Markham's Storm Petrel breeding colonies discovered in Chile

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The Atacama Desert 80 km east of Antofagasta, a huge extension of apparently lifeless sand, rock and salt-plain (Fabrice Schmitt / WINGS Birding Tours)

Markham's *Oceanodroma markhami* (front) and Elliot's Storm Petrels *Oceanites gracilis*, off Arica, Chile, October 2009 (Steve N. G. Howell / WINGS Birding Tours)

The place we are visiting today has not seen a single drop of rain since humans thought about monitoring rainfall. We are in the north of Chile, in the Atacama Desert, the driest place in the world. Two thousands kilometres of sand, rocks and salt plains. After a full day's birding, we can send our list to *eBird*: 5 Turkey Vultures *Cathartes aura*. That's it! That is the only species we have seen today… yet it has been one of our most exciting trips in the Neotropics!!

Everything began in 2013, when a biologist from a consultancy company recorded "snipe singing by night in the desert". On the recording, there were obviously no snipe singing, but what we identified, with the help of Alvaro Jaramillo, were seabirds. In every Neotropical birder's mind, the association of seabirds and Atacama Desert immediately evokes storm petrel colonies and, for a few of us, the hope of discovering the Holy Grail: the first breeding colony of Ringed (Hornby's) Storm Petrel *Oceanodroma hornbyi*!

The Ringed Storm Petrel, as well as Markham's *O. markhami* and Elliot's Storm Petrels *Oceanites gracilis*, are very poorly known species. All three remain amongst the 62 of the world's bird species currently classified as Data Deficient, because too little is known about them to be able to assign to them a meaningful threat category (BirdLife International 2015). Nevertheless, Markham's and Elliot's Storm Petrels are fairly common to common, and Ringed Storm Petrel uncommon, at sea off northern Chile and as far north as central Peru; but almost nothing is known about their breeding biology. Until 2013, only one breeding colony of Markham's Storm Petrel has been found (Paracas, Peru; 2,305–4,362 pairs in 1992/1993; Jahncke 1994), a very few nests of Elliot's Storm Petrel have been found, all on one island (Isla Chungungo, Chile; Schlatter & Marin 1983, Hertel & Torres-Mura 2003), and the location of breeding colonies of Ringed Storm Petrel is still an absolute mystery!

In the very first issue of *Neotropical Birding*, Tobias *et al*. (2006) already pointed towards the Atacama Desert as the likely breeding area for Markham's and Ringed Storm Petrels. Every year, hundreds of flying chicks, still with some down, are found in the north of Chile—so the breeding colonies have to be tantalisingly close! But very few people have spent time in that very inhospitable area. Mike Brooke is one of them, but even after spending 25 days on field work in 1999, he failed to locate any breeding colony (Brooke 2000). During the last decade, hardly anyone has really looked for these mysterious birds.

So when seabirds were recorded near Arica, a group of Chilean birders from the Red de Observadores de Aves de Chile (ROC, the Chilean Birding Network), led by Rodrigo Barros, rapidly decided to organize a first expedition, in November 2013, with the hope of finding a few breeding storm petrels. Incredibly, we discovered multiple evidence of breeding during the very first day in the field: footprints at the entrances of cavities, old mummified chicks, several fresh dead birds (mostly wings), and we even heard chicks calling deep within the cavities! All the nests were found in natural cavities in saltpetre crust, at 800–900 m in Pampa de Camarones, 45 km south of Arica and 10–12 km from the coast. A rapid estimate made in the field indicates that thousands of pairs are probably breeding here, only one hour from Arica!

We later learned that a few months earlier Juan Torres-Mura and Marina Lemus (2013) had also discovered a Markham's Storm Petrel colony 22 km south-east of Arica, in similar habitat (saltpetre crust). Ironically, after decades of mystery, the same breeding area had been discovered by two independent teams almost simultaneously!

But that was just an appetizer! Stimulated by the discovery of that Markham's Storm Petrel colony, we wanted now to prospect the rest of the Atacama Desert to find more! Since many of these colonies could be threatened by mining and other human activities, the Western Alliance for Nature (WAN Conservancy) rapidly understood the importance of locating the breeding grounds of these storm petrels and agreed to cover the costs of our field work. From April 2014 to April 2015 we carried out six further field trips, comprising a total of 45 field days, and the detailed results of these expeditions will be presented in a scientific journal very soon. Before that, we wanted to share some of the highlights of our discoveries and alert conservationists about the threats to these colonies.

The key question when looking for storm petrel colonies is: where can they possibly lay their eggs in such an arid and inhospitable habitat? Eggs have to be protected from harsh sun, strong wind, cold nights and—even though there is almost no life in the desert—from predators such as Turkey Vulture and Culpeo *Lycalopex culpaeus* that can travel long distances to feed on chicks and adult storm petrels. Breeding in the open would not seem to be a sensible strategy, even if Grey Gulls *Leucophaeus modestus* do so: discovered only in the early 1940s, their colonies are found deep within the Atacama Desert (sometimes 100 km inland), where they lay their eggs in the shade

of a large rock, travelling to the colony by night, perhaps in order to avoid being followed by avian predators.

We believe that the storm petrels breeding in the Atacama Desert must dig their burrow or nest inside a natural cavity, as do the other storm petrel species of the world. But even if the Atacama Desert seems to offer almost infinite opportunities for establishing a colony, most of the soil is too hard or too soft for a storm petrel to dig its burrow. The saltpetre crust, on the other hand, offers wonderful breeding possibilities! The crust is so hard that few predators can break it to access the nests, and the holes and space found below the crust offer a potential breeding habitat for tens of thousands of storm petrels. After finding our first colony near Arica, we realised that we had to focus our search on these salt plains. Actually, this had already been suggested by Brooke (2000) and, obvious as the colonies turn out to be, it seems unbelievable that it took so much time to confirm his suspicions!

We discovered two main breeding areas in northern Chile: an extensive salt crust south of Arica of more than 80 km long and as much as 5 km wide, and the Salar Grande area near Iquique, potentially 30 km long and 7 km wide. All breeding colonies have been found between 8 and 20 km from the coast, at 400–900 m elevation. We do not yet have enough data to permit a precise estimate of this breeding population, but we believe that tens of thousands of pairs are located in northern Chile. This is probably where most of the world population of Markham's Storm Petrel breeds!

During our expeditions, we have been very concerned by the many threats affecting these storm petrels. The destruction of their breeding habitat is pronounced, since the saltpetre crust beneath which they breed has been intensively exploited, mostly at the end of the 19th and beginning of the 20th centuries. In most areas of the salt plain where the saltpetre crust has been exploited, there is absolutely no cavity left: the entire surface has been completely removed, totally destroying the superficial crust and huge extensions of potential breeding habitat. The exploitation of these salts still continues and we discovered active destruction of breeding habitat during the breeding season.

The 'killing lights' of cities, industries, roads, and other infrastructure attract the fledglings during their first flight and have a disastrous impact too, killing thousands of birds every year. At the base of one particular light located close to an active breeding colony, we discovered hundreds of wings (the bodies are eaten by Turkey Vultures) and 10–20 fresh corpses every single morning. Other threats include human construction (a highway crosses one of the colonies), military activities (soldiers have been operating and camping on one colony) and collision with electrical cables in transit to the breeding sites.

After these first important discoveries, the ROC is now looking for funding to begin monitoring the breeding colonies, and to work with the industries and Chilean government to control and manage their impact as soon as possible.

What about Elliot's and Ringed Storm Petrels?

Besides the Markham's colonies presented here, we also found hundreds of inactive cavities dug in a very different geological substrate. In these cavities we discovered lots of feathers, a few old eggs, and even a mummified storm petrel chick. The chick's DNA is in the process of being analysed to confirm the identity of the species, although the egg sizes match the only known egg of Elliot's Storm Petrel (Schlatter & Marin 1983). Surprisingly, even after visiting these cavities at different seasons of the year, we still have not found any fresh breeding evidence. During our prospecting we also discovered tens of dead Ringed Storm Petrels, but nothing to conclusively lead us to a breeding colony. The Ringed Storm Petrel guards its secret... and keeps up our levels of excitement during our field trips, in the hope that we will discover their breeding grounds very soon!

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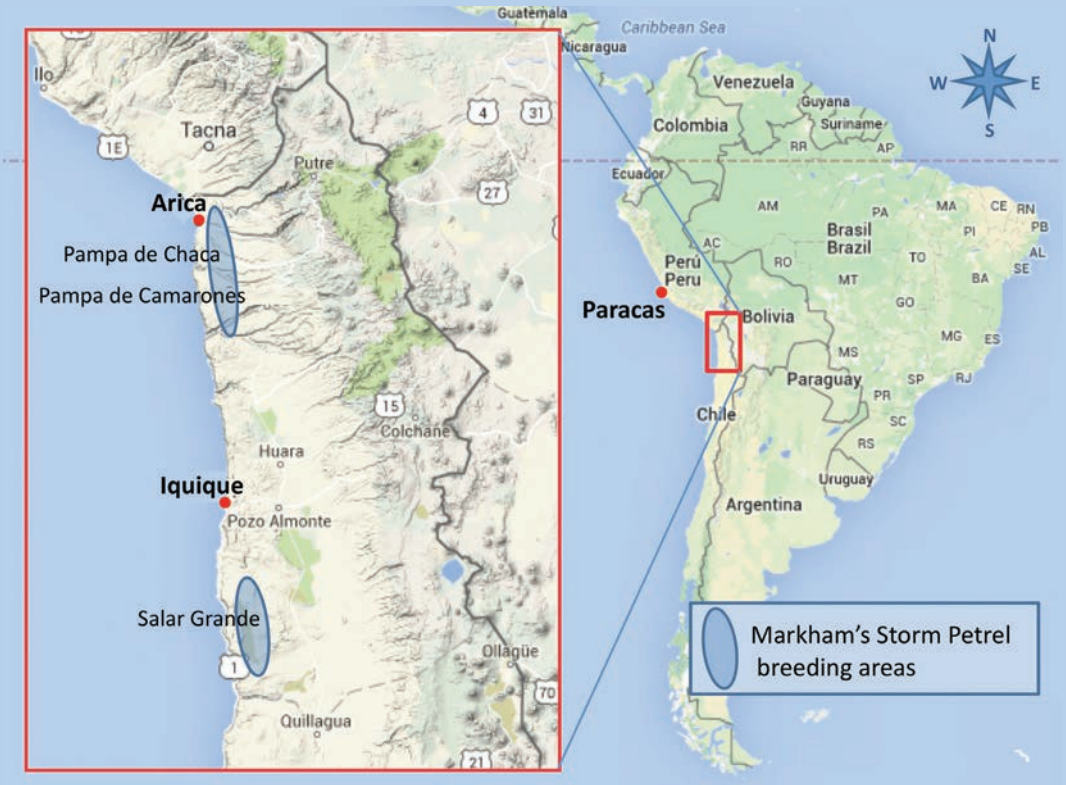
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Markham's Storm Petrel breeding areas

Facing page, top: Landscape at breeding colony, Salar Grande, south of Iquique, Chile, May 2014 (Rodrigo Barros / www.redobservadores.cl)

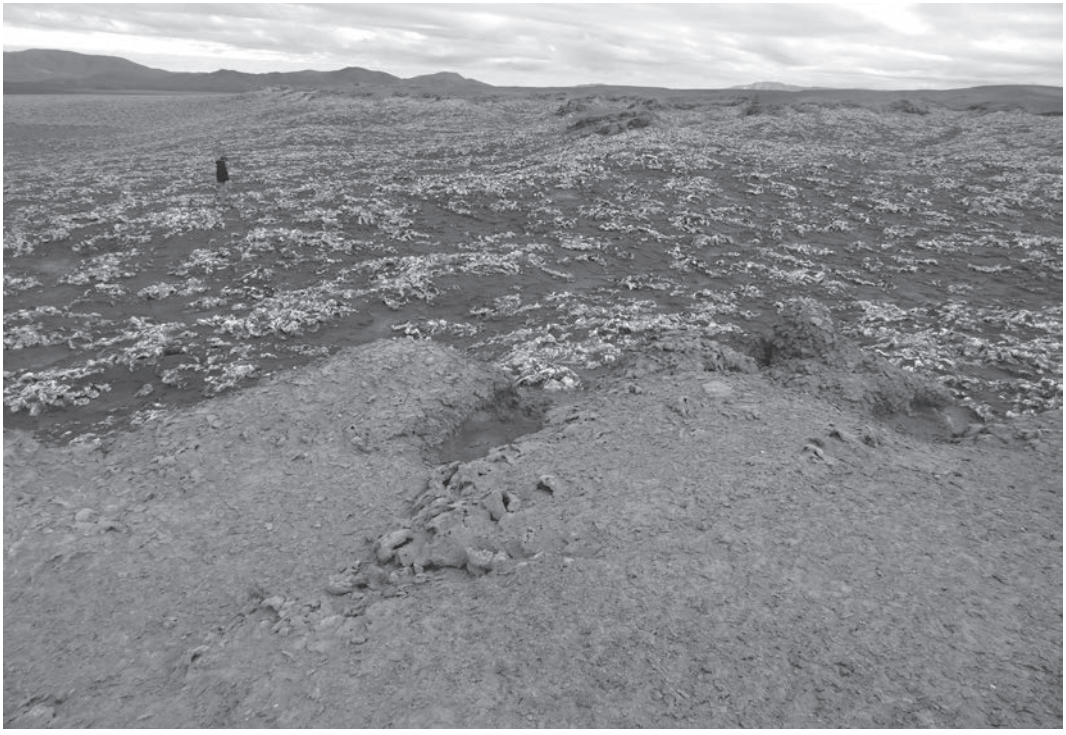
Facing page, bottom: Locations of Markham's Storm Petrel *Oceanodroma markhami* colonies discovered in 2013–2014 (extracted from Cornell Lab of Ornithology's Neotropical Birds http://neotropical.birds.cornell.edu and eBird http://www.ebird.org)

Above, left: Footprints at the entrance of a breeding cavity, Pampa de Chaca, south of Arica, Chile, April 2014 (Rodrigo Barros / www.redobservadores.cl)

Above, right: Wings of Markham's Storm Petrel *Oceanodroma markhami* found below a "killing light", Punta Patache, south of Iquique, Chile, May 2014 (Rodrigo Barros / www.redobservadores.cl)

Right: Markham's Storm Petrel *Oceonodroma markhami* incubating an egg, Pampa de Chaca, south of Arica, Chile, September 2014 (Ronny Peredo / www.redobservadores.cl)

Below: A recently fledged chick of Markham's Storm Petrel *Oceanodroma markhami*, still with down, Salar de Pintado, east of Iquique, Chile, April 2014 (Raúl Ignacio Díaz Vera / www.flickr.com/photos/nacho_dayz)



Landscape at breeding colony, Salar Grande, south of Iquique, Chile, May 2014 (Rodrigo Barros / www.redobservadores.cl)

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