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Offshore hummingbird sightings in Chilean Patagonia

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ABSTRACT—By many metrics hummingbirds are excellent fliers, but few species are known to undertake long flights over open water. Here we report 33 sightings of Green-backed Firecrowns (*Sephanoides sephaniodes*) crossing the Corcovado Gulf in Chilean Patagonia. Sightings ranged between 1.2 and 12.6 km from shore and occurred in a variety of weather conditions. The high frequency of offshore encounters suggests that either the Green-backed Firecrown performs a seasonal migration between Patagonian islands and fjords or a high level of connectivity exists between geographically separated metapopulations. *Received 27 April 2017. Accepted 18 March 2018.*

Key words: dispersal, Green-backed Firecrown, hummingbird, Patagonia, *Sephanoides sephaniodes*.

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Avistamientos marinos de colibríes en la Patagonia chilena

RESUMEN (Spanish)—Los colibríes, en base a muchas variables, son excelentes aviadores. Sin embargo, son pocas las especies conocidas que emprenden vuelos largos sobre aguas abiertas. Aquí reportamos 33 avistamientos de colibríes australes (*Sephanoides sephaniodes*) cruzando el Golfo de Corcovado en la Patagonia chilena. Los avistamientos se registraron desde 1.2 a 12.6 kilómetros

de la orilla y ocurrieron en una variedad de condiciones atmosféricas. La alta frecuencia de avistamientos marinos sugiere o que los colibríes australes realizan una migración estacional entre las islas y fiordos de Patagonia o que hay un alto nivel de conectividad entre metapoblaciones que están separadas geográficamente.

Palabras clave: dispersión, colibríes australes, colibrí, Patagonia, *Sephanoides sephaniodes*.

Oceans are unusual places to find hummingbirds. Their energetically demanding flight style is not well suited for exploiting maritime wind patterns (Pennycuick 1975), and they require almost constant refueling from sugar-rich nectar sources to sustain their high metabolism (Pearson 1950). A few notable exceptions exist, however. Ruby-throated Hummingbirds (*Archilochus colubris*) cross the Gulf of Mexico during their yearly migration, accomplishing an endurance flight that covers distances of >800 km (Weidensaul et al. 2013). When they are not transiting across the Gulf of Mexico, Ruby-throated Hummingbirds fly more moderate migration legs overland, ~32 km/d (Courter et al. 2013). Likewise, Rufous Hummingbirds (*Selasphorus rufus*) are known for their long distance migrations, flying overland from Mexico to Alaska along the western coast of North America (Healy and Calder 2006). Although most Rufous Hummingbirds stay on the mainland, some individuals stopover or establish territories on the Channel Islands, the Gulf Islands, and the Queen Charlotte Islands (up to 140 km offshore). Other than these examples, most hummingbird species are highly localized and constrained by geographical barriers such as mountains, deserts, and oceans. Although by many metrics hummingbirds are excellent fliers, for most species long distance water crossings remain the exception and not the rule.

The Green-backed Firecrown (*Sephanoides sephaniodes*; Fig. 1) is a medium-sized hummingbird (~5 g) commonly found throughout Chile up to elevations of 2,000 m (Jaramillo et al. 2003). They inhabit the forests, fjords, and small islands of Patagonia, the central mainland, and, most surprisingly, the Juan Fernandez archipelago, almost 700 km offshore (Colwell 1989, Roy et al. 1998). In Argentina their range is limited to the western mountains on the Chilean border, and they are not commonly found in the Patagonian Steppe. Green-backed Firecrowns are primarily understory generalists that do well in both pristine forests and in human-occupied areas, and their success is demonstrated by their large geographical distribution (Jaramillo et al. 2003). Some populations of Green-backed Firecrowns at the latitudinal limits of their range are known to perform seasonal migrations, gradually retreating north as austral winter arrives (Greenewalt 1960), but some locations have year round residents (Chalcoff et al. 2008). Migration patterns and the interconnection between metapopulations of Green-backed Firecrowns are not well understood. Here we report several sightings of Green-backed Firecrowns crossing the Corcovado Gulf in Chilean Patagonia, a span that may include crossings of >70 km. The high frequency of encounters suggests that either the Green-backed Firecrown performs a seasonal migration between Patagonian islands and fjords or a high level of connectivity exists between seemingly isolated metapopulations.

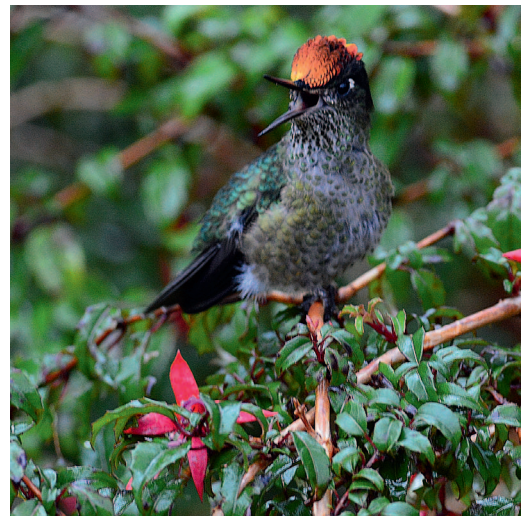

Figure 1. A male Green-backed Firecrown in the Melimoyu Nature Reserve, at the southeastern end of the Corcovado Gulf. Photo courtesy of Alex Machuca.

Methods

Between 19 February and 5 March 2017 we conducted a marine mammal survey of the Corcovado Gulf in Chilean Patagonia. While transiting southward past the mouth of the gulf we sighted several hummingbirds flying past the

ship, even though we were several kilometers from shore. In previous years (2014–2016) we observed, but did not record, similar sightings. On the northward return trip, we recorded GPS position, behavior, and direction of travel of the hummingbirds we encountered starting on 23 February at 1530 h, Chilean Standard Time, and continuing through the end of the expedition. From 0730 to 2030 h we stationed rotating observers on the ship's tower, and during the hourly shift changes we recorded visibility and wind speed estimated using the Beaufort scale. Visibility and wind speed were generally stable over the course of several hours, but precipitation was highly variable and changed frequently, preventing accurate records of rainfall. Surveys were suspended during inclement weather (wind >21 knots). At least 2 observers were always on watch, and most sightings were confirmed by multiple observers. The primary duty of the observers was to record marine mammal sightings, and therefore the majority of hummingbird identifications were from unequivocal encounters within 50 m of the boat, sometimes with the birds hovering within a few meters of the observers. For each sighting, we calculated the closest distance to shore and the shortest straight-line distance between 2 different landmasses that passed through the location of the sighting. The sightings were recorded using Logger 2010 (IFAW), and calculations were made in Python (Python Software Foundation).

Observations

We recorded 33 offshore sightings of Green-backed Firecrowns while transiting through the Corcovado Gulf (Fig. 2). Sightings ranged between 1.2 and 12.6 km from shore (average 7.5 [SE 0.6] km) and occurred in a variety of weather conditions, including high winds (2 sightings in 17–21 knot winds), fog (14 sightings in <2 km visibility), light rain, and sunshine. The majority of hummingbirds were seen at the southernmost part of our survey area, even though most of the cruise effort was concentrated in the north. South of the 43rd parallel south we recorded a hummingbird sighting for every 35 min of effort, but in the north we recorded a sighting for every 11 h 17 min of effort. A complete track of the survey area

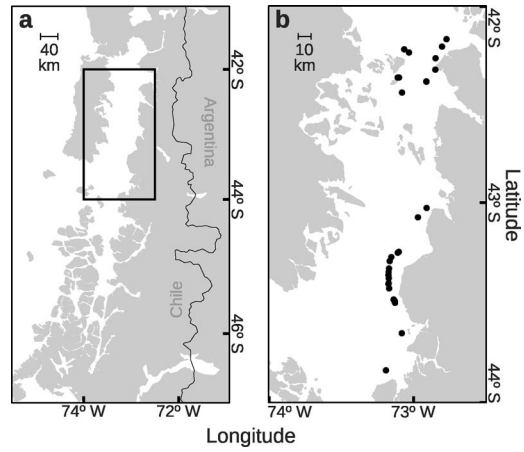

Figure 2. Offshore sightings of Green-backed Firecrowns in the Corcovado Gulf. (a) Map of the Corcovado Gulf. (b) We recorded 33 sightings of Green-backed Firecrowns ranging between 1.2 and 12.6 km from land (black circles).

showing when the official recordings began can be found in the supplemental materials (Supplemental Fig. S1a). Most birds flew past the boat without stopping; however, some approached the boat and investigated the bright-colored equipment onboard. No birds landed on the boat. We observed 3 instances of 2 birds aggressively chasing each other and vocalizing, although 1 instance occurred before we began recording observations. Sex of the birds could not be determined (raw data are available in the Supplemental Materials).

The hummingbirds flew with a near-horizontal body orientation suggesting rapid flight (Tobalske et al. 2007), and judging from the shape of their flight trajectories, they used a bounding gait, although whether this represents true flap-bounding flight is not clear. One bird paced the boat for several minutes, flying at ~3.5 m/s. Most of the birds were seen flying at or above the height of the observation deck (~4 m), although some individuals flew lower, and one bird observed in heavy winds was flying low, near the water surface.

Discussion

Green-backed Firecrowns have the ability and affinity to make long distance crossings over water. While sailing in Patagonia we observed

many hummingbirds crossing the Corcovado Gulf at distances as far as 12.6 km from land. At a minimum, this means the bird sighted farthest from shore was making a 25.2 km round trip flight (Supplemental Fig. S1b). For a bird traveling at 3.5 m/s (a conservative estimate of preferred flight speed; see Tobalske et al. 2007), this would mean a trip of 2 h, which is notable for a bird that normally makes between 15 and 40 feeder visits per hour (Victoria López-Calleja and Bozinovic 2003). Because no known resources are available for hummingbirds to exploit at sea, we likely encountered hummingbirds as they were making transitory, dispersal, or migratory flights between different landmasses. The majority of hummingbirds we encountered were in the southern part of the gulf, where the distances of open water were farthest (with a minimum straight-line distance of up to 72 km; Supplemental Fig. S1c). We only encountered a few individuals traveling between the denser islands in the north, even though we spent more time there (Supplemental Fig. S1a). Assuming a 3.5 m/s flight speed, a 72 km open water traverse would take nearly 6 h.

Flighted birds are often assumed to be capable of crossing large distances and geographical barriers, simply because they can fly; however, whether because of physical or physiological limitations, not all birds have this ability (Moore et al. 2008). In many cases, even species that perform long distance migrations will not attempt long distance water crossings (La Sorte et al. 2016). Hummingbirds represent one of the largest avian families, and their successful radiation is attributed to the mountains, deserts, and islands of the New World, which form substantial geographic barriers (McGuire et al. 2007). It is therefore notable that Green-backed Firecrowns are often encountered several kilometers from land in the fjords and channels of Patagonia. The high frequency of offshore encounters suggests that either Green-backed Firecrowns perform a seasonal migration between Patagonian islands and fjords or a high level of connectivity exists between geographically separated metapopulations. The Green-backed Firecrown's ability to cross open water may also have been the prerequisite needed for colonization of the Juan Fernandez archipelago, the farthest offshore islands inhabited by hummingbirds.

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