

# BILL DEFORMITIES IN PENGUINS (SPHENISCIDAE): A GLOBAL REVIEW

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Bill function is highly specialised for foraging and preening, and deformations can compromise such behaviours, affecting individual birds' health and nutritional status (Van Hemert & Handel 2010) and even causing mortality (Casaux 2004, Marti *et al.* 2008). Such deformities can be the result of genetic defects, deficient diet, disease, injuries and/or pollution (Pomeroy 1962, Giberston *et al.* 1976, Kuiken *et al.* 1999, Buckle *et al.* 2014, Handel & Van Hemert 2015). Deformities have been recorded in various seabirds, including Southern Giant Petrel *Macronectes giganteus* (Marti *et al.* 2008), Antarctic Cormorant *Phalacrocorax bransfieldensis* (Casaux 2004), Black-legged Kittiwake *Rissa tridactyla* (Kylin 2005), and Common Tern *Sterna hirundo* (Gochfeld 1975). There have also been records of bill deformities in several penguin species (Table 1). We provide the first records of bill deformities for three additional penguin species: Adélie, African and Northern Rockhopper, as well as the first for the genera *Spheniscus* and *Eudyptes*.

## OBSERVATIONS

On 11 December 1987, P.G.R. recorded an Adélie Penguin with a strongly laterally displaced upper mandible. The bird was one of a

group of about 15 Adélie Penguins gathered on bay ice adjacent to the ice-shelf edge near the South African research station SANAE II in Queen Maud Land, East Antarctica (approx. 70.30°S, 2.37°W). There are no breeding colonies in this area, and the birds were probably non-breeders. The bird was in adult plumage and had, therefore, survived at least one year with its deformed bill.

In May 2012, A.S. observed an African Penguin chick on Dassen Island, South Africa (33.42°S, 18.08°E), with both mandibles strongly deformed; the upper mandible was bent to the left and the lower mandible, to the right. The chick was being guarded by its parents and was in apparently good condition, so the deformed bill apparently did not hinder receiving food (Fig. 1).

During 2014/15, C.W.J., M.M.R. and W.K. recorded a Northern Rockhopper Penguin chick with an abnormal bill in a Rockhopper Penguin colony on Seal Beach, Transvaal Bay, Gough Island (40.32°S, 9.94°W). The upper mandible was strongly deviated to the left, affecting the bone of the beak, not only the keratin bill sheath (Fig. 2). The chick was first noticed on 29 November 2014 in a small crèche when the chick was approximately 20 d old. Subsequent

**TABLE 1**  
Summary of bill deformities in penguins (Spheniscidae)

Species	Description	Number and age class	Location	Reference
King Penguin <i>Aptenodytes patagonicus</i>	Crossed bill	2 Chicks	Crozet Is. Marion Is.	Voisin <i>et al.</i> 2002
Emperor Penguin <i>A. forsteri</i>	Mandible reduction and crossed bill	3 Chicks	Weddell Sea, Antarctica	Pütz & Plötz 1991; Spletstoesser & Todd 1998
Gentoo Penguins <i>Pygoscelis papua</i>	Crossed bill	1 Chick	George Island, Falkland islands	Juárez <i>et al.</i> 2011
Adélie Penguin <i>P. adeliae</i>	Crossed bill	1 Adult	Queen Maud Land, Antarctica	this paper
Northern Rockhopper Penguin <i>Eudyptes moseleyi</i>	Crossed bill	1 Chick	Gough Island, Tristan da Cunha	this paper
Yellow-eyed Penguin <i>Megadyptes antipodes</i>	Mandible reduction and crossed bill	1 Chick	Otago, New Zealand	Buckle <i>et al.</i> 2014
Little Penguin <i>Eudyptula minor</i>	Mandible reduction and crossed bill	3 Chicks	Victoria, Australia	Reilly & Balmford 1975, Raidal <i>et al.</i> 2006
African Penguin <i>Spheniscus demersus</i>	Crossed bill	1 Chick	Western Cape, South Africa	this paper
Magellanic Penguin <i>S. magellanicus</i>	Crossed bill	1 Adult, 1–2 chicks/year	Punto Tombo, Argentina	P.D. Boersma, pers. comm.

observations every five days indicated that its growth and behaviour were similar to those of the other chicks in its crèche. It fledged in late January 2015, so its bill deformity did not affect its ability to accept food from its parents. The Northern Rockhopper Penguin chick was one of approximately 2600 chicks (0.03%) observed in 2014/15. With this sample size, the probability of detection of such deformities is approximately 75% (Hoye *et al.* 2010).

## DISCUSSION

Bill deformities and other morphological abnormalities are seldom reported, suggesting that they are rare in wild populations, although there are few accurate estimates of their prevalence (Pomeroy 1962). In occasional records, > 1% of a population has been affected; these cases apparently result from proximate pollution, particularly organic pollutants and heavy metals (Giberston *et al.* 1976, Larson *et al.* 1996, Kylin 2005, Buckle *et al.* 2014, Handel & Van Hemert 2015). All previous records of bill deformities in penguins are of chicks (Table 1). These chicks survive their deformities when being fed by their parents, but can grow more slowly than healthy conspecifics (Casaux 2004, Marti *et al.* 2008), and little is known about their survival after fledging. Our Adélie Penguin record indicates that at least a few individuals can support themselves, although we suspect the majority cannot.

Bill deformities have been recorded in nine penguin species from all six genera (Table 1), but given the low incidence we found in Northern Rockhopper Penguins, a large sample (several thousand individuals) would be required to establish the true incidence and prevalence of such deformities within species and populations (Hoye *et al.* 2010). Crossed bills in Magellanic Penguins at Punta Tombo, for example, occur in approximately 1 in 3 000 chicks (P.D. Boersma, pers. comm.). This low incidence also makes it difficult to understand the causes and consequences of deformities. However, it is important to report these abnormalities in order to track potential changes in their incidence and prevalence, which might reflect environmental problems (Giberston *et al.* 1976, Larson *et al.* 1996, Kylin 2005, Buckle *et al.* 2014, Handel & Van Hemert 2015).

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**Fig. 1.** Deformation of the lower and upper mandibles of an African Penguin chick at Dassen Island, South Africa. Photograph by A. Steinfurth.



**Fig. 2.** Deformation of the upper mandible of a Northern Rockhopper Penguin chick at Seal Beach, Gough Island, Tristan da Cunha. Photographs by C.W. Jones.

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