

THE SUNBIRD

Volume 28 No. 2

June 1998

THE PREVALENCE OF SPENT LEAD SHOT IN WETLAND SEDIMENTS AND INGESTED BY WILD DUCKS IN COASTAL QUEENSLAND

G.S. BAXTER, C. MELZER, D. BYRNE, D. FIELDER and R. LOUITT

ABSTRACT

Ingestion of spent lead shot by waterfowl, leading to lead poisoning, has been recorded in many parts of the world. In Australia most attention has been in the southern states where hunting is more popular than elsewhere, and the assumption has been that, except for a few places, the prevalence of lead poisoning is low. To test this assumption we collected digestive tracts of ducks from four localities and sediments from two wetlands in coastal Queensland where hunting occurs, but where there has been no suggestion that large numbers of birds may be exposed to the possibility of ingesting lead.

We found a high prevalence of lead shot in the gut and sediment samples, suggesting that large numbers of birds may be at risk of lead poisoning, and that the prevalence is greater than the State-prescribed threshold which would trigger a ban on the use of lead shot at some wetlands.

INTRODUCTION

Spent lead shot has been shown to cause death in waterfowl which ingest pellets (Pain 1992), but authors of previous local studies (e.g. Lavery 1971) have concluded that only a small number of birds were likely to be poisoned in Queensland. The number of licenced hunters in Queensland is far fewer than in any other Australian state (Australian & New Zealand Environment & Conservation Council 1996) and there has been a widespread assumption that lead contamination is unlikely to be a serious problem in Queensland. Nonetheless in 1992 Queensland adopted a Nature Conservation (Duck and Quail) Plan which determined that the use of lead shot will be banned at wetlands where more than 5% of an unspecified sample of waterfowl are found with lead shot in their gizzards (Queensland Department of Environment & Heritage 1995).

The study reported here was aimed at obtaining information on the prevalence of lead in both wetland sediments and waterfowl digestive tracts to aid in management of waterfowl hunting.

METHODS

Wetlands with a known history of waterfowl hunting were subjectively selected for study with the assistance of members of the Queensland Field and Game Association Inc. These people advised that most ducks are likely to be taken in the first few days of the season. Since we relied on hunters to supply us with carcasses, members of our team collected ducks on the first three days of the 1996 duck season which began on 29 June. We collected ducks from wetlands at Greenlakes, Rockhampton (23° 1'S, 150° 32'E) and Plantation Creek, Ayr (19° 40'S, 147° 25'E). We also received ducks and/or their digestive tracts from two other wetlands; one near Maryborough and the other near Lake Manchester, close to Ipswich. The digestive tracts of ducks were removed and searched for lead shot. Only shot gun pellets found inside the digestive tract were counted. We did not examine whole carcasses for subcutaneous pellets, or attempt any diagnosis of lead poisoning. Across all four sites we collected six species, namely Pacific Black Duck *Anas superciliosa*, Grey Teal *A. gracilis*, Chestnut Teal *A. castanea*, Australasian Shoveler *A. rhynchotis*, Australian Wood Duck *Chenonetta jubata* and Hardhead *Aythya australis* (Table 1).

We planned to visit these four wetlands in September 1996 to obtain sediment samples for examination. However, between the time the ducks were collected and the end of the hunting season, co-operation from the hunters was withdrawn. Since we required the assistance of hunters to locate two of these wetlands we were neither able to definitively identify, nor take sediment samples from, wetlands at Maryborough and Ipswich.

We visited Greenlakes and Plantation Creek during the period 24-26 September 1996. At each wetland we took thirty samples of the top 5 cm of sediment (each 1.8L) with either a bottom grab sampler or a spade, depending on water depth. Sample sites were located haphazardly in clear water where hydrophytes would not clog the sampler. Samples were passed through a 2mm sieve and examined *in situ*. This sieve retained all shot gun pellets (numbers 4 to 7) which could be used to hunt waterfowl.

RESULTS

A single lead pellet was found somewhere in the digestive tract in 8 of 59 ducks examined (Table 1). Only one pellet was found in the hindgut, in a Pacific Black Duck: all others were found in the gizzard. Ingested lead pellets were found in birds collected at each wetland, but the proportion which had ingested any lead

TABLE 1. Number of ducks with ingested lead pellets. Only one pellet was found in any bird.

Location	Pacific Black Duck		Hardhead		Grey Teal, Chestnut Teal, Shoveler and Wood Duck		All species	
	No. sampled	No. affected (%)	No. sampled	No. affected (%)	No. sampled	No. affected (%)	No. sampled	No. affected (%)
Ipswich	20	1(5.0)	1	0	4	0	25	1(4.0)
Plantation Creek	1	0	3	2(66.7)	2	0	6	2(40.0)
Maryborough	9	4(44.0)	0	0	1	0	10	4(40.0)
Greenlakes	11	1(9.0)	4	0	3	0	18	1(5.5)
Total	41	6(14.6)	8	2	10	0	59	8(13.6)

pellets varied greatly from 4% to 40% (Table 1). However, the sample size from Plantation Creek was small (Table 1).

A significantly greater proportion of sediment samples at Plantation Creek (33%) contained one or more lead pellets than at Greenlakes (3%; $Z = 3.29$, $P = 0.001$). All affected samples from both wetlands had a single lead pellet, except for one sample from Plantation Creek which had three pellets.

DISCUSSION

The number of digestive tracts examined at some wetlands was relatively small; hence statistical inference should not be drawn from the findings. Further, since we have no data on the movement of ducks, there can be no inference about the origin of lead found in digestive tracts. However, the prevalence of ingested lead should be viewed as minimum estimates since data were obtained by manual examination of the duck gut contents. Overseas studies, which compared different methods of detecting lead in the digestive tract of waterfowl, found that manual examination underestimated the number of lead shot present by 20-25% (Anderson & Havera 1985) because small, eroded shot may be obscured by grit, food and the muscular wall of the gizzard (Sanderson & Bellrose 1986). However, even these underestimates indicate that the new Queensland Duck and Quail Conservation Plan (1992) would call for a ban on the use of lead shot at the Plantation Creek, Maryborough and Greenlakes wetlands.

The results from the gut analyses are supported by the findings from the sediment analyses. At each wetland we collected only 54L of sediment, yet at Plantation Creek we found twelve pellets, suggesting that there is a high residual lead load in sediments at that wetland. If a similar density of pellets is found in the top 5 cm of sediment over 1 ha of that wetland, there could be as many as 67 000 pellets potentially available for waterfowl to ingest in a single hectare.

A large amount of spent lead shot is likely to be deposited in wetlands each year, even in Queensland where hunting does not occur on State owned land, and is more *ad hoc* than hunting in other states (Australian & New Zealand Environment & Conservation Council 1996). For example the minimum estimate of the total legal Queensland duck harvest in 1994 was 13 842 (Queensland Department of Environment & Heritage 1995). If, for example, only two cartridges were expended for each bagged duck then, depending on the size of shot used, between 7 and 8 million pellets may be released into wetlands annually.

Ingestion of a single lead pellet is sufficient to cause lead poisoning in some cases (Sanderson & Bellrose 1986). However, the susceptibility of any bird to lead poisoning generally increases with decreasing bird size, the degree to which the

bird feeds in a manner likely to pick up spent shot, and the paucity of protein and phosphorus in the bird's diet (Sanderson & Bellrose 1986).

ACKNOWLEDGEMENTS

This project would not have been possible without co-operation and funding from Queensland Department of Environment, or without assistance from Greg Mitchell and Alan Bott (Queensland Field and Game Association Inc.) and land-holders who granted permission for us to enter their properties. The comments of two reviewers improved our original manuscript.

REFERENCES

- ANDERSON, W.L. & HAVERA, S.P. 1985. Blood lead, protoporphyrin, and ingested shot for detecting lead poisoning in waterfowl. *Wildl. Soc. Bul.* 13: 26-31.
- AUSTRALIAN AND NEW ZEALAND ENVIRONMENT COUNCIL 1996. *A discussion paper on alternatives to the use of lead shot in duck hunting in Australia*. Canberra: Australia and New Zealand Environment Council.
- HARPER, M.J. & HINDMARSH, M. 1990. Lead poisoning in magpie geese *Anseranas semipalmata* from ingested lead pellets at Bool Lagoon Game Reserve (South Australia). *Aust. Wildl. Res.* 17: 141-145.
- LAVERY, H.J. 1971. Lead poisoning as a possible cause of death in waterfowl in Northern Queensland. *Emu* 71: 138-139.
- NORMAN, F.I. 1976. The incidence of lead shotgun pellets in waterfowl (Anatidae and Rallidae) examined in south-eastern Australia between 1957 and 1973. *Aust. Wildl. Res.* 3: 61-71.
- NORMAN, F.I., GARNHAM, J.S. & LOWE, K.W. 1993. Further notes on lead concentration in tissue of waterfowl in Victoria. *Wildl. Res.* 20: 621-624.
- PAIN, D.J. 1992. National Reports. In *Lead poisoning in waterfowl*, pp.86-94. Proc. IWRB workshop, Brussels, Belgium 1991. Slimbridge: IWRB Special Publication 16.
- QUEENSLAND DEPARTMENT OF ENVIRONMENT AND HERITAGE. 1995. *Nature conservation (duck and quail) conservation plan 1995-2000*. Brisbane: QDEH.
- SANDERSON, G.C. & BELLROSE, F.C. 1986. *A review of the problem of lead poisoning in waterfowl*. Champagne Illinois: Special publication No.4, Illinois Natural History Survey.
- G.S. BAXTER, C. MELZER, D. BYRNE, D. FIELDER & R. LOUITT. Department of Natural and Rural Systems Management, The University of Queensland, Gatton College, Q 4345.