

BREEDING OF BLACK SWANS ON TWO NEW ENGLAND LAGOONS

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The breeding of Black Swans *Cygnus atratus* on Llangothlin Lagoon Game Reserve and Little Llangothlin Nature Reserve both during and after the 1981-1983 drought is reported. Breeding success rates ranged up to 47% during the drought and 68% afterwards. A possible link between low breeding activity, hunting pressures, and the legal status of the lagoons is discussed.

INTRODUCTION

Llangothlin Lagoon Game Reserve and Little Llangothlin Nature Reserve lie just over a kilometre apart on the New England Tablelands of New South Wales at an altitude of 1360m (Llangothlin Lagoon grid reference: 9 237-800 730 Guyra Sheet 9 237 (Edition 1) National Topographical Map Series). Llangothlin Lagoon has an approximate surface area of 400 ha and Little Llangothlin of 80 ha. Both have extensive areas of emergent macrophytes and the vegetation community, even after a severe drought, remains substantially as described by Briggs (1977, 1979).

The years 1979 to 1981 were ones of general drought in much of south-eastern Australia and the New England region of NSW had lower than average rainfall in each of these years (N. Elphinston pers. comm.).

Both lagoons were dry for an undetermined period of several months in the summer of 1980-1981 but both began filling in June 1981 and retained fluctuating levels of water until the drought broke in the autumn of 1983. They first overflowed in June 1983 and continued to do so for the rest of the study period with Llangothlin Lagoon reaching a maximum approximate depth of 2m at the end of January, 1984.

Black Swans *Cygnus atratus* bred on both lagoons after inundation. Breeding success is discussed in relation to the management of these two lagoons, to the hunting of other avian species and the legal status of the lagoons.

METHODS

Fifty-six "walk-around" censuses of Llangothlin Lagoon and Little Llangothlin Lagoon were made between June 1981 and February 1984 at not more than monthly intervals. Observations were made using 7 x 50 binoculars. Censuses began at sunrise on Llangothlin, and Little Llangothlin was censused on the same day beginning shortly after completion of the Llangothlin census except on three occasions when conditions did not allow this.

All waterbirds were censused but only the data collected for Black Swans are recorded here. Active nests were also recorded: a nest was regarded as active if an adult swan was in attendance. After hatching the number of broods was counted and, when feasible, the number of cygnets in each brood. Broods and brood sizes continued to be counted until they could no longer be recognised as such with confidence. A breeding period was regarded as being between the first sight of new nests and fledging of

cygnets which occurs three to four months after hatching (see Braithwaite 1981).

Because clutch sizes are unknown for all except one breeding season, success rate was based on the maximum number of nests seen at any one time and the number of broods known to have survived past fledging.

RESULTS

Nest Sites and Material;

Density of Breeding Pairs

Swans were present on both lagoons throughout the study. (Llangothlin: \bar{x} = 95, range 2-184; Little Llangothlin: \bar{x} 129, range 13-379).

Swans on Llangothlin Lagoon always nested in *Fleocharis sphacelata* swamp and used *Eleocharis* as nest material. Swans on Little Llangothlin usually nested in *Glyceria* sp. swamp and constructed the nests of *Glyceria*; only rarely were nests sited in and constructed of *Eleocharis*. The three small islands in Llangothlin Lagoon were not used for nest sites. All nests were constructed in water at both lagoons and there was no evidence of a clumped distribution in the available habitat. The maximum density of breeding pairs at Llangothlin was 0.14 pairs/ha in the spring of 1981 and for Little Llangothlin

1.1 pairs/ha in the winter of 1982. Densities are based on the estimated area of potentially suitable nesting habitat.

Timing of Breeding

Three major episodes of breeding occurred commencing in September 1981, April 1982 and May 1983.

A fourth episode began in January 1983 but the nests were later abandoned (See Table 1). Spasmodic breeding involving one to three pairs occurred at other times. All major breeding episodes were preceded by at least one month of rising water levels (See Figure 1).

Synchronisation of Breeding

Commencing in May 1983 swans bred synchronously on the two lagoons. The first nests were seen on 10 May at Little Llangothlin and the first ones at Llangothlin on 26th May. Nest building within lagoons was spaced over six weeks. Major breeding beginning in September 1981 only occurred on Llangothlin (one brood was hatched on Little Llangothlin) and the breeding events beginning in April 1982 and January 1983 were confined to Little Llangothlin. Five broods were produced between June

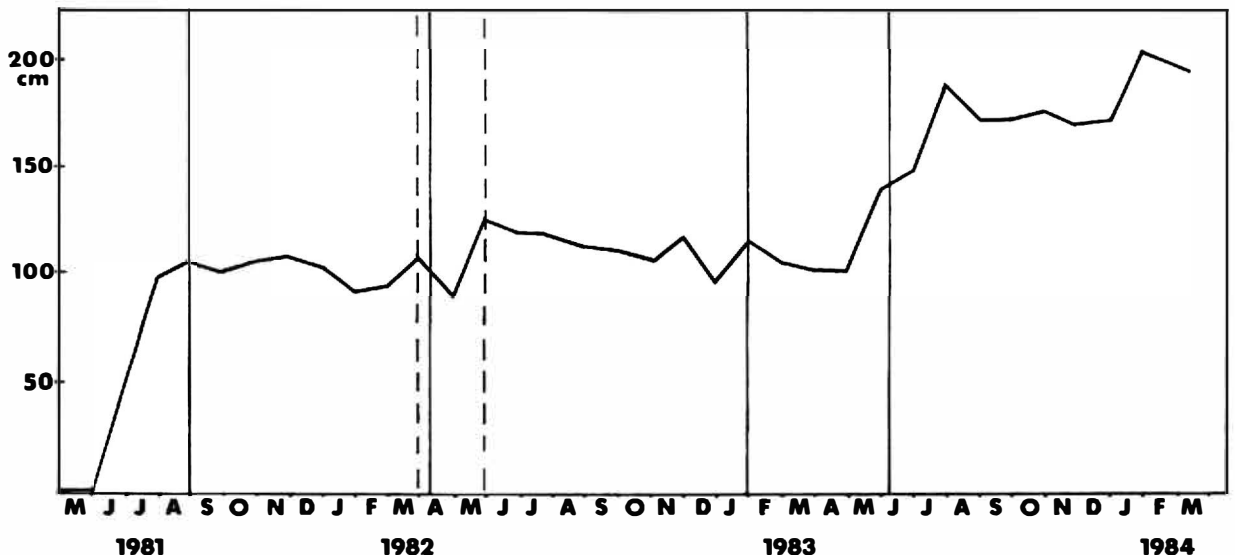


Figure 1. Water levels at Llangothlin Lagoon, June 1981 to March, 1982. Solid vertical lines denote onset of breeding season. Dashed vertical lines denote 1982 duck hunting season. Water height in centimetres.

TABLE 1

Percentage of Nests which produced cygnets surviving past fledging.

Nesting Commenced		No. x	Swans Range (a)	No. Nests	No. Broods Hatched†	No. Broods Fledged†	Success %	Site
September	1981	110	34-159	43	7 (3.0)	3 (3.7)	7	LGR
April	1982	195	110-379	43	33 (3.1)	20 (3.3)	47	LLNR
		85	39-181*	0				LGR
January	1983	124	51-191	16	0	0	0	LLNR
May	1983	135	116-184	38	32 (3.9)	26 (3.6)	68	LGR
		100	43-131	32	19 (3.5)	11 (3.2)	34	LLNR

(a) Numbers of swans increased rapidly over the period of nest building. This accounts for the lower end of the range in some cases being fewer than the final number of breeding pairs.

* Five broods later produced sporadically (see text)

† Figures in brackets are mean brood sizes

LGR: Llangothlin Game Reserve

LLNR: Little Llangothlin Nature Reserve.

and November 1982 on Llangothlin (see Table 1 for numbers of nests at other times).

Clutch and Brood Size

In the spring of 1981, 18 accessible nests were examined, 15 of those contained eggs. The mean clutch size was 3.1. (S.D. = 2.1) with 5.0 being the maximum clutch size. This is comparable to Frith's (1982) figures given for dry years in Queensland (3.5) and Tasmania (3.7 and 3.5).

Mean brood size was 3.0 (S.D. = 1.5) for spring 1981 (recall clutch size 3.1) on the first census after hatching. The largest mean brood size recorded was 3.9 (S.D. = 1.5, n = 32) in August 1983 on Llangothlin. Mean brood sizes recorded at Lake George and Lake Bathurst by Braithwaite (1982) in 1962-1967 varied between 2.14 and 4.94. The largest brood seen was one of eight cygnets at Llangothlin in the spring of 1983 (see Table 1 for brood sizes).

Swans nested at Little Llangothlin in January and February 1983 following storm rains in late December 1982. No further rain fell until March 1983 and all nests were deserted without any eggs hatching. During this time the water level dropped by approximately 20%. This is the most probable reason for the abandonment of the nests. All other episodes of breeding resulted in cygnets being successfully reared past fledging (Braithwaite's "growth stage IV", 1981).

The success of breeding was relatively high with 68% (26 broods fledged from 38 nests) being the greatest and 7% (three broods fledged from 43 nests) the lowest. Details are given in Table 1. The rate of success contrasts sharply with Braithwaite's (1982) finding of only 7.3% of the broods which hatched surviving past fledging.

DISCUSSION

Black Swans bred on both lagoons during the drought and production of cygnets on Little Llangothlin during the drought was higher than it was in the winter following the drought. Braithwaite (1982) and the literature cited therein, state that mortality of cygnets can be very high. He found a survival rate on Lake George and Lake Bathurst near Canberra as low as an estimated 12 fledged cygnets out of 260 hatchlings. With one exception the success rate at Llangothlin and Little Llangothlin was very much higher than this.

The onset of breeding at the two lagoons showed less seasonality than that found by Braithwaite and Frith (1969) at Barrenbox Swamp or Braithwaite (1982) at Lake George. This may be an effect of the shorter study period or, more likely, further evidence that breeding in Black Swans is opportunistic as much as seasonal.

Lack of breeding at Little Llangothlin in 1981 is attributed to the fact that the area where

swans subsequently nested was the last part of the lagoon to be inundated. The area initially flooded was virtually devoid of emergent vegetation and so lacked nesting material. There is no obvious explanation for the lack of breeding on Llangothlin Lagoon in the winter of 1982 when swans were breeding successfully on Little Llangothlin. Braithwaite (1982) related lack of synchronisation of breeding between Lakes Bathurst and George to gross changes in aquatic vegetation. No such relation can be made in this instance. Unpublished data collected by the author shows that biomass of aquatic vegetation on Llangothlin Lagoon was greater in the winter of 1982 (650g/m² dry weight) than it was in the winter of 1983 (450g/m²) when breeding was most successful.

If rearing of cygnets to fledging is used as a criterion these two lagoons can be regarded as significant breeding areas for Black Swans. This has important implications for the management of these two lagoons. Little Llangothlin is a nature reserve and is not open to hunters, although it is subject to a life-time grazing lease in favour of the previous owner. The successful breeding of swans in the severe drought winter of 1982 (88mm of rain from April to September compared with 661mm in the corresponding period of 1983), as well as all other breeding, was achieved in the presence of grazing cattle. There does not seem to be any serious incompatibility. Trials are currently being conducted to assess the effects of grazing on these lagoons and results will be published in due course. Llangothlin Lagoon is a game reserve and birds are therefore subject to hunting pressure in the open shooting season. The lack of breeding on Llangothlin Lagoon in the early winter of 1982 whilst swans were breeding successfully on Little Llangothlin remains unexplained. There was no apparent shortage either of food or of suitable nesting habitat. One factor which might account for the failure to attempt breeding is that the rise in water level (which preceded all breeding attempts), the period of nest building, and much of the incubation period coincided with the hunting season (13 March to 29 May). Reports from local graziers and the finding of fresh camp sites and quantities of recently plucked duck feathers indicated that unknown numbers of hunters were present at Llangothlin Lagoon at least every weekend of the season.

Both camp sites and "hides" were found near the areas where swans nested at other times. Braithwaite (1982) suggests that disturbance may prevent nesting in an otherwise apparently suitable area and it is hypothesised that disturbance due to hunting was the reason for the failure of swans to breed on Llangothlin at that time. There was no substantial rise in water level from the end of the 1982 hunting season until the drought broke in the autumn of 1983 when a further cycle of breeding began almost simultaneously on the two lagoons. No duck hunting season was declared in the autumn of 1983.

These results suggest that the effects of disturbance by hunters may be detrimental to non-game species, especially if breeding seasons coincide with the hunting season. These effects may not be fully recognised at present by authorities controlling hunting and I believe this aspect of waterfowl management warrants further investigation.

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