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Number 26 • Spring 2020

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- increase awareness of the importance of support for conservation in the region
- mobilise the increasing number of enthusiastic birdwatchers active in the region to contribute to the conservation of Neotropical birds
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Neotropical Birding

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FRONT COVER

Chestnut-bellied Flowerpiercer *Diglossa gloriosissima*, 'Montezuma Road', Risaralda, Colombia, November 2018 (James Lowen/ jameslowen.com). Globally Endangered, this bird is one of the stars of John Cahill's article on birding the 'Montezuma Road' (page 3).

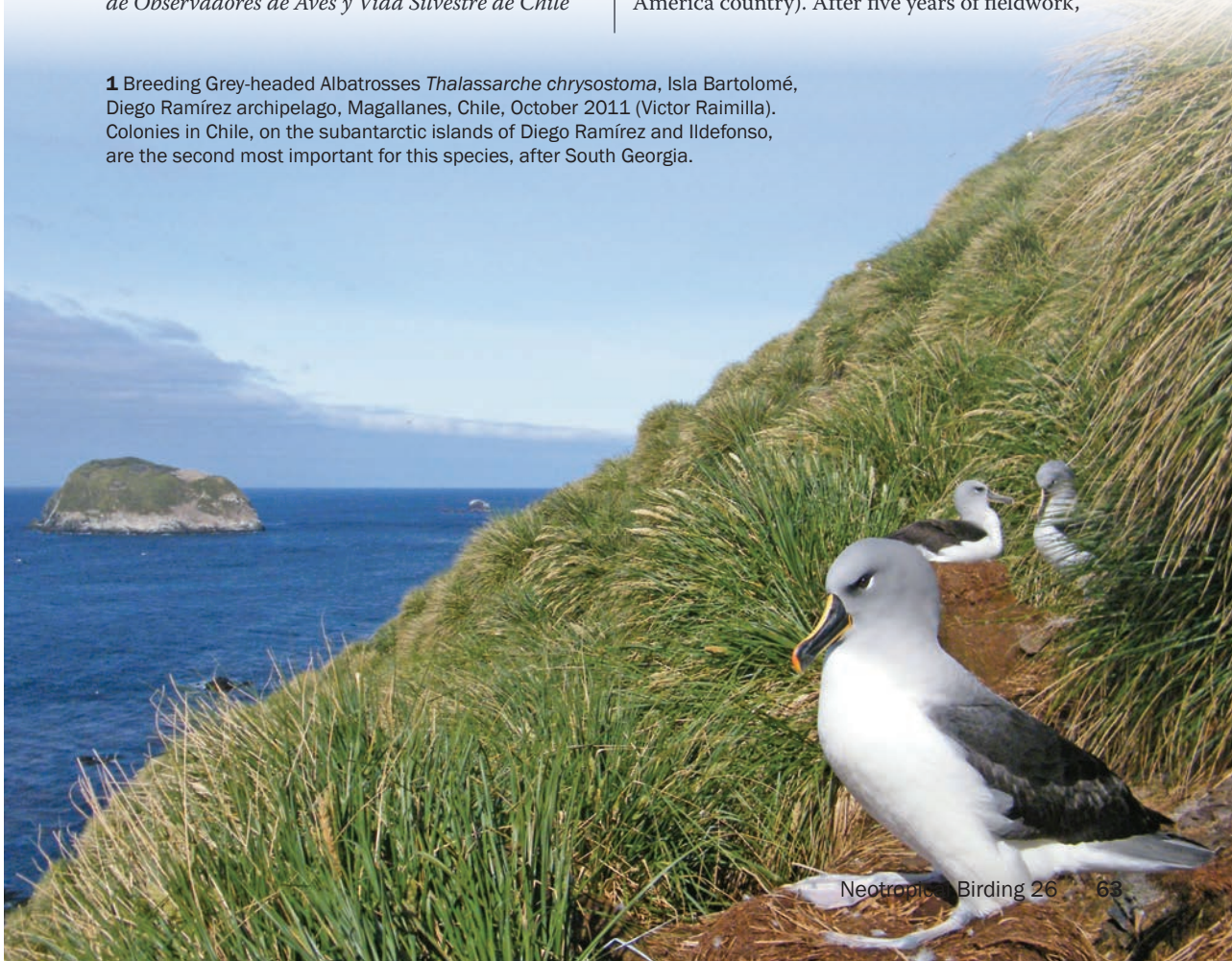
Another exciting bird at 'Montezuma Road' is the Critically Endangered Dusky Starfrontlet *Coeligena orina* ('Montezuma Road', Risaralda, Colombia, November 2018; John Cahill/ johncahillbirding.com).

Mapping Chile's birds: South America's first atlas of breeding birds

Fernando Medrano, Rodrigo Barros, Heraldo V. Norambuena, Ricardo Matus and Fabrice Schmitt

Among the most impressive books to have landed on the desk of the Neotropical Birding *editor in recent years (see review, page 76) was an atlas of the breeding birds of Chile. Those most closely involved describe how they produced the first such publication for any South American country.*

Barely a decade ago, a small group of birding enthusiasts in Chile pledged to substantially improve knowledge of the birds of the country. The cohort's initial actions were to roll out an eBird platform for Chile and to establish the *Red de Observadores de Aves y Vida Silvestre de Chile* (ROC; roughly translated as Network of Bird- and Wildlife-watchers in Chile). It was the potential of eBird that initially suggested to us the idea – the dream! – of producing the first-ever atlas to the breeding birds of Chile (and, indeed, of any South America country). After five years of fieldwork,



1 Breeding Grey-headed Albatrosses *Thalassarche chrysostoma*, Isla Bartolomé, Diego Ramírez archipelago, Magallanes, Chile, October 2011 (Victor Raimilla). Colonies in Chile, on the subantarctic islands of Diego Ramírez and Ildefonso, are the second most important for this species, after South Georgia.

with 1,815 volunteers submitting 675,000 records of 304 species, plus two further years of analysis, writing, mapping, designing and publishing, that dream became reality. The *Atlas de las aves nidificantes de Chile, 2011–2016* was published in 2018 (Medrano *et al.* 2018; now freely available as a download from tinyurl.com/ChileAtlas). This article summarises how we got there – and what we learnt.

What is a breeding-bird atlas?

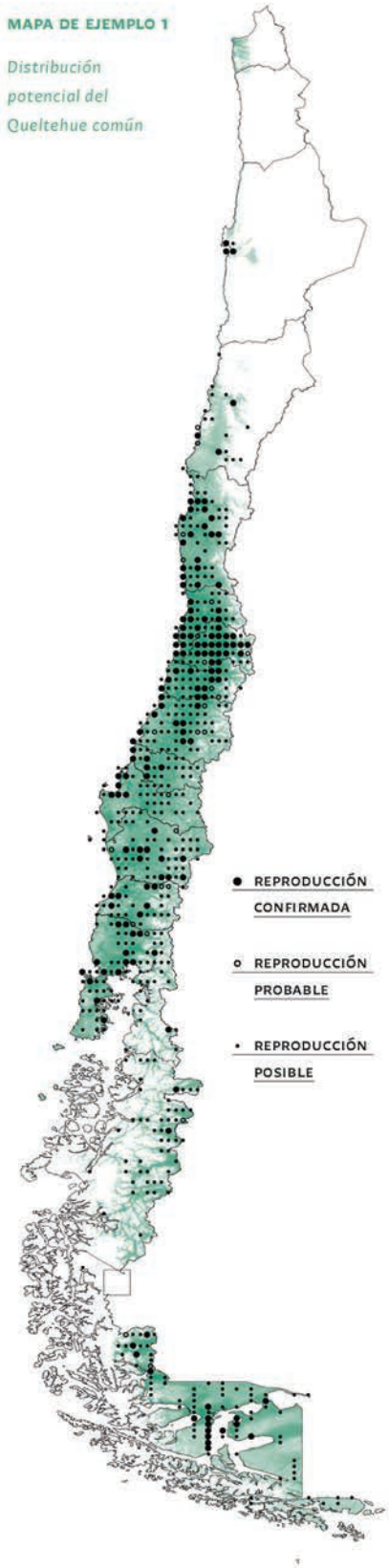
A breeding-bird atlas furnishes a snapshot of the distribution of birds in a particular region over a specified period. It serves as a baseline against which changes can be determined – and thus provides a useful conservation tool. The last 60 years have seen an explosion in the number and geographic reach of such atlases. The trailblazer was produced by the UK's West Midlands Bird Club (Norris 1960), while the first national atlas, actually covering two countries, covered Britain and Ireland in 1976 (Sharrock 1976) and benefited from the input of 10,000 observers. Since then, bird atlases have covered various countries across North America, Africa, Asia, Oceania and Europe – but not Central or South America.

Assessing bird distribution in a changing Chile

The last work that provided a comprehensive assessment of the distribution of Chilean birds was published more than 60 years ago (Goodall *et al.* 1946, 1951). Looking at this two-volume publication now, we can appreciate how substantially Chile has changed across the intervening decades. Chile's human population has risen from 7.3 million to 17.5 million, much of it in ever-expanding urban areas. Industrial forestry has burgeoned, so that the area covered by non-native pine and eucalyptus plantations has increased five-fold. A growing fishing industry has over-exploited the majority of Chile's marine resources. The mining sector has tripled the volumes it extracts. This model of development has impacted most bird species through habitat loss and fragmentation, reduction in food, and – in some places – the spread of non-native species.

It was this context that drove us to provide a fresh baseline of the distribution of Chile's breeding birds. We knew that this would not be easy. At the outset, we numbered just a few dozen birders and lacked any funding. Even if we managed to recruit two orders more of volunteers, we could never hope to reach the ten thousand

2 Map of observer coverage for the *Atlas*.



3 Actual and potential breeding distribution of Southern Lapwing *Vanellus chilensis* in Chile, as it appears in the *Atlas*.

contributors to the Britain and Ireland atlas 40 years previously. Knowledge of the whereabouts of many species was rudimentary at best. Moreover, access to much of our country is tricky, to say the least. And that's without even mentioning that Chile stretches for more than half the length of the continent of South America...

Nevertheless, we were hopeful. The publication of several field guides (e.g. Jaramillo *et al.* 2003) had 'democratised' birdwatching in Chile. The establishment of ROC and the subsequent launch of a free-to-download birding magazine (*La Chiricoca*) was swiftly engendering a sense of community and raising collective knowledge levels. In collaboration with the Cornell Lab of Ornithology, the eBird platform was facilitating the sharing of information. We sensed we were on the cusp of a revolution in our understanding of Chile's birds – and the *Atlas* could foment that. In August 2011, we launched the project – initially for four years, although we ended up extending it by a further 12 months so that it finished in August 2016.

Compiling the Atlas

We divided Chile into 2,453 squares, each covering 400 km^2 (four times larger than the squares used in Britain and Ireland by Sharrock 1976). Volunteers gathered information for locations across the whole of the Chilean territory, submitting it via specially tailored eBird lists that allowed the inclusion of breeding data. However, inadequate data meant that we ended up excluding from the published *Atlas* several remote islands (e.g. Easter, Juan Fernández archipelago). In part, the level of geographical coverage understandably reflected where birdwatchers lived. Thousands of eBird lists were submitted for regions such as Metropolitana and Valparaiso, but we received little information for the Tarapacá mountains, the Atacama Desert, and Aysén's fjords and channels. Figure 2 illustrates the extent of observer coverage.

For each bird encounter, observers used codes based on the behaviour of the individuals, which showed the likelihood of the species breeding. We divided those behaviours into three categories.

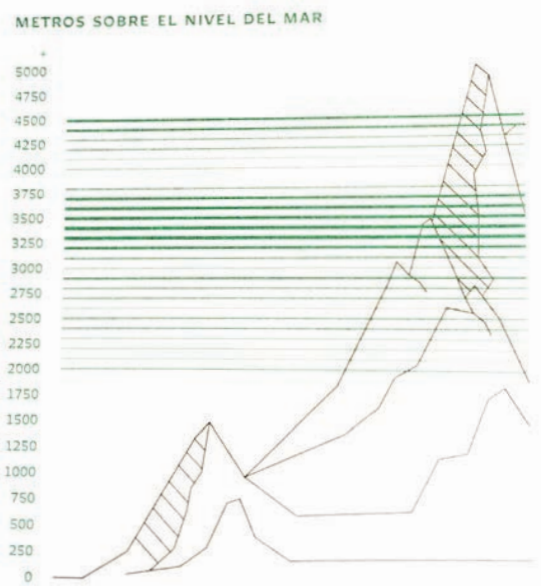
- 'Possible' breeding might comprise a singing male or one or more individuals seen in suitable habitat during the breeding season.
- 'Probable' meant, for example, a displaying pair or an adult repeatedly returning to a probable nest site.
- 'Confirmed' was along the lines of nest-building, a nest with eggs or chicks, or recently fledged young.

Following a process of data validation, we indicated these three levels of certainty by using dots of different sizes on an outline map of Chile. Each dot was placed in the centre of the 400-km^2 square, rather than at the actual location of the observation. For many species, we used Maxent software (see Phillips *et al.* 2018) to expand these actual observations into graphical depictions of *potential* range; the darker the shading, the more confident we were of the species's occurrence (Fig. 3). We treated colonial breeders differently, mapping the exact location of colonies.

One of the innovations in the *Atlas* is its graphical presentation of altitudinal distribution for each species. On a stylised relief map of Chile (with the Pacific Ocean to the left and Andes to the right), we use horizontal lines of different intensity to indicate relative abundance at different altitudes. The darker the line, the more checklists received for the species at that altitudinal band (Fig. 4).

So much for the graphics; what about the text? Given that more than six decades had passed since Goodall *et al.* (1946, 1951), we wanted to make the account for each species as rich as possible. Therefore, as well as distribution, the authors of each species account used published information (more than 2,000 references in total!) and new data collected to compile what we now knew about the species's status, breeding biology, ecology and conservation. Clearly, what we know about Chile's breeding avifauna varies considerably for each species – so some accounts are understandably sketchy, while others are detailed. We don't consider this a drawback of the *Atlas* – but rather a call-to-arms to fill in the gaps.

4 Altitudinal distribution of Bare-faced Ground-dove *Metriopelia ceciliae*, as it appears in the *Atlas* (*y* axis is altitude in metres).



Some key discoveries

Unsurprisingly, the *Atlas* contains novel information for almost all of Chile's breeding species. Surveys revealed the first known breeding sites for two Data Deficient seabirds: Markham's Storm-Petrel *Oceanodroma markhami* (Schmitt *et al.* 2016) and Ringed Storm-Petrel *Oceanodroma hornbyi* (Barros *et al.* 2018, a discovery also celebrated in *Neotropical Birding* 25: 23–24). Fieldwork for the Atlas also produced the first breeding records of Hellmayr's Pipit *Anthus hellmayri* in Chile and clarified its distribution; this for a species previously considered solely a vagrant. Screaming Cowbird *Molothrus rufoaxillaris* was also a hitherto undiscovered breeder. Amazingly, it was found to parasitise Austral Blackbird *Curaeus curaeus* – a wholly new host species whose presence enabled the cowbird's range expansion!

The *Atlas* illustrates range expansions for species such as Oasis Hummingbird *Rhodopis vesper* and Spot-winged Pigeon *Patagioenas maculosa* (the latter towards both the Antofagasta mountains and the lowlands of Arica and Parinacota). Monk Parakeet *Myiopsitta monachus* is expanding from Santiago into other cities. The data extends the known altitudinal ranges for more than half of the 304 species surveyed, particularly for Andean species. For dozens of species, including the globally Vulnerable White-tailed Shrike-Tyrant *Agriornis albicauda*, we now better understand the duration of the breeding season. For many others, we have observed population fluctuations between years, as is the case of several seabirds including Guanay Cormorant *Phalacrocorax bougainvillii*.

The Atlas has also made clear what we don't know about Chile's birds. In some cases, this is surprising as it relates even to fairly common species. For example, we still have very little information about the nests of birds such as Greyish Miner *Geositta maritima*, Black-throated Flowerpiercer *Diglossa brunneiventris* and Chestnut-throated Seedeater *Sporophila telasco*.

Thoughts for the future

We have learnt several fundamental lessons from this project. The first concerns how little we (still) know. We remain a long way from gaining even basic information like the breeding distribution of

5 Female Upland Goose *Chloephaga picta* with two chicks, Tres Puentes, Punta Arenas, Magallanes, Chile, January 2018 (Natacha González). The Atlas confirmed that this waterbird breeds in the regions of Metropolitana, Magallanes, del Maule y Aysén, but the situation in O'Higgins is unknown and worthy of further investigation.

6 Two nests of Red-legged Cormorant *Phalacrocorax gaimardi*, Isla Mocha, Biobío, Chile, February 2016 (Ivo Tejeda). Atlas fieldwork doubled the number of known colonies of this species to at least 130.

many Chilean birds. Examples include Magellanic Diving-Petrel *Pelecanoides magellani* – for which just three nests have been found, all sixty years ago – and Yellow-rumped Siskin *Spinus uropygialis*, whose sole breeding record from 1946 remains as much a mystery now as it was then. Meanwhile, the Lluta Valley of northern Chile is perhaps the best place anywhere to see the rare Peruvian Martin *Progne murphyi* (Vulnerable), but we still lack evidence of it breeding in the country. And we know next to nothing about Striated Caracara *Phalcoboenus australis* (Near Threatened) in Chile! On occasion, the *Atlas* begs as many questions as it provides answers – and we hope that Chile's keen young birders will address those soon.

The second lesson is that many of the changes to which Chile's bird populations have been exposed during the last century have not been fully described, even though they include significant setbacks for some species. One such is Chilean Woodstar *Eulidia yarrellii* (Critically Endangered), whose dramatic recent population decline means that only an estimated 300 birds remained in 2017. Another example is Andean Goose *Oressochen melanopterus*, which has seen its southern populations recede by hundreds of kilometres in recent decades, probably because of the loss of wintering habitat. Again, more work is needed – and the Atlas should provide a start point for future research.

The third lesson – and the most hopeful for the future – is that the project has demonstrated the will of many people to participate in collaborative projects that allow us to know better and conserve our birds. Notwithstanding the many challenges faced by the *Atlas*, we believe that the collective endeavours inherent in this initiative will pave the way for future citizen-science projects that will strengthen our understanding of Chile's birds – perhaps including updates to this *Atlas*. This is what happened in Britain and Ireland, where the first atlas (Sharrock 1976) was part and parcel of the growth of the countries' birdwatching organisations. To coin the words of James Ferguson-Lees in that work, our publication is "not the end, but the start of an era".

Above all, we hope that the *Atlas* will be translated into concrete actions to help develop our fundamental understanding of Chilean birds – and particularly to generate much-needed conservation activities for the species that need them. We have an urgent and challenging road ahead.

ACKNOWLEDGMENTS

We thank the 1,815 individuals who contributed to (and are formally acknowledged in) the *Atlas*, as well as all the organisations involved in its production. We are thankful to the eBird team, from the Cornell Lab of Ornithology, who provided the key platform for development of the

7 Giant Hummingbird *Patagona g. gigas* at nest, Caleu, Metropolitana, Chile, November 2016 (Ivo Tejeda). There are two distinct populations of this massive hummingbird in Chile. The taxon *peruviana* inhabits the extreme north between the ranges of Parinacota and Antofagasta. There is then a break in the species's distribution until the breeding range of taxon *gigas*, which extends south to La Araucanía. It remains unknown where *gigas* winters.

Atlas. We thank ROC for permission to reproduce figures from the *Atlas*. We thank the photographers who allowed their images (which appeared in the *Atlas*) to illustrate this article: Natacha González, Victor Raimilla and Ivo Tejeda. We are grateful to James Lowen for encouraging us to write this article.

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