Some notes on Freckled Duck shot in Victoria, Australia, 1981

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Introduction

The status of the Freckled Duck *Stictonetta naevosa* in Australia is equivocal. Frith (1965) considered that the species was not numerous and that a relatively few permanent swamps, mainly in inland New South Wales, supported the main population. Destruction of habitat could cause a further decline in their insecure position and certainly the species is amongst the less common Australian anatids (e.g. Frith 1967, 1973). Though usually seen in 'family' groups or small numbers, larger concentrations occur, particularly in drier periods, and these may be well outside the species' accepted breeding range. Whilst Lowe & Lowe (1974) noted that the Freckled Duck could be seen regularly in the wetlands of the Kerang area, the species is considered to be rare within Victoria (Wheeler 1967). Thus, of 18,645 ducks, or wings from shot birds, examined in hunters' bags at Victorian sites from 1972 to 1979 (Braithwaite & Norman 1974, 1976, 1977 and unpub.) only 98 (0·5%) were from Freckled Ducks. However, in mid and late 1979 relatively large numbers were found on some wetlands in south-eastern Australia, including South Australia and Victoria, and considerable numbers were shot on the 1980 opening day at some sites in Victoria (198, 4·5% of wings examined, Norman, unpublished data) and at Bool Lagoon in South Australia (Reid 1980). Freckled Ducks were still present on some Victorian wetlands in mid and late 1980 and early 1981 (Corrick 1981) and many were shot on the opening day of the 1981 season.

This note summarizes some observations made on carcases collected on 7 March 1981, the Victorian opening day, at Lake Albacutya (a large generally open, waterbody on the northern end of the Wimmera River in north-western Victoria), Cullen's Lake (c. 600 ha, permanent, shallow, open and moderately saline wetland near Kerang) and Lake Mokoan (c.80,000 ha, regulated, generally shallow, freshwater impoundment in north-eastern Victoria, with flooded and dead timber, extensive open water and grazed edges).

Methods

Freckled Ducks were collected from the water or along the shorelines, and represented only samples of the birds left by hunters. Those obtained at Cullen's Lake and Lake Mokoan were chilled or frozen before later examination, but most ducks from Lake Albacutya were partially processed on site before cooling. The ducks were sexed and aged using cloacal differences and plumage characters, and weighed. Wing chords (right wing, except when damaged), bill length (to start of feathers), middle toe and tarsus were measured. The intensity of the red colouration at the base of the upper mandible on each male, presumed to result from proliferating blood vessels (Frith 1965), was classified as ranging from nil to bright.

Gonads were stored in 5% formal saline. Testes were roll-dried and weighed in pairs, and their maximum lengths and breadths measured, before sectioning (5–7 μ) and staining (haematoxylin-eosin). The diameters of five seminiferous tubules were measured from each testis. Stages of spermatogenesis were scored following Braithwaite & Frith (1969). The maximum diameters of the five largest ovarian follicles were also measured.

The presence of moult in both remiges and rectrices, and in the major body tracts were examined as detailed in standard Royal Australasian Ornithologists' Union moult cards. Scoring procedures followed the RAOU system but in addition the amount of wear on primaries was estimated and categorized into four classes, from no wear (1) to severely worn (4), following Braithwaite & Norman (1974). To some extent, this assisted in the determination of new feathering when traces of feather sheaths were absent. Incidences of moult in body tracts were also subjected to cluster analyses. Records were scaled (no moult—active moult) and affinities between tracts were determined using Bray Curtis dissimilarity indices; dendrograms were then produced by flexible sorting (Clifford & Stephenson 1975).

In statistical tests used below, a 95% level of significance has been adopted.

Results

General

All birds examined were classified as adults. Sex ratios varied (but not significantly) between sites (Lake Albacutya, n = 19 females, 27 males; Cullen's Lake, 52, 63; Lake Mokoan, 14, 7) but averaged 1:0·9 in favour of males.

Weights of males ranged from 800 to 1,200 g, and females from 640 to 1,000 g, the latter being lighter on average (Table 1). Distribution of weights in 50 g classes are shown in Figure 1. Wing and bill lengths, toe and tarsal measurements were all larger in males (Table 1): within both sexes there were no significant differences in measurements between sites.

Bill colouration scores were made on 97

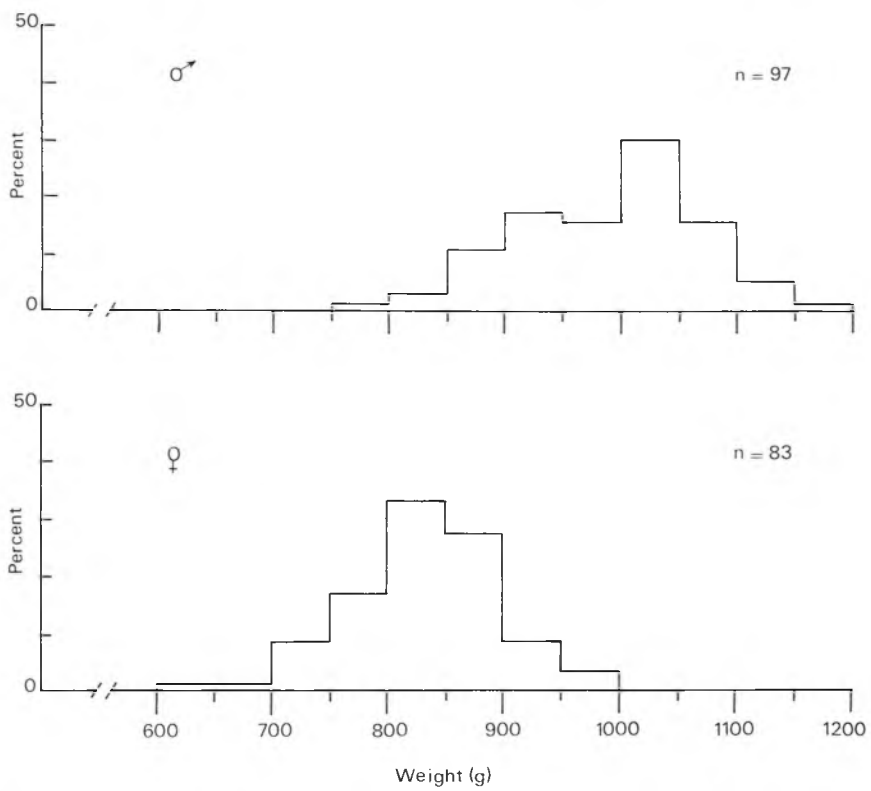

Figure 1. Weights of male and female Freckled Duck shot in Victoria, opening day 1981.

Table 1. Parameters from Freckled Duck collected in Victoria, 1981.

	Weight (g)			Wing (mm)		Bill (mm)		Toe (mm)		Tars. (mm)	
	n	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.	$\bar{x}$	S.E.
Males											
L. Albacutya	27	978	16·6	238	1·1	58·0	0·4	61·1	0·4	49·7	0·8
Cullen's Lake	63	1,000	9·5	232	0·7	56·1	0·2	61·7	0·3	46·8	0·3
L. Mokoan	7	1,000	27·2	231	6·3	55·7	0·6	61·8	0·7	47·8	1·0
All birds	97	994	7·9	234	0·7	56·6	0·2	61·5	0·2	47·6	0·3
Females											
L. Albacutya	18	816	16·3	227	1·0	51·7	0·3	57·9	0·5	45·1	0·4
Cullen's Lake	52	851	8·8	220	0·9	51·0	0·3	57·6	0·3	44·6	0·4
L. Mokoan	14	827	13·8	223	1·1	51·7	0·5	57·1	0·7	44·4	0·4
All birds	83	839	7·0	222	0·7	51·3	0·2	57·6	0·2	44·6	0·3

Note. The sample for weight and wing length of females at Cullen's Lake was only 51.

males; of these 6 had no colour, 6 very slight, 46 slight, 1 slight/medium, 35 medium, 2 medium/bright and only 1 was scored as bright.

Moult

The incidence and inter-relationship of moulting body feathers, within the 15 tracts used in the RAOU system, has been summarized for males and for females separately in Table 2. The table indicates the coincidence of active moult within the series of paired tracts. It is apparent that in both sexes replacement of some feathers was taking place in most tracts, to a varying extent, in many of the birds examined. Thus of the 97 males and 83 females, only 8 and 15 respectively showed no body moult. In both sexes the incidence of moult was higher on and around the head (crown, forehead, throat, etc.) and lower around the rump. The absence of sequential samples (and difficulties associated with the determination of new feathers) precluded detailed determination of rates and sequence of replacement. Nevertheless, an attempt was made to identify groups of tracts in which the incidence of moult was similar, and thus presumably temporally related. Cluster analyses, in which the occurrence of moult in the various tracts was successively compared, provided a measure of similarity between tracts. In Figure 2 levels of similarity are indicated by the junctions of the lines—the dissimilarity index is lower when the association between the indicated tracts is higher. The analyses for males suggested at least three centres of activity—the head region, and upper and lower surfaces. Within these areas, neighbouring tracts were also generally associated. Details for females were, however, more confused. Whilst the head region was generally segregated, other centres were less obvious and tracts did not show comparable associations.

Few birds (19 males, 18 females) had missing or growing tail feathers. Apart from a slightly higher (23 of 81) replacement taking place in the central pair of feathers, no sequence was apparent. Generally, birds replacing tail feathers were also moulting in the upper and lower tail coverts and some ducks (8 males, 2 females) were also growing inner secondaries.

Only three birds (2 males, 1 female) showed active primary moult, all of these involved the distal three or four primaries

Table 2. Incidence and inter-relationship between moulting body feathers in generalised tracts, all sites combined (97 males and 83 females examined).

Females → / Males ↓	Nape	Mantle	Rump	Scapular	Upper t.c.	Throat	Breast	Belly	Flanks	Under t.c.	Crown	Forehead	Ear	Malar	Chin	Tract total (males)
Nape	—	20	6	13	13	21	18	12	16	13	18	17	12	10	9	34
Mantle	26	—	7	17	17	23	21	12	19	13	18	19	12	12	11	38
Rump	14	17	—	6	6	7	6	4	6	5	8	7	7	8	5	17
Scapular	22	26	17	—	15	19	14	10	14	11	17	18	11	14	10	38
Upper t.c.	23	28	15	28	—	18	15	8	12	11	15	17	8	11	7	39
Throat	29	32	16	28	29	—	22	13	20	16	23	25	15	18	15	53
Breast	20	24	13	21	22	28	—	15	19	14	20	22	12	11	11	37
Belly	14	16	8	14	13	19	23	—	13	11	14	13	8	6	6	27
Flanks	16	21	11	22	22	29	23	20	—	14	17	17	10	12	10	35
Under t.c.	16	16	11	18	19	20	15	14	18	—	14	14	10	14	8	24
Crown	28	32	16	30	32	40	28	18	27	18	—	33	21	24	12	59
Forehead	27	32	16	31	31	40	27	18	27	20	51	—	23	23	13	58
Ear	23	27	13	23	22	33	18	11	15	14	33	34	—	18	10	42
Malar	20	26	11	26	23	32	18	12	18	14	34	35	36	—	14	43
Chin	22	23	14	19	23	32	18	13	18	16	27	28	23	22	—	33
Tract total (females)	25	27	10	23	23	33	26	16	24	20	46	43	27	33	18	

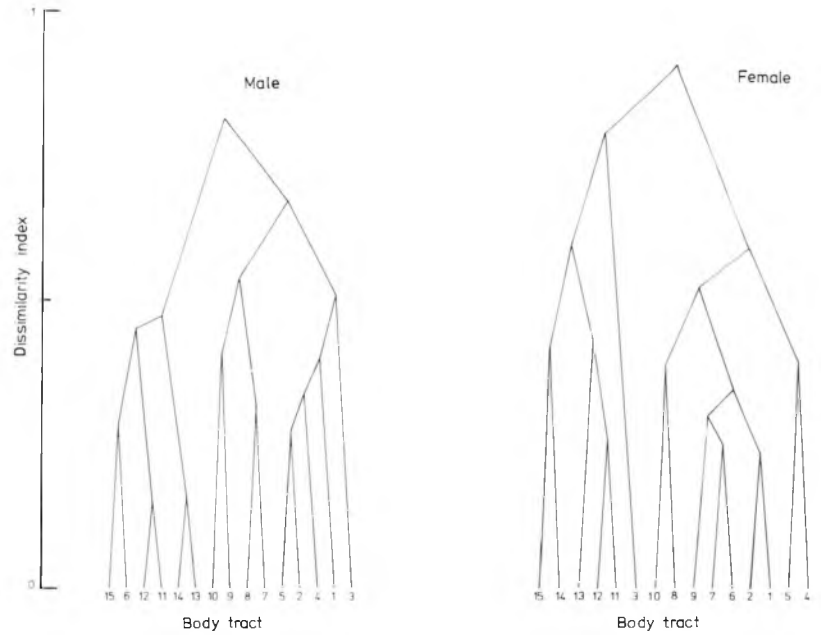

Figure 2. Dendrograms of incidence of moult in body tracts as determined from cluster analyses. Body tract 1 = nape; 2 = mantle; 3 = rump; 4 = scapulars; 5 = upper tail coverts; 6 = throat; 7 = breast; 8 = belly; 9 = flanks; 10 = under tail coverts; 11 = crown; 12 = forehead; 13 = ear; 14 = malar; 15 = chin.

and they were generally in the latter stages (3 and 4) of growth. Apparently secondary regeneration is not exactly coincident with primary moult since only one bird had substantial replacement of secondaries also taking place. Body moult was either absent or reduced in the ducks replacing primaries and only one showed a concurrent moult of central tail feathers.

Missing or growing secondaries were more frequent in the samples. Whilst only one bird (which was also replacing some primaries and tail feathers) had an outer series of secondaries part-grown, others had feathers missing or in pin. Of the 21 ducks (16 males, 5 females) showing moult in the secondaries, most replacement feathers (43 of 64 records) were of the inner secondaries. Often secondary moult was also associated with tail moult (10 birds) and little body moult; nine birds were also showing replacement of secondary coverts. As in the case of primaries, many birds had apparently recently replaced secondaries.

The distribution of wing wear scores, in classes 1–4, was similar in both sexes. Thus 43·6 and 41·5% of 94 males and 82 females had unworn, relatively new, primaries (class 1) and 23·4 and 28·0% had worn (class 3) primaries; no males and only four females were considered to have severely worn (class 4) primaries. There was no significant difference in weights of birds (F-test) in classes 1–4 but the two moulting males (at 905 g) were somewhat lighter than other males; females with very worn (class 4) primaries were also lighter on average than females with less-worn primaries (Table 3).

The relatively few (12) males with no, or very slight, colouring on the upper bill base had older primaries showing some wear (classes 2–3, 11 birds) whilst ducks with slight (43), slight/medium (1), or medium (35) colouration included comparatively more with unworn primaries (class 1, 38 birds), and the two males with primaries in moult had a slightly-coloured bill. Birds with reduced bill colouring (none or very slight) also had slightly more body tracts per bird in moult (average 6·8) than those with slight (6·3) or medium (5·2) colour, though within-group variation was large and differences were not significant.

Some birds showed considerable staining of the underparts, particularly breast and belly feathers, as seen in other Victorian waterfowl and recorded in Queensland by Lavery (1962).

Reproductive status

Weights, maximum lengths and breadths of testes collected at all sites (Table 4) showed no significant variations between sites (F-test). In general, testes were approximately ovoid or pear-shaped and reduced in size. Histologically, all testes showed minimal reproductive activity, and tubule diameters were small. All had primary spermatocytes present and necrosis generally was uncommon. Thus most birds were scored 2A–D, following Braithwaite & Frith (1969). In all birds with undamaged tunica albuginea (82) there appeared to be two layers, similar to the situation described by Marshall & Serventy (1957) for the shearwater *Puffinus tenuirostris*, suggesting perhaps that all males were adults whose testes had recently regressed.

Comparison of average testes weights and wing wear, for all sites combined, showed that though those with unworn primaries (class 1) had heavier paired testes weights (average = 0·238 g, ± S.E. 0·011, n = 38) than those with worn feathers (class 3, 0·195 g ± 0·011, 16) differences were not significant. However, the two birds with part-grown primaries had paired testes weight of only 0·155 g.

Males with little or no red colouration at the base of the upper mandible had lighter testes (average 0·188 g, ± 0·14, n = 10) than those considered to have slight (0·197 g, ± 0·007, 39) or medium colouring (0·245 g, ± 0·013, 32), and the three birds with brighter bases had heavier gonads (0·366 g, ± 0·05). Such differences were significant (F-test).

Maximum follicular diameters were similar at all sites (Table 4), and most ovaries showed minimal external development. There was no significant difference between birds with unworn and worn primaries, though the few birds in the latter group tended to have generally smaller follicles.

Discussion

The samples of Freckled Ducks shot at three wetlands on the opening day of the 1981 Victorian duck season proved to be adult birds, a result similar to those found in other recent surveys (Norman, unpublished data). In this instance all birds were uniformly in a non-breeding condition. Gonad development in both sexes was minimal; the largest and heaviest paired

Table 3. Comparison of weight and primary wear (1 = unworn, 4 = severely worn; M = moulting).

	Wear stage				
	1	2	3	4	M
Males					
Average weight (g)	1,005·5	1,009	958·2		905
S.E.	11·96	14·01	15·55		45
Sample size	41	30	22		2
Females					
Average weight (g)	842·8	846·4	845·2	757·5	800
S.E.	10·88	13·26	11·49	43·28	
Sample size	34	21	23	4	1

Table 4. Gonad details (± S.E.) for individual and all sites combined.

	Lake Albacutya		Cullen's Lake		Lake Mokoan		All Sites	
	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n	$\bar{x}$	n
Males								
Paired testes weight (g)	0·19 (±0·01)	20	0·23 (±0·01)	60	0·23 (±0·04)	5	0·22 (±0·07)	85
Testes lengths (mm)	1·20 (±0·03)	20	1·24 (±0·02)	62	1·19 (±0·06)	7	1·23 (±0·15)	89
Testes breadths (mm)	0·47 (±0·01)	20	0·47 (±0·01)	62	0·47 (±0·03)	7	0·47 (±0·01)	89
Tubule diameters (mm)	0·046 (±0·002)	21	0·051 (±0·001)	62	0·046 (±0·002)	7	0·05 (±0·001)	90
Females								
Maximum follicle diameters (mm)	2·32 (±0·09)	10	2·57 (±0·05)	51	2·61 (±0·08)	14	2·55 (±0·038)	75

testes were inactive and weighed considerably less than those recorded as active in Braithwaite & Norman (1976); the ovaries were similarly undeveloped. Nevertheless, the birds' weights were high in relation to earlier reports (e.g. Frith 1967) and most had large fat deposits, indicative of a good general condition.

Whilst the role of the red colour on the proximal portion of the upper bill is not understood, it is apparently associated with breeding. Known to develop fairly rapidly (in about three weeks), and to persist for some months, the colour disappears after the end of the breeding season (Frith 1965, 1967; Reader's Digest 1976). In this regard the species resembles the changes in bill colour noted in the Black-headed Duck *Heteronetta atricapilla*, which develops a bright orange-red area during the breeding season (Johnsgard 1967). However, Freckled Ducks with red bills (though with no indication of intensity) have been recorded in Victoria in various months outside the presumed breeding season (December–February, April and July; Lowe & Lowe 1974; Corrick 1981). Certainly, in this study, few birds had markedly red bases and there was a positive relationship between intensity of bill colour and gonad size; additionally, males with more obvious colouration included a greater proportion with unworn, apparently new primaries. This feature must surely, since it is variable, persistent for some time, and related to breeding, act as a dimorphic feature (cf. Frith 1965) and its role in aspects of reproductive behaviour would warrant investigation (see also Johnsgard 1965).

Replacement of feathers within body tracts was occurring on most birds examined, whilst fewer showed moulting or growing wing or tail feathers. Indeed over 40% of birds had unworn, apparently recently replaced, primaries and secondaries. Such data do not suggest a simultaneous moult of wings, tail and body feathers as is considered typical of anserines (Weller 1976), though in the Freckled Ducks examined, the body moult may have been in the course of completion. In other recent samples of wings from Freckled Ducks (Braithwaite & Norman 1977, 1981) most had replaced primaries before open seasons in March.

Undoubtedly the Freckled Ducks shot on Lakes Albacutya and Mokoan, at Cullen's Lake, and indeed elsewhere in Victoria on the 1980 and 1981 opening days, originated from outside of the state since there are currently few records of the species breeding within it. Recent records of Freckled Duck (Corrick 1981) in Victoria have been within, and extending considerably beyond, the accepted breeding period in inland New South Wales, August or September to November or December (Braithwaite 1976; Braithwaite & Frith 1969; Frith 1965; Reader's Digest 1976). Such records presumably refer to a part of the population normally breeding inland but which have left for non-breeding habitat, provided by some more permanent wetlands in Victoria, because of the prevailing dry conditions. Certainly the recent occurrences of large concentrations have been on open, mainly permanent, waters with little emergent vegetation which differ from the presumed preferred breeding habitat of wetlands with substantial areas of cover, provided by cumbungi (*Typha* sp.), lignum (*Muehlenbeckia cunninghami*) and tea-tree (*Leptospermum* sp.) (see Braithwaite 1976; Reader's Digest 1976). For a species considered as rare or endangered, whose population size and distribution is so poorly understood that its status can only be considered as indeterminate (Cowling 1978), and whose exact taxonomic status is not finally resolved (e.g. Johnsgard 1965), there is an urgent need for further information. Not the least important is the necessity to determine the extent to which the present illegal levels of shooting affects the species.

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Summary

Freckled Duck *Stictonetta naevosa* shot on the opening day of the 1981 Victorian hunting season were collected from Cullen's Lake, and Lakes Albacutya and Mokoan. Most birds were weighed, sexed and aged, and bill, wing, mid-toe and tarsal measurements taken. The presence of moult in major feather tracts was recorded, as was wear of primaries; gonads were removed and examined. All birds were adult, in

non-breeding condition, and many showed body moult. Few birds were replacing primaries (though many had apparently new feathers) but missing and growing secondaries were more frequent as was the incidence of tail moult. The development of the red colouration of the base of the upper mandible of males was variable; whilst few bases were markedly bright, testes weights increased with intensity of the colouration.

It is presumed that birds examined were shot on non-breeding habitat, having dispersed from drought-affected areas elsewhere. Since the species' status is not clear, the importance of further studies is emphasized since illegal shooting in drier periods may seriously affect population security.

References

Braithwaite, L. W. 1976. Notes on the breeding of the freckled duck in the Lachlan River valley. *Emu* 76: 127–32.

Braithwaite, L. W. & Frith, H. J. 1969. Waterfowl in an inland swamp in New South Wales. III Breeding. *CSIRO. Wildl. Res.* 14: 65–109.

Braithwaite, L. W. & Norman, F. I. 1974. The 1972 open season on waterfowl in south-eastern Australia. *CSIRO Div. Wildl. Res. Tech. Paper* no. 29.

Braithwaite, L. W. & Norman, F. I. 1976. The 1973 and 1974 open seasons on waterfowl in south-eastern Australia. *CSIRO Div. Wildl. Res. Tech. Memo.* no. 11.

Braithwaite, L. W. & Norman, F. I. 1977. The 1975 and 1976 open season on waterfowl in south-eastern Australia. *CSIRO Div. Wildl. Res. Tech. Memo.* no. 13.

Braithwaite, L. W. & Norman, F. I. 1981. The 1977 and 1978 open seasons on waterfowl in south-eastern Australia. *CSIRO Div. Wildl. Res. Tech. Memo.* (in press).

Clifford, H. T. & Stephenson, W. 1975. *An introduction to numerical classification.* New York: Academic Press.

Corrick, A. H. 1981. Freckled duck on lakes in the Western District, Victoria. *Aust. Bird Watcher* 8: 254–5.

Cowling, S. J. 1978. The status of endangered waterfowl and wetlands in Australia. Pp. 123–31 in *The status of endangered Australasian wildlife.* Adelaide: Royal Zoological Society of South Australia.

Frith, H. J. 1965. Ecology of the freckled duck, *Stictonetta naevosa* (Gould). *CSIRO Wildl. Res.* 10: 125–39.

Frith, H. J. 1967. *Waterfowl in Australia.* Sydney: Angus and Robertson.

Frith, H. J. 1973. *Wildlife Conservation.* Sydney: Angus and Robertson.

Johnsgard, P. A. 1965. Observations on some aberrant Australian Anatidae. *Wildfowl Trust Ann. Rep.* 16: 73–82.

Lavery, H. J. 1962. Plumage stains on wild ducks in north Queensland. *Qld. J. Agric. Sci.* 19: 433–4.

Lowe, V. T. & Lowe, T. G. 1974. The freckled duck in Victoria. *Aust. Bird Watcher* 5: 175–81.

Marshall, A. J. & Serventy, D. L. 1957. On the post-nuptial rehabilitation of the avian testis tunic. *Emu* 57: 59–63.

Reader's Digest. 1976. *Complete book of Australian birds.* Sydney: Reader's Digest Services.

Reid, N. 1980. Requiem for the freckled duck. *Bird Observer* no. 581: 44.

Weller, M. W. 1976. Molts and plumages of waterfowl. Pp. 34–38 in F. C. Bellrose, *Ducks, geese and swans of North America.* Harrisburg: Stackpole.

Wheeler, W. R. 1967. *A handlist of the birds of Victoria.* Melbourne: Victorian Ornithological Research Group.

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