Conserving Cracids:
The most Threatened Family of Birds in the Americas



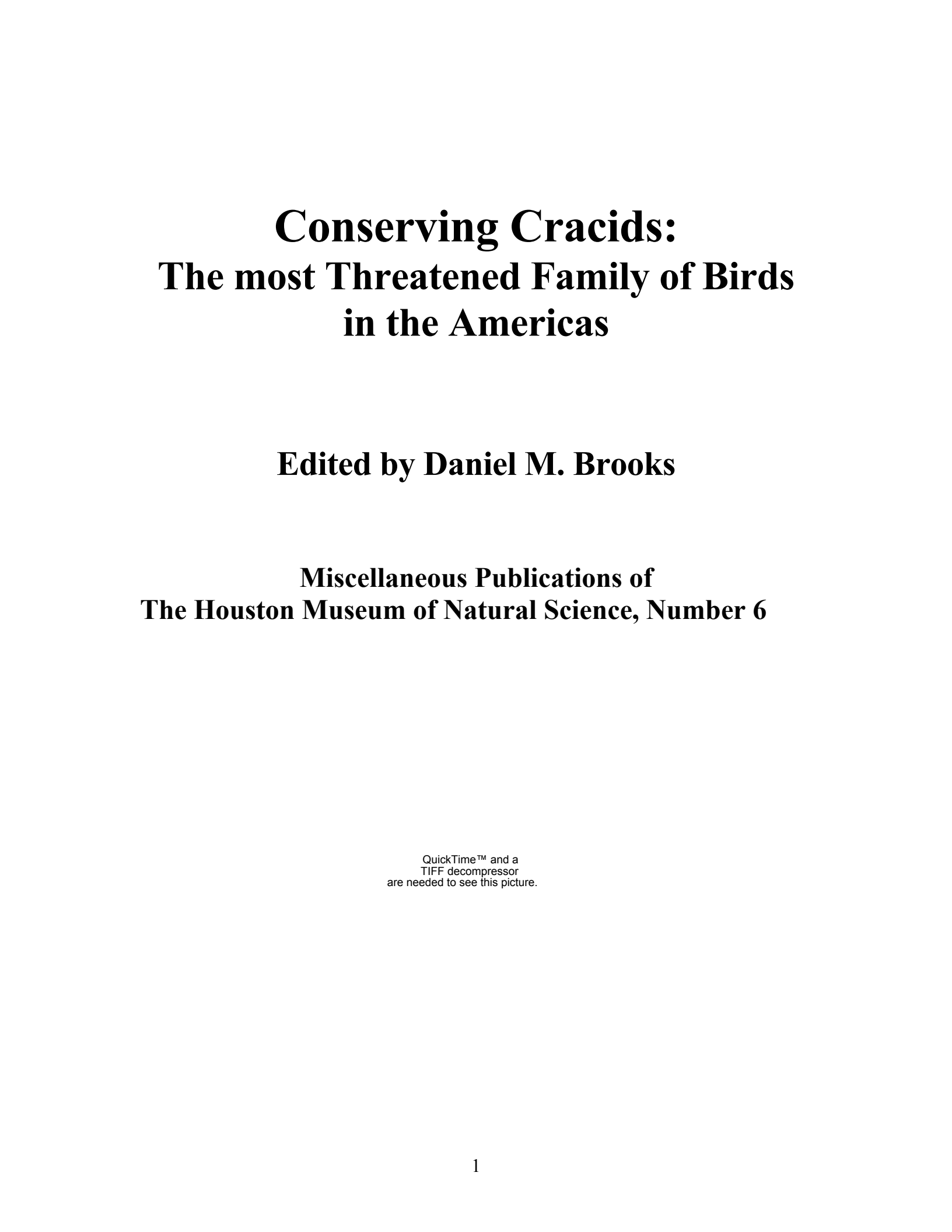
Edited by Daniel M. Brooks

Miscellaneous Publications of
The Houston Museum of Natural Science, Number 6

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ISBN 0-9668278-2-1
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Main entry under title:

Conserving Cracids

Includes some text in Spanish and Portuguese.

Original chapters on biology and conservation of the most Endangered family of birds in the New World.

ISBN 0-9668278-2-1

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Printed in the USA

Cover artwork of Alagoas Curassow (*Mitu mitu*) by Jose Merizio

Published in the USA by the Houston Museum of Natural Science -
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Contributions and views published do not necessarily reflect the opinion of the Editors or their affiliated institutions, the Houston Museum of Natural Science or the Cracid Specialist Group.

Suggested citation for authored accounts:
Authors(s). 2006. Name of Account. Pp. XXX-XXX In: Conserving Cracids: the most Threatened Family of Birds in the Americas (D.M. Brooks, Ed.). Misc. Publ. Houston Mus. Nat. Sci., No. 6, Houston, TX.

Dedication

This book is dedicated to the memory of the late Dean Amadon – conservation scout, taxonomist, and legendary Ornithologist, Dean will always be an inspiration to budding young scientists for many years to come.

This book is also dedicated to Cracidologists who have devoted their lives to studying these fascinating birds. By devoted, they are indeed no less than that - they may risk their lives working in dangerous regions and less than comfortable conditions to satiate their quest to learn all they can about these rare birds. It goes without saying that books such as this would not exist were it not for the countless hours these disciplined students of Ornithology have dedicated to direct study of these life forms they are so passionate to conserve.

Acknowledgments

Thanks to the following individuals for providing helpful comments on species threat criteria: Fernando Angulo P., David Ascanio, Alfredo Begazo, Sara Bennett, Juan David, Víctor Raúl Díaz-M., Thomas Donegan, Jack Eitniear, Jacques Erard, Jon Fjeldså, Mauro Galetti, Fernando González-G., Carlos Otávio A. Gussoni, Bennett Hennessey, Nigel Hughes, Olaf Jahn, Oliver Komar, Miguel Lentino, Gustavo Londoño, Ross Macleod, Adrián Naveda-R., Gustavo Alarcón Nieto, Jose Manuel Ochoa, Fabio Olmos, Mark Pearman, Luis Miguel Renjifo, Robin Restall, Nicolás Rey, Robert Ridgely, Margarita Rios, Javier Rivas, Paul Salaman, Stuart Strahl, Tom Stuart and Rob Wallace.

Also, kind thanks to the following individuals for reviewing and/or providing helpful comments and edits: Fernando Angulo, Paulo Antas, Hugo Aranibar, Hernán Arias, Rodrigo Soria Auza, Javier Barrio, Carolina Bertsch, Carlos Bianchi, Richard Buchholz , Stuart Butchart, Laura Cancino, Rob Clay, Ana José Cóbar, Juan Cornejo, Guy Cox, Víctor Raúl Díaz, Knut Eisermann, Raúl Fournier, Juan Freile, Eduardo Gallo-Cajiao, Melvin Gastañaga, Fernando Gonzalez-Garcia, Floyd Hayes, Néstor Herrera, Julián Idrobo, Olaf Jahn, Ivan Jimenez, Oliver Komar, Gustavo Londoño, Nancy López de Kochalka, Ross Macleod, Eliana Marcela Machado, Silvina Malzof, Miguel Angel Martinez Morales, Marcia Muñoz, Adrián Naveda, David Oren, Sergio Pereira, Alonso Quevedo, Ruben Quintana, Margarita Rios, Javier Rivas, Andrei Langeloh Roos, Paul Salaman, Geer Scheres, Gilles Seutin, Rodrigo Soria, Christine Steiner, Stuart Strahl, Luis Eduardo Urueña and Rob Williams.

Finally, the following individuals were kind enough to provide artwork or photographs for the book. Artwork was provided by: Sara Bennett, Andres Gallo, Waldo Huaman, Jose Merizio, Ed Rooks and H. Vercauteren. Photos were provided by: Fernando Angulo P., Javier Barrio, Christine Steiner São Bernardo, Carolina Bertsch, Brett Cole, Juan Cornejo, Edson Endrigo, Fernando González-García, Melvin Gastañaga, Arthur Grosset, Dolores Ibarguren, Julián Idrobo, Olaf Jahn, J. Kormendy, Gustavo Londoño, Barry MacKay, Marcia Muñoz, Heinz Plenge, F. Poletto, Proaves-Colombia, Javier Rivas, David Sarkozi, Denise Torres and Emilio White.

Preface

A couple of decades back, when I was primarily a field scientist, I went to visit a colleague in Venezuela. This person was Stuart Strahl. We were both at similar stages in our careers and personal lives, and at the time both heavily vested in field research and conservation of Neotropical vertebrates: Strahl in birds, and myself in primates. During this visit Stuart had become interested in a very little-known group of birds that sounded like a type of Mexican dance or drug addict; this was the avian family known as the Cracids.

Stuart was quite excited about studying and conserving these birds, and little did I realize at the time what Strahl had stumbled upon. As someone with a strong background in Anthropology, it began to dawn on me little-by-little how important these birds were to people. For example, Cracids are extremely important in Amerindian folklore, often depicted in molas and other crafts made by the Maya, Kuna, and other indigenous groups. Moreover, the feathers of Cracids are important for traditional body ornamentation created by Amerindians, such as headdresses, armbands and necklaces.

The most dramatic reliance of Cracids by indigenous tribes however, is in relation to their importance as a major protein base. A tightly coupled symbiotic relationship existed between cracids and humans historically, with the birds serving as an important sustainable protein source to Amerindians. Species such as Razor-billed Curassows (*Mitu tuberosa*) and Piping Guans (*Pipile cumanensis* and *P. cujubi*) for example, average in the top five of the most frequently harvested game species in Amazonia. However, in contemporary times, rapid and steady human population growth throughout the Neotropics has led to widespread destruction of tropical forests and dramatic over-hunting of cracid populations. The reproductive strategy of most Cracids simply cannot compete with intensive hunting because most of the larger species that are more vulnerable to over-hunting have a small clutch size (two eggs), long maturation period (at least three years), and need large breeding territories. Consequently, these birds, along with Ateline primates and tapirs, are incredibly accurate bio-indicators of sustainability of harvest in a given region. If the habitat is remote and in good shape but cracids are lacking, chances are good that the region is over-harvested.

Finally, and perhaps most importantly, Cracids are extremely important in regenerating the tropical forests they inhabit through seed dispersal dynamics. It goes without saying that tropical forest is vital to the survival of all species on the planet.

What Strahl had initiated some 15-20 years ago has today grown into one of the strongest taxonomic-oriented conservation groups on record. When Dan Brooks came to Strahl's aid in 1996 as Co-Chair of the Cracid Specialist Group (CSG) things really began to kick into high gear. A plethora of bulletins, workshops, monographs and books began to appear with regularity, and this pattern continues today. With mixed blessings, Brooks was 'promoted' to full Chair in 2000; he could have easily forgotten the group of birds that he helped make charismatic and settled for a less-challenging flagship group (e.g., elephants, pandas or whales), but with all the work done up to date he and Strahl both are to be commended for their hard work and persistent efforts in bringing the family Cracidae to the forefront of avian flagship appeal – not an easy task by any means.

- Russell Mittermeier, Ph.D.
President,
Conservation International

Foreword

It was a nearly 25 years ago when my fascination with the Family Cracidae was awakened while doing dissertation research on Tomas Blohm's research station in central Venezuela, Hato Masaguaral. There I made casual observations on healthy populations of Yellow-knobbed Curassows (*Crax daubentoni*) and Rufous-tailed Chachalacas (*Ortalis ruficauda*) in the gallery forest and seasonally flooded savanna. This quickly led to more in-depth post-doctoral research on this family several years later with my colleague Jose Lorenzo Silva, supported by the Wildlife Conservation Society and FUDENA.

At that time, what little was known of these species was found avicultural journals, Jean Delacour and Dean Amadon's 1973 volume *Curassows and Related Birds*, and the proceedings of a 1981 symposium held in Mexico. All signs from the field indicated that Cracidae populations were in serious decline throughout the Neotropics as a result of the twin threats of hunting and habitat destruction. Few international ornithologists or conservationists were paying attention, meanwhile, while at least one species went extinct in the wild (Strahl 1990, Strahl and Grajal 1991).

As I write this foreword, scientific involvement in Cracid conservation is far more advanced than it was in 1981. The Cracid Specialist Group (CSG) was formed based on interest generated by a major international symposium focusing on the biology and conservation of the Cracidae in Venezuela (1988). This was followed by another symposium in Houston (1994), a Conservation Assessment and Management Plan (Strahl et al. 1995), a Cracid biology volume (Strahl et al. 1997a) and an international Action Plan (Brooks and Strahl 2000). The latter two publications would have never been completed without the disciplined efforts of Dr. Dan Brooks and his colleagues, as is also the case with other important works (e.g., Brooks et al. 1999, Brooks and Gonzalez-G. 2001b, Brooks 2002a, this volume).

Under Brooks' Chairmanship over the past decade, the CSG has also held regional meetings and workshops in Mexico, Panama, Columbia, Bolivia and Paraguay and taxon-specific symposia on Piping Guans (*Pipile* spp.), the Horned Guan (*Oreophasis derbianus*), and the White-winged Guan (*Penelope albipennis*). The Group has active involvement and scientific presence throughout the Neotropics, and publishes a tri-lingual newsletter bi-annually.

This book represents the most recent advances in our knowledge of the biology, ecology and conservation status of the Family Cracidae, serving as an updated Action Plan. It represents the work of over 40 authors from more than a dozen countries, compiling the most recent status updates and action priorities for threatened species and regional populations based on field data and on-the-ground expertise.

The plethora of recent field-based references cited in this volume is a testament to the effectiveness of the CSG, which has over the years significantly expanded and diversified its membership and field activities throughout the Neotropics. If we are to conserve the Cracidae, their Neotropical forest habitats and the species that depend on them, it is imperative that we continue to foster local, regional and international engagement following this model.

- Stuart D. Strahl, Ph.D.
President/CEO
Chicago Zoological Society

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Blue-throated Piping Guan (*Aburria cumanensis*) drawing by J. Merizio

Chapter 1 – Biology and Conservation of Cracids

Daniel M. Brooks and Richard A. Fuller

Introduction

The family Cracidae (chachalacas, guans and curassows), endemic to the Neotropics, comprises a group of large, forest-dwelling, frugivorous (fruit-eating) birds (Brooks 2002a). Cracids are the most endangered avian family in the region, with approximately half of the larger, turkey-sized guans and curassows considered Vulnerable or Endangered.

In 2000, the first Action Plan for the cracids was published, providing a comprehensive review of status and outlines for conservation action (Brooks and Strahl 2000). During the five-year implementation period of that Action Plan, a large volume of work on these species has been undertaken, and virtually all of the projects listed in the Appendix have been realized. The main purpose of this updated book is to provide a new overview on cracid conservation worldwide. This book has been prepared on the basis of the most recent information available during 2005; it therefore supersedes the 2000 Action Plan. It provides specific conservation assessments and interpretation of conservation-related information, as well as full species accounts of threatened cracids.

The book contains a methodology of production (Chapter 2) following the exhaustive Introduction (Ch. 1), which includes pertinent background information on natural history and

biology, threats and conservation action. The next several chapters are written at the species level, for cracids that are Extinct in the Wild (EW) or Critically Endangered (CE – Ch. 3), Endangered (EN – Ch. 4), Vulnerable (VU – Ch.5), or Near Threatened (NT – Ch. 6). Each of these chapters contains a series of species accounts written by Cracidologists who have worked with the respective species, and thus know the current situation of status, threats, and the best road for realistically and actively conserving each of the 24 species. Each account is comprised of three sections: 1) Work to Date, 2) Status and Threats, and 3) Conservation Action; the latter section is a working document for conserving individual species at the population level. The last two chapters deal with conserving cracids at scales of country (Ch. 7), as well as global (Ch. 8).

Every effort has been made to gather information and opinion that is up-to-date, from published and unpublished literature, from correspondence and discussions with people currently involved worldwide in the conservation of cracids and their habitats. Wherever possible, all substantive statements are backed up with references to the literature. As in the first edition of the Action Plan, the information has been thoroughly reviewed. The Cracid Specialist Group is, therefore, confident that this plan has the full backing of its international network of members.

The Cracid Specialist Group (CSG) is the name given to the group formed by Stuart Strahl in 1990 under the supervision of IUCN - The World Conservation Union's Species Survival Commission. The CSG has been Co-Chaired by Dan Brooks and Strahl since 1996, with Brooks serving as full Chair since 2000, with a number of Regional Coordinators that help expand regional interest (see App. 2).

Among the CSG's most important objectives are bringing the Family Cracidae to the global attention of conservationists, and to stimulate additional research and world-wide interest in these Endangered birds. One of the first goals of the CSG was to point out the economic importance of the cracids in the ecological maintenance and preservation of Latin American forest reserves. As indicators of human perturbation and habitat quality, cracids are second to none among Neotropical bird groups as outstanding heuristic tools for the design and implementation of monitoring conditions in natural areas. The CSG maintains its active network through a series of workshops and symposia, a progressive publications series, and through supporting various field conservation projects.

The Natural History of Cracids

Cracids Historically and Today

Cracids range in size from that of a pheasant to a turkey. Chachalacas are the smallest members of the Family, about the body size of a bantam chicken or small pheasant. Guans tend to be medium-sized members, and curassows are the largest, with species such as the Great Curassow (*Crax rubra*) being the size of a turkey.

Cracids are a primitive, ancestral family of gamebirds (Galliformes), probably originating in Central America and southern North America. Approximately 40-50 million years ago, much of North America was tropical, as far as the northern plains states. Within that tropical habitat lived a primitive bird that appeared to be primarily arboreal - the earliest known ancestor of cracids - recognized by an approximately 50 million year old fossil found in Wyoming recently (del Hoyo 1994). Additionally, younger fossils (around 30 million years old), similar to chachalacas, have been found in South Dakota (Tordoff and MacDonald 1957). Recent fragments of more contemporary cracid fossils (e.g. *Crax*, *Penelope*) have been found in their current range aged approximately 20,000 years (del Hoyo 1994).

There are a number of beautiful color morphs (color variations) in some of the curassows. For example, barred morphs are possible in females of the Great (*Crax rubra*) and Blue-billed (*C. alberti*) Curassows. Rufous (reddish-brown) morphs are possible in both Helmeted (*Pauxi pauxi*) and Horned (*P. unicornis*) Curassows, and in female Great Curassows (Brooks unpubl. data, Herzog and Kessler 1998). While it has been suggested that these morphs vary along a latitudinal gradient (see del Hoyo et al. 1994), two different morphs have been observed in the same flock (barred and plain morphs of *C. rubra* in Belize), occupying the same habitat at the same time (Zimmer 1999).

Distribution and General Biology

While cracid diversity is highest in northwestern South America, the family ranges throughout tropical America, from south Texas, USA (Plain Chachalaca, *Ortalis vetula*) to the Paraná delta of central Argentina and Uruguay (Dusky-legged Guan, *Penelope obscura*). Although the distributions of several species have been plotted on range maps (e.g., Delacour and Amadon 1973), there are many large gaps in the known distributions of several species, with some having an extremely patchy distribution, such as Wattled Curassow (*Crax globulosa*).

Perhaps one of the most puzzling and intriguing patterns of cracid distribution occurs in some of the highland species that show a strongly disjunct (separate) distribution (i.e. *Pauxi*, *Chamaepetes*), while most of the lowland forms (i.e. *Ortalis*, *Mitu*, *Crax*) are strongly parapatric (i.e., their distributions adjoin each other rather than overlap), although there are some exceptions such as various subspecies of Speckled Chachalacas (*Ortalis guttata araucuan*, *O. g. squamata*), Alagoas Curassow (*Mitu mitu*) and the Red-billed Curassow (*Crax blumenbachii*). Riverine barriers may be a cause of the strong parapatric distribution of many lowland forms such as *Crax* (Garcia and Brooks 1997), but further analyses are needed. Other more disjunct species may have displayed more continuous distributions historically. Dramatic interruptions are puzzling in species such as the Helmeted and Horned Curassows (*Pauxi*), where the ranges of the two species are more than 2000 km apart (Wetmore 1943, Weske and Terborgh 1971). It is possible that such discontinuous distributions were a result of habitat or climate change (e.g. active Andean volcanoes disrupting once-continuous distributions, F. Olmos, in litt.), or competition with other species, historically (see Remsen and Cardiff 1990). The only group that

shows any type of strong geographic sympatry (overlapping distributions) is the 'true' guans (*Penelope*), with all Amazonian lowland forms geographically overlapping with Spix's Guan (*Penelope jacquacu*), and most highland forms overlapping with the Andean Guan (*Penelope montagnii*). The mechanisms which permit co-existence in some genera have yet to be studied in depth, although some studies have taken place (e.g. Escano 1994, Santamaria y Franco 1994, Brooks et al. 2001c).

Chachalacas live at a variety of altitudes and habitats, but appear to thrive in scrub and secondary forest. The dawn chorus of chachalacas resonates in areas where these birds occur. The 'true' (*Penelope*) guans also occur at a range of altitudes but like most species of cracids, are mostly restricted to forest, both montane and lowland. Piping-guans (*Aburria*) are primarily lowland species, monospecific (single-species genus) taxa of guans (i.e., *Penelopina*, *Oreophasis*) are restricted to montane environments. The two species of Sickle-winged guans (*Chamaepetes*) are also restricted to montane environments, and may be related distantly enough to other guans to warrant four divisions in the family: chachalacas, guans, sickle-winged guans and curassows (Escalante 1994). Nonetheless, all the guans are unique with their 'wing-whirring' calls that are part of their courtship display and can be heard from a great distance at dawn. The Nocturnal Curassow (*Nothocrax*), as its name implies, is active mostly during the night, but a trend in shifting towards nocturnal activity is displayed by all curassows in regions where they are hunted. Unlike most other species of curassows (*Nothocrax*, *Mitu* and *Crax*), the Helmeted and Horned Curassows (*Pauxi*) are strictly montane species.

Cracid Diet and Seed Dispersal / Predation Dynamics

The general trend in diet appears to be more leaves and less fruit in smaller species (e.g. chachalacas), to more fruit and less leaves in larger species (e.g. curassows). Similarly, animal matter seems to be more prevalent in the diets of smaller species (e.g. insects in the diet of *Ortalis*, snails in the diet of *Aburria*) than in curassows (e.g., Guzman et al. 1999). Species that eat animal matter sometimes occur in more temperate environments or more variable habitats (e.g. some *Ortalis*), requiring a seasonal dietary switch (see Caziani and Protomastro 1994).

Cracids are important seed dispersers and apparently play an important role in maintaining tropical forests by dispersing their preferred food plants (see Guix and Ruiz 1997, Sedaghatkish et al. 1999). Seed dispersal is the situation where seeds of some plants and trees are dispersed by particular birds which eat the seed and excrete it in other areas of the forest where it then propagates. Seed predation is the term given to the process where birds eat the reproductive parts of a plant, thereby preventing its regeneration. While chachalacas and guans tend to regenerate tropical forests through seed dispersal, curassows appear to be primarily seed predators, helping to keep plant population density in check (e.g. Caziani and Protomastro 1994, Érard et al. 1991, Érard and Théry 1994, Théry et al. 1992), although curassows may disperse some hard seeds (e.g., Santamaria y Franco 1994, Peres and van Roosmalen 1996). We have barely skimmed the surface in understanding the complex dynamics of seed dispersal and predation. For example, some potential seed dispersers such as *Penelope obscura* may simultaneously spread live, seed-destroying weevils that are contained within seeds (Guix and Ruiz 1997).

Some cracids may prey heavily on their preferred flower species, preventing fruit formation. For example, *Tabebuia* spp. flowers are a preferred dry season food source for guans, piping guans and chachalacas in the Pantanal, and the birds are likely to have an impact on the tree's demography (F. Olmos, in litt.).

Why are Cracids Important?

The Importance of Cracids to Humans

Cracids have a substantial impact on the economies (especially subsistence economies) of Latin American countries. This point, emphasized by several authors (see Delacour and Amadon 1973, Silva and Strahl 1991), should help attract government attention to these species as national resources that have an intrinsic value beyond their biological roles in forest ecosystems. Future studies must emphasize the economic importance of cracids to produce results that are relevant and meaningful to Latin American governments. Aesthetic arguments, however valuable they might be to conservationists and biologists, cannot be used to the exclusion of other, more convincing arguments on a national level.

A wide variety of studies has shown the importance of cracids as a source of meat for the campesino (landless peasants and farmers) and native Indian populations of the Neotropics. In almost all studies of hunting in Neotropical forests, cracids comprise the largest avian biomass taken by either group of hunter (e.g., Silva and Strahl 1991, Begazo 1997). Moreover, cracids rank high when considering all species of game taken, including mammals (e.g. Brooks 1999). These studies demonstrate the reliance of many cultures on cracids for subsistence.

The ecotourism industry has grown dramatically in the past few years, with revenues generated for some countries exceeding that of all other recreational sports combined. For example, Groom et al. (1991) estimated over US$1.2 million was generated in 1987 from foreign tourists viewing wildlife in the Madre de Dios region of the Peruvian Amazon. The revenue generated from ecotourism since then has increased dramatically. For example, at one of the lodges (25 beds) within the Madre de Dios region, Munn (1992) estimated that the number of local people who were supported by tourism profits exceeded 150 in 1987, increasing to 270 by 1989. Ecotourism is also increasing in the Brazilian Pantanal region, where the number of lodges is growing steadily as traditional activities such as cattle ranching decline (F. Olmos, in litt.). Moreover, ecotourism encourages local people to become tour guides who can serve as guardians of rare cracids.

The Importance of Cracids to the Environment

The role that cracids play in regenerating tropical forests is of paramount importance, but the complex dynamics of seed dispersal and predation are little understood. Seed dispersal ensures that some of the birds' preferred food plants replenish themselves in suitable habitats. This area has been subject to relatively little investigation, but it is likely that cracids play an important role in maintaining tropical forests by dispersing their preferred food plants (see Sedaghatkish 1996), especially certain large-seeded, mature forest species such as Lauraceae, Arecaceae, and Sapotaceae (F. Olmos, in litt.). More importantly, several of these plant species are used heavily by man (Sedaghatkish 1996, Sedaghatkish et al. 1999), potentially making cracids keystone species (species that others are dependent on).

Because cracids are so heavily affected by both hunting and habitat destruction and because their populations are easily censused, they can be used effectively (along with several other bird and mammal groups) as indicator species for managing parks and protected areas in the Neotropics (Strahl and Grajal 1991). Their role as bio-indicators, which should help the implementation of land management programs throughout the region, has been largely ignored until recently (Strahl 1990, Strahl and Silva 1997b). By monitoring the population status of cracids in a particular area, wildlife and park managers can determine whether or not the forest resources in a given region are being over-exploited.

Threats to the Survival of Cracids

Hunting Pressure

Cracids are heavily hunted throughout the Neotropics. Several studies have shown the predominance of cracids as a protein source for campesino and native Indian populations in the Neotropics (e.g. Ojasti et al. 1983, Silva and Strahl 1991, 1997a, Begazo 1997, Brooks 1999). These studies provide insight to the most important factor resulting in decline of these species - cracid population levels decline dramatically when subsistence hunters harvest cracids unsustainably. Local population declines and extinctions of several cracid species (e.g. *Aburria, Mitu*, *Crax*) are largely due to hunting, shown by the fact that the habitat is undisturbed (F. Olmos in litt.).

Habitat Destruction

As primary forest species (especially the guans and curassows), cracids are also particularly susceptible to habitat destruction. Those species with restricted ranges are particularly vulnerable, such as all the endemic species of guans and curassows. Combined with hunting, habitat destruction has contributed heavily to the rapid decline of cracids over the past several decades.

Threatened Subspecies and Populations

This Action Plan provides a status survey and recommendations for future action for Cracids. However, there are several instances where certain subspecies and isolated populations of various species are known to be under threat in their own right. Taxa of immediate concern include, but are not limited to, several endemics from the Santa Marta mountain range in Colombia (*Ortalis ruficauda lamprophonia, Chamaepetes goudotii sanctaemarthae* and *Penelope argyrotis colombiana*), eastern Brazil (*O. guttata araucuan*, *P. superciliaris alagoensis* and *Crax fasciolata pinima*), and Mesoamerican island endemics (*O. vetula deschauenseei* and *C. rubra griscomi*).

Brooks (2002b) performed hotspot analysis to determine patterns of peak diversity in cracids, revealing the following trends: Southwestern Colombia and Ecuador harbor peak diversity of *Penelope* guans, as well as all species of cracids, and cracids dependent upon undisturbed forest. When combined, all of the non-*Penelope* species of guans show peak diversity in southeastern Peru, where Andean and Amazonian forests intergrade. Chachalacas represent the only group with a hotspot in Middle America, in the region of the southern Mexican isthmus. Curassows reach peak diversity in western Amazonia, somewhat surprising in light of the increased uniformity of habitat in the Amazon basin relative to the Andean slopes.

Conservation Actions for Cracids

Incorporating experience gained from work carried out during the five-year implementation period of the previous Action Plan, this section outlines the different forms of conservation action that have proved effective (Fuller et al. 2003). They have been divided into areas that emphasize the sequence of actions that must be undertaken to ensure long-term conservation of cracids, and various examples are provided as well.

Clarifying Taxonomic Units

Research Accomplished: There have been great strides made in cracid systematic work since the last Action Plan, thanks in large part to the efforts of evolutionary biologist Sergio Pereira and his colleagues (e.g., Grau et al. 2003, 2005, Pereira and Wajntal 1999, 2001, Pereira and Baker. 2004, Pereira et al 2002, 2004). Indeed, Pereira and his colleagues have accomplished several of the recommendations suggested in the last Action Plan regarding taxonomic research. For example, we now know that:

- The Piping Guans (formerly genus *Pipile*) are closely allied with the Wattled Guan (*Aburria*), such that all five species are now considered congeners within *Aburria*.

- The four species of Piping Guans (*Aburria*) are four unique species. The Critically Endangered Trinidad Piping Guan (*Aburria pipile*) is indeed a unique form, closest allied to *A. cumanensis*.

- The Alagoas Curassow (*Mitu mitu*) and Razor-billed Curassow (*M. tuberosa*) are indeed different species.

Future Research: There are still plenty of areas for research, particularly with reference to the genera *Ortalis* and *Penelope* (S. Pereira pers. comm..). Taxonomic problems related to validation of species or subspecies can be easily resolved by analysing DNA sequence data (S. Pereira in litt.). This section outlines the work that the CSG considers to be a high priority for taxonomic research that might eliminate or greatly reduce the confusion and differences in opinion between authors.

- *Ortalis guttata columbiana*: verify its status as a subspecies of *O. guttata* or its validity as a separate species.

- *Ortalis ruficauda lamprophonia*: verify as a valid subspecies of *O. ruficauda* in northeast Colombia.

- A review of the *Penelope purpurascens - P. jacquacu, P. perspicax, P. ortoni, P. albipennis* groups to define the similarities between them (Brooks and Strahl 2000).

- *Penelope argyrotis*/*Penelope barbata:* conduct a definitive study of the relationships between these two species, as well as a general revision of *P. argyrotis* to examine (among other subspecies) the *albicauda* subspecies.

- *Penelope montagnii:* the two subspecies are separated by the presence of another form (known as a leap-frog pattern), and have very distinct calls. These two populations may

constitute distinct species, and research is needed to substantiate this (J. Fjeldså pers. comm.).

- Revise the classification of *Crax rubra*, which may comprise undescribed subspecies, especially between Central America and the Panama/Colombia/Ecuador populations. Zimmer (1999) suggests the color morphs (color variations) occur in the same flocks as the normal colored *Crax rubra*.

- Studies are needed to evaluate the status of both species of *Pauxi*. Pereira and Baker (2004), found *Pauxi* to be non-monophyletic. *P. unicornis* is more closely allied to *Mitu tuberosa* and other *Mitu* than to *P. pauxi*, whereas *P. pauxi* is the most basal curassow in the *Mitu-Pauxi* group. Additionally, the two populations of *P. unicornis* are separated by more than 1000 km and appear to have distinct vocalizations and could constitute different species; research is urgently needed to substantiate this, as the Peruvian population is Critically Endangered (R. Macleod in litt.).

- Revise the taxonomy of priority species and subspecies identified in this document, particularly the more widespread taxa. Several of these have possible undescribed subspecies (e.g. *Aburria aburri*, J.M. Carrion, pers. comm.), which need immediate attention.

The systematics of *Ortalis* and *Penelope* will be better understood if efforts are realized through an integrative process (S. Pereira in litt.), perhaps coordinated by the Galliformes Genetics Working Group. The integrative process refers to creating a group in which some people would do field work to collect blood or tissue samples from all species and subspecies possible, and some people would do DNA sequencing to analyze samples collected by the field group. Another reason for this is that *Ortalis* and *Penelope* are widespread in the Neotropics, and this implies different permits from different countries to export or import samples, and cover a large area to obtain samples. National and local museums should be involved to build regional capacity. Unless a network of people from several countries is adequately established, it will be very difficult to understand the evolution of these groups and set conservation priorities.

Gathering Basic Information

Surveys: This is the first steps toward understanding a species' requirements and the potential threats to its survival. Extensive surveys involve the collection of basic information on the presence or absence of a species at various sites, as well as data on relative abundance and population size. It is challenging to propose conservation action without such basic knowledge. To generate comparable results for the assessment of long-term changes in abundance, it is important that surveys are designed to repeat the same work at a later date; it is particularly important that methods are clearly described and survey points are accurately located.

Field revisions of the status and distribution of cracids in each country are urgently needed. While most countries have had national-level surveys, it is important that these data are continually updated to examine population changes over time. Such surveys should include reviews of pressures affecting each species, and the development of recommendations for effective conservation of the family on a regional and country scale.

Rapid assessment techniques have been refined to focus on obtaining baseline data on cracid relative abundance and distribution, but still applicable to other sympatric species of importance (Brooks et al. 2005). Such surveys have taken place several regions, including Colombia

(Salaman et al. 2001), Paraguay (Clay et al. 1999) and Bolivia (Mee et al. 2002). Other focused surveys strictly for a given species have taken place as well. The intensive interviews and searches by Hennessey (1999) for the last remaining population of wattled curassows (*Crax globulosa*) in Bolivia have been adopted for searching for other rare species in Peru for example (Hennessey 2004a).

Basic biological research: Research with conservation objectives should be designed to provide detailed information on the biology of a threatened species, including, for example, the effects of hunting pressure and habitat disturbance. Population numbers should be estimated using standardized techniques where possible (Strahl and Silva 1997a, Jimenez et al. 2003). Data on threat parameters (e.g. degree of hunting, logging, habitat availability, population/habitat fragmentation and forest edge effects) should also be collected when obtaining population estimates.

Some of the best studies of a given species are the long-term studies of various Cracidologists in Mexico for example. Fernando Gonzalez-Garcia (1994, 1995, 1997, 2001, 2005) has been studying the Horned Guan (*Oreophasis derbianus*) since 1987, whereas Miguuel Martinez-Morales (1996, 1997, 1999, 2001) has studied the very rare subspecies of Great Curassow (*Crax rubra griscomi*) on Cozumel Island since 1994. Intensive studies of ecology and foraging behavior of Amazonian curassows (primarily *Mitu salvini* and *Crax alector*) in Parque Nacional Natural Tinigua, Colombia took place intensively during the 1990s (e.g., Escano 1994, Franco and Santamaria 1997, Jimenez et al. 1998, 2001, 2003, Santamaria and Franco 1994, 1997, 2002, Yumoto 1999).

Making Conservation Recommendations

Identifying priority areas for conservation: Analyses (e.g. using Geographic Information Systems [GIS]) are needed to estimate the effect of habitat destruction on cracids (I. Jimenez in litt.). Widespread habitat destruction in some under-developed or even pristine areas has resulted from government-sponsored colonization projects under the title of 'land reform'. In some cases, land is unmanaged to the extent that colonists will sell available timber, burn the remaining forest, plant pasture and then sell their government-donated lots. It is of paramount importance that governments implement land reform in areas which are already deforested, rather than in areas of primary forest. Moreover, in some regions, a great deal of habitat destruction is caused by logging to serve the foreign market. Foreign governments or consumers buying only “green seal” timber harvested in environmentally-friendly ways would help prevent over-harvest of trees.

Experiments investigating and documenting the importance of cracids in forest regeneration dynamics (i.e. seed dispersal and predation) are vital. Such seed dispersal experiments have been conducted predominantly for guans (e.g., Érard and Théry 1994, Théry et al. 1992, Guix and Ruiz 1997, Sedaghatkish et al. 1999), although reviews have been carried out for certain species within the entire cracid family (e.g., Sedaghatkish 1996).

One of the longest standing conservation actions is the creation of protected areas. This can be accomplished by using cracids as the flagship species to design the reserve around (B. Hennessey in litt., 2002, Flanagan and Angulo 2002, Ureña and Quevedo 2005). Although it is true that enforcement is often weak in protected areas, the fact remains that there is some impetus behind them and they have legal standing. Although we often see these places as being set aside primarily for the conservation of species or habitats, it is important to realize that there are a variety of purposes why protected areas are created or managed. It is, therefore, advisable to assess effectiveness of protected areas. The first step involves assessing how well the current system of protected areas

covers cracids and identifying species poorly represented by, or even completely absent from, the current network (Clay et al. 1999, 2001, Peres 2001, Redford 1991). We can then provide recommendations for embarking on the difficult challenge of trying to fill in these gaps.

Population dynamics of individual species: Once set in the context of large-scale patterns and priorities, it is often desirable to understand the dynamics of populations (changes in numbers over time), and how particular threats and proposed management strategies are likely to affect them (Soule 1986).

One way of looking at the population dynamics of a single species is to perform a Population Viability and Habitat Analysis (PHVA). The basic aim is to use information on the life history, ecology, and distribution of the species to assess how population sizes might change in the future as a consequence of alternative management strategies, such as habitat improvement, controlled hunting, and captive breeding (Galetti in litt.). The process allows combinations of actions to be identified that reduce the risk of extinction to a minimum, at least in theory. Various computer programs that simulate populations under different conditions have been developed, but data input into these programs must be carefully checked to avoid misleading results. A major limitation for population modelling is the adequacy and reliability of available data. The amount and extent of information needed to run a simulation providing meaningful and feasible models is vast, hence there is a need for caution when attempting such an exercise.

Types of Conservation Recommendations

Protecting habitat: Given that habitat loss and degradation are major threats to cracids, establishing and maintaining areas of suitable habitat is usually the best way of insuring their long-term survival. Thus, even in the absence of detailed recommendations of the type emerging from a PHVA, large-scale distribution and habitat information can be used to recommend the designation and expansion of important protected areas as described above. This may either occur formally or result from the development of a local partnership. It is necessary that recommendations for protected area designation are based on sound science and assessment of social needs, and are effectively promoted through lobbying of governments, local groups, and other parties involved in the decision-making process. Thus, designation of protected areas, often in addition to those already in existence, is an important step for protection of numerous threatened species, as is the protection and management of critical habitats within these areas.

A critical review of the effectiveness and extent of reserve design for cracids is essential. This should be done at both regional and national scales, but is a higher priority on a country-by-country basis. If these reserves fail to protect cracids, future reserves will not be taken seriously by the people inhabiting them. But if existing reserves prove to be functional, newly-declared reserves should also serve as working protection units. Factors that may contribute to the success of reserves include low human population density, adequate size, the existence of suitable habitat and viable dispersal routes to allow the birds to populate new areas, closure of existing roads and prevention of new access routes. In some cases, it is important that funding agencies promote good governance practices and mangement standards to be used by protected areas managers.

Although tremendous progress has been recently made in reserve establishment and habitat preservation, the size and effectiveness of reserves varies from country to country. For example, many areas are protected only in name because the institutions responsible for their management lack the necessary finances, adequately trained staff, or legal mechanisms and framework for developing and maintaining reserves. However, private reserves throughout

Latin America have been successful because the landowners recognize their property rights, making them effective at managing and protecting the land they value as private wildlife reserves (e.g. Bodmer and Brooks 1997). Privately owned reserves may be established by stimulating private-sector conservation, especially in large tracts of company-owned natural habitat. For example, the Crax Foundation's Red-billed Curassow (*Crax blumenbachii*) project in Brazil (Simpson and Azeredo 1997) serves as an ideal template for creating a private reserve to protect a flagship cracid species.

Re-linking known cracid refugia through forest restoration and habitat corridor establishment will promote genetic interchanges among cracid populations, increasing genetic heterogeneity (i.e., strengthening the gene pool, see Soule 1986) thereby reducing the risk of inbreeding and population extinctions. Areas for restoration and corridor placement can be identified using GIS to identify gaps between forest fragments. When restoring forest, it is important to create a plant community as similar as possible to that of naturally occurring forest. In cases where agro-forestry techniques are implemented, restoration projects should promote cultivation of native trees, particularly species that are used for lumber and furniture.

Regulating hunting and encouraging sustainable use: Detailed investigations are needed to determine the effects of hunting on cracids and other wildlife, and the general use of cracids by colonist and indigenous peoples. Curassows especially have a low reproductive rate (two eggs per clutch for most species), hence their populations are highly susceptible to over-harvest. Hunting should be monitored and carefully regulated where cracids form an important part of the diet of a subsistence society. Ideally, such regulation should be imposed by the local society, whose members can monitor populations to avoid over-harvesting and subsequent local population extinction. It is also important to investigate and promote the use of cracids as indicator species of human disturbance. The absence of cracids in good habitat is often a strong indication of over-harvest. Ideally, monitoring and investigations should be implemented in extractive (hunting) reserves, where the goals are the sustainable use of wildlife and biodiversity protection. Harvest assessments have been carried out on cracids, both at the level of community (e.g., Begazo 1997, Hill 2003, Peres 2000) and taxon (e.g., Begazo 1999, Brooks 1999).

Additionally, education programs on poultry farming or rearing potential game species in captivity should be implemented for local people. Evaluation of other alternative food sources for rural human populations is also important (Bodmer 1993, C. Galvez pers. comm.). For example, organic gardening can be complemented with sustainable gathering of wild plants (Galetti 1995, 1998). However, such agrarian programs must be carefully monitored initially to avoid unnecessary (over-)application of toxic pesticide (see Castaño-Uribe 1991) or excessive livestock production (see Rifkin 1992).

Conducting conservation awareness programs: Cracids are affected by the political, social and cultural behavior of all sections of the community, from local people to governments. Individuals must be aware of the importance of saving cracids and other endangered species of wildlife from extinction. Education of local people is needed in most extractive (hunting) reserves, where cracids are often over-hunted, together with programs that promote conservation ethics and sustainable use of wildlife (Silva 1997, Brooks et al. 2001a). Government and non-government organization programs should work with both rural and urban populations. Successful models of this type of work have taken place for multiple species in Venezuela (Strahl et al. 1997b), and for individual flagship species, such as *Penelope albipennis* in Peru (Flanagan and Williams 2001) and *Crax globulosa* in Colombia (Bennet 2003) and Bolivia (Hennessey 2004b).

Particular attention should be paid to decision makers, as their environmental values and perceptions may determine the outcome of cracid conservation. It is important to promote cooperative development of conservation education programs throughout the Neotropics, with specific emphasis on cracids and other wildlife as flagship educational tools. The importance of cracids (i.e., in forest regeneration dynamics) should be emphasized in these programs. Field researchers should contact educators and provide them with useful data and materials that can be used in education projects.

Because of the close relationship between humans and many species of cracid, there is great potential for conservation awareness programs to highlight plights of individual species, and raise awareness environmental stewardship and sustainable use. In many situations, especially where species declines were directly caused by humans, effective long-term conservation measures cannot be put in place without a rigorous and well-audited conservation awareness program.

Specific conservation awareness programs are most appropriate at the local community level where a species of concern occurs. Initiatives may include, for example, workshops involving stakeholders to discuss problems and possible solutions, establishment of mechanisms for distributing information in communities such as pamphlet distribution, construction of an information center, creation of a nature trail, establishment of nature clubs at local schools with regular events (e.g., slide/video shows, field trips, and talks), and development of a field camp for schoolchildren or teachers.

More generalized awareness programs could involve funding publications, visual education material, or exhibitions (travelling or static) to provide information about the birds, why their conservation is important, and what people can contribute as individuals and as members of their communities. Such materials need to be carefully designed, taking into account the intended audience.

All conservation awareness programs must be evaluated to reveal how people benefited from the initiative, and what conservation goals were achieved. The latter may not be specific, but the former can be tested using questionnaires and feedback workshops, depending on the situation.

The overall message is that conservation awareness programs should not just be added on to biological conservation projects because it seems the right thing to do. These important initiatives must be carefully planned, executed, and evaluated to be effective, and such activities should be sustained long-term. Ideally, experiences and evaluations should be published both locally and internationally to aid in designing future projects.

Ecotourism: The development of ecotourism would encourage local people to become tour guides who can serve as guardians of rare cracids. By entering into contractual agreements with government and/or local ecotour operators to act as guardians and guides, qualified local people would derive economic benefit from cracids, both from government subsidy and tourist revenue. Tourist visits should be limited by rotating them between the different areas that contain cracids. This would prevent disturbing a particular population while maintaining public vigilance in protecting the birds.

A successful ecotourism program is being established by Bennet (2003) on Isla Mocagua, Colombia. By prior arrangement with riverboat cruise operators, foreign tourists stop at the island to see the curassows, and learn more about this rare species from the island's inhabitants. The passengers pay a fee for this program, which goes directly back into the community, helping to justify the no-hunting moratorium the community has established for this species.

Re-introduction and translocation: Cooperative development of reintroduction and translocation techniques to manage wild populations is needed. This will require close cooperation between breeding facilities, field researchers, and government and non-government organizations. Translocations to safe regions void of cracids should be investigated to establish rarer species throughout their former distribution, and to prevent inbreeding by placing additional founders into small and/or isolated populations (Soule 1986). If every effort to prevent habitat depletion has been exhausted, cracids that are being displaced from suitable habitat could be translocated to more suitable regions that are unoccupied or under-populated. These habitats must be as physically similar and as close to the species' original locations as possible. Alternatively, in cases where cracid populations are large enough to sustain the loss of several pairs, the possibility of translocations into different regions could be examined to supplement existing isolated populations with additional stock. All reintroductions and translocations should follow the IUCN Guidelines for Re-introductions and follow the methods of others (e.g. Balda and Schemnitz 1997, Simpson and Azeredo 1997, Scheres 1997, Pereira and Wajntal 1999, Angulo 2003, Angulo and Barrio 2004).

The Red-billed Curassow (*Crax blumenbachii*) has been bred successfully in an intensive, well-documented program in Belo Horizonte, and has been reintroduced into part of its former range through the efforts of Fundación Crax with support from Crax International, Europe (Azeredo 1996, Simpson and Azeredo 1997). Currently, the introduced birds have a high rate of survival, and multiple-generation offspring from the released birds have been produced (Azeredo 1996, Scheres 1997). The White-winged Guan (*Penelope albipennis*) is also the subject of a coordinated captive breeding program and reintroduction program, with offspring produced in the wild from the reintroduced birds (Angulo 2003, Angulo and Barrio 2004, F. Angulo and R. Williams pers. comm.).



Nocturnal Curassow (*Nothocrax urumutum*) drawing by J. Merizio

Chapter 2 – Methods

Daniel M. Brooks and Stuart D. Strahl

The process to update the last Action Plan (Brooks and Strahl 2000) began in July 2004. The initial step was to compile a list of all threatened cracids, initially working off of Birdlife's (2004) recommendations for cracids. We used input from Birdlife's "Threatened Birds in the Americas Forums" (Birdlife International 2004), but more importantly, solicited every person we knew that had actively worked with the taxa we were concerned with.

Of the 24 species of cracids listed as NT, VU, EN, CR or EW, we received good initial feedback for 19 species. In most cases we received sufficient feedback (e.g., six responses for *Crax fasciolata* and *C. alberti*; seven for *Penelope ortoni*, *Aburria aburri*, *Pauxi pauxi, Crax rubra* and *C. globulosa*; eight for *P. unicornis*, etc.), but in some instances we received relatively little to no feedback; for the five species we did not received feedback on, we did not recommend diverging from Birdlife's (2004) recommendations. In situations where recommendations were made to up- or down-list a certain species it was usually unanimous among all Cracidologists providing feedback, or democratic rules provided a solution; for example, in the case of *C. rubra*: five recommended leaving the species as NT, one recommended down-listing to LC and one recommended up-listing to VU, so the solution was made to leave it as NT.

Once all of our responses were returned (May 2005) we contacted individuals who had worked intensively with a given species in the field, inviting them to author species accounts for chapters 3-6. In all cases the responses were overwhelmingly positive; only one individual declined

initially, and two were replaced later as they had time constraints that precluded them from meeting initial deadlines. All authors were allowed to invite additional co-authors as they wished. One or two individuals authored some of the chapters, but the majority had three co-authors, and some had as many as four (e.g., *Penelope albipennis*) or five (e.g., *Crax alberti*) co-authors. Each author was sent a three-page document titled 'Instructions for Cracid Action Plan - Authored Species Accounts' with 12 bulleted points. The majority of the document's content was template information (paragraph content layout, citations, etc), but it was stressed first and foremost that co-authors must actively communicate with one-another to make sure efforts were well coordinated and communicated. Each author was asked to try not to exceed two pages of text if at all possible, with three sections: 1) Work to Date, 2) Status and Threats and 3) Conservation Action. Each species account was allowed one or two visual aids (graphics, maps, tables or appendices), but in most cases the authors provided only a single photo; only a few chapter authors provided maps, tables or appendices. The first round of edits for the species accounts took place September-October 2005. Every attempt was made to maintain the creative style of respective authors as much as possible.

The compilation of the book was announced through a variety of sources, with a call for reviewers. The first version (Introduction through Species Accounts) was sent out in September 2005 for review; at this time the species accounts were sent out without the respective authors names attached to avoid under- or over-biased reviews. The feedback from the first review was used to accurately update the book, and then the final two chapters were produced: "Country Assessments" and "Ecoregional Analysis".

The country assessments chapter overviews summaries for 17 countries lumped into six regional accounts: northern Central America, southern Central America, northern South America, western South America, southern South America, and Brazil. Each regional account was generally separated into five sections: 1) Reserves, 2) Research, 3) Legal Protection, 4) Education and Outreach, and 5) Captive Breeding.

The ecoregion chapter used hotspot analysis, a way to identify and prioritize regional conservation by comparing equal blocks representing species richness in regional map quadrats (Mittermeier et al. 1998). Peak cracid diversity was analyzed in various geographic regions at two comparative scales of cracid species richness: all cracids and threatened cracids.

The final updated version was sent out in November 2005 for review before sending the book to the translators. The completed list for Threatened cracids is provided below:

Extinct in the Wild (1 species)

Mitu mitu	Alagoas Curassow	EW

Critically Endangered (4 species)

Penelope albipennis	White-winged Guan	CR - C2a(i)
Aburria pipile	Trinidad Piping-guan	CR - C2a(ii)
Oreophasis derbianus	Horned Guan	CR - E
Crax alberti	Blue-billed Curassow	CR - A3b,c,d

Endangered (7 species)

Penelope ortoni	Baudó Guan	EN - A2c,d; A3c,d
Penelope perspicax	Cauca Guan	EN - B2a+b(i,ii,iii,v); C2a(i)
Aburria jacutinga	Black-fronted Piping-guan	EN - A2c,d; A3c,d
Pauxi pauxi	Helmeted Curassow	EN - C2a(i)
Pauxi unicornis	Horned Curassow	EN - A1a & d, A2d; B1+B2b,c,e
Crax blumenbachii	Red-billed Curassow	EN - B1a+b(i,ii,iii,v); C2a(i); D1
Crax globulosa	Wattled Curassow	EN - A2b,c,d; A3b,c,d; C2a(i)

Vulnerable (7 species)

Ortalis erythroptera	Rufous-headed Chachalaca	VU - A2c,d; A3c,d; B1a+b(i,ii,iii,v); C2a(i)
Penelope barbata	Bearded Guan	VU - B1a+b(i,ii,iii,v)
Penelope ochrogaster	Chestnut-bellied Guan	VU - B1a+b(i,ii,iii,iv,v); C2a(i)
Penelope jacucaca	White-browed Guan	VU - A2b,c,d; A3b,c,d
Chamaepetes unicolor	Black Guan	VU - B1b(i,iii)
Penelopina nigra	Highland Guan	VU - A2c,d; A3c,d
Crax daubentoni	Yellow-knobbed Curassow	VU - A3a,c,d

Near-threatened (5 species)

Ortalis superciliaris	Buff-browed Chachalaca	NT - C2a(i)
Penelope pileata	White-crested Guan	NT - C2a(i)
Aburria aburri	Wattled Guan	NT - C1; C2b
Crax rubra	Great Curassow	NT - A2c,d; A3c,d
Crax fasciolata	Bare-faced Curassow	NT - A2c,d; A3c,d



Young male Blue-billed Curassow (*Crax alberti*) photo by Proaves-Colombia

Chapter 3 - Extinct in the Wild and Critically Endangered

Only a single species (*Mitu mitu*) is considered Extinct in the Wild, with an additional four Critically Endangered. Of these, only one (*Oreophasis derbianus*) was up-listed from Endangered. All are strongly endemic to specific ecosystems and regions; only *Oreophasis derbianus* is found in more than a single coutry, endemic to highlands of southern Mexico and Guatemala. Below is a list of the five species highlighted in this section:

Mitu mitu	Alagoas Curassow	EW
Penelope albipennis	White-winged Guan	CR - C2a(i)
Aburria pipile	Trinidad Piping-guan	CR - C2a(ii)
Oreophasis derbianus	Horned Guan	CR - E
Crax alberti	Blue-billed Curassow	CR - A3b,c,d



Drawing by J. Merizio

Alagoas Curassow (*Mitu mitu*)

Carlos A. Bianchi

Work to Date

Considered for a long time as a geographic variation of *Mitu tuberosa*, this species was first reported by Marcgrave in 1648 and described by Linnaeus in 1766, but only after 1951 it began to be treated as a distinct species (Silveira et al. 2004). Distribution was reported for northeastern Brazil (Helmayr and Conover 1942), or more restricted to Pernambuco (Pinto 1964, 1978), but Teixeira (1997) suggests *M. mitu* ranges from Rio Grande do Norte to Alagoas (at the São Francisco River), based on Marcgrave's description of forest. However, all confirmed information about the species refers to Alagoas State, possibly involving an area less than 2500 km^2 (Silveira et al. 2004).

The species was considered rare (Sick 1980, Teixeira 1986) and supposedly vanished from nature in the early 1980's (Collar et al. 1992). Nardelli (1993) described his efforts on the rescue of what was possibly the last group of curassows in Alagoas. In 1976 the first curassows were collected for captivity, which died a few months later. During the following two years, he visited the areas again observing six birds and an active nest. In 1979 he captured five birds at Mata do Othon (municipality of Barra de São Miguel), and got another one from captivity in Maceió, bringing all of them to his facilities in Rio de Janeiro. One of the six birds died, and the rest (two males and three females) were separated into a pair and a trio. By 1990 the whole population of

curassows reached 19 birds (12 males and 7 females), all descendants from the trio, as the pair failed to lay eggs. Due to the high number of males, Nardelli hybridized some birds with Razor-billed curassows (*M. tuberosa*) aiming to recover "pure" birds in the future by back-crossing (Silveira et al. 2004). The captive population reached 44 birds in 1999 when Nardelli's breeding center was closed. IBAMA decided to transfer the curassows to two new centers: CRAX-Brazil, which received 23 specimens (11 males and 13 females, of which 3 males and 4 females were considered "pure"), and CCCPC, which received 20 specimens (10 males and 10 females of which only one pair was considered "pure").

Conservation action of this rare species by the Brazilian government was incipient from the 1970's to the 1990's, relying only on two unsuccessful field projects (Bianchi in prep.). However, since 1996 a local NGO named Instituto para a Preservação da Mata Atlântica (IPMA) started working on preservation and recovery of forest remnants on lands owned by the sugar cane industry. IPMA also disseminated information through a well-developed environment education program for schools in Alagoas State. In 2003, IBAMA established the "Committee for the recovery and management of Alagoas Curassow *Mitu mitu*" with several experts, researchers and institutions interested in conserving this rare species (Bianchi in prep.). The first Committee meeting in 2003 produced several recommendations (see Conservation Action).

Status and Threats

The Alagoas Curassow is considered the most threatened cracid in the world, being treated in several sources as "Extinct in the wild" (Collar et al. 1992, Brooks and Strahl 2000, MMA 2003, BirdLife International 2004), and several authors have reported its rarity (Coimbra-Filho 1971, Sick and Teixeira 1979, Sick 1980, Teixeira 1986). Low numbers of wild birds (20-60 birds) were reported at different sites during the 1970's and 1980's (Coimbra-Filho 1971, Teixeira 1986, Collar et al. 1992). Regional hunting pressure was a strong factor causing *M. mitu* and other game species to diminish. Nevertheless, the fast and intense deforestation during the 1970's and 1980's due to governmental incentives for sugar cane plantation development for the Proalcool Project (producing alternative fuel to gasoline – Cavalcanti 1992) is certainly the main reason for this species decline to extinction (Collar et al. 1992, Nardelli 1993, Silveira et al. 2004, Bianchi in prep.). Hunting activity is still present in the region however (Silveira et al. 2003a).

Currently, the only chance remaining for the species is the captive population and the restoration of its original habitat in northeastern Brazil. Since transferring from Nardelli's facilities, the population has been bred successfully, reaching 70 birds in 2002 (Silveira et. al. 2003b) and the current number of birds has recently reached 115 (in May 2005) with nearly 50% considered "pure" birds (Bianchi in prep.). Wajntal and Silveira (2005) carried out genetic analysis to investigate degrees of hybridization in the entire captive population, but results were inconclusive mainly due to the lack of certainty on individual identification of older birds in the original stock. Morphology remains the best tool to separate pure birds from hybrids, and details on valid diagnostic characters are in Silveira et al. (2004). IBAMA is assessing the genetic aspects of the captive breeding program to help manage constraints of the small population of birds, aiming to establish a viable population in the future. Two new holders (São Paulo Zoo and CESP) have already been evaluated and selected to receive curassows, which will expand the number of breeding centers to four.

Conservation Action

At the first meeting of the Committee in 2003, IBAMA coordinated discussions on several issues regarding establishing strategies for conservation of *M. mitu*. A second meeting took place in

July 2005, where the prior recommendations will be updated. Parts of the recommended actions have already been completed. Although creation of a more detailed Action Plan is in the works, the main actions remaining to be achieved are:

I. Recommendations for the Captive Population

a. Transfer curassows to the new breeding centers selected to increase biological security and increase reproductive chances of the entire population.
b. Insure rigorous segregation of hybrid birds to insure pure stock.
c. Evaluate the use of artificial insemination as a technique for the captive breeding program.
d. Create a captive management protocol to be used by all breeding centers.
e. Create a breeding studbook.

II. Habitat Restoration and Protection

a. Evaluate possible vegetation restoration in larger forest fragments (Usina Serra Grande and Usina Leão) as potential reintroduction sites.
b. Establish oriented restoration management of vegetation by establishing corridors among forest fragments within the area of distribution.
c. Guide and intensify IPMA's action on the recovery of forest fragments (seedling plantation and corridor establishment).

III. Public Awareness

a. Expand the environment education program, establishing a Visitor's Center at one of the educational sites, as well as producing educational material and workshops (papers, folders, lectures, campaigns).
b. Promote environmental education as it relates to shifting hunting patterns of local people.



White-winged Guan (*Penelope albipennis*)

Fernando Angulo Pratolongo, Víctor Raúl Díaz, Rob Williams and Laura Cancino

Work to Date

The White-winged Guan was described in 1877 and was known from three skins, one collected in mangroves of Tumbes department, in extreme Northwestern Peru, and two collected from the Equatorial dry forest at Hacienda Pabur, Piura department, 200 km southeast of the first locality (Vaurie 1968, de Macedo 1979). After these records, no other observations of the species were made until 1977, when was rediscovered at Quebrada San Isidro, near the border between Piura and Lambayeque departments (de Macedo 1979). In 1978 the first population survey was conducted and resulted in 62 individuals (Ortiz 1980). A second survey carried out in 1987 reported 97 birds (Ortiz and Diaz 1997) and a third survey in 1990 resulted in 153 birds (Diaz and del Solar 1997). Fernando Angulo is currently carrying out a fourth survey.

This Peruvian and Tumbesian endemic guan is monogamous and territorial, being active during the first and last hours of the day. It has a breeding season between January and August and usually lays two eggs. It feeds on fruits, flowers, seeds, leaves and sprouts of bushes and trees (Ortiz 1980, Ortiz and Diaz 1997). The nest is constructed around 3 m above ground and is composed of twigs and leaves (Ortiz 1980, Williams 1980). Eley (1982) studied the systematic relationships and zoogeography of the White-winged Guan. The current distribution of the species occurs between 5º25'S-79º55'W to the north, and 6º39'25"S-79º22'30"W to the south, inside the equatorial or Tumbesian dry forests of the western slope of the main Andean chain, between 300-1100 masl (Ortiz and Diaz 1997, Diaz and del Solar 1997), but has been reported up to 1400 masl. The White-winged Guan inhabits small ravines or quebradas in a strip approximately 120 km long and 10 km wide.

There is a captive breeding program for the species, which started in 1978 and currently (June 2005) holds around 80 individuals. This program supplies birds for the species reintroduction program, which began in 2000 in the Chaparrí private conservation area. Both sites are located in Lambayeque department (del Solar 1988, Angulo 2003). Until late 2003, there were three chicks born in the wild from reintroduced parents (Angulo 2004), and to date (June 2005) there are 20 that were born in the same conditions. El Angolo Hunting reserve (Piura) and the Laquipampa

reserved zone (Lambayeque) had been surveyed to determinate their potential as reintroduction sites and both had been found to be favorable (Angulo and Barrio 2004, Angulo and Beck 2004).

Research on wild populations is being carried out to determine seasonal diet changes and assess habitat. Diet has been determined for reintroduced populations (Lerner 2003). Survivorship is estimated at 55% two years after release (Angulo 2004).

Status and Threats

The White-winged Guan is considered Critically Endangered (BirdLife International 2000) and under the same category by the Peruvian legislation. This cracid was considered of Immediate Conservation Priority by the IUCN/SSC Cracid Specialist Group (Brooks and Strahl 2000), and is listed in the appendix I of CITES. The Peruvian government created the Laquipampa reserved zone (11,347 ha) in 1982 with the aim of especially protecting this species and its habitat (Flanagan y Angulo 2002). In 2003 a law declared it to be of "National Interest". In addition to this, the government of Lambayeque has declared the White-winged Guan as the "Regional Bird", and Park guard training has taken place (Flanagan and Williams 2001).

The total captive population is estimated at 105 individuals placed at four different sites: two of them housed in breeding centers in Olmos, and two in zoos in Lima. The population at the Bárbara D'Achille breeding center holds the largest captive population, numbering around 80 individuals (June 2005). The reintroduced population, estimated at 35 birds (June 2005), is found in the Chaparrí private conservation area and probably bordering property as well. The wild population has been projected to number less than 300 individuals (Diaz and del Solar 1997) and preliminary results of ongoing population surveys suggest that this number is accurate.

Threats for the species short-term survivorship include habitat loss by seasonal agriculture (during the rainy season), tree extraction for flooring, firewood, cattle feed, construction, religious use (*Bursera graveolens*) and for the fruit box industry. Additionally, cattle impact plant regeneration in the habitat, and also destroy water sources. Another important threat for wild White-winged Guan populations is poaching by local and urban people.

With regard to the long-term threats, habitat fragmentation is becoming a major hazard for the species survival. The wild population is being fragmented into two metapopulations, one to the south and one to the north of the distribution range, with the Chiclayo-Tarapoto road acting as a barrier between them. This paved road facilitates human settlement, leading to forest clearance for agriculture sprawling on both sides of the road, resulting in an ecological barrier that the guans are unable to cross. This process does not allow for gene flow and viability of the metapopulations must be determined through genetic assessment.

Conservation Action

I. Expand protected habitat network, increase capacity and infrastructure for Park Staff at Laquipampa and implement the Lambayeque Biological Corridor proposal, supporting communities in establishing private reserves.

II. Continue captive breeding (establishing at least two viable populations) and reintroduction and supplementation programs to unite small isolated populations through the guan's range.

III. Coordinate eco-tourism to enhance community and conservation benefits.

IV. Initiate a multi-faceted environmental educational program in the region.

V. Create a "National Conservation Strategy" for the White-winged Guan, to serve as a basic tool for directing future actions regarding this species.

VI. Establish a studbook for the species to coordinate among holders of captive individuals to insure that a long-term viable captive population is maintained, as well as research on genetic status of both captive and wild White-winged Guan populations.

VII. Develop and promote dry forest sustainable use strategies such as eco-tourism or apiculture in the White-winged Guan area of distribution and surrounding regions.

VIII. Research the effects of the "El Niño" event on the guan populations.

IX. Fundraising for the continuity of the White-winged Guan conservation project.



Reintroduced White-winged Guan on nest (photo by F. Angulo)



Drawing by E. Rooks

Trinidad Piping-Guan (*Aburria pipile*)

Floyd E. Hayes

Work to Date

Despite "rapidly becoming a rare bird" by the late nineteenth century (Chapman 1894) and being "confined to the eastern half of the northern range and the extreme south of the island" by the mid 1930s (Belcher and Smooker 1935), only a few scattered sightings were reported in the technical literature up until the early 1980s (Worth 1973, ffrench 1969, 1977, 1986). From 1982-1987, extensive surveys and interviews with local hunters were conducted by the Wildlife Section of the Forestry Division, providing anecdotal notes on the piping-guan's biology and the first detailed assessment of its status (James and Hislop 1988, 1997).

After surveying five potential study sites in the Northern Range in 1989, students from the University of Glasgow spent 10 days in 1989 and 18 days in 1991 studying guan ecology and behavior (Alexander et al. 1990, 1992, Alexander 2002). From 1999-2002, a group from the University of the West Indies and Caribbean Union College conducted extensive surveys of guans at various sites throughout the Northern Range and conducted extensive studies of the guan ecology and behavior at Grande Riviere (Hayes et al. 1999, in prep.). However, their attempts to capture and radio-track the birds at Grande Riviere were unsuccessful. Since 2004, a new study of the status and biology of the guan in the Northern Range is being conducted by another group from the University of the West Indies (John Cooper pers. comm.).

Status and Threats

The Trinidad Piping-Guan is endemic to the island of Trinidad, where it is Critically Endangered. It was formerly widespread on the island but by the mid 1930s was "confined to the eastern half of the northern range and the extreme south of the island" (Belcher and Smooker 1935). Intermittent surveys from 1982 to present (see above) revealed the bird to be rare and local at scattered localities, sparsely inhabited by humans within an area of about 150 km^2 in the eastern half of the Northern Range in northeastern Trinidad. There is only one recent report from the Southern Range (Mark Berres, pers. comm., 2000), where it is likely to become extirpated if not already. It occurs

primarily in forest areas but tolerates limited human activities in small-scale agricultural plantations, such as at Grande Riviere where a small group of individuals has persisted for at least 20 years. It ranges from sea level up to 900 m, potentially occurring at the highest elevation on the island (925 m). The size of the population is unknown but is unlikely to be more than a few hundred birds.

More than a century ago, Chapman (1896) reported "The flesh of this species is deservedly esteemed, and through the persecution of hunters it is rapidly becoming a rare bird". Illegal hunting, both for subsistence and sport, clearly has been and continues to be the major threat, but has declined in recent decades thanks to public education campaigns by the Forestry Division in the early 1980s (James and Hislop 1997) and by the Rare Center for Tropical Conservation (in conjunction with the Forestry Division) in the late 1990s (Butler et al. 1998). Although recent studies in Grande Riviere indicate the guan tolerates limited human disturbances in small-scale agricultural plantations of rural communities as long as canopy trees are left intact in nearby forest, habitat loss has been a significant and growing threat. Construction of access roads in remote areas negatively affects the guan because this activity is usually accompanied by illegal timber extraction and squatting. Deforestation, most of it conducted illegally, has increased in recent decades as settlers move into the more remote and rugged areas of the eastern part of the Northern Range. Deforestation initially involves timber harvesting followed by cultivation of small-scale agricultural crops (including marijuana) or exotic agroforestry plantations (e.g., pine or teak), and the construction of human dwellings. Habitat destruction will almost certainly accelerate if a proposed highway is built to connect an 18 km stretch of rugged, relatively pristine habitat along the north coast between Blanchisseuse and Matelot.

Conservation Action

Despite several recent and ongoing public education campaigns and research projects, there has yet to be a national action plan adopted for the conservation of the guan. Nevertheless, several recommendations for conservation actions have already been proposed (e.g., King 1981, Collar et al. 1992, James and Hislop 1988, 1997, Temple 1998, Connolly and Seutin 1998, Brooks and Strahl 1999).

I. Research
Several recent research projects have greatly increased our knowledge of the guan's biology, yet its status in remote areas of its range remains poorly documented and almost nothing is known of its reproductive biology. More intensive surveys are needed to better estimate the current population. Banding and radio-tracking studies are needed to better understand its reproductive biology, life history parameters and metapopulation dynamics.

II. Public Education
Recent public education campaigns have been effective in highlighting the plight of the guan. Hunters interviewed in northeastern Trinidad often report that they quit hunting the bird after learning that it was Endangered. Nevertheless, some illegal hunting still occurs and continued public education campaigns are needed to improve public attitudes toward the environment in general and the guan in particular.

III. Habitat Conservation
Although legislation has been proposed for developing a system of national parks, such legislation has yet to be passed. The proposed Matural National Park in northeastern Trinidad would provide legal habitat protection in a large portion of the guan's range. Passing such legislation will require political lobbying.

IV. Law Enforcement

The guan has been officially protected since 1958 by the Conservation of Wildlife Act, which has been poorly enforced. Because hunting has been the primary cause of the guan's decline, more effective enforcement of hunting laws are needed, which requires political lobbying, capacity building and training.

V. Captive Breeding

The development of a captive breeding program has often been urged (e.g., King 1981, Collar et al. 1992, Connolly and Seutin 1998) but has never been attempted. Such a program should be planned and implemented as soon as possible. A captive bird is kept at the Emperor Valley Zoo, which is probably too small, crowded, and noisy to be an effective site for captive breeding. The Point-a-Pierre Wildfowl Trust may be the best facility for a captive breeding project.



Horned Guan (*Oreophasis derbianus*)

Fernando González-García, Javier Antípatro Rivas Romero and Ana José Cóbar Carranza

Work to Date

González-García et al. (2001) summarized recent distribution data for Mexico. Its occurrence in the Chimalapas, Oaxaca zone, has always been suspected, but never completely confirmed through a specimen or scientific publication (Navarro et al. 2004, Peterson et al. 2003, Delacour and Amadon 2004). Recent fieldwork (2005) and interviews with local people of San Antonio and Benito Juarez's town in the municipalities of San Miguel and Santa María, Chimalapas suggest the presence of the Horned Guan in the Chimalapas area. Verbal evidence suggests the Horned Guan is present in the areas known as Cordón El Reten y Sierra Tres Picos. The Chimalapas region still holds large amounts of suitable habitat (Peterson et al. 2003), although in 1998 cloud forest was reduced substantially due to forest fires (Asbjornsen y Gallardo 2004).

The presence of Horned Guan has historically been listed at 23 sites in Guatemala. Recent records are from Fuentes Georgina, on Zunil Volcano, and from the volcanoes Tolimán, Atitlán, San Pedro, Acatenango, Fuego and Sierra de las Minas (Birdlife International 2000, Veliz 2000, García 2005, Martínez 2005, Secaira 2005, D. Tenes pers. comm.). Currently (July 2005), JR and AJC are carrying out a project to determine historical and current geographical distribution of this species in Guatemala. Guans may occur in Honduras at Cerro Volcán Pacayita Biological Reserve, but this remains unconfirmed (Delacour and Amadon 2004).

In Sierra Madre de Chiapas, Mexico, the Horned Guan's habitat is characterized by *Quercus-Matudaea-Hedyosmun-Dendropanax* plant associations (Long and Heath 1991, Williams-Linera 1991, del Hoyo et al. 1994, Birdlife International 2000, González-García et al. 2001, Delacour and Amadon 2004). Habitat characteristics in the area of Chimalapas, Oaxaca have not been described yet. Horned Guans inhabit both slopes of the Sierra Madre de Chiapas and appears to be more frequent on the Atlantic Slope. The Horned Guan is primarily recorded in primary evergreen humid broadleaf forest (cloud forest) at elevations of 1600-3350 m. As with other frugivorous birds, the Horned Guan seems to perform seasonal altitudinal movements, perhaps

synchronously following phenological fruit blooms. Post-breeding home range and habitat use is still largely unknown.

Natural history data have been summarized (González-García et al. 2001, Delacour and Amadon 2004), but very little is known of Horned Guan population ecology outside of the breeding season. In Mexico, females nest on the upper portions of the canopy of relatively isolated trees, at an average height of 18.87 ± 5.54 m (n = 5). The nest is built with vegetation (bromeliads roots, orchids and dead leaves) and measures 32 ± 4 x 30.3 ± 2.52 cm. Trees used as nesting sites include *Matudaea trinervia* (Hammameliaceae), *Ternoestroemia lineata* (Theaceae), *Quercus* sp. (Fagaceae) and *Clethra* sp. (Clethraceae). Females lay two white eggs of rough texture, with an average size of 83.94 ± 1.13 x 58.46 ± 1.02 mm (n = 6) (González-García 1994, 1995, 1997a, 1997b, González-García et al. in review). In Guatemala, Horned Guans seem to nest at a lower height than at El Triunfo, Chiapas. At Tolimán Volcano a nest was recorded 7.8 m high in a tree of *Chiranthodendron pentadactylum* (Méndez 2000).

Horned Guans consume fruits and green leaves. At El Triunfo the diet comprises at least of 57 species of plants; guans consume the leaves of 12 of these plant species (González-García 2005). In April 2005 a female was observed eating flowers of an orchid at El Triunfo Biosphere Reserve (Abundis pers. comm.). In Guatemala, the Horned Guan has been registered feeding on fruits of *Dendropanax arboreus* (Araliaceae), *Symplocos hartwegii* (Symplocaceae), *Phoebe sp*. (Lauraceae), and drinking nectar of *Chiranthodendron pentadactylum*. Other species in the diet are known with the local names of Palo blanco, Jocotillo and Aguacatillo (O. Mendez pers. comm.).

At El Triunfo population density was estimated to be 4.5-6.7 ind./km^2 (González-García 1995, Gómez de Silva et al. 1999). Considering the five core areas of the El Triunfo that total 19,784 ha of cloud forest, the population size in these core areas is estimated to be between 890-1325 individuals. Considering the whole reserve, with a total of 55,000 ha of cloud forest, the population size is estimated to be 2475-3685 individuals (González-García 2001). Finally, in the whole Sierra Madre de Chiapas, with approximately 100,000 ha of cloud forest (Challenger 1998), the population is estimated at 4500-6700 individuals (González-García 2005).

In contrast to Mexico, less information has been gathered on the ecology and basic biology of the Horned Guan in Guatemala. Most information comes from studies carried out in the second half of the 19th century and the first half of the 20th century (Sclater and Salvin 1859, Salvin 1860, Salvin and Godman 1897-1904, Griscom 1932, Wetmore 1941, Andrle 1967, Zepeda 1981, Escobar 1997,Vannini and Rockstroh 1997). More recently, Mendez (2000) gathered the first records of nesting behavior at the Tolimán Volcano, and González-García et al. (2001) made a conservation status assessment in Mexico and Guatemala.

The Horned Guan has been studied and bred successfully in captivity (Cornejo 2005, González-García 2005, González-García et al. in review). Moreover, the first "Population and Habitat Viability Analysis" workshop (PHVA) was carried out in Panajachel, Sololá, Guatemala, in 2002 (Cornejo 2005, CBSG 2002). At this workshop the main threats to the species were identified, and action plans were developed based on the following topics: impact of local human activities, habitat protection and management, captive breeding and population biology. An important result of this workshop was the creation of the "Binational Comittee for the Conservation of the Horned Guan and its Habitat", wich promoted the following meetings. In 2003 the I International Symposium for the Conservation of the Horned Guan took place in conjunction with the VII Congreso de la Sociedad Mesoamericana para la Biología y la Conservación, Chiapas, Mexico (Cornejo in litt.). In 2005 the II International Symposium for the Conservation of the Horned

Guan took place at Los Tarrales Natural Reserve, Patulul, Guatemala. At this workshop the progress of the actions outlined in the PHVA were revised. During this symposium experts from Mexico and Guatemala talked about advances in research, habitat conservation and captive breeding, and also outlined future plans for the Horned Guan bi-national committee.

Status and Threats

Status: Using predictive modeling, Peterson et al. (2001) have predicted a 86-89% decline (assuming no dispersal) due to global warming. Although considered globally Endangered by BirdLife International (2000), we consider this species Critically Endangered, more similar to Immediate Conservation Priority recommendations by the IUCN Cracid Specialist Group (Brooks and Strahl 2000). Since 1979, the Horned Guan has been listed on CITES Appendix I in Guatemala, where its hunting and capture is prohibited. Currently, BirdLife International (2000) estimates the range of the species at approximately 7700 km^2. Nesting records and apparently viable populations are only known from El Triunfo Biosphere Reserve in México and the Tolimán Volcano, Guatemala (González-García et al. 2001, Méndez 2000). Although the Chimalapas region in Oaxaca, Mexico still holds large amounts of suitable habitat (Peterson et al. 2003), we will not assess status and viability of this possible population due to extensive forest fires (see Threats).

Current distribution and population size has not yet been determined for Guatemala, but successful reproduction can be assumed based on some observations in the Sierra de Las Minas, in the Los Tarrales Reserve and other regions of Atitlán Volcano. The latter is a private reserve and seems to be an efficient and effective form of protection motivated by strong personal interests. Several private reserves (e.g., on Atitlán Volcano), as well as other sites along the mountain chain, protect habitat and prohibit hunting of the Horned Guan (CONAP 2001). Vannini and Rockstroh (1997) indicate the Horned Guan´s range has diminished from 6000 km^2 to 3000 km^2 and that the species is now distributed in discontinuous patches. Currently (July 2005) JR and AJC are updating the actual distribution in Guatemala, as well as selecting potential sites to carry out more in-depth studies of Horned Guan biology and ecology. Among the most important results obtained to date are the records at San Marcos forest and Las Palomas Volcano in the Sierra de Las Minas Biosphere Reserve. It is important to note that government and non government organizations are developing conservation activities in the forests of the western and central volcanic mountain range of Guatemala, including Sierra de Las Minas Biosphere Reserve (García 2005, Martínez 2005, Secaira 2005).

Some captive breeding efforts have been successful in hatching chicks, mainly in Mexican zoos (e.g., Africam Safari in Puebla, Leon Zoo and Miguel Alvarez del Toro Zoo in Chiapas) and private collections (e.g., REAVYFEX in Querétaro and La Siberia in Mexico city), with an additional private breeder in Portugal (M. Leal). The founder population and its progeny from Fundación Ara are now held at Africam Safari, which has experienced the highest and most consistent breeding success, with 15 chicks raised in 3 years. Additionally, breeding loans from Africam Safari to other institutions (Leon Zoo and Guadalajara Zoo) are important accomplishments as a means of opening the path to cooperative management. Currently a captive population of approximately 100 individuals is estimated in Mexico, along with a few more in Guatemala and seven in Europe (J. Cornejo in litt., J. Rivas in litt.). An International Studbook has been published (Cornejo 2005), which permits sound genetic management of the captive population. As of 31 December 2004 there were 53 individuals in captivity distributed among nine participating institutions. Less than half of the potential founders have bred in captivity,

producing 31 offspring (>50% hatched between 2002-2005), with 32% of the offspring from the same pair.

Threats: The Horned Guan is a protected species in Mexico and Guatemala with laws prohibiting hunting and any human actions that could have negative impacts on population viability. Habitat alteration, hunting and illegal trade have been generally identified as main threats (Brooks and Strahl 2000, González-García et al. 2001, González-García 2005). Uncontrolled forest fires are a more recent threat to primary cloud forest. For example, 210,000 ha of tropical and subtropical forest were burned in the Chimalapas communal forest reserve in 1998, where 60% of the cloud forest (38,000 ha) was reduced to ashes (Asbjornsen y Gallardo 2004); if there is a population of Horned Guans at Chimalapas reserve it will surely be in a very critical situation. Fires have had negative impacts at El Triunfo also, mainly at Cerro Quetzal.

There is no long-term guarantee for Horned Guan survival due to potential fragmentation of continuous forest; fragmentation could easily lead to extinction of this species (Peterson et al. 2001). This is especially true at El Triunfo where non-sustainable agriculture and clandestine deforestation in three critical zones are endangering the continuity of the cloud forest (IDESMAC 1997, J.C. Castro pers. comm..). Another potential threat is the effect of global climate change, which ultimately can severely affect dispersal ability of the Horned Guan.

Recently in Guatemala, biologists and conservation institutions are carrying out various actions for conserving the Horned Guan. However, the execution of these measures is extremely difficult due to the complexity of factors that intervene: sites the Horned Guan inhabits are remote, basic necessities of the human population, demographic pressures on these areas, indifference of authorities and decision makers to the problem, inefficient institutions that lack adequate staff and funds to operate, lack of inter-institutional coordination between management of protected areas and those responsible for application of the law, and the lack of properly educating the local population on the importance of the conserving the Horned Guan and its habitat (CBSG 2002).

Conservation Action

I. Support establishment of more protected areas. For example, other important areas to protect in the Sierra Madre de Chiapas besides El Triunfo, include the Cordón Pico El Loro-Paxtal and the Tacana Volcano.
    a. The Cordón Pico El Loro-Paxtal (15,000 ha) reserve needs to be expanded.
    b. A binational reserve should be created in the Tacana area, between Mexico and Guatemala, where there is viable cloud forest with Horned Guan populations (Heath and Long 1991, González-García 1995, Challenger 1998, González-García et al. 2001).
        - These two new areas could be managed as ejidales or communal reserves with the development of an ecologically sustainable system.
        - In support of this, the Tacana Volcano (6378 surface ha) has been recently declared a biosphere reserve (Diario Oficial de la Federación, January 28, 2003).
    c. Another area is the Frailescana (60,450 surface ha), located to the west of the El Triunfo; no protection for the forest or Horned Guan is provided in this region (Heath and Long 1991).

II. Reinforce management and control in national protected areas in order to reduce deforestation and illegal hunting.

a. Reinforce entities and organizations in charge of managing and protecting cloud forests inhabited by Horned Guans.
b. Prohibit fragmentation at El Triunfo Biosphere Reserve and other important sites.

III. Horned Guan Research
   a. Continue to study actual distribution and population size.
   b. Monitor presence at known sites and estimate population densities with methods suggested by Strahl and Silva (1997a) or Jiménez et al. (2003, in prep.).
      - It is of vital importance to correlate demographic population changes with human and natural factors that can affect population size.
   c. Carry out detailed research on ecology and population demography, mainly at the sites where possibility of survival is higher.
      - Study the role of the Horned Guan as a seed disperser in the maintenance of cloud forest communities, and further investigate diet.
      - Evaluate possible altitudinal migration using radio telemetry. Altitudinal migration has been suspected (Gómez de Silva et al. 1999), reflecting the importance of conserving altitudinal gradient of habitat.
   d. Evaluate the impact of hunting in the current range.
   e. Genetic studies could provide valuable data on genetic structure of subpopulations (e.g., isolation, gene flow, and intra- and interpopulation viability), valuable for conservation planning.

IV. Habitat Research
   a. Monitor the extent of montane cloud forests available to the Horned Guan.
   b. Monitor the impacts of forest fires (especially in Oaxaca, Mexico).
   c. Restore habitat through reforestation; this is especially important in the Chimalapas region of Oaxaca.

V. Create public awareness in local communities and government agencies regarding the importance of the Horned Guan, involving local communities in the conservation process.
   a. Develop and distribute educational programs in order to reduce hunting pressure.
   b. Promote conservation of indigenous traditions, such as sustainable use of communal reserves.
   c. Foment productive activities of low impact in communities near viable habitat.

VI. Establish a conservation program as it relates to the captive population.
   a. It is imperative to achieve higher breeding success in captivity, with equal representation of the wild caught individuals not currently represented in the gene pool (J. Cornejo in litt.). To achieve this, it is imperative to:
      - Establish an active international captive breeding network that cooperates by sharing information and exchanging animals.
      - Establish husbandry guidelines to improve management, and train all Horned Guan curators and keepers at different institutions, to insure consistency and enhance chances of successful captive reproduction.
      - Establish all captive Horned Guans (including those in the private sector) under one management umbrella.
   b. Genetic and demographic management are a high-priority.
   c. Once the captive population is viably reproducing, establish the long-term goal of the reintroducing of captive-bred descendants.
      - Reintroductions should take place in viably preserved habitats.

- Effective environmental education program should accompany reintroduction efforts before the birds are reintroduced.



Mural depicting Horned Guan in San Marcos, Guatemala with conservation message (J. Rivas): "Let's protect the communal forest of San Marcos, home of the Horned Guan and other species".



Crax alberti perched on reserve sign (photo by Proaves-Colombia)

Blue-billed Curassow (*Crax alberti*)

Luis Eduardo Urueña, Alonso Quevedo Gil, Paul Salaman, Hernán Darío Arias and Eliana Marcela Machado

Work to Date

Density values found in the El Paujil Natural Reserve (PNR) are higher than those reported by Gonzalez (in prep.). Using the Distance 4.1 program the population density in PNR was 3.1 ind/km^2, whereas using the methodology proposed by Strahl and Silva (1997a) a general population density of 5.5 ind/km^2 was found. The density at PNR was higher than other sites that also followed the Strahl and Silva (1997a) methods: density is1.66 ind/km^2 in the rural community of Maceo, and 0.78 ind/km^2 at Puerto Berrio.

A project is currently being carried out on habitat use by *C. alberti*, assessing structural analysis of the sites used by *C. alberti*, and the relationships of these sites to different behavioral activities (e.g., resting, foraging and nesting). Preliminary results suggest the sites frequented by *C. alberti* are considerably heterogeneous (Melo y Vargas 2003). Additionally, many of the vulnerable and overexploited species of Colombian plants are well represented in areas used by *C. alberti* (Silva pers. comm.). Most of the recorded behaviors of *C. alberti* were registered inside the forest, which in biological terms would indicate a predilection for more 'quality' habitat.

Status and Threats

Information about this species has been gathered since 1998 when the Universidad de Antioquia Bird Study Group began investigating *C. alberti* in northeastern Antioquia; two publications

about the natural history aspects were generated (Cuervo and Salaman 1999, Cuervo et al. 1999), with later anecdotal evidence from the same region (Salaman et al. 2001). As a result of the initial groundwork by Cuervo and his colleagues, later research in this region included a population assessment (GEAUA 2000), an assessment of forest use (Ochoa et al. 2002), an evaluation of threats in northeastern Antioquia (Melo y Ochoa 2004), and an estimation of population density (Gonzalez pers. comm.).

The most recently discovered populations of *C. alberti* are in tropical dry forests in Antioquia, in the northeastern and lower Cauca valley, ecosystems that are subject to heavy deterioration due to timber extraction, mining or destruction for crops and cattle (Melo y Ochoa 2004), in the National Natural Parks of Tayrona and Sierra Nevada de Santa Marta (Renjifo et al. 2002), as well as in the Serrania de las Quinchas, in the Departments of Santander and Boyaca (Quevedo et al. 2005).

Due to the serious threats that this species faces, efforts were coordinated to achieve conservation by generating The National Strategy for the Conservation of the Blue-billed Curassow, through the project, "Saving the Blue-billed Curassow" led by the Proaves-Colombia Foundation (Quevedo et al. 2005). This project's priorities are to rescue and protect existing populations of *C. alberti* in the mid Magdalena (Boyaca-Santander), Antioquia, Santa Marta and Cordoba in the Sinu valley. In 2004 this project evaluated and prioritize threats (Machado 2004), assessed population density and structure (Arias 2005), as well as habitat use and behavioral aspects (Urueña 2005). It also promoted an environmental education campaign and the creation of a Private Natural Reserve called "El Paujil" that comprises more than 1000 ha (Urueña and Quevedo 2005).

Antioquia: Melo and Ochoa (2004) found extensive cattle ranching as the principal economic activity in the region where *C. alberti* populations are found; this activity leads to decreased employment, and consequential habitat destruction. Apparently hunting in Antioquia does not seriously jeopardize *C. alberti* populations because of far distances from villages to productive hunting grounds, as well as communities having good access to meat of domestic animals in the rural centers (Melo y Ochoa 2004).

Serranía de las Quinchas: Inhabitants in the sector of Puerto Pinzon center their economy principally on the timber extraction, agriculture and cattle ranching (Urueña and Quevedo unpubl. data 2004), which leads to habitat fragmentation and reduction. Settlers displaced from the Departments of Antioquia, Tolima and Cundinamarca, due to the violence and public disorder in these Departments, are the principal threat to the Serranías in terms of habitat destruction. Hunting is done not only to secure needed protein, but also for entertainment and sport. Other factors such as poaching nests for eggs and chicks, both for the market and household domestication, are of direct concern in this zone.

Conservation Action

An environmental education and conservation action plan was created in the Serrania de las Quinchas, implemented principally in the school at Puerto Pinzon, in Boyaca. This plan involved children and young people ages 5-19, as well as parents and teachers from different areas, and even active participation by the rural community, including hunters, lumberjacks and farmers. Work in the Alicante River canyon of Antioquia was also done with school children, as well as hunters, to reinforce the no-hunting rule established during the breeding season.

I. Enviromental Education
   a. Develop local interest in conserving the curassow

- Design and distribute posters, vests, caps and other project materials to the communities of Puerto Pinzon and surrounding areas
- Create the "Amigos del Paujil" ecological group
- Accomplish 11 environmental education workshops with round-table discussions
- Create four outdoor wall murals on buildings, with the theme of conserving *C. alberti* and other threatened animals in the region
- Establish the rural community´s 'guard badge', which contains figures of two curassows

b. Promote and establish bird related festivals and events
- Establish a National Curassow Day
- Promote and develop World Birding Festivals locally
- Develop the 1st National Course for Banding Birds
- Develop environmental education interaction at these events, especially for the community of Puerto Pinzon

II. General Conservation

a. Establish and enforce a hunting prohibition for *C. alberti*, which was proposed by communities within the zones, and approved by the local authorities.

b. Adequately maintain the El Paujíl Natural Reserve (PNR) and other reserves
- Purchase of 1200 ha of forest in the Departments of Boyaca (Puerto Boyaca) and Santander (Cimitarra) to add to PNR property
- Intensify work with members of the guide program in the Alicante River canyon
- Develop and maintain a nursery for reforestation of deforested patches, containing threatened native woody species and other plants consumed by *C. alberti* and other Endangered wildlife
- Accomplish conservation workshops on nursery development and management, and also management of silvo-pastoral systems in tropical zones



Mural on side of schoolhouse (photo by Proaves-Colombia)

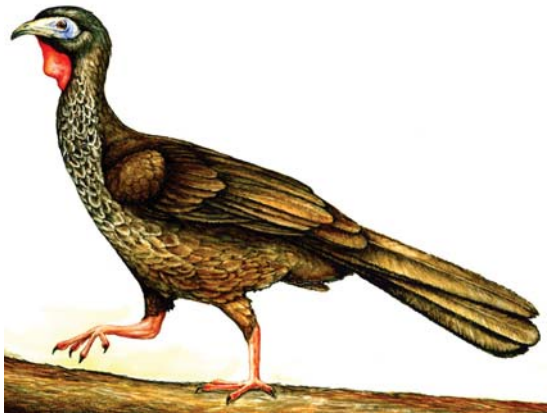


Pauxi unicornis koepckeae by W. Huaman -
(this rendition is based upon hunters' descriptions)

Chapter 4 – Endangered Cracids

All of the seven Endangered cracids are restricted to specialized eco-regions. Two are Brazilian endemics (*Aburria jacutinga* and *Crax blumenbachii*) and *Penelope perspicax* is endemic to Colombia. *Penelope ortoni* and both species of *Pauxi* are very localized along the borders of two neighboring countries, and *Crax globulosa* is extremely patchily distributed in the western Amazonian basin where it is restricted to *Varzea* habitat. Below is a list of the seven species highlighted in this section:

Penelope ortoni	Baudó Guan	EN - A2c,d; A3c,d
Penelope perspicax	Cauca Guan	EN - B2a+b(i,ii,iii,v); C2a(i)
Aburria jacutinga	Black-fronted Piping-guan	EN - A2c,d; A3c,d
Pauxi pauxi	Helmeted Curassow	EN - C2a(i) [VU]
Pauxi unicornis	Horned Curassow	EN - A1a & d, A2d; B1+B2b,c,e [VU]
Crax blumenbachii	Red-billed Curassow	EN - B1a+b(i,ii,iii,v); C2a(i); D1
Crax globulosa	Wattled Curassow	EN - A2b,c,d; A3b,c,d; C2a(i) [VU]



Painting by A. Gallo

Baudó Guan (*Penelope ortoni*)

Carlos Julián Idrobo-Medina, Eduardo Gallo-Cajiao and Olaf Jahn

Work to Date

The Baudó Guan (*Penelope ortoni*) is poorly known (Delacour and Amadon 1973, Hilty and Brown 1986, del Hoyo 1994, Franco-Maya 2002). This guan is endemic to the Chocó biogeographic ecoregion (Stattersfield et al. 1998), where it is locally known from the Pacific slope of the Andes of northwestern South America, ranging from north of Choco Department in Colombia to Guayas province in Ecuador (Delacour and Amadon 1973, Hilty and Brown 1986, Ridgely and Greenfield 2001).

This species is distributed between 50-1500 m asl (Hilty and Brown 1986, Jahn and Mena 2002). *P. ortoni* inhabits foothills, usually in steep terrain adjacent to level ground, as well as hills and mountain ridges, where it occupies early to late (i.e., primary) sucessional stage humid and wet forests (Delacour and Amadon 1973, H. Álvarez-López pers. comm., O. Jahn unpubl. data). The variety of forest along sheer slopes of this region of the Andes is probably related with unstable soils that cause frequent landslides (H. Álvarez-López pers. comm.). Considering man as a limiting factor of the guan's distribution, the more frequent records in abrupt terrain are not surprising (Delacour and Amadon 1973, Ridgely and Greenfield 2001), due to inaccessibility to hunters. For example, this guan has been recorded regularly far from human settlements in extensive plains and rolling lowland hills adjacent to foothills (Jahn 2001, in press).

This guan lives in all strata of forest. In the canopy it feeds, vocalizes, preens, and flies in courtship displays. In the medium stratum it hides avoiding its main predators, suchs as large raptors (e.g., *Spizaetus ornatus*). On the ground it looks for food and is able to cross roads (see Hilty and Brown 1986, Stotz et al. 1996, Ridgely and Greenfield 2001, Franco-Maya 2002, O. Jahn unpubl. data, J. C. Luna pers. comm.). As with most cracids, this species is primarily frugivorous (del Hoyo 1994, O. Jahn unpubl. data). One stomach containing two unknown seeds was reported (Salaman 1994), the species is known to eat fruits of Chanul (*Humiriastrum procerum*, Humiriaceae; J.C. Luna, A. Cortes and N. Hughes pers. comm.).

Territorial pairs are established during the breeding season, and post-breeding birds live in family flocks, usually numbering around four individuals and exceptionally to eight. When one member

of a pair dies, the remaining individual takes some time to establish a new partner to bond with (O. Jahn unpubl. data). Data from Colombia and Ecuador suggest this species breeds between July and September, with the clutch numbering two eggs (Haffer 1968, Salaman 1994, Salaman et al. 2000, O. Jahn unpubl. data). Jahn and Mena (2002) have estimated 24 years for three generations, but considering the two to three year maturation period of medium-sized cracids (del Hoyo 1994), a more realistic estimate is perhaps 12-18 years.

Status and Threats

Using visual and auditory transect mapping samples (Jahn in press), extrapolated population size is estimated at 7,000-21,000 mature individuals (O. Jahn unpubl. data). However these values are in regions far from human settlements and therefore must be considered preliminary. It is likely that true global population size is considerably less, concordant with BirdLife International's (2005) estimate of 2,500-10,000 mature individuals.

Status in Colombia: The species is patchily distributed, sometimes absent from habitat that seems suitable (Hilty and Brown 1986). It has reported as common in "alto Anchicayá" (Valle del Cauca Department) and in the Pangan reserve (Nariño Department), where forests are intact without hunting pressure. Conversely, the species is less common in the "bajo Anchicayá" (Valle del Cauca Department), which contains human settlements (H. Álvarez-López pers. comm., J.C. Luna and R. Strewe pers. comm.).

Status in Ecuador: There are records in Esmeraldas Province, mainly in the buffer zone of Cotacachi-Cayapas Ecological Reserve, where the species is rare to uncommon in intact forest. This guan is absent in the vicinity of human settlements because it is sensitive to unsustainable anthropogenic activities, such as over-hunting and unplanned habitat modification, disappearing even under light pressures (Jahn 2001, Ridgely and Greenfield 2001, Jahn and Mena 2002). Additionally there are small populations of this guan in Pichincha Province, where it is rare on the slopes of the Pichincha Volcano (B. Herrera-V. pers. comm.). Apparently there are no recent confirmed records south of this province (Ridgely and Greenfield 2001).

Threats: In short, the threats for *Penelope ortoni* are unmanaged hunting, as well as habitat loss and modification (Franco-Maya 2002, Jahn and Mena 2002). Both threats are related to cropland expansion (Fajardo Montaña 2002) and regional integration projects (Critical Ecosystem Partnership Fund 2001).

The concentration of land suitable for farming and cattle ranching in the hands of only a few owners, often results in migration of landless people to remote and extensively forested areas which are not of economic interest for cash crop enterprises. The social and political conditions in these isolated settlements often favor overexploitation of natural resources, as well as the cultivation of illicit use crops, accelerating deforestation even further (Álvarez 2002). In the Pacific region of Colombia, the Baudó Guan shares its distributional range with some of the primary cultivation areas of the coca plant (*Erythroxylon coca*, Erythroxylaceae; Uribe Ramírez 1997).

Due to the prevalent condition of isolation, the inhabitants of such settlements have to sustain on the natural environment (e.g., through hunting and selective logging; Critical Ecosystem Partnership Fund 2001, Fajardo Montaña 2002, Jahn 2001, in press). Cracids are an important source of protein in rural areas of Latin America, and as frugivores their populations may also be affected by selective harvesting of important food trees. Additionally, it must be taken into account that the Baudó Guan usually does

not flee if approached by humans (Hilty and Brown 1986, Jahn and Mena 2002, Johns 1998, Redford and Robinson 1987, Redford 1992).

Furthermore, regional integration projects, like pipeline construction (e.g., Oleoducto de Crudos Pesados in Ecuador; Soltani et al. 2001), hydroelectrical dams (e.g., Arrieros del Micay hidroelectric dam in Colombia; Critical Ecosystem Partnership Fund 2001), and roads (e.g., Ibarra – San Lorenzo and Borbón – Matajé in Ecuador; Jahn and Mena 2002), among others, have accelerated the degradation of ecosystems in the Colombian and Ecuadorian Pacific region. Consequently natural resources can be more easily accessed and exploited, as is the case with the Baudó Guan and important elements of its habitat, such as valuable hardwood trees (Salaman 1994, Jahn in press).

Conservation Action

The distributional range of *P. ortoni* coincides with the Chocó-Manabí conservation corridor, a joint effort of Colombian and Ecuadorian social organizations, NGOs, governmental agencies, academic institutions, and the private sector. The aims of this conservation effort are the maintenance of the Choco biogeographic region's diversity by creating a network of protected areas, ensuring the continuity of ecological and evolutionary processes and improving human life conditions through sustainable development (Critical Ecosystem Partnership Fund 2001).

I. Insure protection and assess status in existing Colombian reserves
   a. The species inhabits the northern region of the Farallones de Cali National Natural Park (205,266 ha, Valle del Cauca Department; see Franco-Maya 2002).
   b. The species is also protected in the Ensenada de Utria National Natural Park (54,300 ha, Chocó Department), which covers a coastal mountain ridge (i.e., Serranía del Baudó, see BirdLife Internacional 2005).
   c. Assess status of the population in the Pangan Private Reserve (1,000 ha, Nariño Department), where the forest is protected and there is no hunting pressure (see Franco-Maya 2002).

II. Enforce "no hunting" laws
   a. In Ecuador hunting of this species has been prohibited by law (Resolución Ministerial No. 105 del 7 de enero de 2000, see Jahn and Mena 2002).

III. Insure protection and integral maintenance in Ecuadorian reserves and their buffer zones
   a. A population occurs in the lower parts of the Cotacachi-Cayapas Ecological Reserve (204,400 ha, Esmeraldas and Imbabura Provinces). However, hunters are immigrating at a fast rate due to the recent construction of a road in the northern part of this protected area, and in the west through fluvial systems (Jahn and Mena 2002).
   b. The Baudó Guan inhabits the Mindo-Nambillo Protected Forest (19,200 ha, Pichincha Province, Soltani et al. 2001).
   c. The community of Playa de Oro (10,900 ha, Esmeraldas Province), located at the borders of the Cotacachi-Cayapas Ecological Reserve, contains what is perhaps the best assessed guan population throughout its range. This community implements alternative development strategies that reduce the pressure on natural resources.
   d. Small numbers of this guan can be found in the Jocotoco-Canandé Private Reserve (1,500 ha, Esmeraldas Province), where it is protected despite of the presence of human settlements in its neighborhood. The Jocotoco Foundation is planning to expand this reserve further. In addition it aspires to develop a joint cooperative management of nearby forests together with a local timber company (R. Ridgely pers. comm.).

IV. Assess status in existing Ecuadorian reserves

a. The species probably inhabits the Awá Ethnic Reserve (101,000 ha, Carchi Province), even though its status remains unknown; hunting pressure exists (Jahn and Mena 2002).
b. The Awacachi Corridor (10,000 ha, Esmeraldas Province), a private reserve that connects the Cotacachi-Cayapas Ecological Reserve with the Awá Ethnic Reserve, may protect a population of the Baudó Guan.



The guan's habitat in the upper Río Santiago drainage, Ecuador (photo by O. Jahn)



Photo by G. Londoño

Cauca Guan (*Penelope perspicax*)

Marcia C. Muñoz, Margarita M. Rios and Gustavo A. Londoño

Work to Date

The Cauca Guan is endemic to the central and western Andes of Colombia, where it inhabits remaining forest between 1200-2600 m elevation. The present distribution of the species is still uncertain and surveys are required in some areas. One of the most important populations of the Cauca Guan is located between the departments of Risaralda and Quindío in forest fragments of different sizes (Naranjo 1994, Renjifo 1998, 1999, 2001, 2002). Another population is located in the Department of Valle del Cauca, at the Reserva Natural del Bosque de Yotoco (Silva 1996). Recently, Kattan et al. (in review) confirmed the presence of new populations in the forest of La Sirena and Chorro de Plata (Valle del Cauca). They also reported aural detection of the guan in four other localities in the western Andes. Some observations suggested the presence of two populations of the Cauca Guan in the Department of Cauca. One of these is located at Munchique National Natural Park, although this population has not been detected since the first report in 1987 (Negret 1991). The other population is located in the Patía Valley, where a small population was discovered at the El Hoyo locality (Negret 1992). This author suggested that other small populations may live along creeks and rivers, in the Patía Valley, on the eastern flank of the western Andes (Negret 2001).

Diet of the Cauca Guan is well described. The first observations at the Otún Flora and Fauna Sanctuary Quimbaya (SFFOQ hereafter) were anecdotal and the consumption of a few fruit species, one leaf species, and a flower species was documented (Nadachowski 1994, Renjifo 2002). At another locality (Yotoco), Silva (1996) reported the consumption of 11 species of fruit. The most recent study was conducted over a one-year period with the population at the SFFOQ, where the consumption of 111 items was reported in the diet: 90 species are fruits; 11 flowers; and 10 leaves. Consumption of invertebrates was recorded when the guans followed army ants (*Labidus praedator*). This study also documented the aggregation of guans in Chinese ash plantation (*Fraxinus chinensis*), where they consumed young leaves of this tree during times of low fruit abundance in the forest (Muñoz 2004, Muñoz et al. in prep.).

Until now, only two studies have investigated natural history of this species, contributing new information on reproduction and behavior. Most of the guan sightings are of individual birds, although large groups may be seen feeding on fruits or leaves. During the breeding period, guans remain in pairs with their chicks until they are one year old (Rios et al. 2006). The nest of the guan is a non-elaborate circular cup made with leaves and small dry branches, where the female guans usually lay two white eggs (Nadachowski 1994, Silva 1996, Rios et al. 2006). Preliminary information on three nests suggests the use of low branches for nest location. Information about chick plumage is available for different stages of maturity (Silva 1996, Rios et al. 2006), as well as information on the chick's consumption of two fruit species (Rios et al. 2006).

Status and Threats

Kattan et al. (in prep.) estimated the population at SFFOQ between 196-342 individuals. However, beyond this estimate, population status of the Cauca Guan in Colombia is not clear due to lack of data on population density, population size, and habitat quality. The presence of populations at several localities is confirmed, but other localities require confirmation (Kattan et al. in review). The potential sites to be evaluated are the forests on the eastern and western slopes of the western Andes, such as San Antonio (Chocó), el Chicoral, las Brisas, Chorro de Plata and La Sirena (Valle del Cauca), Tatamá (Risaralda), Munchique and valle del Patía (Cauca).

The principal threats to the Cauca Guan are population isolation and hunting pressure. Fragmentation in the Colombian Andes has reduced forest cover and increased habitat loss (Cavelier *et al*. 2001), isolating some Cauca Guan populations (Renjifo 2002). These small isolated populations are vulnerable to extinction, as they are more prone to demographic and stochastic factors (Kattan 2002). Another problem faced by the Cauca Guan is the threat of hunting (Rios et al. 2006), although this activity is illegal in Colombia.

Conservation Action

An important step for the conservation of the Cauca Guan was the formulation of a national conservation action plan (Kattan and Valderrama-A 2005). This plan proposes different types of activities (i.e., research, education and promoting public awareness) and involves a diverse group of stakeholders (e.g. researchers, universities, NGOs, landowners with resident guan populations, officers of national parks and regional environmental authorities). The goal of this conservation action plan is to maintain viable long-term populations of this species in its entire range. This plan was done in the context of developing a regional system of protected areas, for which the guan is the focal species. The action plan has four main objectives:

I. Increasing the number of established protected areas where guan populations occur without any legal protection.

II. Increase habitat quantity and quality, with associated field research and education. To accomplish this objective 27 activities were proposed in different components of the action plan; some of the priority activities to be carried out as soon as possible are:

a. Habitat Management
    - Identify the needs and possible opportunities to establish or increase connectivity among populations.
    - Restore degraded habitats where populations of guans still occur.
    - Evaluate the influence of exotic or introduced species as possible competitors for resources, and as predators in some forests where the guans occur.

b. Research
    - Assess population status (density and population size) and guan habitat.
    - Confirm the occurrence of populations at potential locations within the range of their geographic distribution.
    - Evaluate the genetic population structure and the amount of gene flow.
c. Develop education plans with landowners, communities, rural schools, and tourists in parks and protected areas.

III. Eliminate mortality by hunting.
a. Increase participation by landowners, police, and wildlife inter-institutional committees (environmental police, army, road police) to enforce controlling and vigilance of illegal wildlife trafficking.
b. Estimate the amount of extraction and use of guans by local communities.
c. Develop informative and sensitization campaigns for hunters, using current guan status and hunting laws.

IV. Encourage guan conservation in rural landscapes.
a. Restore degraded habitats where guan populations still occur.
b. Promote low impact use and management of rural landscapes for increasing connectivity.
c. Develop education plans with landowners and local communities in areas where the guans occur.
d. Use the presence of the guan as criteria to provide incentives for conservation on private lands.



Photo by A. Grosset

Black-fronted Piping-guan (*Aburria jacutinga*)

Christine Steiner São Bernardo and Rob P. Clay

Work to Date

The Black-fronted Piping-guan ***Aburria*** *jacutinga* is endemic to the Atlantic forest of eastern Brazil, north-eastern Argentina and eastern Paraguay. Once abundant, extensive deforestation and severe hunting pressure have extirpated the species from large parts of its former range, and caused a dramatic decline in the remainder, and it now barely exists outside of protected areas.

Recent studies have focused on consolidating knowledge of the species in protected areas. Censuses are being carried on in many protected areas of São Paulo state, Brazil, in order to assess density and population size of this species. Population viability analysis will ultimately be used to indicate which protected areas hold viable populations, and to help identify sites where management actions (reintroductions, translocations, etc.) are required to prevent local extinction. Recent censuses of Jacutingas (summarized below) were analyzed using DISTANCE software (Buckland et al. 1993, Laake et al. 1994).

At Serra da Paranapiacaba (Intervales and Carlos Botelho State Parks), one of the largest remaining fragments of Atlantic forest, Piping guans occurred in high densities (2.67 ind./km^2), and the population is estimated at over 2000 individuals (Galetti et al. 1997, Guix et al. 1997, Sánchez et al. 2002). However, no surveys of Piping guans have been conducted in PETAR, which is a continuous State Park adjacent to Intervales and Carlos Botelho.

At Ilhabela State Park, an island located off the northern coast of São Paulo State, Galetti et al. (1997) reported a mean population density of 0.93 ind./km^2. About 270 km of transect surveys have been conducted there since 2003, with the species recorded 33 times (S.K. Gobbo unpubl. data). Interestingly, the palmito palm or juçara (*Euterpe edulis*) does not occur naturally on this island, and the majority of recent sightings at Ilhabela have been in bamboo vegetation (S.K. Gobbo unpubl. data). This does not support previous observations that the species is dependent upon *E. edulis* palms, as was at one time speculated.

At Ilha do Cardoso State Park, a land bridge island along the southern coast of São Paulo State, guans have been recorded at a mean density of 1.19 ind./km^2, which equates to a maximum population size of 176 individuals (Bernardo et al. in review). Ilha do Cardoso is an important Brazilian biodiversity hotspot and protected by law. However, both people living inside the park (Guarani Mbya Indians and "Caiçaras") and visitors from nearby cities frequently poach wildlife and illegally extract *Euterpe edulis* palm hearts. Such activities occur in many Brazilian protected areas and comprise one of the main factors causing declines in animal populations, ultimately leading to local extinctions (Olmos et al. 2001, Olmos et al. 2004). A population viability analysis was conducted using Vortex software (Lacy et al. 2003) in order to determine extinction probability rates of Piping guans at Ilha do Cardoso State Park, under different hunting scenarios (Bernardo 2004, Bernardo et al. in review). The simulations revealed a high extinction probability for the Ilha do Cardoso guan population during the coming decades, even with low hunting intensity. All poaching must therefore be eliminated if this population is to survive.

Although Serra do Mar is the largest Atlantic forest remnant in Brazil (310,000 ha), only a single Piping guan was recorded there recently, flying across a major road in the northern part of this State Park (Oswaldo Cruz road, near Santa Virginia region). Marques (2004) speculated that this bird may have been reintroduced by CESP (Companhia Energética do Estado de São Paulo) in 1998. This species is probably locally extinct elsewhere in the northern portion of the park (the Cunha and Picinguaba regions), as well as in Jurupará State Park (Steffler et al. 2004)."

Clay et al. (1998) provided a summary of the status of *A. jacutinga* in Paraguay, with an update presented in Clay (2001). Fieldwork undertaken since 2000 has focused on locating populations of *A. jacutinga* in remnant blocks of Atlantic Forest. However, only a few birds were recorded at a handful of sites (Guyra Paraguay unpubl. data). The above authors postulated that San Rafael, one of only two large tracts of Atlantic Forest remaining in Paraguay, might still hold a substantial population of the species. However, considerable fieldwork effort has not produced any records since 1998 (Clay 2001). A project to assess indigenous knowledge of *A. jacutinga* in San Rafael is currently underway, with support from the Chicago Zoological Society. Preliminary results have shown the species has significant cultural value for the indigenous Mbyá-Guaraní, and they have expressed a strong commitment to help save the species (R. Villalba pers. comm.).

Status and Threats

This species is considered Endangered (A2c,d; 3c,d), mainly as a result of habitat loss and poaching (BirdLife International 2005). In Brazil the species has disappeared from the states of Bahia, Espírito Santo and Rio de Janeiro, and barely survives in Minas Gerais. Currently the species has sizeable populations only in the states of São Paulo, Paraná and Santa Catarina (BirdLife International 2005). A small population has recently been found in the 17,491 ha Turvo State Park, Rio Grande do Sul (Bencke and Mauricio 2002). The integrity of many Brazilian protected areas is threatened by illegal harvesting of palm-hearts (*Euterpe edulis*) and by poaching, practiced by squatters inside the parks (Caiçaras, and Mbya-Guarani Indians) and people from nearby cities (Olmos et al 2001). At some localities, such as Serra do Mar State Park (São Paulo State), this situation is exacerbated by a reduction in the number of park guards. At Serra do Tabuleiro State Park, Santa Catarina, poaching levels are extremely high, with tens, if not hundreds of Piping guans reportedly killed recently (Tomim-Borges et al. 2002). In Paraná state, the species is found in both the coastal mountains and Iguaçú National Park. The latter is continuous with Iguazú National Park in Misiones, Argentina. Although the species has been found in two additional areas, it is suffering from high levels of exploitation throughout its range, including some protected areas.

In Argentina, this species has undergone a decline and retraction of its range (now restricted to northern and central Misiones Province), though overall numbers appear to remain high in the northeast of the province. Important populations of *A. jacutinga* occur in the Yaboti Biosphere Reserve, which encompasses the provincial parks of Esmeralda and Moconá (adjacent to Turvo State Park, Rio Grande do Sul, Brazil). The species is also seen on a regular basis at Iguazú National Park and Uruguai Provincial Park, and was recently reported for the first time at Yacutinga Lodge in extreme northeast Misiones (see also Benstead and Hearn 1994). Palmito palms are not found in Uruguai and are largely absent from Iguazú, with the exception of dense stands in the eastern part, where only vagrant individuals of *A. jacutinga* occur (N. Rey pers. comm.). This, combined with the absence of palmitos from llhabela State Park, São Paulo State (see above) and from many areas of the Paraguayan range of *A. jacutinga* (including its remaining stronghold, the Mbaracayú Forest Nature Reserve), provide additional evidence that the species is not dependent on *Euterpe edulis* palms. Chebez (1985) mentions the following sites of occurrence in Argentina: Iguazu, Gral. Belgrano, Eldorado, San Pedro, Montecarlo, Guarani, Cainguás, 25 de Mayo; with local extinctions in San Ignacio and Candelaria.

In Paraguay, the total population was estimated at 870-1515 individuals in 2000, with the lower figure likely closer to the actual population size (Clay 2001). The one theoretically well-protected population occurs in the Mbaracayú Forest Nature Reserve. However, even there the species appears to be undergoing a rapid decline (presumably as a result of poaching); the encounter probability for the species declined from 0.007 in 1994 to less than 0.001 in 1999 (Clay 2001). Deforestation of the Atlantic Forest in eastern Paraguay has reached 30% over the past ten years, and combined with high hunting pressure, has reduced the Paraguayan population to probably no more than a few hundred individuals scattered between largely fragmented and degraded sites.

Conservation Action

I. Surveys to locate and census populations in Atlantic forest areas of Paraguay (especially in Amambay and San Pedro Departments), Argentina and Brazil (Rio Grande do Sul, Santa Catarina and Parana States)
    a. It is imperative to use standardized methods to insure comparability among sites.
    b. Methods used in studies of São Paulo State should be followed: transect lines analyzed using DISTANCE software.

II. Conduct Population Viability Analyses for those localities where censuses have been conducted and population size is available.

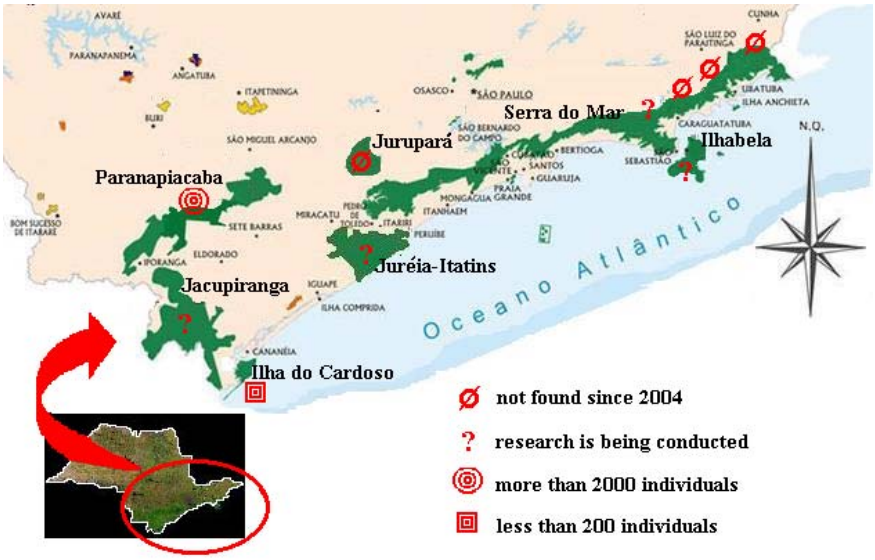
III. Monitor the population in known strongholds
    a. Intervales and Carlos Botelho State Parks, São Paulo State, Brazil
    b. Yaboti Biosphere Reserve, Misiones Province, Argentina
    c. Mbaracayú Forest Nature Reserve, Canindeyú Department, Paraguay

IV. Develop more effective anti-poaching measures at key strongholds by involving indigenous people in the conservation of the species.

V. Develop distribution and occurrence maps for each Brazilian state, as well as for Paraguay and Argentina.
    a. Should indicate which altitudinal gradient Piping guans are frequently seen, as well as areas needing translocated or reintroduced populations.

b. Should be used as a model in other localities of Brazil, as well as in other countries.

VI. Studies are needed to validate if Piping guans depend on *Euterpe edulis* palms to survive in some areas.



Protected areas for *A. jacutinga* in Atlantic forest of São Paulo State, Brazil
(map from www.iflorestsp.br, modified by C.S.S. Bernardo)

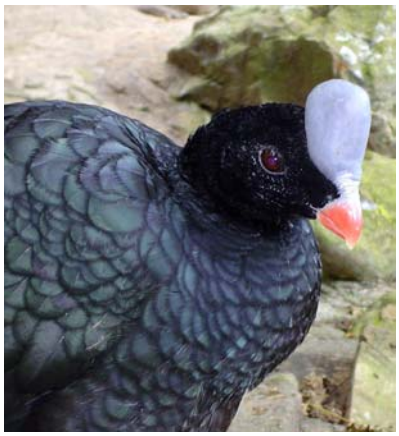


Photo by D. Torres

Helmeted Curassow (*Pauxi pauxi*)

Adrián Naveda-Rodríguez and Stuart D. Strahl

Work to Date

Wetmore and Phelps (1943), Phelps and Phelps (1958, 1962), Delacour and Amadon (1973), Meyer de Shauensee and Phelps (1978), Silva (1999) and Hilty (2003) generally describe the geographic distribution of the species in Venezuela: in the central coastal mountain chain (Aragua, Carabobo, Miranda and Yaracuy states), Andean mountain chain (Lara, Mérida, Táchira and Trujillo states), Sierra de Perijá (Zulia state), Sierra de San Luis (Falcón state) and probably in the eastern Venezuela in Monagas state. In Colombia it is distributed through the eastern slope of the Andes in Sierra de Perija, from southeastern Norte de Santander to northern Boyaca, and reported by hunters from the foothills of southwestern Arauca (Hilty and Brown 1986).

Two subspecies are recognized in Venezuela, *P. p. pauxi* in the central coastal mountain chain and the Andes, and *P. p. gilliardi* in Sierra de Perijá (Meyer de Shauensee and Phelps 1978, Hilty 2003); although Calchi and Perez (1997) report the presence of *P. p. pauxi* in Sierra de Perijá. Also in Colombia both sub-species are present, *P. pauxi gilliardi* in Sierra de Perija and *P. p. pauxi* in the remainder of its distribution.

This species inhabits wet, cloudy, montane and premontane forest interior, between 500-2200 m asl, with 1000-1800 m being the optimum (Schäfer 1953, Silva and Strahl 1997a, Hilty 2003, Hilty and Brown 1986). *P. pauxi* feeds especially on fruits that fall on the ground, which are swallowed (but not crushed), and the seeds are subsequently regurgitated (Schäfer 1953).

Schäfer (1953) provided a very complete description on reproductive aspects at Henri Pittier National Park in Venezuela. *P. pauxi* is a monogamous species, with only a single case of polygamy observed. During the breeding season males select and defend a territory of 300 m^2. The nests are constructed between 4-6 m off ground during a maximum of six days and are oval, measuring 60-80 cm in length x 35-50 cm in width. The clutch size is two eggs that are white in color, and 10-12 cm in length x 6-6.5 cm in width. The incubation period is 34-36 days and both parents protect the chicks.

Pauxi pauxi was considered scarce and "almost exterminated in inhabited places" (Schäfer 1953) in Venezuela during the 1950's. In 1985 population density was estimated at 2 and 8 birds/km^2 in Aragua and Yaracuy states, respectively (Silva and Strahl 1991), and 5 birds/km^2 was estimated in Lara state in 1987 (Silva and Strahl 1997a).

Environmental education and sensitivity programs have been developed in areas inhabited by *P. pauxi* where hunting pressure exists, with satisfactory results obtained from sensitized poachers (Silva 1997, Strahl et al 1997b). Different institutions have initiated *ex-situ* conservation projects. Fundacion Zoologica de Cali in Colombia, Parque Zoologico y Botanico Bararida in Venezuela and several zoological parks in North America have had experience captive breeding this species (Brooks and Strahl 2000, Franco-Maya y Álvarez 2002, Naveda obs. pers.)

Status and Threats

Although considered Vulnerable by Birdlife (2005), we consider the Helmeted Curassow Endangered (P. Salaman and S. Strahl pers. comm.). This species is included on CITES App. III (CITES 2005), and was considered a species with Immediate Conservation Priority by the IUCN Cracid Specialist Group (Brooks and Strahl 2000).

This species is considered Endangered in Venezuela according to Presidential Decree 1496 (Republica de Venezuela 1996a), and the Red Data Book of Venezuelan Wildlife (Rodríguez and Rojas-Suarez 1999). It is also included on the list of animals prohibited for hunting due its low populations levels (Republica de Venezuela 1996b).

Its status in Colombia is Vulnerable [Vu A2cd+4cd; B2ab (ii, iii); C2a (i)] due low population levels, habitat fragmentation, loss and destruction and for the reduction of its occupied areas (Franco-Maya and Alvarez 2002).

The principal threats both in Colombia and Venezuela are habitat alteration and destruction, and the fragmentation of the remnant populations (Brooks and Strahl 2000, Franco-Maya y Álvarez 2002). Hunting can also negatively affect its populations due to the low density and reproductive rate of this species (Silva and Strahl 1991, Franco-Maya and Alvarez 2002).

Conservation Action

I. Venezuela
   a. Biological Research
      - Continue determining status and distribution, especially in Zulia state, to update existing information.
      - Promote ecological research of this species.
   b. Contextual Research
      - Analyze the relationship of *P. pauxi* to Venezuela's protected areas system, to evaluate the effectiveness of habitat protection, and recommend actions for habitat management.
      - Study Ethnozoology of *Pauxi* and other wildlife species, to try and understand the effects of human activities on populations.
   c. Environmental Education and Captive Breeding
      - Continue and extend environmental education programs, especially in areas inhabited by *P. pauxi*.
      - Design and implement a serious captive breeding program as a 'backup alternative' for population preservation.

II. Colombia

a. Research
   - Evaluate distribution and actual population status, especially in Sierra de Perijá, in order to design and execute conservation programs.
   - Execute studies on the effect of hunting pressure.
   - Autecological research is needed about the natural history of this species.

b. Environmental Education and Conservation
   - Design and implement an environmental education campaign that supports other conservation actions.
   - Support and continue *ex-situ* conservation projects carried out by regional institutions.



First photo of a live Peruvian Horned Curassow, *P. u. koepckae* (M. Gastañaga).

Horned Curassow (*Pauxi unicornis*)

Ross MacLeod, Rodrigo Soria and Melvin Gastañaga

Work to Date

The Horned Curassow was discovered in the late 1930s within what was to become Carrasco National Park, Dept. Cochabamba in central Bolivia (Bond and Meyer de Schauensee 1939, Herzog and Kessler 1998). Until the 1980s it remained unstudied and virtually unknown. The species was studied from 1979 through the 1980s in Amboro National Park in Dept. Santa Cruz, and during the 1990s in Carrasco National Park (Cox et al. 1997, Renjifo and Renjifo 1997, Herzog and Kessler 1998, Gúzman et al. 1999, Mee 1999, Mee an d Gates 1999, Macleod and Duguid 2000, Macleod et al. 2003, R. Soria in litt.). These studies combined provide data on the distribution of the species in central Bolivia along with basic data on habitat association and altitudinal range, as well as limited data on diet and breeding season. Additionally the vocalizations have been well studied (Cox et al. 1997). The main part of the breeding season is believed to be September - December, and one nest with a single egg was found in October in an isolated forked tree (Renjifo and Renjifo 1997, Cox et al 1997). Food appears to be comprised of fruit and some insects (Cox et al. 1997, Renjifo and Renjifo 1997, Macleod et al. 2000).

In the last 30 years there have been confirmed records at eight scattered localities between 400-1300 m in the upper tropical and lower montane zones of the Bolivian Yungas. The species appears to be restricted to a very narrow band (average width 8-10 km) of suitable habitat along the base of the Andes (Renjifo and Renjifo 1997). All confirmed records of the species in Bolivia lie within or immediately adjacent to Carrasco and Amboro National Parks. Work by Rodrigo Soria (unpubl. data) in 2004 combined with earlier extensive local knowledge surveys by Hennessey and others (unpubl. data) in Madidi National Park and Pilon Lajas show that despite previous assumptions (BirdLife 2000) the Horned Curassow is unknown between the Peruvian border and Cordillera Mosetenes in Cochabamba Dept., central Bolivia. There is also currently no definitive evidence for the presence of this species from Cordillara Mosetenes and the area stretching southeast to the borders of Carrasco National Park. However there is photographic evidence from 30 years ago of the species present at an unknown location along the outer (north eastern) edge of the Mosetenes Cordillera (Guido Gonzales and Rodrigo Soria pers. comm.) and we believe that a population could still survive in that area. In contrast, the results of three

extensive biodiversity inventory expeditions since 2000 to the south western side of the Mosetenes Cordillera and the adjacent the Cocapata Cordilllera have found no evidence for the existence of the species (MacLeod et al. 2003, Herzog in litt., Rodrigo Soria in litt.). The habitat on the River Altamachi side of the Mosetenes Cordillera is considerably drier and more seasonal. However, the Horned Curassow has only been found in extremely wet forest along the outer edge of the Andes to date. Therefore, despite falling within known altitudinal range of *P. unicornis*, the habitat on the Altamachi side of Mosetenes appears unsuitable for the species.

In Perú, the subspecies *P. u. koepckeae* was discovered in July 1969 (Weske and Terborgh 1971) in the isolated Ceros del Sira mountains, Dept. Huánuco (9º26'S, 74º45'W; 1200 m); when the only two individuals seen were collected as specimens. There was a potential sighting reported near the confluence of the Cerros de Rio Távara, near the Rio Tambopata in Dept. Puno, SE Peru from 1992 (Collar et al. 1992). However, from recent work (Gastañaga and Hennessey 2005, see below), it is now recognized that the observer (T. Parker) did not regard this as a definite record, but only an interesting possibility. In November 2000 Alan Mee conducted an ornithological survey in the area where the species was discovered, but despite registering 258 other species there were no observations of the species; Mee et al. (2002) concluded that if it still occurred in the area it was at very low densities. In 2003 Asociación Armonía began using local knowledge surveys to investigate the distribution of P. u. koepckeae in Perú (Hennessey 2004). In the Sira mountains, a survey conducted found 14 local people in one area who could described the bird without previous information, and who knew of the species through observation or hunting (Gastañaga and Hennessey 2005). However, none of the locals reported its presence when the same interviewed survey methods were conducted in the area of the 1992 potential sighting (near Távara, Dept. Puno). After unsuccessful searches in 2004 at three locations in Sira from which *P. u. koepckeae* had been reported in the last decade, M. Gastañaga observed an individual and heard three more singing at 1180 m in the mountains of Sira (unpubl. data).

Status and Threats

Pauxi unicornis was regarded as Vulnerable (B1 + B2a,b,c,e) until 2004 because it had a small and declining extent of occurrence, estimated to be 11,400 km^2 (BirdLife 2000). However based on extensive fieldwork carried out between 2000 and 2005 (reported above) it is now clear that this species should be regarded as Endangered. The two key improvements in data that have lead to this change in status are: 1) there is now no reliable evidence to back up the assumption that this species inhabits the area between the populations in central Peru and central Bolivia, and 2) there is strong evidence that the population at known sites (even within national parks) can decline rapidly and even catastrophically due to human impacts, principally hunting, and that such human pressure exists throughout the known and potential range of the species. Using IUCN/BirdLife criteria (BirdLife 2000) we upgrade *Pauxi unicornis* to Endangered under criteria A1a&d, A2d; B1+B2b,c,e.

On the basis of the information reported in the preceding section, we now estimate the potential Extent of Occurrence for the Bolivian subspecies *P. u. unicornis* to stretch in a 10 km wide strip from near Buena Vista in Amboro National Park (NP), along the outer edge of the Andes through Carrasco NP, and along the outer edge of Cordillera Mosetenes to the northwestern edge of Issiboro Secure NP. This is an area of approximately 4000 km^2 although there have not been any confirmed locations for the species in the most north western 2000 km^2 of this area. Despite widespread fieldwork in the last five years, so few sites are known for the species that we cannot currently estimate the area of occupancy or population of the species. However investigations during the breeding season, when the species is easily detectable at known locations, have failed to find it at many sites within the potential extent of occupancy.

There is only one population of Horned Curassow known in Peru and this is separated from the Bolivian population by more than a 1000 km. This population, found only in the isolated mountains of Cerros del Sira (Huánuco Dept.) in central Peru, is currently recognized as a distinct subspecies *P. u. koepckeae* but we believe urgent work is needed to examine if the taxon is actually a separate Critically Endangered species. The local knowledge surveys reported above and the sighting in 2005 provide evidence that hunters have encountered very small and decreasing numbers of the species in the last decade. Based on these sources and examination of maps we estimate that this population has a potential extent of occurrence of approximately 400 km^2 and probably a considerably smaller area of occupancy.

The two principal threats to the species are hunting and habitat destruction. Hunting is the most immediate of these threats and a study in Carrasco NP showed that, by 2004, hunting accompanying small-scale land clearance appears to have resulted in local extirpation of this curassow in a period of less than 5 years. Given that similar and much greater human encroachment is being observed throughout the species range it seems reasonable to use the observed decline to infer that at least a 50% decline has occurred in the last decade, and will do so again in the next decade. Finding ways to reduce hunting pressure is therefore the immediate conservation priority for the species, with habitat conservation the longer-term priority.

Conservation Action

I. Bolivia

a. Conduct field studies to locate and estimate the size of the surviving population, determine its conservation requirements and vulnerability to human encroachment.
b. Work with Carrasco and Amboro National Parks and local communities to develop and implement population monitoring and conservation management plans for the species and its habitat.
c. Develop work with local educators and schools to inform local people about the conservation importance and uniqueness of the species and its habitat to their area.
d. Work with local communities to promote a community based hunting ban for the species and to reduce human pressure on its habitat.
e. Identify and implement measures that will significantly improve the livelihoods of the local communities in return for their assistance in conserving the species.

II. Peru

a. Continue working with communities around Cerros del Sira, conducting local knowledge surveys about *P. u. koepckeae* distribution, and raising awareness of its unique status.
b. Identify and implement measures that will measurably improve the livelihoods of the local indigenous communities in return for their essential assistance in conserving the species through a community enforced hunting ban.
c. Obtain sound recordings and behavioral observations to be used in combination with morphological and genetic assessment to determine if the Peruvian taxon is a full species.
d. Conduct field studies of the ecology of the Peruvian taxon to estimate surviving population size, and determine conservation requirements and vulnerability to human encroachment.
e. Work with INRENA (the protected areas authority) to develop and implement a conservation management plan for the species and its habitat.



Distribution of the two subspecies of Horned Curassows



Photo by A. Grosset

Red-billed Curassow (*Crax blumenbachii*)

Carlos A. Bianchi

Work to Date

The Red-billed Curassow is endemic to the Atlantic Forest of Brazil and has been threatened by forest destruction over the last century. The historical distribution is in forest less than 500 m asl from the south of Bahia towards Rio de Janeiro and east of Minas Gerais (IBAMA/MMA 2004). Evidence of current populations remains only for Espírito Santo and Minas Gerais, and information available about its biology is mostly taken from captive accounts (Candido-Júnior 1996, Azeredo 1996, 1998a), with biological data known from wild populations (Sick 1970, Teixeira and Snow 1982, Collar and Gonzaga 1988, Collar et al. 1992).

A captive breeding program run by CRAX-Brazil initiated between 1978 and 1985. After years of successful breeding, CRAX-Brazil began some pilot reintroduction projects in several private reserves of Minas Gerais (Azeredo 1996, 1998a, Azeredo et al. 1992, Simpson and Azeredo 1997). A detailed protocol was developed to orient curassow reintroduction (Azeredo and Simpson 2004), describing the success of this initiative where over 164 individuals have been reintroduced since 1990 (IBAMA/MMA 2004).

Status and Threats

Considered Endangered (MMA 2003, BirdLife International 2004), Red-billed Curassow populations in the wild are estimated to be less than 250 individuals (IUCN/SSC CBSG 1995), and are currently found in less than six localities (IBAMA/MMA 2004). In captivity, the studbook recorded 885 individuals but 673 are still alive, and more than 90% of the population is kept in Brazil, mainly with private holders rather than in Zoos (IBAMA op. cit.).

Habitat loss and hunting activities are the main threats to the species (BirdLife International 2004, IBAMA/MMA 2004). The Atlantic Forest was drastically reduced in the past century, not only for hardwood exploitation and land conversion to plantation and pastures, but also by agricultural settlements and land occupancy by indigenous populations (Rocha 1995). The remnant forest fragments also suffered significant degradation caused by fire, edge effects and other human activities. Hunting for subsistence and leisure is still a strong pressure and possibly has reduced the isolated populations of curassows in forest fragments (IBAMA/MMA 2004).

Conservation Action

In February 2004, IBAMA in a partnership with CRAX-Brazil, Chester Zoological Gardens and BirdLife International – Brazilian Program, organized a workshop with the participation of several experts and institutions aiming to create a national Action Plan for the Red-billed Curassow (IBAMA/MMA 2004). The document proposed 32 actions in five different themes with indications of deadlines, priorities and executors. Some of the most important actions are listed below (brackets codes refers to action number in the Brazilian Action Plan):

I. Public Policies and Legislation
   a. Incorporate the need to preserve wild populations of Red-Billed Curassow on the processes of establishing indigenous reserves and/or agricultural settlements, especially within areas with potential for the species occurrence, such as the National Parks in southern Bahia State, aiming to reduce hunting activities and deforestation but to promote connectivity among forest fragments in the region (actions 1.1, 1.2 and 1.3).
   b. Review and modify law enforcement (e.g., hunting, capture, illegal trade and deforestation) to stronger penalties (actions 1.6 and 1.7).
   c. Create and implement economic-ecological zoning to all municipalities in southern Bahia (action 1.8).

II. Species and Habitat Protection
   a. Set effective protection to all reserves established within the species area of distribution, especially Una Biological Reserve, Pau Brasil and Descobrimento National Parks. Set reserves' infrastructure, guard corps, land ownership regularization and removal of former human occupants (actions 2.1 and 2.2).
   b. Carry out environmental education programs for human communities surrounding the National Parks in Bahia, focusing especially on change of hunting activities (action 2.3).
   c. Evaluate the possibility to expand the National Park limits in Bahia, as well as stimulating establishment of private reserves, including forest remnants within the species area of distribution (actions 2.4 and.2.5).

III. Research
   a. Carry out surveys on historical sites to investigate the species occurrence, and search for new wild populations considering patterns of vegetation distribution and integrity (actions 3.1 and 3.3).
   b. Carry out censuses of known populations to estimate population size and habitat-use patterns (action 3.2).
   c. Carry out projects to investigate ecology of wild populations (in the Linhares/Sooretama Biological Reserves complex, Una Biological Reserve and Descobrimento National Park) (action 3.4).
   d. Carry out projects to study ecology, demography and monitoring in reintroduced populations in Minas Gerais (action 3.5).

IV. Captive Population Management
   a. Search for sponsorship and financial support for all institutions holding curassows that are legally recognized by IBAMA in the captive breeding program (action 4.1).
   b. Update the studbook (action 4.2).
   c. Carry out genetic analysis of founder individuals to determine lineages that could help with orientation of future pairings, to improve genetic diversity of captive populations (action 4.3).

d. Integrate private breeders and zoos holding the species by facilitating the interchange of specimens following studbook recommendations, and establish a captive management protocol based on CRAX-Brazil's experience (actions 4.4 and 4.5).

V. Reintroduction

a. Develop and establish a reintroduction protocol, including recommendations for blood sample collection of released curassows, and long-term monitoring (action 5.1).
b. Evaluate and select new reintroduction sites preceded by projects of viability studies. Several areas in four different states are recommended: Rio de Janeiro (União and Poço das Antas Biological Reserves, Guapiaçu Biological Station and Desengano State Park); Minas Gerais (Rio Doce State Park and surroundings of Doce river); Espírito Santo (Córrego Grande Biological Reserve) and Bahia (surroundings of Una Biological Reserve, Vera Cruz Station and other private reserves) (action 5.2).
c. Promote protection for all potential reintroduction areas and upgrade privately owned sites to the nationally recognized category of Private Reserves of Natural Heritage (actions 5.4 and 5.5).



Drawing by S. Bennett

Wattled Curassow (*Crax globulosa*)

Hugo Aranibar-Rojas

Work to Date

The Wattled Curassow has a discontinuous distribution through the Amazon Basin that encompasses NW Brazil, SE Colombia, E Ecuador, E Peru and N Bolivia (BirdLife 2004). In contrast to other curassows it is considered primarily an arboreal species (Garcia and Brooks 1997, Bennett 2003) strongly associated with forest habitats periodically flooded by white and black water, as well as forest and swampland islands (Begazo 1997, Santos 1998, Hennessey 1999, Bennett 2003, Aranibar-Rojas et al. 2005). During the dry season this species feeds of small fish, crustaceans and other invertebrates, which differs from the rainy season when fruits and seeds are preferred (Defler 1991, Bennett 2000, 2003).

Although, the breeding season is not strictly seasonal, two optimum nesting periods are observed. The first period is between July-August and the second between January-February (Bennett 2003). The clutch size can range from 2-6 eggs (Bennett 2000), but are typically at the lower end of the spectrum. Preliminary evidence on the social system indicates solitary males and females, as well as groups ranging up to 15 individuals (Bennett 2003, Aranibar-Rojas and Hennessey in rev.)

Population census indicate a maximum of 61 individuals for Mocagua Island (Bennett 2003) and approximately 40 individuals for Miritί Island (Alarcón-Nieto and Palacios 2005) in Colombia. Also, density was estimated at 0.64 ind./km^2 in the Mamiraua Reserve, Brazil (Santos 1998), and relative abundance was estimated at0.36 ind./hr in the Rio Negro of Bolivia (Aranibar et al. 2005). Analyses are now being done on population genetics at a regional level (D. Álvarez pers. comm..).

Status and Threats

The Wattled Curassow is regionally considered Vulnerable (BirdLife 2004) and this species is considered a high priority for conservation (Brooks and Strahl 2000). Based on the IUCN Red List categories (IUCN 2001), the listing of the this species should be upgraded from Vulnerable to Endangered (EN - A2b,c,d; A3b,c,d; C2a(i) since the smallest subpopulations are fewer than 250 individuals, (61 individuals on Isla Mocagua [Bennett 2003]; 40 individuals on Miritί Island [Alarcón-Nieto and Palacios 2005], Colombia). In Ecuador this species is probably extinct (Johnson 1993).

Principal threats for this species today are related to subsistence and sales hunting, as well as habitat loss due to logging (Begazo 1997, Santos 1998, Hennessey 1999, Bennett 2003). Another mid- and long-term potential threat is isolation that some subpopulations face, which can cause local extinction due to loss of genetic viability.

Conservation Action

I. Ecuador
   a. Establish expeditions to search for new populations within and outside its historical range.

II. Peru
   a. Evaluate presence and conservation status in areas where indigenous communities indicate they are present.
   b. Initiate environmental education programs with the indigenous communities that are close to regions occupied by this species.
   c. Generate research programs at localities where this species has been confirmed.
   d. Monitor market places that sell game meat to determine the time of year and rate at which this species is hunted, as well as the demand of this species compared to other game.

III. Bolivia
   a. Established a protected area concordant with Bolivian law.
   b. Jointly develop a management plan for timber and non-timber forest resources with surrounding indigenous communities.
   c. Continue the search for new populations in the Bolivian Amazon.
   d. Initiate environmental education programs with the indigenous communities that are close to regions occupied by this species.
   e. Continue the current monitoring program of the species and its habitat.
   f. Continue support of sustainable development programs (e.g., ecotourism) for communities close to regions occupied by this species.

IV. Colombia

a. Continue research and environmental education programs.
b. Evaluate presence and conservation status in areas where indigenous communities indicate the species is present.
c. Continue support of sustainable development programs (e.g., ecotourism) for communities close to regions occupied by this species.
d. Monitor market places that sell game meat to determine the time of year and rate at which this species is hunted.

V. Brazil

a. Generate a potential captive reproduction program with other countries to maintain the genetic viability of the existing group. However, it will be important to maintain pure stock with respect to different populations (R. Macleod in litt.).
b. Continue research of ecology, distribution and monitoring programs of hunting.





Yellow-knobbed Curassow (*Crax daubentoni*) photo by C. Bertsch

Chapter 5 – Vulnerable Cracids

All of the seven Vulnerable cracids are restricted to specialized eco-regions. Two are endemic to Brazil (*Penelope ochrogaster* and *P. jacucaca*). Two species are restricted to specialized habitat within the Andes (*Ortalis erythroptera* and *Penelope barbata*). Two species are restricted to isolated islands in the highlands of Middle America (*Chamaepetes unicolor* and *Penelopina nigra*), and *Crax daubentoni* is very localized along the borders of Venezuela and Colombia, restricted to the Llanos. Below is a list of the seven species highlighted in this section:

Ortalis erythroptera	Rufous-headed Chachalaca	VU - A2c,d; A3c,d; B1a+b(i,ii,iii,v); C2a(i)
Penelope barbata	Bearded Guan	VU - B1a+b(i,ii,iii,v)
Penelope ochrogaster	Chestnut-bellied Guan	VU - B1a+b(i,ii,iii,iv,v); C2a(i)
Penelope jacucaca	White-browed Guan	VU - A2b,c,d; A3b,c,d
Chamaepetes unicolor	Black Guan	VU - B1b(i,iii)
Penelopina nigra	Highland Guan	VU - A2c,d; A3c,d
Crax daubentoni	Yellow-knobbed Curassow	VU - A3a,c,d



Photo by J. Barrio

Rufous-headed Chachalaca (*Ortalis erythroptera*)

Javier Barrio and Víctor Raúl Díaz

Work to Date

The Rufous-headed Chachalaca inhabits dry to humid montane forests of southwest Colombia to northwest Peru. Most of the work done on this species is related to its distribution, which was accomplished via general status surveys (Best and Kessler 1995, Barrio and Begazo 1998, Begazo and Valqui 2000). The species inhabits several forest types: dry forest, humid montane forest and dry scrub from sea level up to 1850 m (Best and Kessler 1995). However, it also inhabits heavily settled, degraded areas and cropland near forests (Isherwood and Willis 1999, Ridgely and Greenfield 2001).

Little research has been done on the natural history of the Rufous-headed Chachalaca in the field (Isherwood and Willis 1999), but its ecology is probably similar to its congeners. The species is usually found in small groups up to 8 individuals. Reproductive ecology in the wild is unknown, but it is probably monogamous, and reproduction might occur during the rainy season (December-April). Clutch size averages three chicks (Díaz unpubl. data). Several individuals in captivity show size differences between sexes, with males averaging 900 g and females 760 g (Díaz unpubl. data). The Rufous-headed Chachalaca has been observed feeding on coffee and banana fruits (Isherwood and Willis 1999).

Status and Threats

This species is distributed over the Tumbesian Endemic Bird Area, Northwest Peru through Western Ecuador to extreme Southwest Colombia. Most populations are small and some are decreasing due to habitat loss. Several protected areas in Ecuador and Peru harbor the species.

Status in Ecuador: Significant Rufous-headed Chachalaca populations occur in Machalilla National Park, but are negatively affected by nearby illegal human settlements (DarwinNet 2005). Other protected areas harbor populations, but they are mostly isolated from each other, occupying small patches of remaining forest or forest edge (Best and Kessler 1995). Although small populations exist in areas connecting forested areas, they are more abundant further away from settled areas (Ridgely and Greenfield 2001). No natural corridors between populations are

known, but the chachalacas can cross between available forest patches. The species is legally protected in Ecuador.

Status in Peru: In Peru the Rufous-headed Chachalaca is mostly uncommon, but its distribution is larger than previously published (e.g. Best and Kessler 1995). The southernmost known populations are found in northern Piura and Cajamarca (Barrio and Begazo 1998). Significant populations are stable in protected areas of the Northwest Peru Biosphere, but the species is declining in most other areas due to habitat loss. There are no reports of the species lower than 800 m in Peru, possibly due to extensive goat ranching, and most populations are located only in protected areas. However, local people consider a population in northern Piura stable even though it is outside a protected area. The species is legally protected in Peru.

Threats: The main threats in both countries are habitat loss, degradation and fragmentation due to agriculture activities, cattle and goat ranching, and wood extraction for fuel. Hunting is a minor threat as ammunition is too expensive to be used for smaller game such as the chachalaca. Vegetation cover has been reduced in lowland western Ecuador to 4.4% of the original cover (Dodson and Gentry 1991, Best and Kessler 1995). However, habitat is in better condition at higher elevations of the species distribution. The same can be said for the Cordillera de los Amotapes, enclosed by the Northwest Peru Biosphere, where vegetation cover is still over 96% of the original cover (Best and Kessler 1995). Unfortunately, new roads in both countries have provided easier access for agriculture and ranching.

Conservation Action

I. Ecuador
   a. Increase effective protection (improve capacity and infrastructure) in protected areas throughout the species distribution.
   b. Evaluate populations throughout forest patches along Cordillera Chongon-Colonche to identify conservation priority areas (DarwinNet 2005).
   c. Initiate a multi-faceted educational program throughout the Tumbesian forest of Ecuador, which encompasses most of the west of the country, working ideally towards the implementation of habitat corridors.
   d. Evaluate populations throughout the distributional range of the species, calculating its density wherever it is possible. Promote basic biological and ecological studies.

II. Peru
   a. Increase effective protection (improve capacity and infrastructure) throughout the Northwestern Peru Biosphere: Tumbes Reserved Zone, Amotapes National Park and El Angolo Hunting Reserve.
   b. Evaluate available habitat in the Andean sector of the species distribution, proposing conservation areas as effective habitat corridors.
   c. Initiate an educational program along the areas limiting the Northwestern Peru Biosphere.
   d. Evaluate populations throughout the distributional range of the species, calculating its density wherever it is possible. Promote basic biological and ecological studies.



Photo by F. Angulo

Bearded Guan (*Penelope barbata*)

Fernando Angulo Pratolongo and Rob Williams

Work to Date

The Bearded Guan inhabits cloud and montane forests along the western Cordillera of the Andes of southern Ecuador and Northern Perú. In recent years, several new locations for the Bearded Guan had been discovered in southern Ecuador and northern Peru (e.g., Flanagan et al. 2000, Flanagan and Angulo 2002). In Ecuador it has been found on Lomo Angashcola, in Loja province (Collar et al. 1992). In Peru, this species has been found in the "Cerro Chinguela" range, along the border between Piura and Cajamarca Depts., south nearly to Tabaconas-Namballe National Sanctuary (Begazo and Valqui 2000). Near the town of Ayabaca, there is a proposal to create a local conservation area of about 400 ha in "Bosque de Cuyas", a location where this species is regularly recorded (Flanagan et al. 2000).

Densities of this species have been estimated in three Ecuadorian forests at Cordillera de Chilla (Azuay): 2.3 birds/km^2, 6.7 birds/km^2 and 17.1 birds/ km^2 (Jacobs and Walker 1999). Additionally, density estimates were obtained at two sites in Loja province: 33 birds/km^2 at Cajanuma (relatively protected area) and 17 birds/km^2 at the mining zone of Curishiro (Medina et al. 1994).

Status and Threats

This species is considered Vulnerable (BirdLife International 2000) and nationally Endangered by both Peruvian and Ecuadorian legislation. This cracid is also considered of Very High Conservation Priority by the Cracid Specialist Group (Brooks and Strahl 2000).

The Bearded Guan persists in a 16,600 km^2 range of the western Cordillera of the Andes, from southern Azuay south through Loja Provinces in Ecuador (it formerly also occurred in El Oro province but is likely extinct there now), and in Perú through Piura into Lambayeque and adjacent Cajamarca Depts., as far south as the upper Zaña watershed. The species ranges between 1200-3100 m asl but appears to be most common from 2200-2800 m (Collar et al. 1992). It has been estimated that some 2,637 km^2 of habitat remained in Ecuador in 1998 (Krabbe et al. 1998) and we believe this has subsequently been reduced even further. The amount of habitat remaining in Peru is not quantified but continues to decline.

The species occurs in the following protected areas: Podocarpus National Park (146,280 ha), Tapichalaca Private Reserve (2000 ha), Huashapamba Forest Reserve (217 ha) and Angashcola Community Reserve in Ecuador, and Tabaconas-Namballe National Sanctuary (29,500 ha) and the Laquipampa Reserved Zone (11,347 ha) in Perú, although not all habitat within these areas is suitable for the species.

The total population has been estimated at less than 10,000 birds (BirdLife 2000), with the Ecuadorian population estimated to be approximately 3000 birds (range = 1000-6000) (Jacobs and Walker 1999). No estimate exists for the Peruvian population, but we consider it to be smaller than that of Ecuador because the habitat is more restricted and there are fewer protected areas; there probably are no more than 1000-2000 birds in Perú. This infers a global population of 2000-8000 birds.

The main threat to the species is ongoing habitat destruction due to expansion of grazing lands and fields, agriculture and also increased mining activity, both legal and illegal. Legal mining is particularly a threat in Peru, with many concessions having been granted throughout the species range. Several of these legal concessions will impact protected areas including Tabaconas-Namballe National Sanctuary. Habitat destruction is not only a direct threat due to loss of habitat, but is also fragmenting the species range and promoting long-term isolation of small, non-viable populations. Hunting continues to exacerbate the situation in both countries and is largely uncontrolled. The expansion of mining in the region and the creation of new roads improve access and may cause increased hunting locally.

Conservation Action

I. Ecuador
- a. Protected Areas
  - o Encourage the protection of more forested areas in the southern Andes of Ecuador and support the establishment of private reserves like Tapichalaca.
  - o Insure adequate protection of Podocarpus National Park; increase capacity and infrastructure for Park Staff.
  - o Support the reserves of Angashcola and Huashapamba.
- b. Community Conservation
  - o Conduct educational campaigns highlighting the importance of the species for montane forests.
  - o Produce a participative conservation strategy for the species.

II. Peru

a. Protected Areas
   - Expand protected habitat network in montane areas of Lambayeque, Piura and Cajamarca, including the "Cerro Chinguela" area.
   - Implement proposals that help support communities to establish private reserves.
   - Implement the reserve at "Bosque de Cuyas", Ayabaca.
   - Increase capacity and infrastructure for Park Staff at Laquipampa.

b. Search for further sites where the species can be found and estimate its density and population size.

c. Community Conservation
   - Produce a participative conservation strategy for the species.
   - Conduct educational campaigns highlighting the importance of the species for montane forests.



Photo by J. Kormendy

Chestnut-bellied Guan (*Penelope ochrogaster*)

Paulo de Tarso Zuquim Antas

Work to Date

Described from a skin collected by Pelzeln in 1870 at the Pari River mouth in the Cuiabá River (Naumburg 1930). This site is now inside the Cuiabá/Várzea Grande complex (capital of Mato Grosso state) and this population of guans has completely vanished from the type locality. The species is a Brazilian endemic, with three disjunct populations in the São Francisco River basin, Central Brazil and Pantanal regions.

The São Francisco population is located in the northern and northwestern portions of Minas Gerais, where it was collected in 1912/13 (Collar et al. 1992). Recently, it has been reported from Arinos, Januária and Manga, and historical data from 1908 indicated its presence in Itacarambi and Peruaçu (Azeredo 1998b). Hunters reported two kinds of guans in gallery forest of the Preto and Paracatu Rivers, one being larger and reddish. In addition to gallery forest, deciduous forest is found in scattered patches in this region, likely expanding the guans range in this area.

The known southern limit of the Central Brazilian population is a century-old record at Aruanã, Araguaia River (Collar 1992) and the lower Mortes River (a major left bank tributary), where it was collected in two places in 1949 (Pinto and Camargo 1952). The Paranã River population, believed to be connected with the Araguaia population, only has records from the 1930s. The upper Paranã River valley has been surveyed since the 1980s, but has not revealed any records of *P. ochrogaster*. Northward, the Côco River appears to be its northern limit, with recent records within the last few years (Yamashita 2001, Olmos 2003). In the Côcos River, the species inhabits decidous forest, similar to Pantanal habitat (Olmos 2003).

The Pantanal population occurs in the northern lowlands, from the São Lourenço River to Cuiabá (historical distribution), and westward until Descalvados (Naumburg 1930, P. Antas pers. obs.). Apparently the Paraguay River is its western boundary, but it is uncertain which bank of the tiver the

record is from. The northern limit is the border of Pantanal flatland and Cáceres mountains, or the upper terrain north of Poconé.

Although the northeastern border of the Pantanal National Park is near the forest strip of the Santa Isabel farm (see below), and Collar et al. (1992) suggested the guans presence near the farm´s southwestern corner, a 46 field-day intensive survey (April and August 2001) of forested habitats near the confluence of the Cuiabá and Paraguay Rivers and the Amolar mountains (on the right bank of the Paraguay River) failed to reveal the bird (Antas, Pereira, Yabe and Strike, unpl. data). Upstream, the SESC-Pantanal RPPN private reserve survey found a pair of guans in the seasonally flooded cambará (*Vochysia divergens*) forest in July and October 1998 (28 field-days total). In July 2001, 30 Chestnut-bellied Guans were counted along a 12 km trail in decidous forest in the reserve´s southern border. In addition to using seasonally flooded cambará forest and decidous forest within the reserve, guans have been found in gallery forest, cerradão (forest type savanna), and dense cerrado woodlots and strips (Antas 2002).

When the Transpantaneira road was built in the early 1970s from Poconé to the Cuiabá River it crossed good patches of habitat; consequently many guans have been recorded by various sources in three areas: 1) The upland forest at Santa Isabel farm provided most of the available data (Cintra and Yamashita 1990, Olmos 1998, pers. obs.); 2) North of that region, between the Cassange and the Pixaim Rivers (Kaestner 2003, P. Antas pers. obs.); and 3) The deciduous forest between the Bento Gomes and Pixaim Rivers (P. Antas pers. obs.).

A 7 day census (August 1997) in the forest at Santa Isabel farm showed *P. ochrogaster* as perhaps the third common cracid there (tied with *Aburria cujubi nattereri*) with 13% of 278 individual contacts with cracids, although some Piping-guans could not be identified to the species level (Olmos 1998). During the seasonal peak of flooding (early March 2003) a 50 km road count along the Transpantaneira (from the Pixaim River south) logged 25 *P. ochrogaster*, of which 75% were on the road, and no young were recorded (Kaestner 2003).

Most observations (13 out of 18) record *P. ochrogaster* in the forest canopy at Santa Isabel farm (Olmos 1998). However this species is observed on the ground more frequently during early morning and late afternoon at SESC. Pairs can be flushed while they are walking on dirt roads, apparently seeking invertebrates, seeds or green leaves along the roadside (P. Antas pers. obs.). *P. ochrogaster* fed on *Tabebuia impetiginosa* flowers (Olmos 1998) in forest at Santa Isabel. Within the SESC reserve guans consumed flowers of three species: *T. impetiginosa* (July), *Tabebuia aurea* (July-August), and *Vitex cimosa* (September). It also consumed green leaves of an unknown liana and an unidentified fruit in October (P. Antas pers. obs.).

Dawn wing-drumming occurs during October-November. Two nests were found during the same months as peak wing-drumming activity: one along forest edge, and the other inside forest; each nest was on top of an Acuri palm (*Scheelea phalerata*), and each contained two white eggs. Half-grown juveniles were recorded with parents in June, suggesting a long breeding season (P. Antas pers. obs.).

Status and Threats

Conservation units were created in the Peruaçu region of the São Francisco basin beginning in the late 1990s. A national park, a state park, a wildlife refuge and an environmental protection area were established there, all with suitable habitat for the guan.

In Central Brazil the species occurs within the Araguaia National Park (Collar et al. 2002), the Côcos-Javaés Ecological Station and the Cantão State Park. Although Araguaia has been invaded by Carajás and Javaés indians, making overhunting and logging a major threat to the species within the national park (Olmos 2003).

Guan hunting was considered low at Santa Isabel farm in the Pantanal (Olmos 1998), perhaps due to the presence of IBAMA´s field camp there, as well as a large number of ecotourists. However, in Barão de Melgaço county, where the SESC reserve is located, human population density is quite high compared to other regions of the Pantanal, and the guan is a prized gamebird by residents, including Bororos indians in a nearby reserve. Apparently creating the SESC reserve decreased hunting pressure and the guan population increased over time at RPPN (P. Antas pers. obs.). Fire protection at RPPN has also been effective, diminishing the former threat of widespread wildfires and its associated damage to important guan habitat. Unfortunately however, this is not the case in most of the Pantanal, including the Transpantaneira borders.

The Chestnut-bellied Guan is threatened throughout its range: least threatened in the Pantanal but critically threatened in the São Francisco basin. As indicated above, habitat loss is the major threat in all areas, followed by hunting.

Fire has been used as an agricultural/ranching tool, to renew old pastures or for new areas. Most of the fires are set without proper control however, significantly affecting deciduous forest - the most preferred habitat of Chestnut-bellied Guan.

Deciduous forest has been cleared with agricultural and ranching activities throughout the guans range. Habitat has been damaged since cattle grazing began in the 17th century. For example, large tracts of Cerrado in central Brazil have been reclaimed for large-scale grain agriculture and cotton, as well as pastures planted since the early 1970s. Additionally, grazing of cattle was extensive in the Pantanal lowlands until the 1970s. After the huge cattle crash in the late 1970s, ranchers made a significant change to semi-intensive management. As a result, upland forest has been continuously cleared and introduced grasses (mainly African species) were planted. Based on 1998 Landsat imagery, 70% of this biome was completely or largely modified (MMA 1999).

The guan is considered a very prized game species and hunting pressure is still considerable. Hunting has been an increasing threat since the human population has increased, especially since the 18th century gold rush.

Conservation Action

I. São Francisco
- a. Reserve and Habitat Protection
  - o Protection of deciduous forest remnants in the Urucuia, Paracatu and Preto River valleys is urgent considering land use changes and current pressure.
  - o A conservation unit is needed in the Arinos region, northwest Minas Gerais state.
- b. Research
  - o Establish former range coverage, and search for the species at both former and recent sites, as well as other areas with suitable habitat.
  - o Census recently created conservation units to determine if the species is present, and if so, assess the current population.

II. Central Brazil
- a. Reserve and Habitat Protection

- Coordinate an immediate national and international campaign to re-establish Araguaia National Park, showing its importance to the guan and other endangered Brazilian species.
- Protection of suitable habitat in the Paranã River valley must be a target considering land use changes in the area.

b. Research
- Assess suitable habitat and carry out population surveys in its current range where populations have not yet been documented.
- Establish a population census in Araguaia National Park and other protected areas to assess current population size.

c. Public Awareness - Local people must be taught that the guan is an endangered species endemic to Brazil. The guans presence is potentially profitable for the local economy since birdwatchers want to see this rare cracid.

III. Pantanal

a. Habitat Protection
- As upland areas are increasingly deforested for pastureland, deciduous forest must be protected on ranches, and recovering part of the guans habitat is needed.
- Use of fire should be controlled, avoiding upland habitats, especially along the Transpantaneira that was declared a state park road.

b. Research
- A population dynamics study is urgently needed, as populations showed potential for recovery after creation of the SESC RPPN.
- Assess suitable habitat and carry out surveys in its current range where populations have not yet been documented. Poorer known areas along the right bank of the Paraguay River and at the Bolivian border must be included in this effort.
- Reproductive data and a dietary inventory are needed.
- As the species has increased within the SESC reserve, a translocation experiment to recolonize guans in suitable habitat elsewhere within the known range would be possible once proper protection measures were met.

c. Public Awareness
- Hunting is a scattered yet serious threat because the guan is a prized game species. It is important to change this pattern through public awareness and environmental education.
- Local people must be taught that the guan is an endangered species endemic to Brazil. The guans presence is potentially profitable for the local economy since birdwatchers want to see this rare cracid.



Painting by A. Gallo

White-browed Guan (*Penelope jacucaca*)

Andrei Langeloh Roos and Paulo de Tarso Zuquim Antas

Work to Date

This species is endemic to the Caatinga region of Brazil, and is also found in the contact zone between the Caatinga and Cerrado (Fiuza 1999), as well as the Atlantic Forest. The type specimen is from the municipality of Poções, Bahia (Pacheco 2000, Pacheco and Bauer 2000), and today the species is found principally in the states of Paraíba, Bahia, Ceará, Piauí, and Pernambuco (Meyer de Schauensee 1970, Schulz Neto 1995, Sick 1997, Fiuza 1999, Farias et al. 2002, Girão e Silva and Albano 2002, BirdLife 2004, Roda and Carlos 2004), although most recent records are for the latter five states (see Records App.). Birdlife (2004) considers the species possibly extinct in Alagoas, Pernambuco and Paraíba, due to lack of recent records, although the species is present in Pernambuco (Roda and Carlos 2004). Recent records expanded its distribution to the northern portion of Minas Gerais (Kirwan et al 2001, 2004), which contains Caatinga-Cerrado transitional habitat (Fiuza 1999); these are the southernmost records for the species, and the first for the state of Minas Gerais.

The species is found in taller vegetation, including semi-deciduous forest, but also in second-growth caatinga near human dwellings (Olmos 1993). It is found in second-growth forest in Serra das Almas Natural Private Preserve (Crateús, Ceará), and has also been seen in fringes along seasonal riverbanks in Bahia, where vegetation included *Tabebuia caraiba*, *Ziziphus joazeiro*, *Schinopsis brasiliensis* and *Caesalpinia pyramidalis* (Roos unpubl. data). In Raso da Catarina Ecological Station (Bahia) the species is found in low-bush caatinga, and in the Serra das Confusões National Park it was observed in arboreal areas (Roos unpubl. data). The species has been recorded in the Atlantic Forest in the Murici Ecological Station (Alagoas) (Fernando Pinto pers. comm.) and humid forest in São Vicente Férrer (Pernambuco interior). This ecosystem is strongly linked to the Atlantic Forest (Roda e Carlos 2004), as is Serra Negra Biological Preserve (Floresta, Pernambuco) (Coelho 1987).

Field information is mostly regarding occurrence (see Records App.) and little is known about natural history. There is no information about the species diet, although the species has been observed proximal to *Ziziphus joazeiro* trees (Olmos 1993). Although it has been suggested that the species is omnivorous, captive animals did not eat quail eggs when offered in predation tests

(Marini and Melo 1998). Sick (1997) states that the species spends a lot of the time on the ground, concordant with observations by Roos (unpubl. data 2003) in the Serra das Confusões National Park. Observations at Serra das Confusões indicate the species is rarely seen, being detected in the wet season by wing-drumming, a behavior associated with courtship display (Olmos 1993). The guans often found in pairs, or in small flocks up to six or seven birds (Olmos 1993, Roos unpubl. data).

Status and Threats

Some studies have suggested that the species is Endangered (Sick 1997) or Near Threatened (Collar et al. 1992, Lima et al 2003). The species is included in the Lista Oficial da Fauna Brasileira Ameaçada de Extinção (MMA 2003), the official Brazilian list of endangered species, and in the IUCN list (2004) it is considered Vulnerable (VU A2bcd+3bcd).

Some of the recent records for *P. jacucaca* are from Federal and State Conservation Units. Although these areas sometimes have problems with conservation and protection, they are more protected and less disturbed by human activities than surrounding areas. The species seems to be well protected in Serra da Capivara and Serra das Confusões National Parks and in Raso da Catarina Ecological Station. In Serra da Capivara National Park *P. jacucaca* is more rare than *P. superciliaris*, but it seems to be very common around Raso da Catarina Ecological Station in Jeremoabo, Bahia (Roos unpubl. data, Lima et al 2003).

P. jacucaca has been considered highly sensitive to human disturbance (Silva et al. 2003); the main threats to this species are habitat destruction and hunting. The Caatinga has been replaced by pastures for sheep and goats, and more recently by pastures for cattle. Areas close to seasonal rivers are being transformed into irrigated land for agriculture, reducing habitat even further. During the early days of colonization in the1570s, rivers and streams in the Caatinga were the first habitats replaced by pasture and destroyed by timber harvesting.

Being a relatively large bird, *P. jacucaca* is a protein source for humans and therefore is regularly hunted. In certain areas hunting requires a high investment of activity because it takes a long time to find the guan, resulting in hunters looking for other sources of protein. However, hunting is still a serious threat because of the extreme poverty of human populations in the Caatinga, aggravated by constant drought. Therefore, hunting may be the only source of food for some human populations, increasing the risks of extinction for the species.

Conservation Action

I. Implement conservation units (BirdLife 2004).

II. Research is needed on natural history, conservation status and threats.

III. Develop and implement a national action plan for the species and habitat (BirdLife 2004).

IV. Implement educational programs for local communities against illegal hunting, especially within conservation units (BirdLife 2004).

RECORDS APPENDIX - Alagoas: Murici Ecological Station (Fernando Pinto pers. comm. 2003). **Bahia:** Poções (Spix 1825 *in* Pacheco and Bauer 2000); Lagoa do Boqueirão (Reiser 1925 *in* Pacheco and Bauer 2000); Lamarão (Hellmayer 1929); Barra (Pinto and Camargo 1961); Raso da Catarina (Sick et al 1987); Barreiras 1988; Caetité 1996; Curaçá 1999 (Fiuza 1999); Chapada

Diamantina (Parrini et al. 1999); Raso da Catarina Ecological Station, Jeremoabo (Lima et al 2003); Curaçá 1998; Jeremoabo 2004 (Roos unpubl. data). **Ceará:** Serra do Castelo: Serra de Maranguape (Lima 1915 *in* Girão e Silva and Albano 2002); Pacoti (Pinto and Camargo, 1961); Serra do Baturité (Otoch 1991); Chapada do Araripe (Nascimento 1996); Caucaia (Otoch and Silva 1998); Morada Nova (Coelho and Silva 1998 *in* Girão e Silva and Albano 2002); Maciço do Baturité (Rodrigues et al 2004); Crateús (Antas and Pereira 2000). **Minas Gerais:** Mocambinho (Kirwan et al. 2001); Januária (Kirwan et al. 2004). **Paraíba:** Coremas (Pinto and Camargo 1961); no specific locality (Schulz Neto 1995). **Pernambuco:** Floresta (Coelho 1987); Betânia, Chã Grande e Floresta (Farias et al 2002); Mata do Estado, São Vicente Férrer (Roda e Carlos 2004). **Piauí:** Serra da Capivara National Park. (Olmos 1992, 1993); Caracol 2003; Guaribas 2003 (Roos unpubl. data).



Photo by B. Cole

Black Guan (*Chamaepetes unicolor*)

Gilles Seutin

Work to Date

Little is known about the Black Guan; there has been no study published specifically on this species and much information is anecdotal in nature. This species ranges at high elevation from Costa Rica close to the Nicaragua border, to west-central Panama (AOU 1998). Its distribution is patchy in northwestern Costa Rica (e.g., NatureServe 2005), reflecting the fragmented nature of preferred habitat in that area. The easternmost confirmed records are from the area of El Copé, Coclé Province, Panama, with a sighting needing confirmation from Cerro Campana, about 70 km to the west (G. Angehr pers. comm.).

In Costa Rica the species occurs primarily at 1000-3000 m (McCoy 1997), and in Panama at 900-2500 m (Delgado 1997). Within this range, it is more frequent at higher elevations (Blake and Loiselle 2000, L. Pomara pers. comm.). Where prime habitat subsists, it is occasionally found below 1000 m, including observations at 450 m in the Bocas del Toro Province, Panama (Wetmore 1981). Altitudinal transect work on the Caribbean slope of the Cordillera de Tilarán of Costa Rica suggests that the species is an altitudinal migrant (Chaves-Campos 2003); there is no comparable data for other areas.

The Black Guan is closely associated with mature montane evergreen forests. Specific topographic, microclimatic and ecological requirements have not been studied, but it is most often seen in very humid and densely forested areas of steep terrain with ravines and ridges. It is generally absent from isolated forest patches, but can persist in patchy forest interspersed with clearings and second growth (Stiles and Skutch 1989). In eastern Chiriquí, Panama, it has been observed occasionally near forest edges in shade coffee fields where the tall tree cover is dense (L. Pomara, pers. comm.).

The species is essentially an arboreal frugivore. It feeds on fleshy fruits of at least three dozen plant species with no great preference for fruit types or size (Wheelwright et al. 1984, Wenny 1993). It is rarely found in lower forest strata or on the ground.

Black Guans are most frequently seen singly, in pairs, or in family groups of 3-5. Stiles and Skutch (1989) described a nest as a platform of twigs and leaves placed in a mass of epiphytes 4.5 m above ground; it contained two white eggs. The breeding season is inferred to last from February - June (Delgado 1997, Stiles and Skutch 1989).

Status and Threats

Based on the IUCN Red List categories (IUCN 2001), the listing of the Black Guan should be upgraded from Near Threatened to Vulnerable - VU B1b(i,iii). This proposal reflects the species extent of occurrence being less than 20,000 km^2 (9000 km^2, Komar and Herrera 2005) and severe habitat fragmentation in Costa Rica and on the Pacific slope of Panama's western highlands, an area that represents more than 50% of the species total range. Habitat fragmentation is less advanced along the Carribean slope of Panama's western highlands but could rapidly progress if effective conservation measures are not put in place. A number of observers reported the species as locally fairly common in remote, undisturbed areas. However, most observers consider it rare in disturbed forests, near human settlements, or where hunting pressure is moderate or high. High densities reached at the Monteverde Cloud Forest Preserve, Costa Rica (4 birds/km^2, Wenny 1993; 7.4 birds/km^2, Brooks and Strahl 2000) are not representative of the vast majority of the species' range where habitat integrity is reduced and protection against hunting is often ineffective. Still, the existence of large areas of relatively intact habitat and low hunting pressure (e.g., Braulio Carrillo and Chirripo National Parks, La Amnistad International Park, Fortuna Forest Reserve), where relatively high densities may be reached, suggests that the global population size is in the order of several thousand individuals.

The main threats to the Black Guan are habitat degradation and hunting. Preferred habitat in Costa Rica is now largely fragmented and has been reduced to about 30% of its original extent (based on extrapolations from data in McCoy 1997). In Panama, most forested areas have been lost on the Pacific slope of the Cordillera Central (Chiriquí, Veraguas and Coclé Provinces), but a large band of largely intact forest remains at the highest elevations and on the Caribbean slope from the Costa Rica border to the eastern end of the species' range (ANAM 2002). Except for the latter area, deforestation rates are relatively high in both countries (FAO 2001).

Hunting Black Guans is illegal in Costa Rica. In Panama, sport hunting is illegal but sustenance hunting by indigenous people and campesinos is allowed. In both countries, compliance promotion and enforcement mechanisms are generally ineffective and the species continues to be hunted regularly (Delgado 1997, McCoy 1997). There is no quantitative information about the impact of these takes, but all observers report that the species is less abundant and much more wary where hunted than in secure areas.

Conservation Actions

Priority actions listed below are general in nature and apply throughout the species range. A better understanding of local status and threats will, in the future, permit identification of actions needed at a more local scale.

I. Habitat Studies

a. Compile detailed information about habitat availability throughout the species range. This analysis will help assess the conservation status and needs of many other threatened species in the Costa Rica and Panama Highlands Endemic Bird Area (BirdLife International 2003).
b. Analysis of remote sensing data should be followed by:
    - On-the-ground assessment of habitat integrity variables that are poorly reflected in such data (e.g., selective logging), and
    - Building realistic scenarios of future trends using social and economic development indicators.
c. Special attention should be paid to the largely intact highland forest on the Caribbean slope of the Panamanian Cordillera Central.

II. Population Studies
a. Obtain standardized density estimates in areas showing varying levels of habitat integrity and hunting pressure.
    - Repeated measures should be obtained at different times of the year
    - Group size should be recorded.
b. Assess population response to various types of habitat degradation (e.g., fragmentation, creation of large gaps, selective removal of tall trees).
c. Assess frequency of, and population response to, hunting.
d. Assess minimal area and population size required to maintain an isolated population over the long-term.

III. Educational Campaigns and Legal Protection
a. Establish awareness through promotional campaigns in core areas of occurrence to reduce hunting pressure.
b. Considering the exceptional quality of the highland forests on the Caribbean slope of the Panamanian Cordillera Central, there is an immediate need to establish effective measures to maintain long-term integrity of these forests outside existing protected areas.
c. In Panama, the Autoridad Nacional del Ambiente (ANAM) should immediately consider prohibiting all forms of hunting during the breeding season.

Highland Guan (*Penelopina nigra*)

Knut Eisermann, Néstor Herrera and Oliver Komar

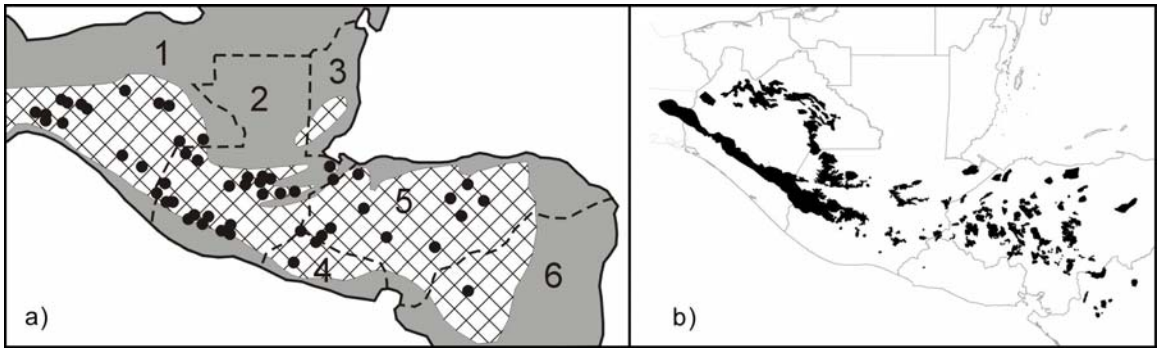


Fig. 1a) Locations of records (black dots) of Highland Guan from 1990-2004. Sources: Vannini and Rockstroh (1997), Valdez et al. (1999), Arizmendi and Márquez-Valdelamar (2000), Sandoval (2000), González-García et al. (2001), Bonta and Anderson (2002), Cerezo and Ramirez (2003), Komar and Herrera (2003), Nájera (2004), Eisermann (2005), pers. comm. and pers. obs. by: D. Anderson, M. Bonta, T. Jenner, R. Downing, D. Medina, M. Welton and F. Urbina (Honduras); J. Berry, K. Eisermann, J. Rivas, A. Schumacher, G. López, C. Avendaño and D. Tenes (Guatemala); F. González-García, G. Escalona Segura, C. Macias and Eduardo Morales (México); S. Morales, M. Torrez, A. Martínez, and S. Vilchez (Nicaragua); and H.L. Jones (Belize).

Key: Northern Mesoamerica in gray, highlands (>700 m) hatched, and country borders in dashed lines. 1 = Mexico, 2 = Guatemala, 3 = Belize, 4 = El Salvador, 5 = Honduras, 6 = Nicaragua.

Fig. 1b) Potential distribution of the Highland Guan. Potential areas of distribution were predicted based on the confluence of appropriate ecoregions and altitudes above 800 m. The ecoregions were Chiapas Montane Forest, Chimalapas Montane Forest, Central America Montane Forest, and Central America Pine-Oak Forest. We excluded small, isolated forest patches in Belize, El Salvador, and Nicaragua, especially in the volcanoes of the Pacific slope, where experts declared that the species was absent. We also used ecosystem and land use maps to exclude areas used for agriculture, pasture, and other anthropogenic uses, or other inappropriate ecosystems such as lava flows. The source of GIS coverages was CBM (2003).

Work to Date

The Highland Guan is monotypic. The status of two described subspecies (van Rossem 1934) is considered doubtful (del Hoyo el al. 1994, Dickinson 2003). The species has been reliably recorded in southern Mexico, Guatemala, El Salvador, Honduras and Nicaragua (del Hoyo et al. 1994, Howell and Webb 1995, AOU 1998). A report from Belize (Vannini and Rockstroh 1997), subsequently included in González-García et al. (2001) and Delacour and Amadon (2004), is probably erroneous (Jones and Vallely 2001, Jones 2003, Jones pers. comm.). González-García et al. (2001) summarized recent distributional data; additional distributional data are summarized (see Appendix), and Fig. 1a shows sites with recent records. Based on a computer model, Peterson et al. (2001) predicted no substantial decline due to climate change.

The Highland Guan is mainly recorded in primary cloud forest (evergreen humid broadleaf forest) and pine-oak forest at elevations of 900-3300 m (del Hoyo et al. 1994, Delacour and Amadon 2004), but also in adjacent low-canopy (15 m) secondary forest (Eisermann 2005), 10 m tall secondary forest in dpto. Huehuetenango (J. Rivas pers. comm.), and mature cypress (*Cupressus lusitanicus*) plantations (Komar 2002a). Low elevation records at 300-700 m (Hoffmeister 1951, Álvarez del Toro 1980, González-García et al. 2001, Eisermann 2005), at 800 m in the Los Tarrales Reserve, Atitlán Volcano (17 December 2002, K. Eisermann pers. obs.; 7 February 2005, C. Avendaño pers. comm.; April 2005, R. Rivas pers. comm.), and at 700 m in El Boquerón Natural Monument, Honduras (M. Bonta pers. comm.), may indicate dispersive movements (Delacour and Amadon 2004) or altitudinal migration. Display behavior was observed in secondary forest in Honduras (M. Bonta pers. comm.).

Densities were estimated at 6-106 birds/km^2 in the Quetzaltenango region (Morales 1991), 1-7 birds/km^2 at Montaña Caquipec (Eisermann 1999), 9-10 birds/km^2 at Montaña Yalijux (Renner 2003), and 5.5-26.7 birds/km^2 in the Sierra de las Minas (Morales 2004). However estimates higher than 25 birds/km^2 are likely to be unrealistic and due to sampling error. An alternative measure of relative abundance was provided for three habitats at Montecristo National Park, El Salvador during 1999, where pine-oak forests had greatest abundance and averaged 1 bird/4 hr obs., cloud forest averaged 0.7 birds/4 hr obs., and cypress plantations averaged 0.3 birds/4 hr obs. (Komar 2002a). Pullen (1983) recorded 121 sightings (1-5 birds) during 126 days in Montecristo.

Status and Threats

The Highland Guan (*Penelopina nigra*) is endemic to the mountains of northern Central America. Today, the core distribution with known reproductive populations is limited to Oaxaca and Chiapas (Mexico), Guatemala, Honduras, northern El Salvador, and perhaps Nicaragua, where population status appears critical. Declines due to habitat alteration are expected and we suggest listing this species as Vulnerable (VU A2cd+3cd), following IUCN Red List criteria.

Status: Currently considered globally Near Threatened (BirdLife International 2004) and High Conservation Priority (Brooks and Strahl 2000). The guan reproduces in forests of four ecoregions: Chiapas Montane Forest (6309 km^2), Chimalapas Montane Forest (902 km^2), Central America Montane Forest (14,215 km^2) and Central America Pine-Oak Forest (119,076 km^2), which combined have an area of occurrence of 140,502 km^2 (CBM 2003). Infrequent observations of guans in drier forests at lower elevations probably are non-breeding vagrants or altitudinal migrants. This area of occurrence is somewhat smaller than a polygon that encloses all recent records, but is probably more representative of the core breeding range. The historical area of occupancy is estimated to be only 15,197 km^2, a much lower figure owing to the highly fragmented nature of suitable habitat, which often is limited to small patches on mountaintops (Fig. 1b). Historically, the guan has been reported from at least 65 localities (data not presented, generated from consultations with experts throughout the region, and with the database of Nicaraguan bird specimens [http://avesnicaragua.org]). Since 1990, the guan's presence has been confirmed at only 53 sites (Fig. 1a), but no data is available on the current area of occupancy. Our analysis of GIS coverage suggests that only 8597.1 km^2, (Mexico 1440.8 km^2, Guatemala 2294.3 km^2, Honduras 3724.4 km^2, El Salvador 21.1 km^2, Nicaragua 1116.5 km^2) or 65% of the potential area of occupancy, is currently within a protected area as defined by CBM (2003).

Assuming a range-wide density estimate of 6 guans/km^2 in highland forests, based on the potential distribution and on results presented in the previous paragraph, the world population

would be approximately 91,200 birds. If this population density were restricted only to protected areas, the global population would be only ~51,600, and we suggest that this figure may be a realistic projection for the guan's situation within 50-100 years. A considerable population decline is to be expected due to loss of habitat and increasing hunting pressure (see Threats). Based on the IUCN Red List categories (IUCN 2001), the listing of the Highland Guan should be upgraded from Near Threatened to Vulnerable (VU A2cd+3cd). According to FAO (2003) overall forest loss in the five countries where the guan lives was ~12% of the remaining forest (81,320 km^2) between 1990-2000, and the human population increased 22% in Chiapas from 1990-2000 (INEGI 2000), and 35% in Guatemala (1994-2002, INE 2002). For these reasons, we suspect that the Highland Guan population declined 30% or more within the last 10 years due to habitat destruction and exploitation. These threats have not ceased and the population is expected to reduce a further 30% within the next 10 years.

Following is a status summary for each country and achievements of conservation work based on, and since, the last Cracid Conservation Action Plan (Brooks and Strahl 2000):

Mexico: Key areas of distribution have been identified. Viable populations are reported in the following protected areas: El Triunfo, El Ocote, La Sepultura, Lagunas de Montebello and Cañón El Sumidero (González-García et al. 2001). The Chimalapas region, Oaxaca, holds still large amounts of suitable habitat (Peterson et al. 2003), with viable populations (App.). Hunting of the guan is prohibited (SEMARNAT 2002).

Guatemala: Several studies (Valdez et al. 1999, Sandoval 2000, Eisermann 2005) added to the knowledge of the current distribution. Nesting has been recently confirmed in Alta Verapaz (Eisermann 2005), and on the Atitlán Volcano (G. López pers. comm.). Reproduction can be assumed based on frequent observations in the Sierra de las Minas, Biotopo del Quetzal, and the southern volcanic chain. The guan was reported from Cerro San Gil, dpto. Izabal (Vannini and Rockstroh 1997), but has not been reconfirmed despite annual field research (e.g. Dowell et al. 1994, Robbins and Dowell 1993, 1995, 1996, Robbins 1996). The record is probably based on a vagrant.

Of 54 Guatemalan protected areas declared in 1999-2004, 46 are private (CONAP 2005). Private reserves may be an important form of protection motivated by strong conservation ethics of the forest owners. Several private reserves (e.g., on Atitlán Volcano and in the Yalijux mountains, Alta Verapaz) protect habitat of Highland Guan and prohibit hunting. Fire protection zones adjacent to primary cloud forest were established in some areas in Alta Verapaz through the introduction of permanent crops like fruit trees in local communities (KE pers. obs.). Hunting of this species is generally prohibited (CONAP 2001).

El Salvador: The current distribution has been investigated and at two sites (Montecristo, Cerro El Pital) nesting is evidenced or assumed (Komar 2002a, Komar and Herrera 2003). The Salvadoran system of protected areas is underdeveloped; legalized reserves cover only 0.3% of the country (MARN 2003). Private protected areas cover 0.48% of the country (Godoy 2004). The Highland Guan is legally protected (MARN 2004).

Honduras: Midence (1997) documented a lack of information on this species distribution. Surveys have been carried out recently; Bonta and Anderson (2002) consider the species common in cloud forest. Display behavior was observed and nesting is assumed (M. Bonta pers. comm.). The development of a system of private reserves is just beginning (Godoy 2004).

Nicaragua: Information on the current distribution is lacking, and there is apparently no recent evidence of a reproductive population. The development of a system of private reserves is just beginning (Godoy 2004).

Threats: Habitat alteration and hunting have been generally identified as main threats to the guan (Brooks and Strahl 2000). These are expected to increase due to a growing human population with increasing land requirements. In Guatemala for example, the human population has quadrupled since 1950, with the majority living in the highlands (INE 2002). The human population in Chiapas and Honduras has grown more than sevenfold since 1930 (INEGI 2000, INE 2001). Because the majority of inhabitants are farmers, the population increase is linked with a high annual deforestation rate, indicated by FAO (2003) for 1990-2000 as follows: El Salvador (4.6% of remaining forests, equaling 56 km^2), Nicaragua (3.0%, 981 km^2), Guatemala (1.7%, 485 km^2), Mexico (1.1%, 6073 km^2), and Honduras (1.0%, 538 km^2). Slash-and-burn is a common agricultural method in the region, and can generate uncontrolled fires in neighboring primary forests. Although many guan populations occur within protected areas, there is no long-term guarantee of their survival because of clandestine hunting and deforestation, due to management deficiencies in national protected areas. On a more positive note, the current political stability in the countries of northern Central America will enhance tourism in the region, which can benefit conservation (Brooks and Strahl 2000). The lack of knowledge especially on the population ecology of this species makes an evaluation of threats difficult. An account of principal threats in each country follows:

Mexico: Clandestine deforestation (Donaldson 2003) and hunting (González-García et al. 2001) are reported. Subsistence hunting is common in Chimalapas for example (F. González-García, pers. comm.). Approximately 380 km^2 of forest was burned in Chimalapas during 1998 (Asbjornsen and Gallardo 2004).

Guatemala: Coffee (*Coffea arabica*) plantations between 800-1600 m have reduced suitable habitat considerably. The recent economic coffee crises have forced landowners to alternative land uses. New plantations of leather leaf ferns (*Rumohra adiantiformis*) have expanded in the last years in Alta and Baja Verapaz, in part converting primary forest above 1600 m. At Cerro Montecristo, Chiquimula, ponytail (*Beaucarnea sp.*) plantations were established at elevations of 1900 m. Communal forest reserves, which are used sustainably by indigenous communities under local regulations, are threatened by the ongoing loss of indigenous traditions (Secaira 2000). Hunting was recently reported in the Yalijux mountains, Alta Verapaz (Schumacher pers. comm.), as well as in Dpto. Quetzaltenango (Jurado 1995), in the Sierra de las Minas (Jolón 1997), and in the Atitlán region (Castellano et al. 2002).

El Salvador: The range is very restricted and population size within the country is small (probably <500, Komar 1998); therefore the guan is especially vulnerable to incidental events that could cause local extirpation (Komar and Herrera 2003). Small size and number of protected areas make conservation planning difficult.

Honduras: Hunting was observed, but at least in the Sierra de Agalta National Park, the Highland Guan is not the priority species for hunters. Highland Guan populations did not reduce, converse of the pattern observed with Crested Guans (*Penelope purpurascens*) that declined in the 1990s (M. Bonta pers. comm.). Some sites are threatened by deforestation, such as Santa Barbara and Comayagua National Parks (D. Anderson pers. comm.).

Nicaragua: The Highland Guan is considered in danger of local extirpation due to deforestation (Martínez-Sánchez 1997, Gillespie 2001). There are no published data on the population or current status available, but populations are probably small and isolated.

Conservation Action

Following is a list of recommendations targeting short and long-term conservation of Highland Guan populations:

I. Research
   a. Monitor population trends at known sites, estimating densities with simple methods as suggested by Strahl and Silva (1997a) or applied by Komar (2002a).
      - Investigate current distribution and population sizes in Nicaragua.
   b. Monitor the extent of montane forests.
   c. Study ecology
      - Habitat use
      - Home range size
      - Reproductive rate
      - Diet and role as seed dispersers/predators
      - Seasonal movements - altitudinal migration has been reported in several other frugivorous Mesoamerican species (Powell and Bjork 1994, Paiz 1996, Winker et al. 1997, Eisermann 2005), and is suspected for the Highland Guan.
   d. Genetic studies could provide valuable data on colonization processes and metapopulation dynamics, valuable for conservation planning such as gene flow between mountain areas (if any).
   e. Reevaluate taxonomic status of described subspecies (van Rossem 1934, del Hoyo et al. 1994). The southern (Honduras and Nicaragua) subspecies may, if valid, be considerably more threatened than the northern form.

II. Conservation Action
   a. Protected Areas
      - Expand system of public and private protected areas.
      - Enforce management and control in national protected areas in order to lower deforestation rates and illegal hunting.
      - In El Salvador, expand the system of protected areas, with special attention to Cerro El Pital (Komar and Herrera 2003), and increase size of existing reserves (Komar 2002b).
   b. Education and Outreach
      - Through education programs, create public awareness in local communities and government agencies of the species' vulnerability.
      - Continue to extend sustainable land use outreach activities in local communities near guan populations. For example, promote permanent crops adjacent to primary forest instead of annually burned cornfields.
      - Promote conservation of indigenous traditions (e.g., sustainable use of communal reserves, Secaira 2000), especially in Guatemala and Mexico.
   c. Restore habitat through reforestation.

Appendix. Current distributional data of the Highland Guan (*Penelopina nigra*), which were not included in González-García et al. (2001).

Site	Coordinates	Observation	Source
Mexico			
San Miguel Chimalapas, Oaxaca	16°43'N 94°45'W	frequent observations, May 2005	F. González (pers. comm.)
Santa María Chimalapas, Oaxaca	16°54'N 94°41'W	frequent observations, May 2005	F. González (pers. comm.)
Cordon El Reten, Oaxaca	16°40'N 94°13'W	frequent observations, May 2005	F. González (pers. comm.)
Cerro Baul, Oaxaca	16°35'N 94°10'W	several observations, May 2005	F. González (pers. comm.)
Guatemala			
Caquipec mountain, Alta Verapaz	15°23'N 90°11'W	frequent observations	Eisermann (2005)
Yalijux mountain, Alta Verapaz	15°23'N 90°04'W	frequent observations	Eisermann (2005)
Sierra Sacranix, Alta Verapaz	15°30'N 90°30'W	frequent observations	Eisermann (2005)
Sierra Pampajché, Alta Verapaz	15°25'N 90°35'W	frequent observations	Eisermann (2005)
Chicamán, Quiché	15°29'N 90°47'W	recorded in 2004	D. Tenes (pers. comm.)
Montaña de Carmona, Sacatepéquez	14°32'N 90°41'W	diplays April 2004, February and March 2005	K. Eisermann and C. Avendaño (pers. obs.)
Tectitán, Huehuetenango	15°18'N 92°04'W	recorded in August 2004	R. Rivas (pers. comm.)
Laguna de Yolnabaj, Huehuetenango	16°02'N 91°34'W	recorded	Sandoval (2000)
Buenos Aires Chiblac, Huehuetenango	15°53'N 91°14'W	recorded	Sandoval (2000)
Tajumulco Volcano, San Marcos	15°02'N 91°53'W	recorded in April 2004	R. Rivas (pers. comm.)
Municipal Park, San Marcos	15°00'N 91°48'W	recorded in April 2004	R. Rivas (pers. comm.)
Sierra Merendón, Izabal	15°27'N 88°34'W	recorded in March-May 2002	Cerezo & Ramírez (2003)
El Salvador			
Cerro El Pital, Chalatenango	14°19'N 89°07'W	frequent observations	Komar & Herrera (2003)
Santa Ana Volcano, Santa Ana	13°51'N 89°38'W	feather findings	Komar & Herrera (2003)
Honduras			
La Muralla National Park, Olancho	15°08'N 86°45'W	frequent observations	Bonta & Anderson (2002)
El Boquerón Natural Monument, Olancho	14°45'N 86°05'W	frequent observations	Bonta & Anderson (2002)
Sierra de Agalta National Park, Olancho	14°57'N 85°55'W	frequent observations	Bonta & Anderson (2002)
Montaña de Botaderos, Olancho	15°20'N86°09'W	frequent observations	M. Bonta (pers. comm.)
La Tigra National Park, Francisco Morazán	14°14'N 87°06'W	frequent observations	Bonta & Anderson (2002)
Güisayote Reserve, Ocotepeque	14°27'N 89°04'W	frequent observations	Bonta & Anderson (2002)
Comayagua region, La Paz and Comayagua	14°21'N 87°39'W	frequent observations	Bonta & Anderson (2002)
Montaña de Comayagua NP, Comayagua	14°30'N 87°31'W	feather findings in 2000	D. Medina (pers. comm.)
Cusuco National Park, Cortés	15°31'N 88°14'W	single bird on 26 March 2005	D. Medina (pers. comm.)
Celaque NP, Copán, Ocotepeque & Lempira	14°30'N 88°42'W	single bird on 18 March 2002	T. Jenner (pers. comm.)
Santa Barbara National Park, Santa Barbara	14°54'N 88°08'W	heard at 3 different sites March 2003	D. Medina (pers. comm.)
Nicaragua			
Reserva Privada El Jaguar, Jinotega	13°14'N 86°03'W	single male seen 11 November 2004 display observed 17-18 March 2005	S. Morales (pers. comm.) A. Martínez (pers. comm.)



Image by B. MacKay

Yellow-knobbed Curassow (*Crax daubentoni*)

Richard Buchholz and Carolina Bertsch

Work to Date

The Yellow-knobbed Curassow is a lowland species (up to 1500 m; Hilty and Brown 1986), enigmatic of the gallery (or riparian) and dry deciduous forests associated with rivers in the Venezuelan and Colombian Llanos. In Venezuela its distribution includes the Maracaibo Basin, (Zulia and western Mérida), western Falcón (including Tucacas), lowlands and foothills of Yaracuy and Carabobo, and eastward through Aragua to Miranda, and generally from the eastern base of the Andes in Táchira, Apure, Barinas and Cojedes to Guárico, and locally to eastern Sucre and Monagas. In Colombia it occurs in the northeastern part of the country, along the border with Venezuela (Hilty 2003). There are records from the 1940s and 1950s at scattered localities in Boyacá, La Guajira and Norte de Santander; more recently (1990s) it was reported by local people in Arauca (del Hoyo and Motis 2004).

Although it is mostly a forest species, curassows like to venture out along gallery forest borders and into openings or onto narrow shady roads, but no more than 250 m from forest cover (Bertsch in prep.). At Hato El Frío the strips of forest that grow on water retention dikes may provide new habitat for *C. daubentoni* (R. Antelo pers. comm.). Recent plant succession of open areas to more closed forest in western areas of Hato Masaguaral has led to increased numbers of curassows in this part of the cattle ranch (S. Beissinger pers. comm.). No curassows were encountered in isolated tree clumps during the dry season at Hato El Cedral, although they were in riparian forests (K. Kriese pers. comm.).

At Hato Masaguaral, Niño (1994) did not find an effect of forest structural attributes on curassow abundance or habitat preference; he suggests instead that it is the local availability of fruits that is the major determinant of curassow presence. Buchholz (1995) found that most calling males chose display perches in especially tall trees so that they were positioned above the surrounding canopy, and found one case where removal of the traditional calling site probably resulted in dispersal by that male but not a neighboring male. Jorgenson (2000) suggested that the calling display of male curassows makes them more obvious to human hunters. Bertsch (in prep.) relates that her own studies, and the study of nesting behavior by Kvarnbäck (2004), suggest this

curassow makes use of the forest edge for nesting (mostly in *Cecropia* spp.) and feeding (on *Guazuma ulmifolia* and *Mangifera indica* fruits), when protected from hunting. Indeed, Kvarnbäck (2004) notes that isolated forest fragments may help females evade egg predators.

Reproduction takes places during the beginning of the rainy season (April-June), where females spend 28 days (average) incubating the 1-2 eggs in the nests. Moreover, a single nest may be re-used by different females during the same breeding season (Kvarnbäck 2004). During the breeding season males are usually found singly, while females may be found in the company of a displaying male, another female, or perhaps immature offspring from previous years (Strahl et al. 1997c). Strahl et al. (1997c) had observations suggesting that this species may be polygynous, and observations by others are indicative of sequential associations of individual males with different females (Bertsch in prep, Kvarnbäck 2004), but no field studies have documented that individually-identifiable males have copulated with multiple females.

At Hato Masaguaral, males call from specific tree perches from April-June by emitting a descending whistle (described as "wheeeeeuuuuuu" by Hilty and Brown 1986), and wing-flapping and booming (action patterns described in Buchholz 1995; sonograms in Buchholz 1989). Ten different males displayed regularly in the 2 km^2 study area where Buchholz (1995) found that males call in longer bouts when other males are nearby, wing-flapping is less in the presence of females, and males that whistle most often within a calling bout are less likely to be visited by females. Buchholz (1995) concluded that the male whistle call is primarily for intra-sexual competition; males were never observed to be directly aggressive to one-another.

Strahl et al. (1997c) reported mixed sex flocking and a high density of individuals in riparian areas during the dry season in the central Llanos (Estado Guárico, Venezuela), and much lower densities as the birds dispersed to the surrounding dry, deciduous forest as the annual rainy season began (App.). If one averages the seasonal and forested habitat values from Strahl et al. (1997c), the resulting densities are roughly similar to values calculated by Polisar (2000) from the Hato Piñero study site in Estado Cojedes, Venezuela. A recent survey by Bertsch (in prep.), also at Hato Piñero, found slightly higher population densities than Polisar (2000) did. Interestingly Bertsch (in prep.) reports seeing about twice as many females as males in all habitat types examined, and 91% overlap in the 138-196 ha home range estimates of females and males as determined by radio-telemetry, combining wet and dry seasons.

It took 15 years of protection from hunting for the population to grow from "a few pairs over the years" to seeing "foraging groups of 12" in the non-breeding season at Hato El Cedral (D. Ascanio pers. comm.). We still lack the basic life history data, such as age-related mortality and fecundity, for an un-hunted (or any) wild population, needed to plan for the conservation of this species.

Status and Threats

Status: Globally the species was listed as 'Near Threatened' (BirdLife International 2005), with a similar conclusion in the next update to the Venezuelan red list (Sharpe 2005), but in Colombia the species is categorized as Vulnerable (VU C1 + 2a(i), Franco-Maya and Renjifo 2002). As recently as 1994, this species was ranked as being of "Least Concern", but concern has increased with each Redlist update (BirdLife International 2005), largely because nothing is being done to address its apparent decline. In lieu of abundance data from population surveys throughout their recent range, given its poor reproductive potential, continuing habitat destruction (see below) and widespread hunting warrant that the species be considered globally Vulnerable (VU A3a,c,d).

Despite repeated calls for a comprehensive population survey of this species (e.g. Franco-Maya and Renjifo 2002, Strahl and Silva 1997a), none have been completed. There are no data on their population densities in protected or unprotected areas of Colombia (Franco-Maya and Renjifo 2002). They are rarely seen in the buffer zone of El Cocuy National Park in Colombia (O. Cortes pers. comm.). In Venezuela, their distribution in the Cordillera de la Costa Central is said to be at least 50% less than previously, and in the Llanos, the distribution is thought by some to be about 70% of the original range (BirdLife International 2003). The range reductions for these areas are considered higher than Birdlife International's (2003) estimates (D. Ascanio pers. comm.), and are suggested to be 70% and 60% losses, respectively. The map in Strahl and Silva (1997b) shows the species extirpated from approximately 30% of its historic range in Venezuela, and they found the species is nearly eliminated from the two national parks in its distribution, Guatopo and Henri Pittier. Although there have been reports of one individual seen (January 2005) and one heard (May 2005) in the lowlands on the northern slope of Henry Pittier National Park (C. Sharpe and A. Naveda, pers. comm., respectively) and local people report the presence of an active nest along the road between Cata-Cuyagua in Aragua State (A. Naveda, pers. comm.). Curassows are absent from areas of the central Llanos where they were once seen regularly (G. Ríos pers. comm.). Populations can be large if protected from hunting (App.), but not all conservation ranches in the Llanos mentioned by previous authors (BirdLife International 2000) necessarily have the appropriate combination of dry and wet season habitats, or the ability to control hunting in order to attain larger *C. daubentoni* populations (D. Ascanio and K. Kriese pers. comm.).

Threats: In Colombia subsistence hunting is thought to be the major factor associated with continuing decline, but habitat destruction and possibly contamination of water sources are contributing factors (Franco-Maya and Renjifo 2002). Rural hunters ('Campesinos') specifically target gallery forests for hunting Yellow-knobbed Curassows (O. Cortes pers. comm.). In Venezuela the impact of hunting on populations in parks and reserves has been previously documented (Silva and Strahl 1991) and probably continues in the absence of education programs. Additionally, this species is included in the Venezuelan sport-hunting calendar, set by the Venezuelan government.

An on-going study of LANDSAT 7 satellite photos of land cover changes from 1990-1999 reveals that the forested areas of the Llanos continue to be deforested or degraded, leaving few large or medium sized patches of the habitat most critical to *C. daubentoni* (G. Ríos pers. comm.). Policy changes in the Venezuelan government have created the possibility that some of the private ranch lands in Venezuela where the curassow has been protected in the past, may be converted to other agricultural uses less suitable for this species (Sanchez 2005).

Conservation Action

I. Colombia
   a. Survey historical range for presence/absence and abundance of this species
   b. Conduct satellite photo analysis of forest cover changes to identify suitably large and connected habitat patches
   c. Begin hunter education program to reduce use of this species

II. Venezuela
   a. Survey historical range for presence/absence and abundance of this species
   b. Collaborate with on-going satellite photo analysis of forest cover changes to identify suitably large and connected habitat patches that may be protected
   c. Re-initiate hunter education program to reduce use of this species (Silva 1997)

d. Conduct a long-term demographic study of a protected population (e.g. at Hato Piñero) so that fecundity, mortality and dispersal data can be collected for population viability analysis. This will be imperative to plan a network of private and government protected or controlled-hunting areas (Ríos 1997).

Appendix. Seasonal and year-related differences in *C. daubentoni* population densities in three habitat types. Sampling effort differed between studies, but hunting varied from none to low at all sites.

Years	Habitat	Density (per km^2) Dry / Wet Season	Site	Reference
1985-89	Riparian	80 / 13	M	Strahl et al. 1997c
1985-89	Dry forest	2.7 / 7.6	M	Strahl et al. 1997c
1993	Riparian	- / 151.4	M	Niño 1994
1993	Dry forest	- / 3.1	M	Niño 1994
1996-98	Riparian and Dry forest	38.5 (combined)	P	Polisar 2000
1996-98	Hill forest	7 (combined)	P	Polisar 2000
1996-98	Pastures	0.5-0.7 (combined)	P	Polisar 2000
2001-02	Riparian	160.7 / 39.7	P	Bertsch in prep.
2001-02	Dry forest	43.7 / 28.3	P	Bertsch in prep.
2001-02	Open areas near forest	12.5 / 8	P	Bertsch in prep.

M = Hato Masaguaral; P = Hato Piñero.



Male Bare-faced Curassow (*Crax fasciolata*) photo by J. Idrobo

Chapter 6 – Near-threatened Cracids

Two of the five Near-threatened cracids are Brazilian endemics (*Ortalis superciliaris* and *Penelope pileata*), with a third species (*Aburria aburri*) patchily distributed within its Andean range. The remaining two have subspecies with very restricted ranges: *Crax rubra griscomii* is restricted to Cozumel Island off the northeastern coast of Mexico's Yucatan peninsula, and *C. fasciolata pinima* of northern Brazil is likely extinct in the wild currently. Below is a list of the five Near-threatened cracids highlighted in this section:

Ortalis superciliaris	Buff-browed Chachalaca	NT - C2a(i)
Penelope pileata	White-crested Guan	NT - C2a(i)
Aburria aburri	Wattled Guan	NT - C1; C2b
Crax rubra	Great Curassow	NT - A2c,d; A3c,d
Crax fasciolata	Bare-faced Curassow	NT - A2c,d; A3c,d



Painting by A. Gallo

Buff-browed Chachalaca (*Ortalis superciliaris*)

David C. Oren

Work to Date

Buff-browed Chachalaca (*Ortalis superciliaris*) is distributed in Brazil south of the Amazon River from west of the Tocantins River east to at least northern Piauí. Sibley and Monroe (1990), among others, consider *O. superciliaris* as forming a superspecies with *O. motmot* (sensu lato) and *O. guttata* (sensu lato). Traditionally the distribution has been described as from the Tocantins east to Piauí (Delacour and Amadon 1976, del Hoyo 1994, BirdLife 2004), but the ornithological collections of the Museu Paraense Emílio Goeldi in Belém, Brazil, hold two specimens from localities just west of the Tocantins, at Sítio Calandrinho collected in October 1978 and Tocantins left bank across from Jatobal collected in June 1984. Unfortunately both sites have since disappeared under the waters of the Tucuruí hydroelectric project. The region surrounding the resulting artificial lake has largely been deforested, but there are large areas of second growth and the Paracanã Indigenous Reserve is located near the collecting sites. At Carajás, approximately 200 km further west, the local chachalaca is *O. m. ruficeps* (specimens at Museu Goeldi, D. Oren pers. obs.).

Ortalis superciliaris is found in evergreen *terra-firme* tree fall gaps and edge, várzea edge, and second growth in Pará and Maranhão (Snethlage 1935, Oniki and Willis 1983, Novaes and Lima 1998, D. Oren pers. obs.), semi-deciduous forest in Maranhão (D. Oren pers. obs.), and in gallery forest edge in northwestern Piauí (Souza e Souza, pers. comm.). It is possible that the species extends (or extended) into northwestern Ceará, which has habitats similar to those in Piauí, especially in the Serra do Ibiapaba complex. It was considered common by Novaes and Lima (1998) around Belém, scarce around São Luís in northern Maranhão (del Hoyo 1994), and rare elsewhere BirdLife (2004).

Nests are described by Snethlage (1935) and Oniki and Willis (1983). Snethlage (1935) found nests from 15 Dec to 14 Feb, and Oniki and Willis (1983) found three nests in June, July and Nov, constructed as loose platforms of palm leaflets lined with dry leaves, grass and twigs in forks of low trees in high grass located in an open grassy field, and in secondary várzea forest edge, averaging 90 cm off the ground. One nest had a 22 cm outside diameter and 10 cm inside diameter. The clutch size was 3 eggs in two nests and only 1 in the third. The 7 white, equipolar

eggs were stained with dirt, and measured on average 53.0 mm x 36.1 mm, with an average weight of 33.6 g.

Status and Threats

Because *O. superciliaris* is relatively small in size and apparently breeds during much of the year, it is not surprising that it is still reasonably common in many areas where hunting pressure is low. However, its habitats are declining and becoming more and more fragmented with the advance of timber extraction, mining activities, cattle ranching, soy production, and fuel wood collection, the last especially for charcoal production to supply the region's growing pig iron industry. Recent poorly planned agrarian reform settlements have increased hunting pressure markedly in many areas, even though hunting native game is officially illegal in Brazil. The region where it lives is the most highly altered portion of the Brazilian Amazon and adjacent drier areas (Oren and Matsumoto 2005). The main protected areas are the Gurupi Biological Reserve, widely invaded by timber interests, gold miners, cattle ranchers, and slash and burn agriculturists, and a mosaic of important indigenous reserves, including the Alto Guamá Tembé, Mãe Maria, and Amanayé Reserves in Pará, and the Alto Turiaçu Urubu-Ka'apor, Caru, Awá, and Arariboia Reserves in Maranhão. Large areas of these indigenous reserves remain intact and the human population density is low in most, but they also suffer increasing pressure, especially from timber interests with the exhaustion of commercially valuable wood outside protected areas. Invasion by gold miners is also important in reserves where that metal occurs. Pressure to extract fuel wood for charcoal from indigenous areas is also increasing.

Conservation Action

I. Conduct surveys to determine current distribution, especially:
    a. The western limits of *O. superciliaris*, where it may be in contact with *O. m. ruficeps*
    b. The eastern limits in Piauí and adjoining Ceará, where the species may be most critically endangered

II. Consolidate existing conservation units and indigenous reserves within the species range.

III. Promote fieldwork to understand more about the status of the species throughout its range.



Chachalaca habitat at Tomé-Açú, eastern Pará, Brazil (photo by F. Poletto)



Image by H. Vercauteren

White-crested Guan (*Penelope pileata*)

David C. Oren

Work to Date

The White-crested Guan is considered monotypic, forming a superspecies complex with *P. jacucaca* and *P. ochrogaster* (Sibley and Monroe 1990). The species historically was distributed in Amazonian Brazil south of the Amazon River from the Madeira east to the forest's limits in western Maranhão. The full extent of the range was long underestimated and accounts into the 1990s placed the eastern limit at the Tapajós River (e.g., Sibley and Monroe 1990). The southern limit of *Penelope pileata* is still unclear. It is still found in western Maranhão in the Gurupi Biological Reserve and surrounding indigenous reserves (D. Oren pers. obs., photograph in the Urubu-Ka'apor Indigenous Reserve by anthropologist W. Balée), but its status in eastern Pará is unknown. The species was not found during recent fieldwork in the region of Paragominas, Pará (A. Aleixo pers. comm.). Novaes and Lima (1998) consider it "probably extinct" in the vicinity of Belém.

No real fieldwork has been conducted other than rapid observations of the species and recordings of its vocalizations during ornithological inventory work (Oren and Parker 1997, D. Oren unpubl. data), and a few photographs taken in the wild (e.g., Grosset 2000). The species occurs primarily in tropical lowland moist evergreen forest. *Penelope pileata* is mostly arboreal, but sometimes also forages on the ground. It is found in intact *terra-firme* forest, as well as selectively logged forests and relatively tall secondary growth. It appears to prefer uplands, but in Redenção, Pará, where it was found in selectively logged (for mahogany) high broadleaf forest that had recently suffered extensive understory burning, it was concentrated in moister riverine forest that had escaped burning. In captivity, a female laid two clutches of four eggs, each measuring 73-84 cm in length and 51-54 in breadth, weighing from 107-121 g (Taibel in litt., apud Delacour and Amadon 1973).

Status and Threats

Buzzetti (2000) recorded both *P. pileata* and *P. ochrogaster* at the Cantão State Park in western Tocantins State during a rapid ecological assessment (Sobrevila and Bath 1992). He conducted two field trips in the dry season (28-29 Aug 1999 and 16-27 Sept 1999) and one in the rainy season (16-30 Jan 2000). On the first excursion he recorded both species in seasonally inundated forest at different sites and *P. ochrogaster* in secondary gallery forest; only *P. pileata* in seasonally flooded forest on the second; and only *P. ochrogaster* in seasonally flooded forest on the third excursion. He unfortunately is not available to clarify potential identification problems related to these records, since he drowned tragically during another rapid ecological assessment in 2001, but it is extremely unlikely that two different members of the *P. jacucaca* superspecies complex are sympatric in the same habitat of seasonally inundated forest at Cantão State Park. Later, Fábio Olmos (in litt. apud BirdLife 2003) recorded *P. ochrogaster* at two additional sites in areas around the park. We consider that the birds Buzzetti recorded at Cantão State Park were probably all *P. ochrogaster*, as were the birds reported to Oren (N.D.) by field assistants in Santana do Araguaia, Pará. The region of Santana do Araguaia is extremely interesting, with Amazonian species nearby to Cerrado forms, such as *Thraupis episcopus* in *terra-firme* forest and *T. sayaca* in the seasonally flooded savannas. The possibility that both *P. pileata* and *P. ochrogaster* occur there in close proximity, but different habitats, merits investigation.

Because *P. pileata* has a relatively small range for an Amazonian lowland cracid, appears to prefer high forest, is actively hunted both for food and as an aviary specimen, and lives in territory that has suffered some of the greatest deforestation in the Brazilian Amazon, BirdLife International (2004) and IUCN list it as Near Threatened. The most critical part of its range where it is most highly threatened encompasses the region from the Tocantins River to the eastern limits of Amazonian forest in western Maranhão. Further west, its known range includes extensive areas occupied by large indigenous reserves with very low human population density, and a complex mosaic of rapidly encroaching deforestation from logging, cattle ranching, and soy and cotton plantations moving from along the BR-163 highway, the Trans-Amazonian highway, and a complex of "endogenous" roadways in the interfluvium between the Tapajós and Xingu Rivers (Souza et al. 2004), but also with several biological reserves, national parks, and extractive reserves. Both indigenous people and more recent settlers hunt *P. pileata* for meat, and its feathers are prized for arrow fletching and other uses. With the lack of detailed field surveys, there is no real information on the true status of the species anywhere it occurs, and its southern limits are still unclear.

Conservation Action

I. Conduct surveys to determine current range, especially the southern limits of *P. pileata*.

II. Consolidate existing conservation units within the species range, especially in the easternmost part where it is most highly threatened.

III. Promote fieldwork to understand more about the habits and status of *P. pileata* throughout its range.



Wattled Guan (*Aburria aburri*)

Margarita M. Rios, Marcia C. Muñoz and Gustavo A. Londoño

Work to Date

The Wattled Guan is distributed from eastern Venezuela and northern Colombia, throughout eastern and northeastern Ecuador to central and southern Perú. The known distribution has increased due to information collected on expeditions, surveys and studies conducted in the Andes in the last few years (Fig. 1; Marin et al. 1992, Silva 1999, Salaman et al. 2001, Donegan et al. 2001, Freile and Chaves 2004).

It was believed that the Wattled Guan lived only in mature montane forest (Delacour and Amadon 2004), but recent studies report frequent detections of this species in secondary forest with different disturbance levels, forest edge and even in exotic plantations (Nadachowski 1994, Ortiz and O'neill 1997, Donegan et al. 2001, Freile and Chaves 2004, Rios et al. 2005). The guan inhabits altitudes ranging from 450-2000 m; rarely ranging 400-2450 m (Delacour and Amadon 2004).

The Wattled Guan is considered rare or uncommon throughout its distribution, but most of this information is the result of sporadic visits or interviews with local hunters (Hilty and Brown 1986, Greenfield and Ortíz-Crespo 1997, Ortíz-Tejada and O'neill 1997, Renjifo 1998, Silva 1999, Donegan et. al 2001, Salaman et al. 2001, Negret 2001, Briceño-E. pers. comm.); few data come from systematic studies, until recently (e.g., Rios et al. 2005). The few studies conducted on the Wattled Guan reported very low densities. Nadachowski (1994) reported densities between 0.005 and 0.03 ind/km^2 in the Otún river valley. At the same locality, Rios et al. (2005) reported a density of 0.87 ind/km^2 (ecological density of 2.6 ind/km^2). Silva and Strahl (1997a) estimated a density of 2 ind/km^2 in Venezuela. Sporadic explorations in Colombia at Serranía de San Lucas (Donegan et al. 2001), Cueva de los Guácharos National Park (Hilty and Brown 1986), and Serrania de los Yariguíes National Park (Donegan et al. 2004), as well as in Perú at Jirillo-San Martín and Cosñipata-Cuzco (Ortiz-Tejada y O'neill 1997) have shown this species to be fairly common. However, recent observations reported a considerable decrease in the number of detections of this species at Cueva de los Guácharos, Colombia (Salaman et al. 2001).

The reproductive information is principally anecdotal, as the known reports of the breeding period are based on male vocal activity (Ortíz Tejada and O'neill 1997, Donegan et al. 2001, Salaman et al. 2001, Delacour and Amadon 2004, Rios et al. 2005) and only two reports provide information on chicks or nests (Hilty and Brown 1986, Strewe and Navarro 2003). A nest was found along the edge of a creek at Reserva del Bosque Nublado Séptimo Paraíso (Perú), and the family group remained close to the nest for three months (B. Palacios unpubl. data). Only two studies provide information on subadults (Delacour and Amadon 2004, Rios et al. 2005).

One of the few studies that provided information on the feeding behavior of this species was conducted by Rios et al. (2005), which reported consumption of fruit and leaves. Other unknown aspects for this species are the social behavior, population structure and dynamics, interspecific interactions and seasonal movements. It is also important to evaluate the status of different populations at local and global scales.

Status and Threats

The Wattled Guan is considered Near Threatened (BirdLife 2004), with a High Conservation Priority (Brooks and Strahl 2000) and is not currently listed on CITES. Based on the IUCN Red List categories (IUCN 2001), the Wattled Guan should perhaps be upgraded from Near Threatened to Vulnerable (VU - C1; C2b) in light of population declines, and fluctuations in number of individuals; however we treat it as NT until more data are available. In terms of population declines, the species was "numerous" at Cueva de los Guácharos NP, Colombia prior to mid 1980s (Hilty and Brown 1986), but only one individual was observed during four days of surveys in the late 1990s (Salaman et al. 2001). In terms fluctuations in number, densities range from 0.005 to 0.87 ind/km^2 at one site in Colombia (Nadachowski 1994, Rios et al. 2005), up to 2 ind/km^2 in Venezuela (Silva and Strahl 1997a). Moreover, the current distribution in Venezuela is only 50% of the historical range (Phelps and Meyer de Schauensee 1979, Rodríguez and Rojas Suárez 1999), and nearly 70% of the original Andean forest cover has been lost in Colombia (Etter and van Wyngaarden 2000), suggesting the species also qualifies under VU B1b(iii)+c(iv) criteria (IUCN 2001).

On a global level, the Wattled Guan is facing abrupt population declines and local extinctions (Renjifo et al. 2002, Rodríguez and Rojas-Suárez 1995, Salaman et al. 2001). Most of the habitat for this species occurs in the Andes, which currently has only 5% of its original cover (Cavelier et al. 2001). Some authors suggested that the Wattled Guan undergoes altitudinal migrations, but the evidence is not very strong. If this were true however, protection of this species would require preservation of large areas, including continuous forest along altitudinal gradients (Salaman et al. 2001). As an additional threat, the large size, the static behavior when detected, and the song produced by the males during the reproductive period (Delacour and Amadon 2004), increase the vulnerability of guans to hunters (Salaman et al. 2001).

Venezuela: The Wattled Guan is considered Threatened in Venezuela (República de Venezuela 1996a). It appears that populations are decreasing rapidly and some are already locally extinct (Silva 1999). The current distribution is only 50% of the historical range (Phelps and Meyer de Schauensee 1979, Rodríguez and Rojas Suárez 1999). The future of these populations is also grim due to unabated high levels of fragmentation within their range. These populations also face moderate hunting pressure, as they are often used as a food source (Strahl and Silva 1997b, Silva 1999).

Colombia: This species covers almost the entire Colombian Andes, but their populations are declining, so it is considered Near Threatened in this country (Renjifo et al. 2002). The principal

threat to this species is habitat loss and fragmentation through land transformation for agricultural purposes, cattle ranching, and urban expansion (Renjifo et al. 2002). This has resulted in the loss of nearly 70% of the original Andean forest cover (Etter and van Wyngaarden 2000). Although hunting is currently a problem (Salaman et al. 2001, Briceño-E. pers. comm.), it does not seem to strongly affect the populations in at least some regions (Rios et al. 2005).

Ecuador: Some of the Ecuadorian populations are isolated and rapidly decreasing, and therefore *A. aburri* is considered Vulnerable in this country (Pacheco 2002). The principal threats faced by this species are habitat loss through logging activities, especially in the eastern portion of the country, and hunting pressure.

Perú: This species is considered Near Threatened in Perú (F. Angulo pers. comm.). Although there are some stable populations, many are isolated (Koepcke and Koepcke 1963, Ortiz-Tejada and O'Neill 1997) and in some regions local extinction has already occurred, especially along the western Andes (Salaman et al. 2001). The principal threats are high logging rates for agricultural purposes and coca plantations, as well as hunting pressure for human consumption and use as pets (Ortiz-Tejada and O'Neill 1997, Pulido 1997). Until 1997, this species was present in several protected areas (Ortiz-Tejada and O'Neill 1997).

Conservation Action

Despite the fact that the Wattled Guan is considered threatened throughout its entire range of distribution, there is little intervention to promote its protection. No protected area has been established specifically for protection of this species, and few actions have been undertaken to avoid hunting. Conservation plans must be developed at local and global scales because the Wattled Guan has special characteristics such as low density, seasonal movements, possibly low dispersal ability, and vulnerability to fragmentation (Rios et al. 2005). It is with this in mind that we recommend the following actions to be taken:

I. Study basic ecological aspects of the Wattled Guan
   a. Habitat use and requirements
   b. Population dynamics
   c. Assess seasonal movements
   d. Assess the impact of fragmentation on populations

II. Evaluate population status of the Wattled Guan
   a. Evaluate presence in protected areas
   b. Evaluate effectiveness of protected areas for conservation
   c. Determine minimum viable population sizes to plan and execute specific conservation actions

III. Protected Areas
   a. Establish new protected areas
   b. Enhance existing protected areas

IV. Control Hunting
   a. Create and enforce established or new hunting restrictions for some countries such as Venezuela (e.g., Decreto 1485, Gaceta Oficial de la República de Venezuela, No. 36059)
   b. Ban hunting completely, for coutries such as Ecuador (e.g., resolución ministerial No. 105, 7 de enero de 2000)

V. Create public awareness and environmental education programs, especially focusing on hunters

VI. Support captive breeding programs, such as the recent program initiated at the Cali Zoo (Colombia), CREA (Centro de Reproducción de Especies Amenazadas)

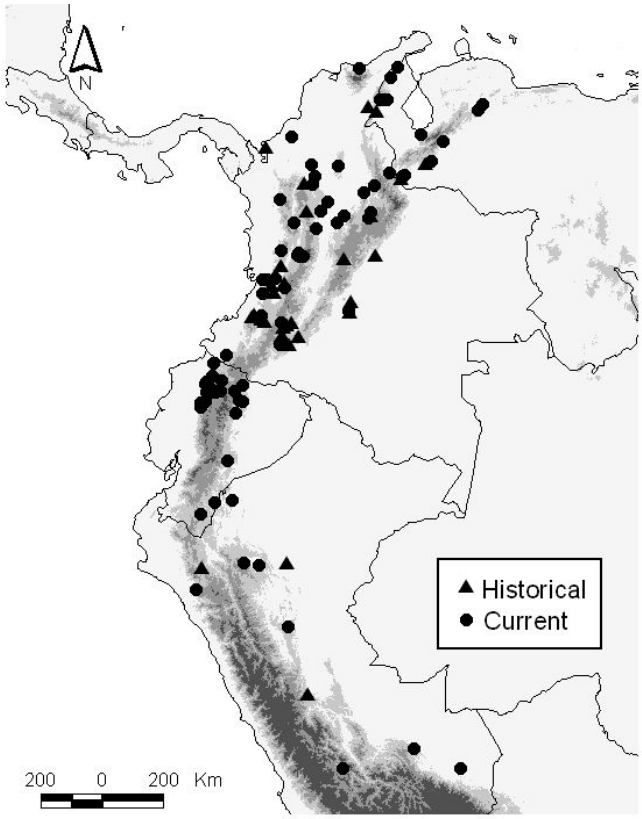


Fig. 1: Current and historical records (prior to 1980) of the Wattled Guan (Koepcke and Koepcke 1963, Phelps and Meyer de Schauensee 1979, Hilty and Brown 1986, Marin et al. 1992, Ortiz-Tejada and O'neill 1997, Greenfield and Ortíz-Crespo 1997, Strahl and Silva 1997b, Silva 1999, Salaman et al. 1999-2001, Negret 2001, Pacheco 2002, Strewe and Navarro 2003, Delacour and Amadon 2004, Freile and Chaves 2004, Andean IBAs 2005 [BirdLife Intl.], World Bird Database 2005 [BirdLife Intl. Ecuador and Colombia], BioMap [Darwin Database] Alliance Partnership 2005 [Nat. Hist. Mus., Cons. Intl., Inst. Cien. Nat., Univ. Nac. Col., Dataves - Colombia]; and pers. comm. by M. Lentino, D. Calderón-F., D. Francisco Cisneros, B. Palacios, J. Maria Loaiza, N. Krabbe, M. Nieto, S. Ocampo, E. Briceño, D. Susanibar, C. Vinueza, S. Villamarin Gil, F. Kaston, L. Chasqui, A. Felipe Betancourth López, A. Quevedo and J. Harold Castaño).



Photo by D. Sarkozi

Great Curassow (*Crax rubra*)

Margarita M. Rios and Marcia C. Muñoz

Work to Date

The Great Curassow has two subspecies: *Crax r. rubra* is the mainland form, distributed in ten countries from eastern Mexico through Ecuador; *C.r. griscomi* is the Cozumel Curassow, restricted to the 486 km^2 island of Cozumel, off the northeastern Yucatan Peninsula of Mexico (del Hoyo 1994, Delacour and Amadon 2004).

Crax r. rubra inhabits large tracts of virgin, mature, and secondary rainy tropical forests and dry forests (Sermeño 1997a, Arguedas et al. 1997, Delgado 1997, McCoy 1997, Vannini and Rockstroh 1997, Midence 1997), principally between 0-1200 m asl, and occasionally reaching 2000 m (Vaughan 1983). On the other hand, the Cozumel Curassow has a preference for tropical semi-deciduous forest (Martínez-Morales 1999) and probably lives in mangroves as well (Paynter 1955, Martínez-Morales 1996, 1999). Both subspecies spend most of the day on the forest floor, but roost in trees at night (del Hoyo 1994, Sermeño 1997a). It is common to observe curassows alone or in small groups of 2-6 birds (Sermeño 1997b, Hilty and Brown 2001). Occasionally they may form flocks up to 20 or more adult and young birds of both sexes, but flocks typically do not exceed 10-15 birds (Sermeño 1997a, Zimmer 1997). This species is territorial and rarely allows other species into their territories (Vaurie 1968, Estudillo-López 1979, 1986).

There are few population density studies. On Cozumel Island, a study was done using distance-sampling methods, obtaining a density of 0.9 ind/km^2, with the population estimated at 97-304 birds for the island. It was also estimated that 81-253 individuals in the population were adults and 16-51 were sub-adults less than one year of age; the sex ratio was 1:1 (Martinez-Morales 1999). In forest fragments in Costa Rica, densities of the curassow were estimated to range between 0.4-1.2 ind/km^2, and the minimum population size was 500 individuals (Vaughan 1983, McCoy 1996). Eisermann (2004) estimated a density of 1.4 ind/km^2 for this species too, in Punta Manabique, a protected area along the Atlantic Coast of Guatemala. Donegan (2001) estimated 6-8 individuals along ~45 km of transect in Tikal, Guatemala. Jiménez et al. (2003) suggested a methodology for estimating the population of this species. There is currently a lack of

information on longevity, mortality rate, and recruitment in wild populations (Arguedas et al. 1997).

The breeding season of the Great Curassow has been documented in some areas of its distribution. In El Salvador, Costa Rica and Panama it breeds during the dry season between February - May (Sermeño 1997b, Estudillo-López 1986, Delgado 1997, G. Seutin pers. comm.), and in Mexico it breeds during the dry season as well (Martinez-Morales 1996, 1999). Reproduction is well documented from studies conducted both in the natural habitat (Sutton 1955, Sermeño 1997b) and captivity (Guido 1985). Sermeño (1997b) found 85 arboreal nests that were 3-23 m above the ground, and both sexes participate in nest construction. The nests were 26-46 cm in diameter, 16-27 cm high, and 8-13 cm deep (Sutton 1955, Guido 1985, Sermeño 1997b), and each contained two eggs averaging 92.3 x 63.7 mm. Females incubated the eggs for approximately 33 days, and parental care was provided until the young were 8 months. Sermeño (1997b) provided information on plumage changes by observing 15 young.

One of the first dietary studies was done by Sermeño (1997b), who observed the birds consuming fruits of 15 plant species, the youngest leaves of 4 plant species, and 4 species of invertebrates. In another study, Rivas (1995) found that the diet included fruits or seeds of approximately 44 plant species and over 22 species of arthropods. Rivas (2004) also studied aspects of seed dispersal by this curassow.

Status and Threats

The status of the Great Curassow is Near Threatened, according to BirdLife International (2004), with a high priority for conservation (Brooks and Strahl 2000), and listed as "Apparently Safe" by NatureServe (2005). Additionally, this species is listed on CITES App. III to regulate commercial exploitation.

Principal threats are loss, degradation, and fragmentation of its natural habitat (BirdLife International 2004). Furthermore, the great size of this bird and its terrestrial habits make it an easy target for hunting. This species is hunted for human consumption, sport, and illegal pet traffic throughout its range (Brooks and Strahl 2000), and although it can tolerate some habitat intervention (McCoy 1997), it is sensitive to changes in habitat structure. Consequently increasing crop lands and expansion of settled areas have reduced available habitat (Vannini and Rockstroh 1997).

Belize: This country has 60% original forest cover, suggesting the Great Curassow has good conservation status (Delgado 1997). There are some viable populations, including Laguna Seca and Chan Chich (Zimmer 1997, Brooks and Strahl 2000, Gonzalez-García et al. 2001). Curassows face two threats in Belize: low density in adequate habitat (e.g., Chiquibul NP, Mantí and Columbia River Forest Reserves), and commercial and subsistence hunting (BBIS 1998).

Colombia: Curassows are not currently considered Endangered. Nevertheless, in some areas, such as the Cauca Valley, the bird is considered locally Endangered because habitat has been transformed considerably, and curassows have not been encountered in recent years (Velasco 1997, Andrade 1992). The curassow was previously distributed continuously along the Pacific coast (Haffer 1967, Hilty and Brown 2001), but now its distribution is fragmented (Salaman et al. 2001). In a recent exploration of the Pacific region, this species was not observed, and some hunters indicated it is rare (Salaman et al. 2001). This species is rare due to intense hunting pressure (Andrade 1992).

Costa Rica: This species is considered Endangered. The Great Curassow had lost 69% of its original habitat by 1977; 6381 km^2 of its habitat is currently in protected areas, but few of the remaining forest tracts are continuous (McCoy 1997). Hunting is responsible for local extirpation in some places, and in other areas populations have been greatly reduced (McCoy 1997, Vaughan 1983).

Ecuador: This species is considered Critically Endangered (Mena-Valenzuela and Jahn 2002). Several formerly documented populations have not been recorded in 30 years. In recent years, there have been independent sightings of this bird (Greenfield and Ortíz-Crespo 1997, Mena-Valenzuela and Jahn 2002); the largest populations inhabit the Bravo River, Guaduero, Chimbagal, Hoja Blanca, and Ónzole. The population was estimated at 30-60 adults with a reduction of 80% or more projected over the next 33 years (O. Jahn in litt.); it is probable that there will be a 90-100% habitat reduction over the same period of time (Mena-Valenzuela and Jahn 2002).

El Salvador: This species is considered Endangered - only 3% of the original forest cover remains, and curassows are rarely sighted with several local extinctions already. The only population that still exists is in El Imposible NP, where population size was estimated at 500 individuals and hunting pressure is very low (Sermeño 1997a, Gonzalez-García et al. 1999, Komar and Herrera 2003). Recent evidence suggests the persistence of a population in the hills of Jacuarán, departments of San Miguel and Usulután (Komar and Herrera 2003).

Guatemala: The Great Curassow was historically common with a wide distribution. More recently however, several populations have been reduced, and curassows are very scarce in some areas (K. Eisermann pers. comm.). The species is Threatened in some regions, and in others its status is unknown. Its potential area of distribution is 62,000 km^2, 46,000 km^2 of which is covered by fragmented forest (Vannini and Rockstroh 1997). Among the Guatemalan species of cracids, curassow populations have been the most affected by agricultural expansion, as well as by exploitation of marble quarries (Wetmore 1965, Alvarez del Toro 1981, Vannini and Rockstroh 1997, Delacour and Amadon 2004, Eisermann 2004). Other populations are healthy, as is the case of Punta de Manabique Wildlife Refuge, in the northen region of Petén and the north of El Quiché (Vannini and Rockstroh 1997, Eisermann 2004). Hunting pressure, both for survival and sport, accounts for 34% of mortality at Uaxactún (Roling 1995). Between August 1992 and November 1994, 796 individuals were killed by poachers in the Mayan Biosphere Reserve (J. Rivas pers. comm.). Despite strong hunting pressure in this area, curassows are still common (Soto 2003).

Honduras: The Great Curassow is considered Endangered. Hunting was deregulated in the 1960s, resulting in the birds becoming rare in various regions (Midence 1997). Curassows are also used as pets in local communities. This country has 36% of its original forest cover, and populations might survive in the Río Plátano Biosphere Reserve, Tawahka and Patuca NP, as well as the Cusucu Montains (Midence 1997).

Mexico: Considered Threatened, mainland populations have been extirpated in some parts of their Mexican range (Howell and Webb 1995), with other populations consistently decreasing (González-García 2001, Brooks and Strahl 2000). Although most remaining populations are highly fragmented (F. Gonzalez-García pers.com.), populations are abundant at several localities, such as the jungles of Chimalapas-Uxpanapa and El Ocote in Veracruz, Tabasco, Oaxaca and Chiapas states (Martínez-Morales 1996). The curassow is the favorite game species for hunting and is an important source of protein for local communities (Jorgenson 1997).

The other subspecies, the Cozumel Curassow, is considered Critically Endangered, because of its restricted distribution on Cozumel Island. Martinez-Morales (1997) found a relatively robust population on the island, due to low density and isolation of this population. However, one of the most serious threats for this subspecies is hunting (Martinez-Morales 1997). Currently, other serious problems include the expansion of settlements and tourist attractions in its natural habitat. One important factor that has helped this population is the elimination of exotic predators such as dogs (Martínez-Morales 1999, Gonzalez-García et al. 2001).

Nicaragua: Loss of habitat due to deforestation has been the principal factor causing curassow population declines (Martínez-Sánchez 1997). Forests have been transformed into agriculture systems and pastures for cattle raising, with a loss of 37% of rainforest and 99% of dry forest in the flatlands (Martínez-Sánchez 1997). A few populations persist in forest fragments and places difficult to access. In the central region of the country the status of this species is unknown. However, curassows are abundant in the Atlantic region, where extensive forests remain.

Panama: Sport hunting of curassows is illegal in Panama, but subsistence hunting by both indigeneous people and campesinos is authorized (G. Seutin pers. comm.). Curassows are broadly distributed throughout the country; in some regions this species is still fairly common, but in other areas it is rare or numbers have been significantly reduced (Ridgely and Gwynne 1989, Delgado 1997). It is estimated that 38% of the preferred vegetation cover remains for *C. rubra*, and older low-elevation forests where curassows thrive suffer higher rates of deforestation (Delgado 1997). Subsistence and sport hunting, along with the pet trade, exert heavy pressure on curassow populations (Delgado 1997) where human density is high (i.e., Pacific-slope in the west, central provinces; G. Seutin pers. comm.).

Conservation Action

In several countries this species is protected in reserves, and laws that prohibit or control its use. Captive breeding programs are limited to four countries currently, and reintroduction and environmental education efforts are restricted only to the CRAVE program in Costa Rica. Examples of current hunting laws, numbers of protected areas, countries with captive breeding programs and other measures for curassow conservation are all provided in this section. It is imperative to strengthen hunting laws and expand protected areas and curassow conservation programs throughout the range of *Crax rubra*.

I. Hunting Laws
    a. Subsistence hunting is allowed in several countries:
        - Costa Rica (Law of conservation in wild life 1984, article 17, 18 and 48)
        - Colombia (Resolution 1317 and Decree 266 year 2000)
        - Guatemala (General hunting law, Decree 36-04, Congreso de la República de Guatemala, 2004)
        - Honduras (Resolution 208-86 on 7 July 1986 reconfirmed by Resolution 017-87 on 28 de July in 1987)
        - Panama (Law Nº 23, on 30 of January 1967, project of law No. 107 of 10 May 2005)
        - Mexico
    b. Prohibition of hunting is more severe or absolutely prohibited in other countries:
        - Ecuador (ministerial resolution No. 105, on 7 January of 2000)
        - Nicaragua (La Gaceta 1983, ministerial resolution No. 54-02 de December 6 of 2002), Mexico (for Cozumel Curassow)
        - El Salvador (ministerial law of agriculture and cattle farming)

c. Until 1999, there were no laws prohibiting or restricting its hunting in Belize.

II. Designation of Protected Areas (PAs) such as National Parks, Reserves, or Refuges.
   a. Costa Rica has eight PAs containing curassows as of 1997 (Arguedas et al. 1997)
   b. Belize has three PAs containing curassows (Gonzalez-García et al. 2001)
   c. Colombia has three PAs containing curassows
   d. Ecuador has two PAs containing curassows (Mena- Valenzuela and Jahn 2002)
   e. El Salvador has one PA containing curassows, and it is currently under expansion (Komar and Herrera 2003)
   f. Guatemala has 18 PAs containing curassows (K. Eisermann pers. comm.)
   g. Honduras has four PAs containing curassows (Midence 1997)
   h. Nicaragua has several PAs for this species, but they are not effectively controlled
   i. In Panama curassows are protected on Barro Colorado Island as well as larger sites such as Darien NP

III. *In-situ* Captive Breeding Programs currently exist in:
   a. Costa Rica (Arguedas et al. 1997)
   b. El Salvador (Guido 1985)
   c. Guatemala (J. Rivas com. pers.)
   d. México (Gonzalez-García et al. 2001)

IV. Reintroduction
   a. Since 2000 the Centro de Reproducción de Animales en Vías de Extinción (CRAVE) in Costa Rica has worked on a captive reproduction and reintroduction program for the Great Curassow.
      - As of 2004, 168 chicks have hatched, of which 96 have been released.
      - This institution is working on a protocol for breeding, releasing and monitoring the Great Curassow (R. Fournier pers. comm.).

V. Environmental Education
   a. The organization CRAVE is making environmental education information available.
      - CRAVE gives public lectures and prepares educational materials for schools and the community in general.
      - In 2003, they held "the Carnival of the Curassow" in conjunction with surrounding communities (R. Fournier pers. comm.).



Drawing by D. Ibarguren

Bare-faced Currasow (*Crax fasciolata*)

Rob P. Clay and David C. Oren

Work to Date

The Bare-faced Currasow (*Crax fasciolata*) is widely distributed throughout central South America, and three subspecies are normally recognized: *C. f. pinima* in northeastern Brazil, *C. f. grayi* in eastern Bolivia and the nominate subspecies in central and southwest Brazil, Paraguay and northern Argentina. A fourth subspecies, *C. f. xavieri* (Nardelli 1993) described from captive birds, is perhaps no more than a plumage aberration. The species may have occurred in coastal Alagoas, in the Atlantic Forest of northeastern Brazil, until at least the 1930s (Teixeira et al. 1987), though too little information is available to determine the subspecies, or even to be certain that reports refer to *C. fasciolata* (Teixeira 1997).

The species occurs primarily in tropical lowland evergreen forest, semi-deciduous forest and gallery forest. Despite reports of it occurring to 900 m or above in Bolivia, there are no well-documented records above 500 m (Hennessey et al. 2003). *Crax fasciolata* is largely terrestrial, and is often recorded at the forest edge or in small clearings. In many parts of its range it shows a clear preference for the vicinity of rivers (Lowen et al. 1996, Wallace et al. 2001, White 2001).

Most sightings are of individual birds or pairs, although there are occasional records of groups of males. In Dept. Santa Cruz, Bolivia, mean group size was 1.83 ± 0.71 birds (range 1-3; N=18; Wallace et al. 2001). Diet is believed to primarily comprise fallen fruits, as well as shoots and seeds, and in Brazil the species has been recorded foraging on the flowers of the tree *Tabebuia* (Collar et al. 1992). It is also known to consume salt-rich earth at salt licks (del Hoyo 1994). Only limited breeding data are available for the species. It apparently lays two eggs in a nest platform made of sticks and twigs and lined with leaves (de la Peña 1992), which at least in captivity may be placed on the ground.

Status and Threats

As a result of its wide distribution and relevant abundance in certain areas, *C. fasciolata* is currently considered Least Concern (BirdLife International 2005). However, the species is highly prized by hunters, and there is a clear pattern of local extirpation at the edges of its range, which therefore warrants treatment as Near Threatened. It is primarily threatened by a combination of subsistence

hunting and habitat loss, and these pressures are further exacerbated by low level of animal trade (Caziani et al. 1997).

The subspecies *C. f. pinima* was thought possibly extinct until populations were found near Rio Pindaré (Maranhão) in 1977 and at Ourém (E Pará) in 1978 (Sick 1993). A lack of records since then led to renewed suggestions that it might be extinct (C. Yamashita in litt. 2000 - Bol. CSG 11) and Novaes and Lima (1998) concluded that the subspecies was extinct around Belem (Pará). However, it did still occur in Maranhão in the late 1990s, in the Gurupi Biological Reserve and surrounding indigenous reserves (Urubu-Ka'apor, Awá, and Caru), where it was hunted for food and feathers for plumage art and arrow quills (DCO pers. obs., and photographs by W. Balée and L. Forline). The current status of the subspecies in these areas and that of other possible populations in eastern Pará is unknown. The Gurupi Biological Reserve, although invaded by loggers, is surrounded by indigenous reserves that represent the last large block of relatively intact forest east of the Tocantins, totaling approximately 800,000 ha. *C. f. pinima* is formally considered Endangered with extinction by the Brazilian Ministry of Environment (IBAMA 2003).

The taxonomic status of a population inhabiting extensive forest in S Pará (Carajás) remains unclear, and may be referable to *C. f. pinima* (Brooks and Strahl 2000). F. Novaes (unpubl. notes and pers. comm. to DCO) considered the Carajás, population phenotypically intermediate between *pinima* and *fasciolata*, based on specimens deposited at the Museu Paraense Emílio Goeldi in Belém, Brazil. He proposed that *pinima* be considered limited to the area between the Tocantins River in Pará and western Maranhão, and that the new form, which he did not describe before his death in March 2004, be considered a Xingu-Tocantins influvium endemic.

The nominate subspecies remains relatively common in parts of its Brazilian range, especially in the Pantanal of Mato Grosso and Mato Grosso do Sul (BirdLife International 2005). However, elsewhere it would appear to be extinct or close to extinction, such as in Paraná and São Paulo states (F. Olmos cited in BirdLife International 2005, Martuscelli and Olmos 1997). In both Paraguay and Argentina the species has undergone a marked decline and range retraction, and in the latter is considered highly threatened (Fraga 1997). The only healthy populations in Argentina appear to remain in Formosa Province, with a particular stronghold at the Guaycolec ranch (White 2001). In Paraguay the species would also appear to be in danger of disappearing altogether (Clay 2001). It remains relatively common only in northern Dept. Concepción, where a density of 4 birds/km^2 was estimated in gallery forest along the Río Apa (Clay 2001).

In Bolivia the race *C. f. grayi* appears to survive in good numbers where suitable habitat exists and hunting pressure is low (Cox and Cox 1997). However, even in a relatively remote area, Rumiz et al. (2001) found annual hunting pressure to be close to the limit of sustainability. The species occurs in at least seven large protected areas (Miserendino 1998, Hennessey et al. 2003), though in Ríos Blanco y Negro Wildlife Reserve and Noel Kempff Mercado National Park it was found to be the least frequently encountered cracid (Wallace et al. 2001).

Conservation Action

I. Paraguay
    a. Enforce environmental legislation prohibiting hunting and forest clearance, especially in Dept. Concepción.
    b. Initiate a multi-faceted educational program in Dept. Concepción, as well as nationwide.
    c. Survey gallery forest along the Paraguay River and major tributaries for possible new populations.

d. Consolidate the captive breeding program managed by the Entidad Binacional Yacyretá, and evaluate the potential for reintroductions.

II. Argentina
    a. Enforce environmental legislation prohibiting hunting and forest clearance, especially in Formosa Province.
    b. Survey gallery forest along the Paraguay River and major tributaries for possible new populations, and monitor known populations.

III. Bolivia
    a. Conduct systematic surveys to obtain distributional and population size data.

IV. Brazil
    a. Conduct surveys to locate and determine the status of extant populations of *C. f. pinima*.
        - Once populations are identified, recommend and facilitate multi-tiered reserve building programs for newly identified populations.
    b. Consolidate existing populations in the Gurupi Biological Reserve and western Maranhão.
    c. Conduct studies to determine the taxonomic status of *C. f. pinima* and the Carajás population of the species.



Little Chachalaca (*Ortalis motmot*) drawing by J. Merizio

Chapter 7 – Country Assessments

This chapter deals with assessments of countries harboring threatened cracids (with data summarized in the table below). Brazil and Colombia are tied for containing the highest numbers of threatened cracid taxa (nine species each), followed by Peru and Ecuador (tied with six species each). However, if we exclude Near-Threatened (NT) species from the analyses, Colombia ranks highest with seven species, followed by Brazil (six species) and Peru (five species). In terms of geo-political units harboring the highest number of country endemics, Brazil ranks highest with six species (including NT species) and four species (exclusive of NT species), followed by Colombia (two endemic species), and Trinidad and Peru (one endemic each).

The remainder of this chapter will summarize country recommendations, based on pooling Conservation Action sections in the preceding four chapters that focused on individual species accounts. The regions in this chapter are generally presented north to south, then west to east, for ease of reference. The accounts in this chapter are pooled regions based upon regionally shared taxa, and include: Northern Central America (Mexico, Guatemala, Belize, El Salvador, Honduras, Nicaragua), Southern Central America (Costa Rica, Panama), Northern South America (Colombia, Venezuela, Trinidad), Western South America (Ecuador, Peru, Bolivia), Brazil, and Central South America (Paraguay, Argentina). Geo-political units not harboring threatened cracids include Suriname, Guyana, French Guiana and Texas, and therefore these regions are not treated in this document. Each of the following regional accounts is divided into five sections: 1) Reserves, 2) Research, 3) Legal Protection, 4) Education and Outreach, and 5) Captive Breeding.

Threatened cracids with patterns of species richness and endemism by country

Species / Pattern	Mx	Gt	Be	ES	Ho	Ni	CR	Pa	Co	Ve	Tr	Ec	Pe	Bo	Br	Py	Ar	Endmc
EW																		
Alagoas Curassow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
CR																		
White-winged Guan	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X
Trinidad Piping-guan	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X
Horned Guan	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Blue-billed Curassow	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X
EN																		
Baudó Guan	-	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-	
Cauca Guan	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	X
Black-fronted Piping-guan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	
Helmeted Curassow	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	
Horned Curassow	-	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	
Red-billed Curassow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
Wattled Curassow	-	-	-	-	-	-	-	-	X	-	-	X	X	X	X	-	-	
VU																		
Rufous-headed Chachalaca	-	-	-	-	-	-	-	-	X	-	-	X	X	-	-	-	-	
Bearded Guan	-	-	-	-	-	-	-	-	-	-	-	X	X	-	-	-	-	
Chestnut-bellied Guan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
White-browed Guan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
Black Guan	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	
Highland Guan	X	X	-	X	X	X	-	-	-	-	-	-	-	-	-	-	-	
Yellow-knobbed Curassow	-	-	-	-	-	-	-	-	X	X	-	-	-	-	-	-	-	
NT																		
Buff-browed Chachalaca	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
White-crested Guan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	X
Wattled Guan	-	-	-	-	-	-	-	-	X	X	-	X	X	-	-	-	-	
Great Curassow	X	X	X	-	X	X	X	X	X	-	-	X	-	-	-	-	-	
Bare-faced Curassow	-	-	-	-	-	-	-	-	-	-	-	-	-	X	X	X	X	
Species Richness/Country	**3**	**3**	**1**	**1**	**2**	**2**	**2**	**2**	**9**	**3**	**1**	**6**	**6**	**3**	**9**	**2**	**2**	
Richness (excl. NT)	**2**	**2**	**-**	**1**	**1**	**1**	**1**	**1**	**7**	**2**	**1**	**4**	**5**	**2**	**6**	**1**	**1**	
Country Endemics	-	-	-	-	-	-	-	-	**2**	-	**1**	-	**1**	-	**6**	-	-	**10**
Endemics (excl. NT)	-	-	-	-	-	-	-	-	**2**	-	**1**	-	**1**	-	**4**	-	-	**8**

Country abbreviations and pooled regions as presented below:
Northern Central America (Mexico [Mx], Guatemala [Gt], Belize [Be], El Salvador [ES], Honduras [Ho], Nicaragua [Ni]), Southern Central America (Costa Rica [CR], Panama [Pa]), Northern South America (Colombia [Co], Venezuela [Ve], Trinidad [Tr]), Western South America (Ecuador [Ec], Peru [Pe], Bolivia [Bo]), Brazil [Br], and Central South America (Paraguay [Py], Argentina [Ar]).



Highland Guan (*Penelopina nigra*) photo by J. Cornejo

Northern Central America: Mexico, Guatemala, Belize, El Salvador, Honduras and Nicaragua

Fernando González-García, Javier A. Rivas Romero, Ana José Cóbar Carranza, Knut Eisermann, Néstor Herrera, Oliver Komar, Margarita M. Rios, Marcia C. Muñoz and Daniel M. Brooks

The threatened species of cracids listed below are found in northern Central America. Two species are endemic to the highlands of northern Central America: Horned Guan (*Oreophasis derbianus*) is restricted to Mexico and Guatemala, and Highland Guan (*Penelopina nigra*) is absent only from Belize. The Great Curassow (*Crax rubra*) is more widespread in the lowlands, but is absent from El Salvador.

Oreophasis derbianus	Horned Guan	CR - E
Penelopina nigra	Highland Guan	VU - A2c,d; A3c,d
Crax rubra	Great Curassow	NT - A2c,d; A3c,d

Reserves

Both public and private protected areas need to be established and expanded, especially for the highland species (*Oreophasis* and *Penelopina*). In the Sierra Madre de Chiapas, protection needs to be established in the Frailescana region, west of El Triunfo (Heath and Long 1991). Additionally, the Cordón Pico El Loro-Paxtal needs to be expanded and a binational reserve should also be created in the Tacana area; these two new areas could be managed as ecologically sustainable communal reserves. It is also essential to expand the system of protected areas in El Salvador, with special attention to Cerro El Pital (Komar and Herrera 2003).

Management and control in national protected areas need to be enforced to lower deforestation rates and illegal hunting. This should be accomplished by reinforcing entities and organizations responsible for managing and protecting cloud forest reserves. It is also essential to prohibit fragmentation at El Triunfo Biosphere Reserve and other important sites.

Research

It is important to continue studying distribution, population size and demography of all three species by monitoring presence at known sites and estimating population densities with methods suggested by Strahl and Silva (1997a) or Jiménez et al. (2003, in prep.). It is also of vital importance to correlate demographic population changes with human and natural factors that can affect population size, as well as evaluating the impact of hunting.

Detailed ecological research is needed. It is important to study the role of *Oreophasis* and *Penelopina* as seed dispersers, further investigate their diet, and evaluating possible altitudinal migration (Powell and Bjork 1994, Paiz 1996, Winker et al. 1997, Gómez de Silva et al. 1999, Eisermann 2005) using radio telemetry. Additionally, basic ecological studies are needed to determine habitat use, home range size and reproductive rate of *Penelopina*.

Genetic studies could provide valuable data on genetic structure of subpopulations (e.g., metapopulation dynamics, isolation, gene flow, and intra- and interpopulation viability), valuable for conservation planning. With respect to *Penelopina*, taxonomic status of described subspecies (van Rossem 1934, del Hoyo et al. 1994) needs to be re-evaluated; if the southern (Honduras and Nicaragua) subspecies is indeed a valid form, it may be considerably more threatened than the northern form.

In terms of habitat research, it is important to monitor the extent of montane forests available to *Oreophasis* and *Penelopina*, and also to monitor the impact of forest fires (especially in Oaxaca, Mexico). Habitat must be restored through reforestation, especially in the Chimalapas region of Oaxaca, Mexico.

Legal Protection

It is important to strengthen hunting laws. With respect to *Crax rubra* for example, subsistence hunting is allowed in Mexico, Guatemala and Honduras, but is prohibited in Nicaragua and El Salvador. In Belize however, no laws prohibited or restricted hunting *C. rubra* until 1999.

Education and Outreach

Through educational programs, public awareness of cracid vulnerability must be created in local communities and government agencies, to aid in teaching why cracids are important. Development and distribution of educational programs to reduce hunting pressure is imperative in this regard.

It is essential to involve local communities in the conservation process. Conservation of indigenous traditions, such as sustainable use of communal reserves (Secaira 2000), should be encouraged, especially in Mexico and Guatemala. Additionally, low impact activities should be fomented in communities near viable habitat. For example, it is important to promote permanent crops adjacent to primary forest instead of annually burned cornfields.

Captive Breeding

With respect to *Oreophasis*, it is imperative to achieve a higher breeding success in captivity, with equal representation of wild caught individuals not currently represented in the gene pool (J. Cornejo in litt.). To achieve this, it is imperative to establish an active international captive

breeding network that cooperates by sharing information and exchanging animals. It is also necessary to standardize husbandry guidelines and training, and establish all captive birds (including those in the private sector) under one management umbrella. Additionally, genetic and demographic management are a high-priority.

Once the captive *Oreophasis* population is viably reproducing, the long-term goal of reintroducing captive-bred descendants can be established. Reintroductions should take place in viably preserved habitats, and effective environmental education programs must accompany reintroduction efforts before the birds are reintroduced.



Black Guan (*Chamaepetes unicolor*) photo by B. Cole

Southern Central America:
Costa Rica and Panama

Fernando González-G., Gilles Seutin, Margarita M. Rios, Marcia C. Muñoz and Daniel M. Brooks

The threatened species of cracids listed below are found in southern Central America (Costa Rica and Panama). The Black Guan (*Chamaepetes unicolor*) is restricted to the highlands and the Great Curassow (*Crax rubra*) is more widespread in the lowlands.

Chamaepetes unicolor	Black Guan	VU - B1b(i,iii)
Crax rubra	Great Curassow	NT - A2c,d; A3c,d

Reserves

It is imperative to ensure adequate protection within existing protected areas, to expand protected areas in some regions, and to manage surrounding forested areas to ensure habitat connectivity between protected areas. For example, considering the exceptional quality of the highland forests on the Caribbean slope of the Panamanian Cordillera Central, there is an immediate need to establish effective measures to maintain long-term integrity of these forests outside existing protected areas.

Research

Standardized density estimates sampled repeatedly over different months are needed in areas showing varying levels of habitat integrity and hunting pressure; minimal area and population size required to maintain an isolated population over the long-term should be estimated. It is also important to assess population response to various types of habitat degradation (e.g., fragmentation, creation of large gaps, selective removal of tall trees), as well as frequency of, and population response to, hunting.

It is important to compile detailed information about habitat availability throughout the range of *Chamaepetes unicolor*, to aid in assessing the conservation status and needs of many other

threatened species in the Costa Rica and Panama Highlands Endemic Bird Area (BirdLife International 2003). Analysis of remote sensing data should be followed by on-the-ground assessment of habitat integrity variables that are poorly reflected in remote sensing data (e.g., selective logging), while building realistic scenarios of future habitat trends using social and economic development indicators. A priority is the largely intact highland forest on the Caribbean slope of the Panamanian Cordillera Central.

Legal Protection

It is important to strengthen hunting laws. With respect to for *Crax rubra* for example, subsistence hunting is allowed in Costa Rica and Panama. The Autoridad Nacional del Ambiente (ANAM) in Panama should immediately consider prohibiting all forms of hunting during the breeding season for *Chamaepetes unicolor*.

Education and Outreach

It is imperative to expand conservation programs. Awareness through promotional campaigns must be established in core population areas to reduce hunting pressure.



Female Blue-billed Curassow (*Crax alberti*) photo by Proaves-Colombia

Northern South America:
Colombia, Venezuela and Trinidad

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The threatened species of cracids listed below are found in northern South America. The sole cracid occurring on Trinidad is the endemic local Piping-guan (*Aburria pipile*). Blue-billed Curassow (*Crax alberti*) and Cauca Guan (*Penelope perspicax*) are also endemic species, restricted to different portions of the Colombian Andes. Both Helmeted Curassow (*Pauxi pauxi*) and Yellow-knobbed Curassow (*Crax daubentoni*) are restricted to Colombia and Venezuela, in montane forest and Llanos habitat, respectively, whereas the Baudó Guan (*Penelope ortoni*) is restricted to the Andes of Colombia and Ecuador. Species found in three or more countries include the higher dwelling Rufous-headed Chachalaca (*Ortalis erythroptera*) and Wattled Guan (*Aburria aburri*), as well as the lowland dwelling Great Curassow (*Crax rubra*) and Wattled Curassow (*C. globulosa*), with the latter species restricted to Varzea habitat.

Aburria pipile	Trinidad Piping-guan	CR - C2a(ii)
Crax alberti	Blue-billed Curassow	CR - A3b,c,d
Penelope ortoni	Baudó Guan	EN - A2c,d; A3c,d
Penelope perspicax	Cauca Guan	EN - B2a+b(i,ii,iii,v); C2a(i)
Pauxi pauxi	Helmeted Curassow	EN - C2a(i)
Crax globulosa	Wattled Curassow	EN - A2b,c,d; A3b,c,d; C2a(i)
Ortalis erythroptera	Rufous-headed Chachalaca	VU - A2c,d; A3c,d; B1a+b(i,ii,iii,v); C2a(i)
Crax daubentoni	Yellow-knobbed Curassow	VU - A3a,c,d
Aburria aburri	Wattled Guan	NT - C1; C2b
Crax rubra	Great Curassow	NT - A2c,d; A3c,d

Reserves

Functioning protected areas are mandatory where lacking. For example, the proposed Matural National Park in northeastern Trinidad would provide legal habitat protection in a large portion of the range of *Aburria pipile*, but passing such legislation will require political lobbying; although legislation has been proposed for developing a system of national parks in Trinidad, such legislation has yet to be passed.

Similarly, new reserves need to be established for threatened cracids of the Colombian Andes. For example, approximately 1200 ha of forest in the Departments of Boyaca (Puerto Boyaca) and Santander (Cimitarra) need to be purchased to add to El Paujíl Natural Reserve property for *Crax alberti*. Additionally, it is important to create a network of protected areas in the Choco biogeographic region of Colombia for *Penelope ortoni*, per the Chocó-Manabí conservation corridor (Critical Ecosystem Partnership Fund 2001). It is also imperative to increase the number of established protected areas where *Penelope perspicax* occurs without any legal protection.

It is important to adequately maintain existing reserves, especially in the Colombian Andes. At El Paujíl Natural Reserve, an important stronghold for *Crax alberti*, guide training in the Alicante River canyon must be intensified, and it is essential to develop and maintain a nursery for reforestation of deforested patches. Additionally, conservation workshops need to be created on nursery development and management, as well as management of silvo-pastoral systems in tropical zones. Similarly, the Farallones de Cali National Natural Park and Ensenada de Utria National Natural Park need to be well managed, as these two reserves are among the last strongholds for *Penelope ortoni*. Habitat management is also needed for sites where *P. perspicax* occurs, identifying needs and opportunities to establish or increase connectivity among populations and restoring degraded habitats where guans still occur.

Establishment of new reserves and maintenance of existing reserves is also important for species that are wider-ranging yet patchy in their geographic distribution, such as *Aburria aburri* and *Crax rubra*. Additionally, conservation should be encouraged in rural landscapes for species such as *Penelope perspicax*; restoring degraded habitats where guans still occur and promoting low-impact use are important aspects of managing rural landscapes for increased connectivity. It also is important to develop education plans with landowners and local communities in areas where the guans occur during this process, and also using the presence of the guan as criteria to provide incentives for conservation on private lands.

Research

Status and population assessments are needed for various species. In Trinidad the status of *Aburria pipile* needs to be determined in remote areas of its range. In Colombia the northern region of Farallones de Cali National Natural Park, the Ensenada de Utria National Natural Park, and the Pangan Private Reserve need population assessments for *Penelope ortoni*. Similarly, it is important to assess density, (minimal) population size, and distribution for species such as *Penelope perspicax, Pauxi pauxi* (especially in Sierra de Perijá, Colombia and Zulia state, Venezuela), *Crax daubentoni* (especially in Colombia) and *A. aburri* (especially in protected areas). Evaluating presence and conservation status in areas where indigenous communities indicate species occur is also important, expecially for *Crax globulosa*.

More intensive population biology research is needed for many species of cracids. Mark-release and radio-tracking studies are needed for species such as *Aburria pipile* to better understand

reproductive biology, life history parameters, actual population size and metapopulation dynamics. Genetic population structure and gene flow should be investigated for species such as *Penelope perspicax*. A long-term demographic study of a protected population of *Crax daubentoni* at Hato Piñero, Venezuela is needed so that fecundity, mortality and dispersal data can be collected for population viability analysis; this will be imperative to plan a network of private and government protected or controlled-hunting areas (Ríos 1997). Habitat use and requirements, population dynamics, seasonal movements and the impact of fragmentation on populations need to be assessed for *A. aburri*.

Basic autecological research is needed for species such as *Pauxi pauxi*. Additionally, ethno-zoological studies are needed to assess the effect of hunting pressure for species such as *Penelope perspicax, Pauxi pauxi* and *Crax globulosa*, as well as amount of extraction and use at scales of local community versus rural markets.

Studies of habitat and reserve feasibility are also needed. It is also important to conduct satellite photo analysis of forest cover changes to identify suitably large and connected habitat patches that may be protected for species such as *Crax daubentoni*. The influence of exotic or introduced species as predators or possible resource competitors for species such as *Penelope perspicax* needs to be assessed as well. The relationship between *Pauxi pauxi* and Venezuela's protected areas system needs to be assessed to evaluate the effectiveness of habitat protection, and recommend actions for habitat management. Similarly, the effectiveness of protected areas needs to be evaluated for species such as *Aburria aburri*.

Legal Protection

Hunting bans need to be reinforced throughout the year, or during the breeding season. For example, *Aburria pipile* has been officially protected since 1958 by the Conservation of Wildlife Act of Trinidad, which has been poorly enforced. Because hunting has been the primary cause of this species decline, more effective enforcement of hunting laws are needed, which requires political lobbying, capacity building and training.

It is also important to increase participation by landowners, environmental and road police and military, and wildlife inter-institutional committees to enforce controlling and vigilance of illegal wildlife trafficking. It is imperative to develop informative and sensitization campaigns for hunters, using current cracid status and hunting laws. For example, local authorities proposed and approved a hunting prohibition for *Crax alberti* within local zones of its protected range, whereas subsistence hunting is permitted for *Crax rubra* in Colombia.

Education and Outreach

It is important to support and initiate sustainable development programs (e.g., ecotourism) for communities, as well as initiating hunter education programs (Silva 1997) to reduce use of cracids for protein. Continued public education campaigns are needed to improve public attitudes toward the environment in general and cracids in particular, especially in Trinidad, where there is apparently still some poaching of the Critically Endangered *Aburria pipile*.

Local interest in conserving cracids can be developed by designing and distributing materials (e.g., posters, vests, caps, etc.) to community inhabitants (e.g., land owners and rural schools) by creating ecological groups or environmental clubs, creating wall murals with school children that feature cracid conservation themes, and establishing 'guard badges' for people inhabiting rural communities. Additionally, developing and promoting environmental education events are

essential, such as a National Curassow (or Cracid) Day, local World Birding Festivals, bird banding courses, and environmental education workshops with round-table discussions.

Captive Breeding

A captive breeding program for *Aburria pipile* should be planned and implemented as soon as possible. A captive bird is kept at the Emperor Valley Zoo, which is probably too small, crowded, and noisy to be an effective site for captive breeding. The Point-a-Pierre Wildfowl Trust may be the best facility for a captive breeding project.

Similarly, it is important to design and implement a serious *in-situ* captive breeding program for *Pauxi pauxi* as a 'backup alternative' for population preservation.



White-winged Guan (*Penelope albipennis*) photo by H. Plenge.

Western South America:
Ecuador, Peru and Bolivia

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The threatened species of cracids listed below are found in western South America. The White-winged Guan (*Penelope albipennis*) of northwest Peru is the only endemic species. Baudó Guan (*Penelope ortoni*), Horned Curassow (*Pauxi unicornis*) and Bearded Guan (*Penelope barbata*) are restricted to only two countries each (Colombia and Ecuador, Peru and Bolivia, Ecuador and Peru, respectively), where they inhabit highlands, as does the Rufous-headed Chachalaca (*Ortalis erythroptera*) which is restricted to three countries (Colombia, Ecuador and Peru). Species found in four or more countries include the higher dwelling Wattled Guan (*Aburria aburri*), as well as three species of *Crax* Curassows: Great Curassow (*C. rubra*), Bare-faced Curassow (*C. fasciolata*) and Wattled Curassow (*C. globulosa*), with the latter species restricted to Varzea.

Penelope albipennis	White-winged Guan	CR - C2a(i)
Penelope ortoni	Baudó Guan	EN - A2c,d; A3c,d
Pauxi unicornis	Horned Curassow	EN - A1a & d, A2d; B1+B2b,c,e
Crax globulosa	Wattled Curassow	EN - A2b,c,d; A3b,c,d; C2a(i)
Ortalis erythroptera	Rufous-headed Chachalaca	VU - A2c,d; A3c,d; B1a+b(i,ii,iii,v); C2a(i)
Penelope barbata	Bearded Guan	VU - B1a+b(i,ii,iii,v)
Aburria aburri	Wattled Guan	NT - C1; C2b
Crax rubra	Great Curassow	NT - A2c,d; A3c,d
Crax fasciolata	Bare-faced Curassow	NT - A2c,d; A3c,d

Reserves

It is imperative to implement and expand the number of protected areas for cracids. This is especially important for *Penelope albipennis* (implementing the Lambayeque Biological Corridor proposal, Peru), *P. barbata* (especially in the southern Ecuadorian Andes and montane areas of Dept. Lambayeque, Piura and Cajamarca, Peru, including the "Cerro Chinguela" area; and implementing the reserve at "Bosque de Cuyas", Ayabaca, Peru), *Crax globulosa* (concordant with Bolivian law), *Aburria aburri* and *Crax rubra*. Proposals need to be implemented to help communities establish private reserves in Ecuador and Peru.

Insuring protection and integral maintenance in existing reserves and their buffer zones is essential. For example, a population of *Penelope ortoni* occurs in the lower parts of the Cotacachi-Cayapas Ecological Reserve, Ecuador, but hunters are quickly immigrating due to the recent construction of a road in the northern part of this protected area, and through fluvial systems in the west (Jahn and Mena 2002). Other sites in Ecuador needing insured protection and maintenance include Mindo-Nambillo Protected Forest, the community of Playa de Oro, and the Jocotoco-Canandé Private Reserve for *P. ortoni*, as well as Angashcola, Huashapamba, and Podocarpus National Park (along with increased capacity and infrastructure for staff at the latter site) for *P. barbata*.

Developing and implementing a conservation management plan for *Pauxi unicornis* habitat is essential, though work with INRENA (Peru) and Carrasco and Amboro National Parks (Bolivia) and local communities. Similarly, effective protection should be enhanced throughout the ranges of species such as *Ortalis erythroptera* (especially in the Northwestern Peru Biosphere: Tumbes Reserved Zone, Amotapes National Park and El Angolo Hunting Reserve) and *Aburria aburri*. Increased capacity and infrastructure is needed for teams at Laquipampa, Peru, where *Penelope albipennis* and *P. barbata* occur.

Research

It is important to evaluate status with population assessments (e.g., density, minimal population size, distribution) for various species to identify conservation priorities. In Ecuador status needs to be assessed for *Penelope ortoni* (in the Awá Ethnic Reserve and the Awacachi Corridor), *Ortalis erythroptera* (Cordillera Chongon-Colonche and other parts of its range; DarwinNet 2005) and *Crax globulosa*. In Peru status needs to be assessed for *O. erythroptera* and *P. barbata*; it is also important to continue conducting local knowledge surveys to assess distribution of *Pauxi unicornis koepckeae* (with communities around Cerros del Sira) and *Crax globulosa*. In Bolivia monitoring needs to be continued for *Crax globulosa,* and status needs to be assessed for *P. unicornis* (especially to monitor populations in Carrasco and Amboro National Parks) and *C. fasciolata*. The presence of *Aburria aburri* in protected areas needs to be evaluated throughout its range.

The effects of "El Niño" on *Penelope albipennis* populations need thorough investigation. Basic ecology, including habitat use and requirements, population dynamics, seasonal movements and the impact of fragmentation on populations need to be assessed for *Aburria aburri*. Basic biological and ecological studies are also needed for *Crax globulosa* in Peru, and *Ortalis erythroptera* throughout its range.

Markets that sell game meat need to be monitored to record the time of year and rate that *Crax globulosa* is hunted in Peru. Field studies on the effectiveness of protected areas, determination of conservation requirements and vulnerability to human encroachment are needed for *Pauxi*

unicornis and *Aburria aburri*. Habitat evaluation is needed in the Peruvian Andes for species such as *Ortalis erythroptera* to identify conservation areas that can serve as effective habitat corridors.

Finally, it is important to obtain sound recordings and behavioral observations to be used in combination with morphological and genetic assessment to determine if *Pauxi unicornis koepckeae* is a full species.

Legal Protection

Hunting must be adequately controlled. Hunting of *Penelope ortoni*, *Aburria aburri* and *Crax rubra* is prohibited by law in Ecuador for example, but these laws must be adequately enforced. In Bolivia it is important to work with local communities to promote a community based hunting ban for *Pauxi unicornis*.

It is also important to work with local Bolivian communities to reduce human pressure on *Pauxi unicornis* habitat, and to jointly develop a *Crax globulosa* management plan for timber and non-timber forest resources with surrounding indigenous communities.

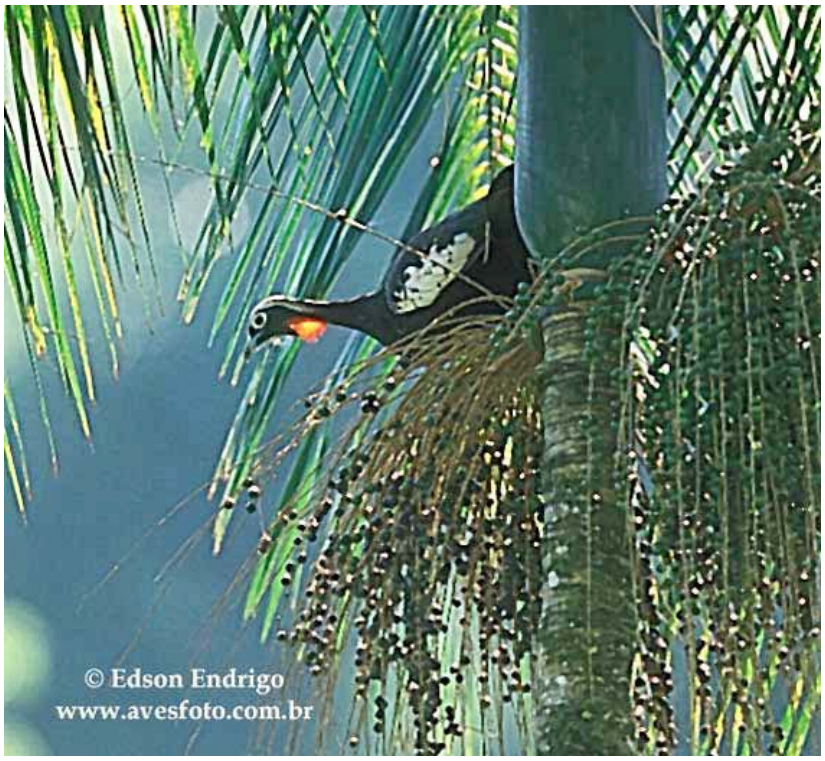
Education and Outreach

Multi-faceted educational programs need to be initiated, working towards implementation of habitat corridors. It is essential to produce participative conservation strategies and conduct educational campaigns highlighting the uniqueness of cracids to the regions they live in, as well as the importance of cracids to critical habitats (e.g., montane forest).

Creating public awareness and environmental education programs focusing on hunters is necessary. Coordinating sustainable use strategies (e.g., ecotourism, apiculture) to enhance community and conservation benefits is important in this regard.

Captive Breeding

The successful captive breeding for *Penelope albipennis* must be continued, establishing at least two viable populations. A studbook must be established to coordinate among holders of captive guans, to insure that a long-term viable population is maintained in captivity, as well as to coordinate research on genetic status of both captive and wild populations. Reintroduction and supplementation programs should be continued to unite small isolated populations throughout the species range.



Black-fronted Piping Guan (*Aburria jacutinga*) photo by E. Endrigo

Brazil

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The threatened species of cracids listed below are found in Brazil. This country contains many endemic species, including the Alagoas Curassow (*Mitu mitu*) which is now extinct in the wild yet surviving in captivity, as well as the Red-billed Curassow (*Crax blumenbachii*), Chestnut-bellied Guan (*Penelope ochrogaster*), White-browed Guan (*P. jacucaca*), Buff-browed Chachalaca (*Ortalis superciliaris*) and White-crested Guan (*P. pileata*). Other species include the Black-fronted Piping-guan (*Aburria jacutinga*), restricted to fragments of the South Atlantic forest, and the more wide-ranging Bare-faced Curassow (*Crax fasciolata*) and Wattled Curassow (*C. globulosa*), with the latter species restricted to Varzea habitat.

Mitu mitu	Alagoas Curassow	EW
Aburria jacutinga	Black-fronted Piping-guan	EN - A2c,d; A3c,d
Crax blumenbachii	Red-billed Curassow	EN - B1a+b(i,ii,iii,v); C2a(i); D1
Crax globulosa	Wattled Curassow	EN - A2b,c,d; A3b,c,d; C2a(i)
Penelope ochrogaster	Chestnut-bellied Guan	VU - B1a+b(i,ii,iii,iv,v); C2a(i)
Penelope jacucaca	White-browed Guan	VU - A2b,c,d; A3b,c,d
Ortalis superciliaris	Buff-browed Chachalaca	NT - C2a(i)
Penelope pileata	White-crested Guan	NT - C2a(i)
Crax fasciolata	Bare-faced Curassow	NT - A2c,d; A3c,d

Reserves

The possibility to expand the National Park limits in Bahia for *Crax blumenbachii* needs to be evaluated, as well as stimulating establishment of private reserves, including for forest remnants within the distribution of *C. blumenbachii*. It is essential to incorporate the need to preserve wild *C. blumenbachii* populations by establishing indigenous reserves and/or agricultural settlements, especially within areas of potential *C. blumenbachii* occurrence (e.g., National Parks in southern Bahia State, where economic-ecological zoning is needed), aiming to reduce hunting activities and deforestation, while promoting connectivity among forest fragments in the region.

Expansion of protected areas needs to take place in other areas as well. Protection of deciduous forest remnants in the Urucuia, Paracatu and Preto River valleys (São Francisco basin), as well as habitat in the Paranã River valley is urgent for *Penelope ochrogaster* considering land use changes and current pressure. A conservation unit is also needed in the Arinos region of northwest Minas Gerais for *P. ochrogaster*, and an immediate international campaign is needed to reestablish Araguaia National Park, showing its importance to *P. ochrogaster* and other endangered Brazilian species. Brazil contains the highest population concentrations of *Crax globulosa* in South America due to the greater concentration of varzea, especially in regions such as Mamiraua; it is imperative that appropriate reserves are afforded for this species. Additionally, if *Crax fasciolata pinima* populations are found during intensive surveys, multi-tiered reserve building programs for newly identified populations need to be recommended and facilitated.

It is essential to have effective protection in all reserves within *Crax blumenbachii* distribution (especially Una Biological Reserve, Pau Brasil and Descobrimento National Parks), establishing reserve infrastructure, guard corps, land ownership regularization and removal of former human occupants. It is also important to consolidate existing conservation units and indigenous reserves within the ranges of *Penelope pileata* (especially in the east, where it is most threatened), *Crax fasciolata* (in the Gurupi Biological Reserve and western Maranhão) and *Ortalis superciliaris*.

Habitat restoration is also an important component to reserve conservation. Regarding habitat restoration and protection for *Mitu mitu*, it is important to guide and intensify IPMA's action on forest fragment recovery (i.d., seedling plantation and corridor establishment). The possibility of vegetation restoration in larger forest fragments (Usina Serra Grande and Usina Leão) as potential reintroduction sites needs to be evaluated. Finally, oriented vegetation restoration management techniques need to be evaluated by establishing corridors among forest fragments within the area of *M. mitu* distribution. Habitat recovery is also needed for *Penelope ochrogaster* in the Pantanal, where deciduous forest must be protected on ranches since upland areas are increasingly deforested for pastureland. Additionally, use of fire should be controlled, avoiding upland habitats (especially along the Transpantaneira).

Research

Broad surveys are needed to locate historical and currently unknown cracid populations. Surveys of historical *Crax blumenbachii* sites are needed to investigate occurrence considering patterns of vegetation distribution and integrity, while searching for new wild populations to determine population size and habitat use. Surveys are also needed to locate, census, assess habitat and determine ranges at both historical and new sites for *Aburria jacutinga* (Atlantic forests of Rio Grande do Sul, Santa Catarina and Parana states), *Penelope ochrogaster* (São Francisco basin and in poorer known areas of the Pantanal along the right bank of the Paraguay River and the Bolivian border), *P. pileata* (southern limits), *Ortalis superciliaris* (eastern limits in Piauí and adjoining Ceará where it is most threatened) and *C. fasciolata pinima*.

Censuses of *Penelope ochrogaster* are needed at Araguaia National Park and other protected areas (including recently created conservation units in the São Francisco basin) to assess current population size. A population dynamics study of *P. ochrogaster* is urgently needed at SESC RPPN in the Pantanal, as populations showed potential for recovery after creation of the reserve; translocation experiments to recolonize *P. ochrogaster* populations in suitable habitat elsewhere might be possible once proper protection measures are met. Populations of *Aburria jacutinga* need to be monitored in known strongholds, including Intervales and Carlos Botelho State Parks; Population Viability Analyses need to be conducted for those localities where censuses have been conducted, and population size is available.

Field research is needed to understand more about general natural history, conservation status and threats for species such as *Penelope jacucaca, P. pileata* and *Ortalis superciliaris*. Projects are needed investigating ecology of *Crax blumenbachii* in the Linhares/Sooretama Biological Reserves complex, Una Biological Reserve and Descobrimento National Park. Studies are needed to validate if *Aburria jacutinga* depend on *Euterpe edulis* palms to survive. Reproductive data and a dietary inventory are needed for *P. ochrogaster*.

Taxonomic studies are needed for *Ortalis superciliaris* in its western limits where it may come in contact with *O. motmot ruficeps*. Additionally, taxonomic studies are also needed to determine the status of the Carajás population of *Crax fasciolata*, as well as *C. fasciolata pinima.*

Maps of *Aburria jacutinga* distribution and occurrence need to be developed, highlighting altitudinal gradients of occurrence and areas needing translocated or reintroduced populations.

Legal Protection

It is important to review and modify law enforcement (e.g., hunting, capture, illegal trade and deforestation) to stronger penalties as they relate to *Crax blumenbachii*. Additionally, more effective anti-poaching measures for *Aburria jacutinga* need to be developed at key strongholds by involving indigenous people in the conservation.

Education and Outreach

In relation to public awareness for *Mitu mitu*, it is important to expand the environmental education program, establishing a Visitor's Center at one of the educational sites, as well as producing educational material (papers, folders, lectures, campaigns) and workshops. Additionally, promoting environmental education as it relates to shifting hunting patterns of local people is essential.

Hunting is a scattered yet serious threat because cracids are prized game. Environmental education programs are needed for human communities focusing on change of illegal hunting activities, especially within conservation units (e.g., surrounding the National Parks in Bahia for *Crax blumenbachii*). Local people must be taught that certain cracids are rare species endemic to Brazil, and their presence is potentially profitable for the local economy since birdwatchers want to see rare cracids.

Captive Breeding

Regarding the captive breeding program for *Mitu mitu*, curassows need to be transferred to new breeding centers to increase biological security and increase reproductive chances. It is also

mandatory to insure rigorous segregation of hybrid birds to maintain pure stock, and the use of artificial insemination should be investigated. Finally, creation of both a studbook and captive management protocol is needed to develop standardized methods among separate institutions.

Regarding the captive breeding program for *Crax blumenbachii*, genetic analysis of founder individuals is needed to determine lineages that could orient future pairings, as well as improving genetic diversity of captive populations. Additionally, a new studbook is needed, and private breeders and zoos holding the species need to be integrated by facilitating specimen exchanges following studbook recommendations, and establishing a captive management protocol based on CRAX-Brazil's experience.

A reintroduction protocol needs to be developed for *Crax blumenbachii*, including blood sample collection, and long-term monitoring of released curassows. New reintroduction sites for *C. blumenbachii* need to be evaluated and selected based upon sound viability studies, with several areas in four states recommended: Rio de Janeiro (União and Poço das Antas Biological Reserves, Guapiaçu Biological Station and Desengano State Park); Minas Gerais (Rio Doce State Park and surroundings of Doce river); Espírito Santo (Córrego Grande Biological Reserve) and Bahia (surroundings of Una Biological Reserve, Vera Cruz Station and other private reserves). Protection for all potential reintroduction sites needs to be promoted, while privately owned sites should be upgraded to Private Reserves of Natural Heritage. Ecological, demographic and monitoring studies are needed for reintroduced *C. blumenbachii* populations in Minas Gerais.



Argentine Cracidologist holding Bare-faced Curassow (*Crax fasciolata*) hen photo by E. White

Central South America:
Paraguay and Argentina

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David C. Oren and Daniel M. Brooks

The threatened species of cracids listed below are found in central South America. The Black-fronted Piping-guan (*Aburria jacutinga*) is restricted to fragments of the South Atlantic forest, and the Bare-faced Curassow (*Crax fasciolata*) is more wide-ranging geographically.

Aburria jacutinga	Black-fronted Piping-guan	EN - A2c,d; A3c,d
Crax fasciolata	Bare-faced Curassow	NT - A2c,d; A3c,d

Reserves

Maps of *Aburria jacutinga* distribution and occurrence need to be developed, highlighting altitudinal gradients of occurrence, as well as areas needing translocated or reintroduced populations.

Research

Surveys are needed to locate and census *Aburria jacutinga* populations in Atlantic forest areas of Paraguay (Amambay and San Pedro Depts) and Argentina using standardized methods (i.e., transect lines analyzed using DISTANCE software) to insure comparability among sites. Similarly, surveys of gallery forest are needed along the Paraguay River and major tributaries to identify possible new populations of *Crax fasciolata*.

Populations of *Aburria jacutinga* need to be monitored in known strongholds, including Yaboti Biosphere Reserve, Argentina and Mbaracayú Forest Nature Reserve, Paraguay. Population Viability Analyses need to be conducted for those localities where censuses have been conducted, and population size is available.

Studies are needed to validate if *Aburria jacutinga* depend on *Euterpe edulis* palms to survive.

Legal Protection

More effective anti-poaching measures need to be developed at key strongholds by involving indigenous people in the conservation of *Aburria jacutinga*.

In regards to *Crax fasciolata* environmental legislation prohibiting hunting and forest clearance must be enforced, especially in Dept. Concepción, Paraguay and Formosa Province, Argentina.

Education and Outreach

A multi-faceted educational program is needed (especially Dept. Concepción, Paraguay).

Captive Breeding

The *Crax fasciolata* captive breeding program managed by the Entidad Binacional Yacyretá needs consolidation, and the potential for reintroduction needs to be evaluated.



Dusky-legged Guan (*Penelope obscura*) drawing by J. Merizio

Chapter 8 – Ecoregional Analysis

Daniel M. Brooks

In this final chapter, patterns of peak cracid diversity in various geographic regions are assessed using hotspot analysis, a way to identify and prioritize regional conservation by comparing equal blocks representing species richness in regional map quadrats (Mittermeier et al. 1998). Hotspot analysis is used here to identify cracid species richness at two scales: all cracids and threatened cracids only.

Peak diversity at the scale of all cracids is in southwest Colombia and western Ecuador, where more than 12 species occur. This is followed closely by regions containing 10-12 species, including: the Santa Marta mountains and central Colombia, north-central Venezuela, southern Peru including the Madre de Dios region, and northern Brazil (Brooks 2002b).

When we look at all threatened cracids, species richness is also in the region of southwestern Colombia (including the Chocó and Cauca Valley) and western Ecuador (including the Tumbesian region), where six threatened species occur. Three or four threatened species are found in other regions spanning the northwestern Andes from northwest Venezuela, through the Santa Marta Mountains and central Colombian Andes, to northwest and Tumbesian Peru (see table below).

Threatened cracids of the northwestern Andes

Species	SW Colombia / W Ecuador	Santa Marta and central Colombia	NW Venezuela	NW Peru
Rufous-headed Chachalaca	X	-	-	X
Cauca Guan	X	-	-	-
White-winged Guan	-	-	-	X
Baudo Guan	X	-	-	-
Bearded Guan	X	-	-	X
Wattled Guan	X	X	X	X
Helmeted Curassow	-	X	X	-
Great Curassow	X	-	-	-
Blue-billed Curassow	-	X	-	-
Yellow-knobbed Curassow	-	-	X	-
TOTALS	6	3	3	4

In sum, southwestern Colombia and western Ecuador harbor the highest diversity of cracids at both levels of analyses, with particularly important regions including the Chocó, Cauca Valley and the Tumbesian region. However, the entire northwestern Andes are of value at both levels as well.

The findings herein are similar to those of Brooks and Strahl (2000), who identify the Colombian Pacific and Andean slopes, Santa Marta Mountains, and the northern Andean foothills and cloud forest spanning Venezuela to Bolivia, as among the most critical ecoregions harboring threatened cracids, being especially high in species richness. Habitat destruction continues to accelerate in this region due to unsustainable agriculture and timbering; therefore this region is especially susceptible to erosion (Brooks and Strahl 2000).

Other important ecoregions noted by Brooks and Strahl (2000) include eastern Brazil and the Central American highlands. Eastern Brazilian cracids include *Mitu mitu*, *Crax blumenbachii*, *Penelope jacucaca* and *Aburria jacutinga*, which are threatened by habitat destruction and human intervention. The highland cloud forests in northern Central America harbor *Oreophasis* and *Penelopina*, which are threatened by severe habitat destruction.

Appendix 1 - Taxonomic Reference List

Stuart D. Strahl and Angela Schmitz
with comments by Sergio L. Pereira

Chachalacas - *Ortalis* (Merrem 1786): 12 species

Species	Subspecies	Description	Range
Plain Chachalaca / Chachalaca Norteña			
Ortalis vetula	*vetula*	Wagler 1830	Mx, Gu, Hn, Ni, CR
	deschauenseei	Bond 1936	Utila Island, Hn
	mccalli	Baird 1858	US, Mx
	pallidiventris	Ridgway 1887	Mx (Yucatan), Be
	intermedia	Peters 1913	Mx (Quintana Roo)
Chestnut-winged Chachalaca / Chachalaca Alirroja			
O. garrula	*garrula*	Humboldt 1805	Co (N)
Grey-headed Chachalaca / Chachalaca Cabecigrís			
O. cinereiceps[1]		Gray 1867	Hn, Ni, CR, Pa, Co (NW)
West-Mexican Chachalaca / Chachalaca Pechigrís			
O. poliocephala	*poliocephala*	Wagler 1830	Mx (S)
	lajuelae	Moore and Medina 1957	Mx (C)
Wagler's Chachalaca / Chachalaca Ventricastaña			
O. wagleri		Gray 1867	Mx (NC)
White-bellied Chachalaca / Chachalaca Ventriblanca			
O. leucogastra		Gould 1843	Mx, Gu, ES, Ni
Rufous-vented Chachalaca / Guacharaca			
O. ruficauda[2]	*Ruficauda*	Jardine 1847	Ve (N), Co (E), To
	Ruficrissa	Sclater and Salvin 1870	Ve (NW), Co (NE)
Rufous-headed Chachalaca / Chachalaca Cabecirrufa			
O. erythroptera		Sclater & Salvin 1870	Ec (W), Pe (NW), CO (SW)
Chaco Chachalaca / Chachalaca Charata			
O. canicollis	*Canicollis*	Wagler 1830	Bo (E), Py, Ar
	pantanalensis	Cherrie and Reichenberger 1921	Br (S), Bo, Py

Species	Subspecies	Description	Range
Speckled Chachalaca / Chachalaca Moteada			
O. guttata	*guttata*	Spix 1825	Co, Ec, Pe, Br, Bo (N)
	subaffinis	Todd 1932	Bo (E)
	araucuan	Spix 1825	Br (NE)
	squamata	Lesson 1829	Br (SE)
	columbiana[3]	Hellmayr 1906	Co (N)
Buff-browed Chachalaca / Chachalaca Cejuda			
O. superciliaris	*superciliaris*	Gray 1867	Bra (NE)
Little Chachalaca / Guacharaca guayanesa			
O. motmot	*motmot*	Linnaeus 1766	Ve (SE), Gy, Su, FG, Br
	ruficeps	Wagler 1830	Br (E)

True Guans - *Penelope* (Merrem 1786): 15 species

Crested Guan / Pava Cojolita			
Penelope purpurascens	*purpurascens*	Wagler 1830	Mx, Gu, Be, Hn, EL, Ni (N)
	aequatorialis	Salvadori and Festa 1900	Ni (S), CR, Pa, Co, Ec, Ve
	brunnescens	Hellmayr and Conover 1932	Co (NE), Ve (NW)
Cauca Guan / Pava del Cauca			
P. perspicax		Bangs 1911	Co (Cauca Valley)
White-winged Guan / Pava Aliblanca			
P. albipennis		Taczanowski 1877	Pe (NW)
Baudo Guan / Pava de Orton			
P. ortoni		Salvin 1874	Co (W), Ec (NW)
Marail Guan / Pava bronceada			
P. marail	*marail*	Müller 1776	FG, Su, Gy,Ve
	jacupeba	Spix 1825	Ve (SE), Br (N)
Spix's Guan / Pava Amazónica			
P. jacquacu	*jacquacu*	Spix 1825	Co, Ec, Pe, Bo, Br
	orienticola	Todd 1932	Co, Br, Ve, Gy
	granti	Berlepsch 1908	Gy, Ve (SE)
	speciosa	Todd 1915	Bo (C, E)
Chestnut-bellied Guan / Pava Ventrirrufa			
P. ochrogaster		Pelzeln 1869	Br (C)
White-crested Guan / Pava Crestiblanca			
P. pileata		Wagler 1830	Br

Species	Subspecies	Description	Range
Red-faced Guan / Pava Carirroja			
P. dabbenei		Hellmayr and Conover 1942	Bo (S), Ar (NW)
White-browed Guan / Pava Yacucaca			
P. jacucaca		Spix 1825	Br (NE)
Rusty-margined Guan / Pava Yacupemba			
P. superciliaris	*superciliaris*	Temminck 1815	Br (N)
	jacupemba	Spix 1825	Br, Bo
	major	Bertoni 1901	Py, Ar, Br (S)
Dusky-legged Guan / Pava de Monte			
P. obscura	*obscura*	Temminck 1815	Br, Ur, Ar, Py
	bridgesi	Gray 1860	Bo, Ar (NW)
	bronzina	Hellmayr 1914	Br (SE)
Band-tailed Guan / Pava Camata			
P. argyrotis	*argyrotis*	Bonaparte 1856	Co, Ve
	albicauda	Phelps and Gilliard 1940	Ve (Perija)
	colombiana	Todd 1912	Co (Santa Marta)
Bearded Guan / Pava Barbuda			
P. barbata[4]		Chapman 1921	Ec (S), Pe (NW)
Andean Guan / Pava Andina			
P. montagnii	*montagnii*	Bonaparte 1856	Ve, Co (E)
	atrogularis	Hellmayr and Conover 1932	Co (SW), Ec (W)
	brooki	Chubb 1917	Co (SE), Ec (E)
	plumosa	Berlepsch and Stolzmann 1902	Pe (E)
	sclateri	Gray 1860	Pe (s), Bo

Piping and Wattled Guans - *Aburria* (Reichenbach 1852): 5 species

Trinidad Piping Guan / Pava de Trinidad			
Aburria pipile		Jacquin 1784	Tr
Blue-throated Piping Guan / Pava Goliazul			
A. cumanensis	*cumanensis*	Jacquin 1784	FG, Su, Br (N), Ve, Gy, Co (SE), Ec, Pe, Bo (N)
	grayi	Pelzeln 1869	Bo (NC), Py (NE), Br (SW)
Red-throated Piping Guan / Pava Cuyubí			
A. cujubi[5]	*cujubi*	Pelzeln 1858	Br (NE)
	nattereri	Reichenbach 1862	Br (N), Bo (E)
Black-fronted Piping Guan / Yacutinga / Jacutinga			
A. jacutinga		Spix 1825	Br (E), Py (E), Ar (NE)
Wattled Guan / Pava Aburria			
A. aburri		Lesson 1828	Ve (NW), Co, Ec (E), Pe (E)

Species	Subspecies	Description	Range
Sickle-winged Guans - *Chamaepetes* (Wagler 1832): 2 species			
Sickle-winged Guan / Pava Falcialar			
Chamaepetes goudotii	*goudotii*	Lesson 1828	Co
	sanctaemarthae	Chapman 1912	Co (Santa Marta)
	fagani	Chubb 1917	Co, Ec
	tschudii	Taczanowski 1886	Co, Ec, Pe
	rufiventris	Tschudi 1843	Pe, Bo
Black Guan / Pava Negra			
C. unicolor		Salvin 1867	CR, Pa
Highland Guan - *Penelopina* (Reichenbach 1862): 1 species			
Highland Guan / Pava Pajuil			
Penelopina nigra		Fraser 1852	Mx (S), Gu, ES, Hn, Ni
Horned Guan - *Oreophasis* (G.R. Gray 1844): 1 species			
Horned Guan / Pavo de Cacho			
Oreophasis derbianus		Gray 1844	Mx (S), Gu (W)
Nocturnal Curassow - *Nothocrax* (Burmeister 1856): 1 species			
Nocturnal Curassow / Paujíl Nocturno			
Nothocrax urumutum		Spix 1825	Ve (SW), Co (E), Ec (E), Pe (NW), Br (W)
Razor-billed Curassows - *Mitu* (Lesson 1831): 4 species			
Alagoas Curassow / Paujíl de Alagoas			
Mitu mitu[6]		Linnaeus 1766	Br (E)
Razor-billed Curassow / Paují Tuberoso			
M. tuberosa		Spix 1825	Br (W,C), Co (SE), Pe (E), Bo (N)
Salvin's Curassow / Paujíl Culiblanco			
M. salvini		Reinhardt 1879	Co (SE), Ec (E), Pe (NE)
Crestless Curassow / Paujíl Culicastaño			
M. tomentosa		Spix 1825	Gy, Ve (S), Br (NW), Co (E)

Species	Subspecies	Description	Range
Helmeted and Horned Curassows - *Pauxi* (Temminck 1813): 2 species			
Helmeted Curassow / Paujíl Copete de Piedra			
Pauxi pauxi	*pauxi*	Linnaeus 1766	Ve (W), Co (E)
	gilliardi	Wetmore and Phelps 1943	Ve (NW), Co (NE)
Horned Curassow / Paujíl Unicornio			
P. unicornis	*unicornis*	Bond and de Schauensee 1939	Bo
	koepckeae	Weske and Terborgh 1971	Pe (SE)
True Curassows - *Crax* (Linnaeus 1758): 7 species			
Great Curassow / Pavón Norteño			
Crax rubra	*rubra*	Linnaeus 1758	CA (Mx - Pa), Co (W), Ec (W)
	griscomi	Nelson 1926	Mx (Cozumel Island)
Blue-billed Curassow / Pavón Piquiazul			
C. alberti		Fraser 1850	Co (N)
Black Curassow / Pavón Guayanés			
C. alector	*alector*	Linnaeus 1766	FG, Su, Gy, Br (N), Ve (SE)
	erythrognatha		Ve (SE), Co (E), Br (N)
Yellow-knobbed Curassow / Pauji copete rizado			
C. daubentoni		Gray 1869	Ve (N), Co (NE)
Bare-faced Curassow / Pavón Muitú			
C. fasciolata	*fasciolata*	Spix 1825	Br, Py, Ar
	grayi	Ogilvie-Grant 1893	Bo (E)
	pinima	Pelzeln 1869	Br (NE)
Wattled Curassow / Pavón Carunculado			
C. globulosa		Spix 1825	Br (W), Bo (N), Pe (E), Ec (E), Co (SE)
Red-billed Curassow / Pavón Piquirrojo			
C. blumenbachii		Spix 1825	Br (E)

Country Key: Ar = Argentina, Be = Belize, Bo = Bolivia, Br = Brazil, CA = Central America, Co = Colombia, CR = Costa Rica, Ec = Ecuador, ES = El Salvador, FG = French Guiana, Gu = Guatemala, Gy = Guyana, Hn = Honduras, Mx = Mexico, Ni = Nicaragua, Pa = Panama, Pe = Peru, Py = Paraguay, Su = Suriname, To = Tobago, Tr = Trinidad, Ur = Uruguay, US = United States, Ve = Venezuela
Direction Key: C = Central, E = east, N = north, S = south, W = west
[1] considered a subspecies of *garrula* by Blake (1977).
[2] *lamprophonia* (Wetmore 1981) may be a third subspecies in extreme NE Colombia.
[3] *columbiana* is considered a separate species by some (i.e., Hernandez and Rodriguez)
[4] considered as subsp. of *argyrotis* by Blake (1977).
[5] Sick (1993), and Delacour and Amadon (1973) regard both *cujubi* subspecies as *cumanensis* subspecies.
[6] following Linnaeus (1758, 1766), Salvin (1867, 1874), Peters (1934) and Pinto (1952).

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