

# OBSERVATIONS ON BREEDING IN THE BLACK SWAN *Cygnus atratus* IN SOUTH-EASTERN QUEENSLAND

J. T. COLEMAN

22 Parker Street, Shailer Park, Qld, 4128, Australia

*Received: 25 May 2009*

Black Swans *Cygnus atratus* were studied in south-eastern Queensland during 2007–2008. Birds were recorded breeding throughout the year with some pairs breeding twice, three or even four times in the same year, often having two generations of cygnets on the water at the same time. Productivity in the first two years of the study was low compared to that published for northern Queensland and New South Wales.

## INTRODUCTION

The Black Swan *Cygnus atratus* is known to nest both colonially (Guiler 1970) and territorially (Kraaijeveld and Mulder 2002) within its range and data on breeding have been collated and published for the species in south-eastern Australia (Braithwaite 1982), northern Queensland (Lavery 1964), Tasmania (Guiler 1970) and Western Australia (Halse and Jaensch 1989). Information from these regions has been presented on breeding seasons, clutch size and brood size.

In New South Wales breeding has been recorded in every month of the year but was more frequent between July and October (Braithwaite and Frith 1969). This was similar to Western Australia, which also recorded breeding year round and frequent breeding between May and October (Halse and Jaensch 1989). In northern Queensland a marked breeding season between February and June was recorded and in that study, only one clutch per year was recorded for breeding pairs (Lavery 1971) although Guiler (1970) indicated that some birds may nest more than once if the first nesting attempt fails. Guiler (1970) also demonstrated that breeding in Black Swans in Tasmania was highly seasonal with birds nesting between June and August in that study.

Marchant and Higgins (1990) commented on the lack of breeding success data for this species. However, Frith (1982) indicated an average of 4.1 cygnets hatched per pair with 2.7 fledging in a New South Wales. More detailed work in another part of New South Wales (Braithwaite 1982) documented a hatching rate of 4.78 cygnets. Postgraduate research in North Queensland identified a hatching rate of 4.38 cygnets per breeding attempt (Lavery 1964) while work in New Zealand (Miers and Williams 1969) demonstrated a mean of 3.62 cygnets hatched per nest over a two-year period.

This paper aims to provide comparative information from south-eastern Queensland describing hatching and rearing success in Black Swans, the breeding season, and the number of breeding attempts recorded by individually identifiable birds each year.

## METHODS

During 2007–2008 Black Swans were studied within an area of south-eastern Queensland just north of the New South Wales border to the Brisbane River (Fig. 1). The study area has a wide range of freshwater and marine habitats with numbers of breeding and non-breeding swans in a variety of locations throughout the area.

Each month a fixed route was travelled through the area visiting sites known to be frequented by Black Swans. The birds at these sites were counted and their status recorded as *non-breeding*, *paired*, *breeding* or *dependent*. A *non-breeding* classification was assigned to any bird that was alone or in small groups or flocks; *paired* was recorded for obvious pairs that exhibited territorial behaviour; *breeding* were paired birds, which had made an attempt to nest during that year; *dependent* was assigned to any cygnet still associated with its parents. A breeding attempt was defined when a pair built a nest and incubated eggs. Each month, as many as possible, of the band numbers present on the birds were recorded so that life history data, including breeding information could be accumulated over time. As many unbanded birds as possible were trapped and banded during monthly surveys.

Two bands were attached to birds caught; the first was a standard Australian Bird and Bat Banding Scheme leg band and the second was a plastic leg band with an individually engraved code that could be read in the field, without the need to recapture the bird. Each bird caught was aged on plumage, sexed cloacally and weighed to the nearest 0.1kg.

For paired birds, breeding histories were recorded through monthly observations of nesting attempts. This included noting the number of cygnets hatched and reared for each breeding bird. Data on pairing were also recorded to determine mate fidelity as well as accumulating breeding data for individual birds. The parentage of birds banded as cygnets was also recorded so that the fate of the offspring of all breeding individuals could be monitored.



**Figure 1.** Study Area, encompassing parts of Brisbane, the Gold Coast and southern Morton Bay.

## RESULTS

### *Number of breeding attempts*

Twenty-two territorial pairs were recorded in 2007 of which nine pairs were individually identifiable through reading their engraved bands; the remaining thirteen pairs being unbanded pairs. Table 1 identifies the numbers of banded and unbanded pairs monitored in the study. Of the pairs recorded, seven (31.8%) did not breed and the remaining 15 (69.2%) bred at least once. The 15 breeding pairs, recorded 23 breeding attempts of which six attempts (26.1%) failed to produce any cygnets. Eight breeding pairs (53.3%) nested only once during the year, six (40%) nested twice and one pair (6.7%) nested three times during the year.

For the pairs that nested twice, cygnets were hatched in all first breeding attempts but 50 per cent of the second nesting attempts failed to produce any cygnets. The one pair that nested three times reared five cygnets successfully in the first breeding

attempt, failed to hatch eggs in the second attempt and reared five cygnets in their third breeding attempt.

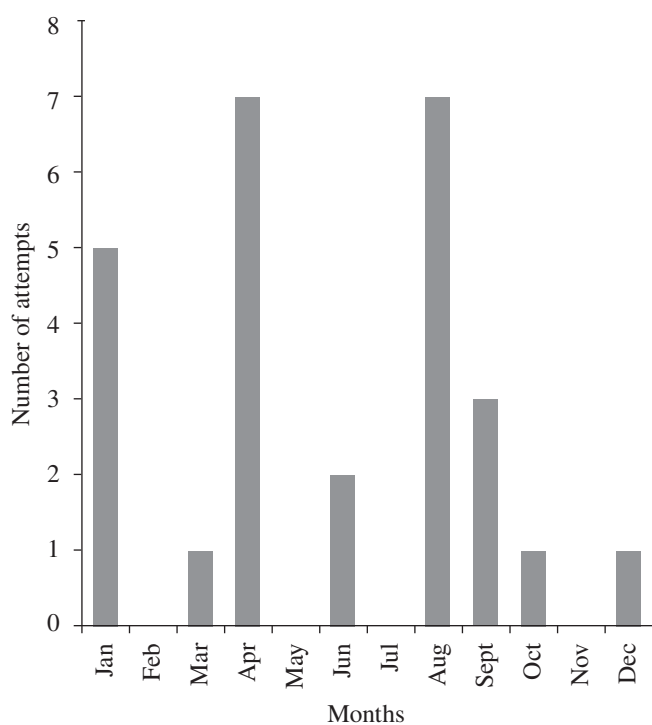
This compared well to data recorded in 2008 in which twenty-six territorial pairs, nineteen of which were individually identifiable as a result of banding, were recorded of which nine (34.6%) pairs did not breed. The 18 pairs recorded as breeding recorded 28 breeding attempts of which seven (25%) failed to produce cygnets. As with 2007, some pairs nested multiple times with 11 (61.1%) breeding only once, four pairs (22.2%) breeding twice, two pairs (11.1%) breeding three times in the year and one pair recording four breeding attempts (6.6%).

In 2008, all the pairs that nested twice reared cygnets in both breeding attempts. The two pairs that had three breeding attempts both hatched cygnets in two of their three attempts (attempts one and two and attempts one and three respectively) but both only reared cygnets in one of those breeding attempts (attempt two and attempt three respectively).

**TABLE 1**

Number of banded individuals recorded in the pairs monitored for this study.

Number of breeding attempts recorded for each pair	Number of pairs in category with both birds unbanded	Number of pairs in category with only one bird banded	Number of pairs in category in which both birds were banded
<b>2007</b>			
None	7	0	0
One	4	1	3
Two	2	1	3
Three	0	0	1
<b>2008</b>			
None	3	3	3
One	5	3	5
Two	1	0	2
Three	0	0	2
Four	0	0	1



**Figure 2.** Number of broods recorded as hatched by month. Data are combined for 2007 and 2008 and only include nesting attempts in which cygnets were hatched and the month of hatching was known.

The 2008 pair that nested four times failed to hatch cygnets in their first breeding attempt, reared four cygnets in their second attempt, hatched five cygnets, which died before fledging, in their third attempt and failed to hatch eggs in the fourth attempt. The pair that nested three times in 2007 was the same pair that nested four times in 2008. The birds forming this pair were individually identified from their bands.

#### *Breeding season*

Newly hatched cygnets were recorded in all months except February, May, July and November with peaks in newly hatched broods recorded in January, April and August (Fig. 2). The minimum period between hatching for pairs that bred more than once was only two months.

#### *Productivity*

The 23 breeding attempts in 2007 resulted in 60 cygnets being hatched (brood size range 1–6) of which 51 were reared to fledging (brood size range 1–6), an average of 2.61 (s.e.  $\pm$  0.45) cygnets hatched per breeding attempt and 2.20 (s.e.  $\pm$  0.56) reared.

In 2008, 60 cygnets were hatched (brood size range 1–5) and 32 cygnets reared (brood size range 1–4) from the known 28 breeding attempts. This was an average of 2.14 (s.e.  $\pm$  0.36) cygnets hatched and 1.14 (s.e.  $\pm$  0.25) cygnets reared from each breeding attempt.

Of the broods recorded in 2007 and 2008, 55.2 per cent were reared intact with all the cygnets hatched being reared to fledging, 20.7 per cent were lost entirely before fledging with at least half of the brood being reared to fledging in the remaining 24.1 per cent of broods.

## **DISCUSSION**

Approximately one quarter of breeding attempts in this study failed to produce cygnets. Re-nesting under those circumstances has been documented in the Black Swan (Guiler 1970), although, this does not explain all the multiple nesting attempts recorded for some pairs. Seventy-seven per cent of the pairs breeding more than once were recorded as hatching two broods in a year with half of those successfully rearing two broods in the year.

Marchant and Higgins (1990) record the Black Swan in Australia, as normally only breeding once per year. However, the frequency of resightings, for marked birds in the studies cited, is

not recorded and it is likely that the number of breeding attempts recorded in Marchant and Higgins (1990) is an underestimate. This study has involved monthly resightings of most birds since banding and the data suggest that nesting more than once per year may be more regular than currently thought, at least where circumstances are favourable for breeding.

Breeding was recorded throughout the year in both years of the study and this extended breeding period is well documented in south-east Australia (Braithwaite and Frith 1969; Braithwaite 1982). Braithwaite and Frith (1969), studying Black Swans in New South Wales linked breeding activity to littoral flora abundance and also fluctuations in water level at their study site. Halse and Jaensch (1989) also demonstrated a clear link between rainfall and the onset of breeding. These factors were not investigated in this study but may have been applicable.

Compared to published data from New South Wales and North Queensland, when mean brood size at hatching was recorded as 4.78 and 4.38 cygnets respectively (Braithwaite 1982; Lavery 1964) the hatching rate in this study seems very low with a mean of 2.61 cygnets hatched per breeding attempt in 2007 and 2.14 cygnets hatched in 2008. The reasons for this difference are not clear and require further investigation.

#### ACKNOWLEDGEMENTS

The author would like to thank Gold Coast City Council, Logan City Council and The Port of Brisbane Corporation for access to their land for the purposes of monitoring and capturing swans for banding. The fieldwork was authorised by the Queensland Environmental Protection Agency under permit number WISP03747606. Bands use were

provided by the Australian Bird and Bat Banding Schemes, Department of the Environment, Water Heritage and the Arts. John Farrell and two anonymous referees provided comments that significantly improved the final draft. In addition Stephen Macdonald has helped with many hours of fieldwork for which the author is grateful.

#### REFERENCES

- Braithwaite, L. W. (1982). Ecological studies of the black swan IV. The timing and success of breeding on two nearby lakes on the Southern Tablelands of New South Wales. *Aust Wildl. Res.* **9**: 261–275.
- Braithwaite, L. W. and Frith, H. J. (1969). Waterfowl in an inland swamp in New South Wales. *Aust Wildl. Res.* **14**: 65–109.
- Frith, H. J. (1982). 'Waterfowl in Australia'. (Angus & Robertson: Sydney.)
- Guiler, E. R. (1970). The use of breeding sites by black swans in Tasmania. *Emu* **70**:3–8.
- Halse, S. A. and Jaensch, R. P. (1989). Breeding seasons of waterbirds in south-western Australia - the importance of rainfall. *Emu* **89**: 232–249.
- Kraaijeveld, K. and Mulder, R. A. (2002). The function of triumph ceremonies in the black swan. *Behaviour* **139**: 45–54.
- Marchant, S. and Higgins, P. J. (Eds) (1990). Handbook of Australian, New Zealand and Antarctic Birds, Vol. 1B'. (Oxford University Press: Melbourne.)
- Miers, K. H. and Williams, M. (1969). Nesting of the Black Swan at Lake Ellesmere, New Zealand. *Wildfowl*. **20**: 23–32.
- Lavery, H. J. (1964). 'An investigation of the biology and ecology of waterfowl in Northern Queensland'. MSc thesis. University of Queensland, Brisbane. (unpub.)
- Lavery, H. J. (1971). 'Wild Ducks and other Waterfowl in Queensland'. (Department of Primary Industries: Brisbane)

## RECOVERY ROUND-UP

*This section is prepared with the co-operation of the Secretary, Australian Bird and Bat Banding Schemes, Australian Nature Conservation Agency. The recoveries are only a selection of the thousands received each year; they are not a complete list and should not be analysed in full or part without prior consent of the banders concerned. Longevity and distance records refer to the ABBBS unless otherwise stated. The distance is the shortest distance in kilometres along the direct line joining the place of banding and recovery; the compass direction refers to the same direct line. (There is no implication regarding the distance flown or the route followed by the bird). Where available ABBBS age codes have been included in the banding data.*

*Recovery or longevity items may be submitted directly to me whereupon their merits for inclusion will be considered.*

Hon. Editor

The following abbreviations appear in this issue:

BBO – Broome Bird Observatory, Broome WA

NPWSSP – National Parks and Wildlife Service (NSW) Seabird Project

VWSG - Victorian Wader Study Group.

#### Southern Giant-Petrel *Macronectes giganteus*

1068-10016\*. Nestling banded by D. Patterson-Fraser on Hermit Island, near Palmer Station, Antarctica (64° 46'S 64° 04'W) on 7 March 2010. Recovered injured at sea, (later euthanased) 3 miles east of Wollongong, NSW (34° 29'S 151° 00'E) on 21 Sep. 2010. 8563 km.

\* Bird Banding Laboratory-USGS band

#### Northern Giant-Petrel *Macronectes halli*

1436068\*. Nestling banded on Bird Island, South Georgia, Antarctica (54° 00'S 38° 02'W) on 3 March 2009. Recovered dead, at Morgan Beach, Cape Liptrap, Vic. (38° 54'S 145° 55'E) on 12 June 2010. 9676 km.

\*BTO Ringing and Migration band.

#### Short-tailed Shearwater *Ardenna tenuirostris*

162-75130. Nestling banded by NPWSSP on Montagu Island, NSW (36° 15'S 150° 14'E) on 23 March 2010. Recovered dead, on the Beach of Akahama, Takahagi, Ibaraki Pref., Japan (36° 44'N 140° 44'E) on 12 June 2010. 8172 km N.