FIRST EVIDENCEOF CHILEAN FLAMINGO *PHOENICOPTERUS CHILENSIS* BREEDING IN GALAPAGOS

By: K. Thalia Grant & Gregory B. Estes

Puerto Ayora, Isla Santa Cruz, Galapagos, Ecuador. <galapagos@earthlink.net>

SUMMARY

Evidence of Chilean Flamingo *Phoenicopterus chilensis* breeding in Galapagos was obtained in 2017, when an adult was photographed feeding a dependent juvenile in the Punta Cormorant lagoon on Floreana Island on 9 April and an independent immature, possibly the same individual, was photographed at the same site on 21 May. These observations constitute the first record of *P. chilensis* breeding anywhere in Ecuador. This mainland South American species was recorded in Galapagos for the first time in 2008. Since 2015 there have been many sightings, but always of 1–3 birds and only on Floreana. Because flamingos nest colonially and engage in group displays as a precursor to breeding, we posit that the breeding pair, whose nest was not found, may have been either part of a larger group of *P. chilensis* adults existing undetected in the archipelago, or stimulated to breed by joining the group courtship displays of the resident American Flamingo *P. ruber*, either on Floreana or another island. Given these possibilities, the likelihood that *P. chilensis* will breed again in the islands appears to be high, perhaps leading to the establishment of a permanent breeding population.

RESUMEN

Primer registro de Flamingo chileno *Phoenicopterus chilensis* reproduciéndose en Galápagos. Evidencia de reproducción del Flamingo chileno *Phoenicopterus chilensis* en Galápagos se obtuvo en 2017, cuando un adulto fue fotografiado alimentando a un juvenil dependiente en la laguna de Punta Cormorán en la isla Floreana el 9 de abril. También en el mismo lugar un inmaduro independiente, posiblemente el mismo individuo, fue fotografiado el 21 de mayo. Estas observaciones constituyen el primer registro de *P. chilensis* criando en Ecuador. Esta especie de Sudamérica continental fue observada en Galápagos por primera vez en 2008. Desde 2015 ha habido muchos avistamientos, pero siempre solo de 1–3 individuos y únicamente en Floreana. Ya que los flamingos anidan en colonias y participan en despliegues grupales como preámbulo a la reproducción, proponemos que la pareja reproductora cuyo nido no fue encontrado, pudo haber sido, o parte de un grupo más numeroso de *P. chilensis* adultos viviendo indetectados en el archipiélago, o estimulada a anidar al sumarse a los despliegues nupciales del residente Flamingo americano *P. ruber*, en Floreana u otra isla. Dadas estas posibilidades, parece probable que *P. chilensis* vuelva a reproducirse en las islas, y tal vez hasta establecer una población reproductiva permanente.

INTRODUCTION

The Chilean Flamingo *Phoenicopterus chilensis* is the most common and widespread flamingo species in South America. Found south of the Equator, it breeds in saline lakes, often at high altitude, in Peru, Chile, Argentina, Bolivia and Paraguay (Hoyo *et al*. 2020). It is a non-breeding migrant to southern Ecuador, where flocks feed in the Lagunas de Ecuasal of Salinas on the Santa Elena peninsula (Freile & Restall 2018). The species was recorded in Galapagos for the first time on 25 Jul 2008, when a single adult was photographed in the Punta Cormorant lagoon (PCL: 1°13'40"S, 90°25'42"W), Floreana Island, by A. Jaramillo (Table 1). For much of the year this salt water lagoon supports small numbers (<50) of the genetically and morphologically distinct population of the American Flamingo *P. ruber* which resides in Galapagos as an isolated, panmictic population of *c*. 500 individuals (Weidenfeld & Jiménez-Uzcátegui 2008, Frias-Soler *et al*. 2014, Tindle *et al*. 2014), separated by some as *P. r. glyphorynchus* (Jiménez-Uzcátegui *et al*. 2017, Hoyo *et al*. 2020). The *P. chilensis* individual was, at the time, mistaken for this native species and was only identified correctly when the photograph was re-examined in 2020 (A. Jaramillo, pers. comm.). Another (or the same) individual was photographed by one of us (KTG) in the same location on 2 Aug 2015 (Fig. 1). It, too, was initially presumed to be a *P. ruber*, even though *P. chilensis* is distinguished from *P. ruber* by its yellow and grey legs, relatively thick neck, and more extensive black pigmentation of the lower mandible; the head and neck feathers of *P. chilensis* are also typically paler than those of adult *P. ruber* (Fig. 2) although progressive loss of pigmentation in *P. ruber* during breeding can

Table 1. Sightings confirmed by photographs of Chilean Flamingo *Phoenicopterus chilensis* adults in Galapagos. Photos deposited on <eBird.org> are identified by the corresponding checklist number. N = number of adults photographed.

Date	Location	N	Photographer	Source
25 Jul 2008	PCL	1	A. Jaramillo	https://ebird.org/checklist/S11093600, originally misidentified as *P. ruber*
2 Aug 2015	PCL	1	KTG	Fig. 1, originally misidentified as *P. ruber*
17 Oct 2015	PCL	2	TDR	Jiménez-Uzcátegui 2017
29 Oct 2015	PCL	2	TDR	Jiménez-Uzcátegui 2017
14 Jul 2016	PCL	2	LDD	https://ebird.org/checklist/S32825231 Jiménez-Uzcátegui 2017
19 Jan 2017	PCL	1	J. Stone	https://ebird.org/checklist/S33813829, misidentified as *P. ruber*
29 Jan 2017	PCL	1	GBE	
9 Feb 2017	PCL	1	M. Cowlard	https://ebird.org/checklist/S44615545, misidentified as *P. ruber*
9 March 2017	PCL	1	LDD	https://ebird.org/checklist/S39241940
9 April 2017	PCL	2	GBE	Fig. 4
21 May 2017	PCL	1	GBE	Figs 5, 6
10 Mar 2018	PCL	1	GBE	
15 Apr 2018	PCL	1	LDD	https://ebird.org/checklist/S44657562
25 Apr 2018	PCL	1	D. Degel Andrade	https://ebird.org/checklist/S44950073
20 Sep 2018	LOB	1	LDD	https://ebird.org/checklist/S48742882
2 Oct 2018	PCL	1	M. Homan	https://ebird.org/checklist/S48889361
12 Jan 2019	PCL	1	GBE	
12 Aug 2019	PCL*	1 (2 recorded)	D. Plambeck	https://ebird.org/checklist/S59900447
18 Aug 2019	PCL	1	C. Brown	https://ebird.org/checklist/S59155054
24 Nov 2019	PCL	1	LDD	https://ebird.org/checklist/S61933816
11 Dec 2019	LOB	1	P. Freire	Fig. 2
26 Jan 2020	PCL	1	KTG	

*And "Post Office Bay", probably referring to LOB.

also result in almost-white plumage (R. Tindle, pers. comm.). Subsequently, *P. chilensis* was photographed in October 2015, by T. de Roy (TDR), who had also recorded two individuals in May of that year (TDR, pers. com), and in July 2016 by L.D. Dejean (LDD) (Jiménez-Uzcátegui 2017: Table 1). Since then, intermittent sightings of 1–2 *P. chilensis* adults have been reported by naturalist guides and tourist visitors at PCL and at the beaches of La Olla Bay (LOB: 1°13'48"S, 90°26'28"W), near the "Baroness's Lookout" visitor site, which lies *c.* 1 km from PCL (Fig. 3). Records supported by clear identifying photographs are included in Table 1.

Until now, *P. chilensis* has been considered a vagrant to Galapagos, meaning a naturally-arriving species that is recorded rarely or occasionally and does not breed in the archipelago (Jiménez-Uzcátegui 2017). However, the number and continuity of recent sightings suggest that birds recorded since 2015, and including perhaps the bird seen in 2008, may be residing permanently in Galapagos. Furthermore, the following observations made at PCL indicate that the species recently bred in the archipelago and could potentially establish itself as a breeding population.

Figure 1. An adult Chilean Flamingo *Phoenicopterus chilensis* (on right), feeding next to two adult American Flamingos *P. ruber* in the Punta Cormorant lagoon, Floreana Island, 2 Aug 2015. (Photo: KTG)

OBSERVATIONS

At *c.* 8h00 on 9 Apr 2017, GBE photographed an adult *P. chilensis* feeding a dependent juvenile flamingo (Fig. 4) in the northern corner of PCL (Fig. 3, point 1). They were surrounded by five adult *P. ruber* and another adult *P. chilensis*. Seven more *P. ruber* adults were present elsewhere in the lagoon. Six weeks later, on 21 May 2017, GBE photographed a solitary independent juvenile that may have been the same bird (Fig. 5). It was first spotted at *c.* 7h00, standing on its own on the northwestern edge of the lagoon (Fig. 3, point 2). Twenty minutes later it had moved into deeper water on the western side (Fig. 3, point 3) where a group of 16 *P. ruber* adults was feeding. By 8h00 the juvenile and adults had moved to the northeastern edge of the lagoon (Fig. 3, point 4) where they were joined by another ten adult *P. ruber* and one adult *P. chilensis*. No

Figure 2. Left: an adult *P. chilensis* (front) stands with an adult *P. ruber*, Punta Cormorant lagoon, 9 Apr 2017 (Photo: GBE). Right: a *P. chilensis* standing behind a *P. ruber* at La Olla Bay, 11 Dec 2019. (Photo: P. Freire)

interactions between the juvenile and the adults were observed; rather, the adults appeared to ignore it. An additional ten *P. ruber* adults were observed sitting (presumed incubating) in a known *P. ruber* nesting area on the eastern side of the lagoon (Fig. 3, point 5; Fig. 6); the total lagoon count was 38 flamingos.

We did not find *P. chilensis* on any subsequent trips to the lagoon in 2017: on 4 Jun (when 31 *P. ruber* adults were counted, 13 of them in the nesting area), 30 Jul (when 6 *P. ruber* chicks with grey down were in the nesting area) and 27 Aug (when a single juvenile *P. ruber* was observed being fed by a *P. ruber* adult). The next sighting of *P. chilensis* was at PCL on 9 Mar 2018 (Table 1), when one adult was with a flock of 25 adult *P. ruber*.

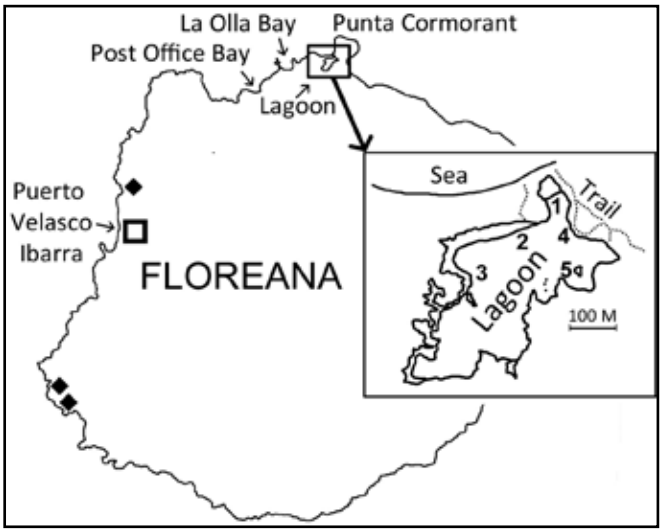

Figure 3. Floreana Island showing localities mentioned, with an enlargement of the Punta Cormorant lagoon. Black diamonds indicate smaller flamingo lagoons.

Figure 4. *P. chilensis* adult feeding a juvenile, with two adult *P. ruber* (facing forward) and another *P. chilensis* adult (tail forward) nearby, PCL, 9 Apr 2017. (Photo: GBE)

Figure 5. Juvenile *P. chilensis* surrounded by adult *P. ruber* in PCL, 21 May 2017. (Photo: GBE)

Figure 6. Juvenile *P. chilensis* (centre, side arrow) preening, with one *P. chilensis* adult (at back, downwards arrow) and 22 *P. ruber* adults in the PCL, 21 May 2017. A small cluster of nesting *P. ruber* can be seen on the far shoreline. (Photo: GBE)

DISCUSSION

The juvenile flamingo being fed by an adult *P. chilensis* in April 2017 (Fig. 4), and the juvenile seen on its own the following month (Figs 5 and 6), appear to be conclusive evidence of *P. chilensis* breeding in Galapagos. The juvenile in Fig. 4 is almost certainly the offspring of the *P. chilensis* adult feeding it, though not necessarily of the other adult *P. chilensis* in the photograph: the attending adult's very pallid plumage indicates that it had been feeding the offspring regularly and over a long period, losing pigmentation in the process, whereas the other adult's pinker feathers on its lower back and face suggest otherwise (R. Tindle, pers. comm.). The off-duty parent may have been feeding elsewhere, perhaps at another lagoon, as is typical for flamingo parents which take turns attending their juvenile rather than remaining together (Tindle *et al.* 2014). Because no nesting was observed, two alternative possibilities regarding the identity of the juvenile must be considered: that it was a *P. ruber* juvenile, which the *P. chilensis* had adopted or fostered, or that it was the result of a hybrid pairing between a *P. chilensis* and a *P. ruber*. The first of these can almost certainly be ruled out because adoption is virtually unknown in flamingos, including *P. chilensis* and *P. r. glyphorhynchus*; parents care only for their own progeny and rebuff other begging chicks (Rooth 1965, Brown & King 2005, R. Tindle pers. comm.). Fostering, in which a flamingo pair takes over the nest of another pair, hatches the egg and rears the chick as their own, has rarely been recorded and only among captive Greater Flamingos *P. roseus* (Anderson 2017).

The second alternative is more plausible because hybrid pairing between *P. chilensis* and *P. ruber* is known to occur readily in zoos (Anderson 2017) and in the wild in Europe, where escaped captive *P. ruber* and *P. chilensis* coexist with natural populations of *P. roseus* (Cezilly & Johnson 1992, Anderson 2017). It is thought that hybridisation occurs when these normally allopatric species come together, because all three species are colonial nesters, have similar courtship displays, and do not differ greatly in body size. *Phoenicopterus chilensis*, at roughly 105–110 cm tall (Anderson 2017, Freile & Restall 2018, Hoyo *et al.* 2020) is close in size to *P. r. glyphorhynchus* (Frias-Soler *et al.* 2014), which measures c. 105 cm in height (Castro & Phillips 1996) but has a slighter body (Figs 1, 2, 5). There is, in fact, circumstantial evidence that hybridisation between these two species may have been attempted in Galapagos in 2018, for on 2 Oct of that year a *P. chilensis* was photographed (https://ebird.org/checklist/S48889361) at the PCL, standing within a group of incubating flamingos, all of which appear to be *P. ruber*; one of them may have been the Chilean Flamingo's mate.

Despite the potential for hybridisation, there is no obvious physical evidence that the juvenile at PCL in 2017 was a hybrid. Although *P. chilensis* and *P. ruber* juveniles are similar in appearance, the thick (densely-plumaged) neck, white abdomen and brownish dorsal plumage of the PCL juvenile in Figs 5 and 6 are characteristic of a pure *P. chilensis*; *P. ruber* juveniles have a thinner neck and darker dorsal and ventral plumage, and a hybrid would presumably exhibit some of these traits (Hoyo *et al.* 2020, R. Tindle pers. comm.).

Assuming that the juvenile was a pure-bred *P. chilensis*, based on known patterns of plumage development in flamingos it was probably 2.5–4.5 months old in early April 2017. Vaned feathers start to emerge at 35 days (Allen 1956, Brown & King 2005, Anderson 2017, Hoyo *et al.* 2020), juvenile plumage in *P. chilensis* develops over a variable period of at least 56 days and often twice that (Chiale *et al.* 2018) and flight is generally achieved at 84–120 days (Allen 1956, Wackernagel 1959, Brown & King 2005). The juvenile in Figs 5 and 6 was probably ≥ 6 months old, because at this age *P. chilensis* offspring stop being fed by their parents, even intermittently, and are typically ignored (Wackernagel 1959, Rooth 1965).

As the incubation period of *P. chilensis* is 27–31 days (Anderson 2017, Hoyo *et al.* 2020), the egg that gave rise to the juvenile in Fig. 4 must have been laid sometime between November 2016 and January 2017. This date range falls within the egg-laying periods both of *P. chilensis* in South America, which is October in Lago Junín, Peru, Nov–Dec in Argentina, and Jan–Mar in the lakes of the Altiplano (Hoyo *et al.* 2020) and of *P. r. glyphorhynchus* in Galapagos, which can occur anytime between August and May but in the 1970s when this subspecies was studied in greatest detail, it was mostly Oct–Dec (Tindle *et al.* 2014).

No flamingo nesting was recorded at PCL during this putative breeding period (Nov 2016 to Jan 2017). Although unobserved or unrecorded nesting may have occurred there, the juvenile in Fig. 4 appears capable of flight, so its parents might have nested at another lagoon, on Floreana (Fig. 3) or another island (R. Tindle pers. comm.). Arrival of the juvenile from outside Galapagos is unlikely, not only because of the distance (>1000 km) from the mainland but also considering the juvenile's young age and its dependency on the adult. Long-distance dispersal of juvenile flamingos is only known for independent individuals no longer being fed by their parents (Winkler *et al*. 2020). Although long-distance post-fledgling dispersal of juveniles <1 yr old is known in some *P. roseus* populations, this occurs only after independence (*e.g*. Johnson 1989). Given that flamingos are colonial nesters it seems likely that the *P. chilensis* family nested with *P. ruber*, rather than on its own, though solitary nesting cannot be ruled out. Nesting by *P. ruber* has been recorded at nine sites: Quinta Playa, Cuarta Playa, and Cementerio on Isabela Island; Espumilla, Mina de Sal, El Sartén on Santiago; the lagoon on Rábida island; the lagoon on Bainbridge 3; PCL on Floreana (Vargas *et al*. 2008). Three of these (Espumilla, Mina de Sal and Rábida) have not hosted flamingo nesting for many years (Vargas *et al*. 2008), and most recent nesting has been recorded on Isabela (the closest nesting island to Floreana) and Bainbridge 3. Adult and immature *P. ruber* readily fly around the archipelago (Tindle *et al.* 2014) but whether the juvenile would have been capable of flying the >80 km required to reach Floreana from one of these islands is unknown.

Breeding by *P. chilensis* in Galapagos is surprising, because like most flamingos, the species typically breeds in large colonies, sometimes of thousands of birds, with group courtship involving large numbers of birds being a precursor to nesting (Anderson 2017, Hoyo 2020). Even in captivity flocks of ≥40 individuals are generally needed to stimulate regular breeding (Brown & King 2005). In contrast and unusually among flamingos, *P. r. glyphorhynchus* regularly breeds in small groups, sometimes of only three pairs, with courtship displays involving just 4–22 individuals (Tindle *et al*. 2014). Given the difficulty of long-distance oceanic flight, the founder population of *P. r. glyphorhynchus* is presumed to have been small, and a capacity to breed in small numbers may have allowed its establishment in the archipelago, >70,000 years ago (Frias-Soler *et al*. 2014, Tindle *et al*. 2014). *P. chilensis* is clearly also capable of breeding in small numbers, because once a flock of just four individuals successfully bred in captivity (Brown & King 2005). However, no more than two adult *P. chilensis* (three according to unsubstantiated reports) have been recorded at any one time in Galapagos, and a single pair would normally be insufficient to expect breeding.

Two factors could explain *P. chilensis* breeding in Galapagos. First, there may be more *P. chilensis* in Galapagos than we know about. To date, all confirmed sightings of *P. chilensis* in Galapagos have been on Floreana Island; reports of this species at Las Bachas on Santa Cruz Island and at Puerto Villamil on Isabela Island are not supported by the photographs we have seen. However, many of the archipelago's *c.* 40 flamingo lagoons are rarely visited (Tindle *et al*. 2014), so more birds could be "hiding" elsewhere. The other explanation is that the parents of the juvenile in Fig. 4 were stimulated to breed by joining the group displays of a flock of *P. r. glyphorhynchus*. Courtship involving more than one flamingo species occurs in captivity and among escaped captives (Cezilly & Johnson 1992, Anderson 2017). It also occurs in Galapagos, for on 24 Nov 2019 a *P. chilensis* was photographed engaging in courtship display with a group of *P. ruber* in the PCL (https://ebird.org/checklist/S61933816). Courtship uncoupled from nesting can occur any time of year and does not always lead to breeding, so the *P. chilensis* did not necessarily nest in the same location or at the same time as the *P. ruber*, but it might have stimulated in them a physiological response allowing them to breed.

The juvenile *P. chilensis* has not been seen since the records listed above. There have been several confirmed sightings of a single adult (Table 1), and other reports of 2–3 adult *P. chilensis* on Floreana but, as flamingos do not attain adult plumage for 3–6 years, these sightings almost certainly represent repeated sightings of the parents or of other immigrants, rather than the grown juvenile. *Phoenicopterus chilensis* does not occupy PCL year round, and presumably, like *P. ruber*, travels to other lagoons in the archipelago as food supplies fluctuate, (Vargas *et al*. 2008, Tindle *et al.* 2014). The alternative explanation, that it returns to mainland South America, seems unlikely as it would require a ≥ 1000 km non-stop flight over the open ocean against the prevailing east winds. Generally, flamingos that undertake long (>900 km) migratory flights rest at wetland stopovers along the way (Amat *et al.* 2005). As it is, *P. chilensis* now shares with *P. r. glyphorhynchus* the long distance record for oceanic travel among all flamingos (Frias-Soler *et al.* 2014).

The arrival and breeding of *P. chilensis* in Galapagos could lead to a rare colonisation event involving a bird group that last successfully colonised the islands tens of thousands of years ago. Whether *P. chilensis* establishes a breeding population in the archipelago remains to be seen, but its continued presence suggests that further nesting can be expected. This presents a unique research opportunity, as *P. chilensis* and *P. ruber* do not normally overlap in the wild. An investigation of the breeding, feeding and dispersal of the *P. chilensis*, with a focus on their interactions with the

resident *P. ruber* would inform greatly on the biology of both species. Although the Galapagos population of *P. ruber* has been studied (Tindle *et al.* 2014) and monitored (Gordillo 1967–2007) in detail, significant ecological changes have occurred in several flamingo lagoons since the 1960s and 1970s when these projects began, owing to major El Niño episodes, vegetational succession, feral animal eradication and control, and improved management of human activities; as a result some lagoons (*e.g*. Espumilla) no longer host flocks of flamingos, whereas others (*e.g*. PCL, which supported flamingo nesting just once in 13 years in the 1960s-70s), have since seen a significant increase in flamingo activity (Vargas *et al.* 2008, Tindle *et al.* 2014). Flamingo surveys and censuses conducted since 1995 have tracked population fluctuations in *P. r. glyphorhynchus,* but more detailed monitoring is needed to understand breeding occurrence and success in the various parts of the archipelago. Such monitoring would also help to reveal where *P. chilensis* might be nesting. Studying *P. chilensis* feeding would help our understanding of how it might impact the *P. r. glyphorhynchus* population, which is already considered vulnerable to fluctuations in food supply and climate change (Vargas *et al.* 2008). Food partitioning occurs where *P. chilensis* overlaps with the Andean Flamingo *Phoenicoparrus andinus* and James's Flamingo *Phoenicoparrus jamesi*, with *P. chilensis* feeding in deeper water than these other species (Mascitti & Castañera 2006), so perhaps a similar form of resource partitioning might develop between *P. chilensis* and *P. r. glyphorhynchus*. The research recommendations suggested by Vargas *et al.* (2008), for monitoring *P. r. glyphorhynchus* in the context of climate change, would provide information on many of these points. We recommend marking birds to monitor their survival, radio-tracking to reveal movement between lagoons and islands, and making detailed observations on feeding, courtship and other social behaviour. Searches for *P. chilensis* at lagoons favoured by *P. ruber* but which are rarely visited by humans are highly recommended, especially during peak nesting months. Continued reporting of *P. chilensis* by visitors to Floreana should also be encouraged but caution needs to be used in interpreting reports unaccompanied by photographs, as *P. chilensis* is easily confused with pale subadult and adult *P. ruber* (which can become almost white during breeding: R. Tindle pers. comm.), as the several mislabelled photographs on eBird (<https://ebird.org/species/chifla1>, <https://ebird.org/species/grefla2>) demonstrate. Reports of several *P. chilensis* seen separately in place and time, for example at PCL and LOB in different hours of the day, must also be treated cautiously, as flamingos fly readily between sites during the day.

ACKNOWLEDGMENTS

Many thanks to Gustavo Jiménez-Uzcátegui for encouraging us to write up our observations, to Tui de Roy, Luis Die Dejean, Peter Freire, Alvaro Jaramillo, Richard Polatty and members of the Pajareros WhatsApp group for sharing their flamingo observations, and to Robert Tindle for his valuable and thought-provoking input.

LITERATURE CITED

Allen, R.P. 1956. *The Flamingos: their Life History and Survival, with Special Reference to the American or West Indian Flamingo (*Phoenicopterus ruber*).* National Audubon Society, New York.

Amat, J.A., Rendón, M.A., Rendón-Martos, M., Garrido, A., Ramírez, J. M. 2005. Ranging behaviour of Greater Flamingos during the breeding and post-breeding periods: linking connectivity to biological processes. *Biological Conservation* 125: 183–192.

Anderson, M.J. 2017. *Flamingos: Behavior, Biology, and Relationship with Humans.* Nova Science, New York.

Brown, C. & King, C. (eds) 2005. *Flamingo Husbandry Guidelines: a Joint Effort of the AZA and EAZA in Cooperation with WWT.* Dallas Zoo, Dallas.

Castro, I. & Phillips, A. 1996. *The Birds of the Galápagos Islands*. Princeton University Press, Princeton.

Cezilly, F. & Johnson, A.R. 1992. Exotic flamingos in the western Mediterranean region: a case for concern? *Waterbirds* 15: 261–263.

Chiale, M.C., Montalti, D. & Maragliano, R. 2018. Age determination of captive Chilean Flamingo (*Phoenicopterus chilensis*) chicks based on plumage characteristics. *Ornitología Neotropical* 29: 107–110.

Hoyo, J. del, Boesman, P.F.D. & Garcia E.F.J. 2020. Chilean Flamingo (*Phoenicopterus chilensis*), version 1.0. *In*: Hoyo, J. del, Elliott, A., Sargatal, J., Christie, D.A. & Juana, E. de (eds) *Birds of the World*. Cornell Lab. of Ornithology, Ithaca. <https://doi.org/10.2173/bow.chifla1.01> consulted 10 May 2020.

Freile, J.F. & Restall, R. 2018. *Birds of Ecuador*. Bloomsbury, London.

Frias-Soler, R., Tindle, E., Lopez, G. E., Blomberg, S., Studer-Thiersch, A., Wink, M. & Tindle, R. 2014. Genetic and phenotypic evidence supports evolutionary divergence of the American Flamingo (Phoenicopterus *ruber*) population in the Galapagos Islands. *Waterbirds* 37: 349–361.

Gordillo, J. 1967–2007. *Vida y Costumbres de los Flamencos* (Phoenicopterus ruber *var*. ruber). Unpubl. rep. in the library of the Charles Darwin Research Station, Puerto Ayora.

Jiménez-Uzcátegui, G. 2017. First record of the Chilean Flamingo in Galapagos. <https://www.darwinfoundation.org/en/blog-articles/221-first-record-of-the-chilean-flamingo-in-Galápagos> consulted 10 May 2020.

Jiménez-Uzcátegui, G., Wiedenfeld, D.A., Vargas, F.H. & Snell, H.L. 2017. *CDF Checklist of Galapagos Birds*. Charles Darwin Foundation, Puerto Ayora. <http://darwinfoundation.org/datazone/checklists/vertebrates/aves/> consulted 10 May 2020.

Mascitti, V. & Castañera, M.B. 2006. Foraging depth of flamingos in single-species and mixed-species flocks at Laguna de Pozuelos, Argentina. *Waterbirds* 29: 328–334.

Rooth, J. 1965. *The Flamingos on Bonaire (Netherlands Antilles): Habitat, Diet and Reproduction of Phoenicopterus ruber ruber*. Zoological Laboratory of the State University, Utrecht.

Tindle, R.W., Tupiza, A., Blomberg, S.P. & Tindle, L.E. 2014. The biology of an isolated population of the American Flamingo *Phoenicopterus ruber* in the Galapagos Islands. *Galapagos Research* 68: 15–27.

Vargas, F.H., Barlow, S., Hart, T., Jiménez-Uzcátegui, G., Chavez, J., Naranjo, S. & Macdonald, D.W. 2008. Effects of climate variation on the abundance and distribution of flamingos in the Galápagos Islands. *Journal of Zoology* 276: 252–265.

Wackernagel, H. 1959. Ein Bruterfolg beim Chilenischen Flamingo im Zoologischen Garten Basel. *Ornithologische Beobachter* 56: 33–40.

Weidenfeld, D. & Jiménez-Uzcátegui, G. 2008. Critical problems for bird conservation in the Galápagos Islands. *Cotinga* 29: 22–27.

Winkler, D.W., Billerman, S.M. & Lovette, I.J. 2020. Flamingos (Phoenicopteridae), version 1.0. *In*: Billerman, S.M., Keeney, B.K., Rodewald, P.G. & Schulenberg, T.S. (eds) *Birds of the World*. Cornell Lab. of Ornithology, Ithaca. <https://doi.org/10.2173/bow.phoeni1.01> consulted 27 Dec 2020.