

New nesting sites of the threatened Andean flamingo in Argentina

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Abstract

Successful reproduction in flamingos is dependent on the availability of nesting sites for the establishment of colonies that provide both protection from predators and a suitable microclimate for the eggs and developing nestlings. The Andean flamingo (*Phoenicoparrus andinus*) is the rarest and most threatened flamingo species. This species makes complementary and alternative use of high Andean and lowland hypersaline wetlands in Argentina, Bolivia, Chile and Peru. Very few breeding places are known, located mainly in Chile and Bolivia. Our objective was to identify new nesting sites in Argentina. We report on six new breeding sites in Argentina and confirm the already cited Laguna Mar Chiquita as a breeding site for Andean flamingos. Our results highlight that isolated nesting colony locations are relatively common in Andean flamingos across their broad range- even at lowland sites like Mar Chiquita, showing that nesting colonies not are restricted to the Andes.

Resumen

La reproducción exitosa en flamencos depende de la disponibilidad de sitios de nidificación para el establecimiento de colonias que brinden protección contra los depredadores y un microclima adecuado para los huevos y nidos en desarrollo. El flamenco andino (*Phoenicoparrus andinus*) es la especie de flamingo más rara y amenazada. Esta especie hace uso complementario y alternativo de humedales hipersalinos altoandinos y de tierras bajas en Argentina, Bolivia, Chile y Perú. Se conocen muy pocos sitios de nidificación, ubicados principalmente en Chile y Bolivia. Nuestro objetivo fue identificar nuevos sitios de nidificación en Argentina. Describimos seis nuevos sitios de reproducción en Argentina y confirmamos la ya reportada Laguna Mar

Chiquita como lugar de reproducción para los flamencos andinos. Nuestros resultados resaltan que establecer colonias de nidificación en sitios aislados es relativamente común en los flamencos andinos a lo largo de su amplia distribución, incluso en lagunas de tierras bajas como Mar Chiquita, lo que muestra que las colonias de reproducción no están restringidas a los Andes.

Résumé

Le succès de la reproduction des flamants dépend de la disponibilité de sites de nidification pour l'établissement de colonies assurant à la fois une protection contre les prédateurs et un microclimat approprié pour les œufs et les oisillons en développement. Le flamant des Andes (*Phoenicoparrus andinus*) est l'espèce de flamants la plus rare et la plus menacée au monde. Cette espèce utilise de manière complémentaire et alternative les zones humides hypersalines des hauts plateaux andins et des basses terres d'Argentine, de Bolivie, du Chili et du Pérou. Très peu de lieux de reproduction sont connus; situés principalement au Chili et en Bolivie. Notre objectif était d'identifier de nouveaux sites de nidification en Argentine. Nous décrivons six nouveaux sites de reproduction en Argentine et confirmons que la Laguna Mar Chiquita, déjà citée, est un lieu de reproduction pour les flamants des Andes. Nos résultats montrent que les colonies de nidification isolées sont relativement communes chez les flamants des Andes dans toute leur aire de répartition, même sur les terres basses comme Mar Chiquita, ce qui montre que les colonies de nidification ne se limitent pas aux Andes.

Introduction

The Andean flamingo (*Phoenicoparrus andinus*, Philippi, 1854) is the rarest and most threatened flamingo species (Caziani et al., 2007). The species is typical of the South American Andes, although, regularly, 50% of the total population migrate every winter to lowland areas in the plains of Central Argentina (Caziani et al. 2007; Derlindati et al., 2014). Although its breeding range expands over large areas in the Chilean, Bolivian and Argentine Andes, currently known nesting sites are limited to very few locations (Figure 1)- all in shallow hypohaline lakes (Childress 2005; Caziani et al., 2007). These facts, plus frequent colony failures owing to natural or man-induced causes, justified the Andean flamingo's categorisation as "Vulnerable" by the IUCN and inclusion in the Endangered Species List of the U.S. Fish and Wildlife Service (IUCN 2018).

Until 2006, the most important breeding places were five wetlands in Northern Chile (Childress 2005). In 2005-2006, Andean flamingos started to breed in Southwestern

Bolivia in several wetlands, with a colony in Laguna Colorada becoming one of the most important breeding places. At the same time, breeding sites in Chile declined in the number of nesting pairs and chicks fledging. In Argentina, nesting was first recorded in 1986 at Mar Chiquita (a large saline lake located in plains of Central Argentina) with 100 active nests in a mixed colony with the Chilean flamingo, *Phoenicopterus chilensis* (Cobos et al. 1999). This finding drew the attention of specialists as Mar Chiquita lake lies at 64–71 m above sea level (a.s.l.) in the Chaco ecoregion (Olson et al., 2001), whereas Andean flamingos are believed to nest most frequently at 2,300 to 4,300 m a.s.l. (Caziani et al., 2007).

Subsequently, the species was cited nesting in Laguna La Brava (La Rioja province) in 1998 (Bucher et al. 2008) and in Laguna Los Aparejos (Catamarca province) in 2001 (Caziani et al., 2007). The first documented nesting record in Argentina was made in 2010 at Laguna Purulla, Catamarca (Marconi and Clark 2011). All of these nesting colonies never exceeded 200 individuals; unlike the

thousands Andean flamingos counted at main colonies in Chile. In these Chilean colonies, breeding is concentrated in areas where mineral and hydrocarbon exploration and exploitation have increased in the last four decades, therefore both the number of successful breeding colonies and the total production of chicks for the Andean flamingo has declined since the 1980s (Caziani et al., 2007). In the context of delineation of breeding colonies, the detection of new colonies is key, as their role in the survival of this species becomes important. As such, our objective is to identify new nesting sites in Argentina.

Methods

Since 2007 we carried out simultaneous flamingo censuses, by visiting 259 wetlands through all of the flamingo's range in Argentina, Bolivia, Chile and Perú (Caziani et al., 2007). Since 2010 we included lowland wetland in Argentina during breeding season. We used the census methods described in Caziani et al. (2007) and a standardised as survey methodology during international censuses. During surveys, we stood at one or more survey points on the lake shore and used spotting scopes, binoculars, and manual

counters to count adults, nest and/or chicks. For a given wetland, we used the same census points during each subsequent survey. Each count was conducted by at least two people, and the average count was used as the estimated abundance. The most practical sampling to estimate the population density of some species in Mar Chiquita lake is via an aerial census. The flamingo count was performed following the protocol established by the GCFA (Marconi 2010). This results in the direct count of individual adults, chicks and/or nests.

Results

We can now report six new breeding sites for Andean flamingos in Argentina, and document nesting in another location previously cited (Figure 1). We were able to confirm Mar Chiquita as a breeding place. During an aerial survey in February 2014 we observed a nesting colony in a muddy barren island (Figure 2) near a larger nesting colony of Chilean Flamingos. In this site, nesting also occurred in 2015, with a large number of two-month old chicks observed in February, suggesting an earlier start of incubation than that in 2014.

Table 1. Detail of new breeding records of the Andean flamingo in Argentina

Site	Coordinates	Altitude (m above sea level)	Date	Nest count	Comments
Salar de Incahuasi	26° 23' 27" S, 67° 40' 13" W	3,280	Jan 2012	81	Eleven adults were sitting in nests, whereas the other 70 nests were failed due to the collection of eggs by locals
			Feb 2014	28	Five chicks were also observed. By March 2014 only one chick survived, although there was no evidence of disturbance by locals
Laguna Blanca	26° 38' 24" S, 66° 54' 26" W	3,147	Feb 2014	420	Nests were abandoned as result of perturbation caused by collection of eggs by locals in January 2014
Salar de Lullaillo	24° 47' 38" S, 68° 18' 23" W	3,200	March 2014	134	Nests appeared to be recently abandoned. Also, 78 alive chicks, 47 dead chicks and 8 failed eggs were recorded
Laguna Carachipampa	26° 28' 18" S, 67° 31' 27" W	2,915	Feb 2015	5	Four of the five nest were already abandoned at the time of census
Salar de Antofalla	25° 34' 24" S, 67° 39' 15" W	3,400	Feb 2015	40	A mixed colony with <i>Phoenicopterus chilensis</i> . By March 2015 only one non-breeding <i>P. andinus</i> was observed
Laguna Mar Chiquita	30° 35' 15" S, 62° 47' 08" W	71	Feb 2014	187	Twenty adults were sitting in nests, and other 61 fed their chicks at nests. Also, 16 older chicks foraged independently
			Feb 2015	--	At the time of the census, 460 adults in breeding plumage and 651 chicks two-month old were counted

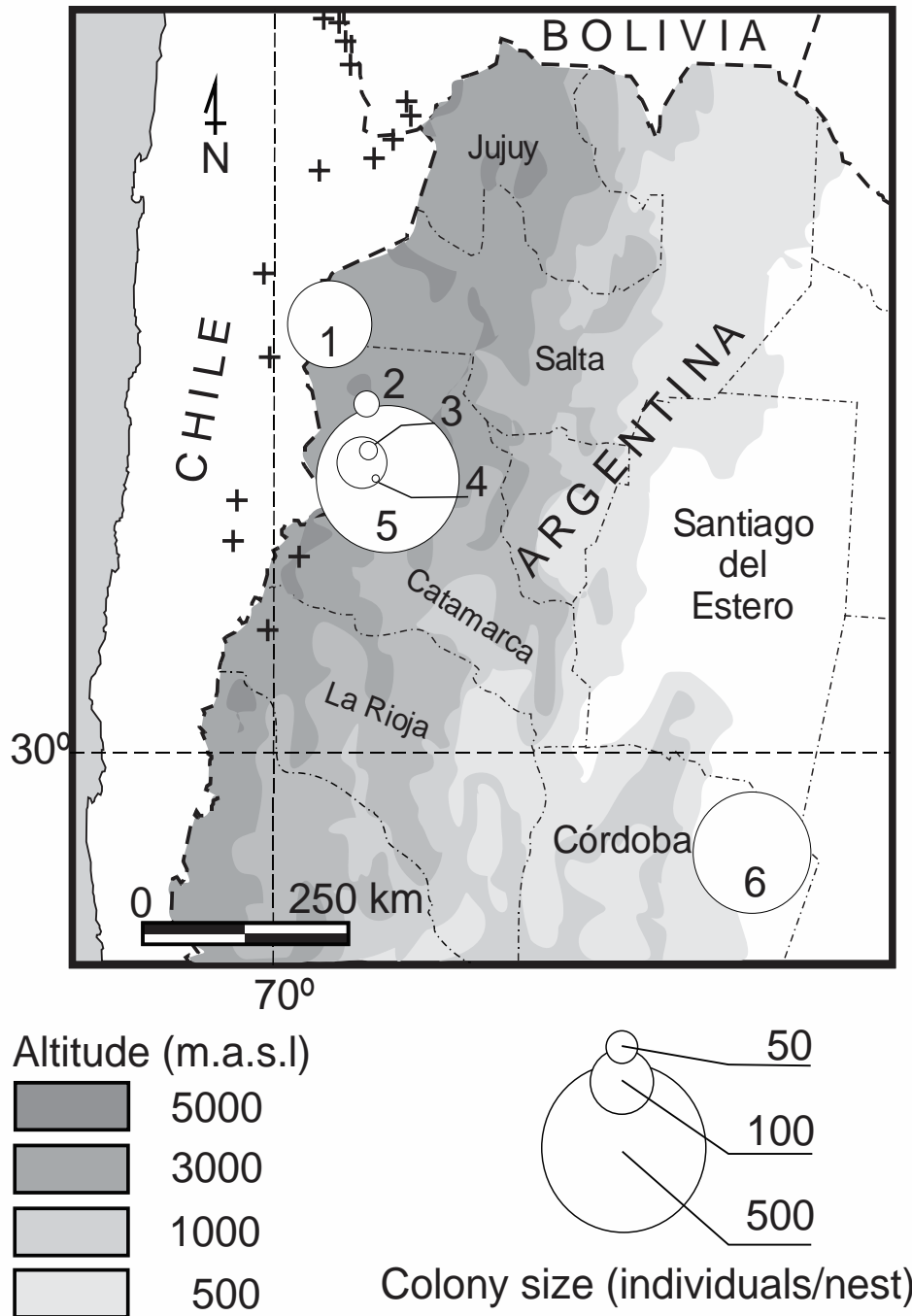


Figure 1: Known nesting sites of the Andean flamingo (given as crosses) and new nesting sites reported in this paper (give as circles): 1. Salar de Llullaillaco; 2. Salar de Antofalla; 3. Salar de Incahuasi; 4. Laguna Carachipampa; 5. Laguna Blanca and a confirmed breeding place already reported; 6. Mar Chiquita.



Figure 2: Part of the nesting colony of Andean flamingos recorded in Laguna Mar Chiquita, in the lowlands of Central Argentina. Andean flamingos are clearly distinguishable from any sympatric flamingo species by a larger proportion of black on their folded wings. Photo credit: R. Torres.

Discussion

Patterns of intermittent breeding and shifting of nesting colony locations are common in all flamingo species globally (Baldassarre and Arengo 2000; Balkiz et al. 2007, 2010; Bouchecker et al. 2011). The Andean flamingo was believed to breed only in Chile and Bolivia, but our data cast doubt on this long-held assumption. However, reasons for this apparently more frequent and widespread breeding are not clear. An explanation could be that some individuals prevent others from settling in a high-quality habitat, so that the last group of individuals (i.e. later arrivals to an established nesting colony) who wish to nest are forced to use lower-quality habitats in which their fitness may be lower. Such behaviour is frequently noted in the greater flamingo (*Phoenicopterus roseus*) during extreme years in terms of conditions and resources (Rendón et al. 2001; Bouchecker et al. 2011). Older birds displace younger age-classes to suboptimal habitats as competition for resources. Consequently, with regards to the Andean flamingo, it will be a key to

determine the ages of the individuals in the different new colonies.

The nesting records at Mar Chiquita suggest more behavioural plasticity for the Andean flamingo than previously believed and that lower altitudes may not be a limiting factor for successful nesting. This recorded variability in food availability and nesting suitability for Andean flamingos has major monitoring and management implications. The maintenance of a stable Andean flamingo population in Argentina (and probably over its whole distributional range) depends on the availability and connectivity of multiple foraging and nesting sites (Caziani et al. 2007), although any given site may not be actively in use at any given time. Flamingos are opportunistic breeders (Rendón et al. 2001) and for this reason breeding sites may vary spatially and temporally. These birds should be able to use alternative habitats in response to variations in conditions and resources.

Interannual variations in flamingo nesting within sites may be a response to

environmental variability. The quantity and quality of habitat that flamingos find at these wetlands may condition their reproductive success, as has been noted in other species of bird too (Galvez and Chavez-ramirez 2010; Galvez Aguilera and Chavez-Ramirez 2010; Stirnemann et al., 2012; Li et al., 2013). The effects of human activities on these breeding patterns are little known but could potentially adversely affect flamingos by decreasing time spent feeding or on courtship display and therefore negatively affecting fitness. There is a need for further research on the feeding ecology and reproductive physiology of the Andean flamingo, as well as detailed studies of wetland hydrology and food availability to better inform future management and conservation work for this specialised flamingo species.

Conclusions

Andean flamingos show pattern of intermittent breeding and shifting of nesting colony locations like that recorded for other flamingo species in other parts of the world. Our data show that widespread breeding is more frequent than we thought and that birds are not only nesting at high altitude locations.

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