

New records of South American sea lion *Otaria flavescens* predation on southern rockhopper penguins *Eudyptes chrysocome* at Staten Island, Argentina

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Abstract Predation by fur seals and sea lions has been identified, among others, as a potential cause of the declines in rockhopper penguin populations. Here, we report a multiple predation event of southern rockhopper penguins *Eudyptes chrysocome* by South American sub-adult male sea lions *Otaria flavescens* at Staten Island, Argentina. The sea lions attacked and preyed on penguins mostly using a wait and rush tactic at sea, but in some cases, penguins were also pursued on land. Although observations suggested that only a few sea lions are involved in predation, further research is necessary to elucidate the importance of this predation in the rate of population decline.

Keywords Predation · Rockhopper penguin · South American sea lion · Staten Island · Population threats

Introduction

Southern rockhopper penguins *Eudyptes chrysocome* inhabit sub-Antarctic islands in the South Atlantic, South Pacific and South Indian Oceans (Williams 1995). Worldwide, their populations have been decreasing to a great extent in the last decades (Cunningham and Moors 1994; Pütz et al. 2001), and thus the species is cited as ‘vulnera-

ble’ by the International Union for the Conservation of Nature (Birdlife International 2008). Predation by marine mammals (especially seals) due to top-down changes in the food web structure has been identified as one of the eight putative causes of the declines in rockhopper penguin populations (Birdlife International 2010).

Staten Island holds one of the largest concentrations of southern rockhopper penguins with 166,762 pairs located in one single locality, Franklin Bay (Schiavini 2000). The South American sea lion *Otaria flavescens* population in Tierra del Fuego and Staten Island is estimated to be 4,500 animals, and the population trend is unknown (Schiavini et al. 2004). Sea lions are known to prey on several species of penguins (Boswall 1972; Strange 1982; Campagna 2008), but the importance of penguins in their diet has not been assessed. This fact draws attention to the potential impact that predation by sea lions may have on rockhopper population dynamics. To date, there are a few observations of southern sea lions preying on southern rockhopper penguins from Staten Island and the Falkland/Malvinas Islands colonies (Boswall 1972; Strange 1982; Birdlife International 2010), and very little is known about the interaction between these two species.

Here, we report new observations of South American sea lions hunting and feeding on southern rockhopper penguins at Staten Island, Argentina.

Methods

We carried out opportunistic observations of South American sea lion predation on southern rockhopper penguins during November 2010 while conducting research on the rockhopper penguin colony located at Franklin Bay, Staten Island, Tierra del Fuego (54°50.0'S, 64°40.5'W).

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Observations were made from the top of ca. 12-m-high cliff near Punta Frola (central coordinates: 54°51.3'S, 64°40.7'W), which allowed us a clear view of the 900-m-long landing rock ledge from where penguins access the sea. During lower tides, the penguins must clamber up the rock ledge and across a sloping 3-m-wide landing zone to reach dry land. The water surface beneath the most favoured exit point was covered with fronds of the giant kelp *Durvillaea antarctica*.

During November, male rockhopper penguins were undertaking foraging trips, while females remained on incubation duties (Raya Rey et al. 2007). The closest breeding colonies of sea lions are Bahía Flinders and Península Mitre on Tierra del Fuego, 50 km to the north (Schiavini et al. 2004).

Results and discussion

During November 2010, we observed almost every day predation events by South American sea lions on southern rockhopper penguins. The point of exit from the water appeared to be where the penguins were most at risk of being captured by a sea lion. The sector of the bay out from the rocky ledge exit area was often observed to be patrolled by at least two sub-adult male South American sea lions (4 or 5 years old, E. Crespo pers. comm. to A Raya Rey), a behaviour previously reported by Boswall (1972) at Staten Island and Strange (1982) at a southern rockhopper penguin colony at New Island, Falkland/Malvinas Islands. A group of southern giant petrels *Macronectes giganteus* invariably followed the sea lions to feed on offal originated from dead penguins left by the seals. Thus, the location of the seals in the water was to a great extent easier to determine. We describe a multiple predation event observed on 4 November 2010.

Two male sub-adult seals were observed swimming parallel along the length of the rock ledge staying within ca. 50 m of the ledge. Several groups of penguins coming from foraging trips repeatedly attempted to reach the land, but some groups could not access the rock ledge due to the presence of the seals.

On 4 November at 19:45 h after several attempts to exit the water, a group of penguins were observed swimming towards their favoured exit point of the rock ledge at high speed. The presence of the seals was not evident when the first penguin in the group reached the rock ledge. A few minutes later, the bigger seal appeared from under the water among the kelp fronds and captured a penguin that was trying to clamber onto the rock ledge (Fig. 1). At the same time, the other seal chased the remaining penguins left in the group that were climbing up on the rock ledge. This seal pursued the penguins up the landing zone until it reached a

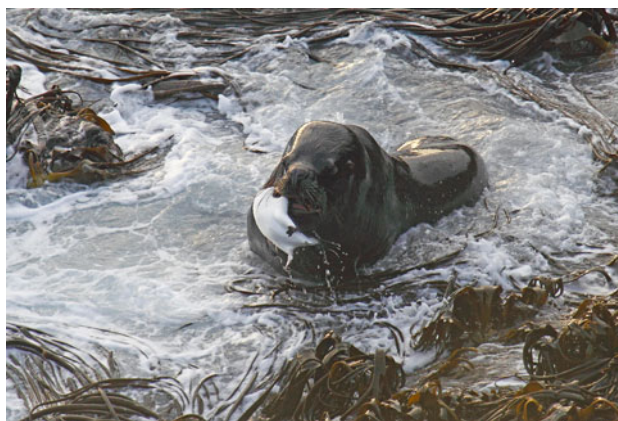


Fig. 1 Sub-adult South American sea lion *Otaria flavescens* preying on a rockhopper penguin *Eudyptes chrysocome* in the water at Staten Island, Argentina (photograph by PF Petracci)

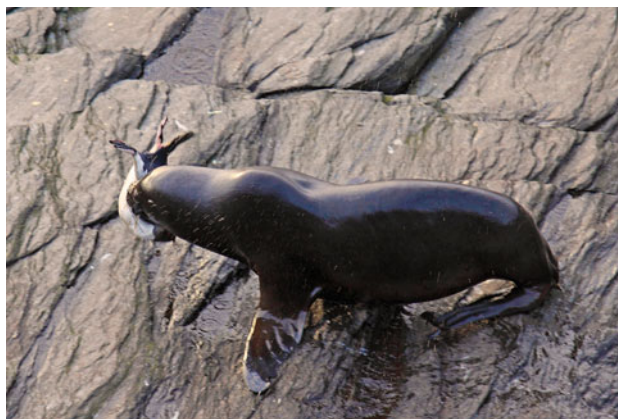


Fig. 2 Another sub-adult South American sea lion *Otaria flavescens* preying on a rockhopper penguin *Eudyptes chrysocome* after pursued the penguin on land at Staten Island, Argentina (photograph by PF Petracci)

penguin. Once there, it dropped its body over, immobilized and caught the penguin with its mouth (Fig. 2) and returned to the sea, where it consumed the penguin. As described by Strange (1982), the seal trashed the penguin back and forth on the surface in an attempt to remove its skin. Seals use a stealth wait and rush tactic as has been described for leopard seals *Hydrurga leptonyx* (Ainley et al. 2005), but also pursue penguins on land (Strange 1982).

Several studies have reported that other penguin species comprise a small part of the diet of several fur seal and sea lion species (Casaux et al. 2004; du Toit et al. 2004; Lalas et al. 2007; Makhado et al. 2008; Campagna 2008; Charbonnier et al. 2010). Although South American sea lions are known to feed on penguins (Boswall 1972; Strange 1982, Campagna 2008), diet studies report fish and cephalopods but not penguins (George-Nascimento et al. 1985; Thompson et al. 1998; Koen Alonso et al. 2000; Drago et al. 2010).

Birdlife International (2010) identified that a potential cause of the decline of northern and southern rockhopper penguin populations could be that top-down changes in the food web structure that has led to increased secondary predation on rockhopper penguins by pinniped populations. The predation could be the result of a small number of individuals specializing on penguins (as suggested by Strange 1982 and du Toit et al. 2004) or from the opportunistic but infrequent behaviour of many seals (as suggested by Casaux et al. 2004 and Makhado et al. 2008). Sea lions observed hunting and feeding on penguins at Staten Island were young adults, sexually mature but not able to access females (E Crespo pers. comm. to A Raya Rey). While it is not known whether it was the same individuals, the predation was being undertaken by a particular strata of the seal population, but the reason remains uncertain.

The populations of southern rockhopper penguins have suffered dramatic decreases across their range (Birdlife International 2010). However, the penguin population at Staten Island has been stable for the last 30 years (Schiavini 2000). In Tierra del Fuego, the South American sea lion population dropped by 15% during the period 1940–1990, although juveniles dominated the social structure of the colonies by the end of the 1990s, suggesting a likely increase in the following years (Schiavini et al. 2004). The recent trend is unknown. Fur seals also inhabit the Tierra del Fuego/Staten Island region and although they have not been observed taking southern rockhopper penguins at Staten Island, they have been reported preying on other penguin species (e.g. Charbonnier et al. 2010). The importance of the predation risk faced by penguins was demonstrated by a multi-seabird foraging study at New Island, Falkland/Malvinas Islands, where all three species of penguin studied avoided foraging in the waters offshore from seal colonies (Masello et al. 2010).

Observations of predation of southern rockhopper penguins by South American sea lions at one exit point at Staten Island suggest that predation during November is accomplished by a few specialized individuals, in this case being sub-adult males. However, a more systematic study of predation rates is necessary to determine whether the behaviour recorded at one site occurs at other exit points around Staten Island. This is especially important given that the Franklin Bay colony is a very large colony and it has been shown that, for example, leopard seals choose preferably to prey on penguins at larger rather than smaller colonies (Ainley et al. 2005). In addition, it is important to determine predation rates during other periods of breeding and moulting when the penguins are returning to land.

Quantifying the impact of apex predators is essential for the conservation of the species as well as for an ecosystem-based management (Forcada et al. 2009). With this in mind, more studies, not just collating ad hoc observations, are

necessary to model the actual effect of predation on southern rockhopper penguin populations by South American sea lions and sub-Antarctic fur seals.

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