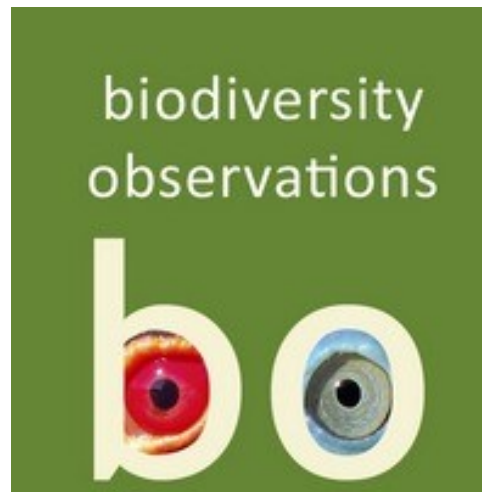


# Change in moult behaviour of African penguins *Spheniscus demersus* on Robben Island

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## Ornithology

# Change in moult behaviour of African penguins *Spheniscus demersus* on Robben Island

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## Abstract

This paper reports a change in the location of moulting adult African penguins on Robben Island over the period 1998 to 2020. Until 2004, the birds tended to moult along the coastline. By 2020, nearly all the birds moulting on the island appear to do so inland at or near to their nest sites. This behavioural change has implications for estimates of total population size made using counts of moulting birds that do not include the inland moulters.

## Introduction

All birds and mammals replace feathers and hair. Usually this is done using a strategy that involves gradual replacement. However, in a small number of species of birds (all penguins) and mammals (some seals), moulting is so rapid that the insulation function of feathers and hair is compromised such that moulting animals are not able to feed; this known as catastrophic moult (Beltran et al. 2018).

African penguins *Spheniscus demersus* undergo a catastrophic moult every year when they come ashore at their breeding colonies and replace all their feathers over a two-week period centred on midsummer. It has been suggested that counting moulting penguins can be used as a method for estimating the overall population at a colony

(Randall et al. 1986, Crawford et al. 1991, Shelton et al. 1984, Underhill and Crawford 1999). Provided that regular counts at two-week intervals are performed, it is believed that, by interpolation, a reliable estimate of the number of birds in moult each day can be made. Furthermore, the total population can be estimated by dividing the sum of the daily total of moulting birds by the mean moulting period of 12.7 days (Randall et al. 1986, Underhill and Crawford 1999).

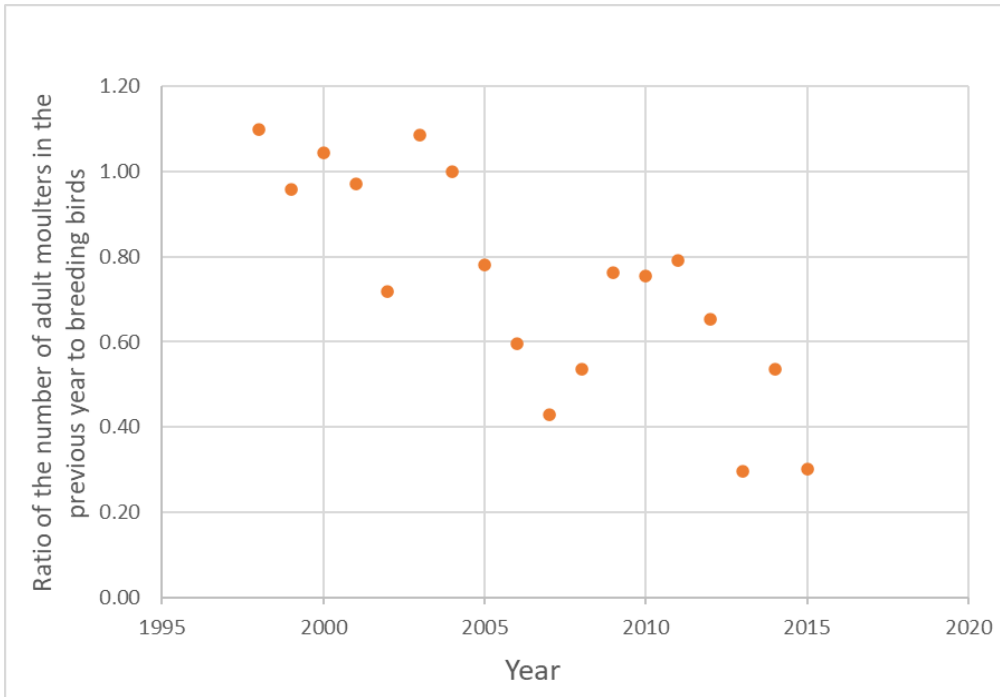
Crawford and Boonstra (1994) proposed that African penguins moult along the coastlines adjacent to the colonies where they breed, and this idea has been generally accepted. Subsequently it was found that, at Dassen Island, penguins moulted in the interior of the island, often in nest burrows (Wolfaardt et al. 2009).

In this paper we report a change in behaviour of African penguins on Robben Island. Instead of moulting along the coastline, they have switched to moulting in the interior of the island, often near their nest sites.

## Methods and Results

Counts of penguins moulting along the coastline of Robben Island have been made at two-week intervals since October 1988, when the size of the colony was estimated to be 849 breeding pairs, four years after the colony was established in 1984 (Underhill and Crawford 1999, Underhill et al. 2006). In addition, Underhill and Crawford (1999) reported that few penguins moulted away from the coastline between 1988 and 1998.

The ratio between the estimated size of the moulting population on the Robben Island coastline and the estimated size of the breeding population (Underhill et al. 2006, DFFE unpubl. data) was calculated (Figure 1). This ratio was close to one until 2004, and has subsequently steadily decreased to values below 0.5 (Figure 1). The implication is that since c. 2005, fewer than expected numbers of penguins have been seen moulting along the coastline of the island.



**Figure 1:** The ratio of adult African penguins moulting in the previous austral summer to the number of breeding African penguins calculated from the nest census data at Robben Island.

Photographic evidence of this trend is demonstrated by two images taken from the same viewpoint – the penguin hide at the landing beach north of Murray’s Bay Harbour – at the peak of the moult season in mid-November (Figure 2). These photographs show the dramatic decline in numbers of penguins moulting north of the harbour on Robben Island. However, it should be noted that the number of birds breeding on Robben Island decreased from c. 4,000 pairs in 1999 to c. 1,000 pairs in 2019 and that the area of the colony expanded over the same period. Therefore, by 2019, this beach was no longer the shoreline adjacent to many nest sites.



**Figure 2:** Photographs of the main landing beach on Robben Island where penguins moulted in large numbers during the 1990s and up to the early 2000s. Top early December 2002, bottom 16 November 2019. Photographs: Les Underhill.

The peak moult time on Robben Island is typically late November to early December (Underhill and Crawford 1999). Up until 2012, a Robben Island Museum (RIM) environmental officer monitored the penguins throughout the year. Between 2012 and 2018, no regular monitoring during the summer months was carried out. Thereafter, SANCCOB employed (AM) as a seabird ranger, permanently based on the Island. Once the ranger was appointed, a different pattern of moult behaviour from that previously reported was observed in the period 2018 to 2020.

The first evidence of a change in moult behaviour was the discovery of large numbers of moulted adult feathers at some nest sites (Figure 3). This indicated that penguins were starting to moult inland, in the breeding colony, during the same period in which the number of penguins counted moulting along the coastline decreased.

In 2019 and 2020, we observed more birds moulting within the breeding colony – often at nest sites – than birds moulting along the coastline (Figure 3). To quantify this, we selected an area of the colony that was regularly monitored throughout the breeding season as part of the Earthwatch penguin project (Sherley et al. 2014) and where estimates of the total number of nesting birds were made. The number of adult birds moulting in this area at the peak of the moult was then counted by AM. Where it was possible to do so without causing disturbance, he checked penguins for transponders. He also counted the number of adult birds moulting along the coast within two days of making the inland count.

In November 2019, AM recorded more than 50 birds moulting inland. Many were in nest boxes and in well-shaded nests that had been used that year; far fewer, 5–10 adults, were seen moulting along the coastline.

In late October 2020, AM found c. 30 birds moulting in the Earthwatch area and no adult birds moulting along the coastline. In 2020, on two coastal moult counts he observed no adult penguins moulting on 22 November and four on 2 December. However, on 25 November, he found 63 penguins moulting in or close to nest sites (see examples in

Figure 3) in the Earthwatch area, where c. 270 penguins had nested during the prior breeding season. Some of the moulting birds could be approached closely enough to check for transponders. AM found seven birds with transponders of which six were moulting at or within 20 m of nest sites they had used in the period 2018 to 2020. The other moulter with a transponder was not yet of breeding age. Its transponder had been fitted in 2017 when it was a chick on Robben Island; it had been recorded once at Boulders in 2019 and the site where it was observed moulting is about 300 m from where it hatched and its transponder was fitted.

## Discussion

These observations demonstrate a change in the moulting behaviour of African penguins on Robben Island since c. 2005 (Figure 1). Instead of moulting along the coastline, most adult birds started to moult inland, with a strong indication that they moult at or near places where they have nested in previous years.

The moult period on Robben Island usually extends from late October to early January (Underhill and Crawford 1999). In the years 1998 to 2005 the total number of moulting adults along the coastline of Robben Island during the annual moult period exceeded 5,000 birds. In these years, the total number of moulting adults was typically between 4.25 and 5.00 times larger than the maximum individual count of moulting adult birds. Hence, if we assume that the count of 63 birds moulting in the Earthwatch area corresponds to the peak of the moult, we can multiply this figure by 4.25 to estimate the total number of moulters in the area during the entire moult period:  $4.25 \times 63 = 267$  adult birds. The match between the estimates of 270 breeding birds and moulting birds suggests that the penguins on Robben Island now moult inland and have abandoned their previous practice of coastline moulting.

Between 2005 and 2020, a steadily increasing proportion of penguins began to moult inland. As a result, these penguins have not been included in the two-weekly moult counts along the coastline; it follows that the data from the coastline moult counts can no longer be used to infer the overall population size of penguins on Robben Island.



**Figure 3:** Photographs taken in November 2020 of adult African penguins moulting inland on Robben Island.

We suggest four possible explanations for this behavioural change:

(1) By moulting inland, African penguins may experience lower temperatures than they would along the coastline. Inland birds moult in the shade of trees and shrubs. However, the cooling effect of the prevailing winds would be reduced compared to birds moulting along the coastline.

(2) The number of African penguins breeding on Robben Island has decreased strongly since 2004 (Underhill et al. 2006, DFFE unpubl. data). It may be that Penguins prefer to moult in large groups along the coastline but, because this is no longer possible, the birds moult elsewhere.

(3) In the past there were substantial numbers of antelope, deer, rabbits and cats on Robben Island. These roamed freely and could easily disturb any penguins moulting inland. Since 2006, the Robben Island management has culled cats, deer and rabbits (Quintana et al. 2021). Therefore, the chances of moulting birds being disturbed if they moult near their nest sites has decreased.

(4) The presence of seals in the water along the Robben Island coast may deter penguins from moulting along the coastline. During the breeding season penguins will hide in the bushes near the coast if they see any seals in the water (PJB pers. obs.). An increase in the number of seals around the island could lead to penguins deciding to move inland to moult. Seals are sometimes observed swimming close to the coast and even hauling-out on rocks. It is not known whether there has been an increase in seal presence around Robben Island in recent years.

Thus, further studies are required before any definite conclusions about the underlying causes of this change in behaviour can be determined.

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