

A new breeding site for Markham's Storm-Petrel *Hydrobates markhami* in northernmost Chile

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Received 17 June 2024; final revision accepted 14 January 2025

Cotinga 47 (2025): 2–5

published online 5 May 2025

La Golondrina de Mar Negra *Hydrobates markhami* (Procellariiformes) es un ave marina de tamaño mediano (21–23 cm) distribuida principalmente a lo largo de la corriente de Humboldt entre el norte de Chile y el sur de Ecuador. En Perú y Chile, se conocen 13 sitios de reproducción entre la península de Paracas (Perú; 13°54'03''S) y Antofagasta (Chile; 23°47'16,8''S). Estos sitios albergan una población reproductiva de aproximadamente 58.000 parejas. En este trabajo, informamos sobre un nuevo sitio de reproducción de *H. markhami*, ubicado en Pampa Colorada (18°22'55,2''S 70°10'51,6''O) en el extremo norte de la región de Arica y Parinacota, cerca del límite de Chile con Perú. El sitio de reproducción se encuentra sobre un sustrato de arena rojiza fina y gruesa con una costra salina parcialmente protuberante creando cavidades naturales en los salares del desierto. Durante tres campañas de monitoreo, registramos 92 nidos; 24 tenían crías, 26 crías y adultos y 42 evidencias indirectas de reproducción. La conservación de este sitio es fundamental para mantener la conectividad genética de las poblaciones del norte de Chile y las presentes en el sur de Perú.

Markham's Storm-Petrel *Hydrobates markhami* is a medium-sized (21–23 cm) pelagic tubenose (Procellariiformes) found mainly in tropical waters of the Pacific Ocean, between 5°N and 29°54'S, and 71°W and 118°W^{7,14,20}. It breeds in 13 colonies grouped in four dispersed sites in the Sechura and Atacama Deserts (southern Peru and northern Chile), nesting in fissures and holes created by saltpetre deposits in saline areas^{1,9–11,17,21}. The northernmost colony is in Paracas, Ica, Peru, where the species breeds at small, dispersed sites on sloping ground, up to 5 km from the sea^{9,10}. There are two additional colonies in Peru: Isla La Vieja (Ica)⁵ and Pampa Pie de Candela (Tacna)⁴. The 10 other known colonies are all in Chile located in the Atacama Desert, up to 50 km inland^{1,11,12}. From north to south, these are Arica, Chiza, Jarza, Quiuña, Caleta Buena, Carmen Norte, Salar Grande, Pampa Hermosa, Loa and Salar Navidad^{11,12}.

Throughout the species' range, reproduction is asynchronous^{1,12}. In the northern colonies of Paracas and Arica, most pairs lay eggs between May and August, and birds attend nestlings between July and January^{1,10,12}. In the colonies of Caleta Buena, Salar Grande and Salar Navidad, however, breeding pairs lay eggs between November and January, and adults attend nestlings between January and April^{1,12}. The species' population size is estimated at 2,305–4,362 breeding pairs in Peru^{9,10} and 55,308–55,733 breeding pairs in Chile^{1,12}. Markham's Storm-Petrel is currently classified as Near Threatened globally and Endangered in Chile¹³, mainly due to its declining population and extended threats across all breeding colonies^{1,12}. Here, we report a new breeding site for

Markham's Storm-Petrel in northernmost Chile, near the border with Peru.

Methods

The study area corresponds to road A-135 Sector de Acceso Central – Coronel Alcérreca, in Arica y Parinacota region, northern Chile. This road is north of the Río Lluta basin, north of Arica, and in the extreme southwest of General Lagos (Fig. 1). Focussed searches for storm-petrels (Hydrobatidae and Oceanitidae) were conducted during 14–19 June, 30 September and 28 October 2023. Searches for reproduction clues within potential cavities (i.e., tracks, scents, faeces, feathers and bones) were conducted within the areas identified as possible breeding sites, following guidelines described by Barros *et al.*^{1,2}.

In addition, because adults usually respond to vocalisations¹, recordings of conspecific calls (Macaulay Library ML83166671) were played at the entrance of cavities to confirm activity in nests. Storm-petrel calls were also recorded using an autonomous AudioMoth v1.2 recorder⁶. This was installed at a potential ground-level breeding site during 14–19 June. Acoustic monitoring comprised four 1-minute recording sessions per hour, each followed by a 14-minute pause, for 24 hours per day; this generated 96 1-minute recordings on each of four days. The sampling frequency ranged from 4–96 kHz, which is adequate for bat and bird recording. Fine-scale measurements were taken, and sonograms were prepared using the Raven Pro 1.5 program³.

We used digital elevation models (DEM-ALOS PALSAR) with geological maps¹⁸, slope, orientation and contour lines to delimit the breeding site.



Figure 2. Photographic evidence confirming Pampa Colorada as a breeding site for Markham's Storm-Petrel *Hydrobates markhami*, Arica y Parinacota region, Chile (Benjamín Gallardo). **A** Habitat at Pampa Colorada, 30 September 2023; **B** nest cavity, 30 September 2023; **C** nest inspection with an endoscopic camera, 28 October 2023; **D** Markham's Storm-Petrel egg, 28 October 2023; **E** Markham's Storm-Petrel nestling, 28 October 2023; **F** Markham's Storm-Petrel adult and nestling, 28 October 2023.

Discussion

Considering the high fidelity of this species to its breeding sites^{9,10,12} and the strong population genetic structure¹⁵, this newly discovered colony is critical for the conservation of this globally Near Threatened species. Potential threats to this site are vehicular traffic along the A-135 road, which borders the area and will soon incorporate lighting into its improvement plan; the risk of collisions between storm-petrels and power lines;

and garbage thrown out of vehicles. Management measures should be considered to prevent impacts on this breeding site (see Silva et al.¹⁹). Some effective practices include installing warm-toned lighting and placing lighting near the ground to reduce birds' attraction to lamps.

Acknowledgments

We thank the American Bird Conservancy and Biocron SpA for their financial and technical support, which made part of this expedition possible. We also thank