

NATURAL HISTORY NOTE

Breeding of Markham's Storm-Petrel (*Oceanodroma markhami*, Aves: Hydrobatidae) in the desert of northern Chile

Reproducción de la golondrina de mar negra (*Oceanodroma markhami*)
en el desierto del norte de Chile

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Storm-petrels (family Hydrobatidae) are diverse and widespread in the Pacific Ocean. Their breeding grounds are poorly known because they typically nest on islands, their nests are in burrows and crevices, and usually they attend their nests at night. Among the South Pacific species, Markham's Storm-Petrel (*Oceanodroma markhami* (Salvin, 1883)) is listed as Data Deficient by the IUCN (2012) because data on overall numbers, trends, and threats are not known. Only a few nesting sites on the Paracas peninsula (and offshore Isla Vieja) in Perú have been documented (Jahncke 1993, García-Godos et al. 2002) and therefore this species is considered endemic to Perú (Croxall et al. 2012). Here we present the first record of reproduction of Markham's Storm-Petrel in Chile, where it is categorized as endangered (Inadequately Known, SAG 2012).

In April 2012, fellow entomologist Laurence Packer (York University) told us he heard seabird calls at night while crossing the desert. Between 14 and 17 June 2013 we surveyed that area for nests or other signs of activity. During the day, approximately 22 km southeast of Arica (Arica Parinacota region) above the Acha ravine, we found cavities in the saltpeter with fecal stains and a strong odor, some dismembered black wings, and a mummy of a Storm-petrel in a crevice. At night we heard vocalizations and saw several birds flying. We identified the birds as Markham's Storm-Petrel (*Oceanodroma markhami*) based on their size, long pointed wings, and a deeply forked tail. This species is dark sooty brown above, shading to blackish brown on the underparts

with pale grayish brown upperwing coverts forming a distinct pale bar across the surface of the wing, which extends almost to the carpal joint. Wing flight feathers are almost black though the bases of the primary shafts look white. The underwing is blackish gray, and has a slight silvery sheen. The distal uppertail coverts are paler than the back, creating a slight contrast with the blackish tail (Murphy 1936, del Hoyo et al. 1992). Other dark brown storm-petrels with a pale wing bar are allopatric and differ in size (Murphy 1936, Harrison 1987).



Fig. 1: Markham's Storm-Petrel (*Oceanodroma markhami*) at its nesting site in Arica, Chile.

Golondrina de mar negra (*Oceanodroma markhami*) en su lugar de anidación, en Arica, Chile.

Markham's Storm-Petrel is common in the Humboldt Current, including pelagic and coastal waters of Ecuador, Perú, and Chile between 18° N and 30° S (Murphy 1936). It has been observed west of the Galápagos Islands near the equator, in the Panama Bight, and off Baja California, reaching as far west as 118° W (Spear & Ainley 2007). Maximum upwelling in the Humboldt Current occurs during the austral winter and may not vary appreciably with latitude. Coincidentally, the highest densities of this storm-petrel have been documented from austral autumn to spring off southern Perú and northern Chile (Figueroa & Suazo 2012, Spear & Ainley 2007).

The nesting area of this new locality occurs in a tropical hyper-arid climate with no precipitation and a mean annual temperature of 19 °C with minor differences between summer and winter (Luebert & Plissock 2006). The substrate is sandy with interspersed saltpeter patches and completely devoid of vegetation. Nests are located within a narrow band of saltpeter running west-east. The distance of the most inland (eastward) colonies is 15 km from the sea at a mean altitude of 650 masl. To reach the sea, birds must fly over the 850-900 m high coastal range.

We observed flying storm-petrels over an area of 6 km² (centered at 18° 30' S, 70° 15' W). We sampled burrowed areas via nest counts in eight 10 x10 m plots. Nest density was 2.6*100 m⁻² but the saltpeter areas were smaller with 12 patches with nests, and rendering a population of more than 5000 pairs. The widest part of the opening of 14 burrows had a mean (\pm SD) of 10.3 \pm 3.1 cm (range 7-18 cm), the narrowest part was (mean \pm SD) 6.8 \pm 1.9 cm (range 4-11 cm), and the depth of these burrows was > 40 cm; occupied burrows were narrower than those measured in Perú. There, nests with narrow diameters or with deeper burrows had a greater probability of success (Jahncke 1994). All nests were located inside saltpeter crevices and consisted of hollow scrapes in the sand with no nest material (only some feathers and feces). During nuptial displays storm-petrels engage in aerial pursuits with one bird following the other and both calling loudly (del Hoyo et al. 1992). During our survey we only observed solitary birds flying in circles above the nesting area, vocalizing frequently. Birds called in flight and also from within their burrows.

Most of the nesting areas we located were in salt pans that were very flat with only a few on slopes facing a creek, in contrast with the sloping terrain utilized by Markham's Storm-Petrels in Perú (Jahncke 1993). Both Brooke (2000) and Tobias et al. (2006) considered the salt flats of Atacama as possible colony sites, but questioned "whether the small salt peaks would provide a sufficient take-off point for birds, particularly fledglings on their first flight". This apparently does not seem to be a problem.

Egg laying by Markham's Storm-Petrel in Perú occurs from late June to August (Jahncke 1993), which indicates an austral winter-spring breeding season. In Chile reproduction seems to occur between March and June; fledglings are attracted by lights in cities from April to June. During our visit to the area in June we heard several fledglings vocalizing from the nests (but saw only one), even during the day.

Several dismembered storm-petrel wings were found in the salt pans, along with culpeo fox (*Pseudalopex culpaeus* (Molina, 1782)) footprints and feces with feathers of storm-petrels, and tracks of Turkey Vultures *Cathartes aura* Linnaeus, 1758 (and some of them soaring); no other vertebrate species were seen. In Paracas, two foxes (*P. culpaeus* and *P. sechurae* (Thomas, 1900)) are the predators of Markham's Storm-Petrel (Jahncke 1993, 1994).

Despite this storm-petrel being relatively common in the Humboldt Current, it was not until 1992 that a colony of 2300-4300 pairs was found on the Paracas Peninsula, Perú, in saltpeter deposits, between 200 and 300 m above sea level and about 5 km inland (Jahncke 1993, 1994). As a result of finding mummies, roadkills, and grounded nestlings, several authors (Johnson 1965, Brooke 2004, Tobias et al. 2006) suggested that this species likely breeds in the salt expanses, canyons, and coastal hills of the Atacama desert, extending from southern Perú to northern Chile. They also recommended that searches for colonies should be focused around Iquique, where breeding evidence has been suspected. As Paracas is at 13°48' N - 76°24' W, our finding extends the reproductive range 830 km south.

Threats to the nesting populations include mining (more common in the southern Tarapacá region; e.g. 20°58' S, 69°39' W) and human occupation. Near the nesting area

we saw bulldozer trails and a camp of road construction workers with machines and dogs. Seabirds, especially pelagic species, are more threatened than most other bird groups with similar numbers of species (Croxall et al. 2012), and several authors (Croxall et al. 1984, Tobias et al. 2006, Spear & Ainley 2007) suggested that the breeding seasons for Markham's and three other species known or suspected to nest in Chile-Perú deserts need better documentation (see Hertel & Torres-Mura 2003, Bernal et al. 2006). Data should include full coverage of the breeding range, which, judging from coastal distributions appears to extend along the South American coast from about 8° S to 25° S.

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