COLOUR ABERRATIONS IN AFRICAN PENGUINS *SPHENISCUS DEMERSUS*

GWENDOLINE TRAISNEL[1], LORIEN PICHEGRU[1], HENVIK J. VISSER[2] & LLOYD C. EDWARDS[3]

[1] *DST-NRF Centre of Excellence at the Percy FitzPatrick Institute of African Ornithology, Institute for Coastal and Marine Research and Department of Zoology at the Nelson Mandela University, Port Elizabeth, South Africa (traisnel.gwendoline@gmail.com)*
[2] *Addo Elephant Marine Section, South African National Parks, Port Elizabeth, South Africa*
[3] *Raggy Charters, Port Elizabeth, South Africa*

Received 31 July 2017, accepted 3 October 2017

ABSTRACT

TRAISNEL, G., PICHEGRU, L., VISSER, H.J. & EDWARDS, L.C. 2018. Colour aberrations in African Penguins *Spheniscus demersus*. *Marine Ornithology* 46: 19–22.

Colour aberrations among wild birds are of long-time interest because they are uncommon, particularly in seabirds, although recent publications have revealed varying forms of aberrations in cormorants and penguins. In African Penguins *Spheniscus demersus*, there have been previous sightings of abnormal plumages, particularly in Algoa Bay, South Africa. This paper reveals new cases of plumage aberrations in African Penguins: leucism, "brown," and phaeomelanism, all within Algoa Bay. While all aberrations seemed of natural origin, one in the shape of a number eight may have resulted from human actions.

Key words: African Penguin, abnormal plumages, Algoa Bay, leucism, phaeomelanism, "brown"

INTRODUCTION

Production of melanin pigments eumelanin and phaeomelanin can be subject to alterations, both of heritable and non-heritable origin, resulting in abnormalities in plumage colour (van Grouw 2013), varying from common to extremely rare (e.g., Crossland 2012). Sightings of birds with these aberrations are rare, especially for albinos, because survival in the wild is relatively low, perhaps due to reduced abilities to hunt (Cook *et al*. 2012), higher risk of predation, or conspecific harassment and conflicts (Alaja & Mikkola 1997). "Brown" is a mutation more commonly observed but often misinterpreted as leucism, isabellinism, or albinism (van Grouw 2012). It causes an incomplete oxidation of eumelanin, resulting in a brown plumage colour instead of the normal black (van Grouw 2013). Incomplete oxidized eumelanin is extremely susceptible to sunlight, and mutation "brown" produces a plumage that bleaches rapidly (van Grouw 2013). "Brown" is recessive and sex-linked in inheritance; as a result, in the wild this mutation is mainly found in female birds (van Grouw 2013). By contrast, phaeomelanism, ino, leucism, or albinism are less common. Phaeomelanism is defined as the abnormal production of phaeomelanin in juvenile plumage in species that normally only produce eumelanin, both in their juvenile and adult plumage (H. van Grouw, pers. comm.). When they reach adult stages, the individuals usually recover a natural plumage. Phaeomelanism has been recorded in young Western (or Eurasian) Jackdaw *Coloeus monedula* (H. van Grouw, pers. comm.), Eurasian Blue Tit *Cyanistes caeruleus*, and Great Tit *Parus major*, all species that naturally do not have phaeomelanin in their juvenile plumage. Whether this aberration is heritable remains a mystery (H. van Grouw, pers. comm.). Leucism, finally, is the lack of melanin pigments from all or parts of the plumage (and skin), caused by a heritable failure in early migration of melanoblasts (which are responsible for feather pigment production) in all or parts of the skin (van Grouw 2013).

The recent increase in the number of reports of plumage aberration in seabirds may reflect an increased focus on seabird research in general, but also an effort on the part of the scientific community to report these rare observations. For example, albinism has been recently recorded in shags and cormorants (Cook *et al.* 2012, Crossland 2012), as has isabel (incorrect term, as the mutation involved was "brown") (Oosthuizen & De Bruyn, 2009) and ino (Juàres *et al*. 2011) in penguins. "Brown" (incorrectly called isabel by the author) was recorded for the first time in Adélie Penguins *Pygoscelis adeliae* early in the 20th century (Wilson 1907). Interestingly, most of the sightings of plumage aberrations are recorded in penguin species (Oosthuizen & De Bruyn 2009, Juáres *et al*. 2011, Smith & Voogt 2014, Carpenter-Kling *et al*. 2017), probably reflecting the ease of sighting aberrations in this seabird family, as these species systematically exhibit a dark plumage and breed in large numbers. In African Penguins *Spheniscus demersus*, only three previous cases of colour aberrations have been scientifically recorded, all of them incorrectly named isabellinism (Everitt & Miskelly 2003, Smith & Voogt 2014). Two of them were, in fact, "brown" and ino. Here, we report new forms of plumage aberration in African Penguins.

METHODS

Bird Island (33°50′S, 26°17′E) and St. Croix Island (33°48′S, 25°46′E) in Algoa Bay, South Africa, host half of the world's population of African Penguins (Crawford *et al*. 2011). As part of a long-term monitoring project initiated in 2008 (see Pichegru *et al*. 2012), researchers spend three weeks to two months on these islands every year, during the peak breeding season between March and June. In addition, two rangers from SANParks are permanently based on Bird Island. Opportunistic sightings of plumage aberrations were made by researchers and SANParks rangers between 2009 and 2017.

RESULTS AND DISCUSSION

Two unguarded unusual "blues" (i.e., penguin chicks that have undergone their moult from down to the dark blue waterproof

plumage of fledglings; Hockey *et al*. 2005) were spotted on St. Croix Island in 2011. Unlike other young of their age, the siblings exhibited a reddish-brown colouration (Fig. 1a). Their colour may be the result of phaeomelanism, an abnormal production of phaeomelanin, a pigment not naturally produced by penguins (H. Van Grouw, pers. comm.). No parent was sighted around the youngsters because of their late stage of development. Therefore, we could not determine whether the parents exhibited a similar plumage or a normal one. It is also unknown to us whether these two youngsters retained their abnormal colour as adults, or whether they subsequently exhibited a normal black plumage, with eumelanin only. This sighting is in line with the record of an abnormally coloured downy chick from Bird Island reported by Smith & Voogt (2014). In their observation, referred to as isabellinism, when the chick lost its reddish-brown down, the feathers were replaced by the normal dark-blue plumage characteristic of the young fledglings of this species. This agrees with phaeomelanism, as defined above.

Two "brown" penguins were sighted in the study area, although only one is discussed in detail here. The first one was sighted on St. Croix in 2009 and 2010, and possibly on Bird Island in 2011, while the other was seen only on Bird Island (2017). Between April and June 2017, an adult exhibiting a bleached-brown plumage was sighted on Bird Island. The entire body was gold-brown, while the head was darker (Fig. 1b). The colouration of the back seemed heavily bleached, resembling colours sometimes seen in adult African Penguins just prior to moulting when they have badly damaged plumage. The bird exhibited two characteristic dark dots on the skin on top of the right eye, which made it recognizable. It was first spotted among a large group of adults returning from a foraging trip at night, but it was then seen transiting in the colony for the next two months. Surprisingly, conspecifics did not show any aggressive behaviour towards it, as is often the case when conspecifics exhibit plumage differences (Cook *et al*. 2012). This adult was likely hatched on the island, as this species has high site fidelity. The two characteristic dots on the adult's face, which made him distinguishable, will ease identification in future sightings.

Although the mutation "brown" is fairly common in the wild, leucism may be even more common in African Penguins, as more cases of leucism were recorded on the two islands. In two interesting cases, birds with strong partial leucism were recorded breeding on St. Croix Island. In 2013, a bird spotted incubating two eggs had breast and face almost entirely covered with white feathers, while a few black feathers were spread over its back (Fig. 1c). It was spotted again on the same nest incubating the following year. In 2016, chicks in poor body condition were removed from the colony to be hand-reared and rehabilitated, as part of an active management measure undertaken by SANParks. During this effort, rangers came across another case of interesting partial-leucism on the same island. The bird was rearing two chicks in good health. This breeding bird, in good condition as well, had light, almost white, plumage covering a large part of the body (Fig. 1d). The colour aberration was especially visible on the bird's back, while both belly band and head showed

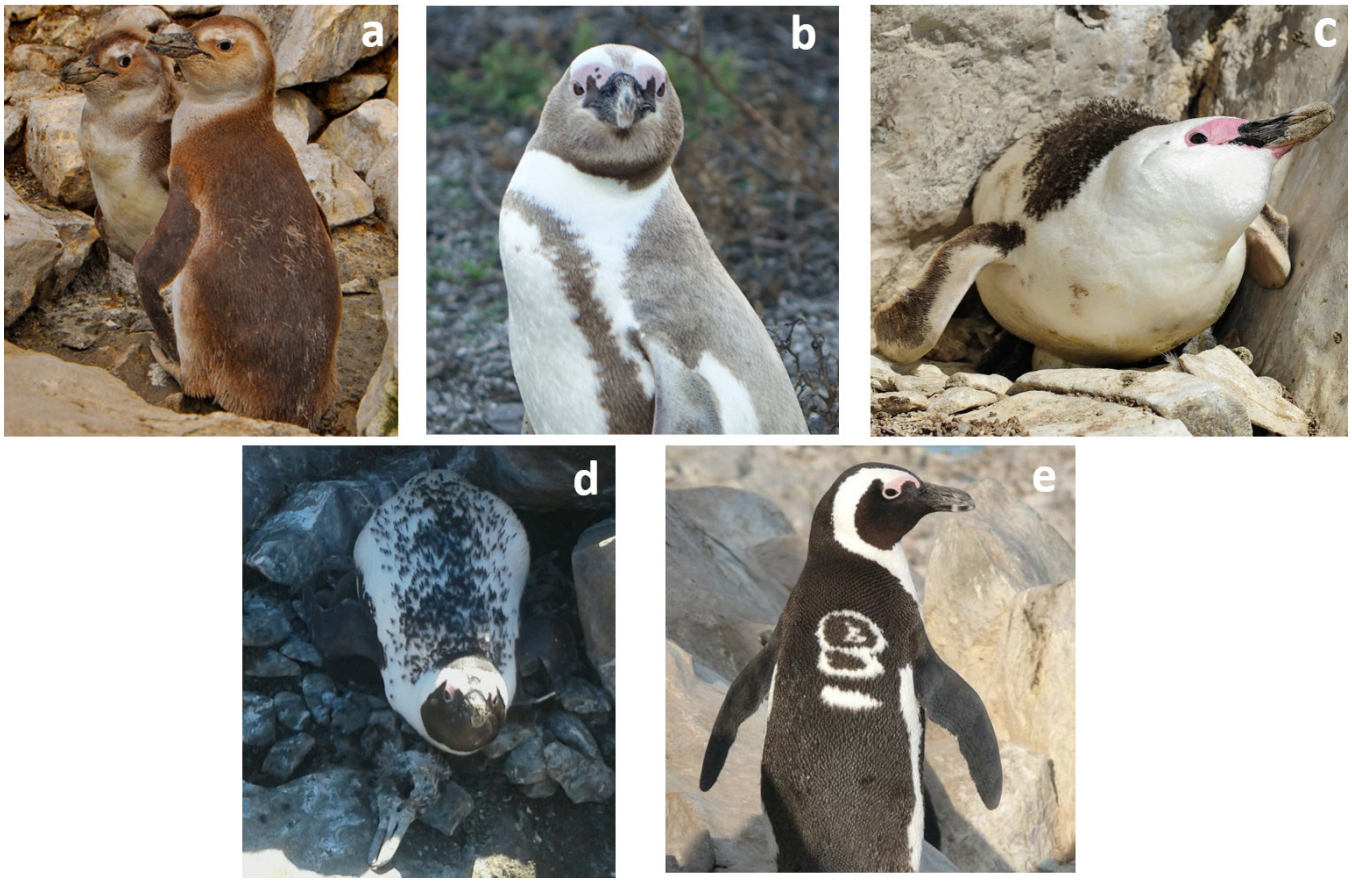

Fig. 1. Observations of plumage aberrations in African Penguins in Algoa Bay, South Africa: (a) phaeomelanism in fledglings on St. Croix Island in 2011; (b) a "brown" adult on Bird Island in 2017; (c) (d) (e) leucism in breeding penguins on St. Croix Island in 2013, 2016, and 2011, respectively.

the normal black colour characteristic of African Penguins. The random distribution of white feathers observed (Fig. 1d) could indicate a case of progressive greying, i.e., loss of pigment cells with age. Progressive greying has a slightly different nature than true leucism. However, without knowing the bird's history, it is difficult to distinguish one aberration from the other in such a case (van Grouw 2013), and therefore we have recorded this observation as leucism. The most surprising pattern, however, was sighted on the back of a bird returning from the sea to its nest on St. Croix Island in 2011. The penguin showed a singular partial-leucism that consisted of a white figure of eight marked on its black back plumage, underlined with a white short line and white dot inside the eight (Fig. 1e). Other than this mark, the plumage of the bird was identical to that of any other individual of this species. Indeed, birds usually display a typical black and white pattern: the back of the bird is entirely covered with black feathers while the breast is white, separated by vertical black bands along both sides and a horizontal one on the throat (Hockey *et al*. 2005). Because of the complexity of the pattern on this bird with partial-leucism, we believe this mark to be a result of some human action. This hypothesis is also supported by the fact that the penguin did not seem particularly disturbed by the presence of the human observer, unlike typical St. Croix penguins (Pichegru *et al*. 2016). However, the mechanism at the origin of this mark remains unclear. Most likely it resulted from some sort of injury that had permanently damaged the pigment-producing cells of the skin, as the bird was re-sighted in April 2013 after two moulting seasons with exactly the same pattern.

Although phaeomelanism, "brown," and leucism are more common than albinism (van Grouw 2006), they remain rare events in seabirds (e.g., Oosthuizen & de Bruyn 2009). Indeed, only few other cases of plumage aberrations in African Penguins have been recorded in captivity or in the wild (e.g., Hardaker & Graham 2017, although the authors had confused "brown" for leucism). However, only three wild African Penguins with plumage aberrations ("brown," ino, and phaeomelanism) have been scientifically recorded to date, all within Algoa Bay (Everitt & Miskelly 2003, Smith & Voogt 2014), although these aberrations may occur through the entire range of this species. Despite hypotheses suggesting that unusual colouration poses a disadvantage to birds (e.g., poor abilities to catch prey caused by an absence of melanin in the eye; Cook *et al*. 2012), all African Penguins spotted with a colour aberration were seemingly in good health, and a few were breeding normally. However, only three of these birds were re-sighted in a later year. As long-lived species, penguins have a generally high annual adult survival (0.8–0.9; e.g., Le Bohec *et al.* 2007), favouring the re-sighting of individuals with plumage aberrations (Juáres *et al.* 2011). However, African Penguin adult and juvenile survival probabilities fluctuate and have recently dropped to <0.4 (Sherley *et al*. 2014). Therefore, low apparent survival rates in African Penguins with plumage aberrations, as observed in this study, may be undistinguishable from penguins with a normal plumage. Overall, the species' generally low survival is a major concern for its persistence, leading to call for appropriate measures to conserve this endangered penguin. Additional information from sightings of colour aberrations, and their re-sighting rates across colonies, could help determine the survival probability between birds with normal plumage and those with aberrations. Therefore, we encourage researchers to share information collected on plumage aberrations on African Penguins throughout the species' range. In addition, we urge our colleagues to ban the terms "isabel," "isabelline," or "isabellinism" for describing colour aberration in penguins, as the name "isabel" is normally assigned to a form of dilution in which the phaeomelanin is unaffected. As penguins naturally do not have phaeomelanin in their plumage, they cannot exhibit such a mutation.

ACKNOWLEDGMENTS

A great thanks to Passuni G. for lending us her camera. These sightings would not have been possible if the three following institutions were not supporting our projects financially and logistically: DST-NRF Centre of Excellence at the Percy FitzPatrick Institute of African Ornithology; the Institute for Coastal and Marine Research, Department of Zoology, at the Nelson Mandela University; and Raggy Charters. We would like to thank SANParks, the Department of Environmental Affairs, and Nelson Mandela University for providing all appropriate permits and ethical clearance to access the islands. Finally, we would like to thank the D. Ainley and an anonymous referee for their useful comments on a previous version of the manuscript, as well as H. van Grouw for his valuable input.

REFERENCES

ALAJA, P. & MIKKOLA, H. 1997. Albinism in the great gray owl (*Strix nebulosa*) and other owls. In: DUNCAN, J.R., JOHNSON, D.H. & NICHOLLS, T.H. (Eds.). *Biology and Conservation of Owls of the Northern Hemisphere.* General Technical Report NC 190. Washington, DC: United States Department of Agriculture Forest Service. pp. 33-37.

CARPENTER-KLING, T., DYER, B.M., MAKHADO, A.B. & PISTORIUS, P.A. 2017. Plumage aberrations in Macaroni Penguins *Eudyptes chrysolophus* at sub-Antarctic Marion Island. *Polar Biology* 40: 1907-1911. doi:10.1007/s00300-017-2080-9.

COOK, T.R., JEWELL, O.J.D., CHIVELL, W. & BESTER, M.N. 2012. An albino cape cormorant *Phalacrocorax capensis*. *Marine Ornithology* 40: 72-73.

CRAWFORD, R.J.M., ALTWEGG, R., BARHAM, B.J., ET AL. 2011. Collapse of South Africa's penguins in the early 21st century. *African Journal of Marine Science* 33: 139-156. doi:10 .2989/1814232X.2011.572377.

CROSSLAND, A.C. 2012. A second albinistic spotted shag (*Stictocarbo punctatus*) in 116 years. *Notornis* 59: 82-84.

EVERITT, D.A. & MISKELLY, C.M. 2003. A review of isabellinism in penguins. *Notornis* 50: 43-51.

HARDAKER, T. & GRAHAM, J. 2017. *Zest for Birds. African Penguins Spheniscus demersus* [Online]. [Available online at: http://www.zestforbirds.co.za/leupenguin1.html. Accessed 25 September 2017].

HOCKEY, P.A.R., DEAN, W.R.J. & RYAN, P.G. 2005. African Penguin Jackass Penguin Sphenisucs demersus. *Roberts Birds of Southern Africa,* 7th ed. Cape Town: The Trustees of the John Voelcker Bird Book Fund. Pp. 631-634.

JUÁRES, M.A., NEGRETE, J., MENNUCCI, J.A., LONGARZO, L. & CORIA, N.R. 2011. "Ino" colour aberration in Gentoo Penguin (*Pygoscelis papua*) in Antarctica. *Notornis* 58: 169-172.

LE BOHEC, C., GAUTHIER-CLERC, M., GRÉMILLET, D., ET AL. 2007. Population dynamics in a long-lived seabird: I. Impact of breeding activity on survival and breeding probability in unbanded king penguins. *Journal of Animal Ecology 76*: 1149-1160. doi:10.1111/j.1365-2656.2007.01268.x.

OOSTHUIZEN, W.C. & DE BRUYN, P.J. 2009. Isabelline king penguin *Aptenodytes patagonicus* at Marion Island. *Marine Ornithology* 37: 275-276.

PICHEGRU, L., RYAN, P.G., VAN EEDEN, R., REID, T., GRÉMILLET, D. & WANLESS, R. 2012. Industrial fishing, no-take zones and endangered penguins. *Biological Conservation* 156: 117-125. doi:10.1016/j.biocon.2011.12.013.

PICHEGRU, L., EDWARDS, T.B., DILLEY, B.J., FLOWER, T.P. & RYAN, P.G. 2016. African Penguin tolerance to humans depends on historical exposure at colony level. *Bird Conservation International* 26: 307-322. doi:10.1017/S0959270915000313.

SHERLEY, R.B., ABADI, F., LUDYNIA, K., BARHAM, B.J., CLARK, A.E. & ALTWEGG, R. 2014. Age-specific survival and movement among major African Penguin *Spheniscus demersus* colonies. *Ibis* 156: 716-728.

SMITH, D. & VOOGT, N. 2014. A peculiar case of isabellinism on Bird Island, Algoa Bay. *Ornithological Observations* 5: 108-111.

VAN GROUW, H. 2006. Not every white bird is an albino: sense and nonsense about colour aberrations in birds. *Dutch Birding* 28: 79-89.

VAN GROUW, H. 2012. Plumage aberrations in Australian birds: a comment on Guay *et al*. (2012) and Frith and Murphy (2012). *Australian Field Ornithology* 29: 210-214.

VAN GROUW, H. 2013. What colour is that bird? *British Birds* 106: 17-29.

WHITTINGTON, P.A., RANDALL, R.M., CRAWFORD, R.J.M., ET AL. 2005. Patterns of immigration to and emigration from breeding colonies by African penguins. *African Journal of Marine Science* 27: 205-213.

WILSON, E.A. 1907. "Aves." In: *National Antarctic Expedition 1901–04,* Vol. 2: *Zoology,* Part 2, pp. 1-121. London: British Museum.

CORRECTION

For Traisnel, G., Pichegru, L., Visser, H.J. & Edwards, L.C., "Colour aberrations in African Penguins *Spheniscus demersus"* appearing in this issue, a previous version appeared on the website (marineornithology.org) from 16 February 2018 to 7 March 2018. This version was extensively corrected to better define plumage colour abnormalities and their causes, to correctly identify abnormalities from previous reports, and to more accurately identify the abnormalities seen in the African Penguins reported in this paper. One photo was removed from Fig. 1.