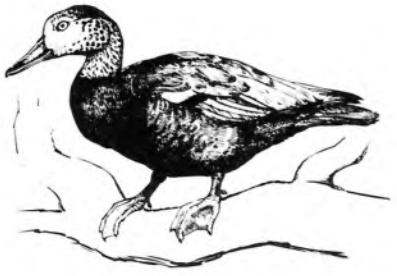
The Epidemiology of Avian Tuberculosis in White-winged Wood Ducks *Cairina scutulata* at The Wildfowl & Wetlands Trust, Slimbridge Centre (1976-91)



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The disease avian tuberculosis is affecting drastically the management of White-winged Wood Ducks Cairina scutulata *in captivity. An epidemiological survey of the disease in adult White-winged Wood Ducks at The Wildfowl & Wetlands Trust, Slimbridge Centre, (1976-91) has been carried out. The disease was recorded in 102 out of 121 (84%)* post mortem *(PM) examinations during the study period. The greatest proportion of deaths from the disease occurred in summer and winter rather than spring and autumn. Although there was no difference in the total numbers of males and females dying of the disease, the greatest number of female deaths occurred during the summer, probably due to the stress of breeding.*

The study highlights the importance of screening for avian tuberculosis in relation to potential reintroduction programmes. Recommendations to control the disease are put forward.

The status and conservation measures to ensure the survival of the White-winged Wood Duck have recently been re-assessed (Green 1992). This assessment includes maintaining birds in captivity, both for research into their biology and in order to sustain a genetically diverse population as an insurance against the extinction of the species in the wild. One of the long-standing problems of managing White-winged Wood Ducks in captivity is the disease avian tuberculosis caused by *Mycobacterium avium* (Mackenzie & Kear 1976, Tomlinson *et al.* 1991, Cromie *et al.* in press (a)). Of six White-winged Wood Ducks sent from Thailand to Slimbridge in 1955, five died of avian tuberculosis (Mackenzie & Kear 1976). Between 1967 and 1970, 23 White-winged Wood Ducks were sent to Slimbridge. Of these birds and their progeny, all except three died, aged six months or over, of avian tuberculosis. Since then the disease has continued to affect seriously the captive breeding programme.

This paper reports an epidemiological study of the disease within adult White-winged Wood Ducks held at The Wildfowl & Wetlands Trust Centre at Slimbridge. The study suggests which factors increase the birds' susceptibility to the disease and hence how it can be controlled.

Materials and Methods

Sixteen years (1976-91) of data on PM examinations of adult White-winged Wood Ducks have been analysed. An adult bird is classed as one that has survived to its first January. Diagnosis of avian tuberculosis was made on macroscopic appearance of tuberculous lesions at PM examination, supported by the detection of acid-fast bacilli in Ziehl-Neelsen stained smears. Avian tuberculosis was the primary cause of death in most cases but those with subclinical infection have also been included in the analyses. All PMs were carried out by the same researcher (MJB). A number of isolates of *M. avium* were made. These were shown by thin-layer chromatography (Jenkins 1980) to be analogous to serotype 1. Statistical analyses have been carried out using Fisher's exact test.

Results

There were 121 deaths in adult White-

winged Wood Ducks during the study period. Of these, 102 birds (84%) had obvious tuberculous lesions at PM. The annual mortality of White-winged Wood Ducks due to avian tuberculosis is shown in Table 1. This rate was consistently high with no significant increase during the study period. In one year, over 60% of the White-winged Wood Ducks in the collection were lost due to the disease. There was no difference in the total numbers of males (51/59) and females (49/60) dying of avian tuberculosis, i.e. there was no sexual predilection for the disease. All the avian tuberculosis deaths were in birds aged 2 years or over.

Table 2 shows avian tuberculosis mortality according to sex and season. There was little difference in total mortality rates according to season. However the greatest proportion of deaths due to avian tuberculosis occurred in winter and summer. These levels were statistically significantly greater than those of spring ($P<0.01$ and $P<0.04$ respectively). The winter level was also significantly greater than that of autumn ($P<0.03$). If the seasonal mortality is broken down into numbers of males and females, female mortality was significantly greater than male mortality in the summer ($P<0.03$). Conversely male mortality was significantly greater than that of females' in the autumn ($P<0.04$).

Table 1. Annual mortality of captive White-winged Wood Ducks at Slimbridge due to Avian Tuberculosis (TB).

	Estimated *n* present	TB PMs/ total PMs		Annual TB mortality
1976	46	8/9	(89%)	17%
1977	53	4/4	(100%)	8%
1978	41	8/14	(57%)	20%
1979	36	3/6	(50%)	9%
1980	52	8/8	(100%)	15%
1981	40	5/5	(100%)	13%
1982	11	7/7	(100%)	64%
1983	5	2/2	(100%)	40%
1984	6	2/4	(50%)	33%
1985	12	1/1	(100%)	8%
1986	14	5/6	(83%)	36%
1987	44	2/5	(40%)	5%
1988	51	12/15	(80%)	24%
1989	33	19/19	(100%)	58%
1990	32	7/7	(100%)	22%
1991	21	9/9	(100%)	43%
Total		102/121	(84%)	mean=26% (se=4.5)

Estimated *n* present = estimated number of captive White-winged Wood Ducks in the Slimbridge collection.

Annual TB mortality = TB cases/estimated number of White-winged Wood Ducks in the Slimbridge collection.

Table 2. Avian Tuberculosis mortality of captive White-winged Wood Ducks at Slimbridge according to sex and season.

Season	Male TB PMs	Female TB PMs	TB PMs/ total PMs	%TB
Spring	14	9	25/33	76
Summer	9	17	26/28	93
Autumn	15	8	23/30	77
Winter	13	15	28/29	97
Total	51	49		

(Total figures omit 3 birds for which no sex or date of death was recorded.)

Discussion

Avian tuberculosis was the main single cause of adult White-winged Wood Duck mortality at The Wildfowl & Wetlands Trust, Slimbridge Centre. The 26% (range 5-64) annual avian tuberculosis-related mortality reflects how long the disease has been prevalent within these birds at Slimbridge and how seriously it has reduced the size of the available gene pool (see Tomlinson *et al.* 1991). The problem is exacerbated as the birds do not breed until they are 2 or 3 years old i.e. an age at which avian tuberculosis deaths occur.

In perching ducks (Cairinini) as a whole, the disease has been recorded in up to 52% of adult PMs (Cromie *et al.* 1991). If the exceptionally high incidence of the disease in this group is a reflection of increased genetic susceptibility, it may be due to the fact, that as perching ducks,

they would normally have less contact with the ground, and therefore mycobacteria, than other wildfowl groups (Hillgarth & Kear 1981). Mycobacterial immunity in the evolution of arboreal species may have exerted less selective influence than in other species. Also, as the birds in captivity are pinioned and spend all of their time at ground level in contact with their own and other birds' droppings, risk of infection is increased. White-winged Wood Ducks are at additional risk as they require a shaded pen to achieve breeding success, where *M. avium* probably thrives in the absence of the sterilising effects of ultraviolet radiation (Hillgarth & Kear 1981).

Mycobacteria live in damp habitats and hence those wildfowl that dabble or dive for food in the water are at greater risk of becoming infected than those that graze on dry land (Cromie *et al.* 1991). As dabbling ducks, White-winged Wood Ducks will ingest large numbers of bacilli whilst feeding. Stress also plays a rôle in both susceptibility to *M. avium* infection and disease progression (Gross *et al.* 1989). Stress may be caused by pinioning, by being kept in unnatural high densities, and by disturbance from either frequent handling or the constant presence of visitors at Slimbridge. The high winter level of avian tuberculosis mortality may be brought on by increased physiological stress during cold spells; cold weather has been shown to be particularly stressful to those captive birds that have evolved in hot climates (Beer 1964, Hillgarth & Kear 1981, 1982, Cromie *et al.* 1991). The higher avian tuberculosis related mortality in females during the summer may be due to the stress associated with producing eggs and subsequent incubation and brooding (Cromie *et al.* 1991). This results in few females dying in the autumn, hence the number of males dying at this time appears proportionally greater. There was no overall sexual predilection for avian tuberculosis confirming the work of Montali *et al.* 1976 and Cromie *et al.* 1991 in other bird species.

The introduction of diseases to wild populations during reintroduction programmes has only recently received the attention it warrants (Captive Breeding Specialist Group, unpublished report 1991, Black in press). If White-winged Wood Ducks are to be released as part of future conservation efforts, they will almost certainly come from the captive birds held in India and Thailand. There have been published (Dehingia 1991) and unpublished reports of deaths probably due to the disease within these birds.

Deaths from avian tuberculosis are affecting seriously the White-winged Wood Duck captive breeding programme at Slimbridge and elsewhere. If it is to succeed, means of rearing healthy avian tuberculosis-free stock by vaccination (Cromie *et al.* 1989, Cromie 1991, Cromie *et al.* in press (b)) and different avicultural techniques, must be developed. Birds should be housed in clean pens with their own water supply, without access to other birds, and with some provision for heating during cold weather. Pens should be stocked with young, preferably full-winged, birds in appropriate social groups and disturbance should be kept to a minimum (particularly to females during the summer). High standards of hygiene need to be maintained and particular attention should be paid to possible contamination from wardens' footwear, crates, feed barrows and so on.

The diagnostic test currently being developed by The Wildfowl & Wetlands Trust (Cromie *et al.* in press (c)) could also be used to screen routinely the birds in captivity to ensure that they remain disease free. Moreover, any birds to be used in reintroduction programmes must be screened throughout their adult lives to prevent spread of the disease to wild populations of not only White-winged Wood Ducks, but other bird species.

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