

IS FUR SEAL PREDATION DRIVING THE DECREASE IN NORTHERN ROCKHOPPER PENGUINS *EUDYPTES MOSELEYI* AT GOUGH ISLAND?

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The Northern Rockhopper Penguin *Eudyptes moseleyi* is listed as globally Endangered (BirdLife International 2011) based on evidence that the population has decreased by more than 50% over the last three generations (30 years; Cuthbert *et al.* 2009). More than 80% of the population occurs at the Tristan da Cunha archipelago and Gough Island in the central South Atlantic Ocean. Cuthbert *et al.* (2009) summarised the available data on Rockhopper Penguin population trends at these islands and highlighted the need for new population estimates for Middle Island in the Tristan group, because it supports the single largest colony of Northern Rockhoppers. Robson *et al.* (2011) filled this gap and provided further counts for the other islands in the Tristan group. Their findings suggest that the population at Tristan has remained roughly constant over the last three to four decades. It thus appears that recent decreases

in Northern Rockhopper numbers in the Atlantic Ocean are largely confined to Gough Island, where the population has decreased by more than 90% since the 1950s (Cuthbert *et al.* 2009).

The population collapse at Gough Island occurred after the end of the commercial sealing era. Possible factors include landslips, oil pollution, capture for zoos, use as fishing bait, incidental bycatch on fishing gear and entanglement in marine litter (Cuthbert *et al.* 2009, and references therein). However, even taken together, these factors are unlikely to have been sufficient to account for the rapid decrease observed at Gough Island (Cuthbert *et al.* 2009). There is little evidence of competition with fisheries; the penguins' diet is dominated by small crustaceans, which are not exploited by fisheries. Cuthbert *et al.* (2009) suggested that the penguins' decrease is most plausibly explained by the burgeoning population of Subantarctic Fur Seals *Arctocephalus tropicalis*, either as a result of competition for food or through predation of penguins by fur seals.

Direct competition for food is possible. Although the diets of the two species have little overlap, with fur seals feeding mainly on myctophid fish and squid rather than crustaceans (Bester & Ryan 2007), information on the diet of both species is limited and potentially biased by system-wide perturbations (Ainley & Blight 2009). There is now compelling evidence that decreases in Macaroni Penguins *E. chrysolophus* at South Georgia have resulted from competition with fur seals (Trathan *et al.* in press).

What about predation? *Arctocephalus* fur seals do kill *Eudyptes* penguins at sea (Bonner & Hunter 1982), and Subantarctic Fur Seals have been observed to feed on Northern Rockhopper Penguins at Amsterdam Island (Guinard *et al.* 1998). However, they have not been recorded attacking Rockhopper Penguins around the Atlantic Ocean colonies. At Nightingale Island in the Tristan archipelago, fur seals sometimes displace giant petrels *Macronectes* spp. feeding on Rockhopper Penguins at sea, but they are more curious than aggressive and were not observed to feed on the penguins (Ryan *et al.* 2008). Here we report evidence that Subantarctic Fur Seals may be significant predators of Northern Rockhopper Penguins at Gough Island.

On 7 February 2011, J.K. was aboard the MV *Edinburgh* en route from Tristan to Gough Island. As the vessel approached the northeast point of the island, approximately two to three nautical miles offshore, dead penguins were observed floating at sea. They continued to be seen as the vessel steamed south off the east coast of Gough Island to the weather station, and for two to three miles after leaving the station heading east-northeast towards Cape Town. Typically two to three birds were visible at any one time throughout



Fig. 1. Three of the dead Northern Rockhopper Penguins recovered at sea off Gough Island on 7 February 2011. Note that their heads have been bitten off and that the two penguins on the right have everted skins, typical of birds killed by fur seals.

this period, and at least 100 carcasses were observed in total. This appears to be an unprecedented number of penguin carcasses floating at sea. Five carcasses were recovered for examination; all had their heads torn off, and two had their skin everted (Fig. 1). The exposed bones had been picked clean (Fig. 1), possibly by fish such as Five-fingers *Acantholatris monodactylus* (Ryan *et al.* 2008). The carcasses were not retained; because the birds lacked heads, they could not be aged from the photographs.

Although no penguins were observed being attacked, their injuries were consistent with having been killed by fur seals (Cooper 1974, P.G.R. pers. obs.). Fur seals sometimes bite off the heads of penguins (Cooper 1974) and typically batter avian prey vigorously on the water surface, frequently resulting in the skin being stripped off the body (Marks *et al.* 1997, du Toit *et al.* 2004). At Dyer Island, South Africa, half of the African Penguins *Spheniscus demersus* killed by Cape Fur Seals *A. pusillus* had their skins turned inside out (Marks *et al.* 1997). By comparison, penguins killed in gill nets remain intact (A. Wolfaardt, J. Cooper in litt.), as do the occasional penguins killed on longlines (P.G.R. pers. obs.). Seals frequently eat relatively little from the carcass of birds that they kill, consuming mainly the bird's viscera (Cooper 1974, du Toit *et al.* 2004). Other potential predators include giant petrels and Killer Whales *Orcinus orca*; however, neither causes this type of damage to birds. Giant petrels lack the power to evert the skin of penguins (Ryan *et al.* 2008), whereas Killer Whales typically either swallow birds whole or "play" with them, resulting in little obvious external damage (Williams *et al.* 1990).

Although seabirds are typically minor prey items for fur seals, some individuals specifically target seabirds (Cooper 1974, David *et al.* 2003, du Toit *et al.* 2004). Among Cape Fur Seals, immature male seals are responsible for most attacks (David *et al.* 2003, du Toit *et al.* 2004), with individuals killing 5–25 African Penguins per day (Cooper 1974, du Toit *et al.* 2004). Levels of mortality can exceed the rate of production at small penguin colonies, greatly increasing the risk of extirpation (Crawford *et al.* 2001). The 50% decrease in Northern Rockhopper Penguins at Amsterdam Island during the period 1971–1993 coincided with a seven-fold increase in the Subantarctic Fur Seal population from 5 000 to 35 000 animals (Guinard *et al.* 1998). Gough Island supports some 300 000 Subantarctic Fur Seals, close to 80% of the global population (Bester & Ryan 2007), and their numbers are still increasing (Bester 1990, Bester *et al.* 2006). Numbers of Subantarctic Fur Seals also are increasing at the Tristan archipelago, but they are modest compared to those at Gough; with hundreds of pups born each year (P.G.R. pers. obs.) the total population is still only <10 000 animals. This difference in seal population size provides a possible explanation for the different trends in Northern Rockhopper numbers at Gough and Tristan.

The extent and abundance of dead penguins observed on 7 February 2011 suggest that hundreds of penguins were killed at that time. If this occurred regularly, it would doubtless affect the local Rockhopper Penguin population and could account for the trend over the last 50 years (Cuthbert *et al.* 2009). It is surprising that seal predation has not been reported around Gough Island before these observations. The weather station is situated on the island's southeast coast, where fur seal densities are relatively low (Bester *et al.* 2006), and access to other coastal areas is difficult. However, a fishing vessel spends several months each year catching Tristan Rock-lobsters *Jasus tristani* in the coastal waters around

Gough Island, and fishers have not reported seal attacks or dead penguins drifting at sea. Northern Rockhopper Penguin chicks fledge in December–January (Ryan 2007), so many of the dead birds we saw may have been naïve juveniles. However, fur seals are capable of catching and killing adult penguins (Crawford *et al.* 2001, du Toit *et al.* 2004), so the seals likely kill adults as well as juveniles. Personnel at the island's weather station have been asked to look for further evidence of attacks. Removing problem seals can significantly reduce the rate of attacks (David *et al.* 2003, du Toit *et al.* 2004), but the remote nature of Gough Island and the inaccessibility of most of its beaches render this management action unrealistic around most of the island's rugged coastline.

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