Seasonal distribution of the Western Cattle Egret (*Ardea ibis*) in southern South America, the Falkland Islands and the Antarctic region

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Abstract

The Western Cattle Egret (*Ardea ibis*) was confined to western Eurasia and Africa until it colonized northeastern South America in the late 19th century and quickly spread across the Western Hemisphere, arriving in southern South America by 1969. We analyzed its seasonal distribution in southern South America and adjacent regions based on 50,281 eBird records in South America south of 20° S, 77 records from the Falkland Islands and 14 records from the Antarctic region (south of continental South America and the Falkland Islands), during 1978-2023. From 20-40° S, the proportion of records increased with latitude during austral summer and decreased during austral fall, winter and spring. South of 40° S, egrets occurred mostly during fall, indicative of post-breeding dispersal, with the proportion of records increasing with latitude during fall and decreasing during winter, spring and summer. A few individuals lingered during winter at the highest latitudes in southern South America, the Falkland Islands and South Georgia Island, but there are no winter records from farther south. These patterns suggest that the southernmost populations of Western Cattle Egret in South America are partially migratory, with many individuals migrating southward during summer and fall, and returning northward before winter. Most if not all individuals dispersing over open ocean to the Falkland Islands and Antarctic islands die from predation or starvation. Further studies are needed to better document the dispersal and migratory patterns of Western Cattle Egret in southern South America.

Key words: Antarctica, Argentina, Chile, eBird, Falkland Islands, migration, Neotropical austral migrants, Neotropics.

Introduction

Four systems of bird migration occur within the Neotropics, including intra-tropical, altitudinal, austral and longitudinal migrations (Jahn *et al.* 2020). Birds breeding in the temperate latitudes of South America and migrating northward during the non-breeding season are referred to as austral migrants (Chesser 1994, Hayes *et al.* 1994, Jahn *et al.* 2004, Capllonch 2018), Neotropical migrants (Hayes 1995, Joseph 1997) or Neotropical austral migrants (Cueto and Jahn 2008, Jahn *et al.* 2020). Despite a growing number of studies on these species in recent decades (Jahn *et al.* 2020), much more research is needed to better understand which species migrate, the seasonal timing of their migration, and their migratory routes and destinations in southern South America.

The Cattle Egret (*Ardea ibis*, formerly *Bubulcus ibis*) was recently reclassified as *Ardea* (Chesser *et al.* 2024, Gill *et al.* 2025), based mostly on genetic data (Huang *et al.* 2016, Hruska *et al.* 2023). The taxon was also recently split into two sibling species, based largely on differences in alternate plumage and geographic range (Ahmed 2011): (1) Western Cattle Egret (*Ardea ibis*) of western Eurasia, Africa, North America and South America (Fig. 1); and (2) Eastern Cattle Egret (*Ardea coromanda*) of eastern Eurasia and Australia (Gill *et al.* 2025). The Western Cattle Egret first appeared in the Western Hemisphere during 1877-1882 in Guyana (Bond 1957, Palmer 1962) and subsequently spread throughout the Western Hemisphere (Sprunt 1955, Davis 1960, Blaker 1971, Crosby 1972, Handtke and Mauersberger 1977, Arendt 1988, Massa *et al.* 2014, Pulido Capurro *et al.* 2020, Miño *et al.* 2022). The Eastern Cattle Egret was introduced to Australia in 1933 (18 released; Serventy and Whittell 1948) and the Western Cattle Egret was introduced to Hawaii in 1959 (105 released; Breese 1959), augmenting their rate of range expansion to new regions.

In southern South America, the Western Cattle Egret was first recorded in Argentina in 1969 (Olrog 1972, Rumboll and Canevari 1975), Chile

Figure 1. Western Cattle Egret at Westmorland, California, USA, on 6 April 2024. Photo by Floyd E. Hayes.

in 1969 (Post 1970), Paraguay in 1975 (Handtke and Mauersberger 1977), Uruguay in 1976 (Gore and Gepp 1978) and Tierra del Fuego near the southern tip of South America by 1975 (Venegas 1975, Venegas and Jory 1979). Nesting in southern South America was first reported in Argentina in 1972 (Narosky 1973). Individuals dispersing southeastward or southward across the open ocean were first reported from the Falkland Islands in 1976 (Strange 1979) and the Antarctic islands of South Georgia Island in 1977 (Jehl *et al.* 1978), South Shetland Islands in 1979 (Schlatter and Duarte 1979), South Orkney Islands in 1981 (Prince and Croxall 1983) and Argentine Islands of the Antarctic Peninsula in 1979 (Prince and Croxall 1983).

The seasonal movements of Western Cattle Egrets are highly variable, even within a population. Although some individuals are relatively sedentary, many in all four continents exhibit strong patterns of post-breeding dispersal and long-distance migration, which can be difficult to distinguish, especially for individuals breeding in temperate latitudes (Kushlan and Hancock 2005, Telfair 2023). For example, data from nestling Western Cattle Egrets banded in South Africa reveal a seasonal pattern of dispersal northward in austral winter and southward in austral summer, but some banded adults recovered during the summer in Central Africa apparently did not return to South Africa to breed, and coastal populations are more sedentary than inland populations (Siegfried 1970, Kopij 2017). Nomadism and extreme vagrancy also occur, with some individuals dispersing thousands of km from where they hatched to distant locations, including ships (which may facilitate dispersal) and remote islands (Enticott 1984, Kushlan and Hancock 2005, Marin and Caceres 2010, Telfair 2023).

In southern South America, the Western Cattle Egret is considered an austral migrant with post-breeding dispersal south of its breeding range (Kushlan and Hancock 2005, Telfair 2023). However, its seasonal patterns of distribution in southern South America have not been previously analyzed. In 2002, eBird (ebird.org) was launched as an online citizen science database that provides researchers with a vast quantity of distributional records that can be used for analyzing the seasonal distribution of birds (Sullivan *et al.* 2009, 2014, Wood *et al.* 2011). In this study, we use eBird data, augmented with a review of literature records, to document seasonal patterns in the distribution of the Western Cattle Egret in southern South America, the Falkland Islands and the Antarctic region.

Methods

We downloaded all submitted eBird records of the Western Cattle Egret that had been vetted (approved by regional experts as volunteer reviewers) from south of 20° S in southern South America, the Falkland Islands and to the south of these regions through 30 November 2023. A record was defined as an observation of one or more individuals at a given locality on a given date. Duplicates from shared observations were deleted. Records at sea that were closer to the Falkland Islands than the continent were classified as records for the Falkland Islands. All records south of continental South America and the Falkland Islands were classified as records for the Antarctic region.

For each degree of latitude from 20-56° S in South America, we calculated the percentage of records occurring during each month and each season, defined as spring (September to November), summer (December to February), fall (March to May) and winter (June to August). To estimate how the probability that a record falls into each season varies along a latitudinal gradient, a multinomial logistic regression model was

constructed, with latitude as the independent variable and season as the dependent variable, using R version 4.5.0 (R Core Team 2025) and the multinom function from the nnet package (Venables and Ripley 2002). Furthermore, based on the results from the model, the average marginal effect of the predicted probability for each season was calculated, using the avg slopes function from the marginaleffects package (Arel-Bundock *et al.* 2024). This value represents the average rate of change in the predicted probability per degree of latitude change. Because preliminary analyses showed a clear distinction in the trend of the seasonal proportions of records across the 40° S boundary, these analyses were performed separately for the 20-40° S and 40-56° S datasets.

The percentage of records during each season were calculated separately for the Falkland Islands and the Antarctic region, and one-sample chi-square goodness-of-fit tests (χ^2 statistic; Zar 2010) were computed using an online calculator (MedCalc Software Ltd. n.d.) to test for seasonal differences in the proportions of records. An online calculator (National Hurricane Center and Central Pacific Hurricane Center n.d.) was used to measure distances between noteworthy locality records.

Results

After deleting duplicates from shared observations, we obtained 50,281 eBird records of the Western Cattle Egret from the South American continent and adjacent marine areas (excluding records south of the continent) between 20° S and the southern tip of South America at 56° S, ranging from 11 March 1978 to 30 November 2023. From 20-40° S, egrets were most common during spring and summer, with a peak in monthly records occurring in October from 20-28° S, in October or November from 28-32° S, and in either November, December or January from 32-40° S (Table 1, Fig. 2). South of 40° S, egrets occurred mostly during fall, with a peak in monthly records occurring during March, April or May, and much fewer birds during spring, summer and winter (Table 1, Fig. 2). Based on the multinomial logistic regression, in the 20-40° S range, the predicted probability of summer records increased by 1.21 percentage points per degree of latitude ($P < 0.001$), while those for spring, fall and winter decreased by 0.24, 0.12 and 0.85 points, respectively (all $P < 0.001$; Table 2, Fig. 3). In the 40-56° S range, fall records increased by 3.64 points ($P < 0.001$), while those for spring, summer and winter decreased by 1.59, 0.31 and 1.74 points, respectively (all $P < 0.001$; Table 2, Fig. 3). Some individuals lingered throughout the winter even at high latitudes near the southern tip of South America; the southernmost eBird winter record was an egret photographed at Ushuaia, Tierra del Fuego, Argentina (54° 49′ S, 68° 20′ W), from 30 June 2023 (Ledesma n.d.) to 28 July 2023 (Godoy n.d.) (Fig. 4).

We obtained 77 eBird records from the Falkland Islands and adjacent marine areas from 18 March 1993 to 20 April 2023. The vast majority of records occurred during fall (90%; 24 records in March, 34 in April, 11 in May), with 8% during summer (four records in January, two in February), 1% during spring (one record in November) and 1% in winter (one record in August) ($\chi^2 = 172.30$, df = 3, $P < 0.001$). The only winter record was from Saunders Island (51° 19′ S, 60° 14′ W) on 20 August 2013 (Bobowski n.d.).

We obtained 14 eBird records from the Antarctic region southeast or south of the South American continent and Falkland Islands, including four records from the vicinity of South Georgia Island and 10 records in the Drake Passage, South Shetland Islands and Weddell Sea from 30 March 1986 to 19 March 2023. Most of the records occurred during fall (79%; 10 records in March,

Table 1. Percentage of eBird records (1978-2023) for the Western Cattle Egret for each month at each degree of latitude from 20° to 56° S in southern South America. For each degree of latitude, the month with the highest percentage of records is indicated with bold print.

°S	J	F	M	A	M	J	J	A	S	O	N	D	*n*
20°	6	4	4	5	8	7	8	9	13	**20**	11	5	*1997*
21°	12	8	6	6	8	6	8	8	8	**13**	9	9	*2166*
22°	10	8	8	6	8	6	8	8	9	**13**	9	7	*8860*
23°	11	8	7	5	8	6	8	8	9	**13**	10	7	*5263*
24°	7	6	8	9	12	7	9	8	7	**13**	10	6	*1976*
25°	5	6	8	6	9	7	11	10	7	**16**	10	6	*1720*
26°	7	6	6	8	12	7	7	7	8	**14**	13	5	*1380*
27°	8	10	8	6	10	4	6	8	7	**15**	11	8	*2027*
28°	11	9	7	6	7	4	5	6	7	12	**14**	12	*1738*
29°	10	8	7	9	10	5	6	7	8	**12**	9	7	*2148*
30°	12	13	13	5	6	3	3	2	3	9	**15**	15	*1414*
31°	12	10	10	7	8	4	5	4	4	9	**16**	11	*2374*
32°	**15**	13	8	6	6	3	4	2	5	11	15	13	*1872*
33°	12	10	8	6	6	4	4	4	6	13	**16**	10	*4783*
34°	**16**	12	6	4	3	2	4	3	5	15	15	13	*3342*
35°	**15**	15	10	6	5	5	4	3	6	9	11	12	*1385*
36°	10	8	7	7	11	5	8	6	6	11	**13**	7	*1401*
37°	**19**	15	6	3	5	4	6	4	3	6	12	17	*585*
38°	**21**	15	5	5	8	8	3	5	3	3	9	15	*854*
39°	**24**	13	7	6	6	3	2	1	4	8	11	15	*597*
40°	2	3	9	15	**17**	10	9	10	8	9	5	2	*1391*
41°	5	5	11	10	**18**	12	14	6	5	8	5	2	*309*
42°	6	6	10	20	**37**	6	2	–	–	4	6	2	*49*
43°	–	13	7	13	**20**	**20**	–	7	–	13	7	–	*15*
44°	–	5	–	32	**37**	–	–	–	–	–	16	11	*19*
45°	8	10	10	18	**34**	10	–	4	2	4	–	–	*50*
46°	–	–	**44**	33	22	–	–	–	–	–	–	–	*9*
47°	–	–	14	**47**	36	3	–	–	–	–	–	–	*76*
48°	–	–	38	**50**	–	–	–	–	–	–	–	13	*8*
49°	–	–	7	**67**	20	–	7	–	–	–	–	–	*15*
50°	3	5	12	32	**46**	2	–	–	–	–	–	–	*65*
51°	–	3	19	**54**	18	4	1	–	–	–	–	–	*72*
52°	–	–	20	**80**	–	–	–	–	–	–	–	–	*20*
53°	<1	–	21	**38**	32	4	<1	<1	–	<1	–	<1	*224*
54°	–	3	21	30	**34**	1	8	–	–	–	–	3	*73*
55°	–	–	**50**	**50**	–	–	–	–	–	–	–	–	*4*

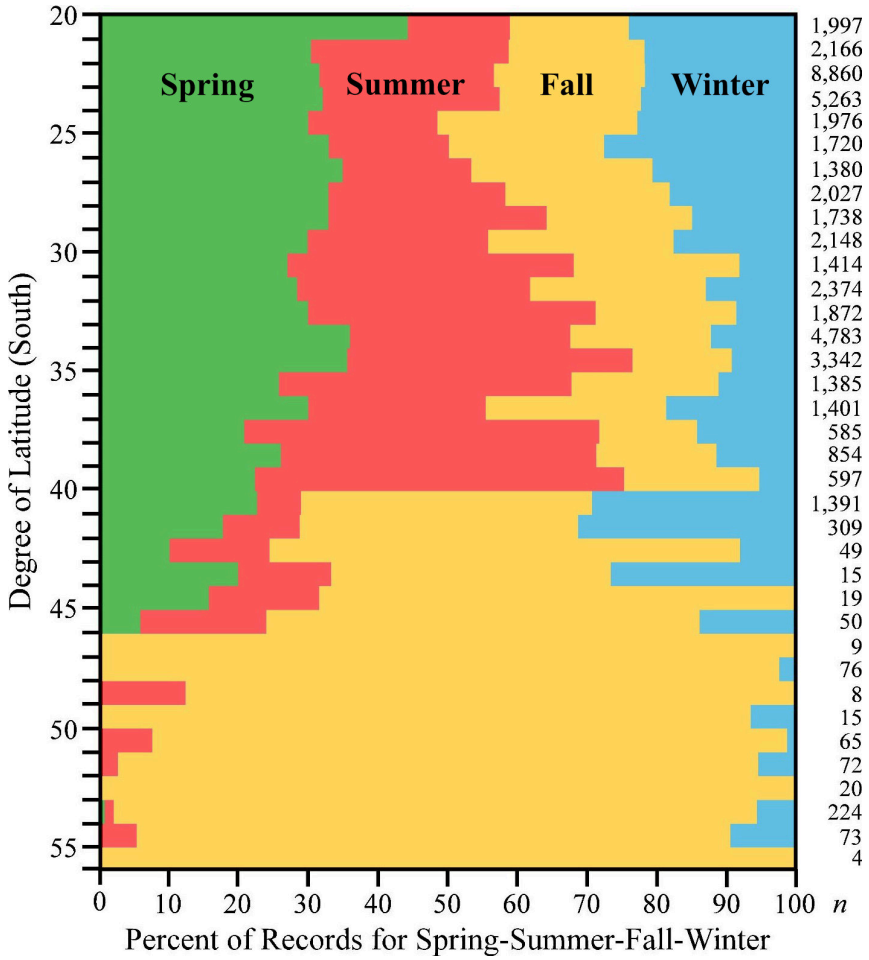

Figure 2. Percentage of eBird records (and total number of records at right) of Western Cattle Egret per season (spring = September to November; summer = December to February; fall = March to May; winter = June to August) at each degree of latitude south of 20° S from 1978-2023 in southern South America.

Table 2. Average marginal effects of latitude on the predicted probability of Western Cattle Egret records in South America, by season, estimated by multinomial logistic regression.

Latitude	Season	Estimate	S.E.	*P*
20-40° S	Spring	-0.00239	0.00038	< 0.001
	Summer	0.01210	0.00039	< 0.001
	Fall	-0.00124	0.00034	< 0.001
	Winter	-0.00851	0.00028	< 0.001
40-56° S	Spring	-0.01590	0.00085	< 0.001
	Summer	-0.00313	0.00067	< 0.001
	Fall	0.03640	0.00106	< 0.001
	Winter	-0.01740	0.00093	< 0.001

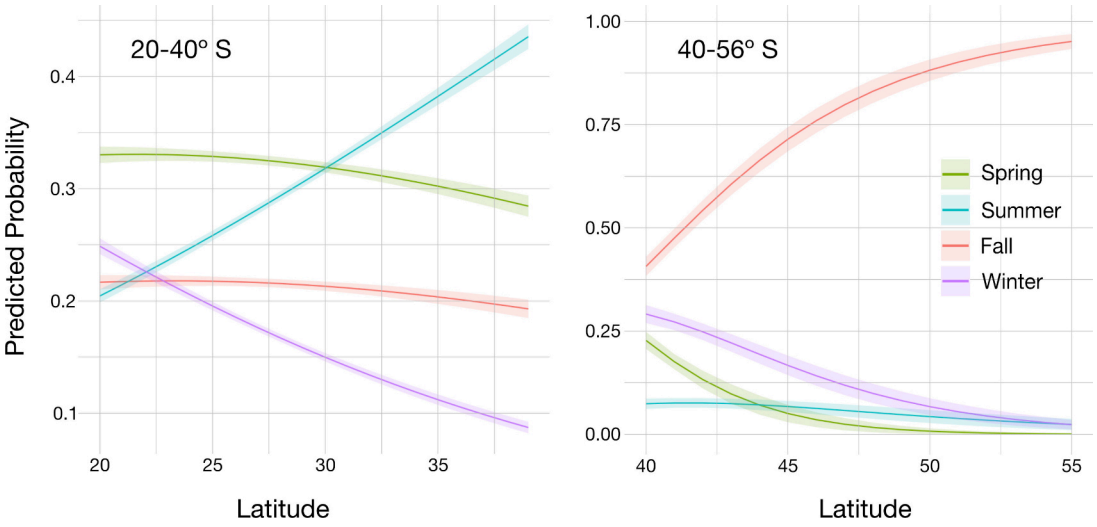

Figure 3. Predicted probability of Western Cattle Egret records by season and latitude, estimated by multinomial logistic regression, for South America (Left: 20-40° S, Right: 40-56° S).

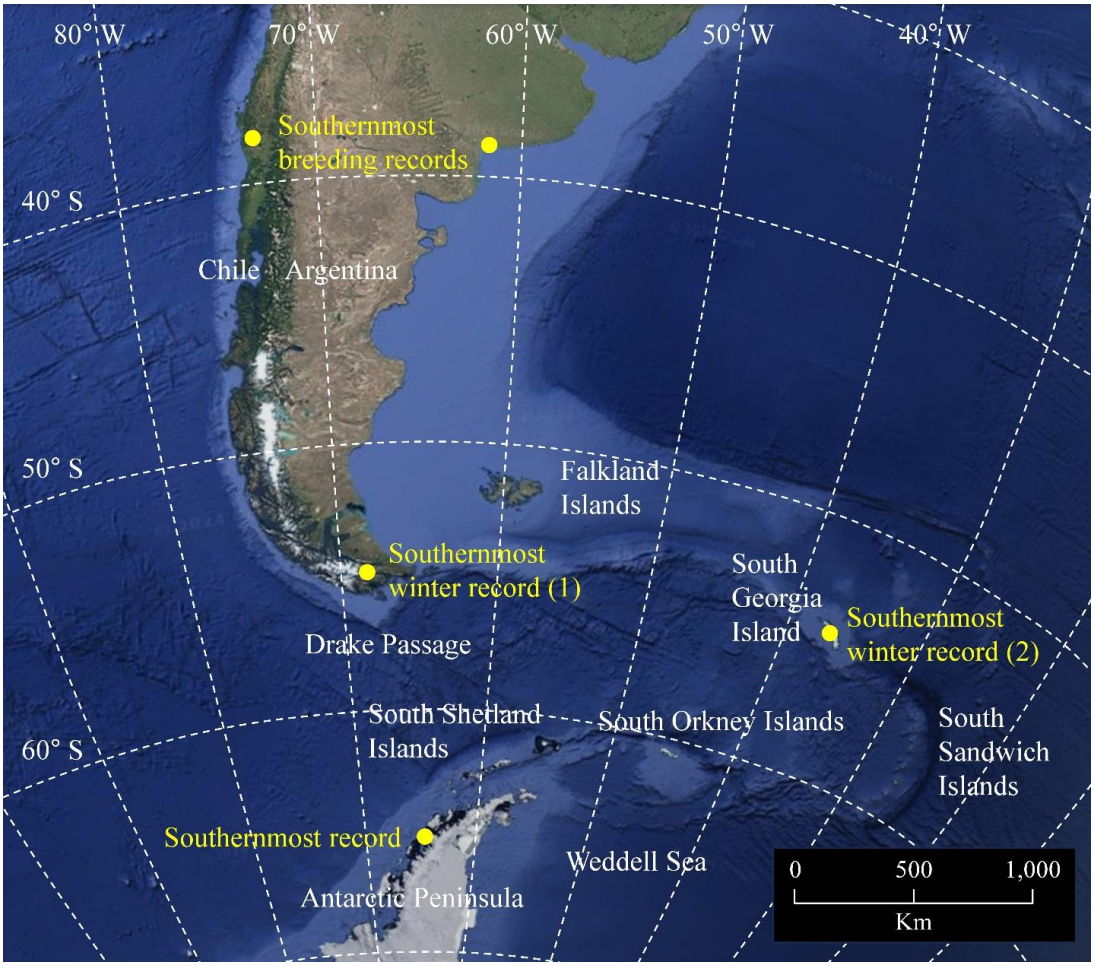

Figure 4. Map of southern South America and the Antarctic region with locations of the southernmost breeding, winter and all-time records of Western Cattle Egret. The base map is from Google Earth (earth.google.com).

one in April), 14% during summer (two records in January) and 7% during spring (one record in November) ($\chi^2 = 22.00$, df = 3, $P < 0.001$). The southernmost eBird record was a flock of 14 extremely emaciated birds attracted to the lights of a ship at night in the northwestern Weddell Sea, 268 km E of Joinville Island at the northeastern tip of the Antarctic Peninsula (63° 11′ S, 49° 41′ W), on 30 March 1986 (Wallace n.d.).

Discussion

In southern South America, the Western Cattle Egret was first recorded nesting at Laguna de Burgos, Buenos Aires, Argentina (36° 36′ S, 59° 59′ W), on 11 December 1972 (Narosky 1973). It subsequently established nesting colonies throughout northern and central Argentina, with incubation occurring from November to March and nestlings from December to April (De la Peña and Montalti 2014). Despite the rapid rate of new records occurring much farther south in Tierra del Fuego and the Antarctic region in the 1970s (see Introduction above), the southernmost nesting colony, first detected in October 1989, is at Laguna Sauce Grande (38° 56′ S, 61° 23′ W; Padín and Néstor 1996), only 287 km south of where it was first found nesting in 1972 (Narosky 1973) (Fig. 4). In Chile, the southernmost nesting colony is at a similar latitude at Labranza, Araucanía (38° 46′ S, 72° 45′ W), where nesting was reported on 4 January 2020 (Raimilla n.d.) (Fig. 4). The Western Cattle Egret does not appear to be expanding its breeding range southward during the last few decades in response to climate change, in contrast with many other birds in the region (Capllonch *et al.* 2020), and despite an increase in exploration of more southerly locations.

Our analyses demonstrate a strong pattern of post-breeding southward dispersal by the Western Cattle Egret in southern South America, beginning during summer at 20-40° and continuing during fall, especially south of 40° S, as the proportion of fall records increases and the proportions of winter, spring and summer records decrease with latitude. Because there are no published studies of band recoveries or satellite telemetry of the Western Cattle Egret in southern South America, the fate of most individual birds that disperse southward after the breeding season is poorly known. Given the paucity of winter records at higher latitudes in continental South America, with some lingering year-round as far south as the southern tip of South America, most southward dispersing birds presumably migrate northward before the onset of winter and return to nesting colonies during the following breeding season. These patterns suggest that the Western Cattle Egret is a partial migrant in southern South America, with a portion of the population migrating southward during summer and fall, and returning northward before winter.

Remarkably, but consistent with their explosive colonization of the rest of the world, some Western Cattle Egrets disperse southeastward or southward across hundreds or thousands of km of open ocean, usually in fall but sometimes during spring or summer, to the Falkland Islands, South Georgia Island, South Sandwich Islands, South Orkney Islands, South Shetland Islands and Argentine Islands (Jehl *et al.* 1978, Schlatter and Duarte 1979, Strange 1979, Prince and Croxall 1983, 1996, Clark 1985, Torres *et al.* 1986, Trivelpiece *et al.* 1987, Kaiser *et al.* 1988, Rootes 1988, Lange and Naumann 1990, Mönke and Bick 1990, Aguirre 1995, Orgeira 1995, 1996, Silva *et al.* 1995, Lumpe and Weidinger 2000, Ibáñez *et al.* 1999/2001, Kampp 2001, Peter *et al.* 2008, Coria *et al.* 2011, Petersen *et al.* 2015, Braun *et al.* 2023, Trokhymets *et al.* 2024). Irruptions sometimes occur, with at least 5,000 individuals arriving in the Falkland Islands from mid-March to mid-May 1986 (Douse 1986) and at least 50 individuals on South Georgia Island in 1979 and

1986 (Prince and Croxall 1996). The southernmost published record is a dead bird found at Black Island, in the Argentine Islands just west of the Antarctic Peninsula (65° 15′ 31″ S, 64° 16′ 51″ W; Fig. 4), in early April 2013 (Trokhymets *et al.* 2024), and there are several records < 5 km to the north at Galindez Island, also in the Argentine Islands, in December 1979 (Prince and Croxall 1983), late March and early April 2013, and April 2019 (Trokhymets *et al.* 2024). These locations are at least 2,930 km S of the nearest known nesting colony (Fig. 4). It is unknown whether any of these birds ever return to the South American continent. Post-breeding dispersal to such inhospitable localities represents normal exploratory behavior rather than an act of desperation or navigational error (Lees and Gilroy 2021, Veit 2022), even though it appears to be a suicidal one-way journey for most if not all individuals. Many are emaciated when they arrive on boats or islands, and are either preyed upon by avian predators or starve to death. Few remain alive by winter, with records from June, July and August in the Falkland Islands (Strange 1979, Bobowski n.d.) and June on South Georgia Island, with a similar latitude (54-55° S, precise locality not given; Prince and Croxall 1996) as the southernmost winter record in continental South America (details cited in Results above) (Fig. 4).

In North America, the Western Cattle Egret breeds at much higher latitudes than in South America, with the northernmost at Middle Quill Lake, Saskatchewan, Canada (51° 56′ N, 104° 13′ W; Beyersbergen 2008). However, it does not disperse as far toward higher latitudes, with the northernmost eBird record in continental North America near Fort Simpson, Northwest Territories, Canada (61° 55′ N, 121° 35′ W), on 26 October 2011 (Larter n.d.). In western Eurasia, it breeds at even higher latitudes, as far north as the Burton Mere Wetlands, Wales, UK (53° 15′ N, 03° 02′ W; Rare Bird Alert 2017, Eaton 2022), and it disperses farther northward, with the northernmost eBird record from Kløkstad, Nordland, Norway (67° 23′ N, 14° 36′ E), on 29 September 2014 (Birkelund n.d.).

In contrast with the Western Cattle Egret, the Eastern Cattle Egret does not disperse as far toward the poles. Its northernmost record was a dead individual found at Agattu, Aleutian Islands, Alaska, USA (52° 25′ N, 173° 36′ E), on 19 June 1988 (Gibson and Kessel 1992, Alaska Historical Data n.d.), and its southernmost record is from Green Gorge, Macquarie Island, Australia (54° 37′ 53.0″ S, 158° 53′ 56.1″ E), on 3 April 2018 and found dead the following day (Bird n.d.).

Further studies of Western Cattle Egrets that are banded, tagged with light-level geolocators or outfitted with satellite transmitters are needed to better document the dispersal and migratory trajectories of individuals and populations in southern South America.

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