

Magellanic Sub-Antarctic Ornithology

First Decade of Long-Term Bird Studies at the
Omora Ethnobotanical Park, Cape Horn Biosphere Reserve, Chile

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Editors

SUB-ANTARCTIC BIOCULTURAL CONSERVATION PROGRAM

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PREFACE

ORNITHOLOGICAL RESEARCH AT OMORA PARK: THE LONGEST BIRD-BANDING PROGRAM IN SUB-ANTARCTIC FORESTS OF THE SOUTHERN HEMISPHERE

The Cape Horn Biosphere Reserve is a landmark for global biodiversity conservation. Today, southwestern South America still preserves an extensive area of evergreen forests that covers most of the Magellanic sub-Antarctic ecoregion (Rozzi *et al.* 2012). In this ecoregion that spans a myriad of islands, Cape Horn emerges as the southernmost forested point in the world. Metaphorically we have called it “the Southern summit of the Americas.”¹

Just as Mount Everest is the world's highest summit, Cape Horn is the highest latitude forested point in the Southern Hemisphere. Because of their extreme altitude or latitude, respectively, both peaks are subject to extreme climatic conditions, which acquire special relevance as we confront global climate change. Furthermore, in contrast to the broad longitudinal extension of temperate and boreal forests in the Northern Hemisphere, the temperate and sub-Antarctic forests of South America extend along a strip of land that is latitudinally very long (33-56°S), but longitudinally very narrow (71-73°W). This inter-hemispheric contrast creates unique possibilities for comparative studies on the life histories, ecology, and impacts of global environmental change on the birds, and biodiversity in general for at least five unique attributes of Cape Horn.

1. *Prevalence of birds.* In contrast to subpolar terrestrial ecosystems of the Northern Hemisphere that are inhabited by birds, large mammals, and some representatives of the herpetofauna, the subpolar Cape Horn region completely lacks the herpetofauna, and terrestrial mammals are almost completely absent. Therefore, birds are the dominant terrestrial vertebrates in the Cape Horn ecoregion, and they are the most diverse vertebrate group in both the sub-Arctic and sub-Antarctic regions. Due to their migratory behavior, the birds of the Northern Hemisphere subpolar forests are studied today as a sensitive biological indicator of global climate change. Birds of subpolar ecosystems in South America could now provide a valuable indicator group to monitor global climate change under environmental conditions that are biotically, geographically, and climatically different from the subpolar ecosystems in the Northern Hemisphere.

2. *Cape Horn: “a geographic funnel” for migratory forest bird species.* In contrast to the Northern Hemisphere boreal forests, which offer a vast expanse of habitat to returning breeding migratory birds, Cape Horn is characterized by a narrow tip where migratory forest birds converge. This geographical attribute has methodological advantages for the study of migration, and provides a unique natural laboratory for inter-hemispheric comparative studies of the avifaunas of subpolar forests.

3. *Oceanic climate.* In contrast to the continental climate (freezing winters and hot summers) that characterizes boreal forests, the climate of the sub-Antarctic forests of Cape Horn is moderated by a strong oceanic influence that determines its mild winters and cool summers (for details see Chapter 1). The isothermal climatic conditions recorded in the sub-Antarctic forests could be a determinant factor for longevity and migration patterns of birds.

¹ The term “Magellanic sub-Antarctic ecoregion” was coined by Ricardo Rozzi as part of the proposal for the UNESCO Cape Horn Biosphere Reserve, in order to distinguish it from Patagonia. He also coined the metaphor of the “Southern Summit of the Americas” to highlight the relevance of proposing Cape Horn as a biosphere reserve to the UNESCO-MAB Committee. See page 13 in Rozzi, R. (2004) “The Cape Horn Archipelago territory: A biocultural treasure at the south of the world,” pp. 11-25, in Rozzi, R., F. Massardo & C. Anderson (Eds.), *The Cape Horn Biosphere Reserve: A Proposal for Conservation and Tourism to Achieve Sustainable Development at the Southern End of the Americas*, bilingual English-Spanish Edition, Ediciones Universidad de Magallanes, Punta Arenas, Chile. For a summary of the main attributes of the Magellanic sub-Antarctic ecoregion see R. Rozzi, J.J. Armesto, J. Gutiérrez, F. Massardo, G. Likens, C.B. Anderson, A. Poole, K. Moses, G. Hargrove, A. Mansilla, J.H. Kennedy, M. Willson, K. Jax, C. Jones, J.B. Callicott & M.T. Kalin (2012) “Integrating ecology and environmental ethics: Earth stewardship in the southern end of the Americas.” *BioScience* 62: 226-236.

4. *Geographic isolation and high endemism.* In contrast to the circumpolar distribution presented by many species of plants and animals (including birds) in the subpolar region of the Northern Hemisphere, the temperate and sub-Antarctic forests of South America represents an “island of forests.” This biome is separated from the temperate forests of New Zealand and Australia by a vast extension of ocean, and from the nearest tropical forests in South America by a barrier of more than 1500 km formed by the dry steppe of Argentina, the high Andes Cordillera, and the hyper-arid Atacama Desert.² This geographic isolation has generated remarkably high levels of endemism in plant and animal species in the South American temperate forest biome. This endemism becomes even more marked in the Cape Horn Biosphere Reserve, where over 50% of the birds inhabiting the sub-Antarctic forests are endemic to southern South America.

5. *Magellanic sub-Antarctic wilderness area.* At the beginning of the 21st century, the Magellanic sub-Antarctic ecoregion was identified as one of the 24 wilderness areas remaining on the planet, because it (i) conserves more than 70% of its original vegetation cover, (ii) encompasses an area >10,000 km² that lacks terrestrial connectivity, industrial, and urban development, and (iii) has one of the lowest human population densities in temperate latitudes (0.14 inhabitants/km²).³ In addition, the Magellanic sub-Antarctic ecoregion is part of the South American temperate forest biome, which extends over 26 degrees of latitude (30-56°S) and cover an area of about 15.6 million hectares (ha) in southwestern South America. This represents the largest expanse of temperate forests remaining in the Southern Hemisphere, more than twice as much as the 5.9 million ha area of the temperate forests of New Zealand (40-47°S) and Tasmania (41-44°S) combined. Hence, southwestern South America represents a unique natural laboratory and conservation area for sub-Antarctic biodiversity, including the forest birds.⁴

In this context, the Long-Term Ornithological Research Program of the Sub-Antarctic Forests of Cape Horn was created at the Omora Ethnobotanical Park in January 2000. This program has included studies on a variety of species and topics, and uninterrupted mist-netting and banding of forest birds that have been conducted for 15 years. This is the longest mist-netting program of temperate and subpolar forest birds in the Southern Hemisphere.

HISTORY AND CORE RESEARCH QUESTIONS

In the first stage of the Long-Term Ornithological Research Program, the interdisciplinary scientific team of Omora Park led the preparation of the technical proposal that created the scientific foundation for the proposal that the State of Chile made to UNESCO for creating the Cape Horn Biosphere Reserve in March 2000. The creation of this biosphere reserve occurred in June 2005. In a second stage, the team of researchers at Omora Park participated in the creation of the southernmost university center of the world: University of Magallanes (UMAG) - Puerto Williams. The establishment of this university center in May 2002 was instrumental for the creation of two new academic programs: (a) the first graduate program in Patagonia, a “Master of Sciences in Sub-Antarctic Conservation and Natural Resources Management” at the University of Magallanes (UMAG), which was inaugurated in August 2003, and (b) the international Sub-Antarctic Biocultural Conservation Program (SBCP) coordinated by UMAG, the Institute of Ecology and Biodiversity (IEB), and the Omora Foundation in Chile, and by the University of North Texas (UNT) and the Center for Environmental Philosophy in the U.S. The SBCP was initiated in October 2004, and formalized in April 2006. In a third stage, the Omora Park scientific team participated with IEB researchers in the creation of the Chilean Network of Long-Term Socio-Ecological Research (LTSER-Chile) sites, which was established in May 2008, and integrated into the International Long-Term Ecological Research Network (ILTER) in September 2011. These three stages of institutional development have provided a solid academic foundation for the Omora Park Long-Term Ornithological Research Program.

This book, *Magellanic Sub-Antarctic Ornithology*, synthesizes the first eleven years of forest bird studies conducted at Omora Park. These studies are being currently integrated with long-term socio-ecological research, education, and conservation programs at the other sites of the Chilean LTSER. During the first decade of long-term ornithological research at Omora Park, we set out to address basic, but essential, questions to understand the composition, structure, dynamics, life histories, and ecological interactions of the austral avifauna. These questions include:

a. How long do passerine species live in the sub-Antarctic forests? What are the demographic patterns and survival rates of the passerine birds inhabiting the world’s southernmost forests?

² Regarding the high degree of endemism and the biogeographic isolation in the South America temperate forest biome, see Armesto, J.J., R. Rozzi, C. Smith-Ramírez & M.T.K. Arroyo (1998) “Effective conservation targets in South American temperate forests.” *Science* 282: 1271-1272.

³ For the definition of wilderness areas see Mittermeier, R.A., C.G. Mittermeier, T.M. Brooks, J.D. Pilgrim, W.R. Konstant, G.A.B. da Fonseca & C. Kormos (2003) “Wilderness and biodiversity conservation.” *Proceedings of the National Academy of Sciences* 100: 10309-10313.

⁴ For more details see Rozzi *et al.* (2012) *BioScience* 62: 226-236, op. cit.

- b. Which and how many species are migratory? Which are resident? How prominent is site fidelity: Do migratory birds return to the same sites in the forests of Cape Horn?
- c. What species characterize the bird assemblage of the Magellanic sub-Antarctic forests? Are these species habitat specialists or generalists?
- d. What is the morphometry of bird populations in the sub-Antarctic forests? Do birds reach a larger size than birds in conspecific populations living at lower latitudes and warmer temperatures in the South American temperate forest biome?
- e. What is the diet of birds at the southern tip of the Americas? How do the diets vary seasonally? Does the diet of bird populations differ from the diet of conspecific populations living at lower latitudes within the South American temperate forests biome? What are the most prominent trophic guilds? How do these trophic guilds compare with those in Northern Hemisphere temperate and boreal forests?
- f. What ecological and social roles do birds play in the sub-Antarctic forest conservation, in education, and in culture in the Cape Horn Biosphere Reserve?

The first question is especially relevant for inter-hemispheric comparisons since, as noted above, the forests of the Magellanic sub-Antarctic zone are characterized by a mild oceanic climate, with an annual temperature range of less than 10°C. Therefore, we hypothesized that sub-Antarctic birds inhabit an environment that would allow them to live longer than congeneric or con-familial species of boreal forests that are subject to a more severe climate where the annual range of temperature exceeds 40°C (see details in the next chapter). The second question is also relevant for inter-hemispheric comparisons due not only to the contrasting climatic conditions, but also due to the “funnel” shape of the temperate forests of South America. This conic form of the southern biome could promote greater site fidelity in migratory birds arriving at Cape Horn compared with those migrating to the vast boreal forests of Scandinavia, Russia and North America. Addressing these six basic set of questions is also important because previous studies on birds of forests in the region of Magallanes have been limited to short-term studies. Most of them correspond to expeditions conducted in less than one month, almost always during the summer season. This book presents, for the first time, long-term ornithological work conducted in Cape Horn to investigate the effects of seasonality on the abundance and migration patterns, diet, habitat use at local scale, and ecological interactions of the avifauna of the forests, wetlands, bogs, coastal, and high Andean sub-Antarctic habitats at the southern end of the Americas.

RESEARCH, EDUCATION, AND CONSERVATION

During the development of our Long-Term Ornithological Research Program at Omora Park, we found that it was not enough to study the birds: we also needed to work for their protection. The region of Cape Horn is currently subject to growing pressures of global climate change, the arrival of exotic invasive mammal species, and the opportunities and threats of growing nature tourism.⁵ In this context it was essential to contribute to the conservation of birds and their habitats. An effective first initiative was to promote conservation through charismatic species, such as the Magellanic Woodpecker (*Campephilus magellanicus*), and to establish educational courses and workshops for transfer of scientific knowledge for sustainable scientific tourism. For this reason, in parallel to long-term ornithological research, we established the Omora Natural History Workshop at the local school, Donald McIntyre, in Puerto Williams, which has held twice weekly sessions and field trips for bird-watching and exploration of the sub-Antarctic biodiversity, without interruption, for 14 years.

The Omora Natural History Workshop at the local school in Puerto Williams has been supplemented with courses and field activities on the knowledge, enjoyment, and observations of birds. These experiences have included “direct encounters” and “eye-to-eye contacts” of the participants with the birds in their habitats. Many people with a diversity of backgrounds have participated in these activities, including families and students from preschool to primary and secondary school levels, undergraduate and graduate university students, members of the Yahgan indigenous community of Mejillones Bay, authorities of the Chilean Antarctic Provincial Government Office, the Municipality of Cape Horn, and the Chilean Navy, and also officials from public services such as the Chile’s Forest Service (*Corporación Nacional Forestal*, CONAF), the Agriculture and Livestock Bureau (*Servicio Agrícola y Ganadero*, SAG), the Ministry of Environment (*Ministerio del Medio Ambiente*), the Ministry of the Land (*Ministerio de Bienes Nacionales*), the National Tourism Service (*Servicio Nacional de Turismo*, SERNATUR), and the Council of the Arts and Culture (*Consejo Nacional de la Cultura y las Artes*). We hope that this book helps to generate baseline information for vulnerable species and their habitats, and assist in making recommendations of best practices for the development of sustainable tourism and “bird watching” in the Cape Horn Biosphere Reserve.

⁵ Since the beginning of the long-term ornithological research program at Omora Park, we conducted bird censuses in areas visited by tourists, schoolchildren and other visitors, compared with simultaneous censuses at neighboring sites that are not visited (see Ippi *et al.* 2009, Chapter 17 in this book).

This book is the result of both long-term research conducted by scientists and by inter-institutional collaborations at regional, national and international scales, for a bioculture that promotes the sustainability of the life of humans, of birds, and of all living beings co-inhabiting in Cape Horn. For example, when we documented the capture of the first mink (*Neovison vison*) detected on Navarino Island, this record was immediately reported to the Governor of the Chilean Antarctic Province, with whom we published the news in the regional and national media. We then contacted the Agriculture and Husbandry Service to collaborate with the establishment of a campaign to control this voracious bird predator.⁶ This challenging campaign to control the explosive expansion of the American mink continues as a priority today. Because the avifauna of Navarino Island and Cape Horn Archipelago evolved without mammalian predators, the arrival of the mink represents one of the most serious threats to the conservation of birds in the Magellanic sub-Antarctic archipelagoes.⁷

THEMES AND STRUCTURE OF THIS BOOK

Part I of this book presents the first synthesis of the methods and results of the studies, censuses, and banding of birds in the sub-Antarctic forests conducted at Omora Park and other study sites in the Cape Horn Biosphere Reserve, between January 2000 and December 2010. These data, based on over 10,000 birds banded and/or recorded in censuses, provide a foundation for studies on morphometry and population dynamics of the most abundant species in the sub-Antarctic forests. Part I and the other parts of the book also include a selection of published articles, which address the six core areas of basic and applied research developed during the first decade of sub-Antarctic ornithological studies.⁸

Parts II and III include a selection of publications on the unique characteristics of the austral avifauna. Part II describes the notable absence of parasites in bird populations living south of Tierra del Fuego. It also highlights the high degree of generalism in the diet of some species whose populations in Cape Horn exhibit a more plastic and omnivorous diet than described in populations living at lower latitudes. Part III contains a selection of papers reporting on the seasonal dynamics of the avifauna inhabiting sub-Antarctic forest and wetlands in the Cape Horn Biosphere Reserve.

Part IV focuses on the devastating impact of the mink on populations of birds inhabiting forests and other terrestrial ecosystems, which is a major conservation issue for the avifauna. For example, the Magellanic Tapaculo (*Scytalopus magellanicus*), a small bird that inhabits the understory of forests and shrublands, disappeared from Omora Park and neighboring areas of Navarino Island by 2002. The selected articles focus on species that nest on the ground in coastal habitats, such as the endemic, Flightless Steamer-Duck (*Tachyeres pteneres*) and Kelp Goose (*Chloephaga hybrida*), whose populations have declined over the last decade. The mink has also dispersed into the high Andean and wetland habitats, where it preys on birds that are particularly vulnerable in these open habitats.

Part V also addresses the conservation of the avifauna. It introduces new ways of relating to the birds as living beings, not as mere natural resources. To this end, direct or face-to-face encounters with birds, such as the one we had with a Rufous-legged Owl (*Strix rufipes*) one evening when we were creating the ornithological program at Omora Park, have been critical. These direct encounters with birds and the integration of ecological sciences and environmental ethics inspired us to create a new methodological approach: field environmental philosophy. The conceptual and methodological framework of field environmental philosophy has led to the development of graduate theses and dissertations that address non-traditional aspects of ornithology, such as the role of birds as charismatic species for education, ecotourism and the conservation of biological and cultural diversity.⁹

⁶ The Omora Park research program together with the Governor of the Chilean Antarctic Province gave the first alert about the arrival of the North American mink to Navarino Island. Together, we contacted the regional and national offices of the Agriculture and Livestock Bureau (SAG), and two days after the detection the news was published on the cover of *El Mercurio* on 28 November, 2001, and *La Prensa Austral* on 27 November, 2001 (See Part I in this book).

⁷ Navarino Island and most of the islands of the Cape Horn Biosphere Reserve have been free of terrestrial carnivorous mammals. For this reason, many species of birds nest on the ground or very close to it, and today are particularly vulnerable to introduced exotic predators, such as the American mink, wild dogs, and cats (see Part IV in this book).

⁸ The chapters that were written especially for this book, and have not been previously published, are presented in one column per page. In contrast, the selected articles that have been previously published are presented in two columns per page. The articles included in this volume that have been previously published, have been carefully revised for this book.

⁹ See Rozzi, R., C.B. Anderson, J.C. Pizarro, F. Massardo, Y. Medina, A. Mansilla, J.H. Kennedy, J. Ojeda, T. Contador, V. Morales, K. Moses, A. Poole, J.J. Armesto & M.T. Kalin (2010). Field environmental philosophy and biocultural conservation at the Omora Ethnobotanical Park: Methodological approaches to broaden the ways of integrating the social component ("S") in Long-Term Socio-Ecological Research (LTSER) sites. *Revista Chilena de Historia Natural* 83: 27-68 [supplementary materials].

Part VI is introduced from an anthropological perspective that takes into account ancient Amerindian knowledge. Selected papers refer to different ways of naming and understanding the birds from the perspectives of ornithological sciences, Yahgan and Mapuche traditional ecological knowledge, as well as traditional knowledge of Spanish and English settlers. The names of the birds also reveal aspects of their behavior, onomatopoeia, morphology, and habitat. For example, in the case of the Bar-winged Cinclodes, the scientific name *Cinclodes fuscus* refers to a similar bird, the White-throated Dipper (*Cinclus cinclus*), that usually lives on the banks of swiftly running streams on the mountains in Europe. The etymology of the genus *Cinclodes* derives from the Greek word *Cinclus* (= snow-sharpener or bird that lives on the edge of the water) and the Greek suffix *odes* that means “like.” The specific name *fuscus* derives from the Latin *fus* that means tawny or dark. The Yahgan name *tularatachij* has a very similar meaning to the European scientific name, as it also refers to the habit and habitat of this little bird. The Yahgan name indicates that in Cape Horn this *táchij* (= bird from the genus *Cinclodes*) has the habit of living along the streams in the habitats of the hills or *tulara*. The Chilean *churrete* name derives from the fact that the birds of the genus *Cinclodes* leave patches of abundant liquid excrement on the rocks or in the mud on the banks of the waterways. In Chilean popular speech “being *churrete*” is to have diarrhea. Finally, the Mapudungun name *chiuchiu* is onomatopoeic with the vocalizations of these birds that often jump from rock to rock at the edge of the marshes emitting short calls “chiu-chiu.”

BIOCULTURAL AND BIOPHYSICAL ORNITHOLOGY: THE FIRST AND SECOND DECADES OF BIRD STUDIES AT OMORA PARK

The Omora Park program began with research on Yahgan ornithological and ecological knowledge, its contrasts with Mapuche and scientific ornithological knowledge, and their implications for environmental ethics. That investigation led to the *Multi-Ethnic Bird Guide of the Sub-Antarctic Forests*, which contains recordings of birds and stories about them in different languages and traditions of ecological knowledge.¹⁰ In that first ornithological book we discussed the cultural sphere of biocultural conservation: the sphere of symbols and language, or “logosphere.” This second book complements the first, as it focuses on the biological sphere of biocultural conservation: the sphere of biological studies of birds in their biophysical dimension, or “biosphere.”¹¹

The present book concludes with an afterword that discusses the research priorities for the second decade of this ornithological program. The first eleven years of the Long-Term Ornithological Research Program of the Sub-Antarctic Forests of Cape Horn at Omora Park were directed by Ricardo Rozzi, who initiated an interdisciplinary research platform with the objective of achieving a balance between basic science and its integration with education and conservation, including ecotourism, and which was based on the ecological, aesthetic, economic, biocultural, and ethical values of the unique life histories of the birds in the southernmost forests of the planet. Since January 2011, the leadership of this program has been taking over by Jaime Jiménez, who has initiated new approaches in:

- (i) Basic research, introducing (a) new subject areas such as the natural history and ecology of keystone species as the Magellanic Woodpecker (*Campephilus magellanicus*), and (b) innovative technologies for deciphering the migratory routes of species as the White-crested Elaenia (*Elaenia albiceps*), which connect Cape Horn to the Amazon.
- (ii) Applied research in conservation, with a focus on the impact on birds by the mink and other exotic mammals that have arrived in recent years to Navarino Island.
- (iii) Education and training in bird watching, with a focus on the integration of ornithological sciences and environmental ethics into biocultural conservation.

¹⁰ See the *Multi-Ethnic Bird Guide of the Sub-Antarctic Forests of South America* by Rozzi, R., F. Massardo, C. Anderson, S. McGehee, G. Clark, G. Egli, E. Ramilo, U. Calderón, C. Calderón, L. Aillapan & C. Zárraga (2010). UNT Press – Ediciones Universidad de Magallanes, Denton, TX and Punta Arenas, Chile.

¹¹ The Sub-Antarctic Biocultural Conservation Program integrates ecological sciences and environmental philosophy. The cultural aspect addressed by philosophy focuses on ethics and comparative epistemology. As part of the latter, the program has emphasized research on the names of plants and animals. These names are symbols and words (in Greek: “logos”). The sphere of the diversity of languages forms a web of intellectual life, which the linguist Michael Krauss has called “logosphere.” This “logosphere” that envelops the planet in a symbolic-linguistic sphere is as essential to human survival as the biophysical sphere of life or “biosphere.” For the interrelationships between “logosphere” and “biosphere” under the conceptual framework of biocultural ethics, see R. Rozzi (2013) “Biocultural ethics: From biocultural homogenization to biocultural conservation,” in: Rozzi, R., S.T.A. Pickett, C. Palmer, J.J. Armesto & Callicott JB (Eds.) *Linking Ecology and Ethics for a Changing World: Values, Philosophy, and Action*, Springer, in press. For the original definition of “logosphere” see Krauss, M. (2007) “Mass language extinction and documentation: The race against time,” pp. 3–24, in *The Vanishing Languages of the Pacific Rim*, Miyaoka, O., O. Sakiyama & M. Krauss (Eds.). Oxford University Press, New York.

(iv) New themes and activities for special interests tourism, incorporating telemetry techniques for the appreciation of the complexities of individual and social behavior of birds that have inhabited the islands of Cape Horn from the days when the evolution of mammals was just starting.¹²

We hope that this first synthesis of ornithological research at Omora Park stimulates new research projects that contribute to filling the gaps in the understanding of the autecology of bird species and their ecological interactions. We also hope to stimulate education and sustainable tourism programs that promote the conservation of the biological and cultural diversity of one of the planet's most unique subpolar forests that are remarkably well preserved at the beginning of the 21st century. In this initiative we appreciate the privilege of working with regional authorities, the educational community, the Navy of Chile, members of the Yahgan community, and a collaborative network of students and researchers from regional, national, and international academic centers. To generate and provide access to a new body of knowledge that can be of interest to environmental decision makers, educators, tourism operators, researchers, and bird enthusiasts is our most proper and responsible way to thank those who have supported and participated in the transdisciplinary Long-Term Ornithological Research Program at Omora Park. We hope that this knowledge will contribute to the welfare of present and future generations of humans, birds, and of all beings that co-inhabit the Magellanic sub-Antarctic ecoregion and the planet.

Omora Ethnobotanical Park

Ricardo Rozzi
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¹² For an evolutionary and biogeographic history of the birds of southern South America see the essay by Francois Vuilleumier (1985) "Forest birds of Patagonia: Ecological geography, speciation, endemism and faunal history," in Buckley P.A., M.S. Foster, E.S. Morton, R.S. Ridgely & F.G. Buckley (Eds.) Neotropical Ornithology. *Ornithological Monographs* 36: 255-304.