receipt of comments on this issues paper, AQIS expects to publish a draft IRA in February 2000 and to finalise the policy review by June 2000.

1.1. Purpose and Scope

This Issues paper is intended to identify those diseases which are of potential quarantine concern in relation to the importation of psittacine birds, from any country, to Australia. To this end, it reviews the unmitigated risks associated with the import. No attempt has been made to quantify the risk associated with the importation. Neither has there been any attempt to develop, or take into account the effects of, risk management measures. The identification of any disease as a potential hazard does not mean that the risk is unmanageable, nor that importation should not occur.

Diseases identified in the issues paper as posing a potential risk will be further considered by the Risk Analysis Panel, and their findings will be reported in the draft Import Risk Assessment, which is expected to be completed by February 2000. Possible risk management measures and their effect on the overall risk of introduction of exotic disease will be included in the draft IRA.

1.2. Background

1.2.1. History of policy development

In 1949, Australia banned imports of all birds and avian genetic material, from all countries except New Zealand. This ban was extended to include NZ in 1972. As a result of concerns at the level of bird smuggling which was occurring, and the potential for introduction of exotic avian disease through this pathway, conditions for the import of live birds were finalised in 1989. Import of live birds under these protocols commenced in 1990.

A routine review of the live bird importation program was initiated in 1992, and completed in 1993. The review raised some concerns that the importation of live birds presented an unacceptable risk of introduction of particular exotic diseases of parrots and related species (psittacine birds) and BRS was commissioned to undertake a review of relevant literature in 1994.

In light of incomplete knowledge on certain diseases of psittacine birds, and with a lack of definitive methods for testing imported birds for the presence of these diseases, AQIS suspended importation of live psittacine birds in 1995. The decision was generally supported by veterinary respondents and the Bureau of Resource Sciences.

Aviculture organisations have been actively pursuing a review of the import conditions, and a relaxation of the ban on imports.

Customs and Quarantine officers at the Barrier continue to detect attempts to illegally import psittacine birds or their eggs, indicating that the incentive for smuggling still exists. This illegal trade poses a very real threat of the introduction of exotic diseases into Australia. It has been suggested that allowing the importation of psittacine birds will decrease the incentive for smuggling. In 1996, AQIS reported that there was “anecdotal evidence to suggest that smuggling, particularly of species approved for importation by the (then) Australian Nature Conservation Agency, decreased while imports were permitted.”

1.2.2. Policy obligations

As a member of the WTO and a signatory to the SPS Agreement, Australia has an obligation to ensure that quarantine conditions are applied only to the extent necessary to protect human, animal or plant life or health, and are based on sound science. The SPS agreement also requires that import conditions applicable in one situation are consistent with those applicable under other, similar situations. This means that any conditions that may be developed for the importation of psittacine birds should be consistent with conditions for import of other avian species.

1.2.3. Relevant legislation

Imports of live birds or hatching eggs are subject to the *Quarantine Act* 1908, Quarantine Regulations and Quarantine Proclamation 1998. Prospective importers will also need to comply with Other Commonwealth legislation, including the *Wildlife Protection (Regulation of Imports and Exports) Act* 1982. The present import risk analysis will not address issues related to the Wildlife Protection Act.

1.3. Stakeholders

The introduction of an exotic pathogen in imported psittacine birds has the potential to impact not only on the aviculture industry, but also on the commercial poultry industry, and on human health, and may also have far reaching effects on the environment.

The stakeholders range from industries of high economic values to those that cannot be valued, and encompass both domestic and export trade. Whilst the traditional avian industries are mostly directed at the Australian market, export value is increasing. Maintenance of a specified disease-free status protects the Australian industry and provides a competitive edge for exports.

1.3.1. Aviculture industry

The aviculture industry in Australia covers a wide spectrum of the population, from individuals with a single pet bird, to commercial enterprises worth millions of dollars. A recent Bureau of Statistics report on pet ownership in Australia reported that 3 out of 5 households in Australia have one or more birds as pets. The Avicultural Federation of Australia, the peak body for the industry, claims to represent 10,000 bird keepers.

1.3.2. Commercial poultry industry

The commercial poultry industry could be adversely effected by the introduction of exotic avian pathogens with imported psittacine birds. In particular, the poultry industry has concerns about the major OIE List A and List B diseases such as highly pathogenic avian influenza, Newcastle disease and infectious bursal disease.

The Australian Bureau of Agriculture and Resource Economics (ABARE) has estimated the gross value of production of the Australian egg industry at \$284 million and the chicken meat industry at \$845 million (1993/4), giving a combined total in excess of \$1100 million.¹ In addition, industries such as the ostrich,

duck and turkey growers, while of smaller size than the mainstream poultry market, could be adversely effected. Harvest of avian wildlife for gourmet foods for local consumption and export - mutton bird and possibly Cape Barron Geese - are very small industries but with important local socioeconomic value.

1.3.3. Native populations and the environment.

The economic value of native birds is difficult to measure. However, AQIS has a responsibility towards the protection of wildlife and the environment. Australia has significant populations of native psittacine birds, many of which occur naturally in no other part of the world. In addition, some of these native species have been shown by overseas experience to be susceptible to the major exotic diseases of psittacine birds. The potential effects of an outbreak of exotic disease in our wild psittacine populations are difficult to estimate.

Despite the difficulty of quantifying the value of native populations of birds, the conservation value is extremely high. Possible effects of exotic disease introduction on native populations and the environment are serious, and must be given adequate consideration in the risk analysis process.

The possibility also exists that imported psittacine birds may escape from captivity and establish feral populations. These could compete with native species for habitat, and nest sites, and could possibly have an adverse impact on the Australian environment. Except for some domesticated animals and certain aquarium fish, the import of live animals and animal reproductive material is regulated by Environment Australia under the provisions of the *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. This regulation is designed to prevent the establishment in Australia of species which may adversely affect the environment. The decision to permit importation depends on the views expressed by each State and Territory conservation authority and other relevant organisations. Since the issue of pest risk potential is addressed by Environment Australia, this issues paper will not consider this aspect further.

1.4. Factors in the establishment of disease

In order for a disease to become established in Australia as a result of the importation of live psittacine birds, the following chain of events must occur:

- the disease agent must be present in the exporting country
- the disease agent must infect at least one of the birds for export
- the infected bird must not be detected by routine surveillance and testing in pre-export quarantine
- the disease agent must survive in the infected bird during transport to Australia, without causing illness or death, either of which should result in detection of the disease agent
- the infected bird must not be detected by surveillance and testing during post-arrival quarantine
- the infected bird must shed the disease agent
- a susceptible Australian bird must come in contact with an infective dose of the disease agent, and become infected
- the infection must be capable of being passed on to other Australian birds.

1.5. Country factors

Exporting country factors which have the greatest potential effect on the likelihood of introductions of exotic disease to Australia are the avian health status of the country in question, and the reliability of the veterinary services available in that country. The prevalence of the individual diseases of concern in the avicultural populations in the country, and the level of surveillance for avian diseases which occurs are also highly relevant to this risk assessment.

For some of the diseases of concern, there is no readily available, sensitive and specific test which can be used to accurately identify individual infected birds, nor to verify the prevalence of the disease of concern in the exporting country, or in Australia.

1.6. Notes on scientific data

The scientific information contained in this issues paper has been derived from a number of sources including peer-reviewed journals, unpublished reports and personal communication with experts in the field. Scientific data on a number of diseases of relevance to the importation of psittacine birds is very limited, reflecting the relatively recent recognition of these diseases.

2. Hazard Identification

2.1. Criteria for Hazard Identification

This issues paper concentrates on significant risks to animal health, which may be posed by the importation of live psittacine birds. The disease agents of concern include those OIE List A, List B and FAO List C diseases of poultry and other birds, which are exotic to Australia, and which are likely to be present in, and transmitted by, psittacine birds.

In addition to the diseases of economic importance as defined by OIE, the 1995 “Review of Exotic Diseases of Parrots”, by WA Snowdon, identified a number of exotic diseases which specifically affect psittacine birds.

Of the diseases referred to above, AQIS intends to exclude from further consideration, those diseases that are endemic in Australia, and those that are not likely to be present in psittacine birds.

Table 1 lists the diseases and their status in Australia.

Table 1: Diseases of quarantine concern that may potentially be introduced via imported psittacine birds.

Disease	Australian status	Disease affects psittacine birds?	Identified as a potential hazard?
OIE List A diseases			
Highly pathogenic avian influenza	exotic	Yes	Yes
Newcastle disease	exotic	Yes	Yes
OIE List B diseases			
Avian infectious bronchitis	endemic; possibly more pathogenic strains overseas.	No	No
Avian infectious laryngotracheitis	endemic	?	No
Avian tuberculosis	endemic	?	No
Duck virus hepatitis	exotic	No	No
Duck virus enteritis (duck plague)	exotic	No	No
Fowl cholera	endemic	?	No
Fowl pox	endemic	?	No

Fowl typhoid (<i>Salmonella Gallinarum</i>)	exotic	Yes	Yes
Infectious bursal disease	very virulent form exotic to Australia	No	No
Marek's disease	endemic	?	No
Mycoplasmosis	endemic	?	No
Psittacosis	endemic	Yes	No
Pullorum disease (<i>Salmonella Pullorum</i>)	almost eradicated from commercial birds	Yes	Yes
FAO List C diseases			
Infectious coryza	endemic	?	No
Avian encephalomyelitis	endemic	?	No
Avian spirochaetosis	endemic	?	No
Avian salmonellosis (excluding fowl typhoid and Pullorum disease)	endemic	Yes	No
Avian leukosis	endemic	No	No
Other diseases of concern			
Pacheco's disease	exotic	Yes	Yes
Amazon tracheitis	exotic	Yes	Yes
Budgerigar herpesvirus	exotic	Yes	Yes
Poxvirus infection in parrots	exotic	Yes	Yes
Reovirus infections in parrots	exotic	Yes	Yes
Internal papillomatous disease	2 cases diagnosed in Australia	Yes	Yes
Psittacine proventricular dilatation syndrome	1 case diagnosed in Australia	Yes	Yes
Megabacteria and proventricular/ventricular disease in birds.	endemic	Yes	No
Chlamydiosis/psittacosis	Endemic, but presents a serious human health concern	Yes	Yes
Haemoparasites Plasmodium Haemoproteus Leucocytozoon	Endemic	Yes	No
Japanese encephalitis	Exotic	Not reported	No
EEE/VEE/WEE	Exotic	Not reported	No
West Nile virus	Exotic	Yes	Yes

2.2. OIE List A diseases

2.2.1. Highly pathogenic avian influenza

a) *Description*

Avian influenza virus is a member of the Orthomyxoviridae. Closely related influenza viruses have been isolated from birds, humans, pigs, horses, mink, seals and whales. Influenza viruses are categorised into subtypes based on the antigens of the haemagglutinin and neuraminidase projections on their surfaces.² All highly pathogenic avian influenza subtypes are found in the H5 and H7 subtypes. An outbreak of a zoonotic form of avian influenza, caused by an H5N1 subtype occurred in Hong Kong in 1997.

Influenza viruses have a high rate of genetic recombination, so that antigenic shift is common.³ Highly pathogenic avian influenza is distributed widely throughout the world, although due to the application of a strict stamping out policy, Australia remains free. There have been five outbreaks of virulent disease in Australia: in 1976 in Melbourne, 1985 and 1992 near Bendigo, 1994 at Lowood in Queensland⁴ and in 1997 at Tamworth in NSW. In none of these outbreaks was the source of infection definitely identified, although there was generally a history of association with wild ducks or access to water that had been frequented by wild ducks.

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs.*

AIV is distributed around the world by migration of many avian species. Infected birds shed the virus in respiratory secretions, conjunctival secretions and faeces.³ Transmission through direct contact and indirect transmission through vectors is possible. Contaminated eggshells can distribute the agent,³ although vertical transmission through embryonated eggs is not known to occur.⁴ Once established in domestic poultry, the disease is highly contagious.⁴ The most important means of spread of AI virus from farm to farm is mechanical, by movement of people, utensils, feed trucks or other fomites.⁴

Infection with avian influenza virus has been reported from a variety of psittacine birds, including the Sulphur Crested Cockatoo, African Grey Parrot and Budgerigar, Yellow-crowned Amazon, Plum-headed Parakeets, Rose-ringed Parakeet, Singing Parrot and Lesser Sulphur-crested Cockatoo.³ Clinically affected free-ranging birds have been shown to be able to transmit the virus to chickens and turkeys.

c) *Conclusions.*

Avian influenza is a significant threat to Australia's aviculture and poultry industries, and potentially to the Australian environment. There is a risk that the disease could be introduced with psittacine birds.

2.2.2. Newcastle disease.

a) *Description*

Newcastle disease virus is a paramyxovirus, with a very broad host spectrum including hundreds of species of birds from at least 27 orders.³ Historically, isolates of NDV have been divided into lentogenic, mesogenic and velogenic groups on the basis of their virulence. More recently, viruses have been classified as being of high or low virulence, on the basis of the intra-cerebral pathogenicity index (ICPI) and/or the presence or absence of particular molecular sequences associated with virulence at the cleavage site of the F protein.

Pathogenic strains of the virus are found virtually worldwide, with the exception of Australia, New Zealand and various islands of Oceania. Low virulence strains are endemic in Australia, but more virulent strains are routinely “stamped out”. Virulent Newcastle disease has occurred in Australia on five occasions - in Melbourne, in 1930 and 1932,⁴ and more recently at Blacktown in 1998, and at Mangrove Mountain and Schofields in NSW in 1999.

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs*

Virus enters the host mainly through the respiratory and gastrointestinal tracts. Embryos can be infected if their shells are contaminated with virus. Some reports suggest that vertical transmission can occur,⁵ but is rare with velogenic strains because viraemic hens usually stop laying, and infected embryos usually die. Mechanical vectors such as wind, insects, equipment and humans readily spread the virus. The most common carriers include free ranging waterfowl and members of the Psittaciformes. Infected psittacine birds have been reported to excrete the virus for at least one year after recovery from clinical disease.⁴

c) *Conclusions*

Newcastle disease is a significant threat to Australia’s aviculture and poultry industries, and potentially to the Australian environment. There is a risk that the disease could be introduced with psittacine birds.

2.3. OIE List B diseases

2.3.1. Avian mycobacteriosis

a) *Description*

A number of species of mycobacteria have been implicated as causative agents of disease in birds. *Mycobacterium avium* is the commonest cause of tuberculosis in most avian species, notably chickens, turkeys, captive wild birds, pet birds, ducks, geese, swans, peacocks, pigeons, water birds (including flamingos) and wild birds. *M. avium* infection has also been reported in Australian birds such as little penguin, black duck, cassowary and little eagle^{6,7}

M. avium is classified into 20 serovars of which serovars 1, 2, and 3 primarily cause disease in avian species. *M. avium* serovar 1, predominantly causes disease in birds and immunocompromised humans while *M. avium* serovar 2, causes disease in chickens. *M. avium* serovar 4 to 20 are primarily human pathogens. There are several *M. avium* isolates that cannot be assigned to any of the 20 serovars.

Generally in chickens signs may vary from asymptomatic infection to severe emaciation due to atrophy of muscles, especially the pectoral muscle. Post mortem examination usually reveals tubercular nodules in many organs, especially in spleen, liver and the intestinal tract. The distribution of lesions can vary widely in birds but may depend on the stage of infection and the species affected. Psittacine and passerine birds tend to show a diffuse granulomatous reaction.

M. genavense, which is the causative agent of a wasting illness in human patients with AIDS,⁸ has been implicated in causing disease in a number of birds, including 7 members of the order Psittaciformes.⁹ In the study, 27 birds of various orders, all kept in the Antwerp Zoo, were reported as showing non-specific gross necropsy findings, but all were smear positive for acid fast bacilli. In most birds, the intestinal mucosa was generally heavily infiltrated, indicating an intestinal origin of the infection. Most birds had an extensive invasion of the lungs. In some of these cases, birds died without prior signs of illness, while others

showed emaciation prior to death. Culture of the organisms took at least 6 months, and required special culture media.

M. genavense has also been reported to cause mycobacteriosis in budgerigars, and an orange winged amazon, as well as in other non-psittacine birds. Gross lesions in these birds included severe muscular wasting, hepatomegaly, and thickening of the wall of the small intestine. Microscopic lesions included granulomas in the lung (1 case) and in the sub-cutis (1 case)¹⁰. In a study of pet birds reported in 1997, *M. genavense* was found to be the causative agent of mycobacteriosis in 19 of 24 birds¹¹.

M. tuberculosis has also been recorded as a cause of mycobacteriosis in birds. Psittacine birds which have been reported to be infected with *M. tuberculosis* include a yellow-naped Amazon parrot¹², an unidentified parrot¹³, and 2 unidentified pet birds.¹⁴

Transmission of the disease agent and its potential to be present in imported psittacine birds

Avian tuberculosis caused by *M. avium* is transmitted via the alimentary tract, following ingestion of material contaminated with faeces of infected birds or other animals. Tubercle bacilli are stable in the environment and may survive for long periods (up to 4 years in a fowl –yard).¹⁵

The source of *M. genavense* in nature and the epidemiology of the disease in birds remain obscure. However, an oral route of infection has been suggested. Direct bird-to-bird transmission in zoo birds was considered unlikely, and contaminated local water supplies may have been the source of infection for birds in Antwerp Zoo⁹. Hoop¹⁰ *et al* consider an environmental source of contamination to be likely for *M. genavense*.

c) *Conclusion*

Although avian tuberculosis is present in Australia, the zoonotic potential of the disease warrants further consideration.

2.3.2. Fowl typhoid (*Salmonella Gallinarum*)

a) Description

Fowl typhoid is an acute or chronic infection of chickens caused by infection with *Salmonella enterica* serovar Gallinarum (*S. Gallinarum*). Many species of poultry including turkeys, ducks, guinea fowl, quail, grouse, and pheasants are susceptible to infection.

Fowl typhoid has a worldwide distribution, but has been diagnosed in Australia only in Victoria and Tasmania-in turkeys in Victoria and in both fowls and turkeys in Tasmania. The disease was last seen in Tasmania in 1940. The Victorian outbreak was in 1952.

Infection occurs as septicaemia which results in a severe haemolytic anaemia. In newly hatched chickens it presents as an acute or peracute infection with high mortality and in older birds as a more chronic disease.

b) Transmission of the disease agent and its potential to be present in psittacine birds and their eggs

Pullets which survive infection become carriers and *S. Gallinarum* localises in the ovary. Eggs are laid containing the organism. As well as transovarian transmission, direct bird to bird transmission can occur. *S. Gallinarum* can be isolated in the bone marrow of carcasses three months after chickens have died of fowl

typhoid. The bacteria can survive for at least 148 days in the livers of naturally infected chickens frozen to -20 °C. ¹⁶

c) *Conclusions*

Salmonella Gallinarum poses a significant threat to Australia's aviculture and poultry industries, and potentially to the Australian environment. There is a risk that the disease could be introduced with psittacine birds.

2.3.3. Pullorum disease (*Salmonella Pullorum*)

a) *Description*

Pullorum disease is a term used to designate infection of avian species with *Salmonella Pullorum*. It usually occurs in an acute systemic form in chicks and poults but in adults is most often localised and chronic. In some parts of the world, *S. Pullorum* and *S. Gallinarum* are considered to be the same species. ¹⁷

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs*

The disease is most commonly spread by true egg transmission. However, transmission from infected to uninfected chicks during hatching can result in extensive dissemination. Transmission can also occur within poultry flocks by cannibalism of infected birds. ¹⁷

c) *Conclusion*

Salmonella Pullorum poses a significant threat to Australia's aviculture and poultry industries, and potentially to the Australian environment. There is a risk that the disease could be introduced with psittacine birds.

2.3.4. Psittacosis (*Chlamydia psittaci*)

a) *Description*

The disease is caused by *Chlamydia psittaci*. There are a number of strains, which commonly affect birds, but also cause significant zoonotic disease. There are no characteristic clinical signs in birds, but conjunctivitis or keratoconjunctivitis with swollen eyelids and discharge are common. A mild upper respiratory disease has been reported in non-commercial and commercial intensive poultry. ^{18,19} These signs may be accompanied by systemic disease, with ruffled feathers, severe depression and diarrhoea. Mortality rates vary from nil to 90%, depending on the virulence of the strain and the age of the birds. Young birds are more severely affected than adults ²⁰. The spectrum of disease produced in birds by infection with *Chlamydia psittaci* ranges from inapparent infection, through chronic upper respiratory infection to acute and rapidly fatal systemic disease ²¹

The infection is worldwide, and is endemic in Australia. McElnea and Cross (1999)²² reported on a cross sectional study to determine the occurrence of *Chlamydia psittaci* in domesticated and wild birds. They found that there was significant infection with *C. psittaci* in racing pigeon lofts, private aviaries and pet shops in NSW and the ACT. They were unable to detect *C. psittaci* in samples taken from ducks, geese, wild waterfowl, or wild psittacine birds, although *Chlamydia* have been previously reported in Australian commercial duck flocks. Arzey *et al* ²³ have reported the disease in commercial ducks, and it is reported as a common problem in wild columbiform birds in Victoria ²⁴.

However, tetracycline resistant strains of *Chlamydia psittaci* have been reported overseas.^{25 26} These strains are not known to occur in Australia. Tetracycline resistant strains are of concern, since the major control measures for the disease rely on the use of tetracyclines.

b) Transmission of the disease agent and its potential to be present in psittacine birds and their eggs

Infection takes place by the inhalation of airborne chlamydia. Organisms are shed in enormous numbers in faeces of diseased birds, and dust contaminated with faeces is heavily infected. Chlamydia are shed in discharges from the respiratory tract and eyes. Egg transmission has been shown to occur in chickens and ducks, and the organism has been found in the eggs of some species of wild birds.

Chlamydial infections commonly persist for long periods, irrespective of whether the original infection was subclinical, or caused disease. Chronic infections are mostly latent, but can flare up and lead to disease or shedding of the organism if the birds are subject to stress.²⁰

c) Conclusion

There is a risk of introduction of chlamydia with imported psittacine birds.

2.4. Other significant diseases of psittacine birds

Many of these diseases have been recently reviewed by Dr W A Snowdon for the Bureau of Resource Sciences.²⁷ In many cases, the information available in the literature is sparse, and the diseases are poorly understood. The following disease summaries are adapted from Snowdon's report. Where additional information is included, this is separately referenced. Copies of the report are available on request from:

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Snowdon concluded that the most critical concerns in relation to these diseases of parrots are:

- The aetiology of two of these diseases (psittacine proventricular dilatation syndrome and internal papillomatous disease) is not known.
- Asymptomatic carriers of infections which occur with Pacheco's disease and possibly PPDS and IPDS cannot be reliably detected.

Most countries, including Australia, have no official requirements to report outbreaks of disease in cage and aviary birds, (with the exception of Newcastle disease and avian influenza) and so it is difficult if not impossible for countries to certify freedom from specific diseases of psittacine birds.

2.4.1. Pacheco's disease

a) *Description*

Pacheco's disease (PD) was initially described by Pacheco and Bier²⁸ and the cause characterised as a herpesvirus by Simpson *et al*²⁹. It is now referred to as psittacine herpes virus type 1 (PHV1). A number of other PHVs have since been identified. Gravendyck *et al* recognise at least 3, and possibly 5, PHVs.³⁰ In species that show clinical signs, there is only a brief illness, and birds in excellent body condition may be found dead with full crops (indicating a rapid death). In some birds, death is preceded by lethargy and puffing of the feathers. There may be moist droppings and/or regurgitation of a clear or sanguineous fluid. The mortality in susceptible species can be very high, and most birds die within 48 hours of initial clinical signs. Raidal *et al* failed to identify PHV1 in a survey of Australian cockatoos,³¹ but few, if any, other attempts at isolation and characterisation of PHVs from Australian birds have been undertaken. Reece and Hartley³² report that they have observed bronchial syncytia associated with a psittacine herpesvirus, without tracheal lesions in Australian birds. A similar syndrome has been reported in Indian Ringnecks in Japan.

Early in 1997, 129 psittacine birds were imported from the United Kingdom to New Zealand into a private quarantine facility. Within the first few weeks of quarantine, 12 birds died, and from 4 of these a virus was isolated. The virus was identified as a herpesvirus by electron microscopy and as PD virus by neutralisation test.

There may be no gross lesions in birds that have died rapidly. Most show enlarged spleens and livers and areas of necrosis of liver tissue. Clinical signs and gross pathology are not specific proof of PD, so histopathology and other aids to diagnosis, such as serological tests, are necessary to confirm the diagnosis. Histopathology shows amorphous areas within the nuclei of liver cells (these contain viral particles), as well as necrosis of areas of the liver and haemorrhage within the liver. The virus may be identified only as a herpesvirus by electron microscopy.

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs*

It is known that Pacheco's disease virus is transmitted in the faeces of infected/carrier birds. A parrot may become infected by swallowing the virus, which may be in or on contaminated food, water or any inanimate object (the faecal/oral route). The faeces of an infected parrot may also dry around the cloacal area. Although not proven, it is possible that this dry material may be distributed over the feathers by preening, and even transmitted to another bird which may also preen the infected bird. The dried faeces may also

conceivably be transmitted to another bird as an airborne infection. In an aviary the disease can appear in birds that are not caged side by side, indicating either that the virus has been transmitted through the air, or by the aviculturist. If the parents are excreting the virus, then an egg may be contaminated with the virus and the nestling will be infected via the horizontal route at hatching. Nestlings may also be infected horizontally after hatching by PD virus-excreting parent(s). Any naive adult bird can be horizontally infected. PD is not known to be transmitted vertically.

A latent infection is one that persists in an animal without producing clinical signs or excreting virus. A "carrier" state is one in which an animal sheds an infectious agent without demonstrating clinical signs. The agent may be shed continuously or intermittently. As with most herpesviruses, Pacheco's virus produces asymptomatic carriers in parrots. There is strong circumstantial evidence that Nanday conures and Patagonian conures play an important role in this regard. Some birds may survive infection, be permanently immune and become latently infected. Latently infected birds shed virus in the faeces after periods of stress, such as transportation and overcrowding.

Pacheco's virus can be readily isolated from affected organs of birds affected with Pacheco's disease, but no satisfactory practical method has been developed for identifying asymptomatic carrier birds. The virus is extremely difficult to detect in latently infected birds or flocks. Serum neutralising antibody levels in recovered birds may be useful in identifying birds that have been recently exposed, but may not be helpful in identifying latently infected birds or carriers, since these may have declining or non-detectable antibody levels. Carrier birds may also excrete virus intermittently, and so would need to be serially sampled. The antiviral drug acyclovir may be used prophylactically to prevent birds showing clinical signs of PD. The drug must be given before exposure, but does not prevent birds from becoming latently infected or carriers of PD virus.

Although there appears to be variation in susceptibility of different species of parrots to infection with Pacheco's virus, it must be assumed that they are all probably susceptible until proven otherwise. Amazon parrots (*Amazona* spp), cockatoos (*Cacatua* spp) and conures (*Aratinga* spp and others) are very susceptible to infection with Pacheco's virus.

c) *Conclusions*

There is a risk that Pacheco's disease could be introduced into Australia with imported psittacine birds. The disease could have significant adverse effects on the avicultural industry. It may also have adverse effects on native populations of psittacine birds.

2.4.2. Amazon tracheitis

Amazon tracheitis virus (ATV) is another herpesvirus, which is closely related to the virus that causes infectious laryngotracheitis (ILT) in chickens. Although it can infect chickens and pheasants, ATV appears to cause the most severe clinical signs in Amazon parrots. A disease similar to ILT has been seen in Bourke's parrots (*Neophema bourkii*), but this is less severe than the disease caused in Amazon parrots by ATV. No antigenic comparisons between ILT, ATV and the virus from Bourke's parrots appear to have been carried out. Snowdon concluded that:

“Amazon tracheitis virus would be of little significance when importing parrots, with the exception of Amazons (*Amazona* spp).”

2.4.3. Budgerigar herpesvirus

Budgerigar herpesvirus infection results in minimal effects, although decreased hatchability of eggs has been observed. The virus is antigenically related to pigeon herpesvirus, but not to Pacheco's disease virus. Snowdon concluded that:

“Budgerigar herpesvirus infection results in minimal effects, and it need not be considered when importing budgerigars into Australia.”

2.4.4. Poxvirus infection in parrots

a) *Description*

Pox in parrots is caused by infection with avipox virus. Three pox viruses of parrots have been described; agapornis (lovebird) pox; psittacine (amazon) pox; and budgerigar pox.

The most common forms of avipox are the cutaneous and diphtheritic forms. The cutaneous form is relatively sub-acute, while the diphtheritic form can produce acute disease and death. Amazon parrots may suffer coryza and ocular lesions, with ocular deformities remaining even after acute infection has resolved. There is no specific treatment for poxvirus infections in parrots. Treatment is aimed at controlling secondary infections.

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs*

Outbreaks of psittacine pox are uncommon in captive populations of parrots except in particular species after importation from Central and South America and Africa. Diagnosis of psittacine pox in parrots is based on clinical signs and histopathology of suspect lesions. Psittacine poxviruses can be readily isolated from affected birds, but serology is of little use for diagnosis. The role of latent infections of poxviruses in parrots is not clear.

There is no reported evidence of egg transmission with psittacine poxviruses.

c) *Conclusions*

Entry and establishment of avian pox viruses could have serious consequences for the aviculture industry. There is a risk of introduction with captive-bred birds, and of disease establishment following introduction.

2.4.5. Reovirus infections in parrots

a) *Description*

Avian reoviruses are prevalent worldwide in chickens, turkeys, ducks, quail, geese, pigeons, parrots, birds of prey and other aviary birds. There are multiple serotypes, and pathotypes which are unrelated to serotype. Reoviruses have been isolated from Australian birds, but little work has been done on characterising the local isolates. Reovirus associated disease in parrots has been most commonly reported in wild caught birds when held in quarantine after international transportation. The disease in parrots appears to be related to severe stress, and is often seen in combination with other potential pathogens. There is no effective treatment for parrots infected with reoviruses, although vaccination has been used with some success in controlling outbreaks. African grey parrots appear to be the most susceptible of those

parrots in which reovirus has been diagnosed. No outbreaks of reovirus associated disease have been reported in wild psittacine populations.

b) Transmission of the disease agent and its potential to be present in psittacine birds and their eggs

The virus is excreted via both the oral and respiratory routes, in chickens. The virus is generally shed for longer periods from the intestinal tract than from the respiratory tract and therefore it appears that the faecal route is likely to be the predominant route of infection.

Reoviruses may be transferred via the oral or respiratory routes, with faeces providing the main source of virus. Asymptomatic carriers of reovirus in parrots probably occur. Since egg transmission occurs in chickens it must be assumed that egg transmission could occur in parrots.

Because of the ubiquitous nature of the reoviruses it seems reasonable to conclude that they are endemic in most psittacine populations throughout the world but are only associated with disease when birds are collected together under stressful conditions.

c) Conclusions

There is little justification for implementing quarantine restrictions based on this disease.

2.4.6. Internal papillomatous disease

a) Description

Internal papillomatous disease (IPD) is primarily a disease of macaws, conures, Amazon and hawk headed parrots.³³ IPD causes the lining of the gut to develop into localised or generalised papillomas. The growths may be found in the mouth at the base of the tongue, on the roof of the mouth, and around the opening of the trachea. Papillomas may also develop in the crop, oesophagus, and glandular stomach. Another common place to find papillomas is just inside the cloaca. Oral papillomas, if large, may obstruct the airways. Severe lesions in the digestive tract cause weight loss and eventual death. Papillomas associated with the vent cause pain.

b) Transmission of the disease agent and its potential to be present in psittacine birds and their eggs

The aetiology of this disease and its method of transmission are not known. However, evidence that the disease is caused by an infectious agent is accumulating. Phalen³³ reports that when a bird with IPD is introduced into an aviary, lesions in other birds often develop. Also, IPD is more common in birds that are in direct contact with other birds having the disease. At least some offspring of birds with IPD will develop the disease. Phalen³³ has also shown that a high percentage of birds with IPD have antibodies which will neutralise Pacheco's disease virus.

However, when eggs are collected from affected birds and hatched in isolation, it is not known whether the progeny remain free of internal papillomatous disease when they are also reared in isolation.

There are no satisfactory screening tests that can be applied to detect subclinically affected birds or birds that may have recovered from the disease.

c) *Conclusions*

Since little is known about the aetiology, or epidemiology of this disease, it is difficult to assess the likelihood of establishment of the disease after introduction.

2.4.7. Psittacine proventricular dilatation syndrome (PPDS)

a) *Description*

PPDS affects a number of psittacine birds, and is characterised by proventricular dilation, weight loss and death. Histologically, there is a lymphoplasmacytic ganglioneuritis, suggesting a strong immune related component to the disease. In such cases, the aetiological agent may well have been eliminated from the bird before the lesions are sufficiently developed to result in noticeable disease. It is commonly a disease of young birds, but adults may also develop clinical signs. The cause of PPDS is not known although an infective agent is suspected. If an infective agent is involved it is possible that the disease has an incubation period extending from weeks to years. PPDS affects a number of psittacine species although macaws are considered the most susceptible. The disease is also commonly seen in conures, African grey parrots and cockatoos. PPDS has not been reported in wild psittacine populations. There is no satisfactory treatment for PPDS.

b) *Transmission of the disease agent and its potential to be present in psittacine birds and their eggs*

It is not known whether eggs that are collected from affected birds, and are hatched in isolation and their progeny are reared in isolation, remain free of PPDS. There are no satisfactory screening tests that can be applied to detect subclinically affected birds, or birds that have recovered from the disease.

c) *Conclusion*

There is a risk that this disease would be introduced to Australia with imported psittacine birds. The importance of the disease for the Australian environment is considered to be small, although there is potential for significant losses in caged birds.

2.4.8. West Nile Virus

a) *Description*

West Nile Virus (WNV) is a member of the *Flavivirus* genus of the family *Togaviridae*.³⁴ The virus is transmitted by many different species of mosquitos as well as ticks³⁵ and has been reported to cause encephalitis and death of humans and animals. Most species of birds may act as reservoir and amplifying host without showing clinical signs of disease. The recent outbreak of WNV in New York³⁶ seems to suggest that some species of birds such as flamingos, crows, and pigeons are probably very susceptible to this disease with fatal outcome.

The virus, which originated from Africa, has spread to many countries of the world^{35,37} with the possible exception of Canada and the South America and Australia. Recently, the disease has been reported in the USA.³⁶

A virus closely related to the WNV, named Kunjin virus has been isolated in many states of Australia.³⁸ The Kunjin virus occasionally causes mild encephalitis in humans with full recovery occurring after a few weeks.

b) Transmission of the disease agent and its potential to be present in psittacine birds

West Nile virus has been reported from a parrot (*Coracopsis vasa*) in Madagascar.³⁹ The virus circulates in blood during the viraemic period and circumstantial evidence strongly suggests that the virus can persist in the brain and neural tissue for prolonged periods. Many species of mosquitos and ticks can transmit the virus from birds to susceptible mammalian hosts especially humans and horses. The transmission of the virus can only occur if the vector population exceeds the threshold value and this is dependent on climatic factors such as ambient temperature and rainfall.

c) Conclusion

The zoonotic potential of this disease is of concern. It warrants further consideration in the IRA process.

Reference List

1. Anonymous. AUSVETPLAN The Australian Veterinary Emergency Plan [Web Page] Located at: <http://www.brs.gov.au/brs/aphb/aha/ausvet.htm>. Accessed 1999 Jul 16.
2. Geering WA, Forman AJ, Nunn MJ. *Exotic diseases of animals*. Canberra: Australian Government Publishing Service; 1995.
3. Gerlach H. Viruses. In : Ritchie B, Harrison G J, Harrison LR, Editors. *Avian Medicine: principles and application*. Lake Worth Florida, Wingers Publishing Inc; 1994. p 862-948.
4. Geering WA, Forman AJ, Nunn MJ. *Exotic diseases of animals*. Canberra: Australian Government Publishing Service; 1995.
5. Capua I, Scacchia M, Toscani T, Caporale V. Unexpected isolation of virulent Newcastle disease from commercial embryonated fowls eggs. *J.Vet. Med. B* 1993;40609-12 .
6. Reece R, Hartley WJ. The Pathology Registry and some interesting cases. In . *Wildlife Proceedings* Post Graduate Committee in Veterinary Science, University of Sydney, Sydney, Australia. 217-233; 1994. p 217-33.
7. Schultz DJ, Hough IJ, Boardman W. Special challenges of maintaining wild animals in captivity in Australia and New Zealand: prevention of infectious and parasitic diseases. *Rev. Sci. Tech. Off. Int. Epiz.* , 1996;15:289-308.
8. Kiehn T, Hoefler H, Bottger E, Ross R, Wong M, Edwards F, Antinoff N, Armstrong D. *Mycobacterium genavense* infections in pet animals. *Journal of Clinical Microbiology* 1996;34(7):1840-2.
9. Portaels F, Realini L, Bauwens L, Hirschel B, Meyers W, de Meurichy W. *Mycobacteriosis* caused by *Mycobacterium genavense* in birds kept in a zoo: 11 year survey. *Journal of Clinical Microbiology* 1996;34(2):319-23.
10. Hoop R, Bottger E, Ossent P, Salfinger M. *Mycobacteriosis* due to *mycobacterium genavense* in six pet birds. *Journal of Clinical Microbiology* 1993;31(4):990-3.
11. Holsboer-Buogo C, Bacciarini L, Robert N, Bodmer T, Nicolet J. Presence of *Mycobacterium genavense* in birds. *Schweizer Archiv Fur Tierheilkunde* 1997;139(9):397-402.
12. Woerpel R W, Roskopf WJ Jr. Retro-orbital *Mycobacterium tuberculosis* infection in a yellow-naped Amazon parrot (*Amazona ochrocephala auropalliata*). *Avian Exotic Practice* 1984;1(3):7-10.
13. Petrak M. A possible case of *Mycobacterium tuberculosis* in a parrot. *AAV Proceedings. International Conference on Avian Medicine*; 1984 Jun 20-1984 Jun 23; Toronto, Ontario, Canada Association of Avian Veterinarians; 1984. p 165-6.
14. Hoop R, Bottger E, Pfyffer G. Etiological agents of mycobacterioses in pet birds between 1986 and 1995. *Journal of Clinical Microbiology* 1996;34(4):991-2.

15. Hart L. Tuberculosis. In : Beveridge W, Hart L, Editors. *Animal health in Australia*> Volume 7. Viral, bacterial and fungal diseases of poultry. Canberra: Australian Government Publishing Service; 1985. p 11-5.
16. Orr BB, Moore EN. Longevity of *Salmonella gallinarum*. *Poult Sci* 1953;32:800-5.
17. Snoeyenbos GH. Pullorum disease. In : Calnek B W, Barnes HJ, Beard CW, Reid WM, Yoder HW Jr, Editors. *Diseases of Poultry*. 9 ed. Ames Iowa USA: Iowa State University Press; 1991. p 87-99.
18. Barr DA, Scott PC, O'Rourke M, Coulter R. Isolation of *Chlamydia psittaci* from commercial broiler chickens. *Australian Veterinary Journal* 1986;63(11):377-8.
19. Arzey G, Arzey K. Chlamydiosis in layer chickens . *Australian Veterinary Journal* 1990;67(12):461.
20. Beveridge W. Chlamydial Diseases. In : Beveridge W, Hart L, Editors. *Animal health in Australia*. Volume 7. Viral, bacterial and fungal diseases of poultry. Canberra: Australian Government Publishing Service; 1985. p 11-5.
21. Phalen DN. *Chlamydia psittaci* infection in birds: a diagnostic dilemma. In: Cross G, Editor. Association of Avian Veterinarians Australian Committee Annual Conference Proceedings; 1998 Oct 8-1998 Oct 10; Canberra ACT Association of Avian Veterinarians Australian Committee; 1998.
22. McElnea CL, Cross GM. Methods of detection of *Chlamydia psittaci* in domesticated and wild birds. *Australian Veterinary Journal* 1999;77(8):516-21.
23. Arzey K, Arzey G, Reece RL. Chlamydiosis in commercial ducks . *Australian Veterinary Journal* 1990;67() p. (9):333-4.
24. Reece RL, Scott PC, Barr DA. Some unusual diseases in the birds of Victoria, Australia. *VETERINARY RECORD* 1992;130(9):178-85.
25. Henning K, Krauss H. Field studies on development of resistance to tetracycline in *Chlamydia psittaci*. *Berliner-Und-Munchener-Tierarztliche-Wochenschrift* 1986;99(11):381-2.
26. Johnson F, Spencer W. Multiantibiotic resistance in *Chlamydia psittaci* from ducks. *Veterinary Record* 1983;112(9):208.
27. Snowdon WA. A review of exotic diseases of parrots. Bureau of Resource Sciences, Department of Primary Industries and Energy, Canberra.; 1995.
28. Pacheco G, Bier O. Epizootie chez perroquets du Bresil. Relations avec la psittacose. *Comptes Rendus Seance De La Societe Biologique*. 1930;105:109-11.
29. Simpson CF, Hanley JE, Gaskin JM. Psittacine herpesvirus infection resembling Pacheco's parrot disease. *Journal of Infectious Diseases* 1975;131:390-6.
30. Gravendyck M, Tritt S, Spenkoch Piper H, Kaleta E F. Antigenic diversity of psittacine herpesviruses: cluster analysis of antigenic differences obtained from cross-neutralization tests. *Avian Pathology* 25(2), June 1996: 345-357, Illustr 1996.

31. Raidal SR, Cross GM, Tomaszewski E, Graham DL, Phalen DN. A serologic survey for avian polyomavirus and Pacheco's disease virus in Australian cockatoos. *Avian Pathology* 1998;27(3):263-8.
32. Reece R, Hartley WJ. The Pathology Registry and some interesting cases. In . *Wildlife Proceedings* Post Graduate Committee in Veterinary Science, University of Sydney, Sydney, Australia. 217-233; 1994. p 217-33.
33. Phalen DN. Further investigation into the aetiology of internal papillomatosis of parrots and detection of birds unapparently infected with Pacheco's disease virus. In: Cross G, Editor. *Association of Avian Veterinarians Australian Committee Annual Conference Proceedings*; 1998 Oct 8-1998 Oct 10; Canberra ACT Association of Avian Veterinarians Australian Committee; 1998.
34. Pierre V, Drouet MT, Deubel V. Identification of mosquito-borne Flavivirus sequences using universal primers and reverse transcription/polymerase chain reaction. *Res in Virol* 1994;145:93-104.
35. Pitigoi D, Popa MI, Streinu-Cercel A. The Epidemiological process of West Nile viral infection. *Bacteriol Virusol Parazitol Epimediol* 1998;43:281-8.
36. Anon. West Nile-Like-Virus-USA (New York City) . [E-mail to (Members of list Pro-Med), 1999].
37. Lundstrom JO. Mosquito-borne viruses in Western Europe: a review. *J Vector Ecol* 1999;24:1-39.
38. Lobigs M, Weir RC, Dalgarno L. Genetic analysis of Kunjin virus isolates using HaeIII and Taq I restriction digests of single-stranded cDNA to virion RNA. *Aust J Exp Biol Med Sci* 1986;64:185-96.
39. Fontenille D, Mathiot C, Coulanges P. The arbovirus-vectors-vertebrates cycles in the Malagasy forests. *Archives De L'Institut Pasteur De Madagascar*. 1986;52: , (1):171-80.