

First record of hybridisation between Northern *Eudyptes moseleyi* and Southern Rockhopper Penguins *E. c. chrysocome*

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Abstract

A Northern Rockhopper Penguin *Eudyptes moseleyi*, typically a vagrant species to the Falkland Islands, spent six consecutive breeding seasons (2009–14) at a Southern Rockhopper Penguin *E. c. chrysocome* colony on East Falkland. During November 2014 it paired with a Southern Rockhopper Penguin and produced a hybrid chick. Although the chick did not survive, an increase in sightings of Northern Rockhopper Penguins at the Falklands suggests that further hybridisation between the two species is likely.

Introduction

Rockhopper penguins have a wide breeding distribution in the South Atlantic, Indian and Pacific Oceans (Williams 1995). Formerly considered one species, the Rockhopper Penguin *Eudyptes chrysocome* was split on phenotypic and genetic differences into the Northern Rockhopper Penguin *E. moseleyi* (Tristan-Gough and Amsterdam-St Paul) and Southern Rockhopper, *Eudyptes c. chrysocome* (extreme southern South America and the Falklands) and *E. c. filholi* (sub-Antarctic islands in the Indian Ocean and off New Zealand (Banks *et al.* 2006; Jouventin *et al.* 2006; de Dinechin *et al.* 2007; Birdlife International 2015).

Hybridisation in birds typically occurs as a result of restricted mate choice where two closely related species overlap in distribution and one taxon is rarer than the other (Randler 2002; Simeone *et al.* 2009). The Falkland Islands, in the Southwest Atlantic, support breeding species of *Eudyptes* penguins: some 320,000 pairs of Southern Rockhopper Penguins (Baylis *et al.* 2013) and < 50 Macaroni Penguins *E. chrysolophus* (Huin 2007). The two species occasionally form pairs and produce hybrid offspring (White & Clausen 2002). Four other *Eudyptes* penguins have been recorded as vagrants to the Falkland Islands: Royal *E. schlegeli*, Snares *E. robustus*, Erect-crested *E. sclateri* and Northern Rockhopper Penguins (Napier 1968; Woods & Woods 2006; Matias *et al.* 2009; Dehnhard *et al.* 2012). However, there are no reports of hybridisation with these species.

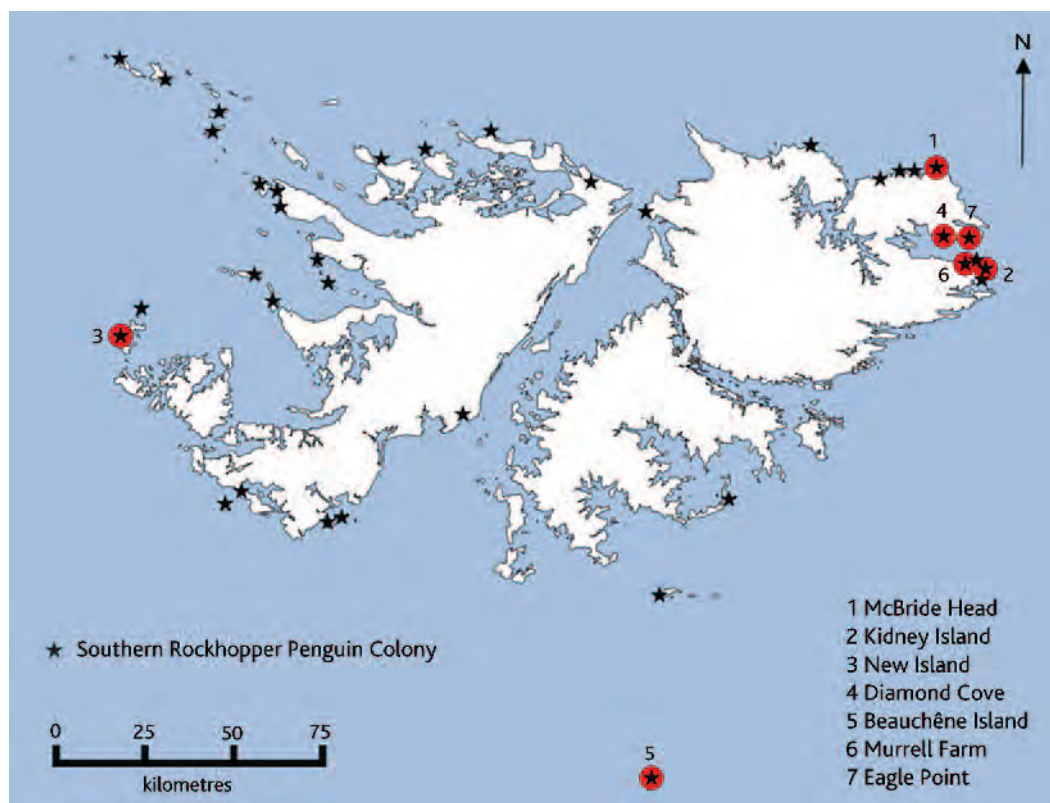


Figure 1. Distribution of Northern Rockhopper Penguin *Eudyptes moseleyi* sightings (red circles) at the Falkland Islands 1995–2014.

The largest and nearest population of Northern Rockhopper Penguins to the Falkland Islands is at Tristan da Cunha and Gough Island which hold > 80% (268,000 pairs) of the estimated breeding population (Cuthbert *et al.* 2009; Robson *et al.* 2011). The first record of a Northern Rockhopper Penguin at the Falklands was an adult in a Southern Rockhopper Penguin colony at McBride Head (Figure 1) on 24 November 1995. Since then, there have been nine further sightings of 6–7 individuals (Table 1). All records were of Northern Rockhopper Penguins in colonies of Southern Rockhopper Penguins during the austral summer. We describe the hybridisation between a Southern Rockhopper Penguin and a vagrant Northern Rockhopper Penguin.

Observations

On 24 November 2009 a Northern Rockhopper Penguin was observed in a Southern Rockhopper Penguin colony at Diamond Cove. It was recognised by its thick and long supercilium, pronounced and shaggy occipital crest feathers, extensive black colouration on the underside of the flipper, and larger body size (Shirihai 2007; Matias *et al.* 2009). Two small black spots on the bird's belly indicate that the same individual was recorded annually on subsequent visits to the Diamond Cove colony in late November from 2009 to 2014, and a Northern

Rockhopper Penguin was observed moulting at the colony in March 2013. None of the sightings suggested that the bird was attempting to engage in courtship, pairing or nesting activities until 9 November 2014, when the Northern Rockhopper was observed paired with a Southern Rockhopper Penguin and incubating one egg (A. Henry pers. comm.). On 26 November we installed an in-situ time lapse camera (Reconyx-Hyper Fire, set at 30 min intervals from 04:00 hrs to 21.30 hrs) at the nest to follow the outcome of the pairing (Figure 2).

A discarded eggshell was photographed on 6 December and on 10 December we observed a recently hatched chick with both Southern and Northern Rockhoppers in attendance. The remote camera images showed the Southern Rockhopper incubating and brooding a chick once it hatched (Figure 2). The Northern Rockhopper was absent during the day, returning to the nest in late afternoon or early evening, suggesting that it was a female, as female *Eudyptes* penguins perform all provisioning duties (Williams 1995). She was photographed until 18 December then was not observed again. The chick was photographed alive on 25 December, but was lying prone on the nest and clearly dead

Table 1. Sightings of Northern Rockhopper Penguins *Eudyptes moseleyi* at the Falkland Islands 1995–2014.

Date of sighting	Location	Observer	Source
24 Nov 1995	McBride Head (51°21'S 57°56'W East Falkland)	Mike Morrison	Matias <i>et al.</i> 2009
31 Dec 1995	McBride Head (51°21'S 57°56'W East Falkland)	Mike Morrison	Matias <i>et al.</i> 2009
30 Nov 1996	McBride Head (51°21'S 57°56'W East Falkland)	Mike Morrison	Matias <i>et al.</i> 2009
12 Dec 2004	Kidney Island (51°37'S 57°45'W East Falkland)	Mark Pearman <i>et al.</i>	Matias <i>et al.</i> 2009
21–29 Dec 2004	New Island (51°42'S 61°17'W west of West Falkland)	Rafael Matias <i>et al.</i>	Matias <i>et al.</i> 2009
24 Nov 2009	Diamond Cove (51°32'S 57°55'W East Falkland)	Various Falklands Conservation	
Jan 2010; Nov 2010, 2011, 2012, 2013, 2014; Mar 2013 & various others	Diamond Cove (51°32'S 57°55'W East Falkland)	Various Falklands Conservation	
27 Nov 2011	Beauchêne Island (52°54'S 59°11'W South of Falklands)	Klemens Pütz	Pers. comm.
Jan 2014	Murrell Farm (51°36'S 57°50'W East Falkland)	Nick Smith Mark Cutts	Pers. comm.
03 Dec 2014	Murrell Farm (51°36'S 57°50'W East Falkland)	Alan Henry Mike Morrison	Pers. comm.
31 Dec 2014	Eagle Point (51°32'S 57°48'W East Falkland)	Alan Henry	Pers. comm.



Figure 2. The Northern *Eudyptes moseleyi* and Southern Rockhopper Penguin *E. chrysocome* pair at Diamond Cove, East Falkland, November/December 2014). Images recorded from an in-situ Reconyx-Hyper Fire camera. **a.** Northern Rockhopper incubating egg. (26 November 2014). **b.** Northern Rockhopper brooding small chick with Southern Rockhopper partner (12 December 2014). **c.** Southern Rockhopper partner with hybrid chick visible (20 December 2014). **d.** Southern Rockhopper partner with hybrid chick dead at nest (27 December 2014).

(presumed to have starved) the following day. The Southern Rockhopper male remained with the dead chick until 27 December, and was photographed returning to the nest site intermittently thereafter.

Discussion

This is the first report of a hybrid chick between these two penguin species. In the austral summer of 2014/15 there were two other confirmed sightings of Northern Rockhopper Penguins in Southern Rockhopper colonies in the Berkeley Sound area of East Falkland (Table 1, Figure 1): one at the Murrell Farm (A. Henry & M. Morrison pers. comm.), on the south shore of Berkeley Sound and one at Eagle Hill on the north side of the sound (A. Henry pers. comm.). Extra-pair copulation in penguin species exists and the involvement of another Northern Rockhopper cannot entirely be ruled out as a possible explanation for the events described above at Diamond Cove; however this is unlikely, as no other Northern Rockhopper Penguins have been sighted at the Diamond Cove colony.

Vagrant Northern Rockhopper Penguins have reached South Africa, Kerguelen, Australia, New Zealand and the Chatham Islands (Matias *et al.* 2009) and are now regular at the Falklands. With the exception of the New Island bird in 2004 and a Beauchêne Island bird in 2011, all sightings of vagrant individuals have occurred in the north and northeast of the archipelago (Figure 1). The most likely source of these birds is Tristan da Cunha and Gough Island, 3,800 km northeast of the Falkland Islands. With only five of the approximate 38 Southern Rockhopper Penguin breeding locations at the Falklands routinely monitored, representing less than 2% of the total breeding population, there is a strong possibility that Northern Rockhopper Penguins are being overlooked.

The lack of available data on movements of Northern Rockhopper Penguins from Tristan-Gough and Amsterdam-St.Paul makes it difficult to draw conclusions about the processes by which they may travel to the Falklands. Rockhopper penguins are wide-ranging species and since most extralimital sightings of Northern Rockhopper Penguins in Africa have concerned moulting juveniles (Cooper 1992) it is possible that immature birds are arriving in the Falklands and not being detected until they reach near-adulthood; the New Island individual was considered to be an 'older sub-adult'.

Pre-breeding penguins are more often reported as long distance vagrants than adults (Dehnhard *et al.* 2012), a trait allowing flexibility to reach new potential breeding sites in response to environmental changes (Crawford *et al.* 2015). For instance, immature African Penguins *Spheniscus demersus* moved away from natal colonies to other sites (several 100 km) during a corresponding period of population declines (Sherley *et al.* 2014). Northern Rockhopper Penguins have also undergone population declines (Cuthbert *et al.* 2009), but in contrast breeding localities are separated by much larger distances (several 1,000 km); hence if Northern Rockhopper Penguins respond to changes by dispersing more widely, it is likely that only a small number are successful in completing these long distance journeys to find suitable new habitats. In saying this, if they continue to arrive and stay at the Falklands hybridisation with Southern Rockhopper Penguins could continue.

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