2004

Proceedings of the Symposium on Conservation of Quail in the Neotropics

Jack Clinton Eitniear
Center for the Study of Tropical Birds

John T. Baccus
Texas State University-San Marcos

Sheldon L. Dingle
Watchbird

John P. Carroll
University of Nebraska-Lincoln, jcarroll2@unl.edu

Conservation of Quail in the Neotropics

Proceedings of a Symposium held during the VI Neotropical Ornithological Congress Monterrey, Mexico, 4-10 October 1999

Jack C. Eitniear, John T. Baccus, Sheldon L. Dingle, and John P. Carroll, editors

inside front cover

Conservation of Quail in the Neotropics

Proceedings of a Symposium held during the VI Neotropical Ornithological Congress Monterrey, Mexico, 4-10 October 1999

Jack C. Eitniear, John T. Baccus, Sheldon L. Dingle, and John P. Carroll, editors

Published by
Center for the Study of Tropical Birds, Inc.
Miscellaneous Publication No. 3

ISBN 0-615-11802-X

Cover drawing by John P. O'Neill
Back cover and drawings within by Ramiel Papish

Printed by
The Printery
1762 Kaiser Avenue
Irvine, California, 92614
U.S.A.

Table of Contents

Elegant Quail

Preface

This volume represents the culmination of a long and slow process that has brought together biologists interested in the biology and conservation of the Latin American quails. The IUCN-SSC/BirdLife/WPA Partridge, Quail, and Francolin Specialist Group (PQFSG) represents conservation interests of a rather eclectic group of species generally quails or partridges. The 140+ species in this group are found on every continent but Antarctica. There has been considerable effort over the last 10 years to focus conservation programs on PQFSG species. We hope this volume highlights some of the work going on in Latin America and provides stimulus for further research and conservation on the generally poorly known quails of the region.

The evolution of this book resulted from Jack C. Eitniear's suggestion that the IV Neotropical Ornithological Symposium held in October 1999 might be an excellent forum for bringing cracid and quail biologists from Latin America together to discuss common interests and issues. The contents of the proceedings comprises the quail papers presented at a short symposium held during the congress. Dan Brooks is heading the effort to publish the cracid papers.

The PQFSG has co-sponsored a number of symposia with the Pheasant Specialist Group resulting in proceedings being published from International Galliformes Conferences held in 1993 in Pakistan, 1997 in Malaysia and most recently, 2000 in Nepal. The Proceedings of the latter have been printed and will shortly be available. However, this book represents the first effort where the Latin American quails have been a specific focus.

As always a large number of individuals, conservation organizations, employers, and businesses contribute greatly to the development of the symposia and this volume. Both the WPA/BirdLife/IUCN-SSC Cracid and Partridge, Quail, and Francolin Specialist Groups supported the symposia logistically and financially. Jack Eitniear spearheaded publication efforts of this volume and graciously offered to publish the proceedings through the Center for the Study of Tropical Birds, Inc. The Editors are indebted not only to these organizations, but more importantly to the authors of the manuscripts which made this proceedings possible, as well as all of the symposium participants - Muchas Gracias!

J.P. Carroll
Chair WPA/BirdLife/SSC-IUCN Partridge, Quail,
and Francolin Specialist Group

Spotted Wood-quail

Quail of México and Adjacent Central America: Status and Conservation Concerns

John P. Carroll[1] *and Jack C. Eitniear*[2]

[1]Daniel B. Warnell School of Forest Resources, University of Georgia, Athens, Georgia 30602-2152, USA
[2]Center for the Study of Tropical Birds, Inc., 218 Conway Drive, San Antonio, Texas 78209, USA

ABSTRACT

A number of reviews of the quail of México and adjacent Central America have suggested that there is limited information on many of these species. Conservation assessments have generally been made using unreliable data. Recently, more detailed studies of the life history and status of several species have improved our knowledge and resulted in one species' conservation status being upgraded. We suggest that there is opportunity for academic studies to improve our knowledge base and allow us to make better conservation assessments. Cooperative ventures and ecotourism offer some opportunities to improve the future prospects for several species, but these have not yet been undertaken.

QUAIL OF MÉXICO AND ADJACENT CENTRAL AMERICA: STATUS AND CONSERVATION CONCERNS

Several recent papers have dealt with the status and conservation of quails inhabiting México and northern Central America (Carroll et al., 1995, Carroll and Eitniear, 2000) in addition to the current revision of the quail "Status Survey and Action Plan 2000-2004" (Fuller et al., 2000). We believe it is necessary to review the present situation and ways to move forward; however, we will address these issues in such a way as to compliment rather than reiterate previous reviews.

Johnsgard (1973, 1988) has suggested that the New World quail evolved in the vicinity of southern México and Guatemala and then radiated to North and South America. México has the greatest diversity of quail of any country in the New World (Carroll and Eitniear, 2000). Despite this, basic information on the life history, population status, distribution and basic ecological requirements of most of México's quail remains unknown. Among populations with potential conservation status, significant research has been ongoing on the plight of the Masked Bobwhite *(Colinus virginianus ridgwayi),* a race of the Northern Bobwhite, (Carroll and Eitniear, 2000); no other quail has received such attention. During 1995, field research began on the Bearded Wood-partridge *(Dendrortyx barbatus)* in Veracruz, México in collaboration with the conservation groups Pronatura, Veracruz, and the Center for the Study of

[1]E-mail: Jcarroll@smokey.forestry.uga.com

Tropical Birds. The effort was under the guidance of Dr. John Carroll of the Partridge, Quail, and Francolin Specialist Group (SSC/Birdlife Int./WPA). In 1998, the study began investigating the species status and ecology in the Sierra Gorda Biosphere Reserve-Querétaro in collaboration with Grupo Ecological Sierra Gorda. In addition to studies on the Bearded Wood-partridge, census and distributional studies were initiated in 1997 on Singing Quail *(Dactylortyx thoracicus)* by Alvaro Aragon Tapia and Jack C. Eitniear in the El Cielo Biosphere reserve-Tamaulipas (Eitniear et al., 1997, Eitniear and Baccus, 2002). Most recently Gilberto Chaves-Leon began a study of the Long-tailed Wood-partridge, *D. macroura,* (Chavez-Leon, 2000). While these 4 studies certainly have expanded our knowledge of México's quail, several additional efforts appear warranted to comply with the recommendations of the 1995-1999 (McGowan et al., 1995) and subsequent 2000-2004 Action Plan (Fuller et al., 2000).

KEY SPECIES

There are a number of key species that warrant more interest and attention from biologists and conservationists. Although these species might in fact be reasonably safe, our understanding of their life history characteristics and biology is very limited.

Spotted Wood-quail *(0dontophorus guttatus):* distributed from southern México, northern Guatemala, Belize, and northern Honduras this species inhabits humid evergreen forest (Howell and Webb, 1995). Observed in pairs or small groups, it is frequently hunted and becoming scarce in areas of suitable habitat throughout Honduras.

Ocellated Quail *(Cyrtonyx ocellatus):* while possibly a race of *C. montezumae,* the 3 disjunct populations of *C. ocellatus* are decreasing throughout much of their range because of hunting and overgrazing (Howell and Webb, 1995). Thorn (pers. lit.) indicated that the Honduran race was uncommon. Given that the song, nest, and eggs of this species remain undescribed, collecting basic natural history information is critically important. A recent internet inquiry to birding tour leaders as to sightings of this species failed to result in any recent positive sightings.

Barred Quail *(Philortyx fasciatus):* this México endemic replaces the Northern Bobwhite in the Balsas drainage (Howell and Webb, 1995). A recent internet inquiry to birding tour leaders resulted in documentation of several large groups. Despite these observations, this species' nest and clutch remain undescribed.

Northern Bobwhite *(Colinus virginianus):* with 22 subspecies of which 16 occur in México, a complete review of the status and distribution of these races seems warranted (especially given decades of introductions, translocations, possible disease introductions and land form changes) throughout México (Brennan, 1999).

CONSERVATION ISSUES

Carroll and Eitniear (2000) considered the conservation of quail in México could best be approached through a multi-level approach. In addition to the 3-level approach suggested, it is also appropriate to suggest that a significant amount of basic biological research could be completed as part of Master's or Doctoral research programs. Given that none of the aforementioned species are considered rare, field studies would likely not be difficult. The current doctoral studies by Chavez-Leon (see various papers in this publication) illustrate the tremendous amount of information obtainable through academic studies. Encouraging additional academic studies on Barred Quail, Spotted Wood-Quail and Ocellated Quail as well as the various races of Northern Bobwhite Quail should be given priority. The increased popularity of "Birding" should also be considered when drafting comprehensive conservation strategies. Particularly with the rarer species (Bearded Wood-Partridge, Ocellated Quail), advanced birders interested in adding to their life list would pay a significant amount to view these species. If local people could benefit from such tours, it could be an added incentive to conserve the species (Eitniear, 1995).

Although goals outlined in the 2 Action Plans (McGowan et al., 1995, Fuller et al., 2000) for surveying quail populations throughout the Republic and adjacent countries would be ideal, we believe that a targeted approach by determining their status in the > 200 CIPAMEX/CONABIO/CCA/FMCN "AREAS DE IMPORTANCIA PARA LA CONSERVACION DE AVES" (AICAS) is a cost effective and efficient way forward. These areas throughout the country represent areas with greatest avian diversity and endemism.

In addition, collaborative projects linking United States based conservation groups with such analogous groups/individuals in México should be encouraged (Carroll and Eitniear, 2000). Upon entering the new millennium, information on the impact of hunting and changing land-use practices needs to be integrated into studies on basic biological and ecological requirements. Ultimately, survival of México's quail will be determined by humans that share their world.

While basic research is needed, the ultimate objective should be to ensure that the next edition of the quail Action Plan does not include species from México. To accomplish this will require an eclectic approach to quail conservation including elements of research, education, and game management.

LITERATURE CITED

Brennan, L. A. 1999. *Northern Bobwhite (Colinus virginianus) in Birds of North America No. 397*. A. Poole and F. G. Gill. (eds.). The Birds of North America, Inc. Philadelphia, PA.

Carroll, J. P., K. E. Church, and M. G. Kelsey. 1995. Status and Conservation of Neotropical Quails: Integrating People and Wildlife for a Sustainable Future. Pp 658-661 *in* P. R. Krauseman (ed.). *Proceeedings of the First International Wildlife Management Congress.* The Wildlife Society. Bethesda, MD.

Carroll, J. P., and J. C. Eitniear. 2000. Quails in México: needs and opportunities. Pp 191-193 *in* L. A. Brennan, W. E. Palmer, L. W. Berger, Jr., and T. L. Pruden (eds.). *Quail IV: Proceedings of the Fourth National Quail Symposium,* Tall Timbers Research Station, Tallahassee, FL.

Chavez-Leon, G. 2003. Abundance of the Long-tailed Tree-Quail in managed and unmanaged pine-oak forest. Pp 27-32 *in* J. C. Eitniear ,J. T. Baccus, J. Carroll, and S. L. Dingle (eds.). *Conservation of Quail in the Neotropics.* Center for the Study of Tropical Birds, San Antonio, TX.

Chavez-Leon, G. 2003. Long-tailed Tree-quail *(Dentrortyx macrouria)*: current knowledge and research needs. Pp 15-26 *in* J. C. Eitniear, J. T. Baccus, J. Carroll, and S. L. Dingle (eds.). *Conservation of Quail in the Neotropics.* Center for the Study of Tropical Birds, San Antonio, TX.

Eitniear, J. C. 1995. Ecotourism as a component of the survival strategy for parrots and partridges in México. (Abstract) 113th meeting of the American Ornithologists' Union, Cincinnati, OH.

Eitniear, J. C., and J. T. Baccus. 2002. Management implications of estimating abundance of quail species inhabiting forest environs in México. Pp 201-205 *in* S. J. Demaso, W. P. Kulesky, Jr., F. Hernandez, and M .E. Berger (eds.). Quail V: *Proceedings of the Fifth National Quail Symposium,* Texas Parks and Wildlife Department, Austin, TX

Eitniear, J. C., V. Gonzalez, A. Aragon T., and J. T. Baccus. 1997. Quail research in El Cielo and Sierra Gorda Biosphere Reserves, México. Pp 87-92 *in Memoria VII Simposium Internacional de Fauna Silvestre.* Universidad Autonoma de Tamaulipas, Ciudad Victoria, Tamaulipas, México.

Fuller, R. A., J. P. Carroll, and P. J. K. McGowan. 2000. Status survey and conservation action plan 2000-2004. Partridges, Quails, Francolins, Snowcocks, Guinefowl and Turkeys. SSC/BIRDLIFE INT./WPA Partridge, Quail and Francolin Specialist Group. IUCN, Gland, Switzerland.

Howell, S. N. G., and S. Webb. 1995. *A guide to the birds of México and northern Central America.* Oxford University Press, London, England

Johnsgard, P. A. 1973. *Grouse and quails of North America.* University of Nebraska Press, Lincoln, NE.

Johnsgard, P. A. 1988. *The quails, partridge, and francolins of the world.* Oxford University Press. London, England.

McGowan, P. J. K., S. D. Dowell, J. P. Carroll, and N. J. Aebischer. 1995. *Partridges, quails, francolins, snowcocks, and guineafowl: status survey and conservation action plan 1995-1999.* IUCN, Gland, Switzerland. ❒

Changing Densities of Singing Quail in El Cielo Biosphere, Tamaulipas, Mexico: 1949-1996

Jack C. Eitniear [1] and Alvaro Aragon T. [2]

[1]Center for the Study of Tropical Birds, Inc., 218 Conway Drive, San Antonio, Texas 78209, USA.
[2] 22 Cesar Lopez de Lara y Venustiano Carranza No. 553, Ciudad Victoria, C.P. 87020, Tamaulipas, México

The Singing Quail *(Dactylortyx thoracicus)* inhabits a number of complex forest communities in Mexico and northern Central America (Warner and Harrell, 1957). It is a small, stout-bodied, large-footed, short-tailed, crested quail with a melodious voice (Howell and Webb, 1995; AOU, 1998). Its northernmost distribution lies in the El Cielo Biosphere Reserve in southwestern Tamaulipas immediately south of the Tropic of Cancer between 22° 48' and 23° 30' north latitude and 99° 30' west longitude. The reserve covers 10,000 ha at altitudes from 200-1600 m and is within the Sierra de Cucharas at the eastern slope of the Sierra Madre Oriental. The mean monthly temperature is 13.03° C. and the mean monthly rainfall is 252.2 mm (Arriaga, 1988). The vegetation has been described as a mixture of tropical and temperature species (Rzedowski, 1978).

Harrell (1951) included the species as part of his thesis titled “The birds of Rancho de Cielo: ecological investigation of the oak-sweet gum forests of Tamaulipas, México.” He documented a number of life history traits, although he never discovered a nest. He concluded that the population in the oak-sweet gum forest for 1949-1950 was about 3.5 pairs per 40.5 ha, which was based partly on the density at a single 8-he plot and partly on the distance between pairs.

We report on a strip survey population assessment from 2 areas and a long-term investigation of population trends detailed by the annual Christmas Bird Count (CBC) indicators in the area. A more detailed discussion was published in Eitniear and Baccus (2002).

METHODS

During 9-10 November 1996, A. Aragon conducted a brief verbal survey of residents in Ejidos San Jose, Lazaro Cardenas, Joya de Manantiales and Alta Cima on their knowledge and observations of Singing Quail. As a result of the survey, 2 areas were chosen for establishing and running strip surveys. Area 1 was located in Ejido Larzaro Cardenas (9 transects). Area 2 was located in Las Minas o La Cueva (5 transects). The 2 areas were 16 km

[1]E-mail: JCEitniear@cstbinc.org

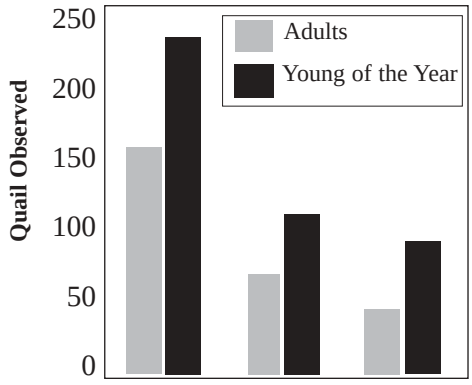
apart to prevent movement between areas by quail. “Walk, look and listen” surveys were conducted 3 times on each transect during 1997 (24 June - 5 July, 21 - 30 July, 21 September - 5 October). Birds were recorded if they were within 10 m on either side of a transect line. Length of individual transects ranged from 1,400 m to 5,000 m (Eitniear et al., 1997; Eitniear and Baccus, 2002)).

During 1972 to 1996, Audubon Christmas Bird Counts (CBC) were conducted at El Cielo Biosphere Reserve once each December (American Birds, 1973). We summarized these data for comparison to our more intensive strip surveys.

RESULTS

We found a maximum of 93 singing quail on the Ejido Larzaro Cardenas transects (Fig. 1) and 72 individuals at Las Minas o La Cueva (Fig. 1). The numbers of birds recorded during surveys decreased from June to October.

Figure 1. Total number of adults and young of the year singing quail observed in Ejido Lazaro Cardenas (transects 1-9) and La Cueva (transects 1-5) during surveys in El Cielo Biosphere Reserve, Tamaulipas, June–October 1997.



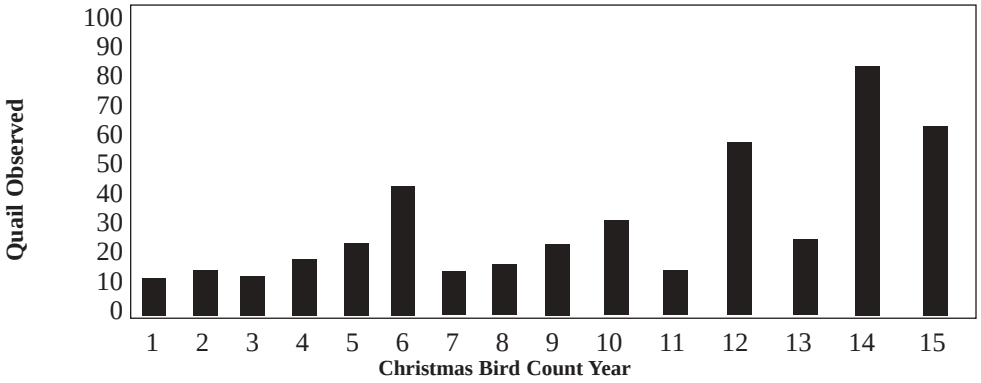


Figure 2. Singing quail recorded during annual El Cielo CBC from 1972 (year 1) to 1996 (year 15). See American Birds (1973) for count site description.

Survey results from Area 1 resulted in a quail density of 56 quail/45.4 ha (1 quail/0.8 ha). Area 2 resulted in 30 quail/15.9 ha (1 quail/0.53 ha).

According to CBC data, numbers of Singing Quail in El Cielo have steadily increased since the 1970s (Fig. 2).

DISCUSSION

In contrast to the density estimates reported here, Harrell (1951) suggested population densities of 1 quail/5.4 ha. Increases are because of the termination of timber harvesting in the early 1970s and the subsequent succession of tree-dominated plant communities. Singing Quail's preferred habitat, based on their foraging in leaf litter, is forested areas with a dense canopy that produces a heavy layer of leaf litter (Leopold, 1959). Harrell (1951) conducted his studies in 1950 when logging activities were ongoing in the El Cielo region.

A possible explanation for the large numbers of quail observed in December (CBC counts) may be the composition of the count area, which includes lowland riverside gallery forest and deciduous forest (American Birds, 1973). We speculate that the species exhibits latitudinal migration moving into lower elevations during winter months. This theory is currently being tested.

ACKNOWLEDGEMENTS

We wish to thank John Carroll (Chair, WPA/Birdlife/SSC Partridge, Quail and Francolin Specialist Group) and John T. Baccus for their guidance throughout this study.

LITERATURE CITED

American Birds. 1973. Gomez Farias Count. 27:537-538.

American Ornithologists' Union. 1998. *Check-list of North American birds*. 7th edition. American Ornithologists Union, Washington, D.C.

Arriaga, L. 1988. Gap dynamics of a tropical cloud forest in northeastern México. *Biotropica* **20**:178-184.

Eitniear, J. C., V. Gonzalez, A. Aragon T., and J. T. Baccus. 1997. Quail research in El Cielo and Sierra Gorda Biosphere Reserves, México. Pp 87-92 *in* Memoria VII Simposium Internacional de Fauna Silvestre. Universidad Autonoma de Tamaulipas, Ciudad Victoria, Tamaulipas, México.

Eitniear, J. C., and J. T. Baccus. 2002. Management implicatons of estimating abundance of quail species inhabiting forest environs in México. Pp 201-205 *in* S. J. Demaso, W. P. Kulesky, Jr., F. Hernandez, and M. E. Berger (eds.). *Quail V: Proceedings of the Fifth National Quail Symposium,* Texas Parks and Wildlife Department, Austin, TX

Harrell, B. E. 1951. The birds of Rancho del Cielo: an ecological investigation in the oak-sweet gum forest of Tamaulipas, México. Unpublished M.S. Thesis, University of Minnisota, Duluth, MN.

Howell, S. N. G., and S. Webb. 1995. *A guide to the birds of México and northern Central America.* Oxford University Press, London, England.

Leopold, A. S. 1959. *Wildlife in México: the gamebirds and mammals.* University of California Press. Berkeley, CA.

Rzedowski, J. 1983. *Vegetacion de México*, 2d edition. Editorial Limusa, S. A. México, D.F.

Warner, D. W., and B. C. Harrell. 1957. The systematics and biology of the Singing Quail, *Dactylortyx thoracicus*. *Wilson Bulletin*. **69**:122-147. ❒

Ocellated Quail

Status of the Bearded Wood-Partridge: with Comments on its Conservation in Querétaro

John T. Baccus

Wildlife Management Program, Department of Biology
Texas State University-San Marcos, San Marcos Texas, 78666

The Bearded Wood-partridge (= wood-quail), *Dendrortyx barbatus*, is a monotypic species endemic to Mexico in the states of San Luis Potosi, Hidalgo, Puebla, and Veracruz. This species is a medium-sized forest dwelling quail with a long tail and erectile crests. Bare parts are often brightly colored (Howell and Webb, 1995). The species is considered to be restricted to the Sierra Madre Oriental mountain range in fragmented, humid, montane, pine-oak, cloud forests and older secondary growth forests, forest edges, and distributed habitats associated with agriculture (American Ornithologist Union, 1998; Howell and Webb, 1995). There is virtually no published information on the ecology or conservation requirements of the species (Johnsgard,1973; 1988). Data on documented populations are old, and there have been few sightings of this bird since the 1960s (Collar et al., 1992). Knowledge of its current status is principally based upon field studies conducted between 1893-1952 (Lowery and Newman, 1951; Davis, 1952; Leopold, 1959; Johnsgard, 1973; 1988). Perhaps, fewer than 1,000 individuals exist in the wild in highly disjunct populations. Because of habitat destruction, hunting pressure, and lack of information, the World Conservation Union has listed the species as endangered with a Mace-Lande status of critical, indicating a high probability of extinction in the wild within 2 to 5 years (McGowan et al., 1995).

As a component of the action plan for this species (McGowan et al., 1995; Carroll et al., 1995), searches for its presence occurred throughout its known range. Localities visited were chosen based on previous sightings by local people or visiting ornithologists and based on a geographic information map showing high, montane elevations in eastern México associated with the Sierra Madre Oriental. Field studies in Querétaro were from 17-27 July 1998. Brief observations made on 19 July 1997 and in October 1998 are included. Playback of a recorded call was used to determine presence in an area (Bohl, 1956; Eitniear et al., 1997). Presence was also documented by interviews with local residents that demonstrated a knowledge of the bird in addition to sitting and listening during dawn and dusk in areas of suitable habitat.

The result of field efforts provided ecological observations and new locality records (Eitniear, et al., 1996; Eitniear et al., in press; Eitniear et al., 2000a; Eitniear et al., 2000b) in the Méxican state of Querétaro.

E-mail: jb02@txstate.edu

QUERÉTARO

Observations in Querétaro were in the recently established Reserva de la Biosfera Sierra Gorda, a 383,567 ha mountainous tract in northeastern Querétaro at Joya del Hielo, Municipio Landa de Matamoros (21° 14' 28" N, 99° 10' 22" W). Three birds were observed on 19 July 1997 at 1500 h at a distance of about 3 m scratching in leaf litter in an area dominated by *Quercus affinis, Q. sartorii, Magnolia dealbata, M. schiedeana, Cupressus lindeleyi,* and *Liquidambar styraciflua.* On 11 July 1998, two birds were observed at 1730 h at a distance of 10 m.

Canada de las Avispas, Municipio of Jalpan de Serra (21° 27' 64" N, 99° 09' 19" W): 5 individuals were observed in October 1998 at 1900 m in a cloud forest fragment composed of *Abies guatemalensis, Cupressus findleyi, Taxus globosa,* and *Pinus greggi* surrounded by a pine-oak forest. On 13 July 1998, five birds were observed at 1900 h along a path that connects Canada de las Avispas to the city of Xilitla, San Luis Potosi.

La Loya, 2 km east of Jose de los Duran (21° 28' 20"N, 99° 09' 44 W): 5 groups were heard during 11 observation periods from 17 July to 27 July 1998. Birds sang between 0630-1045 h (dawn) and at 2030 h (dusk). In total, 39 singing bouts were recorded from the 5 groups, an average of 3.5 groups per singing period. This area is the 4,663-ha Canada de las Avispas nuclear zone. Vegetation varies from secondary growth to mature forest dominated by *Quercus affinis, Q. laurina, Pinus greggii,* and *Liquidambar styraciflua.*

Joya el Buey, 3 km northeast of San Juan de los Duran (21° 29' 23" N, 99° 09' 38" W): On 26 July 1998 at 1230 h, 3 birds were flushed by a dog.

CONSERVATION IMPLICATIONS

All rare and endangered birds in México face extirpation should the current rapid human population growth and land use changes continue unabated and unless safe haven habitat can be designated for these species, especially in east-central México, and rigorously protected from destructive use of the land (Ramos, 1985). There are no short-term solutions to the problem. Therefore, it is important to study and gather critical information on the status of rare birds in México. This was the goal of the study of the Bearded Wood-partridge. The lack of information about the species abundance and distribution resulted in a critically endangered listing by the World Conservation Union (McGowan et al., 1995). To assess the validity of such ominous listing for this bird, presence or absence data for previously known locations of occurrence throughout its known range were made (Eitniear et al., 2000). The results were disappointing in Veracruz, Hidalgo, and Puebla. The distribution of this bird in these states is tenuous. For example, a small, isolated population in a narrow valley with dense forest near Coatepec, Veracruz was studied in 1995 and 1996. Upon return to the site in 1997, all trees had been removed and replaced by sun coffee groves. Even though some birds had transmitters, no evidence of the small aggregation was found. This scenario is the reality of land use throughout much of the species distribution. There is little hope for the species in Veracruz, Hidalgo, and Puebla because

of the expanding human population, the need to furnish goods and services to humans, and changes in land use to accommodate human needs.

The survival of the species in México depends on the concentration of conservation efforts in remote areas with smaller human populations, an ardent effort by local, state, and federal conservations officials to protect the habitat of the species, and education of citizens about the ecological vale of rare birds and the fragility of survival of such species. It is important to identify areas with sustainable populations of the Bearded Wood-partridge and concentrate conservation efforts there. From my perspective, 2 areas at this time offer the best locations for an expanded effort to save this species in México. One area, Pico Orizaba National Park, is near the southern boundary of the distribution. This location is critically important because of the necessity to maintain a diverse gene pool for this bird. Several observations of Bearded Wood-partridges along drainages of the Rio Metac verified a nuclear population and maybe metapopulations exist in this area (Garcia et al., 1993; Montejo and Tejeda, 1996). Since there is federal authority for the conservation of birds in Pico Orizaba National Park, authorities should make every effort to manage the species in this area.

A second area, Sierra Gorda Biosphere Reserve (SGBR), in the northwestern part of the distribution offers the best long-term potential for the survival of the Bearded Wood-partridge in México. This area is remote, has a small human population, does not have the agricultural use of the land like other areas within the distribution, still has extensive, undisturbed stands of forest, and an ongoing environmental education program for the area. This expansive area is located in northeastern Querétaro and southeastern San Luis Potosi. For conservation in this area to be successful, we suggest there has to be economic input into the economy of the region.

Long-term survival of the wood-partridge would be enhanced in SGBR if in addition to protection of the forest some ecotourism revenue could be generated to benefit the local people. Logistically, no housing facilities exist near known populations of wood-partridges. An arrangement would have to be made to "base" operations in a hotel nearby (i.e., Jalpan, Querétaro). From this base, 2-3 day trips afield could be made to view the wood-partridge. While this would be physically demanding, for those birders desiring to add the species to their "life list" it would undoubtedly be marketable. Using local people, the majority of funds derived from such tours could stay with local people and businesses, therefore, creating an additional incentive to conserve the species (Eitniear, 1995).

ACKNOWLEDGMENTS

Gratitude is extended to P. Mota for sharing his knowledge about the biology of wood-partridges. This study was supported by the World Pheasant Association International, IUCNSSC/Birdlife/WPA Partridge, Quail, and Francolin Specialist Group, Prince Bernhard Nature Trust, Panlitet Fentener van Vlissengen Foundation, World Nature Association, Wildlife Preservation Trust International, Chicago Zoological Society, and a SWT Faculty Enhancement grant to J. Baccus. Field studies were conducted under Mexican permit No. DOQ 550-4627/96 from Secretaria de Medio Ambiente, Recursos naturales y Pesca. My work benefited greatly from the assistance in the field by A. A. Tapia and overall guidance by J. P. Carroll (Chair/IUCN-SSC/Birdlife/WPA Partridge, Quail, and Francolin Specialist Group). Special appreciation is due to the conservation organizations Pronatura-Veracruz and Grupo Ecologico Sierra Gorda.

LITERATURE CITED

American Ornithologists' Union. 1998. *Check-list of North American birds.* 7th edition. American Ornithologists' Union, Washington, D.C.

Bohl, W. H. 1956. Experiments in locating wild chukar partridges by use of recorded calls. *Journal of Wildlife Management* **20**:83-85.

Carroll, J. P., K. E. Church, and M. G. Kelsey. 1995. Status and conservation of neotropical quails. *Proceedings of the International Wildlife Management Congress* **1**:658-661.

Collar, N. J., L. P. Gonzaga, N. Krabbe, A. Madrono Nieto, L. G. Naranjo, T. A. Parker III, and D. C. Wege. 1992. *Threatened birds of the Americas: the lCBP/IUCN red data book.* International Council for Bird Preservation, Cambridge, UK.

Davis, L. 1952. Winter bird census at Xilitla, San Luis Potosi, México. *Condor* **54**:345-355.

Eitniear, J. C. 1995. Ecotourism as a component of the survival strategy for parrots and partridges in México. (abstract) 113th meeting of the American Ornithologists' Union, Cincinnati, OH.

Eitniear, J. C., V. Gonzalez, A. A. Tapia, and J. T. Baccus. 1997. Quail research in El Cielo and Sierra Gorda Biosphere Reserves, México. Pp 87-92 *in Memoria VII Simposium Internacional de Fauna Silvestre,* Universidad Autonoma. Tamaulipas, Ciudad Victoria, México.

Eitniear, J. C., S. Aquilar and J. T. Baccus. 1996. Census of Bearded Wood-Partridge with tape recorded call. (abstract) Southwest Association of Naturalists, 43rd annual meeting, McAllen, Texas.

Eitniear, J. C., S. Aguilar, J. Carroll and J. T. Baccus. In press. Censusing Bearded Tree-partridge using play-back of a recorded call. Vida Silvestre Neotropical .

Eitniear, J. C., S. Aquilar R., V. Gonzalez, R. Pedraza R., and J. T. Baccus. 2000[a]. New records of Bearded Wood-Partridge, *Dendrortyx barbatus, in* México. *Southwestern Naturalist* **45**: 238-241.

Eitniear, J. C., A. Aragon. T., V. Gonzalez, R. Pedraza R., and J. T. Baccus. 2000[b]. New galliformes for the Mexican state of Queretaro. *Cotinga* **13**: 10-13.

Garcia, H. M. C., E. Lopez-Flores, M. S. Ramirez, and H. R. Oliva. 1993. *Diagnostico ambiental de la sub-cuenca del Rio Metlac, Veracruz, Mexico.* Pronatura, A. C. Cordoba, Veracruz.

Howell, S. N. G., and S. Webb. 1995. *A guide to the birds of México and adjacent Central America.* Oxford University Press, New York, NY.

Johnsgard, P. A. 1973. *Grouse and quails of North America.* University of Nebraska Press, Lincoln, NE.

Johnsgard, P. A. 1988. *The quails, partridges, and francolins of the world.* Oxford University Press, New York, NY.

Leopold, A. S. 1959. *Wildlife of México: game birds and mammals.* University of California Press, Berkeley, CA.

Lowery, G. H., and R. J. Newman. 1951. Notes on the ornithology of south-eastern San Luis Potosi. *Wilson Bulletin* **63**: 315-322.

McGowan, P. J. K., S. D. Dowell, J. P. Carroll, and N. J. Aebischer. 1995. Partridges, Quails, Francolins, Snowcocks, and Guineafowl: Status Survey and Conservation Action Plan 1995-1999. IUCN, Gland, Switzerland.

Montejo, D., and C. C. Tejeda. 1996. Registro de *Dendrortyx barbatus* en la region del Pico de Orizaba. Final Report. Distribucion y abundancia de los aves migratorias y endemicas de las subconcia del Rio Metlac. Pronatura Veracrua and U. S. Fish and Wildlife Service.

Ramos, M. A. 1985. Problems hindering the conservation of tropical forest birds in Mexico and Central America, and steps towards a conservation strategy. *ICBP Technical Publication,* **4**:67-76.

Wege, D. C., and A. J. Long. 1995. Key area for threatened birds in the neotropics. *Birdlife Conservation* Series no. 5. ❒

Aspectos de la Dieta y Anidacon de la Cordorniz Rayata (Banded Quail) *Philortyx fasciatus*

Fernando Urbina-Torres[1] *y Lucila Zaiñhana-Ortiz*[2]

[1, 2]Centro del Investigaciones Biológicas, Departamento de Biologia Animal, Universidad Autónoma del Edo. de Morelos, Av. Universidad #1001, Col. Chamilpa, Cuernavaca, Mor., México, CP. 62210

ABSTRACT

In this work we present a synthesis of the Banded Quail's diet and breeding background, as well as some new observations. Insects that are part of its diet were identified, and the eggs and clutch of a nest found in Morelos, México were described. with this information the Banded Quail's known breeding period was expanded.

La codorniz rayata, *Philortyx fasciatus,* habita en el oeste y centro de México, desde el nivel del mar hasta los 1500 m en el Bosque Tropical Caducifolio (BTC) y los pastizales abiertos de las zonas áridas de la cuenca del do Balsas (Howell y Webb, 1995). Leopold (1977) menciona que son abundantes donde hay zonas agricolas bordeadas con BTC, en cuanto a su alimentación indica que consiste "de una gran variedad de semillas de yerbas, especialmente leguminosas como *Desmodium* y *Crotalaria*; otras eran semillas de mirasol, cardo, maíz, semillas de *Croton* y plantas cultivadas como frijol y ajonjoli," también añade que Blake y Hanson (1942) encontraron insectos en cinco ejemplares. Por otra parte Cuellar (1981) menciona que de las recolectas obtenidas en abril encontró que un 84.6% eran semillas de "mirasol," 15.0% semillas de maiz y 0.4% insectos. En cuanto a su reproducción Leopold (1977) menciona que no cuenta con información sobre nidos o huevos y Howell y Webb (1995) que se desconoce el nido y la puesta en estado silvestre y que esta se lleva acabo de julio a septiembre.

Para la realización del presente se estudiaron cinco ejemplares depositados en la Colección Ornitológica del Centro de Investigaciones Biológicas (COCIB), de estos se analizaron los contenidos de los buches y se encontró que el mayor peso correspondió al de una hembra con 4.3 gr, el promedio de los contenidos fue de 2.23 gr. Entre los insectos se identificaron dos ordenes, del orden Coleoptera se encontraron representantes de las familias Dermestidae, Derondontidae, Anobiidae y Curculionidae, del orden Herniptera la familia Lygaeidae.

[1] E-mail: urbina@cib.uaem.mx

En la localidad de Teacalco, Amacuzac, 18° 36' N, 990 26'W, con una altitud de 950 m, el día 9 de noviembre de 1996 se nos mostró un nido por trabajadores de la zona, en el cual se encontraban cinco cascarones, se nos informó que dos dias antes habian sido contados seis huevos, lo que nos hace suponer que eclosionaron el día anterior. Los huevos son de color blanco (white), con manchas (beige), claro (cream – color 54) (Smithe, 1974), de forma oval corta y de 30 x 22 mm, los cuales están depositados en la COCIB. El nido fue encontrado en un pastizal cercano al BTC, oculto al pie de un pequeño árbol de "cirian" *(Cresencia alata)* de 35 cm de alto y 43 de diámetro, estaba confeccionado con hojas secas del mismo árbol directamente sobre el suelo y media 16 cm de copa y 13 cm de ancho.

Con esta información se amplía el periodo de reproducción desde agosto a noviembre y se proporciona información sobre el tamaño de la puesta y su dieta insectívora.

AGRADECEMOS

Agradecemos al M. en C. Jesús T. Hernández A. por la identificación de los insectos encontrados y a los propietarios y trabajadores del Zoológico "Zoofari" por las facilidades brindadas durante los trabajos de campo.

LITERATURA CITADA

Blake, E. R., and H. C. Hanson. 1942. Notes on a collection of birds from Michoacan, México. *Field Museum. Natural History Zoological Ser*ies, **22**: 513-551.

Cuellar R., L. M. 1981. Dos especies de codomices que habitan en el Estado de Morelos. *Centzontle*. *Rev. Soc. Mex. Ornitol.* **1** (2): 89-94.

Howell, S. N. G. and S. Webb. 1995. *A guide to the birds of México and northern Central America.* Oxford University Press, New York, NY.

Leopold, A. S. 1977. *Fauna Silvestre de México*. Instituto Mexicano de Recursos Naturales Renovables. pag. 275-278.

Smithe, F. B. 1974. *Naturalist's Color Guide.* The American Museum of Natural History. New York, NY. ❒

Long-tailed Tree-quail *(Dendrortyx macroura):* Current Knowledge and Research Needs

Gilberto Chávez-León

Laboratorio de Biogeografla, Facultad de Ciencias, Universidad Nacional Autónoma de México. Apdo. Postal 128, Uruapan, Michoacán, Mexico.[1]

ABSTRACT

The Long-tailed Tree-quail *(Dendrortyx macoura)* is a little-known Mexican endemic species. Although it is not considered at risk, habitat destruction may be an important factor for the decrease of its populations. In order to identify research needs for its conservation before it becomes endangered or threatened, a literature review of existing information on distribution, natural history and ecology of this species is presented. Four critical research issues are identified: demography, habitat ecology, distribution, and breeding behavioral patterns.

INTRODUCTION

The Long-tailed Tree-quail *(Dendrortyx macoura)* is an endemic species of México protected by law since 1994 under the category of “subject to special protection” (Secretaria de Desarrollo Social, 1994). Although it is not regarded as threatened or endangered, it faces habitat loss and hunting pressure. Little is known about its distribution, natural history and ecology (particularly habitat use and demography). The few existing data are of anecdotal nature. It is a medium-sized, forest-adapted quail, measuring from 29 to 38 cm long, with a body mass of 350 to 465 g. It is sedentary, feeding on the ground mainly on seeds and small flowers and fruits. It roosts on tree branches at night, singing at dawn and dusk. The breeding period last from April to August. It nests on the ground laying a clutch of 4 to 6 eggs. The rural population in its range regards it as highly edible, and there is interest by the most organized communities for its conservation and sustainable use. In this paper a literature review of existing information on this species is given in order to identify research needs for its conservation before it becomes endangered or threatened.

VERNACULAR NAMES

The vernacular name of this species varies little through its distribution in México, being generally known in Spanish as “Gallina de Monte” or "Gallina Cimarrona", referring to its chicken-like size and aspect. Leopold (1959) calls it “Charando,” which in Purhepecha language, spoken in the state of Michoacan, refers to a reddish colored soil, similar to the

E-mail: gchavezl@ultev.net

color of the bare parts and some body feathers of *D. macroura*. The Purhepecha of the village of Angahuan, Michoacan, call it "Tzicata Charandu." The Nahuatl language name for quails is zolin, from which the Spanish "colin" is derived, and is also the basis for the generic name *Colinus* (Johnsgard, 1988). A standard Spanish name was proposed by Escalante et al. (1996): "Codorniz Coluda Neovolcánica." However, this name is misleading because the species is also found in parts of the Sierra Madre del Sur in Guerrero and Oaxaca, and local inhabitants do not recognize it as a quail.

Regarding the English name, Johnsgard (1988) proposed to adopt compound names to distinguish between the larger forest dwelling Odontophoridae forms: "tree-quail" for *Dendrortyx*, and "wood-quail" for *Odontophorus*. The following are other names in different languages.

Spanish: Codorniz Coluda (Davis 1972), Gallina de Monte Coluda (Howell and Webb, 1995), Colin Rabudo (Carroll 1994).
French: Colin d longue queue (Johnsgard, 1988)
German: Langschwanzwachtel (Johnsgard, 1988)
English: Long-tailed Tree-partridge (Carroll, 1994), Long-tailed Wood-partridge (AOU 1998)

DISTINGUISHING CHARACTERISTICS

The Long-tailed Tree-quail is 1 of the largest species of the New World quails (Family Odontophoridae). It is a medium-sized mountain and forest-adapted species endemic to México. The main distinguishing characteristics are its long tail, erectile bushy crest, and bare parts with bright red color. Juvenile and adult plumage differ, the former with white shaft streaks on the back and underparts. Juveniles attain adult-like plumage when about half-grown (Howell and Webb, 1995). The sexes are similar as adults, the only difference is that the female averages smaller in size with a shorter tail (Johnsgard, 1988).

APPEARANCE

Its long tail of 12 rectrices is sometimes as long as the wing. The forehead, sides of head, throat and foreneck are black with 2 white streaks above and below the eye. A bare area of red skin around the eye, red bill and legs allow easy recognition. Adult overall coloration chestnut and grey; breast bluish grey; upper back chestnut with wide grey margins; and pale markings on wings and tail. Crown and short crest black with buff streaks (Carroll, 1994). Immatures spotted with dark brown on underside; apparently with the two outer primaries frayed, and with buffy tips on the greater primary-coverts (Petrides, 1942). Total length 29-37 cm; body mass 350-465 g (Carroll, 1994).

Molts and Plumage

Hatchlings. No data is available.

Juvenile plumage. Immature spotted with dark brown on underside: less chestnut on breast (Carroll 1994). Warner (1959) provides an accurate description of the juvenile plumage, indicating differences with adults:

> "Apparently the juvenile plumage has not been adequately described. Ridgway and Friedmann (1946), in describing the juvenile plumage of *D. m. diversus*, state that this plumage is similar to the adult plumage with a few minor qualifications. Although the specimens at hand are in early postnatal molt, enough of the juvenile plumage shows both dorsally and ventrally to indicate that this plumage is similar in basic pattern to that in other Odontophorinae. The most obvious characters of this plumage are in the pattern of the breast, belly and back where the white shaft streaks expand near the tips, forming large V's or broad white bars at the ends of the feathers. The rest of the feather is blackish in the middle and browner at the base, the brown extending farther out on the lateral sides of the feathers of the back. The over-all impression, then is of a spotted or barred young bird which is very different from the adults."

Description of adult. Howell and Webb (1995) describe in detail the appearance of the adult:

> "Bill orbital ring and legs bright red to orange-red. White supercilium and moustache contrast on black head. Nape and upper mantle coarsely streaked red-brown and blue-grey, rest of upper parts cryptically patterned with grey-brown, buff, and dark brown. Underparts grey to blue-grey, chest and sides spotted and streaked rufous, thighs and flanks mottled brown, dark undertail coverts tipped whitish. Remiges and outer rectrices grey-brown to rufous-brown. *D. m. oaxacae* of northern Oaxaca often has indistinct white face stripes. In flight, remiges and outer rectrices grey-brown."

Measurements

Linear**:** Wing: males 151-166 mm, females 141-158 mm; tail: males 138-169 mm, females, 119-151 mm (Ridgway and Friedmann, 1946). Total length 29-37 cm (Carroll, 1994)

Mass**:** Both sexes 350-465 g (Leopold, 1959); males average 433-450 g, females 374-446 g (Johnsgard, 1973; Carroll, 1994).

Eggs: Average 49.2 x 33.5 mm. (Warner, 1959), estimated mass 30.5 g.

DISTRIBUTION

Resident of highland forests of central and southern México in the states of Jalisco, Michoacan, México, Morelos, Puebla, Veracruz, Guerrero, Oaxaca and Distrito Federal (AOU, 1998). This species is associated with cloud forests and pine-oak forests in the central Volcanic Belt between 1,200-3,300 m (Howell and Webb 1995). According to Johnsgard (1988), it normally occurs in the higher cloud forests, but has been found in pine-oak forests of the Volcanes de Colima, and occasionally extends to the lower edge of the and pine-oak zone. Similarly, in Oaxaca it has been found in the humid pine-oak and cloud forest zones, between 1,500-2,700 m, and in Michoacan has been reported from fir forests and pine-oak forests at elevations from 1,700 to nearly 2,700 m. South of México City the birds have been found in the least disturbed humid fir-pine-oak forests at elevations of 2,800 and 3,300 m.

HISTORICAL CHANGES IN DISTRIBUTION

There are no quantitative data. Leopold (1959) and Johnsgard (1988) delineate a continuous distribution, linking the Central Volcanic Belt and the Pacific Slope with the Sierra

Madre del Sur. The distribution map by Carroll (1994) is at such a large scale that it does not permit comparisons. Howell and Webb (1995) depicted 4 discrete distribution zones representing less area than the former ones, 1 along the central Volcanic Belt, 2 in the Sierra Madre del Sur in Guerrero and Oaxaca, and a 4th in the Atlantic Slope from Veracruz and Puebla to Oaxaca.

SYSTEMATICS

The New World quail are found mainly in the Neotropical Region and in the southern part of the Neartic Region. This group of birds was regarded as a subfamily of Phasianidae until recently. However, DNA-DNA hybridization evidence suggests that they are not closely related to turkeys, pheasants, Old World quail or grouse, indicating that divergence occurred about 63 million years ago in South America during its isolation from North America (Carroll, 1994). Thus, New World quail have been raised from the level of subfamily to that of the family Odontophoridae (AOU, 1998). Based on osteological analysis Gutiérrez et al. (1983) proposed the Odontophoridae be regarded as a monophyletic group consisting of 2 subgroups: the *Odontophorus* group (including *Odontophorus, Dactylortyx, Cyrtonyx, and Rhynchortyx*) and the *Dendrortyx* group (containing *Dendrortyx, Philortyx, Oreortyx, Colinus, Callipepla,* and *Lophortyx*). It is considered that the center of radiation of the family is southern México and Guatemala based on the presence of the most generalized species and the high number of genera.

Dendrortyx, with its 3 species, seems to be the most anatomically generalized of all the New World quails. The nearest relative of this genus is probably *Philortyx*, as implied by ecological and natal plumage similarities (Johnsgard, 1973). Within the genus *Dendrortyx*, there is no clear evidence of relationships; all 3 species seem to be quite distinct from one another and the available evidence provides no overt clues as to their phyletic history (Johnsgard, 1988).

RELATED SPECIES

The genus *Dendrortyx* is composed of 3 largely allopatric species, 2 of them endemic to México:

D. macroura (Jardine and Selby, 1828)
D. barbatus (Gould, 1846)
D. leucophrys (Gould, 1844)

D. barbatus is found in the cloud forests along the Atlantic slope, from southeastern San Luis Potosi, through Hidalgo and Puebla to central Veracruz. It is the rarest of the *Dendrortyx* quails and is considered in risk of extinction because of habitat loss. Local overlap with *D. macroura* occurs on Pico de Orizaba and Cofre de Perote in eastern Puebla and Veracruz (Leopold, 1959). This situation suggests that possible competition may occur there, but otherwise little if any competition from other New World quails is likely (Johnsgard, 1988). *D. leucophrys* is a Central American species distributed in temperate forests from southern Chiapas south to Costa Rica.

GEOGRAPHIC VARIATION

Subspecies

Six subspecies of *D. macroura* are recognized (Johnsgard, 1988; Carroll, 1994; McGowan et al., 1995), although their distribution boundaries are yet to be defined. Subspecies are separated on coloration, notably of rump (Carroll, 1994). Blake (1953), Johnsgard (1988) and Carroll (1994) establish the distribution of each subspecies as follows:

D. m. diversus (Friedmann, 1943). Highland forests of north-western Jalisco; west-central México.

D. m. griseipectus (Nelson, 1897). Oak forests of the Pacific slope of the Cordillera, in Distrito Federal, México, and Morelos; central México.

D. m. macroura (Jardine and Selby, 1828). Mountains above the Valley of México, and highlands of Veracruz; eastern and central México.

D. m. striatus (Nelson, 1897). Highland forests of southern Jalisco to Michoacan, and above 8,000 feet in the Cordillera of Guerrero; west-central México.

D. m. inesperatus (Phillips, 1966). Vicinity of Chilpancingo, Guerrero; southern México. However, the description of the holotype indicates San Miguel Suchixtepec, Oaxaca, as the collection locality (Dickerman and Parkes, 1997).

D. m. oaxacae (Nelson, 1897). Mountain forests of (w)eastern Oaxaca, from Cerro San Felipe to Mount Zempoaltepec; southern México.

HABITAT

The habitat of *D. macroura* has not yet been described in detail. Published information refers to broad vegetation types as synonymous of habitat where the species is found: cloud forest, pine-oak forest and fir forest (Table 1). It is not known which environmental and biological variables limit its distribution, or which ones are needed to support a population with high survivorship and reproductive success rates. There are no quantitative studies about habitat use patterns, home range, and habitat quality.

Table 1. Vegetation types referred to by several authors to indicate habitats where *Dendrortyx macroura* is found.

Author	Vegetation Types			
	Cloud forest or Montane evergreen forest [1]	Pine-oak forest	Fir forest	Dense undergrowth[2]
Leopold (1959)	X	X		
Davies (1972)		X	X	
Peterson and Chalif (1973)	X	X		
AOU (1998)		X		X
Johnsgard (1988)	X	X	X	X
Edwards (1988)	X	X	X	X
Carroll (1994)	X	X		X
Howell and Webb (1995)	X	X		X
Parker (1996)	X	X		

1 = refers to BOSQUE MESOFILO DE MONTAÑA of Rzedowski 1978).
2 = refers to a dense shrub substrate in the forest interior.

FOOD HABITS

Main foods taken are seeds and small fruit, occasionally small arthropods. Young birds may take mainly soft arthropods during their first days. It is primarily a ground forager, scratching in the leaf litter and humus, but also feeds in low branches of trees and brushes.

Leopold (1959) collected a specimen that had the crop full of legume seeds, mainly *Desmodium*. Warner (1959) found flowers, flower buds, small green fruits and seeds in the digestive tract of 1 bird. Others contained similar vegetable matter and arthropod remains. More than 80% in volume of the crop of 2 freshly dead birds that I examined in June of 1999 were seeds of the brush, *Coriaria* sp. The rest included seeds of *Quercus* sp. and arthropod parts.

There are no intensive studies on quantitative diet composition and food habits during different seasons, nor estimates of daily food composition rates (g/day), mean energy intake (kcal/day), or oxygen consumption (cm^2O_2/g-hr). There are no data about the ability to regulate temperature at different developmental stages. No information is available on daily water requirements. No data on daily defecation rates are available. A bird flushed by me perched on a horizontal fallen pine branch, about 1 m above the ground. When approached, it flew away defecating. Two fresh droppings were collected: total length 17 mm, diameter 6 mm, dark-grey colored with 1 side white.

VOCALIZATIONS

There are at least 5 descriptions of the vocalizations of this species (Warner, 1959; Davis, 1972; Johnsgard, 1988; Edwards, 1989; Howell and Webb, 1995). They vary according to

the personal auditive interpretation of each author. The alarm call is a repetition of high-pitched, squeaky notes. It is necessary to generate sonograms as a more objective way of description, and also to compare regional differences among subspecies.

A complete study of sounds and voice is necessary including: development, vocal array (song, territorial announcement call, locative call, duets), phenology and daily pattern of vocalization, places of vocalizing, repertoire and delivery of songs, social context and presumed functions of vocalizations and nonvocal sounds (wing flapping).

BEHAVIOR

There are no behavioral studies of the species. Like other tree-quail, it vocalizes daily at dawn and dusk apparently from pairs or coveys roosting in the same tree (Warner, 1959; Johnsgard, 1988). It is terrestrial, rarely takes to trees except to roost or feeding, is skulking and elusive, mainly detected by voice, runs low and swiftly though dense cover with the tail held cocked, flushes with a loud whir of wings and a repeated short whistling note. The species has been seen singly or in pairs but forms small groups in the non-breeding season August-March (Howell and Webb, 1995). It may use trails often in the same manner of the Marbled Wood-quail (*Odontophorus gujanensis;* Warner, 1959). They seem to gather at feeding and dusting sites even during the nesting period (Warner, 1959). The only information about depredation on a nest is that of Warner (1959) in Morelos, where a nest with four eggs was visited 3 weeks later with only remains of scattered feathers of an adult quail, broken egg shells, and a distorted nest cavity.

There are no data on locomotion (walking, hopping, climbing, flight), self-maintenance (preening, head scratching, bathing, anting, sunbathing, etc.), sleeping and roosting, daily time budget, agonistic behavior (physical interactions, threat and appeasement displays, communicative interactions), individual distance, territoriality (manner of establishing and maintaining territory, interspecific territoriality, seasonal territoriality, dominance hierarchies), sexual behavior (mating system and sex ratio, pair bond, courtship, displays, nest-showing displays, copulatory displays, extra-pair copulations), social and interspecific behavior (degree of sociality, play interactions other than predation, with members of other species), and predation.

BREEDING

Like other Odontophoridae quail, they seem to be monogamous. Scant data indicate a breeding season from February to September. Nesting begins in late April or early May. The non-breeding season is from October to February. There is no information on the incubation period or on the growth of the young. Warner (1959) reported the following measurements on gonadal changes in adults, and observations on a nest, eggs, and young: a male taken in November had a left testis measurement of 8 x 4 mm; testes of 2 males collected in February and early April measured 10 x 3.5 and 10 x 6 mm; the ovary of a

female collected on 20 April had undergone considerable recrudescence, and the oviduct was about 5 mm in diameter; and a female collected on 21 June had a soft-shelled egg in the oviduct, and 10 oocytes in the ovary ranging from 5 to 15 mm in diameter; two downy young in early postnatal molt found 6 June, and reports of young as early as late May show that nesting begins by late April or early May. Pitelka (1948) reported the breeding period in the state of Guerrero extends to August and September, based on the condition of birds collected during those months: 1 female with ovaries greatly enlarged, a half-grown juvenile, and another juvenile in an early stage of the postjuvenal molt.

There is no information on phenology (pair formation, first brood per season, second brood per season), selection process and microhabitat, site characteristics. It is not well known how the nest is built, structure and composition, dimensions, microclimate, maintenance or reuse of nest, alternate nests, or non-breeding nests.

NEST SITES

Three nests of Long-tailed Tree-quail have been described to date. One in Morelos was found in July (Warner, 1959), and 2 in Oaxaca, with 1 found in April (Rowley, 1966). Warner (1959) found a nest near Huitzilac, Morelos, in semi-open fir-pine-oak forest, with tall, mature trees at an altitude of 2,900 m on a steep slope 92 m above a small level area planted with corn. The ground in the slope was rocky with shallow soil, and there was evidence of fire damage in the trees. There was a dense growth of broad-leaved shrubs, with ferns abundant as ground cover. The nest was located in a cavity 91 or 122 cm long and 61 cm wide at ground level. A matting of twigs, pine needles and leaves that had accumulated on dead brush branches protruding from a 61 cm-high rock formed the sloping roof of the cavity. Access to the nest was through a single opening about 15 cm wide. The nest itself was a shallow depression well lined with fine grasses at 30 cm from the entrance and close to the rock wall. There were 6 eggs in the nest; the last two of which were laid within a 25-h period. The whole set of eggs was laid during an extend period of several days, probably in pairs.

One of the nests found by Rowley (1966) was also associated with a rock outcrop, while the other was in a slight depression at the base of a small shrub, but neither nest was well concealed. Each of the 2 nests contained 4 incubated eggs, suggesting to Rowley that the 6-egg clutch found by Warner might have been the work of females. An intensive study is necessary to confirm this assertion.

I found a nest with 4 eggs in April 1998 in Parque Nacional Barranca del Cupatitzio (Campo Experimental INIFAP), Michoacan. It was on the edge of a lava bed at 1900 m asl. The nest was composed of 2 structures: a cavity of pine needles at the base of a rock and a platform at the entrance. The eggs were found in this platform. A detailed desciption of this nest will be published elsewhere.

EGGS

Warner (1959) collected 2 fresh eggs. Each weighed 28.3 grams and measured 49.0 x 33.4 and 48.5 x 33.5 mm. In color they are pale cream and are lightly and evenly spotted with light brown, the spots being of varying sizes with the larger ones nearly 1 mm in diameter. Estimated average weight is 30.5 g (Johnsgard, 1988). The clutch size for the species is 4-6 eggs (Howell and Webb, 1995).

A firewood gatherer took 4 eggs from a nest in the pine-oak forest of Nuevo San Juan Parangaricutiro, Michoacan in June 1997. The eggs were placed in an automatic incubator at unknown temperature and humidity. After 4 weeks, the eggs did not hatch and were preserved. The color of the shell was pale white-cream with small rounded spots, Russet color no. 34 (Smithe, 1975). The size of the spots varied in diameter from 0.5 to 1.5 mm. Average length of these eggs was 44.5 (S.D. 0.9) mm, and average width 31.5 (S.D. 0.8) mm, measured with caliper. Mass was not measured.

There is no information about the incubation process (onset of broodiness and incubation in relation to laying, incubation patch, incubation period, parental behavior), nor hatching (preliminary events, shell breaking and emergence, parental assistance and disposal of shell), condition at hatching, growth and development, growth of body parts, molt into mesoptile plumage, control of body temperature, behavior and locomotion, parental care, brooding, feeding, nest sanitation, parental carrying of young, cooperative breeding, brood parasitism, and fledgling stage (departure from the nest, condition of development, manner of departure, growth, association with parents or other young, ability to get around, feed, and care of self).

YOUNG BIRDS

Warner (1959) obtained 2 live young in Morelos, a male an female, taken at an altitude of 3,000 m. Both were in natal down except for some juvenile feathers among the interscapulars, scapulars, and on the wings and sides of the breast and belly. The wing of the male measured 51 mm in length. On each wing only 7 primaries could be found, and the No. 1 secondary had not appeared. In life the eye was olive-gray. The tip and anterior tomial region of the upper mandible, and the anterior two-thirds of the lower mandible were light orange-red; the rest of the bill was blackish. The tarsi and toes were light orange-red, darker posteriorly on tarsi and on the soles.

DEMOGRAPHY AND POPULATIONS

No demographic or population studies have been carried out to date. McGowan et al. (1994) estimated a population size ranging from 20,000 to 200,000 individuals that seems to be decreasing. Johnsgard's (1973) opinion is that even in favored cloud forest habitats the density is probably quite low, in the vicinity of only about 2 pairs/40 ha. However, in

the pine-oak forests of Michoacan, population densities seem to be much higher according to preliminary surveys by me. All forest-adapted Odontophoridae species have smaller clutch sizes compared with the non-forest-adapted species of North America; although there are no estimates of life span and mortality for this species, the lower productivity rate may be compensated by greater adult survivorship (Carroll, 1994).

There is no information on measures of breeding activity (age at first breeding, intervals between breeding, clutch, annual and lifetime reproductive success, number of broods normally reared per season, daily nest survivorship), life span and survivorship, disease and body parasites, causes of mortality (exposure, predation, human/research related), range (initial dispersal from natal site, fidelity to breeding site and winter home range, dispersal from breeding site or colony, home range), population status (estimates or counts of density, population numbers), population regulation.

CONSERVATION AND MANAGEMENT

The species probably suffers habitat loss and some hunting pressure, but apparently is not at risk. Extensive surveys are required (McGowan et al., 1995; Fuller et al., 2000). The main cause of decline in numbers is habitat loss (McGowan et al., 1995). In México the species is protected by law and listed as “subject to special protection” (Secretaria de Desarrollo Social, 1994). Parker et al. (1996) considered the species to be of “medium” sensitivity to human disturbance, and to have a “medium” conservation and research priority. It is categorized as “low risk/near threatened” by the Animal Redlist of the World Conservation Monitoring Centre. It is not listed by the Convention on International Trade in Endangered Species (CITES).

Although it is considered eminently edible, the effects and dimension of the hunting pressure on the species are not known. The shy and skulking nature of this species makes it very difficult to hunt, which may make the impact negligible. However, current trends toward habitat loss warrant the development of techniques for habitat management as well as captive breeding.

There are no data on effects of human activity, such as sensitivity to disturbance at nest and roost sites, shooting and trapping, pesticides and other contaminants, and degradation of habitat. The species has not been subject to habitat or population management practices.

PRIORITIES FOR FUTURE RESEARCH

Most of the biological and ecological information on this species is of an anecdotal nature. Even its geographic distribution is not well understood. The few data available on distribution, populations and precise habitat requirements restrict the likelihood of achieving accurate conservation assessments and recommendations. In the past, the main consideration to prioritize species in need of conservation measures has been its status of endan-

gered or threatened based on a starting point that a species is facing problems. The result is that those species that are not subject to obvious pressures are overlooked until it is too late and costly to recover them. Although *D. macroura* is not regarded in immediate threat or danger, to avoid this pitfall the first step toward assuring its future existence involves the development of a prioritizing scheme of research questions relevant to the species conservation (Table 2). Four critical issues in need of attention arise from the review presented in this paper and summarize the current knowledge status:**(l)** Habitat ecology, particularly habitat use patterns at the local level and at the landscape level, home range, and their relationship with population density and reproductive success; (**2)** Distribution. For conservation and management of its habitat it is also necessary to determine altitudinal and local movements, if any. Sonograms must be generated in order to differentiate among subspecies and to quantitatively describe their songs and calls; **(3)** Breeding behavioral patterns. If captive breeding programs are to succeed it is fundamental to describe breeding behavioral patterns; and (**4)** Demography, in particular breeding activity, life span and survivorship, relationship with parasites, mortality, dispersal, and population status.

Table 2. Syntheses overview of current knowledge and research needs for *Dendrortyx macroura.*

Topic	Known	Predicted	Unknown
Habitiat ecology	NO	NO	YES
Demography	NO	NO	YES
Breeding Behavior	NO	NO	YES
Distribution	YES	NO	NO

LITERATURE CITED

American Ornithologists' Union. 1998. *Check-list of North American Birds.* 7th edition. American Ornithologists' Union, Washington, D.C.

Blake, E. R. 1953. *Birds of México.* University of Chicago Press, Chicago, IL.

Carroll, J. P. 1994. Family Odonophoridae (New World Quails). Pp. 412-421 *in* J. del Hoyo, A. Elliot, and J. Sargatal (eds.). *Handbook of the Birds of the World. Vol. 2. New World Vultures to Guineafowl.* Lynx Edicions, Barcelona, Spain..

Davis, L. 1972. *A Field Guide to the Birds of México and Central America,* University of Texas Press, Austin, TX.

Dickerman, R. W., and K. C. Parkes. 1997. Taxa described by Allan R. Phillips, 1939-1994: a critical list. Pp. 211-234 *in* R. W. Dickerman, compiler, The Era of Allan R. Phillips: A Festschrift. Horizon Communications, Albuquerque, NM.

Edwards, E. P. 1989. *A Field Guide to the Birds of México.* E. P. Edwards, Sweet Briar, VA.

Escalante, P., A. M. Sada, J. Robles Gil. 1996. Listado de Nombres Comunes de las Aves de México. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, México.

Fuller, R. A., J. P. Carroll, and P. J. K. McGowan. 2000. Status Survey and Conservation Action Plan 2000-2004; Partridges, Quails, Francolins, Snow Cocks, Guineafowl and Turkeys. IUCN, Gland, Switzerland.

Gutiérrez, R. J., R. M. Zink, and S. A. Yang. 1983. Genetic variation, systematic and biogeographic relationships of some galliform birds. *Auk* **100**:33-47.

Howell, S. N. G., and S. Webb. 1995. *A Guide to the Birds of México and Northern Central America*. Oxford University Press, Oxford, England.

Johnsgard, P. A. 1973. *Grouse and Quails of North America.* University of Nebraska Press, Lincoln, NE.

Johnsgard, P. A. 1988. *The Quails, Partridges, and Francolins of the World.* Oxford University Press, Oxford, England.

Leopold, A. S. 1959. *Wildlife of México: the Game Birds and Mammals.* University of California Press, Berkeley, CA.

McGowan, P. J. K., S. D. Dowell, J. P. Carroll, and N. J. Aebischer. 1995. Partridges, Quails, Francolins, Snowcocks and Guineafowl; Status Survey and Conservation Action Plan 1995-1999. IUCN/SSC, Cambridge, UK.

Parker III, T. A., D. F. Stotz, and J. W. Fitzpatrick. 1996. Ecological and distributional databases. Pp. 113 - 436 *in* D. F. Stotz, J. W. Fitzpatrick, T. A. Parker III, and D. K Moskovits (eds.). *Neotropical Birds: Ecology and Conservation.* Chicago University Press, Chicago, IL.

Peterson, R. T. and E. L. Chalif. 1973. *A Field Guide to Mexican Birds.* HoughtonMifflin Company, Boston, MA.

Petrides, G. A. 1942. Age determination in American gallinaceous game birds. *Transactions 7th North American Wildlife Conference* **7**: 308-328.

Pitelka, F. A. 1948. Notes on the distribution and taxonomy of Mexican game birds. *Condor* **50**:113- 123.

Ridgway, R., and H. Friedmann. 1946. The birds of North and Middle America. *US National Museum Bulletin* Vol. 50, Part X. Smithsonian Institution, Washington, D. C.

Rowley, J. S. 1966. Breeding records of birds of the Sierra Madre del Sur, Oaxaca, México. *Proceedings of the Western Foundation of Vertebrate Zoology* **1**: 107-204.

Secretaria de Desarrollo Social. 1994. Norma Oficial Mexicana NOM-059-ECOL-1994, que determina las especies y subespecies de flora y fauna silvestres terrestres y acudticas en peligro de extinción, amenazadas, raras y las suj etas a protección especial, y que establece especificaciones para su protección. Diario Oficial de la Federación, *Tomo* CDLXXXVIII, No. 10, Lunes 16 de Mayo de 1994. México, D.F.

Smithe, F. B. 1975. *Naturalist's Color Guide*. American Museum of Natural History, New York, New York..

Warner, D. W. 1959. The song, nest, eggs, and young of the Long-tailed Partridge. *The Wilson Bulletin* **71**: 307-312. ❒

Abundance of the Long-tailed Tree-Quail (*Dendrortyx macroura)* in Managed and Unmanaged Pine-Oak Forests

Gilberto Chávez-León[1]

Laboratorio de Biogeografla, Facultad de Ciencias, Universidad Nacional Autónoma de México, A.P. 128, Uruapan, Michoactin, México.

ABSTRACT

The abundance of the Long-tailed Tree-quail *(Dendrortyx macroura)* in 2 pine-oak forest sites in western Michoacán, Mexico was determined. One site is an indigenous communal forest managed mainly for timber harvest. The other site is a nearby unmanaged protected natural area. Response rates (mean number of individuals per point count) were lower in the managed forest site. Long-tailed Tree-quail population density in the managed forest was 7.8 birds/km^2, whereas in the unmanaged forest it was 42.9 birds/km^2. Abundance was higher in sampling sites with presence of a dense shrub stratum. This stratum most likely provides escape and feeding cover and is usually perturbed or eliminated during logging activities, pine resin extraction, and livestock grazing.

INTRODUCTION

The Long-tailed Tree-quail *(Dendrortyx macroura)* is a Mexican endemic species protected since 1994 (SDS, 1994). It suffers habitat loss and perturbation (Carroll, 1994; McGowan et al., 1994), but apparently is not at risk. Parker et al. (1996) consider this species to be of "medium" sensitivity to human disturbance and to have a "medium" conservation and research priority. There are no quantitative population estimates of the Long-tailed Tree-quail; Johnsgard (1973) estimates 2 pairs/40 ha. The broad population estimate of McGowan et al. (1994) goes from 20,000 to 200,000 individuals. This species inhabits cloud forests, pine-oak forests and fir forests throughout the Trans-Mexican Volcanic Belt and the Sierra Madre del Sur (AOU, 1998). This is an area remarkably rich in endemic taxa of both plants and animals (Escalante, et al., 1993; Toledo and Ordóñez, 1993). It is also an area of high economical value for its forest resources (Style, 1993). Industrial forestry (mainly timber and pine-resin tapping) in this part of Mexico has been active for several decades. Its impact on populations of native birds is unknown. The current trend of the Mexican forestry industry is towards diversification of timber and non-

[1]E-mail: gchavezl@ultev.net

timber forest production to enhance local economies. I document the relative abundance of the Long-tailed Tree-quail in a forest managed for timber by a local Indian community compared to a nearby unmanaged, natural protected area.

STUDY AREA

The study was conducted in 2 sites located in the sub-humid temperate zone of the southwestern edge of the Trans-Mexican Volcanic Belt range, west Michoacan, Mexico. One site is a communal forest belonging to the Indigenous Community of Nuevo San Juan Parangaricutiro. Extreme coordinates of this site are 19° 21' N, 19° 34' N and 102° 08' W, 102° 17' W. Elevations range from 1,800 m to 3,100 m amsl. The area is almost 18,000 ha in size of recent volcanic terrain covered originally by temperate forests of pine, fir, oaks and their associations, which have been reduced by agricultural clearings and the eruptive events of Paricutin Volcano (1943-1952) to a half of its original extent. Open canopy forests now cover 4,000 ha and closed forests cover 5,700 ha. The arboreal layers of these forests are dominated by *Pinus pseudostrobus, P. michoacana, P. douglasiana, P. montezumae, P. leiophylla, Quercus laurinq, Q. rugosa, Q. candicans, Clethra mexicana, Arbutus xalapensis* and *Alnus jorullensis*. The shrub stratum is dominated by *Arctostaphylos discolor* and *Eupatorium petiolare*. The herbaceous stratum is dominated by *Heteroteca* sp., *Pteridium* sp., *Muhlembergia* sp, *Gnaphallium* sp., *Agave* sp., and *Vitis* sp. Precipitation varies throughout the area, but concentrates between May and October with a mean annual of 1,200 mm. Mean annual temperatures also vary, but do not rise above 15° C.

The Indigenous community comprises 1,300 members and their families. Since the early 1980s, the community organized to manage its forest resources and established a forestry industry that generates 800 permanent and 200 temporary jobs. The operation includes the whole process of timber production: tree nurseries, reforestation, silviculture, transportation, sawing mill and production of saw timber and wood furniture. The silvicultural system, basically selective cutting, is based on a 10-year regeneration scheme, which includes treatments such as single-tree selection, shelterwood, group selection and precommercial thinning. Non-saw timber products (poles, fuel-wood and pine resin) have comprised a larger proportion of harvest in recent years. Every year the communal industry produces 100,000 m^3 of timber and 1 million l of pine resin. Wildfires have been actively suppressed since the mid-1980s. These forestry activities are the core of an integral natural resources management program with a conservation focus that also includes agriculture (maize), fruit farming (avocado and peach), animal husbandry (cattle and Japanese quail), eco-tourism, and wildlife management (captive breeding of white-tailed deer, *Odocoileus virginianus*). The community is interested to diversify the wildlife program with the addition of such species as the cottontail rabbit *(Sylvilagus floridanus)* and the Long-tailed Tree-quail. However, basic ecological and demographic studies are needed before implementation of production activities.

The other site is a natural protected area, Parque Nacional Barranca del Cupatitzio, located 3 km east of the Indigenous Community of Nuevo San Juan Parangaricutiro. This area was declared as a national park in 1938 and placed under the administration of the Mexican Institute for Forestry Research (INIFAP) in 1962. This site is 450 ha in extent covered by pine-oak forest dominated by *Pinus pseudostrobus, P. michoacana, P. douglasiana, P. montezumae, P. leiophylla, Quercus rugosa, Q. candicans, Clethra mexicana, Arbutus xalapensis* and *Alnus jorullensis*. A dense shrub stratum covers the understory. Elevation varies form 1,700 to 2,140 m amsl. The only management practices applied occasionally in this area are wildfire suppression, bark-beetle (*Dendroctonus* sp.) control, and salvage cuttings. There is no cattle grazing nor pine-resin tapping at this site.

METHODS

I used the point-count method (Ralph et al., 1995) to quantify Long-tailed Tree-Quail abundance. Point count stations were systematically laid out at least 300 m apart along abandoned timber roads. This species is difficult to detect because of its secretive habits and the dense vegetation cover where it lives. Playback recordings to elicit calls by tree-quail are an effective way of detecting it and have been used to estimate relative abundance of several species (Johnson et al., 1981; Marion et al., 1981; Carroll and Hoogestiejn, 1995; Eitniear et al., in press). I conducted 5-minute counts using playback of tape-recorded calls. At each station, I played the tape for 1 minute, then listened for 1 minute. This was repeated twice. Next I played the tape for 30 seconds and listened for 30 seconds. Since most individuals were detected aurally, I estimated the distance to each singing bird and assigned it to 1 of the following categories: 0 to 25 m, 25 to 50 m, 50 to 100 m, and 100 to 150 m. Training to estimate distances was conducted during a previous 2-month pilot study. Counts were performed in the morning from sunrise to 3-4 h thereafter, from March to October 1998 and 1999 on fair weather days with low wind and no precipitation.

The mean number of birds detected per point count was used as an index of relative abundance. Because of the lack of reported density estimates in the literature, I performed a preliminary estimate based on the concepts of distance sampling theory (Buckland et al., 1993). The number of birds/unit area was calculated with program DISTANCE 3.5 (Thomas et al., 1998) in grouped data with the distance categories indicated above. Differences in relative abundance between both years and sites were determined with the Mann-Whitney U test (Zar, 1984). Values presented are means ± standard error.

RESULTS

I detected 210 individuals in 556 point counts during 1998 and 1999 at both study sites. There was no difference between years for within site comparisons (Mann-Whitney U-test: $U = 37937.5$, $Z = 0.498608$, $p = 0.618059$). One hundred seventy-two individuals were detected in 501 point counts within the forest area of the indigenous community (0.343 ± 0.032 individuals/point count). In the unmanaged natural protected area, 38 individuals were detected

during 55 point counts (0.691 ± 0.172 individuals/point count). Although the main goal of this work was to determine abundance in the more extensive pine-oak forest, I also sampled the pine-fir forest found in the highest elevations of the communal forest. There were 376 point counts in the pine-oak forest, and 108 point counts in the pine-fir forest. The relative abundance in the former was 0.383 ± 0.040 individuals/point count, while in the latter it was 0.250 ± 0.054. Relative abundance within study sites also varied among geomorphological features. Sampling took place in the two main volcanic structures of the unmanaged, naturally-protected area, while in the communal forest 12 geomorphological units were sampled. Relative abundance was higher in both structures of the naturally-protected area than in any structure of the communal forest. There was a marked seasonal variation with peaks of high values of response rates in March, and September and low response rates in between.

Density was higher in the unmanaged forest (42.9 birds/km^2; CI: 23.8 - 77.3) than in the managed communal forest (7.8 birds/km^2; Cl: 4.7 - 12.9). Considering the estimated population density and the forested area of each study site, a population of 193 tree-quail inhabit the unmanaged naturally-protected area (4.5 km^2) , and 757 individuals the communal forest (97 km^2).

DISCUSSION

The relative abundance and population density of tree-quail are low in the managed communal pine-oak forest compared to estimates for the population in the unmanaged pine-oak forest of the naturally-protected area. During the study, I did not find evidence of hunting pressure in the communal forest, where hunting is now restricted to a traditional communal white-tailed deer hunt for Corpus Day (June). During this hunt, tree-quail are rarely taken. Some birds are more likely hunted by chance by some of the few peasants who still live in the forest.

The low abundance in the communal forest is likely influenced by other human activities, such as logging, pine-resin tapping and cattle grazing, which further habitat disturbance. An important habitat element that usually disappears because of these activities is the dense shrub stratum that seems to be fundamental for tree-quail as escape, nesting, roosting and feeding cover. Most of tree-quail encounters were in areas with a dense shrub stratum. Although tree-quail can withstand a degree of habitat disturbance, like the decline in tree canopy cover, the lack of the shrub stratum or its constant disturbance may affect nesting behavior and abandonment of the area. Habitat structure and composition, and their relation with abundance and reproductive success are being studied by me and the results will be reported elsewhere.

Seasonal variation in response rates may be related to vocal activity. The lower abundance detected from April to August, therefore, reflected a decline in responsiveness, rather than a decline in numbers of tree-quail. During this season, tree-quail are nesting and attending newborn chicks. Low vocal activity may be a strategy to avoid location by predators.

On the other hand, the response rate was higher during March when tree-quail start the mating season and vocalization is high. The response rate was also higher during September indicating an increase in vocalization by young-of-the-year to keep cohesion of the family group. During this season, groups of up to 12 tree-quail were encountered. After this season and dispersion of the new members of the population, smaller groups of 2-3 birds are formed and the response rate declines until the beginning of the next mating season.

The abundance and density estimates reported in this paper are preliminary because of the lack of quantitative information on factors that might affect spatial and temporal differences in response rates. That information is needed to development of a standardized methodology for assessing relative abundance of this tree-quail. It is also necessary to estimate the proportion of tree-quail that respond when in range of call playback. To do this it would be necessary to know the size of the population.

Because of the limited information on the ecology of this species and the effects of human activities on its populations, a long-term monitoring program is required before formal recommendations and measures can be taken for its conservation in human dominated landscapes.

ACKNOWLEDGMENTS

Funding for this project was provided by Fondo Mexicano para la Conservacion de la Naturaleza, A.C. The Instituto Nacional de Investigaciones Forestales, Agricolas y Pecuarias (INIFAP) provided logistical support. Alejandro Velazquez M., Gerardo Bocco and Ma. del Coro Arizmendi discussed ideas with the author to improve this study during field work.

LITERATURE CITED

American Ornithologists' Union. 1998. *Check-list of North American Birds.* 7th edition. Allen Press, Lawrence, KS.

Buckland, S. T., D. R. Anderson, K. P. Burnham, and J. L. Laake. 1993. *Distance Sampling: Estimating Abundance of Biological Populations.* Chapman and Hall, London, England.

Carroll, J. P. 1994. Odontophoridae. Pp 412-433 *in* J. del Hoyo, A. Elliot, and J. Sargatal (eds.). H*andbook of the Birds of the World. Vol. 2. New World Vultures to Guineafowl.* Lynx Edicions, Barcelona, Spain.

Carroll, J. P., and A. Hoogesteijn. 1995. Observations of the Venezuelan Wood-quail at Rancho Grande, Henri Pittier National Park, Venezuela. Pp 67-72 *in* D. Jenkins (ed.). *Annual Review WPA 1993/1994*. World Pheasant Association, Reading, U.K.

Eitniear, J. C., J. T. Baccus and J. Carroll. IN PRESS. Surveying Bearded Wood-partridges using playback of a recorded call. *Vida Silvestre Neotropical.*

Escalante Pliego, P., A. G. Navarro Sig Uenza, and A. T. Peterson. 1993. A geographic, ecological, and historical analysis of land bird diversity in Mexico. Pp. 281-307 *in* T. P. Ramamoorthy, R. Bye, A. Lot, and J. Fa (eds.). *Biological Diversity of Mexico: Origins and Distribution.* Oxford University Press, New York, NY.

Johnsgard, P. A. 1973. *Grouse and Quails of North America.* University of Nebraska Press, Lincoln, NE.

Johnson, R. R., B. T. Brown, L. T. Hight, and J. M. Simpson. 1981. Playback recordings as a special avian censusing technique. *Studies in Avian Biology* **6**:68-75.

Marion, W. R., T. E. O'Meara, and D. S. Maher. 1981. Use of playback recordings in sampling elusive or secretive birds. *Studies in Avian Biology* **6**:81-85.

McGowan, P. J. K., S. D. Dowell, J. P. Carroll, and N. J. Aebischer. 1995. Partridges, Quails, Francolins, Snowcocks and Guineafowl: Status Survey and Conservation Action Plan 1995-1999. IUCN/SSC, Cambridge, UK.

Parker III, T. A., D. F. Stotz, and J. W. Fitzpatrick. 1996. Ecological and distributional databases. Pp 113-436 *in* D. F. Stotz, J. W. Fitzpatrick, T. A. Parker III, and D. K. Moskovits. *Neotropical Birds: Ecology and Conservation.* Chicago Univsity Press, Chicago, IL.

Ralph, C. J., J. R. Sauer, and S. Droege (eds.). 1995. Monitoring Bird Populations by Point Counts. General Technical Report PSW-GTR-149, Pacific Southwest Research Station, USDA Forest Service, Albany, CA.

Style, B. T. 1993. Genus *Pinus*: a Mexican purview. Pp. 397-420 *in* T. P. Ramamoorthy, R. Bye, and A. Lot (eds.), *Biological Diversity of Mexico: Origins and Distribution.* Oxford University Press, New York, NY.

Thomas, L., J. L. Laake, J. F. Derry, S. T. Buckland, D. L. Borchers, D. R. Anderson, K. P. Burnham, S. Strindberg, S. L. Hedley, M. L. Burt, F. Marques, J. H. Pollard, and R. M. Fewster. 1998. Distance 3.5. Research Unit for Wildlife Population Assessment, University of St. Andrews, UK.

Toledo, V. M., and M. J. Ordofiez. 1993. The biodiversity scenario of Mexico: a review of terrestrial habitats. Pp 757-777 *in* T. P. Ramarnoorthy, R. Bye, A. Lot, and J. Fa (eds.). *Biological Diversity of Mexico: Origins and Distribution.* Oxford University Press, New York, NY.

Zar, J. H. 1984. *Biostatistical Analysis*. 2nd edition. Prentice-Hall, Saddle Ridge, NJ. ❒

A Review of the Status of the Spot-winged Wood-Quail *(Odontophorus capueira)* in Paraguay

Robert P. Clay[1]

[1]Guyra Paraguay: Conservación de Aves, C.C. 714, Asunción, Paraguay

INTRODUCTION

The Spot-winged Wood-quail *(Odontophorus capueira)* is endemic to, but distributed throughout the Atlantic Forest of southeastern Brazil, northeastern Argentina, and eastern Paraguay (Parker et al., 1996). The species is generally considered to have 2 subspecies: *O.* c. *plumbeicollis* in northeastern Brazil, and the nominate form throughout the rest of the species' range (Carroll, 1994). Very little information is available regarding the conservation status of *0. capueira*, but it has been suggested that the total population may be as low as 50,000 individuals and declining (Carroll, 1994). Parker et al. (1996) considered the species will become threatened if current trends in habitat destruction persist.

In Brazil, the species is rarely found outside of reserves in the coastal Atlantic Forest (Carroll, 1994), and unprotected populations appear to be declining (Parker et al., 1996). However, where habitat is protected the species can still be common (Carroll, 1994). Although the latter author considered there to be very few recent records of *0. capueira* from Argentina or Paraguay, substantial populations of *0. capuiera* appear to remain in both countries. In Argentina, the species is only known from Misiones Province (Canevari et al., 1991; Chebez, 1997), where it is considered "not uncommon" (J. Mazar Barnett in litt., 1998). Saibene et al. (1996) considered the species to be "Common" in Iguazfi National Park, and Benstead et al. (1993) found the species to be "Uncommon" (occasionally encountered) at 2 sites, and "Fairly Common" (less than 10 individuals per day) at a further 2 sites.

In Paraguay, Hayes (1995) considered *0. capuiera* to be "Uncommon" (recorded every 2-10 days in appropriate habitat) in 3 geographical regions. These regions (as defined by Hayes, 1995) are: Campos Cerrados, Central Paraguay and Alto Parand, and are the 3 that contain Interior Atlantic Forest. Here, I provide a review of the current status of *0. capuiera* in Paraguay based on fieldwork conducted by various institutions and observers over the past 15 years (Appendix 1).

[1]Large Animal Research Group, Department of Zoology,
University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK

[1]e-mail: guyra@highway.com.py

STATUS AND DISTRIBUTION

O. capueira has been recorded widely from at least 21 sites in Paraguay over the past 15 years (1985-1999). The species has been recorded from as far north as Cerro Cord National Park (Amambay Department, 22°39' S, 56° 00' W), as far south as San Rafael National Park (Itapda Department, 26°25' S, 55°40' W), and as far west as Ybycui National Park (Paraguari Department, 26°05' S, 56°48' W, c. 100 km east of the Rio Paraguay). The latter is at the western limit of Atlantic-type forest in Paraguay. Historically, *0. capueira* has been recorded to within 50-60 km of the Rio Paraguay (at Nueva Germania, San Pedro Department, 23°54' S, 56°34' W, Laubmann, 1939).

Of the 21 sites (Fig. 1) where the species has been recorded, some qualitative measure of the abundance of the species is available for 18. Surveys conducted in 1992 and 1994-95 provide standardised relative abundance data, based on encounter rates, for *0. capueira* at 11 of these sites (see Lowen et al., 1996, also Brooks et al., 1993). The species was found to be "Rare" (less than 2 birds/ 100 field hours) at 1 site, "Uncommon" (2.1 to 10 birds/ 100 field hours) at 4, and "Fairly Common" (10.1 to 40 birds/100 field hours) at 6 (see Appendix 1 for details). In addition, Anon. (1993) considered the species "Common" (no definition provided) in 5 areas in the vicinity of the Itaipd Dam, and the species is common (5-15 individuals recorded per day) at Estancia Tapyui, Caazapá Department (own data). Hayes and de Medina (1988) considered *0. capueira* to be "Uncommon" (observed in small numbers at least twice) in the vicinity of Choré, San Pedro Department (24°10' S, 56°35' W).

An analysis of the distribution of the species by relative abundance category suggests a trend for the species to be most common at sites in the far east and south-east of Paraguay, essentially corresponding to the watershed of the Rio Parand. Examining the standardised Lowen et al. (1996) data for 2 sites, of 5 sites in the Rio Paraná watershed, *0. capueira* was considered "Fairly Common" at all but 1. In contrast, in the Rio Paraguay watershed, the species was found to be "Rare" at 1 site (the most westerly of the 11), "Uncommon" at 3, and "Fairly Common" at 2. These latter 2 sites may be the exception, as they were both relatively small, recently isolated fragments, which may have been acting as a refuge for species and individuals displaced from surrounding recently deforested areas. In contrast, *0. capueira* was found to be "Uncommon" at 2 large forest blocks (20,000 ha and 59,000 ha) in the same area.

This division in relative abundance between the 2 principal watersheds is supported by the data from the Itaipú Dam area (5 sites in the Rio Parand watershed). At all 5 of these sites, the species was considered "Common" (Anon., 1993). The one exception is Estancia Tapytá. Although the site is located in the Rio Paraguay watershed, the species is "Common" (own data). However, this fits a general trend for the avifauna of forests of this area to have strong affinities with Paraná forests (R. Clay, unpub. data).

The sites where *0. capueira* have been recorded in Paraguay vary in size from 500 ha to 59,000 ha of forest. However, no clear trend is apparent with regard to abundance and size of forest block. Of the 11 sites with standardised relative abundance data (see Lowen et al., 1996), *0. capueira* was found to be "Uncommon" at both the smallest site (Estancia San Antonio: 500 ha) and the largest (Mbaracayú Forest Nature Reserve: 59,000 ha). However, it is perhaps of note that the 1 site in the Rio Paraná watershed where *O. capueira* was considered "Uncommon" rather than "Fairly Common" was Estancia San Antonio. The 500 ha of this property were noted to suffer from high hunting pressure, with many of the larger game species absent or very scarce (Brooks et al., 1993).

PRESENCE AND STATUS IN PROTECTED AREAS

Of the 21 sites where *0. capueira* has been recorded in the past 15 years, the majority have benefited or continue to benefit from protected area status of some kind. Populations of *0. capueira* are effectively protected in 3 national parks (Cerro Corá, Caaguazú and Ybycuí, totalling 22,574 ha of forest) and 1 nature reserve (the Mbaracayú Forest Nature Reserve, 59,000 ha of forest). In addition, Itaipfú Binacional manages 3 reserves which support populations of *0. capueira* (Tatí Yupí Biological Refuge, Limoy Biological Reserve and Itabó Biological Reserve) and some 22,915 ha of protected forest. The species has been considered "Common" in the general area of all 3 Itaipú reserves (Anon., 1993), as "Fairly Common" in Caaguazú National Park (Lowen et al., 1996) and as "Uncommon" in both Mbaracayú and Cerro Corá National Park (Lowen et al., 1996). No abundance data is available for the species in Ybycuí National Park. The species was cited for Ybycuí by Hayes and Scharf (1995), but was not recorded there during brief visits by Lowen et al. (1996) in 1995, and me in 1997. An additional national park–San Rafael–was decreed in 1992, but has yet to receive effective protection. Once consolidated, San Rafael will protect 58,500 ha of forest. *0. capueira* was considered "Fairly Common" at San Rafael by both Lowen et al. (1996) and Madrofio et al. (1997). The latter authors defined "Fairly Common" as "recorded every day in small numbers."

The Fundación Moisés Bertoni, Paraguay's largest conservation NGO, runs a private nature reserve initiative, which encourages landowners to set-aside areas of their property for nature conservation. Most of the other sites where *0. capueira* has been recorded in Paraguay in the past 15 years have at some point participated in this scheme. The scheme has been hampered by a lack of both legal recognition for individual sites and fiscal benefits for setting land aside. As a result, there are currently just 2 active private nature reserves: Tapytá and Ypetí, which protect about 16,000 ha of forest. A further 7 sites belong to owners with an interest in conservation and participation in the scheme could potentially protect an additional 40,000 ha. At the majority of these sites, *0. capueira* has been considered "Fairly Common" (Lowen et al., 1996). Of particular importance is Estancia Golondrina, where c. 20,000 ha of forest remain. Once part of the private nature reserve scheme, the owner has recently showed renewed interest in active participation (L. Bartrina pers. comm., 1999).

POPULATION

No estimates of the size of the Paraguayan population of *0. capueira* are available. However, some quantitative data are available from the Mbaracayú Forest Nature Reserve. Hill et al. (1997) reported on the impact of hunting on populations of large vertebrates in the reserve. Encounter data were recorded along a stratified random sample of diurnal transects, using trained indigenous Aché field assistants and with each transect essentially a belt 100 m wide, and 2-5 km long (see Hill et al., 1997 for details). During 91 such transects conducted from 1994-96, there were 52 direct encounters with *0. capueira.* Unfortunately, Hill et al. (1997) did not specify whether the number of direct encounters equates to the total number of individuals encountered, a factor potentially of great importance for flocking species such as *0. capueira*. Assuming an average transect length of 3.5 km, and that each encounter equated to 1 individual, an estimate can be made of the Mbaracayú population of *0. capueira.* Transects were not repeated, therefore, the total area surveyed in 91 transects was 3,185 ha, which gives a density of 1.6 individuals/km^2. The total forested area of Mbaracayú is 591 km^2, therefore the total *0. capueira* population in the reserve can be estimated at 946 individuals.

This figure calculated for the Mbaracayú population of *0. capueira* seems most likely to be an underestimate. Hill et al. (1997) reported the mean perpendicular distance from the transect for direct encounters with *0. capueira* as 6.8 m. This figure appears very close for a species where the majority of records are of distantly heard vocalising birds. *0. capueira* primarily calls at dusk and dawn (Sick, 1993). Hill et al. (1997) generally began transects at 0700 to 0900 h and stopped around mid-afternoon. As a result, transects were not conducted at a time of day when *0. capueira* habitually vocalised, and some individuals of the species present in the transect area may not have been recorded.

Although the density (and hence population) estimate for Mbaracayú is most likely not accurate, it can be used to calculate a first approximation of the size of the Paraguayan population of *0. capueira.* Of the original 94,000 km^2 of Atlantic Forest in Paraguay, about 14,000 km^2, now remain. At a density of 1.6 individuals/ km^2 a total population of 22,400 can be extrapolated.

THREATS

The principal threat facing *0dontophorus capueira* in eastern Paraguay is loss of habitat. Deforestation and selective logging continue at an alarming rate, and not only is the total forest cover rapidly diminishing, but what remains is highly fragmented and degraded. From 1984-91 some 38% of eastern Paraguay's remaining forest was cleared (CIF, 1994), with an average of 4,000 km^2 deforested annually during that period (Bozzano and Weik, 1992). Deforestation was accelerating rapidly towards the end of the period, with 10,000 km^2 estimated to have been cleared in 1990 (Bozzano and Weik, 1992). Further, deforestation does not appeared to have slackened subsequently (World Bank, 1995; DOA,

1996, 1998), and present day forest cover is about 14,000 km^2 (based on DOA, 1998). The majority of the remaining forest is secondary or altered, with 60% too severely degraded to be of any commercial value (World Bank, 1995). The resulting structural changes (i.e., the loss of an open understorey) may well further decrease the amount of habitat available for *0. capueira.*

Unlike some of the larger galliformes in eastern Paraguay (especially species of *Pipile* and *Crax*), *O. capueira* does not appear to be particularly threatened by hunting. During interviews conducted with local people at the majority of sites with records of the species, *O. capueira* has never been mentioned as a favoured game species (own data, L. Bartrina pers. comm., 1999; R. Villalba per comm., 1999). Instead, it would appear that the species is hunted only when opportunistically encountered. This is certainly the case in the Mbaracayú Forest Nature Reserve, where the indigenous Aché retain traditional hunting rights. Over a 5-year period in Mbaracayú (1994-98), the Aché only killed 4 *0. capueira,* 3 of them together. In contrast, in the same period they killed 54 Rusty-margined Guans *(Penelope superciliaris)* and 17 Solitary Tinamous *(Tinamus solitarius)* (K. Hill pers comm., 1999, E. Esquivel in litt., 1999). However, some groups of indigenous Guarani still use *0. capueira* plumes in traditional rituals and ceremonies, thus on occasions the species is specifically sought (R. Villalba pers. comm., 1999).

CONCLUSIONS

0. capueira is currently known from at least 21 sites in eastern Paraguay, and appears able to survive, at least in the short term, in small fragments and in degraded habitat. The species is, however, clearly threatened over the medium to long-term by the continued clearance of its Atlantic Forest habitat, and the ever increasing pressure on those fragments that remain. However, unlike other species of Paraguayan Galliformes, *0. capueira* does not appear to be targeted as a game species, and this may in part explain its continued survival in small fragments.

The status of *0. capueira* in Paraguay should be closely monitored in forthcoming years, both at a local and national level. As forest clearance seems likely to continue at its current alarmingly rapid rate, *0. capueira* will doubtless be a candidate species for treatment as globally threatened in the future. At present, the species may best be considered as near-threatened, although this treatment may not yet be warranted given that there is apparently a reasonable sized population surviving in Misiones Province, Argentina.

ACKNOWLEDGEMENTS

Lucia Bartrina kindly summarised records of 0. capeuira from the private nature reserve scheme of the Fundación Moisés Bertoni, and Estela Esquivel provided information from the Mbaracayú Forest Nature Reserve. I would like to thank Kim Hill for the provision of unpublished information, and Dan Brooks for his continued support of *Guyra Paraguay*.

LITERATURE CITED

Anonymous. 1993. Ornithofauna del drea de ItaipA: Lista Aves. Ciudad del Este, Paraguay: Itaipú Binacional.

Benstead, P. J., R. D. Hearn, C. J. S. Jeffs, D. A. Callaghan, J. Calo, G. Gil, A. E. Johnson, and A. R. Stagi Nedelcoff. 1993. "Pato Serrucho '93": An expedition to assess the current status of the Brazilian Merganser Mergus octosetaceus in north-eastern Argentina. Unpub. report.

Bozzano, B. E., and J. H. Weik. 1992. *El avance de la deforestación y el impacto economico.* Proyecto de Planificación del manejo de los Recursos Naturales (MAG/GT-GTZ), Series No. 12, Asunción, Paraguay.

Brooks, T. M., R. Barnes, L. Bartrina, S. H. M. Butchart, R. P. Clay, E. Z. Esquivel, N. I. Etcheverry, J. C. Lowen, and J. Vincent, 1993. *Bird Surveys and Conservation in the Paraguayan Atlantic Forest.* BirdLife International Study Report 57. BirdLife International. Cambridge, UK.

Canevari, M., P. Canevari, G. R. Carrizo, G. Harris, J. Rodriguez Mata, and R. J. Straneck. 1991. *Nueva guia de las aves argentinas. Tomo 2.* Buenos Aires, Argentinia: Fundación Acindar.

Carroll, J. P. 1994. Odontophoridae. Pp 412-433 *in* J. del Hoyo, A. Elliot, and J. Sargatal (eds.). H*andbook of the Birds of the World. Vol. 2. New World Vultures to Guineafowl.* Lynx Edicions, Barcelona, Spain.

Chebez, J. C. 1997. *Fauna Misionera.* Buenos Aires, Argentina: L.O.L.A

CIF. 1994. Uso de la tierra y deforestación en la region oriental del Paraguay, periodo 1984-1991. Universidad Nacional de Asunción, San Lorenzo, Paraguay.

DOA. 1996. Mapa de avance de lo deforestación 1991-1994. Dirección de Ordenamiento Ambiental, Asunción, Paraguay.

DOA. 1998. *Mapa de cobertura boscosa en la Región Oriental del Paraguay en 1997.* Dirección de Ordenamiento Ambiental, Asunción, Paraguay.

Hayes, F. E. 1995. Status, distribution and biogeography of the birds of Paraguay. Mon. Field Orn. No. 1. New York: American Birding Association.

Hayes, F. E., and F. E. Areco de Medina. 1988. Notes on the ecology of the avifauna of Choré, department of San Pedro, Paraguay. *Hornero* **13**: 60-70.

Hayes, F. E., and P. Scharf. 1995. The birds of Parque Nacional Ybycuí, Paraguay. *Cotinga* **4**: 14-19.

Hill, K., J. Padwe, C. Bejyvagi, A. Bepurangi, F. Jajuki, R. Tykuarangi, and T. Tykuarangi. 1997. Impact of hunting on large vertebrates in the Mbaracayú Reserve, Paraguay. *Conservation Biology* **11**: 1339-1353.

Laubmann, A. 1939. Wissenschaftliche ergebnise der Deutschen Gran Chaco Expedition. *Die Vögel von Paraguay. Vol. I.* Strecker und Schröder, Stuttgart, Germany.

Lowen, J. C., L. Baertrina, R. P. Clay, and J. A. Tobias. 1996. *Biological surveys and conservation priorities in eastern Paraguay.* CSB Conservation Publications, Cambridge, UK.

Parker III, T. A., D. F. Stotz, and J. W. Fitzpatrick. 1996. Ecological and distributional databases. Pp. 113 - 436 *in* D. F. Stotz, J. W. Fitzpatrick, T. A. Parker III, and D. K Moskovits (eds.). *Neotropical Birds: Ecology and Conservation.* Chicago University Press, Chicago, IL.

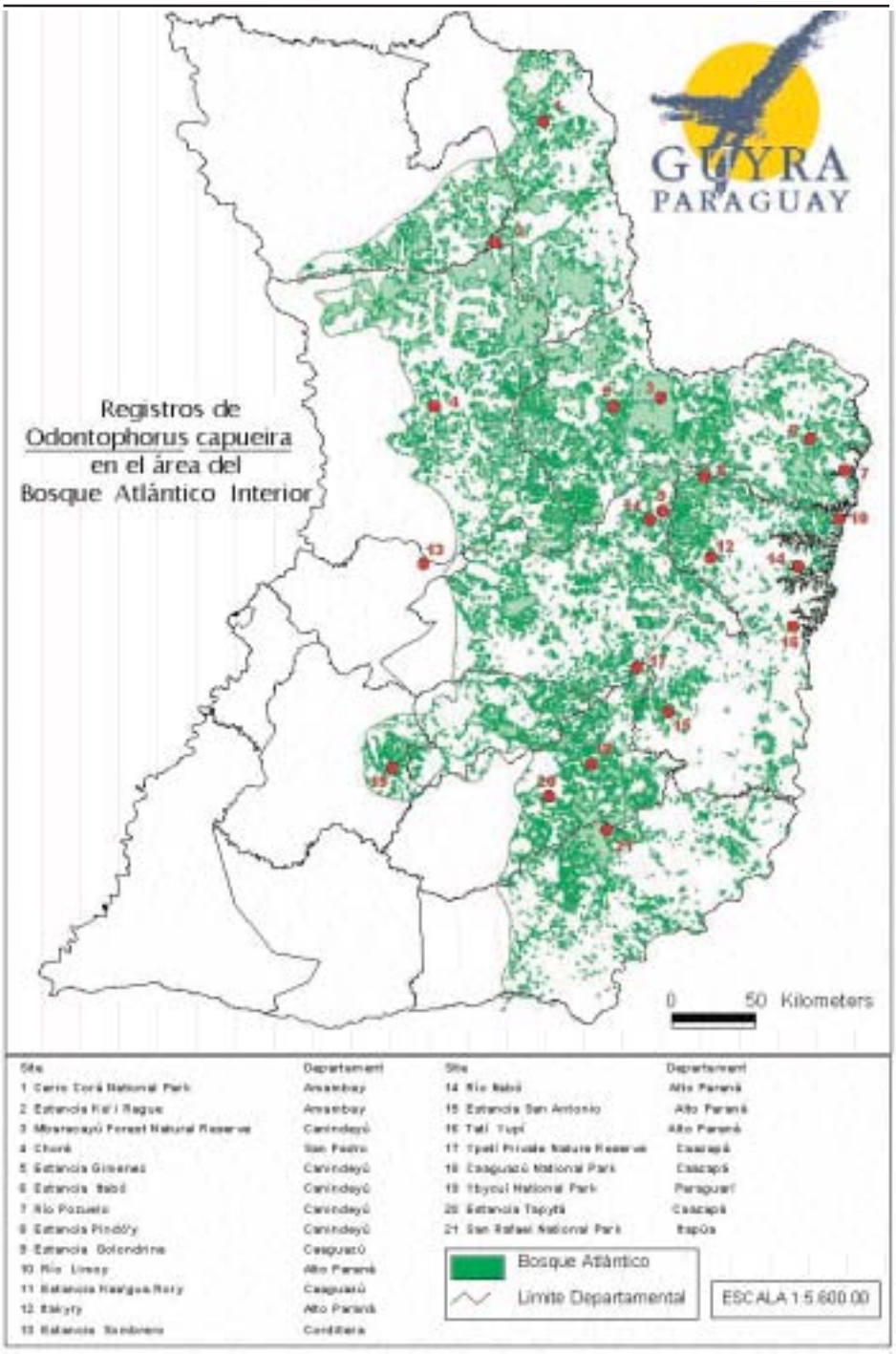
Saibene, C.A., M. A. Castelino, N. R. Rey, J. Calo, and J. Herrera 1996. *Inventario de las Aves del Parque Nacional Iguazú (Misiones, Argentina).* Buenos Aires, Argentina: L.O.L.A.

World Bank. 1995. *Paraguay: agricultural sector review.* Report no. 12123-PA, Technical Volume II: Annexes E-Q. Latin American and the Caribbean regional office, World Bank. Asunción, Paraguay. ❒

Appendix I: Sites where *Odontophorus capueira* has been recorded in Paraguay in the past 15 years.

Site	Department	Coordinates	Forested Area (ha)	Relative Abundance	Sources
Cero Corá National Park	Amambay	22°39'S 56°00'W	6,032	Uncommon	Lowen *et al.*, 1996
Estancia Ka'i Rague	Amambay	23°16'S 56°20'W	2,836	–	L. Bartrina in litt., 1999
Mbaracayú Forest Nature Reserve	Canindeyú	24°07'S 55°23'W	59,000	Uncommon	Lowen *et al.*, 1996
Choré	San Pedro	24°10'S 56°35'W	?	Uncommon	Hayes and de Medina, 1988
Estancia Jiménez	Canindeyú	24°13'S 55°38'W	1,000	Fairly Common	Lowen *et al.*, 1996
Estancia Itabó	Canindeyú	24°20'S 54°35'W	3,000	Fairly Common	Lowen *et al.*, 1996
Rio Pozuelo	Canindeyú	24°30'S 54°24'W	?	Common	Anon., 1993
Estancia Pindo'y	Canindeyú	24°32'S 55°09'W	3,299	–	L. Bartrina in litt., 1999
Estancia Golondrina	Caaguazú	24°43'S 55°22'W	20,000	Uncommon	Lowen *et al.*, 1996
Rio Limoy	Alto Paraná	24°46'S 54°26'W	11,897	Common	Anon., 1993
Estancia Kaa'gua Rory	Caaguazú	24°46'S 55°26'W	7,500	Fairly Common	Lowen *et al.*, 1996
Itakyry	Alto Paraná	24°58'S 55°07'W	?	Common	Anon., 1993
Estancia Sombrero	Cordillera	25°00'S 56°38'W	?	Rare	Lowen *et al.*, 1996
Rio Itabó	Alto Paraná	25°01'S 54°39'W	9,890	Common	Anon., 1993
Estancia San Antonio	Alto Paraná	25°18'S 55°20'W	500	Uncommon	Lowen *et al.*, 1996
Tati Yupí	Alto Paraná	25°20'S 54°40'W	1,128	Common	Anon., 1993
Ypetí Private Nature Reserve	Caazapá	25°33'S 55°30'W	10,000	Fairly Common	Lowen *et al.*, 1996
Caaguazú National Park	Caazapá	26°04'S 55°45'W	12,735	Fairly Common	Lowen *et al.*, 1996
Ybycuí National Park	Paraguarí	26°05'S 56°48'W	3,804	–	Lowen *et al.*, 1996
Estancia Tapytá	Caazapá	26°14'S 55°58'W	6,000	Common	R. Clay unpub. data
San Rafael National Park	Itapúa	26°25'S 55°40'W	58,496	Fairly Common	Lowen *et al.*, 1996

Appendix II: Map of *Odontophorus capueira* recorded sitings in Paraguay in past 15 years.



Habitat Preferences of the Venezuelan Wood-Quail *(Odontophorus columbianus)*

Elisa Bonaccorso and Guillermo R. Barreto[1]

Departamento de Biologia de Organismos. Universidad Simón Bolívar. Apartado 89000, Caracas 1080-A, Venezuela.

The Venezuelan Wood-quail *(Odontophorus columbianus)* is an endemic species of Venezuela that dwells in the humid forests of the central-northern mountain range and southeastern Andes. Its biology, ecology and conservation status are poorly known. The aim of this study was to establish quantitative relationships between the presence and absence of the species and a number of habitat features in the humid forest of Henri Pittier National Park, Aragua State, Venezuela. Twenty-six habitat variables were recorded in 20 plots located at places where quail were observed while foraging and compared with those of 22 plots located at random in areas where quail were not observed. Principal component analysis and generalized linear modelling were used to identify the relevant set of variables determining the presence or absence of the species. These variables were: high frequency of non-palm monocots, high vertical foliage density and low frequency of the palm *Bactris* sp. The logistic model allows one to predict the presence or absence of quails in similar areas to those of our study with probabilities of 80 and 86%, respectively.

HABITAT PREFERENCES BY *O. COLUMBIANUS*

The Venezuelan Wood-quail *(Odontophorus columbianus)* is an endemic species of primary cloud forests, distributed along the northern mountain range and the Andes in Venezuela. Information on *Odontophorus* is very scarce, largely because all species are forest-adapted and generally inhabit deep tropical to sub-tropical forest, where observation is often difficult (Johnsgard, 1979). It is generally known that the Venezuelan Wood-quail dwells in the humid forests where it has been observed as solitary individuals or in groups of up to 14 individuals (Carroll and Hoogesteijn, l994). It is monogamous (Johnsgard, 1988). Additional information comes from Skutch (1947), who reported on nesting period and behaviour of *0. gujanensis* while McDonald and Winnet-Murray (1989) and Schwartz and Lentino (1984) described the nests of *0. leucolaemus* and *0. columbianus*, respectively.

It has been suggested that a decline in numbers because of habitat loss may be occurring in populations of some *Odontophorus* species (Romero, 1983; Stiles and Skutch, 1989; Collar et al., 1992). Population status of the Venezuelan Wood-quail is unknown but it may be similar to other species of the genus. It is, therefore, necessary to improve our knowledge on habitat requirements of this species to better protect suitable areas, to determine possible impacts of habitat modification, and to restore those areas already degraded.

[1]E-mail: guibarre@usb.ve

We use generalized linear models (GLM), specifically logistic regression models, to identify habitat features that are related to the feeding habitat of Venezuelar Wood-Quail in a cloud forest of northern Venezuela. Logistic regression has already been used in a number of studies on animal distribution and habitat preferences (e.g., Bustamante, 1997; Franco et al., 2000; and Rushton et al., 1994). The technique has proved very useful as a standard method for regression analyses of dichotomous data. Our aim is not only to improve our knowledge of the ecology of this poorly known species but also to show the use of an approach with interesting conservation implications applicable to other elusive species.

STUDY AREA AND METHODS

This study was conducted at Henri Pittier National Park, Venezuela. The park is located nearly halfway along the center of the northern Cordillera, Aragua State (Fig. 1). The region has a seasonal rainy period lasting from May to November and a dry period from December to April (Huber, 1986a). Observations and habitat surveys were carried out at 2 localities, Periquito and Guacamayo, respectively, near Rancho Grande Biological Station (10° 21' N, 67° 41' W) between 1,090 and 1,200 m amsl. Annual rainfall averages 1,600 mm and mean temperature is 20° C. The area is characterized by cloud forests (Periquito) and transitional cloud forests (Guacamayo) (Beebe and Crane, 1947; Huber, 1986b). This pristine area has been protected since the creation of Henri Pittier National Park in 1937.

Figure 1. Location of the Rancho Grande Biological Station within the Henri Pitttier National Park, Aragua State, Venezuela.

Habitat Survey

The habitat survey was carried out from July to September 1998 during the rainy season and did not coincide with the known breeding period of species in northern Venezuela (Schwartz and Lentino, 1984). Birds were found by using playbacks and by direct observations. Two 1 km long tracks previously demarcated were slowly walked daily from 600 to 900 h and from 1600 to 1800 h for 4 to 6 days each month. At about 100 m intervals, we stopped and played 3 songs and waited for 1 minute for response of quail. Average

maximum distance at which birds can be detected with reasonable certainty was previously estimated as 30 m. Once a bird or group was spotted, the site was marked and a 4-m diameter circular plot was established. Later, the following habitat variables were recorded inside the plot: slope, average canopy height and cover, understory height and cover, visibility at 1-m height or vertical foliage density, and substrate composition (litter, bare soil, stones, or logs; Table 1).

Table 1. Principal component analysis of habitat variables recorded at 42 plots in Henri Pittier National Park, Venezuela. Table shows factor loadings on the first three principal components (PC), eigenvalues and percentage explained variance. Higher scores (> 0.5) are shown in bold.

Variables	**PC 1**	**PC 2**	**PC 3**
Slope	**0.535**	0.032	-0.066
Canopy height	0.459	-0.442	-0.027
Canopy cover	**-0.515**	**-0.503**	0.074
Understory height	-0.160	0.011	0.492
Vegetation density	0.301	**0.608**	-0.431
Frequency in the plot			
Mature trees	-0.044	0.061	0.251
Bactris sp.	**-0.506**	0.150	0.206
Asplundia goebelii	-0.060	0.447	-0.175
Solitary big palms	0.260	0.310	**0.521**
Solitary short palms	-0.303	**0.705**	0.248
Ferns	0.260	-0.110	-0.046
Heliconia	**0.702**	-0.175	0.481
Monocots (no palms, no Heliconia)	0.263	0.410	0.221
Total Monocots (no palms)	**0.729**	0.046	0.497
Crasularia agustini	-0.161	0.343	0.253
Understory cover			
Palms	-0.227	**0.838**	-0.129
Dicots	-0.078	0.042	**-0.560**
Ferns	**0.540**	-0.378	-0.302
Monocots	0.457	0.027	0.282
Total cover	0.276	0.314	**-0.600**
Litter	**-0.521**	-0.347	0.040
Bare soil	0.232	0.386	0.069
Logs	**0.683**	0.017	-0.206
Roots	0.433	0.116	-0.263
Stones	-0.061	-0.266	-0.298
Eigenvalues	4.105	3.269	2.569
% Explained Variance	16.42	13.07	10.28
% Cumulative Variance	16.42	29.49	39.77

Slope was assessed with a clinometer. Canopy height and vegetative cover were estimated visually. Cover of different understory vegetative types, and substrate composition were estimated in two 1-m^2 plots located 1 m above the ground and at random within the circular plot. Average understory height (including only plants that reached at least l m) was measured directly in the circular plots. Vegetation density was estimated visually using two 1 m^2 black and white boards (similar to a chess board) placed 4 m from the center of the plot at a random spot and counting the number of squares not blocked by foliage between 0 and 1m high. Additionally, the frequency of ferns, palms, *Heliconia* spp. and other monocots, and dicots were recorded. Plots where quail had been recorded were called presence plots.

For comparison with presence plots, we also established plots in sites chosen at random from areas where no songs of quail were recorded during our sampling. We collected the same data as for presence plots. These plots were called absence plots. We surveyed vegetation at 20 presence and 22 absence plots.

Data Analyses

An ordination of habitat data was conducted to extract the main sources of variation across the 42 plots. An attempt was made to separate presence from absence plots and to identify variables producing separation. The number of variables used was reduced by a Principal Component Analysis (PCA). In this way, the variation between plots may be more easily explained and the PCA scores might be used in place of the original variables in the Generalized Linear Models (GLM). PCA was used by standardizing variables through a correlation matrix and by relating the components with the variables by means of Pearson correlation indices (James and McCulloch, 1990).

To identify significant relationships between the presence of quail and habitat variables, logistic regression analyses were performed. Logistic regression is a special case of GLMs, in which the response variable is binary (1 for presence, 0 for absence) and the error structure is binomial rather than normal (McCullagh and Nelder, 1989). The goodness-of-fit of each model to the data was assessed using both the maximum likelihood criteria and the Wald test (Aitkin et al., 1989). Given the respective model, the larger the likelihood of the model, the larger the probability of the dependent variable values to occur in the sample. Therefore, the greater the likelihood, the better the fit of the model to the data (McCullagh and Nelder, 1989). The Wald test compares the estimates with their asymptotic standard errors. The ratio of estimate/error can be treated as having, approximately, a *t* distribution. Proportional data were arcsine square-root transformed while frequency data were square-root transformed before analyses. We chose the best-fit model with the highest number of significant variables. We fit GLMs by using the STATISTICA package (StatSoft Inc., 1998).

RESULTS

When ordinating plots, the PCA could not separate presence from absence plots, although the first 2 components explained 98.3% of the original variance. Rather, these components

separated Periquito and Guacamayo plots thereby showing differences in vegetation between tracks at both sites. The variables contributing the most with this separation were: 1) slope, which was significantly correlated with the first and second principal components (r = 0.719, $P < 0.05$ and r = 0.890, $P < 0.05$, respectively), and 2) litter and bare soil, both correlated with the second PC (r = -0.401, $P < 0.05$ and r = 0.348, $P < 0.05$, respectively). As far as the ordination of the variables is concerned, the first 3 components only explained 39% of the original variance suggesting that many variables were already uncorrelated before doing the analysis (see Table 1). Nevertheless, the ordination identified 14 variables that had high PC scores (> 0.5) giving us a starting point to perform the GLM.

Table 2. Generalized linear model relating the presence of *O. columbianus* with 7 habitat variables in Henri Pittier National Park, Venezuela. Deviance reduction: 10.123, x^2 (6) =37.882, $P < 0.0001$

Variable	Estimate	Standard Error
Constant	-13.490	4.988
Bactris sp.	-2.112	1.213
Asplundia goebelii	-2.400	1.223
Solitary short palms	1.341	0.599
Total Monocots (no palms)	1.886	0.901
Ferns cover	7.597	4.266
Vegetation density	14.852	6.358

Table 2 shows a model relating the presence of wood-quail to 6 habitat variables extracted from the whole pool of variables. According to this model, the presence of the bird is related to a low frequency of *Bactris* sp. (Palmae) ($t_{41} = -1.741$, $P < 0.05$) and *Asplundia goebelli* (Cyclanthaceae) ($t_{41} = -1.962$, $P < 0.05$), high frequency of solitary short palms ($t_{41} = 2.238$, $P < 0.05$), total monocots ($t_{41} = 2.09$, $P < 0.05$), cover of ferns ($t_{41} = 1.781$, $P < 0.05$), and high vegetation density ($t_{41} = 2.336$, $P < 0.05$).

We performed additional GLMs using combinations of these variables. Table 3 shows a model which reduced significantly the original variance while using variables with the highest level of significance, low frequency of *Bactris* sp. ($t_{38} = -2.097$, $P < 0.05$), total monocots ($t_{38} = 2.572$, $P < 0.01$) and high vegetation density ($t_{38} = 2.766$, $P < 0.005$). This model predicted accurately 86.4% of presence plots and 80% of absence plots.

Table 3. Generalized linear model relating the presence of *O. columbianus* with the most significant habitat variables in Henri Pittier National Park, Venezuela. Deviance reduction: 18.264, x^2 (3) = 21.600, $P < 0.0001$.

Variable	Estimate	Standard Error
Constant	-6.586	2.348
Bactris sp.	-1.864	0.690
Total Monocots (no palms)	1.775	0.901
Vegetation density	12.086	4.369

DISCUSSION

Based on the GLMs, we identified 6 variables that best explained the difference between presence and absence plots. Given that *0. columbianus* were mainly observed during mornings when they are foraging, we related these variables to the feeding habitat of the species. Combining variables, a model was produced with the 3 most significant ones, which were high frequency of monocots, low frequency of *Bactris* sp. and high vegetation density.

Sites with a high frequency of monocots and ferns are likely to retain humidity and perhaps high densities of insects and larvae, which are consumed by other quail species (Campbell et al., 1985; Wilson and Crawford, 1987). The low frequency of *Bactris* sp. in presence plots could be attributed to the fact that *0. columbianus* may use these plants to locate their nests, but avoid them during the time they forage (Schwartz and Lentino, 1984) and as observed in *0. leucolaemus* (Skutch, 1947). In this way the birds may diminish the probability of nests being located by predators (Welty, 1982).

There was a positive relationship between presence of wood-quail and vegetation density. Vegetation density in this case means understory density. This variable can be associated with predation avoidance by quail. Other phasianids are known to prefer areas with high vegetation density (Gullion, 1960; Jenkins, 1961; Campbell et al., 1984). Vegetation density has been found to reduce predation significantly in *Perdix perdix* in Montana, USA, where predation is the main mortality factor for this species (Weigand, 1980). *0. columbianus* is a relatively large bird (350 g) with limited flying ability, possibly making it a relatively easy prey. Its cryptic coloration suggests that predation may be important, and feeding within places of high vegetation density may be advantageous.

Although the PCAs were unable to distinguish between presence and absence plots, these analyses did help identify the variables explaining the most variance and produced the best GLMs. PCAs, however, are not predictive tools though they are useful in describing general patterns. In the case of habitat analyses, PCAs and related analyses (e.g., Correspondence Analyses) have been used previously to identify variables relating the presence of several species to their habitat. In most cases, previous studies were done at a larger scale and resulted in more heterogeneity than our study (e.g., Rushton et al., 1994; Woodroffe et al., 1990). In these cases, PCAs produced better though more general results (Barreto et al., 1998). We sampled plots located throughout a relatively homogeneous region. We searched for microhabitat characteristics; hence, PCAs only gave a general idea of the important variables. This idea was, nonetheless, useful as it guided us into the GLM procedure.

The methodology we used allowed us to identify important habitat features related to the feeding grounds of this poorly known species and provided us with a predictive tool by which we were able to identify suitable sites for the species within the National Park; thus,

orienting any attempt to reintroduce the species or to better protect those areas where the species is still present. *0. columbianus* is an elusive species of unknown status, this type of habitat study may help in designing future research and management plans.

ACKNOWLEDGEMENTS

We wish to thank Jesús Manzanilla for allowing access to the Rancho Grande Biological Station and the staff of the Station for their help and collaboration. Miguel Lentino, for his collaboration during-the study and for allowing the use of several resources of the Phelps Ornithological Museum. Martin Rada, Antonio Herrera, Yamil Madi and Julián Mostacero assisted in the field. Carlos Bosque and Emilio Herrera provided helpful comments on the original manuscript. This study was sponsored by EcoNatura and Decanato de Estudios Profesionales/Universidad Simón Bolívar. Field work was done under National Parks Institute Licence N 340/10213/98.

LITERATURE CITED

Aitkin, M., D. Anderson, B. Francis, and J. Hinde. 1989. Statistical modelling in GLIM. Oxford Statistical Science Series 4. Oxford Science Publications, oxford, UK.

Barreto, G. R., S. P. Rushton, R. Strachan, and D. W. Macdonald. 1998. The role of habitat and mink predation in determining the status and distribution of water voles in England. *Animal Conservation* **1**: 129-137.

Beebe, W., and J. Crane. 1947. Ecology of Rancho Grande, a subtropical cloud forest in northern Venezuela. *Zoologica* **32** (1): 1-60.

Bustamante, J. 1997. Predictive models for lesser kestrel *Falco naumanni* distribution, abundance and extinction in southern Spain. *Biological Conservation* **80**: 153-160.

Campbell, K .L., L. H. Blankenship, and L. P. White. 1984. Grazing management impacts on quail during drought in the northern Rio Grande Plain, Texas. *Journal Range Management* **37** (5): 442-446.

Campbell, K .L., L. H. Blankenship, and J. W. Stewart. 1985. Plant and animal foods of Bobwhite *(Colinus virginianus texanus)* and Scaled Quail *(Callipepla squamata castanogastris)* in southwest Texas. *Southwestern Naturalist* **30** (4): 543-554.

Carroll, J. P., and A. Hoogesteijn. 1994. Observations of the Venezuelan Wood-quail at Rancho Grande, Henri Pittier National Park, Venezuela. *Annual Review WPA* 67-72. World Pheasant Association, Reading, UK.

Collar, N. J., L. P. Gonzaga, N. Krabbe, A. Madroño-Nieto, L. G. Naranjo, T. A. Parker, III, and D. C. Wege. 1992. *Threatened birds of the Americas.* The ICBP/IUCN Red Data Book. Third Ed. Cambridge: ICBP

Franco, A. M. A., J. C. Brito, and J. Almeida. 2000. Modelling habitat selection of Common Cranes *Grus grus* wintering in Portugal using multiple logistic regression. *Ibis* **142**: 351-358.

Gullion, G. W. 1960. The ecology of Gambel's Quail in Nevada and the arid southwest. *Ecology* **41**(3): 518-536.

Huber, 0. 1986a. La selva nublada de Rancho Grande. El Clima. Caracas: Fondo EditorialActa Cientffica Venezolana.

Huber, 0. 1986b. La selva nublada de Rancho Grande. Las selvas nubladas de Rancho Grande: Observaciones sobre su fisionomia, estructura y fenologia. Caracas: Fondo Editorial Acta Cientifica Venezolana.

James, F. C., and C. E. McCulloch. 1990. Multivariate analysis in ecology and systematics: panacea or Pandora's box? *Annual Review of Ecology and Systematics* **21**: 129-166.

Jenkins, D. 1961. Social behaviour in the partridge *Perdix perdix*. Ibis **103a** (2):157-188.

Johnsgard, P. A. 1979. The American Wood Quails *Odontophorus. World Pheasant Association Journal* **4**: 93-99.

Johnsgard, P. A. 1988. *The quails, partridges and francolins of the world.* Oxford University Press, Oxford, UK.

McCullagh, P., and J. A. Nelder. 1989. *Generalized Linear Models. (2nd Ed)*. Chapman & Hall, London, UK.

McDonald, D., and K. Winnett-Murray. 1989. First reported nest of the Black-breasted Wood-quail *(Odontophorus leucolaemus). Condor* **91**: 985-986.

Romero, H. 1983. Revisión del status zoogeográfico y redescripción de *Odontophorus strophium* (Gould)(Aves: Phasianidae). *Caldasia* **8**: 775-783.

Rushton, S. P., D. Hill, and S. P. Carter. 1994. The abundance of river corridor birds in relation to their habitats: a modelling approach. *Journal of Applied Ecology* **31**: 313-328.

Schwartz, P., and M. Lentino. 1984. Reproducción de la Perdiz de Montaña, *Odontophorus columbianus.* (PT) Serie de Informes Técnicos DGSllA/lT/l 54. Caracas: MARNR.

Skutch, A. F. 1947. Life history of the Marbled Wood-quail. *Condor* **49** (6): 217-232.

StatSoft Inc. 1998. STATISTICA for Windows. Tulsa, OK.

Stiles, G., and A. F. Skutch. 1989. *A guide to the birds of Costa Rica*. Comstock Publishing Associates, New York, NY.

Weigand, J. P. 1980. Ecology of Hungarian Partridge in northcentral Montana. *Wildlife Monograph* **74**:106 pp.

Welty, J. C. 1982. *The Life of Birds.* Philadelphia: Saunders College Publishing, Philadelphia, PA.

Wilson, M. H., and J. A. Crawford. 1987. Habitat selection by Texas Bobwhites and Chestnut-bellied Scaled Quail in south Texas. *Journal of Wildlife Management* **51**(3):575582.

Woodroffe, G. L., J. H. Lawton, and W. L. Davidson. 1990. The impact of feral mink *Mustela vison* on water voles *Arvicola terrestris* in North Yorkshire Moors National Park. *Biological Conservation* **51**: 49-62. ❒

Rapid Assessments and Conservation of Quail along Three Altitudinal Transects in the Colombian Andes

Paul G. W. Salaman[1], Thomas M. Donegan[2], Andres M. Cuervo[3] and José M. Ochoa[3]

[1]Edward Grey Institute of Field Ornithology, Zoology Dept, Oxford University, OX1 3PS, UK
[2]Christ's College, Cambridge University, CB2 3BU, UK
[3]Dpto. de Biología, Universidad de Antioquia, AA 1226, Medellín, Colombia

Valoraciones Rápidas y Conservación de Odontophoridos a lo largo de Tres Transectos Altitudinales en los Andes Colombianos - Las prospecciones de Valoración Biológica Rápida fueron dirigidos por equipos de ornitólogos en diferentes cotas a lo largo de tres transectos altitudinales, uno en cada una de las Cordilleras Occidentales, Centrales y Orientales de Colombia. Las prospecciones se realizaron en las siguientes localidades: (I) siete sitios a 180–3500 m a lo largo de la vertiente Pacífica Andina en el Dpto. Nariño; (II) siete sitios a 350–2500 m a lo largo de la vertiente Amazónica de la Cordillera Oriental en la Serranía de Los Churumbelos, Dpto. Cauca; y (III) tres sitios a 300-1550 m en la vertiente Caribeña de la Cordillera Central, Dpto. Antioquia. El trabajo de campo incluyó el uso de redes de niebla y observaciones de campo a través de 2-5 observadores, complementado con entrevistas informales con personas locales (principalmente cazadores). Un total de 6 especies de Odontophoridos se registraron en los tres transectos Andinos. Muy importante y nueva información ecológica y de distribución ha sido obtenida para algunas de las especies en peligro y menos conocidas del Neotrópico, especialmente *Odonthophorus hyperythrus* y *O. melanonotus.* Con el beneficio de información biológica adicional de otros taxa (aves y no aves), se han producido valoraciones de conservación para cada uno de las tres regiones estudiadas. Siguiendo nuestra investigación, se han establecido reservas naturales en el transecto Nariño (Río Ñambí) y Noreste de Antioquia (La Forzosa) y una extensión del Parque Nacional se propone abarcar partes de la Serranía de Los Churumbelos, como resultado de nuestro trabajo allí.

Rápido Levantamento e Conservação de Odontophoridos em Três Transectos Altitudinais nos Andes Colombianos - Rápidos levantamentos biológicos foram conduzidos por equipes de ornitologistas em degraus elevacionais ao longo de três transectos altitudinais, um na Cordilheira Colombiana Oeste, outro na Central e outro na Leste. Os estudos foram conduzidos nas seguintes localidades: (I) sete locais a 180 – 3500 m ao longo da encosta Andina Pacífica em Nariño; (II) sete locais a 350 – 2500 m ao longo da encosta amazônica da Cordilheira Leste em Serranía de los Churumbelos, Cauca; e (III) três locais

[1]E-mail: Salaman@ognorhynchus.com

a 300 - 1550 m na encosta caribenha da Cordilheira Central, em Antioquia. A metodologia de trabalho de campo incluiu rede de neblina e observações em campo por 2 a 5 observadores e entrevistas informais com pessoas das comunidades locais (principalmente caçadores). Um total de 6 espécies de Odontophoridos foram registradas nos três transectos andinos. Foram coletadas novos dados de distribuição e informações ecológicas para muitas espécies neotropicais pouco conhecidas, especialmente *Odontophorus hyperythrus* e *O. melanonotus*. Com a informação biológica adicional para outros táxons (aves e não-aves), planos de conservação têm sido elaborados para cada uma das três regiões estudadas. Após nossas pesquisas serem feitas, reservas naturais foram estabelecidas no transecto de Nariño (Rio Ñambí) e ao noroeste de Antioquia (La Forzosa) e uma extensão de um Parque Nacional foi proposta para englobar partes da Serranía de los Churumbelos.

ABSTRACT

Rapid Biological Assessment surveys were conducted by teams of ornithologists at elevational steps along 3 altitudinal transects, 1 on each of the Western, Central and Eastern Cordilleras of Colombia. Surveys were conducted at the following locations: (1) 7 sites at 180–3,500 m along the Pacific Andean slope in Dpto. Nariño, (2) 7 sites at 350–2,500 m along the Amazonian slope of the Eastern Cordillera in Serranía de los Churumbelos, Dpto. Cauca; and (3) 3 sites at 300-1,550 m on the Caribbean slope of the Central Cordillera, Dpto. Antioquia. Fieldwork methodologies included mist netting and field observations by 2-5 observers, supplemented with informal interviews with local people (mainly hunters). A total of 6 quail species were recorded across the 3 Andean transects. Much new distributional and ecological information have been collected on some of the Neotropics' most poorly known and endangered species, notably Chestnut Wood-quail *(Odontophorus hyperythrus)* and Dark-backed Wood-quail *(O. melanonotus).* With the benefit of additional biological information for other taxa (avian and non-avian), conservation assessments have been produced for each of the 3 regions. Following our research, nature reserves have been established in the Nariño transect (Río Ñambí) and Northeast Antioquia (La Forzosa) and a National Park extension is proposed to encompass parts of Serranía de los Churumbelos following our work there.

Colombia lies in the northwest corner of South America at the base of the Central American isthmus. It stretches from the Caribbean Sea to the Río Amazon, and from the Río Orinoco to the Pacific Ocean, covering 1,141,748 km^2. The western half of the country encompasses the northern Andean mountain chain, featuring the most complex topography in South America. This topography supports an extremely wide variety of ecosystems and high levels of endemism localized to specific parts of the country. Colombia contains a large proportion of the planet's biodiversity, including ~20% of all bird species (1,850 species), in what is just 0.77% of the Earth's land surface.

Quail are ecologically important primary forest birds, but are highly susceptible to human disturbance from both hunting and habitat destruction. Odontophoridae in the northern

Neotropics include a large number of range restricted Sub-Andean and Andean forest-dependant species, many of which are threatened. They are also a frequent target of hunting and are highly sensitive to human impact.

Because of the conservation priority of many quail species, and their potential use as 'figurehead species', targeted searches were made for species potentially present at study sites. The projects, Colombia '91, Colombia '92, Colombia '93, Colombia '98 and Colombian EBA Project '99 were Anglo-Colombian student initiatives, which conducted rapid biodiversity surveys and conservation assessments along 3 transects in the Colombian Andes: (1) Western Nariño (West Andes), (2) Serranía de los Churumbelos (East Andes) and (3) Northeast Antioquia (Central Andes).

STUDY REGIONS

I. Western Nariño – Pacific Coast of the Western Andes

The Chocó Endemic Bird Area (EBA), situated on the Pacific slope of the Western Andes in Colombia and northwestern Ecuador, contains the most species rich biological communities in the world (Salaman, 1994). It supports 64 endemic bird species and over 150 endemic bird taxa, more than any mainland EBA in the world. Seventeen of these endemic species are threatened. The Chocó EBA is still considered 1 of the least biologically known regions in the Neotropics. However, deforestation accompanying Colombia's rapid demographic and economic growth is estimated at 100,000 ha/year for southwestern Colombia alone (Salaman, 1994). The Chocó EBA is consistently considered the world's most biologically unique and critically endangered ecosystem by global and regional conservation assessments – it is the world's most important conservation priority.

Seven study sites along the western slope of the Western Andes in western Nariño, encompassed the following broad biogeographical zones:

• Equatorial Pacific plain - extends from the Pacific Ocean coast eastwards across the lowland humid forest plain to the base of the Andean foothills (0-500 m).

• Sub-Andean foothills - rising from the wide Pacific plain at ~500 m, the Sub-Andean foothills lie in between with the lowlands and base of the High Andes which start at ~2,000 m.

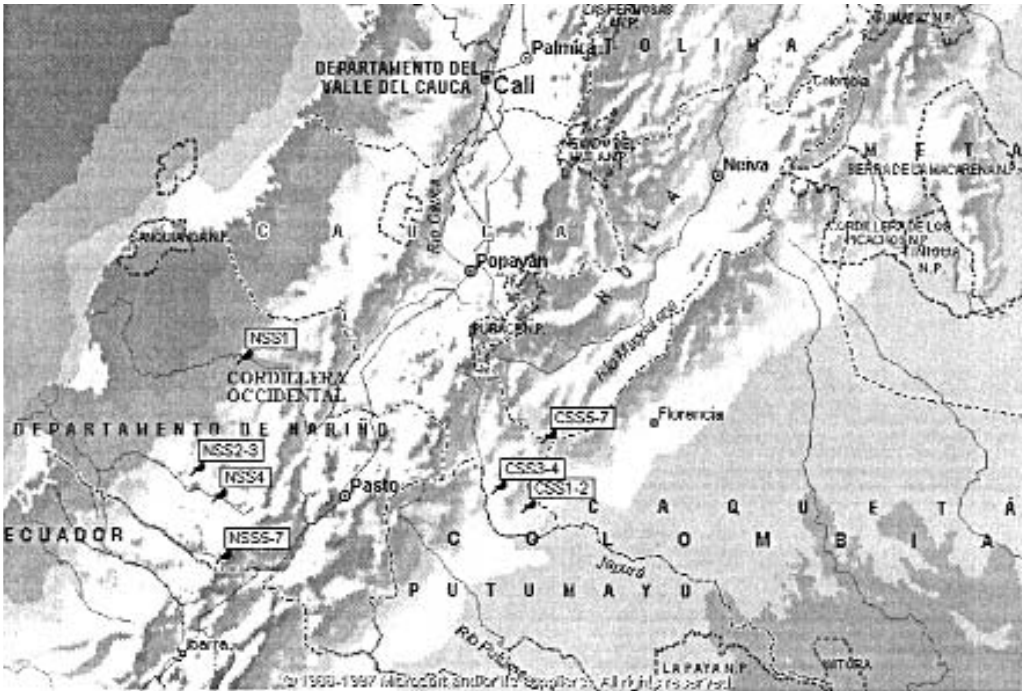
• High Andes - above 2,000 m in the Nudo de los Pastos Massif, being dominated by volcanoes Cumbal, Chiles, Galeras and Azufral, which all tower over 4,000 m.

Western Nariño Study Sites

A total of 7 Nariño Study Sites (NSS) were investigated during 3 expeditions (Fig. 1). Detailed descriptions of physical geography, vegetational types, itinerary of dates and additional information are described in Salaman (1994).

NSS1: Laguna del Trueno (29 July-14 August 1993), Municipality of Barbacoas, Nariño (1° 21' N, 77° 57' W; 180 m); tropical lowland humid forest. This site is by a large lake situated in one of the most remote locations in western Colombia. There has been little human activity around the lake, owing to its inaccessibility and local myths concerning it. An extensive tract of pristine tropical, very humid forest encompasses the lake and surrounding foothills, with many evergreen emergent and canopy trees > 35 m high.

Figure 1. Nariño and Churumbelos study regions



NSS2: Patio (2-18 August 1992, and 11-24 July 1993), Junín, Municipality of Barbacoas, Nariño (1° 27' N, 78° 01' W; 500 m); tropical foothill pluvial forest. A small clearing 15 km north of Junín is set in moderately undisturbed forest on the Andean foothills beside the Río Ñambí. Fieldwork was conducted in a large block of primary tropical pluvial forest around a small clearing and tall secondary forest. The tropical pluvial forest is characterized by a high canopy (> 25 m), high floral diversity, but lower epiphyte density than NSS3.

NSS3: Río Ñambí (7 August-3 September 1991 and 4-25 July 1992), Altaquer, Municipality of Barbacoas, Nariño (1° 18' N, 78° 05' W; 1,400 m); premontane pluvial forest (7,100 mm/yr rainfall). Located 2.5 km from El Barro on the Pasto-Tumaco highway. This habitat is unique and only found in 2 narrow bands within the Chocó EBA. The Río Ñambí area supports predominantly primary forest, which is characterized by a moderately high canopy level (~20-25 m), very high levels of epiphytes and many palms. The high representation of palms is typical for many pluvial forests in the Neotropics.

NSS4: La Planada Nature Reserve (25 July-4 August 1991), Municipality of Ricaurte, Nariño (1° 07' N, 77° 54' W; 1,850 m), upper premontane very humid forest (4,600 mm/yr rainfall). La Planada NR (1,800 ha) is located above Ricaurte, on a large plateau of largely secondary forest and surrounded by forested slopes that descend into the Río Güiza and Río Flora. The forests contain a high species diversity and local plant endemism with an abundance of epiphytes (particularly Orchidaceae).

NSS5: San Felipe (24 August-2 September 1992), Volcán Chiles, Municipality of Chiles, Nariño (0° 51' N, 78° 07' W; 2,250 m); lower montane humid forest. Located 15 km west of El Tambo on the Chiles-Mayasquer road, San Felipe consists of 2 small fragmented montane humid forest patches, in a steep river valley. The forests were heavily disturbed, being deforested for timber, firewood, and pasturelands. The montane humid "cloud" forest is characterized by a low canopy (~10-20 m), heavily festooned with epiphytes and scattered patches of mountain bamboo (*Chusquea* sp.).

NSS6: La Ceja (5-14 September 1992), Volcán Chiles, Municipality of Chiles, Nariño (0° 50' N, 78° 03' W; 2,700 m); montane humid "cloud" forest. La Ceja is a small forest plateau above the Río Blanco valley, 10 km west of El Tambo, which has been deforested with the exception of a small ~50 ha sized montane, very humid "cloud" forest fragment. The forest is characterized by a gnarled and stunted appearance, low canopy (10 - 15 m), and extremely heavily moss- and epiphyte-laden trees. Dense mountain bamboo (*Chusquea* sp.) thickets dominate the understory.

NSS7: El Tambo (7-23 July 1991), Volcán Chiles, Municipality of Chiles, Nariño (0° 52' N, 77° 58' W; 3,100-3,800 m); upper montane humid forest, wet páramo and *Polylepis* woodland. Located 5 km northwest of the Volcán Chiles peak, the site consists of *Polylepis* woodland and wet páramo grassland in the Río Blanco watershed. Fieldwork was undertaken in 3 main areas: treeline of humid montane forest (3,100 m), 2 large fragments of *Polylepis* woodland (3,400-3,600 m), and the surrounding extensive area of páramo (3,100-3,800 m). The forest is characterized by a low canopy, gnarled and stunted appearance with many epiphytes.

II. Serranía de los Churumbelos – Amazonian Slope of the Eastern Andes

The Eastern Andes extend from Serranía de Perijá (10° 30' N) to Mocoa (1° 09' N), with an average ridgeline of 2,500 m, and is the widest of the 3 Andean cordilleras that characterize Colombia. At ~1° 32' N, the Eastern Andes divide, with the main ridge, Picos Fragua, linking to the Cordillera Central to form the watershed for the headwaters to the Río Magdalena. A second range spurs southwards and abruptly ends at the Río Caquetá to form the Serranía de los Churumbelos. This southern extremity of the Eastern Andes is 60 km long, 25-30 km wide at the base, and rises to ~2,800 m, with an average ridgeline of 1,500 m. The serranía is a sedimentary anticline characterized by limestone remnants forming large flat "mesetas." The eastern flank abruptly rised from the flat Amazonian plain at 250 m and ascends to over 1,500 m altitude.

Serranía de los Churumbelos Study Sites

During July-August 1998 and 1999, 7 largely primary forest study sites (CSS) within 1 continuous tract of primary forest covering the serranía were investigated (Fig. 1). Intensive observation and mist netting surveys were conducted for an average 6 days, at ~300 m elevational steps from 350-2,450 m. Detailed descriptions of physical geography and vegetational types, itinerary of dates and additional information are described in Salaman and Donegan (in prep.).

CSS1: Puerto Bello (14 - 21 July 1998), Municipality of Piamonte, Dpto. Cauca (1° 08' 14" N, 76° 16' 55" W; 350 m); tropical lowland humid forest (~3,000 mm rainfall/year) situated in the westernmost Amazonian lowlands, the base of the Churumbelos foothills. A new road had been constructed to the hamlet of Puerto Bello in the last 5 years and deforestation was evident along the roadside. A 1,200 m transect extended from the forest edge through a transition of tall secondary forest to primary forest with a canopy at ~30 m.

CSS2: Río Nabueno (24-30 July 1998), Municipality of Piamonte, Dpto. Cauca (1° 06' 48" N, 76° 24' 86" W; 700 m); an extensive tract of primary tropical foothill humid forest (~4,000 mm rainfall/year) on a steep eastern flank of Serranía de los Churumbelos. An old hunters' trail climbing steeply from Río Nabueno to a flat ridgetop formed the transect. The structure of the vegetation is strongly influenced by the high rainfall and steep terrain, resulting in a relatively low canopy (~20 m) and dense understory.

CSS3: Alto Río Hornoyaco (3-9 August 1998), Municipality of Santa Rosa, Dpto. Cauca (1° 13' 59" N, 76° 31' 58" W; 1,100 m); tropical premontane very humid forest (~ > 4,000 mm rainfall/year). The southern base of Serranía de los Churumbelos rises steeply from the Caquetá valley and is heavily dissected by several southward-flowing streams, including the Río Hornoyaco. A 700 m transect ran through 400 m of primary forest on steep slopes, then into dense young secondary forest (3-5 year growth) up to a 4-ha pasture clearing. This forest was similar in floristic composition and stratifications to montane forest.

CSS4: Villa Iguana (11-17 August 1998), Municipality of Santa Rosa, Dpto. Cauca (1° 14' 18" N, 76° 31' 11" W; 1,450 m); tropical lower montane humid (cloud) forest (~3,000 mm rainfall/year). The transect extended 800 m over a plateau between 2 mesetas, and brief surveys of Alto Cagadero meseta at 1,600 m were also undertaken. The forest at this site contains many elements characteristic of higher elevations, such as high abundance and diversity of vascular epiphytes, bryophytes and a low canopy (~12 m).

CSS5: Nabú (4 - 9 July 1999), Municipality of Santa Rosa, Dpto. Cauca (1° 36' N, 76° 16' W; 1,900 m); tropical lower montane humid forest (~2,500 mm rainfall/year). The northwestern flank of the Serranía de los Churumbelos is flanked by the Río Villalobos and Mocoa-Pitalito Highway. Our transect extended 800 m along a ridge of primary forest characterized by a dense understory, dense arboreal epiphytes, and a canopy of ~20-25 m dominated by white oak (*Quercus* spp.).

CSS6: Tatauí (10-14 July 1999), Municipality of Santa Rosa, Dpto. Cauca (1° 37' N, 76° 16' W; 2,250 m); tropical montane cloud forest (~2,500 mm rainfall/year). Ascending 2 km above CSS5, a 600 m transect along a flat ridgeline was studied. This site's dense, low understory (~3 m high) was dominated by terrestrial bromeliads and *Sphagnum* spp. mosses, had a canopy of ~7 m and is a stunted forest physiognomy, similar to treeline elfin forest influenced by perpetual mists and strong lateral winds.

CSS7: El Dorón (16-20 July 1999), Municipality of Santa Rosa, Dpto. Cauca (1° 40' N, 76° 14' W; 2,500 m); tropical upper montane humid (cloud) forest (~2,000 mm rainfall/year). Situated on a ridge at the head of the Serranía de los Churumbelos and the Río Magdalena valley, our transect ran from a clearing through primary forest with some selective logging. The forest physiognomy was dominated by stunted white oak to ~15 m with large canopy epiphyte burdens, and an understory dominated by flowering Ericaceae, epiphytes and bushes.

III. Northeast Antioquia – Caribbean Slope of the Central Andes

The Central Cordillera of Colombia is a 750 km long mountain range that spurs northward from the bifurcation of the northern Andes at the Macizo Colombiano (~2° N). The Central Cordillera's diverse topography, broad altitudinal span and great climatic variations support a wide variety of ecosystems and associated high levels of endemism. Topographical and ecological isolation from other Andean ranges by the Cauca and Magdalena river valleys, which flank the Cordillera, has accentuated local endemism. Above 1,000 m amsl, the ~41,000 km^2 Central Cordillera supports 29 Endemic Bird Area species: one of the greatest concentrations of montane, range restricted bird species in the world.

The Central Cordillera's rich volcanic soils and mild climate have attracted human colonization and exploitation for many centuries. Cultivation of Colombia's most important economic commodity, coffee, is based on the subtropical slopes of the Central Cordillera. Today, this supports the greatest population concentration in the country, including major cities such as Medellín, Ibagué, Pereira and Armenia. During the past century, relatively good infrastructure has encouraged many bird collectors to explore the Central Cordillera.

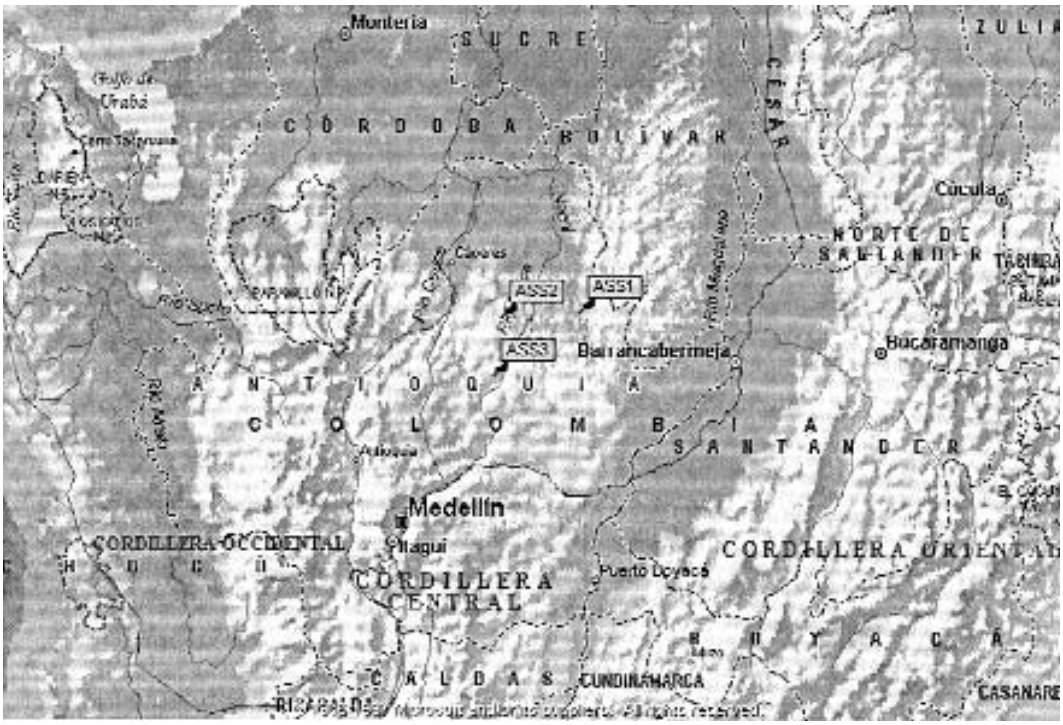
Northeast Antioquia Study Sites

Three Antioquia study sites (ASS) were investigated in 1999 (Fig. 2). Details of other biological and conservation results are presented in Donegan and Salaman (1999).

ASS1: Apollo 13 (3-8 August 1999), Finca La Esperanza, Vereda Río Bagre, Municipality of Segovia, Dpto. Antioquia (7° 21' 14" N, 74° 40' 95" W; 300 m); lowland humid forest (~2,000 mm rainfall/year) located southeast of Puerto Lopez. A lowland forest patch (~1,500 x 500 m) straddling 3 ridges formed the basis of our transect. The canopy was ~35 m with emergents to ~40 m. The understory was sparsely vegetated, although characterized by dense *Heliconia* spp. thickets, spiny palm clusters, and a low diversity of epiphytes.

ASS2: Alto Los Tarros (20-24 August 1999), Reserva Regional Bajo Cauca-Nechí, Vereda La Tirana, Municipality of Anorí, Dpto. Antioquia (7° 18' 49" N, 75° 05' 85" W; 800 m); foothill humid forest (~3,000 mm rainfall/year), lying between the Río Anorí and Río Nechí in an extensive forest fragment (~45,000 ha). The forest physiognomy is similar to SS1, although with lower vegetation strata (canopy ~30 m), more broken canopy by treefalls on steep slopes, higher epiphyte diversity and notably more understory woody stem plants.

Figure 2 Study sites on the Caribbean slope of the Central Andes



ASS3: Alto Combate (26-29 August 1999), Reserva Regional La Forzosa, Vereda Las Ánimas, Municipality of Anorí, Dpto. Antioquia (6° 59' 58" N, 75° 08' 33" W; 1,550 m). Premontane humid forest (~3,000 mm rainfall/year). The Quebrada La Soledad watershed, beside the Medellín–Anorí road, encompasses 300 ha of primary forest. Surveys were conducted through the dense understory of ridgetop forest that was stunted and gnarled, and influenced by strong lateral winds (reminiscent of CSS6), with a canopy height from 5-8 m, and epiphytes abundant, especially mosses, lichens and bromeliads. Vegetation in the valleys as typical of forest at 1,500 m., with a canopy to ~20 m and a moderately dense understory composed of woody stem bushes and sparse herbaceous cover, with a moderate abundance of arboreal epiphytes.

SURVEY METHODS

We used mist nets, sound recording and direct observation along transects at each site with the objectives of: (1) collecting standardized and replicable data rapidly, (2) documenting the species composition and biological variation, and (3) producing conservation priorities across the region. To determine the composition of bird communities at each study site, a 3-fold standardized effort was used by 2-5 ornithologists: Western Nariño (PGWS, David Gandy, Anthony Payne, and Carl Downing), Serranía de los Churumbelos (PGWS, TD, AC, Liliana Dávalos and Dan Davison); and Northeast Antioquia (PGWS, TD, AC, JO). The following methodology is relatively simple and easily used:

1. Intensive diurnal non-systematic field observations, supplemented with sound recording. Observations were maximized in the morning (0530-1000 h) and late evening (1700-2000 h).

2. Diurnal mist netting (up to 450 m length of net) at each site: This method consistently proved indispensable in surveying understory bird species. However, it unlikely of such relevance to quail, although 2 species of *Odontophorus* were caught.

3. Interviews with local people, especially hunters: Interviews focused on recognisable and frequently hunted species, principally quail. Local names were transcribed using plates from Hilty and Brown (1986).

The 3 methods complemented each other well to produce a rapid and reliable firsthand assessment of each site by combining the aims of producing standardized field data with a targeted search of threatened species. All sound recordings have been deposited with Wildlife Sounds (The British Library, London) and selected photographs deposited with VIREO (Philadelphia, PA, USA).

Although we attempted to produce population estimates at some sites, it quickly became apparent that various population assessment methods were unsuitable for such a rapid assessment. Point counts and variable circular plots would be inaccurate in such a short period of time, and would create biases against elusive quail. With targeted intensive, non-systematic observation data relatively constant at each site, a more complete inventory was achieved without the constraints of routine transects. However, meaningful encounter rates in terms of individuals were noted where possible in terms of Mist Net Hours (MNH) or encounters/day of observation.

RESULTS

I. Western Nariño - Pacific slope of the West Andes

In Western Nariño, a total of 525 bird species were recorded in 348 person-days of fieldwork (148 days), and included 3 Odontophorids (Table 1).

In the lowlands, widescale species such as Rufous-fronted Wood-quail *(Odontophorous)* were recorded infrequently in primary forest. *O. erythrops* is replaced above 1,000 m by the threatened Dark-backed Wood-quail *(Odontophorous melanonotus)*, which is locally common from 1,200 -1,900 m in primary forest. Much new breeding biology and ecology information has been collected on *O. melanonotus*. Details of all biological results from these sites are found in Salaman (1994).

Table 1. Quail records at 7 study sites in Western Nariño - West Andes in 1998 and 1999

Species	NSS1	NSS2	NSS3	NSS4	NSS5	NSS6	NSS7
Odontophorous erythrops	U	R					
Odontophorous melanonotus			C	C			
Rynchortyx cinctus	U						

Sites: NSSI = Laguna del Trueno (170 m), NSS2 = Patio - Municipio Barbacoas (500 m), NSS3 = Rio Nambi - Municipio Barbacoas (1,400 m), NSS4 = La Planada N.R. - Municipio Ricaurte (1,850 m), NSS5 = San Felipe - Municipio Chiles (2,250 m), NSS6 = La Ceja - Municipio Chiles (2,700 m), NSS7 = El Tambo - Municipio Chiles (3,100-3,500 m).

Abundance: R = Rare (only 1 observation), U = Uncommon (2-10 records), C = Common (1-10 individuals daily).

II. Serranía de los Churumbelos - Amazonian slope of the East Andes

A total 421 bird species were recorded during 192 person-days throughout the Serranía. These included 2 quail species (Table 2).

Table 2. Quail records at 7 study sites in Serranía de los Churumbelos - East Andes in 1998 and 1999

Species	CSS1	CSS2	CSS3	CSS4	CSS5	CSS6	CSS7
Odontophorus gujanensis	C	C					
Odontophorus hyperythrus				R	U	U	C

Sites: CSSI = Puerto Bello (300 m), CSS2 = Rio Nabueno (700 m), CSS3 = Alto Rio Hornoyaco (1,100 m), CSS4 = Villa Iguana (1,450 m), CSS5 = Nabú (1,900 m), CSS6 = Tatauí (2,200 m), CSS7 = El Dor6n (2,500 m).

Abundance: R = Rare (only 1 observation), U = Uncommon (2-10 records), C = Common (I-10 individuals daily).

Marbled Wood-quail *(Odontophorus gujanensis)* was confirmed below 700 m. The near-threatened and Colombian endemic Chestnut Wood-quail *(Odontophorus hyperythrus)* was heard at sites from 1,400-2,500 m. Details of other biological results are presented in Salaman and Donegan (in prep.).

III. Northeast Antioquia ~ northern slope of the Central Andes

In Northeast Antioquia, a total of 318 bird species were recorded in 60 person-days of fieldwork. Despite spending considerably less fieldwork time here than at the previous transect, 4 species of quail were registered (Table 3).

Table 3 - Quail records at 5 study sites in Northeast Antioquia - Central Andes in 1998 and 1999

Species	ASSA	ASSB	ASS1	ASS2	ASS3
Colinus cristatus	C				
Odontophorus gujanensis			U	S	
Odontophorus hyperythrus					S
Rynchotyx cinctus				R	

Sites: ASSA = Puerto Lopez - 2nd growth (200-400 m), ASSB = Anori to Cruces - 2nd growth (600-1,600 m), ASS I = Finca La Esperanza - Segovia (350 m), ASS2 = Alto los Tarros - Municipio Anori (700 m), ASS3 = Reserva La Forzosa - Anori (1,550 m). Abundance: R = Rare (only 1 observation), U = Uncommon (2-10 records), S = Seen regularly (every 1-2 days), C = Common (1-10 individuals daily), H = Unconfirmed records (reported by local people); C = Photographed in captivity.

In the lowlands, Crested Bobwhite *Colinus cristatus* was recorded in degraded habitats (i.e., pasture) and secondary forest. Marbled Wood-quail was notably common in the 2 lowland sites (300 and 800 m), but was replaced by Chestnut Wood-quail at 1,500 m as in the Churumbelos. General ornithological results are presented in Salaman et al. (1999).

Species Accounts

For each species, our data is presented, followed by a conservation assessment of the species needs.

Crested Bobwhite *(Colinus cristatus)* - Common and widespread in Colombia. Several birds were seen beside and along the road between El Bagre and Puerto López in pastureland.

Marbled Wood-Quail *(Odontophorus gujanensis)* - This species is not considered at risk, being common throughout the humid forest lowlands of Amazonia and northern Colombia (Hilty and Brown, 1986). Large groups (6-10 individuals) were observed on several occasions foraging in the leaf litter of primary forest at CSS1 and CSS2, and also at ASS1 in disturbed primary forest. Flocks were often encountered along mist net rides, and on several occasions were flushed into nets, though they frequently "bounced out" and escaped. At CSS2, 2 individuals were successfully captured in mist nets (mean = 316 g, S.D. = 1.41).

Rufous-fronted Wood-Quail *(Odontophorous erythrops)* - This pacific lowlands specialist was heard calling and tape recorded at dawn in primary forest at NSS1 (uncommon) and NSS2 (rare).

Chestnut Wood-Quail *(Odontophorus hyperythrus)* - The near-threatened *O. hyperythrus* is a Colombian endemic, restricted to 3 disjunct subpopulations in the Western Cordillera, northwestern Central Cordillera and head of the Magdalena valley in Huila. It is uncommon and local in montane humid forest at elevations of 1,600-2,700 m (Hilty and Brown, 1986). The total population is unknown, but has been estimated to total < 10,000 in 3 subpopulations (McGowan et al., 1995), although this figure is considered to be greatly underestimated (PGWS pers. obs.). Further degradation because of agricultural expansion is projected for the Central Andes, and slopes of the Cauca and Magdalena Valleys are now characterized by pasture, coffee, banana, and sugarcane plantations and a few remnant (largely secondary) forest patches (Collar et al., 1992; Wege and Long, 1995).

This species was identified by hunters as being present about CSS4, CSS5 and CSS6. We confirmed the presence of the species at CSS4 (heard), CSS5 (seen and heard), CSS6 (heard) and CSS7 (heard and tape recorded). One hunter distinguished between this species and similar *O. gujanensis,* correctly pointing out the elevational segregation of the 2 species. The species was regularly recorded almost daily in the morning at CSS7, with probably 2 family groups occurring along the 1,000 m transect of heterogeneous forest dominated by the Colombian endemic oak, *Quercus humboldtii. O. hyperythrus* was commonly heard by PGWS in humid primary forest in July 1994 at PNN Cueva de los Guácharos, Dpto. Huila (1° 35' N, 76° 00' W).

At least 2 flocks of *O. hyperythrus* were audible from the ridgetop section of our transect at ASS3. Groups were heard calling regularly, especially in the morning (0600 - 0800 h). Further records from the same fragment (Cuervo et al., 1999) show that the species is present throughout the reserve from 1,500-1,850 m. La Forzosa is thus a critically important site for the particularly endangered Central Andean subpopulation.

Recent records of *O. hyperythrus* from the Western Andes population come from Tambito Nature Reserve, Pacific slope of the Cordillera Occidental, Dpto. Cauca (2° 32' N, 77° 00' W) at 1,800-2,000 m, where individuals can be heard regularly and are considered fairly common (TMD, PGWS). However, *O. hyperythrus* is replaced in Nariño by Dark-backed Wood-quail, which was recorded at NSS3 and NSS4.

These 3 locations redefine the northern, western and southern limits of this species' range. The Churumbelos records present a small geographical range extension from populations at the head of the Magdalena valley, but a more noteworthy ecological extension, being the first records for the eastern (amazonian) slope of the East Andes. As the head of the Magdalena Valley appears not to be the southern limit of this subpopulation, the species' range may extend further south into the Dpto. of Nariño and Putumayo and possibly into

northern Ecuador. Our records from Antioquia represent a northerly range extension for this Colombian endemic, with previous records only as far north as Medellín in the Central Cordillera. Records from Tambito Nature Reserve, Cordillera Occidental are the southwesternmost records, a small range extension from PNN Munchique.

Dark-backed Wood-Quail *(Odontophorus melanonotus)* - This species, a wet subtropical forest specialist found from 1,100-1,900 m, is endemic to the western Andes of southwestern Colombia and northwestern Ecuador. This species is fairly common (by voice) in wet primary forest where there is little or no hunting pressure. The population is estimated to be between 10,000-20,000 individuals, although declining over its extremely restricted range.

Records of pairs and family groups of up to 10 birds were observed daily or located by their characteristic 'corcovado' song at NSS3. The species was fairly common at NSS4. Groups are particularly vocal at dawn during the wet season (March-June), when it is considered that an area of 100 ha supports ~2-3 groups (probably at least 2-3 pairs), exclusively in undisturbed, closed canopy forest. Chicks have been observed and caught in July and August. Birds feed on terrestrial invertebrates and fruits.

On 19 August 1993, a family of 5 adults and at least 3 newly hatched chicks (~2 days old) were encountered in the dense undergrowth of primary forest at NSS3. Several adults were distressed and aggressive, calling frantically (recordings deposited with Wildlife Sounds, The British Library), and approached PGWS to < 1 m with wings outstretched. A description and photographs (deposited with VIREO) were taken of 1 chick that was caught. Three adults were caught at NSS3 at dawn (on 2 mornings), probably descending from roosting trees. Each bird was measured (mean wt = 256 g), banded and released after photographs.

Deforestation is the principal threat to this species which is sensitive to human intervention. It is regularly shot for food, although largely opportunistically, and not targeted for hunting. Large wilderness areas remain in the species' narrow elevational range, but road infrastructure improvements and developments coupled with commercial logging pressures in the past decade have surely resulted in a sharp decline for the species.

Tawny-faced Quail *(Rhynchortyx cinctus)* - This secretive, poorly known and uncommon species is known from the Pacific slope of Honduras south to northwest Ecuador with records extending across the humid lowlands of northern Colombia (Hilty and Brown, 1986). At ASS2, a pair was observed foraging along the primary forest transect, and when surprised, they flew into dense understory calling soft whistles. Pairs and small groups were observed uncommonly in mature, closed-canopy forest with open understory at NSS1.

CONSERVATION PRIORITIES

Western Nariño

The forests of the southern Chocó EBA have long been sustainably used by the Awá indigenous people. However, upon the completion of the Pasto-Tumaco Highway in 1995, along with other projects of the Colombian Government's "Plan Pacifico" development effort, the region rapidly began to be used unsustainably. Its megadiversity is being exploited by the loss of large quantities of precious metals, minerals, and fine timbers. Within the past decade, the forest wilderness of the Colombian Pacific has radically changed as road construction, associated colonization and deforestation, and economic development escalate uncontrolled. At present, there is an inadequate proportion of the Chocó EBA foothill and premontane forests protected, despite this region supporting one of the world's biologically richest centers of endemism.

The Pasto-Tumaco Highway has seemingly brought prosperity and greater material wealth to those along its path. However, the environmental devastation it has wreaked is irreversible. After the removal of timber, extreme rainfall rapidly erodes the volcanic-enriched soils. Brief prosperity vanishes and local people are left even deeper in poverty. To survive under these harsher circumstances, people have leaned more heavily on the remaining forests, logging for cash and hunting for food.

Conservation feasibility - The extraordinary diversity and richness of the Chocó EBA's fauna and flora in western Nariño reflect both its geographical position and isolation on the equatorial Andes and extreme levels of annual rainfall. The resulting diverse topography and lush vegetation on the Pacific slope of the Andes have created a dense stratum of strikingly unique habitats with associated dependent fauna.

Interviews with hunters demonstrated that populations of *Odontophorous* species were more abundant 20 years ago and that hunting for food with shotguns resulted in a steep decline in numbers in even primary forests. The montane forest sites of NSS5, NSS6, and NSS7 have little value for quail. NSS4 (La Planada Nature Reserve) has been protected for almost 2 decades and contains a healthy population of *O. melanonotus* as well as many other endemic bird species. Unfortunately, the reserve is increasingly isolated as forests outside of the reserve's "zone of influence" have largely been heavily exploited for timber and colonized.

The wettest forests (NSS2 and NSS3) support some of the greatest concentrations of endemic avifauna ever recorded on earth, and also populations of the endemic and threatened *O. melanonotus.* Priority should be given to these forests, as they are particularly susceptible to human degradation through deforestation, mining, and colonization.

As a result of the Rapid Biological Assessments, the Rio Ñambí Conservation Programme commenced with the creation of the Rio Ñambí Community Nature Reserve in 1992 with

the help of local and international conservation NGOs. The reserve is owned and managed by the community of Altaquer (a local village) and helps to protect a substantial population of *O. melanonotus.* Further ornithological research is recommended, concentrating on the lowland and foothill areas of western Colombia.

Serranía de los Churumbelos

The eastern slope of the Andes in Colombia was once an unbroken continuum of humid forest propagated by high precipitation from Amazonian convectional cloud formations. Exceptionally steep terrain has until recently deterred human colonization and development. Since the 1960s, the Colombian government undertook massive infrastructural development with road construction projects aimed at providing access to exploit the vast Llanos and Amazonian regions that comprise over half of Colombia's land area. Presently, 5 main routes penetrate the lowlands from the High Andean interior, with a major highway being constructed along the entire eastern Andean foothills of Colombia that will connect Ecuador to Venezuela. Increased and improved access routes have stimulated the destruction of mature tropical forests for pasture lands and petroleum exploitation. Deforestation rates in lowland moist forest on foothills of the eastern Andes of Colombia are rapidly accelerating from 1.4% (1961-1979) to 4.4% (1979-1988) and are correlated with increasing human population density (Viña and Cavelier, 1999).

Despite mounting human pressures on the eastern slope of the Andes in Colombia, research activities have largely neglected this region, owing to fears regarding political instability and the widespread cultivation of coca. What is most disturbing is the lack of protected areas on the eastern slope of the Andes in southern Colombia. PNN Cueva de los Guácharos provides some protection, although it covers a small area (~5000 ha) and suffers greatly from illegal colonists (PGWS, pers. obs.). Furthermore, PNN Cueva de los Guácharos principally encompasses only montane humid forest with premontane and foothill forest unprotected; thus, the protected area is ineffective for seasonal altitudinal transients and migrants.

Fortunately, while much of the Andean Cordilleras and eastern Andean slopes have undergone irreversible changes, Serranía de los Churumbelos has largely avoided the catastrophic human impact that other regions have suffered. The large expanse of virgin tropical lowland to montane forests in the Serranía is extremely important. However, the Serranía de los Churumbelos is increasingly viewed as a treasure box of mineral (petroleum and precious metals) and natural resources (timber and rich organic soils for agriculture).

Mocoa has historically been a poor frontier town, owing to a treacherous and often impassable, single road access from Pasto, Nariño. However, within the last 10 years this has changed on completion of the Bogotá-Mocoa Highway. The final road section from Mocoa to Pitalito was a major breakthrough for the regional economy, allowing the fast and reliable transportation of goods from Mocoa to the heart of Colombia. A 10-year, sustained economic boom has attracted many immigrants that have colonized rural areas, including marginal lands on the fringe of Serranía de los Churumbelos. The most signif-

icant recent development is the development and ongoing paving of the Mocoa to Pitalito road, running parallel to the Serranía. This is scheduled to be completed by 2002 and will greatly facilitate rapid transportation links between Mocoa and the rest of the country, thus further stimulating economic growth and demand, particularly along the road from which CSS5-CSS7 were accessed. In addition, further road infrastructure projects are planned in the region, including a new major highway from the Ecuadorian border near Puerto Asís to Villavicencio. This proposed road would pass along the edge of the eastern base of the Serranía from Villagarzón to San José de Fragua and Florencia in Caquetá.

There is a very real sense of urgency for conservation action to be implemented now, if it is to be effective in the region. It is clear that unless we act soon, the lowland and highland forests of Serranía de los Churumbelos will shortly become the focus for large-scale deforestation and colonization with potentially profound affects on quail populations. The species most susceptible to these changes is the small disjunct population of *O. hyperythrus.* The most important sites for quail in the Churumbelos are those ranging from 1,500-2,400 m, where apparently healthy populations of *O. hyperythrus* still exist. The lowland sites are considered to be of less conservation concern for quail.

Conservation feasibility - The Colombian EBA projects demonstrate the conservation importance of Serranía de los Churumbelos for quail and potential looming threats. Considering these factors, we have proposed that legal protection in the form of establishing a protected area is the only option available to insure the future protection of the forests. It is considered vital to incorporate the entire altitudinal gradient from lowland humid forest to cloud forest, maximizing the biodiversity protected. Colonists dominate the peripheral zone of the Serranía and, once informed of the threats and value of the Serranía, tentatively appear supportive of protecting a core area.

The most feasible and practicable conservation action would be a significant southern extension of PNN Cueva de los Guácharos to encompass Picos Fragua down the central spine of los Churumbelos to the Río Caquetá. All of this land is property of the state (uncolonized and virgin forest) and largely non-conflictive with local communities that are currently only within a short distance from new roads bordering the mountain range. Importantly, the National Park could expand 20 fold (to over 100,000 ha.) with minimal increases of costs of infrastructure or administration.

The Ministerio del Medio Ambiente (MMA), who controls the designation of National Parks and state environmental policies, is now considering enacting this expansion of PNN Cueva de los Guácharos to encompass parts of the Churumbelos as proposed by the results of Colombia ’98 and Colombian EBA Project ‘99.

Northeast Antioquia

Few places in South America have sustained such extensive habitat modification as the Nechí EBA of Colombia. The mid to lower Río Magdalena and Río Cauca valleys have

been almost completely deforested, mainly for agriculture, from the 19th Century to the present day. The moist tropical forests of the coastal plains in northern Colombia have been subjected to extensive deforestation with almost complete forest clearance (Salaman et al., 1999). Two large humid forest fragments survive - the lowlands of Nudo de Paramillo (PNN Paramillo) and the west slope of Serranía de San Lucas. Sadly, old and new threats loom over these remaining forests and include:

- Human population pressures that have forced the conversion of marginal land for subsistence and cash crops.
- Multimillion-ounce gold discoveries on both the eastern slope (Dpto. Bolivar) and western slope (Antioquia, Dpto. Córdoba and Sucre) of Serranía de San Lucas have resulted in a massive and uncontrolled gold rush to previously inaccessible areas of the mountain range.
- Deforestation for timber and agriculture as well as hunting have drastically increased with the gold rush.
- Road and oil pipeline infrastructure projects continue to penetrate previously inaccessible wilderness areas.
- The present construction of the Urra II hydroelectric plant will flood the lowlands of PNN Paramillo, producing immediate changes (massive forest loss and fragmentation from flooding) and long-term changes (increased infrastructure development, colonization, and landscape modification). Furthermore, the future of the indigenous Emberà-Katìos, of southern Dpto. Córdoba poses a complex social and political problem for governmental decision makers.

The situation in the lowlands and foothills of Serranía de San Lucas is the making of an ecological catastrophe. Despite forest coverage maps suggesting continuous forest in northeast Antioquia and Sur de Bolivar, the region has been heavily fragmented within the past 5 years. Based on interviews with local people, aerial maps, and our own observations, we estimate that at least 30% of the forest extant in 1995 is now either deforested or heavily fragmented. Usually, colonization follows closely alongside roads. Forests do not open up until infrastructural improvements facilitate more rapid human access. However, in the San Lucas foothills, loggers are currently extracting timber from a distance up to 2-3 days horse ride from the nearest dirt road. Having walked for ~7 h from Puerto Lopez, we were only able to reach relatively small forest fragments at ASS1. This unprecedented rate of human intervention is being caused by a 'gold rush' of colonists to the zone. The gold rush population explosion has greatly contributed to uncontrolled and unsustainable pressures on remaining forests, particularly with hunting for food. Sadly, the eastern foothills of Serranía de San Lucas are now effectively 'gone.'

Colombia's major economic resource, coffee, is centred on the subtropical slopes of the Central Cordillera. A high human population density exists here. The subtropical forests of the zone have born the brunt of economic development and caused 16 of the Central Cordillera's 29 range restricted bird species to be considered globally threatened (Stattersfield et al., 1997). The plight of these species is directly reflected in continued severe landscape modification and lack of protected areas in the region. Furthermore, as

most of the few protected areas in the Central Cordillera are situated on the highest massifs dominated by páramo and snow-capped peaks (e.g., PNN Los Nevados), the subtropical forests remain at considerable risk. Less than 10% of original forest cover in the Central Cordillera remains (Henderson et al., 1991), but we estimate this figure to be closer to 4% between 1,000-2,000 m elevation, where only a few isolated forest fragments survive.

Conservation feasibility - *O. hyperythrus* is considered to be seriously at risk in the region and is restricted to the small 300 ha La Forzosa forest fragment (ASS3), which has already been purchased by CORANTIOQUIA as a nature reserve.

At present, the current authorities in the zone, the insurgent ELN (National Liberation Army) guerrilla, have developed several conservation-minded initiatives, which will insure some degree of protection to biological communities at least in the short-term. The illicit coca *(Erythroxylon* spp.) is not grown on the western slopes of Serranía de San Lucas because of insurgent group prohibition. Hunting of certain endangered species (e.g., *Tapirus*) has been prohibited. Severe fines are enforced for breach of these "regulations." Furthermore, an ELN designated and protected nature reserve in central-south Serranía de San Lucas needs official recognition and investigation.

CONCLUSIONS

Despite variable levels of field effort within each of the 3 study regions, it is noteworthy that all 3 regional transects were comprised of 2 - 4 quail species with a combined diversity of 6 species. Species pairs of *Odontophorus* wood-quails occurred along each transect, altitudinally separated at about 1,000 m elevation. Both species of highland *Odontophorus* wood-quails are threatened and range restricted, although they are relatively common inside undisturbed primary forest.

From all 3 regions, we have encountered important new locations and ecological information for several poorly known and threatened quail species. However, the most important outcome has been in terms of conservation action. Once the presence of threatened species was established in our study areas, we used this information to make conservation recommendations to national and international conservation bodies, and indeed acted ourselves in facilitating and implementing protective measures.

Conservation is enforced in each of the 3 zones by different means. In northeast Antioquia, CORANTIOQUIA has purchased La Forzosa and deterred local people from entering the area with protection enforced with the respect of local communities. In western Nariño, a Community Nature Reserve has been set up, where local people surrounding the forest have been given the power to make their own decisions as to the forest's future. Both these methods appear to have had some success, despite being highly contrasting formulas: one excluding local people from the process; the other empowering

them. Following our work in the Churumbelos, a National Park extension is proposed to encompass part of the Serranía. It is also hoped that the National Park will also receive the support of local communities, who ultimately threaten any protected area.

In summary, we present examples of knowledge-based conservation that is both efficient and economical. Rapid Biological Assessments, concentrating on threatened and indicator species, has facilitated conservation priority setting, whilst *in-situ* protective measures have been enhanced. Without the biological field information, conservation has little impetus and lesser chances of success. It is through such studies that biologists can practically assist the preservation of remaining Neotropical forests into the new millennium and beyond.

ACKNOWLEDGEMENTS

We are extremely grateful for all the advice, hospitality, and encouragement from the many individuals and organizations who made all 5 expeditions successful throughout their various stages. Full credits of sponsors and acknowledgements for the 3 Nariño expeditions are published in Salaman (1994), for the Churumbelos in Salaman and Donegan (in prep.), and for Antioquia in Donegan and Salaman (1999). Institutional support was given by the Cambridge Expeditions Committee; Instituto de Ciencias Naturales (ICN), Universidad Nacional de Colombia in Bogotá; Project Ognorhynchus; Museo de Historia Natural, Universidad de Cauca; CorpoNariño; Corporación Autónoma Régional del Cauca (CRC); Corporación Autónoma Régional del Centro de Antioquia (CORANTIOQUIA); and the UMATA of the Alcaldias of Anorí and El Bagre.

We are very grateful to the many organizations and individuals, who through their generosity have made various expeditions possible. The following gave generous financial support: Royal Geographical Society, IFAW Charitable Trust, Gilchrist Educational Trust, World Pheasant Association, Cambridge Expeditions Fund, People's Trust for Endangered Species, The Percy Sladen Memorial Fund, British Ornithologists' Union, and many others, credited in the expedition reports.

Thanks are especially due to the following people: F. G. Stiles, L. Alfonso Ortega (CRC), N. Cook, D. Wege (BirdLife International), J. Bustos, L. Mazariegos,W. H. Weber, M. Kelsey, C. Samper, J. Orejuela, W. Beltrán, D. Gandy, J. Fjeldså, N. Krabbe, J. Lázaro Toro, the late T. A. Parker III, and many others. A sincere thanks goes to the local people of all our study areas for their warmth, generosity and support of our work. We could not have completed the project without them. We are grateful to the VI Neotropical Ornithological Congress committee for allowing us to present our work. D. Brooks gave invaluable comments, encouragement and assistance on the paper.

LITERATURE CITED

Collar, N. J., L. P. Gonzaga, N. Krabbe, A. Madroño-N., L. G., Naranjo, T. A. Parker III, and D. C. Wege. 1992. Threatened birds of the Americas: The ICBP/IUCN Red Data Book. Third edition (part 2). ICBP, Cambridge, UK.

Cuervo, A. M., J. M. Ochoa, C. Delgado, and J. A. Palacio. 1999. Evaluación de la aviofauna y de la mastofauna del proyecto de reserva regional La Forosza, Municipio de Anorí, Departamento de Antioquia. Corporación Autónoma Regional del Centro de Antioquia CORANTIOQUIA.

Donegan, T. M., and P. G. W. Salaman (eds.). 1999. Colombian EBA Project Report. http://www.proaxis.com/~salaman/eba.html.

Henderson, A., S. P. Churchill, and J. Luteyn. 1991. Neotropical Plant Diversity. *Nature* 351: 21-22.

Hilty, S. L., and W. L. Brown. 1986. *A Guide to the Birds of Colombia.* Princeton University Press, Princeton, NJ.

McGowan, P. J. K., S. D. Dowell, J. P. Carroll, and N. J. Aebischer. 1995. Partridges, Quails, Francolins, Snowcocks and Guineafowl: status survey and conservation action plan. IUCN, UK.

Salaman, P. G. W. (ed.). 1994. Surveys and conservation of biodiversity in the Chocó, southwest Colombia. *Birdlife International Study Report 61*.

Salaman, P. G. W., T. M. Donegan, A. M. Cuervo, and J. O. Ochoa. 1999. Birds ~ Aves In: Colombian EBA Project Report (T. M. Donegan and P .G.W. Salaman (eds.) http://www.proaxis.com/~salaman/eba.html.

Salaman, P. G. W., and T. M. Donegan (Eds.). in prep. Colombia '98 expedition to Serranía de los Churumbelos: final report.

Stattersfield, A. J., M. J. Crosby, A. J. Long, and D. C. Wege. 1997. Endemic Bird Areas of the World: Priorities for Biodiversity Conservation. *Birdlife Conservation Service.*

Wege, D. C., and A. J. Long. 1995. Key Areas for Threatened Birds in the Neotropics. *Birdlife Conservation Service Ser. 5.* ❒

Populations of the Venezuelan Wood-Quail

Elisa Bonaccorso[1], Miguel Lentino[2] and Guillermo R. Barreto[1]

[1.] Departamento de Biología de Organismos. Universidad Simón Bolívar. Apartado 89000, Caracas 1080-A, Venezuela.
[2.] Museo Ornitológico Phelps. Caracas, Venezuela

ABSTRACT

The Venezuelan Wood-quail *(Odontophorus columbianus)* is an endemic ground nesting bird inhabiting cloud forests of the Northern Coastal Mountains and eastern Andes of Venezuela and occurring between 1,000 and 2,400 m amsl. Available information on the biology and conservation status of the species is very scarce, although it is generally accepted that they are monogamous and form groups of variable size like other *Odontophorus*. We used play-back techniques and direct observations to estimate population density in the vicinity of the Rancho Grande Biological Station at Henri Pittier National Park, Venezuela between July 1998 and February 1999. We established relationships between the variation in the number of responses recorded during the study period and the reproductive cycle and behavior of the species. In addition, observations of group size and composition were made. Group size was about 2-6 individuals, comprising different associations: e.g., groups of adults, 2 adults and chicks, 3 adults and chicks, or solitary individuals. Mean density was estimated as 3.4 birds/ha. Implications of flocking behavior for chicks and young success and the possibility to use playback census techniques to assess conservation status of the species are discussed.

INTRODUCTION

Genus *Odontophorus* is one of the least known groups of American gallinaceous birds. This is because species are forest-adapted and generally associated with tropical to sub-tropical communities, where opportunities for easy observation are difficult (Johnsgard, 1979; Carroll, 1995). Although available information is scarce, it is known that all species are remarkably similar in size and proportion, feeding on much of the same foods (Johnsgard, 1979). They are territorial, monogamous and form groups of variable size during the non-reproductive period (Johnsgard, 1988).

In Venezuela, genus *Odontophorus* is represented by 3 species. The Marbled Wood-quail, *Odontophorus gujanensis,* that occurs at middle elevations in the southern and southwestern regions of the country; the Black-fronted Wood-quail, *Odontophorus atrifrons,* that dwells in the north-western mountains near the Colombian border, and the Venezuelan Wood-quail, *Odontophorus columbianus,* that is endemic to the cloud forests of the Central Northern Mountains and south-eastern Andes between 1,000 and 2,400 m. amsl (Phelps and Meyer, 1994). Like other species of genus *Odontophorus,* little information has been published on the life history and biology of the

[1]E-mail: elisabonaccorso@hotmail.com

Venezuelan Wood-quail. Schwartz and Lentino (1984) described 1 nest and the behavior of breeding birds, and Carroll and Hoogesteijn (1994) assessed the feasibility of population studies using playback techniques and reported on some observations of flocking behavior.

The aim of this study was to estimate density of individuals in the vicinity of the Rancho Grande Biological Station as a first step in assessing the population status of the species at Henri Pittier National Park, Venezuela. At present, nothing is known about the conservation status of the species. However, it has been suggested that annual fires, tourist pressure, and poaching occur frequently in the park and constitute a menace for the resident fauna (Fernandez and Ulloa, 1990). We also established relationships between variations in the number of responses recorded during the study and reproductive cycle and behavior of the species.

METHODS

Study Area

This study was conducted at Henri Pittier National Park, Venezuela. The park is located at the center of the Northern Cordillera, Aragua State. The climate is seasonal with a rainy period lasting from May to November and a dry period from December to April (Huber, 1986b). Population surveys and direct observations were done near Rancho Grande Biological Station (10° 21' N, 67° 41' W) about 1,097 m amsl. Annual rainfall averages 1,600 mm and mean temperature is 20° C.

Population Survey

The population survey was conducted from July 1998 to February 1999. To estimate quail population density, we conducted point count surveys (Colin et al., 1992; Carroll and Hoogesteijn, 1994) using playback to elicit quail responses. Two main tracks, Periquito and Guacamayo, were walked every month during 3 to 6 days from 0600 to 0900 h. Recorded calls were played at sites separated by 100 m. We established 8 point counts in the first track and 10 in the second.

The surveys consisted of aural observations during 10 minutes, 1 minute of silence before arriving to the point and 8 minutes of 3 different calls separated from one another by 30 seconds, followed by 1 minute of silence. The average distance at which quail responded to the recorded calls was estimated at 30 m. A conventional tape-recorder was used to play calls.

At each point count, we recorded the number of quail responses or number of quail groups that responded to calls, cloud cover, and wind speed. We used Kruskal Wallis tests to determine differences in number of quail responses recorded between study months. Chi-square tests were used to determine associations between the number of quail responses and cloud cover or wind speed.

Behavioral observations, number of individuals, and group composition were also recorded from 0600 to 0900 h and from 1,500 to 1,800 h. Data produced by playbacks and direct

observations (group size) gave us the number of groups in each track and the mean group size. Therefore, density was calculated as: D = (N / A x E) S where: D was density of individuals; N was the average of quail responses (groups) in a track; A was the area covered by recorded calls (30 m); E was the number of point counts in each track; and S was the mean group size.

RESULTS

Population Sampling

Quail responded readily to tape-recorded calls, although responses varied during the study. There were no significant differences in number of responses between months (Kruskal Wallis t = 10.54; P > 0.05/ t = 10.12; P > 0.05) nor significant associations between quail responses and cloud cover (X^2 = 5.25; P > 0.05) or wind speed (X^2 = 1.91; P > 0.05).

However, along the 2 tracks, both the maximum number of responses recorded during a day and the mean number of responses for the month declined from July to September. In the Guacamayo track, the mean number of responses for each month increased from October to February. The maximum number of responses registered in a day also increased, except in December. The lowest standard deviations were registered in September, December, and February (Fig. 1). In the Periquito Track, the maximum number of responses was constant from October to February, except in November. In the same period, the mean number of responses was variable. The lowest standard deviations corresponded to July, September, and February.

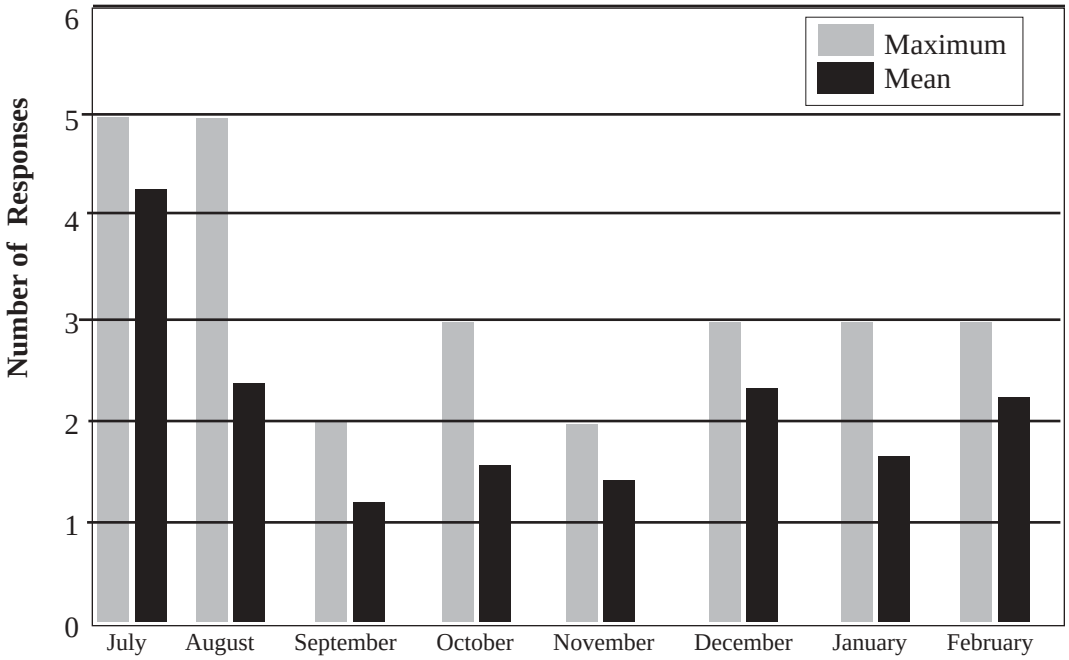


Figure 1. Maximum and mean number of responses registered in the Periquito Track

Groups and Density

We observed some associations between individuals during the study. Some associations or groups were observed at least twice in the same areas during the same month or in consecutive months. We observed a total of 19 different groups in the 2 areas (Table 1). Six individuals, 3 adults and 3 young, formed the largest group, followed by other groups consisting of 2 adults and 3 young, and 2 adults and a single chick. Groups formed by 2-4 individuals and 1 solitary individual were also observed.

The mean group size was 2.95 individuals per group, assuming solitary individuals as a group. Density of individuals was calculated using the average of the average of the number of responses registered during July and August (when number of responses were maximum). Density was 2.71 birds/ha at the Guacamayo Track (2.6 groups in 2.82 ha) and 4.35 birds/ha at the Periquito Track (3.33 groups in 2.26 ha).

Table 1. Group size and composition of Venezuela Wood-quail observed in 2 tracks at Henri Pettier national parkfrom July 1998 to February 1999. The second column shows the track where groups were found, the last one shows the method used to find the groups.

Group	Track	Month	Ind/group	Composition	Method
1	Guacamayo	July	4	?	Playback
2	Guacamayo	July	4	?	Playback
3	Periquito	July	1	Male	Playback
4	Periquito	July	1	?	Playback
5	Periquito	July	4	?	Playback
6	Guacamayo	Aug	1	Male	Without Playback
7	Guacamayo	Aug	3	Adults	Without Playback
8	Guacamayo	Aug	2	Adults	Without Playback
9	Periquito	Aug	1	Male	Without Playback
10	Periquito	Aug	3	3 adults, 1 chick	Without Playback
11	Periquito	Sept.	2	Adults	Playback
12	Periquito	Oct	4	?	Without Playback
13	Guacamayo	Nov	5	2 adults, 3 young	Without Playback
14	Guacamayo	Dec	6	3 adults, 3young	Without Playback
15	Periquito	Dec	1	Male	Playback
16	Guacamayo	Jan	3	Adults	Without Playback
17	Guacamayo	Jan	4	?	Without Playback
18	Periquito	Jan	4	?	Playback
19	Guacamayo	Feb	3	Adults	Without Playback

DISCUSSION

Life Cycle

Most birds show seasonal variations in songs that are mainly correlated with breeding activities and hormone production (Welty, 1982). Thus, knowledge of the life cycle is important in explaining variations in playback responses during the study. Schäfer and Phelps (1954) and Schwartz and Lentino (1984) observed breeding activities of quail from May to July and March to April, respectively. It is possible that breeding season changes according to the rainy season, when food for chicks is abundant (Immelmann, 1971).

Our observations of groups gave us useful information about the breeding season during 1998. Considering an incubation period of 30 days (Schwartz and Lentino, 1984), it is possible that courtship and breeding occurs between June and July. We also observed young in November and December, therefore molting could be occuring around September.

It is generally accepted that the most vocal periods occur during breeding season when birds are busy with territory establishment and courtship. In this work, the higher frequency of responses was registered in July, probably when pairs were forming. Carroll and Hoogesteijn (1994) observed that quail calls were heard throughout the year, but mostly during the rainy and presumably, breeding season.

A decrease in call frequency during August may have related to incubation. In Gray Partridge, *Perdix perdix,* postcourtship calling is lower than courtship, this being interpreted as related to territorial defense (Weigand, 1980).

In September, the low call frequency could have been associated with molting. As a rule, birds are completely silent during the molting period (Welty, 1982) and have a virtual absence of activity (see Snow, 1976) because of both the energetic loss related to molting and an increase in the vulnerability to predators (Palmer, 1972).

It is possible that stable population estimates from October to December corresponded with the young maturation period with some interactions because of territory maintenance. Figure 2 suggests a possible time-table of breeding events. However, more information is necessary on breeding synchronization, behavior, and molting and development patterns in *O. columbibianus* for more insight into its life cycle.

Finally, although we did not find relationships between number of quail responses with cloud cover and wind speed, we recommend avoiding conditions of strong winds and moderate to heavy precipitation, which may produce less accurate results. We suggest making future playback censuses in July and February, when the standard deviation was lower, and during May and June to observe the calling behavior during the mating period.

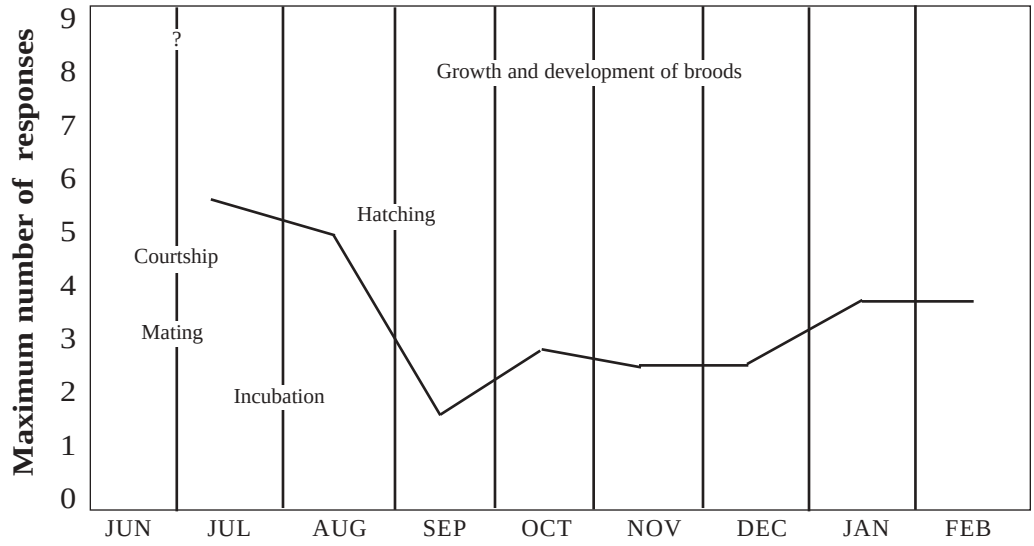


Figure 2. Hypothetic life cycle of the Venezuelan Wood-Quail based on our observations. In this figure, the "maximum number of responses" is the mean between the maximum number of responses recorded in each track.

Group Size and Composition

The largest group observed during this study comprised about 6 individuals. Carroll and Hoogesteijn (1994) observed up to 14 individuals in the same group. Several data registered in Periquito indicate that groups of 8 individuals could be seen in November (M. Lentino, pers. obs.). Gines and Aveledo (1958) reported on groups of 12 individuals and Schäfer and Phelps (1954) observed pairs and groups comprising 5-15 individuals in the same area. This great variability on group size has been reported in many other species of *Odontophorus* (Table 2).

Table 2. Group size in genus *Odontophorus.*

Species	Group Size	Reference
Gorgeted Wood-quail *O. strophium*	3 pairs + until 8 chicks	Collar et al., 1992 Romero, 1983
Marbled Wood-quail *O. gujanensis*	5 – 8	Skutch, 1947
Black-breasted Wood-quail *O. leucolaemus*	5 – 10 3 adults + clutch	Leopold, 1959 (in Johnsgard, 1988) McDonald and Winnett-Murray, 1989
Black-fronted Wood-quail *O. atrifrons*	2 – 10	Gines and Aveledo, 1958
Spotted Wood-quail *O. guttatus*	4 – 10	Stiles and Skutch, 1989
Rufous-fronted Wood-quail *O. erythrops*	2 – 10	Stiles and Skutch, 1989

It is possible that large groups result from 2 or more mating pairs joining during breeding seasons when reproductive success has been unusually low (Johnsgard, 1989). Apparently, we only observed "single family" groups of variable composition formed by the breeding pair and their chicks or young.

Although Phelps and Lentino (1984) did not mention the presence of extra pair adults around the nest, our data indicated that family groups with only 2 adults may be observed. We also observed 1 group formed by more than 2 adults and young as suggested by Carroll and Hoogesteijn (1994). Data about extra pair adults are common in Odontophoridae and Phasianidae (Jenkins, 1961; Johnsgard, 1988).

Specifically in genus *Odontophorus*, there are evidences that in Marbled Wood-quail, a mature male may associate with a nesting pair (Skutch, 1947). Also in Black-breasted Wood-quail *(O. leucolaemus),* it has been suggested that unsuccessful breeding adults might assist in nest guarding (McDonald and Winnett-Murray, 1989). It is possible that nest predation pressure in quail (Skutch, 1947; Phelps and Lentino, 1984; and Johnsgard, 1988) favored the presence of helpers that remain in the family group after breeding season.

Non-family groups could be formed by non-breeding individuals that stay together to enjoy the advantages of being in a group. In *Perdix perdix,* unsuccessfully paired males became accessories to pairs, while subadult males under similar circumstances became either accessories to established pairs or members of bachelor flocks (Weigand, 1980).

It is generally accepted that flock size is a function of predation risk, food availability and interactions between individuals (Krebs and Davis, 1993). Skutch (1947) suggested that in Marbled Wood-quail, bonds between members of a covey are strengthened by mutual assistance in finding food, by reciprocal preening, and apparently also by "the need of companionship." It is probable that in Venezuelan Wood-quail, bonds between individuals are the same, adding to those an apparent vigilance during feeding activities (this work) and the fact that individuals roost together (Carroll and Hoogesteijn, 1994; M. Lentino, pers.obs.).

Finally, we observed 5 solitary individuals (4 males). Maybe they were non-breeding males still searching for a female. It is probable that after breeding season they join to family or bachelor flocks. Evidence supporting this is the fact that the frequency of solitary males decreased after August.

Density

Higher densities at Periquito would confirm previous observations (Phelps and Meyer, 1994) which suggest Venezuelan quails are dwellers of cloud forest, the optimal habitat for the species. Accordingly Huber (1996a), Guacamayo is dominated by transitional forests where quail populations occupy suboptimal habitat. Thus, this might explain lower densities.

Schäfer and Phelps (1954) pointed out that populations of Venezuelan Wood-quail in Rancho Grande reach an optimum between 1,500 and 1, 800 m amsl. Hence, it is possible that higher densities at higher altitudes occur in the least disturbed areas in the park.

We should realize that point census methods using playback are indirect, and therefore more susceptible to errors arising from inaccurate distance estimations or from violation of assumptions about moving birds. All result in population overestimations (Colin et al, 1993). However, this overestimation may be offset by a number of birds that do not respond to calls. Marion et al. (1981) used simultaneously point count playbacks and absolute density data on Chachalacas. They found that about 50% of pairs did not respond to playback.

Finally, it is important to consider that in spite of its several limitations, the playback method seems to be the only practical way to estimate population densities of this elusive bird especially if we take in account that capture and marking techniques for this species are not standardized yet.

ACKNOWLEDGEMENTS

We wish to thank Jesus Manzanilla for allowing access to the Rancho Grande Biological Station and to the staff of the Station for their help and contribution. Martín Rada, Antonio Herrera, Yamil Madi, and Julián Mostacero assisted in the field. This study was sponsored by EcoNatura Association. and Decanato de Estudios Profesionales/Universidad Simón Bolívar. Field work was done under National Parks Institute Licence N 340/10213/98.

LITERATURE CITED

Bull, E. L. 1981. Indirect estimates of abundance of birds. *Studies in Avian Biology* **6**:76-80.

Carroll, J. P., and A. Hoogesteijn. 1994. Observations of the Venezuelan Wood-quail at Rancho Grande, Henri Pittier National Park, Venezuela. Annual Review WPA, 67-72. Reading, UK.

Carroll, J. P. 1995. Odontophoridae. Pp 412-433 *in* J. del Hoyo, A. Elliot, and J.Sargatal (eds.). *Handbook of birds of the world.* Lynx Editions, Barcelona, Spain.

Colin, J. B., N. D. Burges, and D.A. Hill. 1992. *Bird census techniques.* Academic Press Inc., San Diego, CA.

Collar, N. J., L. P. Gonzaga, N. Krabbe, A. Madroño-Nieto, L. G. Naranjo, T. A. Parker III, and D. C. Wege. 1992. *Threatened birds of the Americas:* The ICBP/IUCN Red data book. Tercera edición, Parte II. International Council for Bird Preservation. Cambridge, U.K. pp 171-172.

Gines, H., and R. Aveledo. 1958. *Aves de caza de Venezuela.* Sociedad de Ciencias Naturales La Salle. Editorial Sucre, C.A., Caracas, Venezuela.

Huber, O. (ed.). 1986a. La selva nublada de Rancho Grande. *El Clima*. Fondo Editorial Acta Científica Venezolana. Caracas, Venezuela.

Huber, O. (ed.). 1986b. Las selvas nubladas de Rancho Grande: Observaciones sobre su fisionomía, estructura y fenología. En La selva nublada de Rancho Grande. Fondo Editorial Acta Científica Venezolana. Caracas, Venezuela.

Immelmann, K. 1971. Ecological aspects of periodic reproduction. *Avian Ecology* vol. I, Ed. por D.S. Farner y J. R. King. Academic Press, New York, NY.

Jenkins, D. 1961. Social behaviour in the partridge *Perdix perdix. Ibis*, **103a** (2): 157-188.

Johnsgard, P. A. 1979. The American wood quails. *World Pheasant Association Journal* **4**:93-99.

Johnsgard, P. A. 1988. *The quails, partridges and francolins of the world*. Oxford University Press. Oxford, U.K.

Jonhson, R. R., B. T. Brown, L. Haight, and J. M. Simpson. 1981. Playback recording as a special avian censusing technique. *Studies in Avian Biology* **6**:68-75

Krebs, J. R., and N. B. Davies. 1993. *An Introduction to behavioural ecology.* Third edition. Blackwell Science, Oxford, UK.

McDonald, D., and K. Winnet-Murray. 1989. First reported nest of the Black-breasted Wood-quail *(Odontophorus leucolaemus)*. *Condor* **91**:985-986.

Palmer, R. S. 1972. Paterns of molting. En *Avian Biology* vol II, Ed. por D. S. Farner y J. R. King. Academic Press, New York, New York.

Phelps, W. H. Jr., and R. Meyer. 1994. Una Guía de las Aves de Venezuela. Editorial Ex Libris. Caracas, Venezuela.

Romero, H. 1983. Revisión del status zoogeográfico y redescripción de *Odontophorus strophium* (Gould) (Aves: Phasianidae). *Caldasia*, **8**(65) :775-783.

Schäfer, E., and W. H. Phelps. 1954. Las aves del Parque Nacional Henri Pittier y sus funciones ecológicas. *Boletín de la Sociedad Venezolana de Ciencias Naturales* **16**(83): 3-167.

Schwartz, P., and M. Lentino. 1984. Reproducción de la Perdiz de Montaña, *Odontophorus columbianus*. (PT) Serie de Informes Técnicos DGSIIA/IT/154. M.A.R.N.R., Caracas, Venezuela.

Skutch, A. F. 1947. Life history of the Marbled Wood-quail. *Condor* **49** (6): 217-232

Snow, D. W. 1976. *The Web Adaptation: Bird Studies in the American Tropics.* Quadrangule / The New York Book Company, New York, NY.

Stiles, G., and A. F. Skutch. 1989. *A Guide to the Birds of Costa Rica.* Comstock Publishing Associates, New York, NY.

Wayne, R. M., T. E. O'Meara, and D. S. Maehr. 1981. Use of playback recordings in sampling ellusive or secretive birds. *Studies in Avian Biology* **6**:81-85

Weigand, J. P. 1980. Ecology of the Hungarian Partridge in northcentral Montana. *Wildlife Monographs*, **74**.

Welty, J. C. 1982. *The life of birds*. Tercera ed., Saunders College Publishing, Philadelphia, PA. ❒

Buffy-crowned Wood Partridge

Status of Spotted Wood-quail *(Odontophorus guttatus)* in Belize, Central America*

Jack Clinton Eitniear[1]

[1]Center for the Study of Tropical Birds, Incorporated
218 Conway Drive, San Antonio, Texas 78209-1716 USA

Carroll et al. (1995) lists the current status of our biological knowledge of New World quail with distributions located south of the United States. Their listing (26 species) ranks 5 species as very poorly known (indicating a lack of published information about even the most basic characteristics of the species), 15 as poorly known, 4 as fairly well known and 2 as well known (good). The Spotted Wood-quail *(Odontophorus guttatus)* is widespread in forest from Mexico to Panama (Madge and McGowan, 2002) despite its large range and close proximity to the United States (and hundreds of quail biologists!!) our level of biological knowledge is considered only "fair" with the nest still undescribed. As a precursor to field studies on this species, its status in Belize was investigated. Information was collected through communication with field ornithologists familiar with the species in Belize, the published literature, and information accessable from the Belize Biodiversity Information System.

RESULTS

Few specific details of this species status is provided in the various regional birding guides. Russell (1964) stated that it occurs in tall rainforest and in high secondary growth. Johnsgard (1988) provided no additional details other than Russell (1964). Neither Madge and McGowan (2002) nor Howell and Webb (1995) provided any additional specific information. While considered fairly common to uncommon by Jones and Vallely (2001), they also provided no additional details. Gutierrez and Gutierrez (1997) observed Spotted Wood-quail in Chan Chich Reserve, Orange Walk District in January 1997. The wood-quail have also been recently sighted in the forest adjacent to the Chaa Creek, San Ignacio, Cayo district resort (Omar Figueroa, pers. com.). The Belize Biodiversity Information System (Accessible at: http://fwie.fw.vt.edu/wcs) summarizes all known verified sightings of the species in Belize. Table 1 is a rough summary of the sighting records in Belize.

Only major areas/reserves have been included and a singular reference choosen as verification of the species presence in the area. Figure 1 provides locations in Belize where Spotted Wood-quail have been sighted.

---

* See: P,Q,F 2000-2004 Action Plan, Project 5. Assessing the conservation status of Neotropical quails in northern Central America.

[1] E-mail: JCE@cstbinc.org

Table 1. Recent documented sightings of Spotted Wood-quail *(Odontophorus guttatus*) in Belize, Central America (Data from: Belize Biodiversity Information System, Wildlife Conservation Society, Ministry of Natural Resources' Land Information Centre).

Location	Occurrence	Abundance	Reference
Freshwater Creek	sighting		Reichelt and Philcox, 1994
Chiquibul Forest Reserve	collected	uncommon	ROM, 1997
Columbia Forest Reserve	?		Parker, et al.,1993.
Rio Bravo Conservation Area	sighting	very rare	Vallely and Whitman, 1997
Gallon Jug	sighting	fairly common	Miller and Miller, 1994
Crooked Tree Wildlife Sanctuary	sighting		Robbins, Chandler. 1996
Bladen Nature Reserve	?		Brokaw and Lloyd-Evans. 1987
Cockscomb Basin Wildlife Sanct.	collected		Panza, 1997
Mountain Pine Ridge Forest Res.	?		Miller andMiller, 1992

CONCLUSION

Sightings of Spotted Wood-quail occurred in 9 locations throughout the country of Belize, Central America. The species varies in abundance from very rare to fairly common and is observed in a variety of life zones (Holdridge) from Tropical Moist-transition to Subtropical, Subtropical Wet, Subtropical Moist to Subtropical Lower Montane Wet. Reports indicate that the species is very rare in broadleaf forest and uncommon in northern semi-deciduous moist and northern and southern hardwood forests. It appears commonly in southern moist-wet evergreen broadleaf and sub-tropical lower montane forest. While the species status in Belize appears secure its low densities make local extirpation as a result of land use changes or predation possible. Censusing, perhaps using playback, appears justified in areas of favorable habitat.

Figure 1. Locations where Spotted Wood-quail were documented in Belize, Central America.

(1) Freshwater Creek
(2) Chiquibul Forest Reserve
(3) Columbia Forest Reserve
(4) Rio Bravo Conservation Area (5) Gallon Jug
(6) Crooked Tree Wildlife Sanctuary
(7) Bladen Nature Reserve
(8) Cockscomb Basin Wildlife Sanct.
(9) Mountain Pine Ridge Forest Res.
(10) Chaa Creek Resort
(11) Chan Chich Reserve

ACKNOWLEDGMENTS

The author wishes to thanks Bruce Miller, Lee Jones, Omar Figueroa, and Bill Hasse for their contributions.

LITERATURE CITED

Brokaw, N. L. V,. and T. L. Lloyd-Evans. 1987. The Bladen Branch Wilderness. p.38-42. Unpublished report.

Carroll, J. P., K. E. Church, and M. G. Kelsey. 1995. Status and conservation of neotropical quails. *Proceedings International Wildlife Management Congress* **1**:658-661.

Gutierrez, R. J. and K. L. Gutierrez. 1998. Notes on the nuptial display of the Spotted Wood-quail *(Odontophorus guttatus). Ornitologia Neotropical* **8**:241-242.

Howell, S. N. G., and S. Webb. 1995. *A guide to the birds of Mexico and northern Central America.* Oxford University Press, Oxford, UK.

Johnsgard, P. A. 1988. *Quails, Partridges, and Francolins Of The World.* Oxford University Press, New York, NY.

Jones, L. H., and A. C. Vallely. 2001. *Annotated Checklist of the birds of Belize.* Lynx edicions, Barcelona, Spain.

Madge, S., and P. McGowan. 2002. *Pheasants, Partridges, and Grouse.* Princeton University Press, Princeton, NJ.

Miller, B. W., and C. M. Miller. 1992. Preliminary Avian Survey of the Upper Macal River: Rubber Camp and Francelia Camp, Pp.55-63 *in* Macal River Hydroelectric Development Environmental Impact Assessment Rubber Camp and Chalillo Schemes Pre-feasibility Study - Draft Environmental Appendix. Vol. II of III

Miller, B. W., and C. M. Miller. 1994, Birds of Caracol, 1988 - 1993. in prep.

Miller, B. and C. Miller. 1994. A working checklist of the birds of Gallon Jug. Unpublished list.

Panza, R. 1997. Carnegie Museum, Division of Birds, Holdings of Belize specimens through Jun. 1, 1997.

Parker, T. A. III, B. K. Holst, L. H. Emmons, and J. R. Meyer. 1993. A Biological Assessment of the Columbia River Forest Reserve, Toledo District, Belize. Pp.71-78.

Reichelt, B., and C. Philcox. 1994. DRAFT - Freshwater Creek Forest Reserve Natural History Studies. Unpublished report.

Robbins, C. 1996. U.S.F. & Wildlife Service Wintering Bird Surveys for Belize. Unpublished data provided by C. Robbins.

ROM. 1997. Royal Ontario Museum, Division of Birds, Holdings of Belize specimens through Jan. 1, 1997.

Russell, S. M. 1964. A distributional study of the birds of British Honduras. *Ornithological Monographs* No. 1, A.O.U. Philadelphia, PA.

Vallely, A. C., and A. A. Whitman. 1997. The birds of Hill Bank, northern Belize. *Cotinga*. **8**:39-49. ❒

Barred Quail

Observations of Elegant Quail *(Callipepla douglasit)* in Southern Nayarit, Mexico

Daniel M. Brooks[1]

Houston Museum of Natural Science; Department Of Vertebrate Zoology;
1 Hermann Circle Dr.; Houston, TX 77030-1799, USA

The Elegant Quail *(Callipepla douglasii)* is a species endemic to the northwest Mexican slope, occurring in the states of Sonora, Sinaloa, and Nayarit and barely crossing the borders into Chihuahua, Durango, and Jalisco (Howell and Webb, 1999). Herein I describe some general observations of Elegant Quail from the southern-most part of its geographic distribution. Although the details provided here are non-quantitative, they may be of interest since this species is virtually unstudied (Johnsgard, 1988).

The data were anecdotally recorded during basic scouting work in southern Nayarit and northern Jalisco, Mexico from 24-27 September 2000. The author was accompanied in the field by Jan Van Liere (JVL). We observed birds in southern Nayarit, ~1 km west of Mezcales, off Hwy 200 toward Laguna Quelele. The habitat was comprised of grassy fields and scrub, with a mosaic of wetlands, grazing pasture, and some forest thicket in the general vicinity.

On 25 September 2000 JVL observed a partridge-like bird eating in a small, cultivated beanfield plot (~5x7 m). She immediately photographed the bird, and it was later identified as an Elegant Quail. A few minutes later, ~0.6 km away, we both observed a covey of 7 individuals (1 or 2 males and several hens or subadults).

While difficult to determine relative abundance with such limited sampling time, some very general conclusions can be put forth. Two observers were able to record 8 quail during 75 min. (0900-1015 h) of casual spot-counts, equating to ~3.75 quail/observer-h. The Elegant Quail ranked 9th in individual abundance out of 22 species seen that morning, accounting for 5% (N = 151) of all individuals seen that morning (Table 1).

The observation of the first individual eating in a beanfield is apparently a common behavior adopted by other Neotropical Odontophorines, such as *Dendrortyx barbatus* (J. C. Eitniear, pers. comm.). Perhaps the most compelling observation was that Elegant Quail were not only present, but apparently breeding close to a well-populated town and a major interstate highway (~1 km from both). The fact that we recorded so many individuals in a short time suggests that the population here is not threatened by over hunting.

[1]E-mail: dbrooks@hmns.org

Table 1. Approximate numbers of other bird species associated with sites where Elegant Quail were observed in Nayarit and Jalisco, Mexico in 2000.

No.	Species
30	Blue-Black Grassquit *(Volatinia jacarina)*
21	Mexican Parrotlet *(Forpus cyanopygius)*
14	Black-bellied Whistling Duck *(Dendrocygna autumnalis)*
12	Ruddy Ground Dove *(Columbina talpacoti)*
10 each	Thick-billed Kingbird *(Tyrannus crassirostris)*, White-collared Seedeater *(Sporophila torqueola)*, Bronzed Cowbird *(Molothrus aenus)*, Groove-billed Ani *(Crotophaga sulcirostris)*
8	Elegant Quail *(Callipepla douglasii)*
5	Inca Dove *(Columbina inca)*
4	unidentified Tanager (*Thraupis* sp.)
3	Yellow Warbler *(Dendroica petechia)*
2 each	Cattle Egret *(Bubulcus ibis)*, Green Heron *(Butorides virescens)*, Killdeer *(Charadrius vociferus)*, Great Kiskadee *(Pitangus sulphuratus)*
1 each	Black-necked Stilt *(Himantopus mexicanus)*, Tropical Kingbird *(Tyrannus melancholicus)*, Sinaloa Wren *(Thryothorus sinaloa)* Lincoln's Sparrow *(Melospiza lincolnii)*, Streak-backed Oriole *(Icterus pustulatus)*, Yellow-winged Cacique *(Cacicus melanicterus)*

Literature Cited

Howell, S., and S. Webb. 1999. *A Field Guide to the Birds of Mexico and Northern Central America.* Oxford University Press, Oxford, UK.

Johnsgard, P. 1988. *The Quails, Partridges and Francolins of the World.* Oxford University Press, Oxford, UK. ❒

WORLD PHEASANT ASSOCIATION

IUCN/SSC/WPA
PARTRIDGE, QUAIL, FRANCOLIN
SPECIALIST GROUP

CENTER FOR THE STUDY OF TROPICAL BIRDS, INC.