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Trans-Andean Crossing of Yellow-billed Pintails (*Anas georgica*)

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Abstract.—There is a gap in knowledge of dispersal and migration behavior for many South American waterfowl species. This study presents data describing the movements of three individual Yellow-billed Pintails (*Anas georgica*) tracked with GPS-satellite telemetry that migrated via a trans-Andean Mountains crossing from Chile to Argentina. The frequency of this dispersal suggests that it is not an unusual behavior for the species, showing a possible facultative migratory trait, using different flight paths for the Andean crossing. Finally, there is evidence suggesting that there may be a migratory pattern behind the movements of southern South American populations after breeding season. *Received 27 October 2019, accepted 20 May 2020.*

Key words.—Andes Mountains, Argentina, Chile, flight, GPS, migration, movements, telemetry, waterfowl.

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Large geographical features, such as mountain ranges, may restrict the dispersal of bird species (Leshem and Yomtov 1996), acting as a barrier for their movement. Extreme environmental conditions, such as low oxygen levels or freezing temperatures, are the chief limiting factor for many species (Cox and Moore 1993; Klaassen 1996). The Andes, the longest continental mountain range in the world, divides much of South America. Many phylogeographic studies have demonstrated the role played by the Andes in speciation and genetic divergence (Burnie and Brumfield 2009; Weir and Price 2011). However, studies on trans-Andean movements are particularly scarce. To this date, tracking studies have documented Andean crossing for migrant species, including Black Skimmers (*Rynchops niger*) (Davenport *et al.* 2016) and Artic Terns (*Sterna paradisaea*) (Duffy *et al.* 2013), and Andean Condor (*Vultur gryphus*) (Lambertucci *et al.* 2014).

Despite being one of the most common waterfowl in southern South America, the Yellow-billed Pintail (*Anas georgica*) is a poorly studied species, particularly regarding its behavioral ecology (Martin 2013). This dabbling duck is distributed from northern Peru on the west coast to southern Brazil on the Atlantic coast, and from southern Colombia in the north to Tierra del Fuego in the south, including the Falkland Islands and South Georgia Island (Madge and Burn 1988; Del Hoyo *et al.* 1992). In its range, this habitat-generalist inhabits a variety of wetlands, ranging from 0 to 4,600 m.a.s.l. (Del Hoyo *et al.* 1992), although they are more common at elevations under 1,000 m.a.s.l. (Housse 1954).

Although the species is described as mostly sedentary, there is scant information on its movements. Southern populations are likely migratory and move north during winter (Del Hoyo *et al.* 1992). Band recoveries have shown movements from Argentina to Rio Grande do Sul, Brazil (Capllonch *et al.* 2008), and from the latter to the coast of central Chile (Somenzari *et al.* 2018). Barros (1963) described local movements before and after breeding season, a time when gregarious behavior is observed in coastal wetlands and estuaries. Here, we report the migratory crossing of the Andes Mountains by different individual Yellow-billed Pintail (hereafter pintail) equipped with GPS loggers.

Methods

As part of a broader study, we captured 23 individual pintails at the Carampangue Estuary (37° 14′ S, 73° 18′ W) near Arauco in central Chile. The region, with an oceanic influenced Mediterranean climate and a marked seasonality (Hajek and Di Castri 1975; Amigo and Ramírez 1998), is characterized by coastal plains predominantly used for livestock grazing, with large areas flooded seasonally (Oberdorfer 1960).

Pintail captures were carried out the third week of January 2017 (n = 18) and the first week of February 2018 (n = 5). We used walk-in traps baited with rice (*Oryza sativa*). All captured birds were banded with a metal leg band, weighed (± 10 g), and measured (tarsus length, stretched wing length, head, and culmen; ± 1 mm). We were unable to sex individuals by the bill color, as proposed by Wilson *et al.* (2004), presumably

due to coloration fading at the end of the breeding season. Pintails were equipped with solar-powered satellite transmitters (Ecotone SULA GPS-GSM Logger) programmed to send a fixed position every six hours (altitude and accelerometry data not provided), attached using a backpack harness with 6 mm Teflon ribbon through two loops (neck and body), following Roshier *et al.* (2006). The weight of the transmitters was 29 g (including harness), representing an average of 4.3% (3.4-6.1%) of the birds' body mass. All birds were later released in the same capture area.

RESULTS

Out of the 23 pintails equipped with GPS tags, 20 remained in the region within 150 km to the capture site, whereas three crossed the Andes towards Argentina (Fig. 1). The three individuals (identified by band number) used different paths to cross the mountains. On 5 April 2017, P00950 crossed in the Laguna del Maule area (35° 59′ S, 1,750-4,250 m.a.s.l.) covering a distance of 273 km during a 6 hr period (time between GPS positions). It remained in La Pampa and Buenos Aires Province until the GPS stopped transmitting on 1 Jan 2018. On 29 April 2017, P00941 crossed in the Llaima volcano area (38° 42′ S, 950-2,750 m.a.s.l.), flying 318 km to reach its destination in the Neuquén Province. Only a day later, the GPS signal was lost, just after the bird's arrival to Lago Pellegrini, in La Pampa Province. Finally, on 12 May 2018, individual P00953 crossed to Argentina East from Chillán (36° 43′ S, 1,200-3,000 m.a.s.l.) in an apparently non-stop, 583-km flight that departed from the Carampangue Estuary (sea level) and arrived in La Pampa Province (within two 6 hr GPS position periods). After spending a month in La Pampa, San Luis and Mendoza provinces, the individual returned to Chile crossing the Andes on 17 July 2018 near Laguna del Maule, in a 280 km flight that arrived near the city of Cauquenes (35° 57′ S, 72° 19′ W). The time for initiation of the recorded Andean crossing flights were on civil twilight (2) or night (2).

DISCUSSION

The previous record in Chile of a Yellow-billed Pintail banded in Brazil suggested the

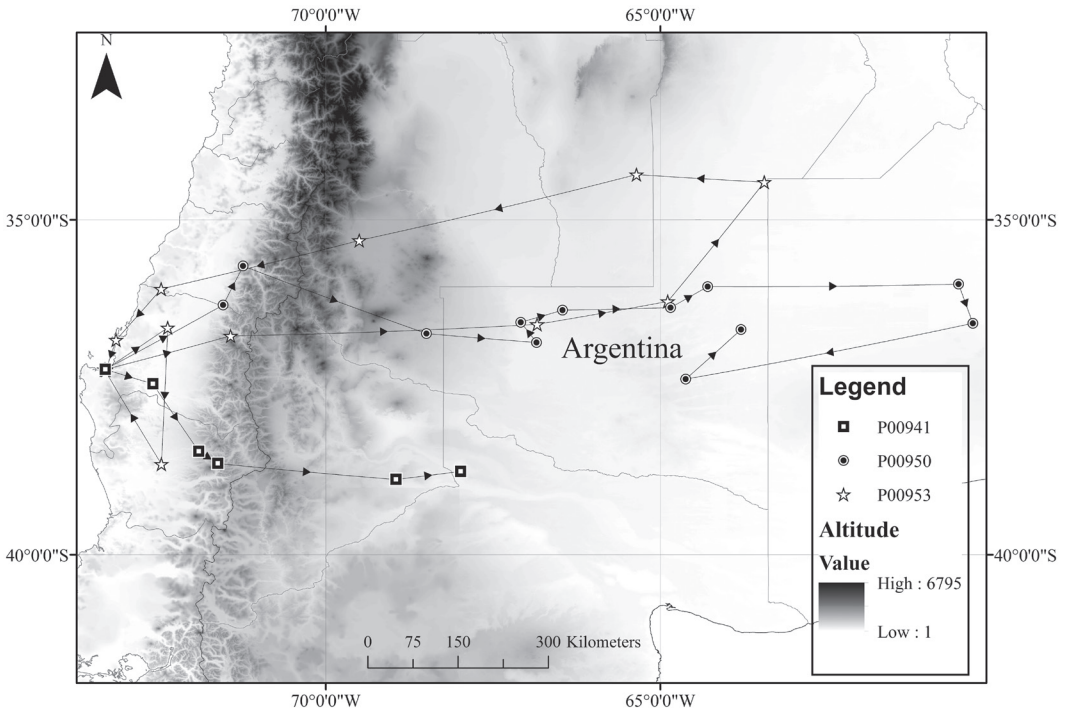

Figure 1. Flight path of three Yellow-billed Pintails (*Anas georgica*) tagged with solar-powered satellite transmitters near Arauco in central Chilethat crossed the Andes Mountains into Argentina.

feasibility of movements across the Andes for this species (Somenzari*et al.* 2018). The fact 13% (n = 23) studied birds crossed the Andean range during our study shows that this is, indeed, not an unusual behavior for the species. The ground level at the zones where the birds most likely crossed the Andes ranged from 1,500 to 2,000 m.a.s.l. (Duffy *et al.* 2013). These mountains are within the range, but higher than the average migration altitude for most waterfowl (Bergman and Donner 1964; Kahlert *et al.* 2012). The Yellow-billed Pintail is considered well adapted to high altitude environments, coping with hypoxia by enhancements in their cardio-respiratory physiology (Lague *et al.* 2017) and through increased O_2-affinity of hemoglobin (McCracken *et al.* 2009).

Our observations suggest that, at least in the southern half of the Southern Cone (i.e., Chile, Argentina), populations of the Yellow-billed Pintail might be well-connected through migratory behavior, with common movements of individuals between Atlantic and Pacific coasts. Further north, where the Andes mountains reach higher altitudes (5,200-6,800 m.a.s.l., between 20-35° S), the movement of individuals may not be as frequent.

The fact that two of the tagged pintails used the same area (Laguna del Maule) to cross the Andes (although going in different directions), suggests that there may be a finite number of passes that the birds could choose. In addition, the fact that all crossings took place as part of long distance (> 270 km in a 6 hr period) flights indicates that birds did not spend much time searching for a path, and that they probably knew the place from previous experience.

Yellow-billed Pintails that crossed the Andes to Argentina did it before the austral winter, between the months of April and May. The individual that returned back to Chile, P00953, crossed at winter in the middle of July. Whether this is general pattern, or it is due to the fact that all captured birds were likely breeding in the coastal plains of central Chile, is a question that can only be answered with more data, from other locations.

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