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Short Note
Further evidence of king penguins' breeding range extension at the South Shetland Islands?

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Introduction

King penguin (*Aptenodytes patagonicus* Miller; hereafter KP) is a circumpolar species that breeds on sub-Antarctic islands, between 45° and 55°S. Although vagrant individuals can be found in the Antarctic region (south of 60°), these sites are not included in the historic breeding range of the species (Williams 1995). However, Petry *et al*. (2013) reported a possible recent southward expansion of the KP breeding range. These authors consider that an increment in the number of breeding pairs observed on Elephant Island, South Shetland Islands (SSI) could occur as a consequence of global warming.

In the Antarctic marine ecosystem, where a substantial environmental variability has been demonstrated in the global climate change context (Ducklow *et al*. 2007), shifts in distribution and breeding range of species are one of the main ecological responses (Gorman *et al*. 2010, McClintock *et al*. 2010). In this paper, we report the southernmost breeding attempt of a KP pair incubating at King George Island (Isla 25 de Mayo), SSI. Our observations contribute further evidence to reinforce the Petry *et al*. (2013) hypothesis.

Observations

Stranger Point (62°15'S, 58°37'W) is an Antarctic location situated on King George Island (Isla 25 de Mayo), SSI (Fig. 1a). At this site, Adélie (*Pygoscelis adeliae* [Hombron & Jacquinot]) and gentoo penguins (*P. papua* Forster) nest sympatrically. During the 2010–11 breeding season, one KP was registered for few days at the study area. The following season, on 21 December 2011, a KP pair was observed breeding in a gentoo penguin's nesting site, about 200 m off the coastline (Fig. 1b). An egg was recorded for the first time on 4 January 2012 but it was abandoned on 2 February 2012 before hatching. During the 2012–13 season (21 October 2012), one KP remained at the colony during pre-nuptial moult fasting for at least 16 days. Later on that season, on 3 December 2012, a pair of KPs were observed and the courtship started the next day. On this occasion an egg was registered on 13 December, the incubation occurred associated to a mixed breeding group (Adélie and gentoo penguins, Fig. 1c) closer to the coastline (70 m). On 8 January 2013 neither the adult nor the egg were registered following two days of a snowstorm.

Discussion

An expansion of breeding range normally coincides with a population increase and gain of new available sites for nesting (McClintock *et al*. 2010). Between the 1960s and 1990s, KP populations recovered from an over-exploitation episode, increasing the number of breeding couples (see Delord *et al*. 2004). Nevertheless, a decrease in population growth rate was recorded for some colonies which have reached carrying capacity (Delord *et al*. 2004). King George Island is situated at *c.* 1500 km from South Georgia, where the largest Atlantic Ocean population of KP is found (Poncet 2006). Given the relevance of immigration in population growth and formation of new colonies (Delord *et al*. 2004), we consider that the KP recorded at Stranger Point possibly came from the South Georgia rookery, for which a population increment was recently report (Poncet 2006).

The occurrence of KP individuals and/or breeding pairs recorded at the SSI, south of the historic range, suggests an incipient expansion of the species' distribution. Probable causes for this event include: 1) the emergence of new suitable breeding areas, as a consequence of environmental change, and 2) density-dependent factors, as a result of the population's increase some individuals may mobilize in search of new breeding sites, possibly the youngest ones that have a higher migration rate (Williams 1995).

The first breeding site south of the KPs' reproductive range was reported by Petry *et al*. (2013), located at Elephant Island, SSI, which is situated *c*. 212 km north-east of Stranger Point (Fig. 1a). Our records represent the southernmost breeding attempts reported so far and the presence of nesting pairs during several seasons could indicate the emerging consolidation of a future breeding colony (Gorman *et al*. 2010). However, for this to occur the number of breeding pairs would have to increase in order to favour the survival of the offspring, as stated by

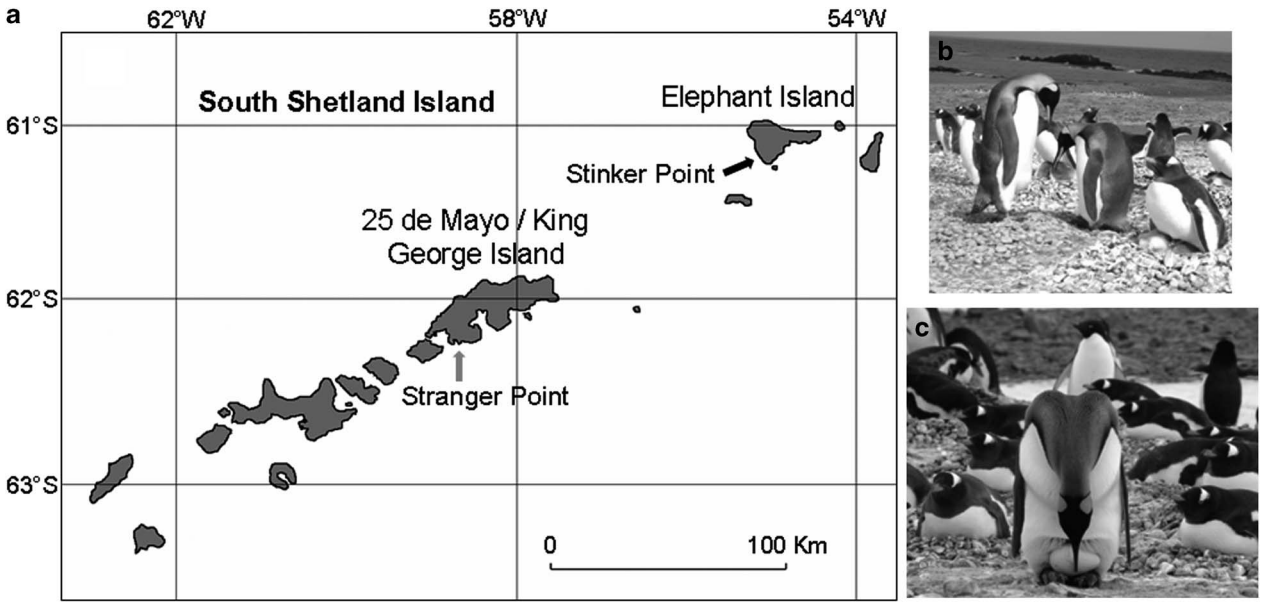

Fig. 1. King penguin southernmost record. **a.** Study area. Stranger Point, King George Island (Isla 25 de Mayo), South Shetland Islands. **b.** Breeding couple observed during 2011–12 season. **c.** Reproductive pair registered in 2012–13 season. Photographs taken by Lucrecia Longarzo and Pablo J. Perchivale.

Petry *et al*. (2013), given that the crèche is important for chicks' protection against adult aggression, predation and the weather (Le Bohec *et al*. 2005). For this reason, despite the fact that local conditions at Stranger Point were favourable for egg laying, it is highly probable that, even if the egg had hatched, the chick would not have survived the winter season.

Although we agree with Petry *et al*. (2013) that the explanations for the presence of these birds in the Antarctic region are speculative, we consider that this new and southernmost record of breeding attempts help to reinforce the conclusions of those authors. It cannot be dismissed that the presence of these individuals could be a result of an inexperienced breeding pair; however, reports of reproductive specimens in the area seem to be increasing. As there is insufficient evidence to recognize the causal mechanisms, it is essential to continue observing and distributing these kinds of events. Moreover, as was proposed by Gorman *et al*. (2010), this type of report also helps to better understand species' life history strategies.

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