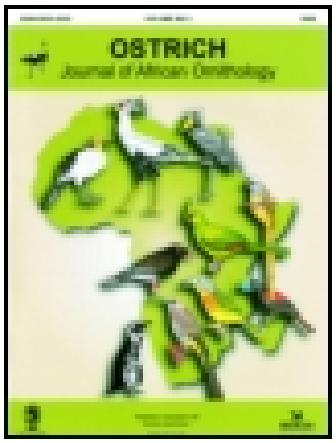

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Lumbering the gauntlet: Cape Gannet fledglings killed by African Penguins

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Short Note

Lumbering the gauntlet: Cape Gannet fledglings killed by African Penguins

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This account presents the first known observations of Cape Gannet *Morus capensis* fledgling mortalities as a result of aggressive nest defence behaviour by African Penguins *Spheniscus demersus*. Observations were conducted in 2013 on Bird Island, Algoa Bay, South Africa – the world's largest breeding colony of Cape Gannets. Twenty-eight attacks were witnessed between 21 March and 18 May 2013 of which 16 resulted in mortality. The absence of previous observations of this phenomenon may be due to an unusually high proportion of African Penguin chicks being present relatively early on in the breeding season, associated with a potential for increased nest defence at this stage, and a larger number of gannet fledglings that year compared to previous years over the same period.

Keywords: interspecific aggression, nest defence behaviour, seabirds

African Penguins *Spheniscus demersus* and Cape Gannets *Morus capensis* are breeding endemics to the Benguela upwelling system off southern Africa's south-west coast where they breed on mostly island localities in close proximity to their pelagic fish prey (Crawford 2005; Crawford and Whittington 2005). These species share three island breeding localities in South Africa: Bird Island (Lamberts Bay) and Malgas Island off the west coast, and Bird Island (Algoa Bay) off the south coast. Globally, populations of both species have declined over the last century, although numbers of Cape Gannets have increased on Bird Island, Algoa Bay, which is now the world's largest gannetry (Crawford et al. 2009). Recent decreases in populations of these two species have been primarily attributed to changes in the distribution and abundance of their principle prey species, anchovy *Engraulis encrasicolus* and sardine *Sardinops sagax*; both of these seabird species are currently listed as threatened (Crawford et al. 2007, 2011; IUCN 2014). The peak breeding season of Cape Gannets occurs during the austral spring and summer, whereas that of the African Penguin is mostly during autumn and winter (Crawford 2005; Crawford and Whittington 2005). Overlap of sympatric colonies is thus limited to the early (laying and incubation) and late (fledging) stages of breeding in African Penguins and Cape Gannets, respectively.

Inexperience, particularly in finding food, of recently fledged Cape Gannets results in high levels of mortality (Oatley et al. 1992), as is the case for other seabirds (Hamer et al. 2002 and references therein). Another significant source of Cape Gannet fledgling mortality at some breeding sites (particularly at Malgas Island) stems from predation by Cape fur seals *Arctocephalus pusillus pusillus* where up to 83% of fledglings have been killed in one breeding season (Makhado et al. 2006). In this study we document the first known incidences of Cape Gannet fledgling mortalities due to attacks by breeding African Penguins. In an effort to explain these events we furthermore investigated inter-annual variation in the timing of breeding of African Penguins and the fledging success of Cape Gannets for three successive breeding seasons (2011–2013) to see if any unusual trends were evident for the 2013 breeding season.

The events described here all occurred on Bird Island (33°50′ S, 26°17′ E), Algoa Bay, in the Eastern Cape of South Africa between 21 March and 18 May 2013. The island is home to the largest colony of Cape Gannets globally with an estimated 80 000–90 000 breeding pairs (Moseley et al. 2012; Oceans and Coasts unpublished data) and is also the breeding ground of c. 3 000 breeding pairs of African Penguins (Crawford et al. 2012). All observations were fortuitously made by our research team while doing routine nest shift observations of African Penguins every 3 h between 07:00 and 18:00 for the entire study period. Video footage of one incident was recorded and uploaded to the following link: http://youtu.be/PC5l_oQVZGo.

Nests of African Penguins were monitored between the months of February and May for three years commencing in 2011. Nest checks were performed which involved recording nest contents at weekly/biweekly intervals noting number of adults present, number of eggs and/or chicks for a set of 266 marked nests dispersed throughout the

breeding colony of this species on Bird Island. No nest checks were conducted during the first half of April 2012 and the entire month of May 2012. This data was quantified to examine the proportion (%) of chicks in active nests (i.e. nests with either eggs or chicks) between all time periods. Further on this, Cape Gannet chick survival (from 1–3 weeks post-hatching until fledging) was estimated for three breeding seasons: 2010/11 (n = 17 nests), 2011/12 (n = 35 nests) and 2012/13 (n = 30 nests). Only nests with recently hatched chicks were selected and were visited on at least three occasions between December and March. The frequency of penguin chicks in active nests was compared between all years for the period that corresponds with the Cape Gannet fledging period, here 15 February to 31 March (Oatley et al. 1992), in order to assess whether 2013 was an anomalous year in either regard.

Twenty-eight gannet fledglings were observed being attacked by breeding African Penguins: five occurred during the last week of March, 19 during April and four during May. A large proportion of these incidences (20 of 28, 71%) involved gannets walking through the penguin colony, the remainder were of birds landing directly within the penguin colonies. Attacks typically occurred from within reach of the penguins' nesting territory and included deliberate pecking, mostly to the hind-neck and the back of the skull, and flipper slapping to the fledglings' flanks, head and wings (Figure 1). These attacks resulted in 16 observed mortalities, with most attacks being initiated by two or more penguins. Several additional Cape Gannet fledglings were observed dead within close proximity to African Penguin nests every week during the study period, but it is unknown whether these fatalities were due to African Penguin attacks.

There was a relatively high proportion of African Penguin nests with chicks earlier in the 2013 breeding season compared to the previous two years (Figure 2). There was also a significant difference in the observed frequency of African Penguin nests with chicks, during the Cape Gannet fledgling period, in 2013 compared to 2011 and 2012 (χ^2 = 47.7, df = 2, P < 0.0001) with 30% of active nests during this period in 2013 having chicks compared to 13% and 16% for 2011 and 2012, respectively. Chick survival for Cape Gannets was also highest during the 2012/13 breeding season with 96.7% of chicks from monitored nests fledging compared to 76.5% and 42.9% for the 2010/11 and 2011/12 breeding seasons, respectively (Figure 3).

Nest defence behaviour in colonial nesting seabird species is usually directed at conspecifics at the onset of the breeding season for territory or nest defence (e.g. Duffy 1983; Williams 1995; Somers et al. 2007) or directed at potential predators at varying degrees of intensity throughout the breeding season, e.g. terns (Cullen 1960) and skuas (Andersson 1976). Intraspecific aggression in *Spheniscus* penguins is well documented (e.g. Seddon and van Heezik 1993; Stokes and Dee Boersma 2000) and African Penguins have been recorded killing a Kelp Gull *Larus dominicanus* (Ward 1998), a known predator of their chicks and eggs (Pichegru 2013). As far as we are aware, the events observed in the current study represents the only other case of African Penguins killing another seabird species, a rare occurrence for a seabird species that does not prey on other birds.

A possible explanation for this unusual occurrence may be related to the relatively high number of active penguin nests already at the chick stage during the period when Cape Gannets were fledging in 2013, in conjunction with a large number of gannet fledglings resulting from a particularly high breeding success. The Cape Gannet population on Bird Island almost doubled between 1986 and 2005 with signs of a slight decrease in 2008 before increasing again to about 90 000 breeding pairs in 2013 (Crawford et al. 2009; Oceans and Coasts unpublished data). It is therefore possible that encounters between breeding African Penguins and Cape Gannet fledglings are likely to have increased as a density dependent function of this trend (*sensu* Ashbrooke et al. 2010).

Although we cannot rule out the possibility of this phenomenon having occurred during previous breeding seasons, we expect this to have been unlikely during 2011 and 2012. Our team did regular nest checks during both the 2011 and 2012 African Penguin breeding seasons and the highly conspicuous nature of this interspecific aggression is unlikely to

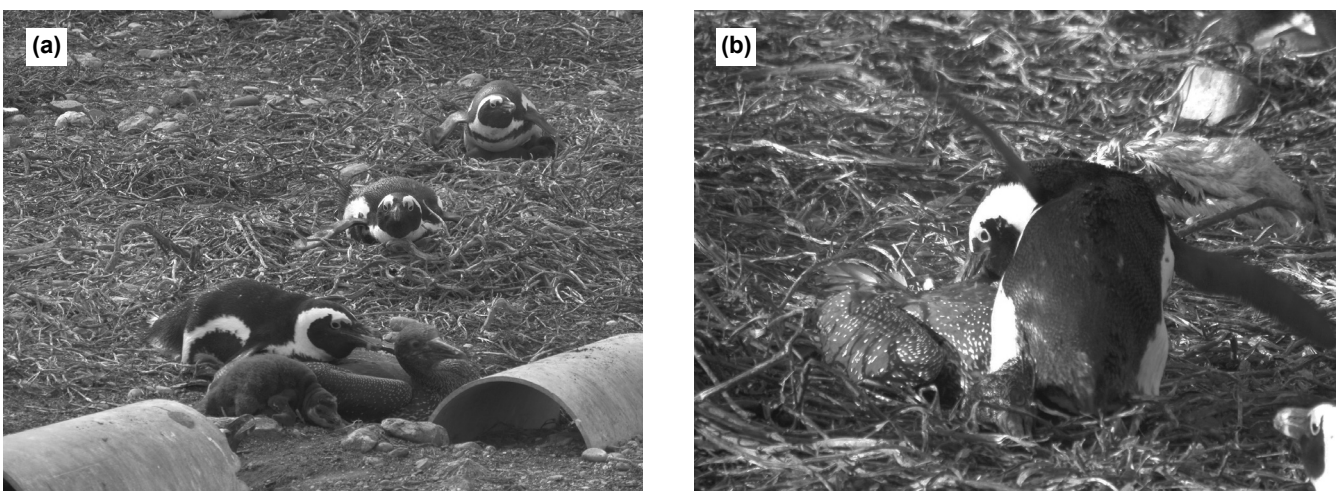

Figure 1: Cape Gannet fledgling attacks. (a) Fledgling being pecked at the back of its head by adult attending large chicks. (b) Fledgling being pecked and flipper slapped

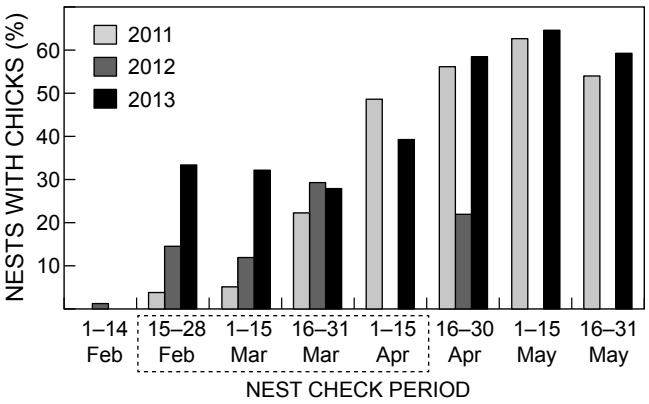

Figure 2: Proportion of active African Penguin nests with chicks for two-week periods between 2011 and 2013. No data was recorded for the first half of April 2012 and during May of the same year. The dashed rectangle denotes the Cape Gannet fledging period

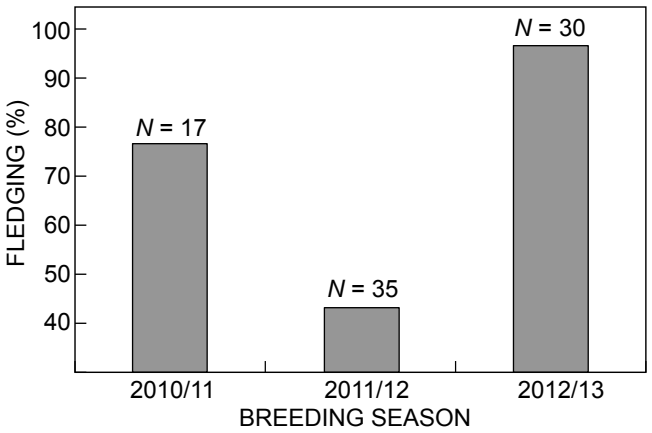

Figure 3: Proportion (%) of Cape Gannet chicks fledged for three breeding seasons between 2010 and 2013

have gone unnoticed, at least during the times when these authors were present in the colony. In addition, during 2011 and 2012, a large proportion of the African Penguin colony to the north of the island was frequented several times a day and, given that the majority of birds bred within c. 100 m of the main path network of the island (AMM, NS and LP pers. obs.), a large proportion of the colony was under observation. Furthermore, Bird Island has been permanently staffed since the 1990s by South African National Park rangers, who have never recorded this behaviour prior to the incidents described here.

Parental investment theory predicts that nest defence should increase with the advance of the breeding season because the fitness value of a chick is higher than that of an egg (Williams 1966). Activities such as nest defence can incur a significant risk for adults in terms of injury or even mortality and the probability of their own survival needs to be measured against the likelihood of their offspring surviving. The intensity of nest defence has been shown to be positively correlated with the age of the nesting effort (in Chinstrap Penguins *Pygoscelis antarctica*, Amat et al. 1996; and King Penguins *Aptenodytes patagonicus*, Côté 2000). The earlier breeding season for African Penguins during 2013 resulted in a large number of penguins attending chicks during the time when Cape Gannets were fledging and it is possible that aggressive interactions were heightened due to the advanced investment that these adults had made at this stage.

The number of mortalities of Cape Gannets observed due to these interactions is unlikely to have had any significant effect on the gannet population. In seabirds, adult survival rather than breeding success or fledging survival, generally plays the major role in governing population growth. Gannets, like most seabird species, typically experience high fledgling mortality rates (e.g. Schreiber and Burger 2002; Makhado et al. 2006), which would likely mask any appreciable effects that could arise from this phenomenon. Prior to the onset of excessive guano harvesting in the nineteenth and early twentieth centuries, African Penguins nested predominantly in burrows (Frost et al. 1976), which would have limited the frequency of interspecific aggression between these species to a small area around the entrance of the burrow (e.g. for *Spheniscus* penguins, see Stokes and Dee Boersma 2000). The loss of this burrowing habitat for penguins has exposed them to heat stress and increased predation, which has prompted conservation managers to install artificial nests to ameliorate these effects (Pichegru 2013; Lei et al. 2014). This study has highlighted another consequence of this habitat displacement, the potential for increased interspecific aggression encounters.

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