

SEASON OF MOULT OF AFRICAN PENGUINS AT ROBBERN ISLAND, SOUTH AFRICA, AND ITS VARIATION, 1988–1998

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Counts of African penguins *Spheniscus demersus* in immature and adult plumage in the feather-shedding phase of moult were made at Robben Island at two-weekly intervals over a 10-year period between 1988 and 1998. For both age-classes, most birds moulted between November and January, although small numbers moulted throughout the year. In most years, the peak moult was in late November or December. Immature birds had a secondary peak in March. In 1994/95 for adults, and 1995/96 for immature birds, moult was less synchronized than in other years. This probably resulted from oiling of about 2 400 penguins in June 1994, following the sinking of the *Apollo Sea*. Half of those birds were cleaned and released. Their subsequent moult may have been earlier than normal.

In 1983, African penguins *Spheniscus demersus* recolonized Robben Island in Table Bay, South Africa, after an absence of at least 180 years (Crawford *et al.* 1995a). Numbers breeding at the island have since increased steadily, except in 1995, after the loss of about 1 200 penguins in 1994 from oiling that followed the sinking of the *Apollo Sea*, a ship carrying bulk ore. At Robben Island, counts of moulting penguins have been undertaken at two-weekly intervals, commencing in October 1988 (Crawford and Boonstra 1994). African penguins moult annually (Randall *et al.* 1986). The main moult period for those at Robben Island is between November and January (Crawford *et al.* 1995a). In this paper, the time-series of moult counts is used to document the average moult cycles for adult and immature African penguins at Robben Island and to examine interannual variation in these cycles.

MATERIAL AND METHODS

Counts were made of African penguins in the feather-shedding phase of moult at Robben Island at approximately two-weekly intervals over a 10-year period between October 1988 and June 1998. A total of 245 such counts was made. On each count a distinction was made between birds in adult and immature plumage (Cooper 1978). Counts were interpolated linearly to estimate numbers in moult for each day between actual counts. These interpolated counts were summed for each half-month. The feather-shedding phase of the moult of

African penguins, which is easily recognizable, lasts on average 12.7 days (Randall *et al.* 1986). Therefore, the half-month totals were divided by 12.7 to estimate the number of birds moulting per half-month.

At Robben Island, most moulting penguins congregate on the shoreline. Counts were made through binoculars or a telescope and recorded on tally counters. Feather-shedding birds in large groups of penguins (>50 individuals) were counted twice, and if there was a substantial difference (>5%), a third count was undertaken. The mean of the two closest counts was adopted (Crawford *et al.* 1995a). Birds seen moulting in the breeding area were added to the count. However, the breeding area was not searched systematically for moulting birds, because few birds were observed to moult away from the shoreline.

In order to obtain an average pattern of the seasonality of moult, the estimated totals for each half-month were summed over all years except 1996/97 (see Results), and expressed as the percentage of birds moulting in each half-month.

RESULTS

Numbers of African penguins in adult plumage that moulted at Robben Island in each half-month between the years 1988/89 and 1997/98 showed peaks in the first half of December for the first five years and in 1995/96 (Fig. 1). This coincided closely with the average annual pattern of seasonality of moult in adults (Fig. 2). In 1993/94 and 1997/98, the numbers moulting

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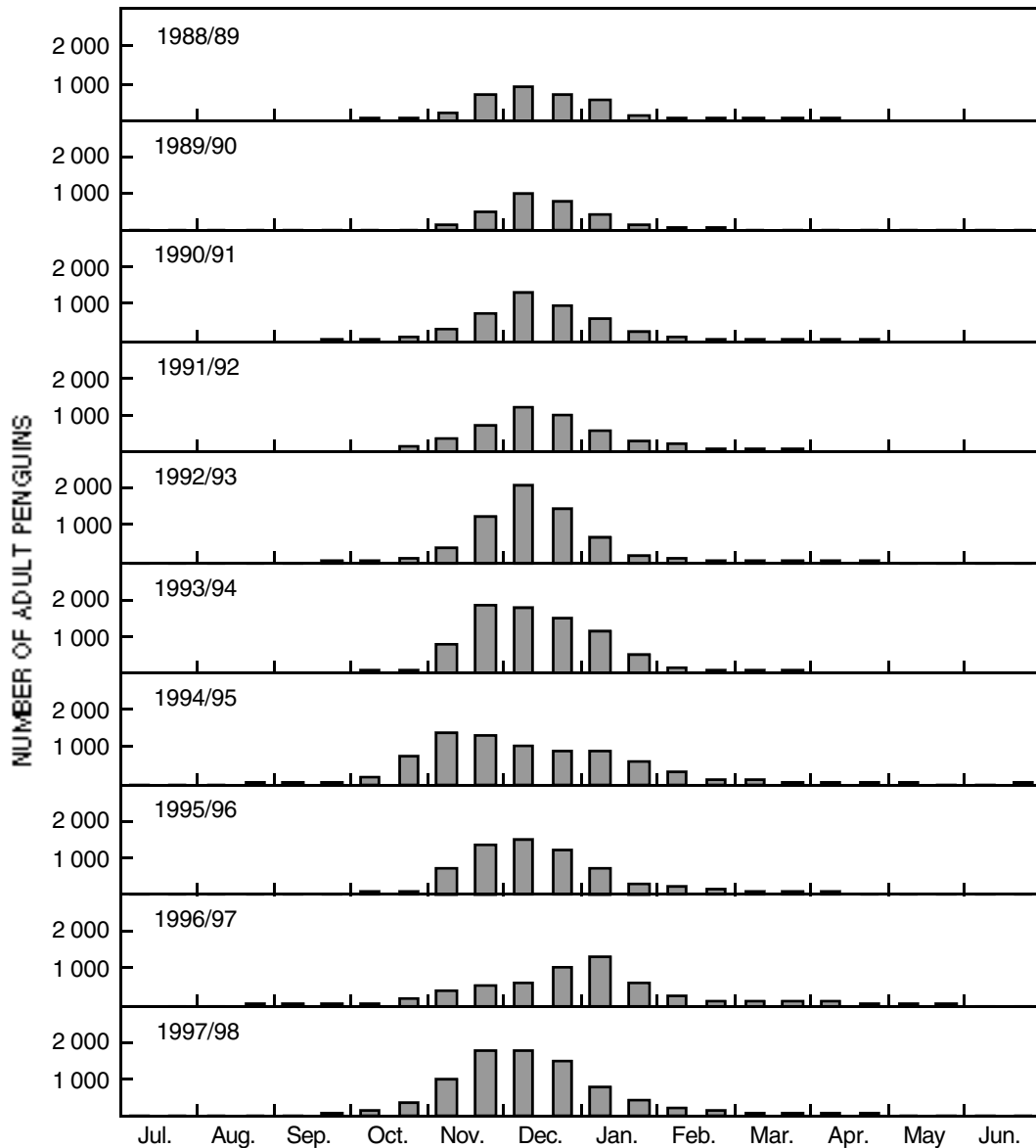


Fig. 1: Numbers of African penguins in adult plumage moulting each half-month at Robben Island, October 1988–June 1998

in the second half of November and the first half of December were nearly equal (Fig. 1). In 1994/95, the normal moult pattern was disrupted in two ways. It was less synchronized than the average pattern: 13.1% moulted before the end of October in 1994/95

(Fig. 1), compared with 5.1% on average (Fig. 2); 17.4% moulted after mid-January, compared with 12.9% on average. The mode occurred in the first half of November, one month earlier than in the average pattern. The abnormal pattern in 1996/97 was a result

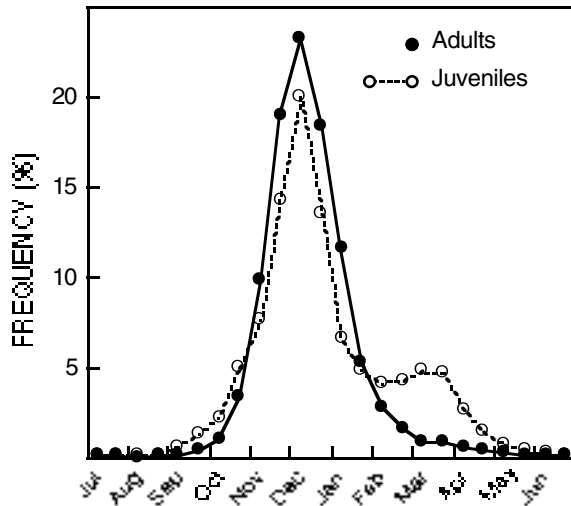


Fig. 2: Average seasonal pattern of moult for adult and immature African penguins at Robben Island

of errors in the November and December counts, which were undertaken by an inexperienced observer. These data were excluded from the calculation of the average pattern of seasonality.

The average pattern of moult for immature penguins was less synchronized than for adults, but it also had its main peak in the first half of December. There was a distinct minor peak in March (Fig. 2). Most individual years conformed closely with the average pattern. There was a late peak in 1994/95, 71.7% moulting after mid-December, compared with 48.5% in the average pattern for immature penguins. There was loss of synchronization in 1995/96, when only 37.4% moulted in the 2½ month period between November and the first half of January when most (61.9% on average) immature birds normally moult (Figs 2, 3). The pattern in 1996/97 was influenced by observer error.

DISCUSSION

As at St Croix Island (Randall *et al.* 1986), there is a clear peak in the timing of moult of African penguins at Robben Island, where the peak moult for both adult and immature birds is normally in early December, although its timing may vary by half a month (Figs 1–3). The subsidiary peak in the moult of immature penguins in March probably results from late clutches. Many eggs

are laid from February to April, but there is a secondary peak in egg laying in July (Crawford *et al.* 1995a).

There were two notable exceptions to the usual pattern of moult. For adults, the peak in 1994/95 was in the first half of November, a full month earlier than the normal peak, and moult was less synchronized than usual. By contrast, immature birds moulted later than usual in 1994/95. In 1995/96, numbers of immature birds in moult remained relatively constant from late October until late March.

In June 1994, about 2 400 African penguins were oiled at Robben Island, following the sinking of the *Apollo Sea*. About half of these died; the remainder were successfully cleaned and released (Underhill *et al.* 1999). Most of the oiled penguins were in adult plumage, but immature birds were also involved (Crawford *et al.* in press). Additionally, 551 orphaned chicks were collected at Robben Island, of which 508 were raised to “fledging” and released (Williams *et al.* in press).

The probable explanation for the early moult of some adults in 1994/95 is that birds that are taken to the rescue station, cleaned and released commence moult earlier than usual. Several factors may be involved and further research is required: captive care may disturb hormonal regimes or the circannual clock; or the washing of oiled birds may affect the insulating ability of feathers, necessitating an earlier replacement of plumage; or released birds may decide to forego further breeding attempts and commence moult. Partners of oiled birds, including those that lost mates, have an early end to their breeding season and may also enter moult sooner than normal. For adults, the moult cycle in 1995/96 was timed similarly to that in 1993/94, so that only the cycle in 1994/95 was disrupted by oiling.

The moult of immature penguins was poorly synchronized in 1995/96. African penguins moult from immature to adult plumage between 12 and 22 months after “fledging” (Randall 1989), about 1.5–2 years after hatching. For immature penguins, numbers moulting in 1994/95 peaked in December, as they did in most other years. Probably, most immature birds that were oiled and cleaned in 1994 had their next moult in 1995/96. These birds might have moulted earlier than the unoiled immature penguins of the same cohort. In addition, productivity during the middle of the 1994 breeding season was disrupted by the oiling incident, with early- and late-hatched juveniles likely to be in larger proportions than in normal years. As a result, the usual December peak was flattened in 1995, leading to the observed relative stability in numbers moulting over several months (Fig. 3).

Cooper (1978) noted that the moult of adult African penguins in one sector of the colony at Dassen Island

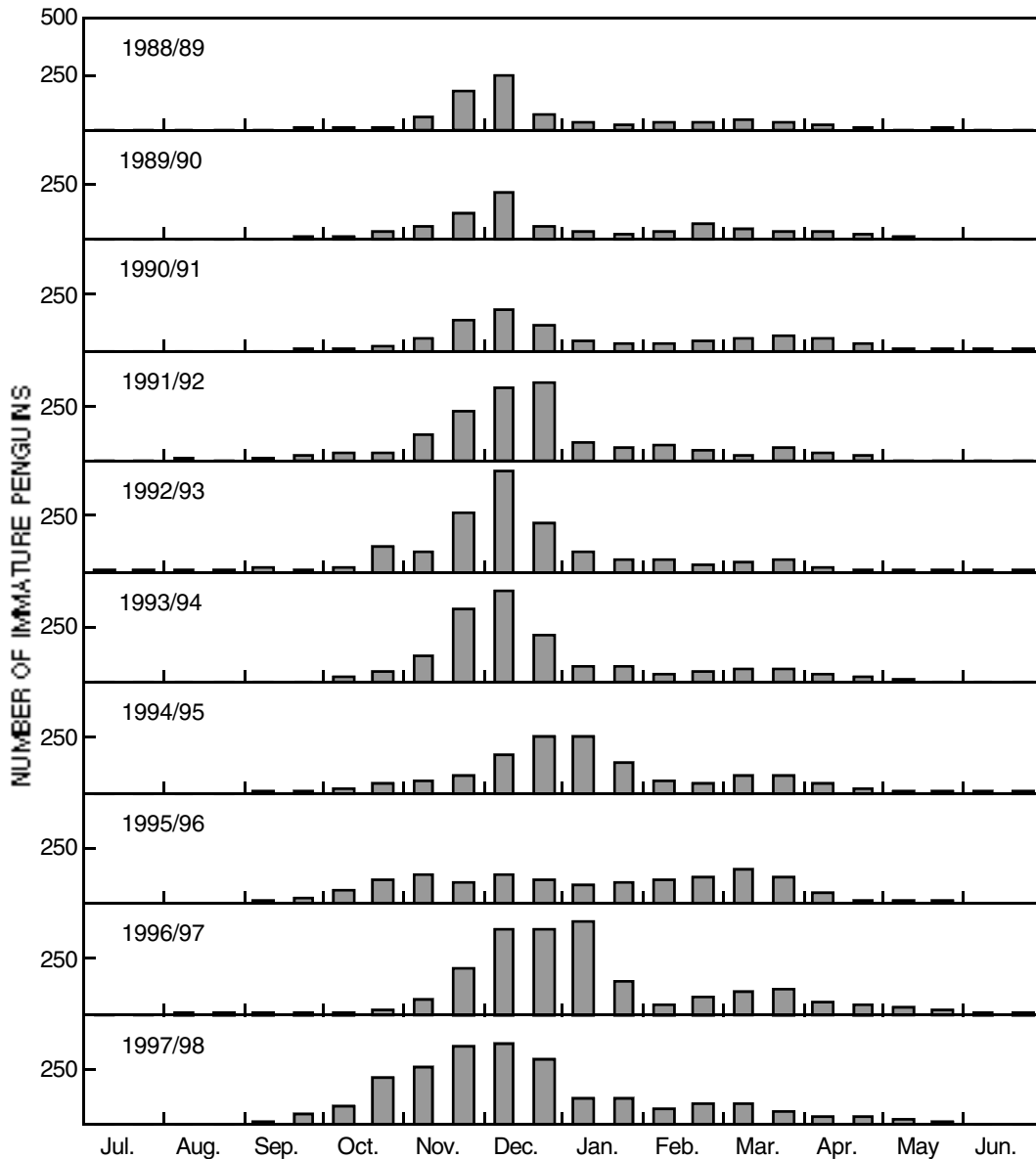


Fig. 3: Numbers of African penguins in immature plumage moulting each half-month at Robben Island, October 1988–June 1998

peaked two months earlier in 1972 than in 1971. This early moult may also have resulted from oiling. In March 1972, about 4 000 penguins were oiled at Dassen Island; of these 1 751 were collected for treatment and 55% were released successfully (Morant *et*

al. 1981).

Why immature African penguins moulted later at Robben Island in 1994/95 than in most years is not known with certainty. The birds would have fledged at Robben Island in the 1993 breeding season, or be

young immigrants to the colony from elsewhere. In 1993, the early part of the breeding season at the island was not successful. In February 1993, a total of 1 699 pairs had established nest sites. However, the number of active sites counted in March was 1 241, indicating abandonment at some sites and a slow return of potential breeders to the colony. In May 1993, some 2 173 active sites were counted. Therefore, production of chicks in 1993 was probably later than normal, in agreement with the relatively late moult of immature birds in 1994/95. Much of the growth of the Robben Island colony has resulted from immigration of first-time breeders to the island (Crawford *et al.* in press). Their pattern of first moult would be influenced by the breeding cycle at islands from which they emigrated.

For African penguins, the breeding season and period of moult varies between colonies (Randall *et al.* 1986, Crawford *et al.* 1995a, b). Ability of first-time breeders to emigrate from natal colonies to those where conditions at the time are favourable for breeding has been postulated (Crawford *et al.* in press). The penguins' flexibility to change the period of moult so that it assumes synchrony with that at the new colony would facilitate such interchange.

ACKNOWLEDGEMENTS

We thank Messrs H. G. v. d. Boonstra, D. A. E. Crawford and P. J. M. Crawford, and Mr B. M. Dyer and Ms L. Upfold (Marine and Coastal Management, Cape Town) and Mr P. A. Whittington (University of Cape Town) and all others who assisted with the counts of moulting penguins at Robben Island. We are grateful to the Robben Island Museum for facilitating this research. The research was partly funded by the Marine Living Resources Fund.

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