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The Annual Cycle and Natural History of a Subtropical Atlantic Forest Avifauna in Paraguay

Mercedes S. Foster and Ned K. Johnson

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ABSTRACT

Foster, Mercedes S., and Ned K. Johnson. The Annual Cycle and Natural History of a Subtropical Atlantic Forest Avifauna in Paraguay. *Smithsonian Contributions to Zoology*, number 648, viii + 84 pages, 8 figures, 2017. — We studied the avifauna in a subtropical humid forest around Hotel El Tirol, Department of Itapúa, Paraguay. The study site is part of the Atlantic Forest biome, a critically endangered biodiversity hot spot. We recorded 205 species of birds in 45 families and provide information on their annual cycles and natural history from collected specimens and field observations. Increased knowledge will contribute to efforts to maintain and manage the bird species of this endangered biome. The annual cycle of the avifauna at El Tirol closely resembled that of birds at north temperate and subtropical latitudes. Birds entering reproductive phases were likely responding to increasing photoperiod and rainfall. In general, breeding was initiated in mid-August and began to decline in late November. Molt rose sharply in early December and continued into April, overlapping with breeding in 16 species. In some species, males replaced juvenal plumage with an immature plumage easily distinguishable from the adult form, which they acquired after several years. Most males in immature plumage bred. For most species skull pneumatization in young of the year was completed during their first year. In several species, however, the pneumatization process extended into year 2, and in other taxa, complete pneumatization requires multiple years or never occurs. The birds at El Tirol were predominantly insectivorous. About a quarter of the specimens in 134 species had noticeable body fat. In general, fat deposition peaked in June, with lesser peaks from February to mid-March and in late August and September. Twenty-seven of the species that we recorded were migratory. We compared the species of birds recorded at El Tirol with those recorded from San Rafael National Park, a large tract of Atlantic Forest farther north in Paraguay with a much more extensive avifauna. Some of the species we failed to record were likely overlooked. However, El Tirol is at the southwestern limit of the Atlantic Forest habitat; absences may reflect faunal attenuation as species reach the limits of their ecological ranges. The lower numbers may also indicate that diversity in forest patches is reduced. Regardless, such patches will play an important role in maintaining the Atlantic Forest avifauna.

RESUMEN

Foster, Mercedes S., and Ned K. Johnson. El Ciclo Anual y la Historia Natural de una Avifauna Subtropical, de Bosque Atlántico en Paraguay. *Smithsonian Contributions to Zoology*, número 648, viii + 84 páginas, 8 figuras, 2017. — Se estudió la avifauna en bosque húmedo subtropical alrededor del Hotel El Tirol, Departamento de Itapúa, Paraguay. El sitio de estudio es parte del bioma del Bosque Atlántico, un área de alta biodiversidad en estado crítico de conservación. Se registraron 205 especies de aves en 45 familias; se proporciona información sobre sus ciclos anuales e historia natural con base en los especímenes y las observaciones de campo. Un mayor conocimiento puede contribuir a los esfuerzos de conservación y manejo de las aves de este bioma amenazado. El ciclo anual de la avifauna en El Tirol se asemeja al de las aves en latitudes templadas y subtropicales del hemisferio norte. Las aves entrando en fase reproductiva probablemente responden al aumento del fotoperiodo y de la precipitación. En general, la época reproductiva comenzó a mediados de agosto y declinó a finales de noviembre. La ocurrencia de muda aumentó considerablemente a principios de diciembre y continuó todavía en abril. Muda traslapa con la cría en 16 especies. En algunas especies, los machos sustituyen el plumaje juvenil con un plumaje inmaduro fácilmente distinguible de la forma adulta, que adquieren después de varios años. La mayor parte de los machos en plumaje inmaduro se reprodujeron. Para la mayoría de las especies la neumatización (u osificación) del cráneo en juveniles se completó durante el primer año. En varias especies, sin embargo, el proceso de neumatización se extendió hasta el segundo año y en otros taxones la neumatización completa requirió varios años o nunca se completó. Las aves en El Tirol fueron predominantemente insectívoras. Aproximadamente una cuarta parte de los especímenes estudiados para 134 especies llevaba grasa corporal notable. El acúmulo de grasa alcanzó su máximo en junio, con picos menores desde febrero a mediados de marzo y a finales de agosto y septiembre. Veintisiete de las especies registradas eran migratorias. Comparamos las especies de aves registradas a El Tirol con éstas conocidas desde el Parque Nacional San Rafael, una gran extensión de Bosque Atlántico más al norte en el Paraguay y con una avifauna mucho más extensa. Algunas de las especies que no se registraron fueron probablemente pasadas por alto. Por otro lado, El Tirol está en el límite suroeste del Bosque Atlántico, y la ausencia de algunas especies pudiera reflejar la atenuación faunística que se presenta cuando las especies alcanzan los límites de sus rangos ecológicos. El menor número también puede indicar que la diversidad en los parches de bosques se reduce. Independientemente, dichos parches cumplen un papel importante en mantener la avifauna del Bosque Atlántico.

Cover image: Detail of Figure 2.

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Dedication

A favorite outing for people of all ages is a visit to a museum of natural history. There one can view examples of our natural world and learn about the characteristics of and interactions among the plants, animals, rocks, fossils, and other objects that make up our environment, and the innumerable ways they affect the human species. The mission of many natural history museums, however, extends far beyond this diffusion of knowledge, to include its creation. Much of the information relating to the natural world that is imparted by exhibits or through articles, books, documentaries, and other media is a product of scholarly research. This research is carried out by museum curators in the field when obtaining specimens and in the museum during the study of those specimens. The specimens upon which this report is based have been distributed among three such research-oriented museums.

Specimens in natural history museum collections are the basis of studies that touch every aspect of human lives. They are critical to our economic, political, and physical well-being. At the most fundamental level they tell us about the existence and distributions of organisms and their habitats, of geological formations, and the physical attributes of our world and the universe, through space and time. This information is used to chronicle biodiversity and extinctions, to locate mineral and energy deposits, to reconstruct the climate and ecological history of the Earth, and to monitor the evolution and movements of pests and pathogens and their effects on human health and agriculture.

In 1979, the Paraguayan National Forest Service, through the efforts of Ing. Hilario Moreno and Peace Corps (U.S.) volunteers David Wood and Diane Wood, initiated a program to inventory the flora and fauna of Paraguay as a basis for ensuring the conservation and proper management of Paraguay's natural resources. This endeavor included the establishment of a National Museum of Natural History to house specimens that would be collected to document their findings and to provide materials for future research. Although early naturalists working in Paraguay, such as Moisés Bertoni (1857–1929), a botanist, meteorologist, and anthropologist, had maintained collections of specimens, many had been lost, and more recent material was needed.

Planning for the museum began in 1979, and it was established in 1980. With the collaboration of individuals and support from institutions such as the U.S. Fish and Wildlife Service, the Peace Corps, the Carnegie Museum of Natural History, the Missouri Botanical Garden, the Smithsonian Institution, the World Wildlife Fund, the U.S. Agency for International Development, and many others, Paraguayan biologists were trained in field techniques and museum practices and studied for postgraduate degrees.

Since that time, they have carried out scientific expeditions throughout the country and have built a collection of more than a million specimens, published checklists of organisms, named new species, and generally contributed to our knowledge of the systematics and ecology of the Paraguayan biota. They also promote the conservation and preservation of resources and encourage good management practices. They continue to do research, train successive generations of museum scientists, and develop educational and outreach programs for students and the general public.

In recognition of their unwavering efforts and significant contributions to scientific research, conservation, and education, we dedicate this work to the personnel and associates (past, present, and future), of the Museo Nacional de Historia Natural del Paraguay, Instituto Forestal Nacional, San Lorenzo, Paraguay.

Contents

LIST OF FIGURES	vii
INTRODUCTION	1
STUDY AREA	2
METHODS	5
Specimens	5
Terminology and Aging	6
Analyses	6
RESULTS	6
Species Accounts	7
Hypotheticals	58
DISCUSSION	59
Skull Pneumatization	59
Reproduction	59
Plumage	60
Molt	61
Diet	61
Fat Deposition	62
Migration and Local Movements	62
Annual Cycle	63
Other Records from Hotel El Tirol	63
Comparison with Avifaunas at Other Sites	64
CONCLUSIONS	64
ACKNOWLEDGMENTS	65
APPENDIX A	67
APPENDIX B	71
REFERENCES	73
INDEX	77

Figures

Frontispiece. Looking east from Hotel El Tirol	viii
1. Map of Paraguay	2
2. Network of forest patches and connecting corridors	3
3. Subtropical humid forest	4
4. Forest interior along a stream	4
5. Tung orchard	4
6. Mean monthly rainfall	5
7. Mean monthly temperatures	5
8. Timing of events in the annual cycles of birds	60



FRONTISPIECE. Looking east from the grounds of Hotel El Tirol, Department of Itapúa, Paraguay.

The Annual Cycle and Natural History of a Subtropical Atlantic Forest Avifauna in Paraguay

Mercedes S. Foster^{1*} and *Ned K. Johnson*^{2†}

INTRODUCTION

When Foster first went to Paraguay in 1976 to study birds, she relied on Meyer de Schauensee's *A Guide to the Birds of South America* (1970) to identify the species she encountered. The book included primarily plumage descriptions and information on habitat and geographic and elevational distributions. Basic? Yes. Incomplete? Yes again, but supremely useful. One can only admire and respect an individual who would endeavor to make the highly diverse avifauna of an entire continent accessible to everyone. Since then, superbly illustrated comprehensive field guides to birds in countries or regions of South America have proliferated, seemingly exponentially. The quality and accuracy of the information and images have increased markedly, as has the breadth of coverage, with notes on vocalizations, nesting, and migration included for many species (e.g., see Restall et al., 2007a, 2007b; Ridgely and Tudor, 2009). At the same time, flourishing communities of trained ornithologists, avian ecologists, and avian systematists in South America are publishing prolifically on the biology of species found in their countries, as are biologists from other continents. Studies tend to focus on the distributions, abundances, and systematics of birds, particularly threatened species and endemics. Such information is critical for identifying and prioritizing areas for protection.

Despite the rapid increase of available information, however, the ecology and natural history of most South American bird species remain poorly known (Marques-Santos et al., 2015). Equally limited are studies of the ecology and natural history of avian communities from single localities or habitats that present an avifauna as an integrated whole. Such information provides a critical baseline for the pursuit of more detailed studies of individual species, interactions among bird species, and interactions between birds and their prey, predators, or competitors. It also supports efforts to conserve or protect habitats and species or, if necessary, to manage them, through an understanding of how the latter function and persist (or not) in pristine and disturbed areas.

Avifaunal studies are concerned with species composition (phylogenetic or ecological) or functional activities (e.g., reproduction, molt, dispersal/migration) within the community and their timing (Miller, 1963; Willard et al., 1991). Most commonly, the functional activities of birds are completed in a single year and collectively are referred to as the annual cycle. A few species complete the events over a longer or shorter period (e.g., Miller, 1962). Our knowledge of annual cycles of South American birds is limited

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and can be subject to two biases. The first bias, which is common to many vertebrate classes and relevant to any geographic region, is the concentration of studies in the primary or expected breeding season. This limits understanding of activities during other parts of the annual cycle and their effects on those occurring during the breeding season (Marra et al., 2015). The second bias is a consequence of modern scientific ornithology having developed primarily in Northern Hemisphere temperate regions, which may unconsciously influence the ways in which studies are designed and data are analyzed and interpreted, through predetermined expectations. This bias can be eliminated only with a much greater knowledge of the natural history and annual cycles of species and avifaunas from all latitudes.

In this publication we report on the avifauna of an area of Southern Hemisphere subtropical humid forest in the vicinity of Hotel El Tirol del Paraguay, Department of Itapúa, Paraguay. The site lies at the southwestern limit of the Atlantic Forest biome of South America, a highly diverse and critically endangered habitat that has been reduced to 7.5% to 15% of its original extent (Myers et al., 2000; Galindo-Leal and de Gusmão Câmara, 2003; Ribeiro et al., 2009). Although efforts are being made to protect large areas of this habitat, smaller patches connected by riparian, windbreak, and other corridors will play a significant role in maintaining many species of birds and other organisms that comprise its diversity.

The patch of forest at El Tirol is connected to other forest patches through a network of corridors. We provide information on the species composition of the avifauna of this forest network as well as information on the annual cycles, plumages, diets, behaviors, and other aspects of the natural history of the included species. Our study is based on field observations and collected specimens. Internal examination of specimens provided information on the timing of events (e.g., reproduction, fat deposition) in the annual cycle, on development of the cranium and reproductive systems, and on diet that cannot be obtained from field observations and revealed differences among species and within species between sexes and age groups. By increasing knowledge of individual species and the avifauna as a whole, we hope to contribute to efforts to maintain and manage the avifauna in remnant patches of this endangered biome as well as in large remaining areas of forest.

STUDY AREA

The study was conducted in the general area of Hotel El Tirol, 27°11'S, 55°47'W (main building, elevation ~250 m, Google Maps, 30 October 2015), and its surrounds (Figure 1) intermittently between 1976 and 2004. In 1976, when the study was initiated, the entrance to El Tirol was located along a dirt road ~19.5 km NNE of Encarnación, the closest city. The road,



FIGURE 1. Map of Paraguay showing the location of Hotel El Tirol, various Paraguayan national parks, and other places mentioned in the text.

which was closed when it rained, ended about ~55 km farther on at Capitán Meza. From there, relatively undisturbed tall humid forest, with few incursions and farms, extended NNE to the vicinity of Puerto Presidente Stroessner (renamed Ciudad del Este in 1989), some 165 km away as the crow flies.

The hotel property consists of rolling hills (moderately steep hillsides and level areas) spanning an elevational range from about 190 to 265 m above sea level (see Frontispiece and Figure 2). The area is dissected by streams fed by natural springs, rain, and runoff that flow east and northeast, eventually reaching the Paraná River. Natural seeps are also found in the forest and with the springs may give rise to small boggy areas. The soil is red clay with exposed sandstone outcroppings. When we worked there from 1976 to 1983, about 50 ha of hotel land were covered in humid forest with a 25-m canopy (Figure 3). This tall, humid forest formation is described in Lopez and Little (1987) and Keel et al. (1993), along with notes on the dominant tree species. Epiphytic *Tillandsia usneoides* (Bromeliaceae) commonly draped the trees. The relatively open understory was periodically interrupted by tangles of *Chusquea* (Poaceae) bamboo often mixed with lianas; the ground layer included a high diversity of ferns (Smith and Foster, 1984). Tree ferns, *Nephelea setosa* (Cyatheaceae), occurred along the creeks, and monospecific stands were occasionally found on hillsides in the forest. At that time, selected trees had been removed to provide timber for use

at the hotel, but the area had not been logged perhaps, since the time of the Jesuit reductions in the early 1700s. Trails had been cut through the forest for visitor access, and a dirt road accessed a small garden area with a stream diverted for irrigation. Brown capuchin monkeys (*Sapajus cay*) were sighted regularly; nine-banded armadillo (*Dasypus novemcinctus*), white-eared opossum (*Didelphis albiventris*), crab-eating fox (*Cerdocyon thous*), and lesser grison (*Galictis cuja*) were also recorded.

The El Tirol forest was continuous with other patches of forest or connected to them by broad corridors of forest along streambeds (Figure 4). In other areas, it abutted orchards of tung trees (*Vernicia fordii*, Euphorbiaceae; Figure 5) and castor beans (*Ricinus communis*, Euphorbiaceae), cultivated fields of yuca, or cassava (*Manihot esculenta*, Euphorbiaceae), tall second-growth forest originally planted in coffee or other crops, abandoned fields in early stages of regeneration, or pastures. Our work was concentrated in the El Tirol forest; the Becker forest, a larger patch of relatively undisturbed forest about ~1 km SSE of the hotel; other smaller forest patches; and the corridors connecting them, with occasional forays into the other habitats.

Foster visited the hotel briefly in 1995 and worked there again in 2004. Sometime in the late 1980s or early 1990s, the road from Encarnación was significantly widened, improved, paved, and extended to Ciudad del Este (formerly Puerto Presidente Stroessner) via routes 6 and 7, ~285 km away by road. By



FIGURE 2. Network of forest patches and connecting corridors with interspersed pastures and cultivated fields in the vicinity of Hotel El Tirol, Department of Itapúa, Paraguay.



FIGURE 3. Subtropical humid forest in the vicinity of Hotel El Tirol del Paraguay, Department of Itapúa, Paraguay, which is located at the southwestern limit of the Atlantic Forest biome.



FIGURE 4. Forest interior along a stream near Hotel El Tirol, Department of Itapúa, Paraguay.



FIGURE 5. Tung (*Vernicia fordii*) orchard near Hotel El Tirol, Itapúa, Paraguay. This habitat is used by many species of birds, including *Columbina talpacoti*, *Guira guira*, and *Sicalis flaveola*. Nests of a *Patagioenas picazuro* and a *Troglodytes aedon* were found here.

1995, the habitat between El Tirol and Ciudad del Este, as far as one could see from the road, had been largely converted to commercial soybean production. Nevertheless, the forest around the hotel continued to interconnect along streambeds with other patches of forest, although some had been reduced in size or degraded with the removal of selected trees. No monkeys were encountered in the forest by three individuals during nearly a month of field work in 2004.

Daily rainfall data for January 1971 to September 1982 were obtained from records taken by Armando Reynaerts at Hotel El Tirol. Days with rain per month vary little (range of mean days/month = 5.5–8.0) over the course of the year (Figure 6). The amount of rain falling each month is considerably more variable, with the rainiest season extending from October through December and the least rain falling in July. The most striking feature of the rainfall pattern is the great fluctuation in the amount of rain falling in any given month between years (Figure 6). Daily

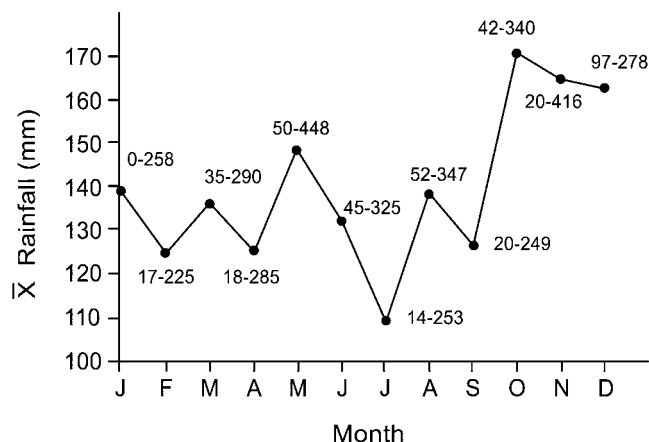


FIGURE 6. Mean monthly rainfall at Hotel El Tirol, Department of Itapúa, Paraguay, January 1971–September 1982. Ranges of the amount of rain falling in any given month illustrating the striking variability between years are noted adjacent to dots.

temperature data for Capitán Miranda, a town ~4 km SW of El Tirol, were obtained for January 1964 to August 1982 from the Meteorological Service of the Ministry of Defense in Asunción (Figure 7). It is warmest during the summer months of November through February and coldest from May through August, when it may occasionally freeze. Mornings are often foggy, especially following a nighttime rain.

METHODS

For his study of the distribution and biogeography of Paraguayan birds, Hayes (1995) divided the country into seven geographical regions based on various environmental characteristics. El Tirol is located in his Alto Paraná region, which he characterized as having hilly terrain dominated by humid forest with abundant rainfall.

The El Tirol collections and observations were made from 1976 to 1983 and in 2004 for a total of about 27 person-months. Because the work was carried out incidental to other research (e.g., Foster, 1981, 1987, 1990; Zink and Johnson, 1984; Johnson and Zink, 1985), collecting efforts were not evenly distributed over all months, and no collections were made in April or July. However, we were able to obtain a sample for many species from every calendar month in which we were present. We worked primarily in mature forest habitats, only occasionally collecting in pastures, croplands, orchards, and scrubby second growth.

SPECIMENS

Bird specimens were prepared according to standard museum methods as round skins, flat skins, or skeletons or preserved in 10% formalin buffered with MgCO_3 . Standard data (see Foster and Cannell, 1990) were recorded for each specimen, including the following: (1) collector and field number, (2) locality, (3) date

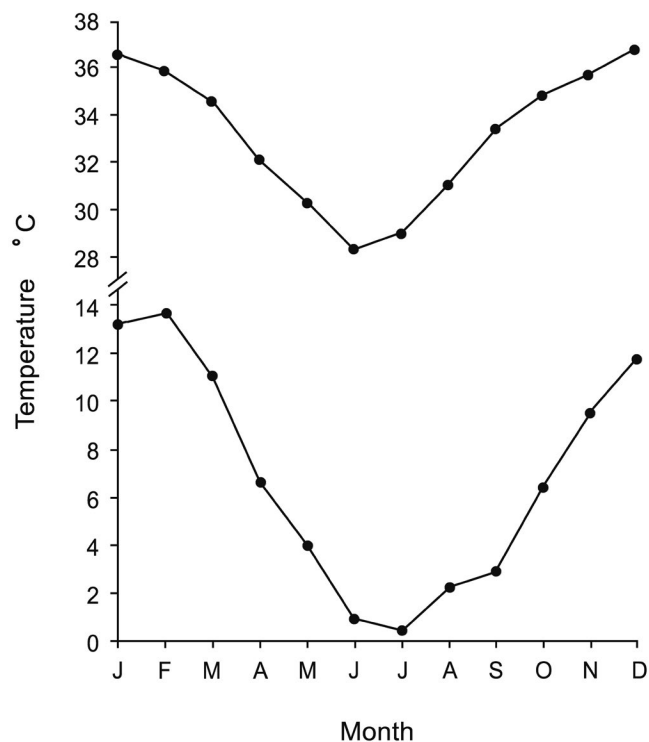


FIGURE 7. Mean monthly maximum and minimum temperatures at Capitán Miranda, a town ~4 km SW of Hotel El Tirol, Department of Itapúa, Paraguay, January 1964–August 1982.

of collection, (4) soft-part colors, as noted by the person preparing the specimen, (5) mass determined with spring balances graduated in 0.2-, 0.5-, 1.0-, or 2.0-g increments, in accordance with the size of the bird, (6) fat condition, which is a subjective designation (but see Foster and Cannell, 1990), as light (includes slight), medium, or heavy, (7) skull pneumatization (or ossification) as a potential indication of age, (8) sex based on examination of the gonads, (9) reproductive condition, (10) presence and extent of molt, (11) plumage stage, (12) stomach contents, classified as mammals, insects, noninsect arthropods (e.g., spiders, millipedes), fruit, seeds, plant material, or “other” (e.g., nonarthropod invertebrates, corn), (13) habitat, and (14) miscellaneous observations on habitat, behavior, vocalizations, nests, or ecology. We used a single locality (i.e., El Tirol, 19.5 km by road ~NNE of Encarnación, Department of Itapúa, Paraguay, elevation 230 m) for all specimens taken on the hotel property or adjacent properties, unless otherwise noted. Skull pneumatization was loosely designated as juvenal skull or skull not pneumatized (little to no pneumatization), immature skull or skull with large windows (or noted as percent of the skull pneumatized), or adult skull or skull with small skull windows (pneumatization nearly complete) or completely pneumatized. For reproductive condition, male characteristics included length or length \times width (mm) of the left testis, testis color if other than white or cream, and presence of a cloacal protuberance. Female characteristics included diameters (diam) of the largest ova, presence or absence

of yolk as indicated by color, presence of collapsed follicles, and enlargement of the oviduct. Surface texture of the ovary was noted if ova were not distinguishable (i.e., smooth, granular, or lumpy). For both sexes, the presence of an incubation patch was noted. Molt included the presence or absence of body, wing, and tail molt. The degree of body molt is a subjective designation as light (scattered feathers in several tracts, a few pin feathers at the beginning of molt or mostly remnant sheaths toward the end), moderate (more feathers in most tracts), or extensive or heavy (many feathers in all tracts). Molt was designated as prejuvenal (= postnatal), first prebasic (= postjuvinal), second and later prebasic (= postnuptial), or prealterate (= prenuptial), if distinguishable (see Humphrey and Parkes, 1959). Birds with unpneumatized skulls and tiny undeveloped gonads and/or extensive juvenal plumage were generally assumed to be undergoing their first prebasic molt. Those with fully pneumatized skulls and developed gonads were assumed to be in a later prebasic molt. Juvenal or immature plumages were described if different from the definitive plumage of adults, as were definitive plumage characteristics differing from those found in Ridgely and Tudor (2009). For stomach contents, taxa names of plants are provided if known but do not imply that these are the only taxa eaten.

Preliminary species identifications were made in the field and verified by comparison with museum specimens on our return. Scientific names, linear sequences, and common English names follow those of the American Ornithologists' Union's South American Classification Committee (Remsen et al., 2016). Plant names follow Tropicos (Missouri Botanical Garden, 2015–2016). Status as an Atlantic Forest endemic follows Brooks et al. (1999).

Specimens are deposited in the collections of the U.S. National Museum of Natural History (USNM) in Washington, D.C., Museum of Vertebrate Zoology (MVZ) at the University of California, Berkeley, and Museo Nacional de Historia Natural del Paraguay (MNHNP) in San Lorenzo, Paraguay. Collections of tissues are deposited in MVZ's Tissue Collection. Sound recordings are deposited in the Laboratory of Natural Sounds at MVZ. Field notes of Johnson (NKJ), Carla Cicero (CC), Robert E. Jones (REJ), and Robert M. Zink (RMZ) are available at the MVZ, and those of Foster (MSF) are at the USNM. Specimens were collected and exported from Paraguay and imported into the United States with permits issued by the Ministry of Agriculture, Secretaría del Ambiente, and Servicio Forestal Nacional of Paraguay and the U.S. Fish and Wildlife Service.

TERMINOLOGY AND AGING

A few comments about terminology and aging of passerines are in order. The term "adult" when referring to the skull signifies that the skull is fully pneumatized. An "immature" skull is partially pneumatized, and a "juvenal" skull shows very little to no pneumatization. When these same terms are used in relation to plumage, "adult" signifies the definitive basic plumage, whose aspect rarely changes except with the intermittent addition and loss of specialized feathers associated with breeding. The "juvenal" plumage is the first complete feather covering

following hatching. The feathers are lax, often downy and dull, and recognizably different morphologically from subsequent plumages. The "immature" plumage follows and is distinct from the juvenal plumage; it may be equivalent to the definitive plumage or distinct from it in color and pattern. Finally, these descriptive terms are also used to refer to reproductive status. The gonads of juveniles are tiny and undeveloped, and the birds are not yet capable of breeding. Immatures have developed gonads, although they may be smaller than those of adults, but the birds have not yet bred. Adults have fully developed gonads (although testes especially may be small following postbreeding regression) and are either breeding or have bred previously. In north temperate birds the stages of development (juvenal, immature, adult) of the skull, plumage, and gonads generally coincide, and the terms are used with little confusion. However, in various tropical and subtropical bird taxa, the stages are not coincident (e.g., a breeding bird with mature gonads may have an immature skull or plumage). Investigators using the terms juvenal (juv), immature (imm), and adult (ad) in reference to a particular specimen often do not indicate the character(s) to which the designation refers. Until the ornithological community reaches a consensus about their implied meanings, readers should be careful to note the characteristic to which such adjectives have been applied.

ANALYSES

For the purposes of analysis, data were combined into bimonthly intervals (days 1–15 and 16–31) and (with the exception of diet) were considered on the basis of percentages of species for which at least one collected specimen showed evidence of the activity (e.g., breeding, molt) in question. Percentages of specimens that showed evidence of an activity generally closely track percentages for species, but use of the latter eliminates the influence of differences among species in numbers of individuals collected. For analyses of diet, specimens with empty stomachs were excluded from the calculations. Values are percentages of specimens with food items in the stomach or percentages of species for which at least one specimen contained food, not percentages of all specimens or species. Specimens with more than one type of food in the stomach were counted once in each food category represented, so combined percentages can exceed 100.

RESULTS

During the study, 1,887 specimens representing 187 species in 43 families were collected. An additional 17 species, including two additional families, were identified with confidence by sight. The latter species are indicated in the accounts with an asterisk. All species are listed in Appendix A. Eleven resident species were sampled in all 10 calendar months covered by our study (January–March, May–June, August–December), 9 species were sampled in 9 months, and 8 were sampled in 8 months. Eight species of migrants were sampled in 6 to 8 calendar months. Specimens collected include 1,401 study skins, 384 skeletons, 94 fluid

specimens, and 8 nests and/or eggs. Data for each species are summarized in the following accounts. Initials in parentheses following “Specimens” indicate the museum collections in which they are deposited. Sound recordings were made of the calls or songs of 55 of the bird species but are not considered in this paper.

SPECIES ACCOUNTS

FAMILY TINAMIDAE: TINAMOUS

Crypturellus tataupa: Tataupa Tinamou

SPECIMENS (MVZ, MNHNP). ♂♂ Mar (1), Sep (1).
 ♀ Jun (1).
 MASS (G). ♂♂ 205 (Mar, light fat), 268 (Sep, extremely fat). ♀ 243.
 IRIS. Greenish or brown.
 BILL. Pale purplish pink, reddish yellow, or orange with pale tip. Mouth lining light green.
 FEET AND TARS. Pale purple to purplish pink.
 GONADS. ♂♂ Testis 14 × 8 mm (Mar), 24 × 13 mm (Sep). ♀ Ovary granular, ova ≤ 1 mm.
 MOLT. Body and flight feathers (Mar).
 STOMACH CONTENTS. One with fruit; 1 with seeds.
 HABITAT. On the ground in mature forest with some undergrowth, but fairly open. Also occasionally flushed in cornfields and in dense, tall (≥1 m) grass in scrubby pasture.
 NOTES. Heard calling commonly in the early morning and late afternoon in all months. Birds often counter call, and 2 birds are often seen together. ♂ tending a nest on 25 Sep, more than a week earlier than the earliest egg date reported by Hayes (2014) from Sapucaí, a locality ~200 km NNW of El Tirol (Figure 1). The clutch was also larger, consisting of 6 smooth mauve-colored eggs with a dull lustrous finish. The eggs averaged 43.0 mm greatest length (standard deviation [SD] = 1.09, range = 41.2–44.0, *N* = 6) × 31.0 mm greatest width (SD = 0.88, range = 30.1–32.5, *N* = 6). Three young observed walking in the forest in Feb.

FAMILY CRACIDAE: GUANS

Penelope superciliaris: Rusty-margined Guan

SPECIMENS (MVZ). ♂ Oct (1).
 MASS (G). 640.
 IRIS. Chestnut brown.
 BILL. Blackish brown.
 FACIAL SKIN. Skin around eyes and upper throat blue gray. Rest of throat and dewlap orange red.
 FEET AND TARS. Legs dusky with faint grayish-purple or grayish-pink cast. Toe pads yellowish green.
 GONADS. Testis 12 × 5 mm.
 MOLT. No.
 STOMACH CONTENTS. Two hard, brown fruits.
 HABITAT. Understory of mature forest and old second growth.

NOTES. Groups of 1–3 feeding 3–5 m up in fruiting trees in Mar, Sep, and Oct.

FAMILY ODONTOPHORIDAE: NEW WORLD QUAILS

Odontophorus capueira: Spot-winged Wood-quail

SPECIMENS (MVZ). ♂ Jan (1), adult skull.
 MASS (G). 335.
 IRIS. Brown.
 FACIAL SKIN. Orange.
 FEET AND TARS. Slate gray.
 GONADS. Testis 6 × 12 mm.
 MOLT. Wing and body feathers.
 STOMACH CONTENTS. Seeds.
 HABITAT. Mature forest and old second growth.
 NOTES. Observed in Feb, Mar.

FAMILY ARDEIDAE: HERONS

Syrigma sibilatrix: Whistling Heron

SPECIMENS (MVZ). ♂ Feb (1).
 MASS (G). 490, light fat.
 IRIS. White.
 BILL. Pink proximally, black distally. Mouth lining pink.
 FACIAL SKIN. Bare skin around eyes powder blue.
 FEET AND TARS. Black.
 GONADS. Testis 7 × 3 mm.
 MOLT. Wing and body feathers.
 STOMACH CONTENTS. Orthopteran remains.
 HABITAT. Marshy pasture.
 NOTES. Generally observed as singles or pairs flying overhead, standing in wet grass or on stumps, or perched in snags in pasture areas. Flushed 8 or 9 birds roosting together in a stand of introduced *Pinus* sp. (Pinaceae) trees. Observed in Jan, Feb, Mar, Jun, Oct, and Nov.

FAMILY CATHARTIDAE: NEW WORLD VULTURES

*Cathartes aura**: Turkey Vulture

NOTES. Occasionally observed (NKJ, MSF, RMZ) soaring over fields and forest in groups of 1 to 4 individuals in Oct, Nov, Jan, Feb, Mar. Not observed at carcasses of a dead horse or a dead calf where black vultures were feeding.

Coragyps atratus: Black Vulture

SPECIMENS (MVZ). ♂ Feb (1).
 MASS (G). 1,735.
 IRIS. Brown.
 BILL. Black basally, green distally. Mouth lining green, tinged white.

FEET AND TARSI. Black dorsally to green on sides. Toe pads brown.

GONADS. Testis 4×2 mm.

MOLT. Wing, tail, and body feather molt.

NOTES. Seen regularly flying overhead in small groups of 1–6 or perched in dead trees in pastures. More than 55 feeding at a calf carcass in a pasture.

FAMILY ACCIPITRIDAE: HAWKS

***Elanus leucurus**: White-tailed Kite**

NOTES. Observed in Jan, Mar, and Nov flying over a clearing or hovering over a pasture (NKJ).

***Elanoides forficatus**: Swallow-tailed Kite**

NOTES. Observed frequently in Sep through mid-Mar usually in groups of 2–7 (rarely alone), circling low over the hotel buildings or the forest canopy, occasionally over fields or clearings, or perched at the top of a 7–10 m dead snag. Their consistent close proximity to the forest canopy suggests that they may be hunting arboreal reptiles and amphibians. Presumed courtship flights observed in Nov. An austral migrant that breeds in Paraguay but moves north for the winter (Hayes, 1995).

***Harpagus diodon*: Rufous-thighed Kite**

SPECIMENS (MVZ). ♂♂ Jan (3), 2 adults, 1 juvenile.

MASS (G). $\bar{X} = 181.0$ (SD = 1.73, range = 179–182, $N = 3$).

IRIS. Adults: red orange; juvenile: dull yellow.

BILL. Adults: upper mandible olive green below nostrils; rest black. Lower mandible olive green. Juvenile: all black.

FACIAL SKIN. Cere and gape at corners lemon yellow. Eye ring and bare orbital skin yellow, tinged green.

FEET AND TARSI. Adults: yellow orange. Juvenile: yellow.

GONADS. Testes small, range: $2 \times 1\text{--}4 \times 2.5$ mm.

MOLT. One adult replacing body and wing feathers.

STOMACH CONTENTS. Three with insect remains.

HABITAT. Forest, woodland, and forest edge.

NOTES. An austral migrant, breeding in Paraguay and moving north for the winter (Hayes et al., 1994). Birds have been observed chasing in Nov, and a juvenile exchanging screams with an adult in Jan may have been begging from a parent. The birds collected in Jan had small testes and likely were not breeding. El Tirol is farther south than previously reported localities (Hayes et al., 1994).

***Ictinia plumbea*: Plumbeous Kite**

SPECIMENS (MVZ). ♂ Sep (1), adult plumage.

MASS (G). 272, some fat.

IRIS. Red.

FEET AND TARSI. Orange.

GONADS. Testes 12×8 mm.

MOLT. No.

STOMACH CONTENTS. Small insects.

HABITAT. Forest, old second growth; soaring over pasture and open areas.

NOTES. A northern austral migrant. Species observed regularly from mid-Sep through Jan. Courtship flights over forest and fields observed in early Oct. Adult observed in Jan feeding a 10-cm-long stick insect (Phasmatodea) to a full-grown juvenile (but with a few down feathers remaining) perched at the top of a forest tree. Call a piercing whistle.

***Rupornis magnirostris*: Roadside Hawk**

SPECIMENS (MVZ). ♀♀ Oct (1), adult plumage; Feb (1), juvenal plumage.

MASS (G). 368 (adult); 345 (juvenile).

IRIS. Dark brown.

BILL. Juvenile: Upper mandible bluish gray with black tip. Lower mandible yellow green at base, then bluish gray with black tip.

FACIAL SKIN. Juvenile: cere orange; line around gape yellowish green; eyelid yellowish green; plate over eye olive green.

TARSI. Juvenile: yellow orange with greenish tinge; toes orange yellow.

GONADS. Adult ♀ ready to lay, with orange ova 20 and 11 mm diam. Juvenile ♀ with undeveloped double ovary.

MOLT. No.

STOMACH CONTENTS. Insect remains, especially grasshoppers, and 1 large beetle.

HABITAT. Forest; forest edge; scrubby, abandoned pasture; active pasture, cornfields.

NOTES. Usually 1 or 2 birds perched at tops of trees or dead snags 3–17 m up or flying overhead. Often screaming; call a high-pitched single note followed by a shrill descending *shree* or a single-note cry given repeatedly. Several perched together in Feb, calling, bill clicking, and chasing. Observed being mobbed by a great kiskadee (*Pitangus sulphuratus*) and chased by an American kestrel (*Falco sparverius*).

***Buteo brachyurus**: Short-tailed Hawk**

NOTES. Seen in Oct, soaring over a forest clearing (MSF).

FAMILY RALLIDAE: RAILS

***Aramides saracura*: Slaty-breasted Wood-rail**

SPECIMENS (MVZ). ♂♂ Dec (1), Jan (1).

MASS (G). 536; 460 with light fat.

IRIS. Pale green.

BILL. Green or olive green, brighter basally. Mouth lining whitish gray.

FACIAL SKIN. Eye ring pink.

FEET AND TARSI. Reddish or purple.

GONADS. Testes enlarged (16×6 mm) in Dec; small (5×2 mm) in Jan.

MOLT. Body (Dec, Jan) and flight (Jan) feathers.

STOMACH CONTENTS. Insect remains in 1.

HABITAT. Along streams in mature forest, second-growth forest, and tall grass (to 2 m) at forest edge.

NOTES. Generally keeps under cover, although occasionally seen on forest trails; on the ground or perched in small trees at about 2 m. Observed in pairs separated by up to 10 m. Vocalizations include strident calls, grunts, and chucks; birds counter call with a low-pitched note when alarmed.

FAMILY CHARADRIIDAE: PLOVERS

***Vanellus chilensis*: Southern Lapwing**

SPECIMENS (USNM). ♀ Sep (1), adult skull.

MASS (G). 250, light fat.

IRIS. Red.

BILL. Light red to purple to black at tip.

FACIAL SKIN. Eye ring red.

FEET AND TARS. Black

GONADS. Largest ovum 4 mm diam.

MOLT. No.

STOMACH CONTENTS. Insects.

HABITAT. Pastures.

NOTES. Usually in pairs, occasionally in small groups. Conspicuous, loud, and aggressive; commonly dive-bomb intruders into their areas. Observed in Sep, Nov, Jan, Feb, Mar, and Jun. A breeding resident.

FAMILY SCOLOPACIDAE: SANDPIPERS

***Calidris subruficollis**: Buff-breasted Sandpiper**

NOTES. Observed (MSF) 19 August 1980, feeding in the drainage trough around the perimeter of a swimming pool; walked around and then flew to perch on the roof of an adjacent building. Myers and Myers (1979) observed small flocks of this migrant from North America in late Aug in the Paraguayan Chaco.

FAMILY COLUMBIDAE: PIGEONS

***Columba livia*: Rock Pigeon**

SPECIMENS (MNHNP). ♀ Jun (1), adult skull.

MASS (G). 345.

IRIS. Pale orange.

BILL. Black.

FACIAL SKIN. Around eye, pinkish tan. Operculum pale pink with black anteriorly.

FEET AND TARS. Deep pink.

GONADS. Ovary active, largest ovum 5 × 5 mm, orange.

MOLT. No.

CROP CONTENTS. Corn and other seeds.

NOTES. Introduced species. Specimen received from a local family that keeps pigeons; likely captive bred. Locality is 2.25 km NNE Hotel El Tirol on Ruta 6, Department of Itapúa.

***Patagioenas picazuro*: Picaazuro Pigeon**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Oct (1). Both with adult skulls.

MASS (G). 418 (Jan), 430 (Oct), neither with fat.

IRIS. Outer ring orange; inner ring blue.

BILL. Dull bluish gray or gray at base and tan at tip.

FACIAL SKIN. Nostril and skin around eye gray (Oct) or orbital skin anterior to eye and eye ring pinkish purple, and orbital skin above and below eye dull gray (Jan). Eye ring pinkish purple. Cere gray.

FEET AND TARS. Rosy red.

GONADS. Testes 15 × 7 (Jan) and 23 × 7 mm (Oct).

MOLT. Wing and body molt (Oct).

STOMACH AND CROP CONTENTS. Large seeds and fruits (Jan) or corn (Oct).

HABITAT. Mature forest, old second growth, second-growth scrub, and tung orchards.

NOTES. Most common large pigeon at El Tirol; seen and heard frequently. Distinguished from other pigeons when flying by their size and a characteristic bend in the neck. Birds usually perch or roost fairly high up in the subcanopy of the forest. Call a 4-note *whoo, who, who, whoo*. Active nests were located in Oct, Nov (2), and Mar (2) in forest and tung orchards. The nests consisted of a simple, loose assemblage of sticks 5–15 m up in the crotch of a tree (see de la Peña, 2010). One parent tended the nest while the other perched nearby. Postbreeding birds may form large flocks. Although present year-round, some winter birds may fly south to breed.

***Geotrygon violacea*: Violaceous Quail-dove**

SPECIMENS (MVZ). ♂ Feb (1), adult skull.

MASS (G). 100, light fat.

IRIS. Gold.

BILL. Red with purplish tinge. Mouth lining pink.

FACIAL SKIN. Flesh around eye purplish red.

FEET AND TARS. Red purple. Toe pads flesh color.

GONADS. Testes 4 × 2 mm.

MOLT. Body feathers.

STOMACH CONTENTS. Fruit.

HABITAT. Forest. Ground or low perches (≤ 2 m) in trees.

NOTES. Observed in Feb and Mar.

***Leptotila verreauxi*: White-tipped Dove**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), Mar (2), May (1), Jun (2), Sep (2). ♀♀ Feb (1, fledgling), Jun (1), Dec (1). Egg Oct (1). Jan, May, 1 Sep ♂, and Jun ♀ with windows covering 10%–50% of the skull. Other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 182.3 (SD = 17.3, range = 154–203, N = 8), with light fat in Mar, May, Jun, Sep. ♀ adult (Dec) 172 g, with light fat.

IRIS. Yellow, pale orange, or brown.

BILL. Black, blackish brown, brown, or dark purple.

FACIAL SKIN. Eyelid and skin around eye reddish pink or purple with some gray above the eye or, in 2 birds, blue gray or powder blue.

FEET AND Tarsi. Reddish, pinkish, or brownish purple or reddish gray. Toe pads sandy brown. Margins of toe and tarsal scutes whitish.

GONADS. ♂♂ Testes enlarged (11×8 – 15×6 mm) Mar through Jun, moderately enlarged (8×5 mm) in Sep, and small (3×1 mm) in Jan and Mar. One Sep ♂ with secretory crop. ♀♀ Largest ovum 6 mm diam, orange (Jun); nonreproductive (Dec).

MOLT. Body and flight feathers in Mar (1) and May. Body molt only in Jan, Mar, Jun, Sep, and Dec. Prejuvinal molt in Feb.

STOMACH AND CROP CONTENTS. Two each with fruit, fruit and corn, seeds, or seeds and grit; 1 with corn only.

HABITAT. Forest, forest edge, tung orchards, cultivated fields (corn).

NOTES. Common medium-size dove generally seen in small groups (1–4 individuals) or, in February and March, in postbreeding flocks (15–20 individuals). Perches 3–5 m up in trees, but often forages on the ground. Low-pitched 2-note call heard year-round. Skull pneumatization does not clearly indicate age, as large skull windows were present in some individuals that were obviously breeding. The timing of gonad enlargement and breeding activity suggests an extended reproductive period and an overlap of molt and breeding in some individuals. Nest with 1 egg located 1 Oct 1980; nest deserted 2 days later, still only 1 egg.

***Leptotila rufaxilla*: Gray-fronted Dove**

SPECIMENS (MVZ). ♂ Mar (1).

MASS (G). 195, light fat.

IRIS. Dark yellow.

BILL. Black.

FACIAL SKIN. Eyelid and skin around eye red purple.

FEET AND Tarsi. Deep red purple. Toe pads pinkish.

GONADS. Testes 7×3 mm.

MOLT. Body and flight feathers.

STOMACH CONTENTS. Fruits.

HABITAT. Netted in forest.

***Columbina talpacoti*: Ruddy Ground Dove**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Mar (1), Jun (1), Sep (2), Oct (2). ♀♀ Sep (3). Oct ♂♂ with skull windows. All other birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 50.4$ (SD = 3.07, range = 47.5–54.5, $N = 6$). ♀♀ $\bar{X} = 47.0$ (SD = 5.20, range = 44.0–53.0, $N = 3$). Light or moderate fat in some Sep (2 ♂♂, 1 ♀) and Oct (1 ♂) birds.

IRIS. Red, orange, or purplish white.

BILL. Upper mandible brown, gray brown, or brownish yellow. Lower mandible gray, brown, or brownish yellow. Mouth lining black.

FACIAL SKIN. Eye ring creamy white. Fleishy skin at base of bill brown.

FEET AND Tarsi. Pink or salmon color.

GONADS. ♂♂ Testes enlarged (9×5 – 11×5 mm) in Sep, Oct, Mar; smaller (4×1.5) in Jun. ♀♀ Largest ova 3.5 (white) to 11 (yellow orange) mm diam; bird with smallest ova with slightly enlarged oviduct.

MOLT. Light body molt in Oct (1).

STOMACH AND CROP CONTENTS. Six with seeds.

HABITAT. Open woods, tung orchard, scrubby abandoned pastures, along roads, cornfields.

NOTES. Common, walking on the ground or perched in trees (especially in living fence rows) from 2 to 12 m up. Usually in pairs or small groups. Birds flushed from nests on 4 Nov (1.3 m up in a bamboo thicket; 1 egg) and 15 Feb (2 white eggs; nest ~1.5 m up in a tree in a weedy field). A third bird was observed carrying a twig (nest material?) in late February. Gonad development along with the nest observations suggests a long breeding period. Hayes (2014) recorded nests of this species in every month from Oct to Feb.

***Columbina squammata*: Scaled Dove**

SPECIMENS (MVZ). ♀ Nov (1).

MASS (G). 52.

BILL. Grayish black.

FEET AND Tarsi. Pale pink. Toe pads pale.

GONADS. Laying, largest ovum 3 mm diam, 1 collapsed follicle.

MOLT. Scattered body.

CROP CONTENTS. Full of tiny seeds.

NOTES. Perched 4 m up in pasture tree.

***Columbina picui*: Picui Ground Dove**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Mar (1), Oct (1). ♀♀ Jan (2), Nov (1). Oct ♂ skull partially pneumatized. All other birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 47.7$ (SD = 4.51, range = 43.0–52.0, $N = 3$); light fat in Mar. ♀♀ $\bar{X} = 43.5$ (SD = 2.18, range = 42.0–46.0, $N = 3$).

IRIS. White, lavender, gray lavender, or blue.

BILL. Upper mandible black. Lower mandible black or black with pale base.

FACIAL SKIN. Eyelid buffy pink. Bare skin around eye purple pink. Operculum black.

FEET AND Tarsi. Reddish purple, including toe pads.

GONADS. ♂♂ Testes enlarged in all (10×4 – 12×5 mm). ♀♀ All with enlarged (2–6 mm) orange ova. Jan birds with early incubation patch or enlarged oviduct; 1 with mate.

MOLT. Jan (2) and Mar (1).

STOMACH AND CROP CONTENTS. All 6 with seeds.

HABITAT. Tung orchards, scrubby early second growth, abandoned pastures, along roads, clearings.

NOTES. Much less common than *C. talpacoti*, but seen or heard at least weekly in pairs or small groups. Forage on the ground and perch in trees to ~7 m. Call is a low-pitched, 3-note, aspirated whistle with the second note emphasized and rising greatly (NKJ). Two adults with a nestling observed in early Mar. Reported by de la Peña (2010) to breed year-round.

FAMILY CUCULIDAE: CUCKOOS

Guira guira: Guira Cuckoo

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Mar (1), Jun (2), Sep (1), Dec (1). ♀♀ Feb (1), Jun (2), Sep (1), Dec (1, juvenile).

MASS (G). ♂♂ $\bar{X} = 143$ (SD = 8.16, range = 134–152, $N = 5$). ♀♀ $\bar{X} = 142$ (SD = 13.66, range = 128–160, $N = 4$). Juvenal ♀ = 106. All Jun birds and 1 Sep bird with light to moderate fat.

IRIS. Pale orange or yellow.

BILL. Upper mandible reddish brown with orange tip and tomium, brownish yellow, or brown with a yellow tomium. Lower mandible dark yellow, orange, or orange with yellow sides at base.

FACIAL SKIN. Light green, yellow green, or pale yellow around eye. Body skin black.

FEET AND TARS. Greenish gray, pinkish brown with olive feet, or pinkish green with light brown toe pads and blue ankle joint.

GONADS. ♂♂ Testes enlarged (10 × 6–14 × 7 mm) in Sep, Dec, and Mar; moderately enlarged or small (7.5 × 1.5, 4 × 2 mm) in Jun. ♀♀ Largest ova 2 mm (Feb, Sep); ovary granular, largest ovum ≤ 1.0 mm (Jun); ovary tiny, undeveloped (Dec).

MOLT. Body and flight feather molt in Dec and Feb; light body molt in Sep. First prebasic molt in Dec.

STOMACH CONTENTS. Eight with arthropod remains, primarily Orthoptera (largest = 6 cm long) but also Coleoptera, other insects, and spiders.

HABITAT. Forest edge, tung orchard, scrubby abandoned fields, pasture, around buildings.

NOTES. Form loose flocks of 2–30 individuals; noisy, conspicuous, and appear clumsy as they move around and alight on branches. Generally in trees or bushes, but often forage on the ground; consequently, the breast, abdomen, and under surface of the tail are usually stained red with soil. Three-quarter grown nestling observed following an adult in February.

Crotophaga ani: Smooth-billed Ani

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 11: Jan (1), Mar (1), May (2, one with small skull windows), Jun (3, one with small skull windows), Sep (1), Oct (2, both nestlings), Nov (1). ♀♀ Jan (2, imm skulls), Feb (2), Jun (3, one with small skull windows), Oct (2, one a nestling).

MASS (G). ♂♂ $\bar{X} = 101.2$ (SD = 11.80, range = 87.0–119.8, $N = 9$). ♀♀ $\bar{X} = 89.1$ (SD = 12.00, range = 77.0–112, $N = 8$). All Jun and Sep birds with light to moderate fat. Nestlings = 55, 51 (♂♂), and 44 (♀♀).

IRIS. Black, dark brown, brown, or gray.

BILL. Black; ridge of culmen on upper mandible may be edged brown. Mouth lining black, grayish white, or slate gray blue.

FEET AND TARS. Black. Toe pads dark brown.

GONADS. ♂♂ Testes enlarged Nov through Mar (12 × 6–15 × 9 mm); regressing in May (8 × 3 mm); small in May, Jun (4.5 × 1.0–3 × 2 mm), and enlarging again in Sep (6 × 3 mm). ♀♀ Jan birds with enlarged ova (2.5–5.0 mm diam), collapsed follicles, and/or enlarged oviducts. Feb ♀ postbreeding with old incubation patch. Ovary granular, largest ovum ≤ 1.0 mm in Feb (1), Jun, and Oct.

MOLT. Body, wing, and tail feathers molting in Jan (3), Feb (2), Mar (1), May (2), Jun (2), Sep (1), and Oct (1), plus 3 Oct nestlings in prejuvenal molt.

STOMACH CONTENTS. Fourteen with insects remains, especially large orthopterans. Two Jun ♂♂ with fruit in stomach, and 1 Jun ♀ with insects and fruit.

PLUMAGE. Juvenal feathers being acquired by nestlings are lax and dull brownish or sooty black with little or no scaling on breast, back, or abdomen.

NOTES. Molt-breeding overlap present in several birds (i.e., body and flight feather molt with testis 9 × 15 mm or ovary with 5-mm ovum, 2 collapsed follicles, and enlarged oviduct). Perhaps the presence of helpers at the nest (Davis, 1940) allows these 2 energy-consuming activities to coincide. The molting period for the species is clearly long. We do not know whether it is also long in individuals. Birds found in flocks in orchards, cultivated fields, and abandoned pastures. Groups of 2–5 adults common in Oct through Feb; probably breeding units. Larger flocks of 10–25 more common in Feb to Oct. Active nest with 3 nestlings located on 13 Oct, 2 m up in an orange tree (*Citrus* sp., Rutaceae). Adults with fledglings and partly grown juveniles encountered in Nov, Jan, and Feb. Plumage of many birds has an unpleasant odor.

Tapera naevia: Striped Cuckoo

SPECIMENS (USNM, MNHNP). ♂ Aug (1), adult skull. ♀ Jun (1), skull not pneumatized.

MASS (G). ♂ 54.0. ♀ 47.8, moderate fat.

IRIS. Yellow or light brown.

BILL. Upper mandible black or gray with a black culmen. Lower mandible gray.

FACIAL SKIN. Unfeathered region around eye, blue gray.

FEET AND TARS. Gray.

GONADS. ♂ Testes 4 × 2.5 mm. ♀ Ovary granular, ova minute.

MOLT. Light body molt (Aug).

STOMACH CONTENTS. Insect remains.

HABITAT. Scrubby abandoned fields, pastures, cornfields.

NOTES. Moves around in low shrubs and bushes, usually ≤ 3 m but has been noted calling 5 to 6 m up in the dead limbs of isolated trees. Call a 2-note whistle (NKJ). Registered only 4 times. Male has a distinct, unpleasant odor, especially in the area of the uropygial gland.

***Dromococcyx phasianellus**: Pheasant Cuckoo**

NOTES. Observed once (MSF) in Oct, during the day, climbing around on a moderately large, recently fallen tree in an orchard. Not recorded from the Alto Paraná region by Hayes (1995), but Esquivel M. et al. (2007) found it in San Rafael National Park.

***Piaya cayana*: Squirrel Cuckoo**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), Mar (1), May (1), Jun (2). Jun birds with skull windows; all other ♂♂ with adult skulls. ♀♀ Jan (1), Feb (1), Jun (3), Sep (2). Jan and Feb birds with immature skulls; others with adult skulls.

MASS (G). ♂♂ \bar{X} = 132 (SD = 16.08, range = 113–150, N = 5). ♀♀ \bar{X} = 123.9 g (SD = 15.97, range = 109–153, N = 7). Five birds (Feb, 1; Jun, 4) with light to heavy body fat.

IRIS. Red or reddish brown. Fleishy eye ring and bare skin around eye red, except gray patch below eye.

BILL. Yellow, yellow green, or pale green with yellow tomium. Gape gray or black. Mouth lining red purple or black.

FACIAL SKIN. Fleishy eye ring, eyelid, and bare skin around eye red or purplish pink, except for a gray patch below the eye.

FEET AND TARS. Gray, blue gray, or blue green. Toe pads yellow, yellow orange, or tan.

GONADS. ♂♂ Testes small (3 × 1–5 × 3 mm) Feb through Jun. ♀♀ Largest ovum 2 × 2 mm or shelled egg in oviduct in Sep. Ovaries smooth and undeveloped in Jan and Jun; 1 ovary granular in Jun.

MOLT. Body and flight feather molt in Feb (1), Mar (1), and May (1). Body feather only molt in Jan (1) and Jun (1). One bird with heavy tail molt observed in Nov.

STOMACH CONTENTS. Eight with insect remains, especially large orthopterans, caterpillars, and 1 praying mantis (60 mm long); 1 stomach with 2 snail shells also. Three Jun individuals with fruit and insect remains; the fruit in 1 = figs (*Ficus* sp., Moraceae).

HABITAT. Primarily in old forest but also found in second growth and in thickets in scrubby abandoned fields.

NOTES. Usually in small groups of 2–4 individuals perched in uppermost quarter of the crown of tall trees but also as low as 1 m up in shrubs. Forage in trees but will swoop to the ground to recover a large insect. Call sounds like a creaky door opening slowly or a rusty spring uncoiling. Birds also make a lot of cackling or squabbling sounds. Twice (Nov, May) small birds were observed mobbing cuckoos, suggesting that the cuckoos eat eggs and/or nestlings of other species.

***Coccyzus melacoryphus*: Dark-billed Cuckoo**

SPECIMENS (USNM, MVZ). ♂♂ Feb (2), Nov (2), Dec (1). ♀ Dec (1). Sex? Dec (1). One Feb and 1 Nov bird with skull windows. Other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 47.0 (SD = 2.16, range = 44.2–50.0, N = 5). ♀ = 64.3.

IRIS. Brown, dark brown, or black.

BILL. Upper mandible black. Lower mandible black with flesh color at base. Mouth lining black in 1 adult ♂ (Nov), white in immature ♂ (Feb); not recorded for other birds.

FACIAL SKIN. Eye ring black. Eyelids yellow green or yellow buff. Bare skin around eyes (especially below and behind) blue gray.

FEET AND TARS. Gray, olive gray, or gray blue. Toe pads reddish brown or light green.

GONADS. ♂♂ Testes moderately large (6 × 4–8 × 4 mm) in Nov–Dec; small (1.5 × 1 mm) in Feb. One Nov ♂ with well-developed brood patch. ♀ Laying, ovary with 2 collapsed follicles, shelled egg in oviduct, and incubation patch.

MOLT. Body and flight feather molt (Feb immature). Body molt in mated pair (Dec), ♂ light and ♀ heavy.

STOMACH CONTENTS. Six with insect remains, including grasshoppers, cicadas, and caterpillars.

HABITAT. Forest edge in dense vegetation, i.e., viny bamboo (*Chusquea* sp.) tangles, dense shrubs (e.g., *Baccharis* sp., Asteraceae).

NOTES. Reproduction and molt overlap in some specimens (e.g., Dec ♀ with heavy body molt was also laying). Bird observed twice on 20 Jan carrying food to presumed nest. The species, although uncommon, obviously breeds at El Tirol. The absence of sightings during the austral winter is consistent with it migrating and wintering to the north during that period (cf. Hayes et al., 1994). Sex-unknown specimen in mist net partially eaten by predator.

***Coccyzus americanus*: Yellow-billed Cuckoo**

SPECIMENS (MVZ). ♀♀ Jan (2), Mar (2). One Mar bird with adult skull; all others with small skull windows.

MASS (G). \bar{X} = 60.8 (SD = 3.01, range = 58.0–63.5, N = 4). One Jan bird with some fat.

IRIS. Dark brown.

BILL. Upper mandible black with yellow-orange sides near tomium and base. Lower mandible orange yellow with black tip. Tongue gray with black tip. Palate pale greenish yellow with slight black suffusion.

FACIAL SKIN. Eye ring yellow or yellow orange. Eyelids bright orange. Orbital skin below eye gray or blue gray.

FEET AND TARS. Gray, lead gray, or blue gray. Toe pads sandy olive, sandy brown, greenish tan, or blue gray.

GONADS. One Jan bird with undeveloped ovary. Other birds, ovary postreproductive.

MOLT. General body and flight feather molt in Jan and 1 Mar specimen. Body molt only in the other Mar specimen.

STOMACH CONTENTS. Insect remains in 3 birds (spiny caterpillars or grasshoppers). One Mar bird with large green fruits.

HABITAT. Forest canopy, forest edge, tung orchard.

NOTES. Migrant from North America and the Caribbean. For a discussion of molt in this species, including consideration of these Paraguay specimens, see Rohwer and Broms (2013). One Jan bird observed swallowing a lizard.

FAMILY STRIGIDAE: OWLS

Megascops choliba: Tropical Screech-owl

SPECIMENS (USNM, MVZ). ♂♂ Sep (1), Oct (1). ♀♀ Feb (1), Oct (1). Sex? Aug (1).

MASS (G). ♂♂ 114, 104, respectively. ♀♀ 140, with light fat, and 147, respectively.

IRIS. Yellow.

BILL. Creamy white, gray green, or greenish yellow.

FEET. Gray, pale green, or greenish gray. Toe pads lighter.

GONADS. ♂♂ Testes enlarged in Sep (14 × 8 mm) and Oct (10.5 × 8 mm). ♀♀ Laying in Oct: largest yolked ova 4, 4, 6, and 11 mm diam; 2 collapsed follicles; shelled egg in oviduct = 30 mm greatest width, 10 g, all white. Feb bird, largest ovum = 1.5 mm diam.

MOLT. Body and wing in Feb.

STOMACH CONTENTS. Three with insect remains, including orthopterans and a 5.5-cm-long caterpillar.

HABITAT. Mature forest, tall second-growth forest, woodland, and secondary scrub or pastures.

NOTES. Species common; birds regularly call at dusk and at night, at least from Aug through Jan. Perch 3–6 m up in trees or on fence posts. Males are spaced out as if on territories. Gonadal development in accordance with Hayes's (2014) record of 4 nests of this species in October in Sapucaí (Figure 1). Birds appear to be sexually dimorphic, with females considerably heavier than males. Aug specimen eaten in a mist net; wings and tail saved. Eye socket of Oct male contained many nematodes.

Glaucidium brasilianum: Ferruginous Pygmy-owl

SPECIMENS (USNM, MVZ). ♀♀ May (1), Oct (1), adult skulls.

MASS (G). 77.0, 85.0, moderate and light fat, respectively.

IRIS. Bright yellow.

BILL. Yellow or pale greenish yellow.

FACIAL SKIN. Cere yellow.

FEET. Yellow or pale greenish yellow.

GONADS. Oct ovary with 8-, 13-, and 15-mm-diam yolked ova; oviduct greatly enlarged. May ovary granular.

MOLT. Body molt, May.

STOMACH CONTENTS. Both with insect remains; Oct bird also containing mammal hair.

HABITAT. Forest, tall second growth, open second-growth scrub, woodland.

NOTES. Calls steadily in the morning from as early as 3:00 am to ~10:00 am, at dusk, and in the evening, at least from Sep through Mar. Calls less on very cold nights. Call is a repeated *wee wee wee* with no apparent frequency modulation; whistle-like. Species is common, but birds appear to occupy specific, widely spaced areas. May bird attempted to grab a *Trichothraupis melanops* from a mist net.

Athene cunicularia: Burrowing Owl

SPECIMENS (MNHN). ♂♂ Jun (2). ♀ Jun (1).

MASS (G). ♂♂ 169, 179, with heavy and moderate fat, respectively. ♀ 162.5, fat.

IRIS. Bright lemon yellow.

BILL. Yellowish green or yellowish gray.

FACIAL SKIN. Cere gray.

FEET. Olive green or gray.

GONADS. ♂♂ Testes 4.5 × 2.5 and 4 × 2 mm. ♀ Ovary granular.

MOLT. One ♂ with a trace of body molt.

STOMACH CONTENTS. Two with insect remains; 1 with small-mammal hair and bones.

NOTES. Part of a group of 6 individuals standing on the ground in scrubby pasture. One burrow noted (CC). Red dirt on feet and abdominal feathers. Groups seen occasionally standing around on the ground in active or abandoned pastures.

Aegolius harrisii: Buff-fronted Owl

SPECIMENS (USNM). ♂ Aug (1), adult skull.

MASS (G). 123, light fat.

IRIS. Greenish yellow.

BILL. Blackish, culmen gray.

FEET. Tan.

FACIAL SKIN. Cere pale yellow.

GONADS. Testes 4 × 2 mm, 1 dark green, 1 orange.

MOLT. No.

STOMACH CONTENTS. Hair; fragment of mammal bone.

NOTES. Only individual encountered. In mature forest, perched about 3 m up in a small tree. Many subdermal nematodes on skull.

FAMILY NYCTIBIIDAE: POTOOS

Nyctibius griseus: Common Potoo

SPECIMENS (USNM, MVZ). ♂♂ Oct (2). ♀ Oct (1). All with completely pneumatized skulls.

MASS (G). ♂♂ 186, 177. ♀ 204.

IRIS. Yellow.

BILL. Upper mandible black; lower mandible black or black with gray at the base. Mouth lining pink.

FEET. Brown or tan.

GONADS. ♂♂ Testes 10 × 9 mm, 10 × 8 mm. ♀ largest ovum 25 mm diam, yolked, and two 3.5 mm diam, unyolked. Oviduct greatly enlarged.

MOLT. ♀ With body molt.

STOMACH CONTENTS. Insect remains in all birds, plus grit in 1.

HABITAT. Forest openings.

NOTES. One male (prepared as skeleton) with very dark phase plumage. Calling regularly through the month of Oct, and occasionally seen at night flying across clearings near the hotel.

FAMILY APRIMULGIDAE: NIGHTJARS

***Nyctidromus albicollis*: Common Pauraque**

SPECIMENS (MVZ). ♂♂ Jan (1), adult skull; Mar (1) skull not pneumatized. ♀♀ Jan (2), both with immature skulls.

MASS (G). ♂♂ 80.0, 78.0. ♀♀ 62.1, 69.0.

IRIS. Brown.

BILL. Mouth lining pinkish flesh color.

FEET AND TARS. Brown or light brown. Toe pads light brown.

GONADS. ♂♂ Testes 3 × 5 mm (Jan), 4 × 2 mm (Mar). ♀♀ Ovaries immature.

MOLT. All birds molting; ♀♀ with downy underparts.

STOMACH CONTENTS. All with insect remains, including beetle elytra.

HABITAT. Forest opening; forest with cleared understory vegetation.

NOTES. Red dirt on underparts and/or underside of tail.

***Setopagis parvula*: Little Nightjar**

SPECIMENS (USNM, MVZ). ♂♂ Sep (1), Oct (1), Dec (1). ♀♀ Jan (2), Sep (1), Oct (1). All except Dec ♂ with adult skulls.

MASS (G). ♂♂ \bar{X} = 40.0 (SD = 1.80, range = 38.0–41.5, N = 3); Sep and Dec specimens with moderate and light fat, respectively. ♀♀ \bar{X} = 40.7 (SD = 4.71, range = 37.2–45.5, N = 3); Sep ♀ not included in mean, specimen = 51 g, with moderate fat and fully shelled egg in oviduct.

IRIS. Reddish brown, brown, or black. Eye shine red or yellow.

BILL. Black.

FEET. Gray, brown, or tan.

GONADS. ♂♂ Testes enlarged (12 × 5–15 × 7 mm) Sep through Dec. ♀♀ Breeding in Sep (largest ovum 11 mm diam, orange; all white shelled egg, 25 × 19 mm, in oviduct) and Oct (largest ovum 7 mm, yellow orange, oviduct enlarged). Jan birds with smooth or postbreeding ovaries.

MOLT. Both Jan birds.

STOMACH CONTENTS. All specimens filled with insect remains, especially scarabs.

HABITAT. Scrubby pasture, forest edge.

NOTES. On the ground or perched in small trees. Sep ♂ and ♀ a mated pair. Oct ♂ calling regularly from a stump in scrubby pasture while ♀ rested on the ground nearby. Both males tape-recorded (MSF). Vocalizations a smooth “bubbling” or “gurgling” sound, suggestive of an extraterrestrial communication. Some birds with red dirt on the abdomen, underside of tail, under tail coverts, and throat.

***Hydropsalis torquata*: Scissor-tailed Nightjar**

SPECIMENS (MVZ). ♀ Sep (1), adult skull.

MASS (G). 63, light fat.

BILL. Brown

FEET AND TARS. Brown

GONADS. Largest ovum 3 mm.

MOLT. Yes.

STOMACH CONTENTS. Insect remains.

HABITAT. Tall grassland with scattered trees and shrubs.

***Antrostomus rufus*: Rufus Nightjar**

SPECIMENS (MVZ). ♀ Nov (1). Broken egg shell, Nov (1).

MASS (G). 99, some abdominal fat.

BILL. Dull purplish brown with black tip and black culmen. Mouth lining pale greenish gray.

FEET. Toes pale brown at base, darker brown toward tips. Toe pads and unfeathered rear edge of tarsi sandy brown.

GONADS. Ova small; 2 collapsed follicles.

MOLT. No.

STOMACH. Jammed with insect parts.

NOTES. Flushed at noon from a bare spot on the ground in forest edge near a weed field. Bird flew about 6 m and performed a distraction display, fluttering along on the ground. Broken egg shell on the ground, cream-colored background with irregular light brown markings. Nestling not located.

FAMILY APODIDAE: SWIFTS

***Chaetura cinereiventris*: Gray-rumped Swift**

SPECIMENS (MVZ). ♂ Jan (1), large skull windows.

MASS (G). 15.1.

IRIS. Dark brown.

BILL. Black.

FEET. Black

GONADS. Testes 2 × 1 mm.

MOLT. No.

STOMACH CONTENTS. Packed with tiny insects.

NOTES. Regularly observed, along with *Progne cha-lybea*, feeding (even during heavy rains) over the hotel, clearings, cornfields, and forest in groups of 2–15 from Nov through Mar.

May be present year-round. Observed 1–5 individuals entering various hotel chimneys on different occasions in Nov, Feb, and Mar.

FAMILY TROCHILIDAE: HUMMINGBIRDS

Phaethornis eurynome: Scale-throated Hermit

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ May (1), Jun (2), Aug (1), Sep (1), Oct (1), Dec (2). ♀♀ Jun (3), Sep (2), Oct (3), Nov (1), Dec (1).

MASS (G). ♂♂ \bar{X} = 4.2 (SD = 0.23, range = 4.0–4.6, N = 8); 1 Jun bird with moderate fat. ♀♀ \bar{X} = 3.8 (SD = 0.31, range = 3.2–4.2, N = 10); 1 Jun bird with slight fat.

IRIS. Brown or black.

BILL. Upper mandible black; lower mandible black with yellow-orange or yellow base or yellow or yellow orange with black tip.

FEET. Various described as black, gray, pinkish gray, or reddish pink.

GONADS. ♂♂ Testes 2.5×2 mm (Sep); all other males testes $\leq 2 \times 1$ mm. ♀♀ Ovary granular with ova ≤ 1 mm in all except 1 Jun bird in which the ovary was smooth and undeveloped. Brood patch present (Nov) in 1 ♀ with ova ≤ 0.5 mm.

MOLT. Three Dec birds molting, and light scattered body molt in May ♂.

STOMACH CONTENTS. Jun ♀♀, 1 with insect remains. Birds visit the red flowers of *Malvaviscus* sp. (Malvaceae; possibly *M. penduliflorus*), which is used widely in ornamental plantings around the hotel and in the region and appears to bloom over most of the year. They also visit the flowers of an ornamental *Fuchsia* sp. (Onagraceae). If the corolla tube of the latter species is particularly long, the birds may pierce the middle of the corolla just above the nectaries and “steal” the nectar (RMZ).

HABITAT. Forest understory as well as ornamental plantings in open areas around buildings.

NOTES. Nest with 2 young located in early February. On 11 Mar, two-thirds grown nestlings found dead (from exposure?) after several days of heavy rain. Moderately common.

Stephanoxis lalandi: Green-crowned Plovercrest

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 11: Jan (2), Feb (2), Jun (2), Sep (1), Oct (3), Dec (1). ♀♀ 11: May (2), Sep (1), Oct (3), Nov (2), Dec (3).

MASS (G). ♂♂ \bar{X} = 3.4 (SD = 0.52, range = 2.6–4.5, N = 11; fat present in 1 Jan and 1 Feb bird. ♀♀ \bar{X} = 2.8 (SD = 0.27, range = 2.5–3.25, N = 11).

IRIS. Brown.

BILL. Black.

FEET. ♂♂ Black, brownish black, or brown; toe pads light green. ♀♀ Pink, pinkish gray, gray, or yellow.

GONADS. ♂♂ Testes enlarged (3×1.5 – 3×2 mm) in 1 Jan, 1 Feb, and 3 Oct birds. One Oct bird with well-developed brood patch. ♀♀ One Oct bird with yellow ova 1.5 mm diam and an enlarged oviduct. All other females, ovary granular or ova ≤ 1 mm except for 2 Nov birds in which the ovary is tiny and undeveloped.

MOLT. Present in some birds in Nov, Dec, Jan, and Feb.

STOMACH CONTENTS. One Feb ♂ with insect remains. Birds were observed feeding at flowers of various forest shrubs and epiphytes, including *Tillandsia stricta* (Bromeliaceae), *Calliandra foliolosa* (Fabaceae), *Ruellia angustifolia* (Acanthaceae), *Manettia luteorubra* (Rubiaceae), *Faramea cyanea* (Rubiaceae), and *Malvaviscus* sp.

HABITAT. Primarily forest, forest openings. Seen in disturbed areas and scrubby second growth in the nonbreeding season.

NOTES. Moderately common in forest. Males observed primarily at leks in mature forest. The lek areas were bowl shaped, surrounded by mature forest, open to the sun above, and with dense, tangled vegetation below. Two leks first located in 1976 and occupied every year through 1983 consisted of 3 males each. Each male had his own court, 6 to 10 m in diam and separated by 5 to 10 m. Within their courts, males had 3 or 4 favorite perches, i.e., bare branches or vines in the open, 2 to 6 m up, and ≤ 1 cm diam, which they used during the day. They defended the perches vigorously against other males with displays, distinct calls (sharp trill or buzz), and rapid chases. Males called from the perches throughout the day with only brief absences (2–3 min), presumably to feed. The call is high and squeaky and consists of several notes. It is repeated at a rapid rate (1 male gave 84 calls in 1 min). Calling males perch nearly erect, with the head/bill pointing upward at $\sim 40^\circ$ from horizontal, the posterior long plume feather pointing upward (but backward) at the same angle, and the purple crest elevated between them about 70° from the posterior horizontal. Males were active at the leks at least from Aug through Dec. These observations are generally consistent with those of Pizo (2012) at leks of this species in Brazil.

Thalurania furcata: Fork-tailed Woodnymph

SPECIMENS (MNHNP). ♂♂ Jun (5); ♀♀ Jun (2).

MASS (G). ♂♂ \bar{X} = 5.0 (SD = 0.19, range = 4.8–5.3, N = 5). ♀♀ 4.3, 4.8. Three ♂♂ and 1 ♀ with slight to moderate fat.

IRIS. Brown or black.

BILL. Black.

FEET. Brown, black, or pink.

GONADS. ♂♂ Testes 0.5×0.5 – 1.0×1.0 mm. ♀♀ Ovary smooth or ovary granular.

MOLT. One ♀ with a trace of body molt.

STOMACH CONTENTS. Three ♂♂ with insect remains; 2 feeding at *Malvaviscus* sp. flowers.

HABITAT. Old forest.

NOTES. Birds nonreproductive. Hummingbirds of various species regularly feed at ornamental plantings of *Malvaviscus* sp., which are common at El Tirol and flower most of the year. The absence of observations of this species outside of Jun suggests that it breeds elsewhere and may move around to exploit local food sources during the winter.

***Amazilia versicolor*: Versicolored Emerald**

SPECIMENS (USNM, MVZ). ♂♂ Sep (3), Oct (2). ♀♀ Feb (1), Sep (1), Oct (1). Sex? Sep (1), Oct (1).

MASS (G). ♂♂ \bar{X} = 3.5 (SD = 0.29, range = 3.25–4.0, N = 5). ♀♀ \bar{X} = 3.1 (SD = 0.19, range = 2.9–3.25, N = 3), Feb ♀ with light fat. Sex? 3.5, 3.25.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible, basal half red or pink red, distal half black. Mouth lining yellow green.

FEET. Black. Toe pads light green.

GONADS. ♂♂ Testes 2.5 × 1.75–3.0 × 2.5 mm (Sep, Oct). ♀♀ Ovary smooth, undeveloped (Feb, Sep); ovary granular, ova ≤ 1 mm (Oct), with moderately enlarged oviduct.

MOLT. Feb ♀ with body and wing molt.

STOMACH CONTENTS. Feb ♀ with insect remains.

NOTES. Observed various times feeding from flowers of ornamental plantings of *Malvaviscus* sp. and at other red flowers in the forest. Solitary males occupy areas (territories?) in late second-growth forest. Areas contain favorite bare open branches (~1.5–3 m up) from which males call nearly nonstop over periods of weeks.

***Hylocharis chrysura*: Gilded Hummingbird**

SPECIMENS (USNM, MVZ). ♂ Sep (1). ♀♀ Oct (1), Dec (1).

MASS (G). ♂ 4.7, moderate fat. ♀♀ 4.0, 4.0.

IRIS. Brown.

BILL. Proximal 60% pinkish red, distal 40% black.

FEET. Black.

GONADS. ♂ Testes 4 × 2 mm. ♀♀ Ova ≤ 0.5 mm (Oct); ovary tiny (Dec).

MOLT. Sep ♂ molting.

NOTES. Observed feeding from flowers of *Ruellia angustifolia* and *Malvaviscus* sp. The fact that observations of this hummingbird species feeding at *Malvaviscus* sp. flowers were confined to the spring/summer season suggests that it may be migratory, wintering elsewhere.

FAMILY TROGONIDAE: TROGONS

***Trogon surrucura*: Surucua Trogon**

SPECIMENS (MVZ, MNHNP). ♂♂ Feb (2), Mar (1), Jun (1), Aug (1). ♀ Jun (1).

MASS (G). ♂♂ \bar{X} = 68.2 (SD = 3.27, range = 64.5–72.5, N = 5). ♀ mass on specimen label and in catalog = 168.5; likely a recording error.

IRIS. Brown.

BILL. Gray, grayish green, grayish white, or greenish white. Mouth lining flesh color with blue in some areas.

FACIAL SKIN. ♂♂ Eye ring and lid orange; naked skin below eye dirty white. ♀ Eye ring white.

FEET AND TARS. Gray, blackish gray, black, or dark blue gray to slate. Toe pads light green or tan white.

GONADS. ♂♂ Testes moderately enlarged (7 × 4 mm) in Aug; small (2 × 1–4 × 2 mm) Feb to Jun. ♀ Ovary granular, ova ≤ 1 mm.

MOLT. Extensive molt of body and flight feathers in Feb, Mar.

STOMACH CONTENTS. Insect remains, including beetles and caterpillars, in 1; fruit and insects in 3; only fruit in 2.

HABITAT. Forest, old second growth.

NOTES. Calling at least in Oct through Mar and Jun from perches 5–13 m up in open trees with little foliage or on horizontal vines. Call is a single note repeated many times in rapid succession; calling bouts may be long, up to 45 min, with brief pauses. Likely breeds from Aug through Jan/Feb. One nest located 21 Sep ~4 m up in the top of a dead snag. Also nests in tree cavities (de la Peña, 2010).

***Trogon rufus*: Black-throated Trogon**

SPECIMENS (MVZ). ♂♂ Mar (1), Sep (1). ♀ Mar (1).

MASS (G). ♂♂ 57, 59. ♀ 55.5.

IRIS. Brown.

BILL. ♂♂ Greenish yellow. Mouth lining light green. ♀ Bill as in males but with black at base and dorsally on upper mandible.

FACIAL SKIN. Eye ring blue; eyelid bluish purple.

FEET AND TARS. Gray, green, or pinkish green. Toe pads tan.

GONADS. ♂♂ Testes 2 × 1 (Mar) and 5 × 4 (Sep) mm. ♀ Largest ova ≤ 1 mm.

MOLT. All birds with body molt; Mar birds also molting primaries.

STOMACH CONTENTS. Insects in 3, including Orthoptera, Coleoptera, and one 70-mm-long grub.

HABITAT. Forest.

NOTES. Call shorter than that of *T. surrucura*. Two Mar birds likely a mated pair.

FAMILY ALCEDINIDAE: KINGFISHERS

***Megaceryle torquata**: Ringed Kingfisher**

NOTES. Heard calling near a scrubby abandoned clearing in Jan and seen flying over a pasture in Oct (NKJ).

FAMILY MOMOTIDAE: MOTMOTS

Baryphthengus ruficapillus: Rufous-capped Motmot

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Sep (1), Nov (1), Dec (1). ♀♀ Jan (1), Sep (1), Oct (1), Dec (2). All except 1 Dec female with adult skulls.

MASS (G). ♂♂ \bar{X} = 134.7 (SD = 2.52, range = 132–137, N = 3). ♀♀ \bar{X} = 128.0 (SD = 6.27, range = 121–136, N = 4).

IRIS. Brick red or brown.

BILL. Black.

FEET AND TARS. Gray or grayish brown.

GONADS. ♂♂ Testes 8 × 4, dark gray (Sep); 6 × 2, dark green (Dec); and 2 × 1 mm (Nov), with incubation patch. ♀♀ Sep ovary granular; breeding in Oct: largest ovum 4 mm diam, yellow orange, oviduct enlarging, brood patch developing. Jan ovary inactive. Ovary undeveloped in Dec immature.

MOLT. Nov, Dec, and Jan birds with body and flight feather molt. Central rectrices continue growing after the molt of all other feathers is completed.

STOMACH CONTENTS. Six with insect (beetle, grasshopper) remains; 1 with fruit and insects.

HABITAT. Forest.

NOTES. Motmots perched low in the forest understory from 2 to 5 m up (most commonly 2–3 m). The birds were usually observed singly, often on a favorite perch that they used repeatedly. Their call was a resonant, hollow hoot given 5 or 6 times. Occasionally, a bird gave a “long call” in which the hoot was repeated 15 to 20 times. The birds frequently called antiphonally, especially in the morning, with bouts lasting for 10 min or more. This may be intrapair communication. Occasionally, 3 birds called antiphonally. One individual was observed with a snake (30–40 cm long × 1–1.5 cm in girth) in its bill. The bird changed perches a few times and then flew off with the snake.

FAMILY BUCCONIDAE: PUFFBIRDS

Nystalus chacuru: White-eared Puffbird

SPECIMENS (MVZ). ♂ Jun (1), adult skull.

MASS (G). 61, moderate fat.

IRIS. Brown.

BILL. Upper and lower mandibles orange with black tip.

FEET AND TARS. Gray green.

GONADS. Testes 4 × 1.5 mm.

MOLT. No.

STOMACH CONTENTS. Full of insect parts.

HABITAT. Scrubby abandoned field.

Nonnula rubecula: Rusty-breasted Nunlet

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Oct (1), Nov (1). ♀♀ Jun (1), Oct (1), Nov (2). All birds with adult skulls.

MASS (G). ♂♂ 19.3 (SD = 1.35, range = 18.0–20.7, N = 3). ♀♀ 19 (SD = 1.38, range = 17.25–20.6, N = 4), Jun ♀ with moderate fat.

IRIS. Brown.

BILL. Upper mandible black; lower mandible gray with black tip or basal half dull olive with distal half dull black. Base of tongue blue gray, tip glossy black. Mouth lining black or pinkish gray.

FACIAL SKIN. Bare patch below eye bluish gray.

FEET AND TARS. Gray.

GONADS. ♂♂ Testes 2 mm (Jan), 4 × 2 mm (Oct). ♀♀ Ova ≤ 1 mm (Jun, Nov); 1.5 mm diam (Oct); largest ovum 8 mm, orange (Nov), plus oviduct greatly enlarged, incubation patch present.

MOLT. Body molt in a Jan and a Nov bird; tail molt in a Nov bird.

STOMACH CONTENTS. Six with insect (including grasshopper) remains.

HABITAT. Forest, forest edge, orchard.

NOTES. Male and female collected together in October and in Nov. Perch 2–8 m up in saplings, vines, and large trees. Make fly-catching sallies of ~1 m out from bare branches 2–3 cm in diam, returning to the perch to eat the insect.

FAMILY RAMPHASTIDAE: TOUCANS

*Ramphastos toco**: Toco Toucan

NOTES. One individual observed in old second-growth forest in Oct 1980 (MSF).

*Ramphastos dicolorus**: Red-breasted Toucan

NOTES. Several birds, including a pair at a nest hole in a large tree, observed several times in Dec 1977 (MSF).

Pteroglossus castanotis: Chestnut-eared Araçari

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), Feb (1), Jun (1), Dec (1). ♀♀ Mar (1), May (1), Jun (1), Dec (1). Jan ♂ with immature skull.

MASS (G). ♂♂ \bar{X} = 263.5 (SD = 19.67, range = 249–292, N = 4). ♀♀ \bar{X} = 251.9 (SD = 24.17, range = 232–283.5, N = 4). Heaviest ♀ (Jun) very fat.

IRIS. White, creamy white, or greenish or yellowish white.

BILL. Narrow yellow band outlining the base of the bill, laterally and ventrally. Patches of reddish mahogany about basal band distally on sides of bill. Upper mandible yellow with a wide black patch extending from the base of the bill and narrowing to a point about two-thirds down the length of the culmen; tomial margin irregularly “notched” distally in adults with alternating splotches of black and yellow. Lower mandible black or dark brown with yellow-green spot distally. Size and extent of color

patches variable; colors duller in immatures. Mouth lining dark green or bright orange.

FACIAL SKIN. Bare skin around eye black. Bare skin farther out above and/or posterior to eye sky blue or turquoise with purple tinge.

FEET AND TARSI. Olive green, green, or yellowish gray; ankle blue. Toe pads tan, olive brown, to yellow green.

GONADS. ♂♂ Testes enlarged (19×8 mm) in Dec; moderately enlarged (4×2 – 8×4 mm) in Jan, Feb, Jun. ♀♀ Ovaries granular or inactive in all.

MOLT. Body and flight feather molt in Dec, Feb, and Mar. First prebasic molt in immature Jan ♂ of body feathers only.

STOMACH CONTENTS. All birds with fruit in stomach, often 2 or 3 species present. One stomach also contained 2 spiders.

HABITAT. Forest, forest edge, mature second growth, second-growth scrub.

NOTES. Usually in groups of 2–6 (occasionally alone) in forest, although they will venture into scrub if there is a tree in fruit. Perches 10–15 m up in large trees; vocal and noisy. One Nov bird observed inspecting a tree cavity ~10 m up in a tree trunk, perhaps for a nest. Juvenile accompanying an adult in Jan.

FAMILY PICIDAE: WOODPECKERS

Picumnus temminckii: Ochre-collared Piculet

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 14: Jan (2), Feb (2), May (1), Jun (1), Aug (1), Sep (3); Oct (3), Dec (1). ♀♀ Feb (1), Sep (2), Oct (2), Nov (2), Dec (1). Sex? Feb (1). Of 19 specimens with data, 3 are labeled as having an adult skull, 3 as having a juvenal skull, and 13 as having partially pneumatized skulls. Pneumatization likely takes 2 or more years to complete, making stage of pneumatization unreliable for aging in this species.

MASS (G). ♂♂ $\bar{X} = 10.4$ (SD = 1.0, range = 8.2–11.7, $N = 14$). ♀♀ $\bar{X} = 10.8$ (SD = 0.89, range = 9.9–12.6, $N = 8$). Sex? = 10.5. One Sep bird with light fat; 1 Nov bird with some fat.

IRIS. Brown or dark brown.

BILL. Upper mandible black or dark gray. Lower mandible black or gray or blue gray with a black tip. Mouth lining yellow to yellow green. Oct juvenile, bill yellow with blackish area at base of upper mandible.

FEET AND TARSI. Gray, blue gray, olive gray, or black. Toe pads tan.

GONADS. ♂♂ Testes were moderately developed (3×2 – 5 mm long) in May, Aug, Sep, Oct, and Jan. Minimally developed (1×0.5 – 3×2 mm) in Jan, Feb, Jun, Oct, and Dec. Testes in Aug, Sep, and Oct were sometimes gray or black. One late Dec ♂ with a refeathering incubation patch. ♀♀ One Oct female had a 3-mm-diam yellow-orange ovum. All other females with undeveloped or granular ovaries with largest ova ≤ 1 mm.

MOLT. Molting birds were collected in Jan, Feb, Aug, Sep, and Dec. One bird in prejuvenal molt in Oct.

PLUMAGE. Red tips on the fore crown feathers of ♂♂ acquired with the first prebasic molt.

STOMACH CONTENTS. Seventeen containing insect remains, including ants and ant larvae.

HABITAT. Forest, second growth, forest edge, trees in scrubby abandoned fields and pastures. Birds frequent understory shrubs and trees, bamboo, vine tangles, thickets.

NOTES. The reproductive cycle is not obvious because of the difficulty in aging birds and the absence of a clearly defined testis cycle. A male was observed over several days in early Jan excavating a nest cavity in a dead tree, with the female perched nearby. That plus observations of a fledgling in Oct and a family group in Jan and the association of body masses at the lower end of the range with tiny or undeveloped gonads and completely (as opposed to partially) unpneumatized skulls suggest that the birds breed from Sep at least through Jan. The birds perch 1.5–7 m above the ground. They hammer, making a soft, distinctive tap-tap-tap, on small (7- to 20-mm-diam) hollow branches or bamboo stems, creating holes from which to remove eggs and larvae of ants or other insects. They also foliage glean, often hanging upside down to poke and probe. The birds make a woodpecker-like call, which can be heard in most months, that sounds like a collection of glass beads bumping into each other.

Melanerpes candidus: White Woodpecker

SPECIMENS (MVZ, MNHNP). ♂♂ Jan (1), Feb (1), Sep (1). ♀♀ Mar (1), Jun (1), Sep (1).

MASS (G). ♂♂ $\bar{X} = 123$ (SD = 4.36, range = 120–128, $N = 3$), Feb bird with light fat. ♀♀ $\bar{X} = 114$ (SD = 6.56, range = 107–120, $N = 3$), Jun bird with slight fat.

IRIS. White.

BILL. Black; lower mandible with gray or slate gray blue basally.

FACIAL SKIN. Bright yellow around eye.

FEET AND TARSI. Olive green or blue green, with or without brownish tinge. Toe pads paler.

GONADS. ♂♂ Testes 7×4 mm (Sep), with incubation patch; 6×4 (Jan); and 4×2 (Feb). ♀ Ova ≤ 1 mm (Mar, Jun); ova 2 mm diam (Sep).

MOLT. Body and flight feathers in Feb, Mar, and only body molt in Sep, Jan, and Jun.

STOMACH CONTENTS. Two with adult and larval insects, 1 with plant pulp, and 1 with corn. Observed feeding on fruit of *Guarea* (Meliaceae).

HABITAT. Pastures, cultivated fields, clearings, tung orchards; less commonly in forest. Occupy snags and isolated trees in open areas.

NOTES. Usually in groups of 2–5 during the breeding season. Flocks may double in size following breeding. Conspicuous, with loud calls, sometimes given antiphonally (Oct). Often with red dirt on breast feathers.

***Veniliornis spilogaster*: White-spotted Woodpecker**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Mar (1), Jun (1), Aug (1) Sep (2), Oct (1). ♀♀ Jan (1), Feb (1), Mar (2), Jun (1), Sep (2), Oct (1). Mar ♂ and Sep ♀ with juvenal skulls.

MASS (G). ♂♂ \bar{X} = 40.5 (SD = 1.52, range = 38.0–42.0, N = 6). ♀♀ \bar{X} = 38.1 (SD = 1.56, range = 36.0–40.3, N = 8). Jun ♀ with light fat.

IRIS. Brown, dark brown, or red brown.

BILL. Upper mandible black; lower mandible light gray with dark tip. Mouth lining pinkish green. Tongue pinkish gray.

FEET AND TARS. Black, gray, green, or olive gray. Toe pads light green, greenish brown, or tan.

GONADS. ♂♂ Testes enlarged (5 × 3–9 × 4 mm) in Aug, Sep; small (2 × 1 mm) in Mar, Jun. ♀♀ One Sep bird, largest ova = 1.5 mm; 1 Feb bird with undeveloped ovary; all other females, ovary granular or largest ovum ≤ 1 mm.

MOLT. Jan, Feb, and Mar ♀♀ with body and flight feather molt. Trace of body molt in Jun ♂.

STOMACH CONTENTS. Insects (including caterpillars) only, in 7; 1 with fruits and seeds.

HABITAT. Forest, old second-growth forest, and forest-pasture edge. One individual observed in a 3-m woody shrub in a pasture.

NOTES. Perches 3–12 m up. Often seen in pairs. On 17 Oct 1979, 1 bird was excavating a nest hole about 10 m up in a dead tree trunk (~11 m tall, broken off above, 30.5 cm diameter at breast height [DBH]); in forest with an open understory. Nest hole ~5 cm diam.

***Colaptes melanochloros*: Green-barred Woodpecker**

SPECIMENS (MVZ). ♂ Sep (1). ♀ Mar (1).

MASS (G). ♂ 125. ♀ 112.

IRIS. Dark brown.

BILL. Grayish black. Palate and mouth lining dull pinkish purple. Tongue dull pink with gray-black tip.

FEET AND TARS. Dull olive green. Toe pads olive brown.

GONADS. ♂ Testes 8 × 4 mm. ♀ Ovary postbreeding.

MOLT. ♀ Heavy prebasic molt, including tail.

STOMACH CONTENTS. One with black ants.

HABITAT. Forest and tung orchard.

***Colaptes campestris*: Campo Flicker**

SPECIMENS (MVZ). ♂♂ Feb (1, ad skull), Sep (2, ad skulls), Dec (2, imm skulls). ♀♀ Feb (1, imm skull), Mar (1), Nov (1, nestling), Dec (3, ad skulls).

MASS (G). ♂♂ \bar{X} = 171.0 (SD = 7.26, range = 160–177, N = 5), Feb bird with light fat. ♀♀ \bar{X} = 161.2 (SD = 5.22, range = 156–170, N = 5), Feb, Mar, and 2 Dec birds with light fat. Nov. nestling = 108 g, with heavy fat along pterylae.

IRIS. Brown.

BILL. Black. Mouth lining gray.

FEET AND TARS. Olive green, brown, or gray. Toe pads brown.

GONADS. ♂♂ Testes enlarged (10 × 6–14 × 10 mm) in Sep. Testes small (4 × 1–4 × 2 mm) in Dec (dark green in 1 ♂) and Feb. ♀♀ All ovaries tiny.

MOLT. Body and flight feathers in Dec, Feb, and Mar, and body molt only in Nov and Dec (3). Nov bird in prejuvenal molt.

STOMACH CONTENTS. Nine with insects only, including small caterpillars, beetles, ants, and/or ant eggs (in 4). The stomach of 1 Dec bird also contained corn.

HABITAT. Pastures, cultivated fields, clearings, tung orchards.

NOTES. Usually found in small groups of 2–8 individuals. The birds make loud, shrill calls, chasing each other and interacting conspicuously. They perch on the ground, on stumps, and on snags up to ~7 m. Underparts (chin, breast, belly) often stained reddish brown by the soil, reflecting their habit of feeding frequently on areas of bare dirt. Hayes (2014) recorded a nest in Oct in Sapucá (Figure 1). A workman at El Tirol removed a ♀ nestling from a tree cavity on 4 Nov 1976. Feathers in all body tracts were with sheath as were both remiges and rectrices.

***Dryocopus lineatus*: Lineated Woodpecker**

SPECIMENS (MVZ). ♂ Jan (1). ♀ Feb (1).

MASS (G). ♂ 210. ♀ 207, light fat.

IRIS. White.

BILL. Upper mandible black. Lower mandible dark gray green, lighter medially.

FEET AND TARS. Gray. Toe pads greenish tan.

GONADS. Testes 4 × 2 mm, orange. Ova ≤ 1 mm.

MOLT. Both birds with extensive body and flight feather molt.

STOMACH CONTENTS. ♂ packed with insects; ♀ with ants and fruit.

HABITAT. Forest.

NOTES. Observed feeding in and drumming on dead trees. Iris is an obvious and impressively bright white. Red dirt on belly of male. Two nests recorded at Sapucá (Figure 1) in Oct (Hayes, 2014).

***Campephilus robustus*: Robust Woodpecker**

SPECIMENS (MVZ). ♂♂ Jan (1), Feb (1).

MASS (G). 279, 267, respectively.

IRIS. White or lemon yellow.

BILL. Upper mandible pale greenish brown, with sides greenish white at the base. Lower mandible greenish white, becoming pale greenish blue at sides of base.

FEET AND TARS. Blackish gray or green. Toe pads brownish green.

GONADS. Testes 7 × 3 and 3 × 1 mm, respectively.

MOLT. Both birds molting extensively.

STOMACH CONTENTS. Beetle larvae up to 4 cm long.

HABITAT. Heavy forest.

NOTES. Feb bird was with a conspecific; possibly a mated pair. Forage between 3–16 m up.

FAMILY FALCONIDAE: FALCONS

***Micrastur ruficollis*: Barred Forest-falcon**

SPECIMENS (USNM, MVZ). ♂♂ Mar (1); Sep (1); Nov (1), immature plumage. ♀♀ Mar (2), 1 adult, 1 immature.

MASS (G). ♂♂ Adults 147, light fat, and 143, respectively; immature 128. ♀♀ Adult 170, immature 162.

IRIS. Dark brown, tan, or tan with purple tinge.

BILL. Upper mandible black or brownish black with yellow, olive, or olive gray at base and below nostril. Lower mandible yellow, greenish yellow, or olive green with black tip. Base of tongue pale pinkish flesh; tip blue gray; palate bluish purple. Mouth lining dark purplish flesh color or green.

FACIAL SKIN. Cere, fleshy tissue at gape, eyelids, eye rings, and bare skin around eyes yellow or greenish yellow; skin brightest anterior and posterior to eye and grayish below.

FEET AND TARSI. Front surfaces of tarsi greenish yellow or olive green; rear surfaces and toe pads bright lemon yellow.

GONADS. ♂♂ Testes enlarged (10 × 4 mm) in Sep; regressing? (5 × 2 mm) in Mar, and small (2 × 1 mm) in Nov immature. ♀♀ Ovary postbreeding (adult); double ovary, with discrete ova (immature).

MOLT. Scattered body molt in Mar ♂ and 1 Mar ♀. Likely the end of the prebasic molt. Primary molt in immature ♂ (Nov).

STOMACH CONTENTS. Orthoptera and other insect remains in crop and stomach of all birds. Stomach of immature ♂ also contained mammal fur, and that of the adult ♀ a 10-mm stone.

HABITAT. Deep forest.

NOTES. Occupy low perches (2–4 m). Birds respond to squeaking and owl calling by human observers.

***Caracara plancus**: Southern Caracara**

NOTES. Observed occasionally flying over open areas or perched in trees near grasslands, cultivated fields, or scrubby abandoned pastures (NKJ, MSF).

***Milvago chimachima*: Yellow-headed Caracara**

SPECIMENS (MVZ). ♀♀ Feb (2), 1 adult, 1 immature.

MASS (G). 295 (ad); 330 (imm); both with light fat.

IRIS. Brown.

BILL. White, tinged green (ad); pale yellow green with wide gray tomium (imm).

FACIAL SKIN. Around eye and cere, pale flesh color.

FEET AND TARSI. White, tinged green.

GONADS. Largest ovum of adult, 2 mm; of immature, ≤ 1 mm.

MOLT. Prebasic molt of adult, flight feathers and body; of immature, only body.

STOMACH CONTENTS. Immature with insect remains (including large ticks, Ixodidae) and hair.

NOTES. Perches at or near the top of the tallest trees bordering scrubby, overgrown pastures or other open areas. Also observed flying overhead from Nov through Mar. Makes a loud, shrill scream.

***Milvago chimango**: Chimango Caracara**

NOTES. Immature perched in a tree at the edge of a pasture in Feb (RMZ).

***Falco sparverius*: American Kestrel**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Mar (1), Jun (1, dead on road), Sep (2: 1 ad, 1 imm plumage). ♀ Feb (1).

MASS (G). ♂♂ \bar{X} = 104.0 (SD = 14.0, range = 93–120, N = 3). ♀ 122, light fat.

IRIS. Dark brown or black.

BILL. Dark gray, lighter basally.

FACIAL SKIN. Cere and skin around eye yellow green, brightest anterior to eye.

FEET AND TARSI. Yellow orange, yellow green, or black.

GONADS. Sep ♂ in immature plumage with enlarged (20 × 10 mm) testes; other ♂♂, testes small (2 × 1–5 × 4 mm). ♀ Ova ≤ 1 mm.

MOLT. Prebasic molt of body, tail, and wing feathers (Feb, Mar).

STOMACH CONTENTS. Three with insect remains.

HABITAT. Perched in trees or dead snags at the edge of or scattered in pastures, cultivated fields, open areas.

NOTES. Present year-round. Two young in dead snag in scrubby pasture in Feb. Two adults perched in dead snag in Mar appeared to be molting.

***Falco femoralis**: Aplomado Falcon**

NOTES. Observed clearly, flying from a perch in a tree in a pasture into an adjacent tung orchard, in Feb (NKJ).

FAMILY PSITTACIDAE: NEW WORLD AND AFRICAN PARROTS

***Myiopsitta monachus*: Monk Parakeet**

SPECIMENS (MVZ). ♂ Feb (1).

MASS (G). 110 (no fat).

IRIS. Pale brown.

FACIAL SKIN. Purplish around eye.

FEET AND TARSI. Gray brown. Toe pads light brown.

GONADS. Testis 2×1 mm.

MOLT. Extensive on body.

STOMACH AND CROP CONTENTS. Full of ground seeds.

HABITAT. Area of farmland with scattered orchards, weedy fields, introduced eucalyptus (Myrtaceae), and native trees.

NOTES. Specimen brought in by local individual. Actual locality is Capitán Miranda, ~4 km SW of El Tirol on Ruta 6. Observed several groups of 3 to 4 individuals and 1 flock of 12 flying around and perched 12–14 m up in trees. Several bulky nests 8 to 14 m up in eucalyptus trees.

***Pionus maximiliani*: Scaly-headed Parrot**

SPECIMENS (MVZ). ♀ Feb (1).

MASS (G). 275, light fat.

IRIS. Brown.

BILL. Upper mandible yellow with black at base. Lower mandible yellow.

FEET AND TARSI. Black. Toe pads green.

GONADS. Largest ovum 2 mm.

MOLT. Wing and body feathers.

STOMACH AND CROP CONTENTS. Corn.

HABITAT. Scrubby pasture, clearings, cultivated fields.

NOTES. Flocks (7–11) flying over open areas or perched 1–4 m up in snags.

***Pyrrhura frontalis*: Maroon-bellied Parakeet**

SPECIMENS (MVZ). ♂ Nov (1).

MASS (G). 75 (no fat).

BILL. Upper mandible olive brown. Lower mandible olive brown, becoming pale grayish brown at the base.

FACIAL SKIN. Bare skin around eye pale bluish white.

FEET AND TARSI. Olive brown. Toe pads pale sandy brown.

GONADS. Testis 2×1 mm.

MOLT. Scattered ensheathed feathers in body tracts.

STOMACH AND CROP CONTENTS. Crushed seeds.

NOTES. Two in the top of a fruiting tree, ~12 m up.

FAMILY THAMNOPHILIDAE: ANTIBIRDS

***Hypodaleus guttatus*: Spot-backed Antshrike**

SPECIMENS (MVZ). ♂ Feb (1), adult skull.

MASS (G). 40.5, light fat.

IRIS. Brown.

BILL. Upper mandible black with blue streak ~1 mm wide just above tomium. Lower mandible blue.

FEET AND TARSI. Gray. Toe pads tan.

GONADS. Testis 4×2 mm.

MOLT. Prebasic.

STOMACH CONTENTS. Orthopteran remains.

HABITAT. Forest.

NOTES. At the southern limit of the species range; also recorded from Misiones, Argentina (Canevari et al., 1991).

***Batara cinerea**: Giant Antshrike**

NOTES. A male and female were observed with binoculars in Nov 1976 from a blind a short distance (≤ 5 –7 m) away for several minutes (MSF). They were skulking around in forest undergrowth but observed clearly. This part of Paraguay has not previously been included in the range of the species (Hayes, 1995; Guyra Paraguay, 2004; Ridgely and Tudor, 2009), nor has it been recorded from San Rafael National Park (Esquivel M. et al., 2007). However, Ridgely and Tudor (2009) noted its occurrence in adjacent Misiones, Argentina, some 200 km to the east (or ~105 km SE) of El Tirol, and Hayes (1995) recorded it from the central Paraguay geographical region, which abuts his Alto Paraná geographical region to the west.

***Mackenziaena leachii*: Large-tailed Antshrike**

SPECIMENS (MVZ). ♂♂ Jan (1), Feb (1), Mar (1). ♀♀ Feb (1), Mar (1), Nov (1). Skulls of Jan and Mar ♂♂ and Feb and Mar ♀♀ immature, with windows.

MASS (G). ♂♂ $\bar{X} = 68.8$ (SD = 1.10, range = 67.5–69.5, N = 3). ♀♀ $\bar{X} = 68.9$ (SD = 2.29, range = 67.2–71.5, N = 3). Feb ♀ with light fat.

IRIS. Dark brown or brown.

BILL. Upper mandible black, brownish black, or grayish black. Lower mandible black, grayish black, or black proximally and gray distally. Palate and tongue grayish white or pinkish gray. Mouth lining pearl, pinkish flesh, pinkish gray, or grayish white.

FEET AND TARSI. Black or blackish brown. Toe pads green or olive brown.

GONADS. ♂♂ Testes all small (1×1 – 3×1 mm). ♀♀ Ovaries undeveloped (Feb), postbreeding (Mar), and with many ova 2 mm diam (Nov).

MOLT. Molt in Feb (2) and Mar (2) birds.

STOMACH CONTENTS. All with remains of insects and other invertebrates, including Orthoptera, Coleoptera, Hemiptera (2 cm), Lepidoptera larva (7.6 cm), and Diplopoda.

HABITAT. Border between forest and second-growth scrub.

NOTES. In dense thickets of *Baccharis* shrubs, bamboo, and vine tangles.

***Mackenziaena severa*: Tufted Antshrike**

SPECIMENS (MVZ). ♂♂ Jan (1), Feb (1), May (1). ♀ Mar (1). Jan ♂ with adult skull. All others with only partly pneumatized skulls.

MASS (G). ♂♂ \bar{X} = 54.8 (SD = 1.25, range = 53.5–56.0, N = 3); Feb bird with light fat. ♀ 53.0.

IRIS. Brown or dark brown.

BILL. Black. Mouth lining yellow green.

FEET AND TARS. Blue gray or light gray. Toe pads tan, bright green, or dull yellowish green.

GONADS. ♂♂ Testes small (1.5×1.5 – 4×1.5 mm), but increasing in size with date. ♀ Ovary undeveloped.

MOLT. All birds molting.

STOMACH CONTENTS. Three with insect remains, including Coleoptera; 1 with insect remains and a fruit.

HABITAT. Forest, forest edge, second-growth scrub.

NOTES. In dense *Chusquea* bamboo and other low undergrowth; shy and nearly always behind cover. In May, part of a mixed-species flock following an ant swarm. Call an almost hawk-like *wee*; a high-pitched whistle going up slightly and then down. The female (MVZ 167304) is likely missexed. Its sooty black plumage, black crest, and lack of any barring suggest a male.

***Thamnophilus ruficapillus*: Rufous-capped Antshrike**

SPECIMENS (MVZ). ♂ Feb (1), adult skull.

MASS (G). 21.0.

IRIS. Red orange.

BILL. Upper mandible black. Lower mandible blue gray. Mouth lining pale yellow green.

FEET AND TARS. Slate gray tinged blue. Toe pads light green.

GONADS. Testis 4×2 mm.

MOLT. Body molt.

STOMACH CONTENTS. Insect remains.

HABITAT. Scrubby pasture.

***Thamnophilus caerulescens*: Variable Antshrike**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 27: Jan (1), Feb (6), Mar (2), May (4), Jun (4), Aug (2), Sep (3), Oct (2), Nov (2), Dec (1). ♀♀ 29: Feb (6), Mar (2), May (2), Jun (5), Aug (2), Sep (4), Oct (5), Nov (1), Dec (2). Sex? Oct (1), Nov (1). Birds with partially pneumatized skulls in Jan (1), Feb (7), Mar (1), May (1), Sep (1), Oct (2), Nov (1), Dec (2).

MASS (G). ♂♂ \bar{X} = 18.6 (SD = 1.13, range = 15.3–20.5, N = 27). ♀♀ \bar{X} = 19.7 (SD = 1.55, range = 15.0–22.5, N = 28). Sex? 17.75, 21.75. Light fat in 2 Feb, 1 Jun, and 1 Nov ♀♀ and 1 Feb ♂.

IRIS. Brown or dark brown.

BILL. Upper mandible black. Lower mandible gray or blue gray, many with a black tip. Mouth lining greenish yellow, orange, ochre, pinkish flesh, or flesh color. Tongue yellowish or orangish flesh color.

FEET AND TARS. Gray or bluish gray. Toe pads green, tan, greenish brown, or bright yellow.

GONADS. ♂♂ Testes enlarged (8×4 – 12×5 mm) Aug through Feb; moderately enlarged (5.5×3 – 7.5×4 mm) Feb and May, which may represent regressing or enlarging gonads, respectively. Other males have small (1×1 – 3.5×1 mm) testes between Feb and Jun. Testis size has no apparent relationship to age, as indicated by degree of skull pneumatization. ♀♀ Largest ova 2–11 mm diam from Aug through Feb, accompanied by collapsed follicles, enlarged oviducts, and active incubation patches; 1 additional ♀ had yolked 2-mm ova in May. Three Feb ♀♀ were designated postbreeding, 1 with an old incubation patch. Ten ♀♀ from Feb, Mar, May, Jun, Oct, and Nov had granular ovaries with largest ova ≤ 1 mm. Two ♀♀ (Dec, Mar) with juvenal skulls had tiny, undeveloped ovaries. However, another 5 ♀♀ with only partially pneumatized skulls appeared to be breeding or postbreeding, and 1 had a developed but inactive ovary.

MOLT. Presumed prebasic (in adults) and first prebasic (in birds of the year) molts recorded in Dec, Jan, Feb, Mar, and May. Light body molts recorded in 3 May ♂♂ with moderately enlarged testes could represent a prealternate molt or the end of a prebasic molt.

PLUMAGE. ♂ from 16 May (USNM 599540) in juvenal plumage with limited black crown. Nape and back feathers and upper wing covers heavily spotted with black-edged whitish buff. Flanks gray or tawny banded white. Throat and breast gray with subtle white barring.

STOMACH CONTENTS. Thirty-four with insect remains, including caterpillars (1 = 35 mm long) and Coleoptera; 1 with insect remains and a 7-mm snail; and 1 with plant material and sand.

HABITAT. Forest understory.

NOTES. This was 1 of the most common species in the forest. The birds occupied low shrubby tangles and dense undergrowth (1–3 m; less commonly to 6 m) but also spent considerable time on the ground. Birds were paired and appeared to occupy territories year-round. Males sang year-round, females occasionally, and they sometimes countersang. They also made a single-note whistle, and pairs communicated frequently with soft *ab* or sharper *tsk* position notes. Males bowed, bobbed, and fanned their tails when calling. The breeding season extended from Aug through Feb, although in any 1 of those months apparently nonbreeding adults were also present. May males had vascular testes of 7×3.5 and 7×4.0 mm and called continually. Family groups were observed in Mar. Males and females foraged together, at distances of 2–6 m. They also joined mixed-species flocks that included *Phylloscartes eximius*, *Basileuterus culicivorus*, and *Trichothraupis melanops*. One pair was observed feeding at an ant swarm.

***Dysithamnus mentalis*: Plain Antvireo**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 24: Jan (1), Feb (2), Mar (1), May (2), Jun (6), Aug (2), Sep (4), Oct (3), Nov (1), Dec (2). ♀♀ 14: Mar (1), Jun (3), Oct (3), Nov (2), Dec (5). Sex? May (1), Nov (2, nestlings). Birds with juvenal skulls

are present in Nov (2), Dec (1), Feb (2), Mar (2), May (1), Aug (1), and Sep (1). All other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 11.7 (SD = 0.94, range = 9.0–13.0, N = 23); light fat in 1 Aug bird. ♀♀ \bar{X} = 11.3 (SD = 1.24, range = 8.8–13.0, N = 13). Sex? 13.0; both nestlings = 10.25. Birds with light to moderate fat noted in Mar (1), Jun (2), Aug (1), and Dec (1).

IRIS. Brown or dark brown.

BILL. Upper mandible black, dark gray, or gray. Lower mandible gray, blue gray, or gray basally with a black tip. Mouth lining gray or flesh color. In nestlings, upper mandible black and lower mandible rosy pink. Mouth lining bright orange, orange pink, flesh color, gray, or yellow green.

FEET AND TARSII. Adults: gray or yellowish or greenish gray; toe pads tan. Juveniles: blue gray or olive; toe pads tan, greenish brown, or yellow.

GONADS. ♂♂ Testes enlarging or enlarged (3.5×2 – 9×5 mm) Aug through Dec; small (1×1 – 2.5×1 mm) Jan through Jun except for 1 May ♂ (5×2 mm). ♀♀ Ovary granular with ova ≤ 1 mm, Mar through Jun plus some in Nov, Dec. Enlarged ova, shelled eggs, and/or active brood patches in Oct, Dec.

MOLT. Prebasic molt of body and flight feathers recorded in Dec, Jan, May. First prebasic body molt recorded in Dec, Feb, Mar, May. Oct nestlings acquiring juvenal plumage.

STOMACH CONTENTS. Twenty-seven with insect remains, including Coleoptera; 1 with fruit and insect remains.

HABITAT. Forest.

NOTES. Common in dense vegetation of the forest understory. These foliage gleaners drop to a low perch (≤ 1 m) and then ascend by hopping up vertical vines and sapling trunks to 5 or 6 m and then drop down again, repeating the cycle. Generally in pairs or small family groups. Call continually while moving, giving a soft, oft-repeated *aur* or *mew*.

***Herpsilochmus rufimarginatus*: Rufous-winged Antwren**

SPECIMENS (USNM, MVZ). ♂♂ Oct (1), Dec (1). Adult skulls.

MASS (G). 10.5, 10.0, respectively.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible gray.

FEET AND TARSII. Pale gray.

GONADS. Testes in both 4×2 mm.

MOLT. Dec bird in prebasic molt of body and flight feathers.

STOMACH CONTENTS. Insect remains in both, including 1 caterpillar.

HABITAT. Forest.

***Drymophila malura*: Dusky-tailed Antbird**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Sep (2), Oct (1). ♀♀ Mar (2), Oct (1). Mar ♀♀ with large lateral skull windows. All other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 11.2 (SD = 1.03, range = 10.0–12.5, N = 4). ♀♀ \bar{X} = 10.5 (SD = 0.06, range = 10.5–10.6, N = 3).

IRIS. Brown or dark brown.

BILL. Upper mandible black or dark brown. Lower mandible pale gray, whitish, white blue gray, gray with pinkish base, or black with a light base. Tongue, palate, mouth lining, and fleshy tissue at gape orange yellow in 2 Mar juvenal ♀♀.

FEET AND TARSII. Gray, greenish gray, or grayish tan. Toe pads green, tannish green, or sandy brown.

GONADS. ♂♂ Testes 3×2 – 5×2 mm. ♀♀ One Mar ovary undeveloped. Other Mar and Dec ovaries with small yolked ova ≤ 1 mm diam; Oct oviduct slightly enlarged.

MOLT. Body and flight feather molt in Jan (1) and Mar (2) birds.

PLUMAGE. Females lack the semiconcealed dorsal white interscapular patch (cf. Ridgely and Tudor, 2009).

STOMACH CONTENTS. Five with insect remains.

HABITAT. Forest, forest edge, second-growth scrub in shrubby bamboo tangles and vine thickets near the ground (≤ 2 m).

***Pyriglena leucoptera*: White-shouldered Fire-eye**

SPECIMENS (USNM, MVZ). ♂♂ Feb (3), Mar (1), May (2), Sep (2), Dec (1). Two individuals from Feb with immature skulls, also 1 from Mar and 1 from May. ♀♀ 10: Jan (1), Feb (2), Mar (2), Sep (1), Oct (2), Nov (1), Dec (1). Both Mar ♀♀ with skull windows.

MASS (G). ♂♂ \bar{X} = 29.2 (SD = 1.94, range = 25.7–32.0, N = 9). ♀♀ \bar{X} = 25.4 (SD = 1.45, range = 23.5–28.2, N = 9). Light fat in birds in Feb (2), May (2), and Sep (1).

IRIS. Red.

BILL. Upper mandible black. Lower mandible black in males; pale gray, blue gray, or pinkish gray basally and gray distally in females. Mouth lining bright orange, orange yellow, or yellow green. Palate and tongue orange or orange yellow.

FEET AND TARSII. Black, blackish gray, gray, blue gray, or dull purple gray. Toe pads green, yellow green, olive brown, tan, grayish tan, or greenish tan.

GONADS. ♂♂ Testes of adult males enlarged (9×4 – 12×7 mm) from Sep through Feb, and 1 ♂ with a cloacal protuberance; testes small (3.5×1.5 mm) in May and undeveloped (1×1 – 2×1 mm) in juvenal males. ♀♀ Ova enlarged (2–8 mm diam), shelled egg in oviduct, enlarged oviduct, and/or incubation patch in adults, Sep to Jan. Feb ♀♀, largest ovum ≤ 1 mm diam. Juvenal ♀♀, ovaries undeveloped.

MOLT. Recorded in Dec, Jan, Feb, and Mar. Some birds with body and flight feather molt; others with only body molt. The latter may be birds in their first prebasic molt.

STOMACH CONTENTS. Fourteen with insect remains. One breeding ♀ with a small snail in addition.

HABITAT. Forest undergrowth.

NOTES. Low in the vegetation, often near the forest floor. Once part of a mixed-species flock following an ant swarm; aggressive, chased away other birds (e.g., *Trichothraupis melanops*). Oviducal egg with unhardened shell (white with a few black dots) = 22 mm long \times 18 mm at widest point. Molt overlaps with breeding in some males with enlarged testes (12 \times 7 mm, Dec; 9 \times 4 mm, Feb). Song a series of descending notes.

FAMILY CONOPOPHAGIDAE: GNATEATERS

***Conopophaga lineata*: Rufous Gnateater**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 24: Feb (5), Mar (2), May (3), Jun (3), Aug (1), Sep (6), Oct (2), Dec (2). ♀♀ 14: Jan (1), Feb (3), Sep (5), Oct (3), Dec (2). Two Dec, 5 Feb, and 1 Mar bird with immature skulls; 1 Feb bird with small skull windows. All others with adult skulls.

MASS (G). ♂♂ \bar{X} = 21.5 (SD = 1.15, range = 19.5–24.0, N = 24). ♀♀ \bar{X} = 19.9 (SD = 2.21, range = 16.0–24.0, N = 13). Two Jun ♂♂ and 1 Oct male with light to moderate fat.

IRIS. Brown or dark brown.

BILL. Upper mandible black. Lower mandible white, pinkish white, flesh color, or tan. Soft, fleshy gapes of juveniles, orange or yellow. Mouth lining orange or yellow. Tongue and palate buffy orange.

FEET AND TARSII. Greenish or yellowish gray or tan, gray, tan, brown, or olive. Toe pads olive green, greenish tan, greenish brown, or tan.

GONADS. ♂♂ Testes small (1 \times 1–4 \times 3 mm) Dec through Jun; enlarged (8 \times 5–17 \times 7 mm), Aug through Oct. ♀♀ Ovaries granular in Dec and Jan; most ovaries with enlarged ova (1.5–11 mm diam) in Sep–Oct, and 1 Sep bird with an enlarging oviduct and developing incubation patch. Juvenal ♀♀ with small, undeveloped ovaries.

MOLT. Adults in prebasic molt recorded in Dec, Jan, Feb, Mar. Immature birds in first prebasic molt in Feb and Mar.

STOMACH CONTENTS. Insect remains, including Coleoptera, Hemiptera, Orthoptera, and Lepidoptera larvae, in 23. One with a large spider.

HABITAT. Forest, forest edge.

NOTES. Skulks around on the ground or in low understory vegetation. Uses both horizontal and vertical perches, especially vines in brushy tangles. Twice observed feeding at ant swarms. Call a harsh, buzzy trill or *churrrp* given repeatedly.

FAMILY FORMICARIIDAE: ANTHRUSHES

***Chamaeza campanisona*: Short-tailed Anthrush**

SPECIMENS (USNM, MVZ). ♂ Sep (1). ♀ Oct (1). Both with adult skulls.

MASS (G). ♂ 87. ♀ 91.

GONADS. ♂ Testes 14 \times 7 mm. ♀ Largest ovum 1 mm diam, yellow orange; with brood patch.

MOLT. No.

STOMACH CONTENTS. ♂ Seeds, crystalline grit, and insect remains. ♀ Insect remains.

NOTES. Powerful muscular stomach with 10-mm-thick lining corrugated with 9 or 10 ridges. Call loud and tremulous and carries a long distance; somewhat ventriloquial and reminiscent of *Glaucidium brasilianum*. Birds call regularly from Sep through Mar and are more often heard than seen. They frequent the densest undergrowth using perches at 1–3 m but sometimes sing from higher perches (10 m) or from the tops of tall trees. Nests in tree cavities at least from Sep through Dec (Bodrati et al., 2014).

FAMILY FURNARIIDAE: OVENBIRDS

***Sclerurus scansor*: Rufous-breasted Leaf-tosser**

SPECIMENS (USNM, MVZ). ♂ Oct (1), adult skull. ♀♀ Mar (1), with skull windows; Oct (2), both with adult skulls.

MASS (G). ♂ 30. ♀♀ \bar{X} = 37.7 (SD = 2.08, range = 36–40, N = 3).

IRIS. Brown or dark brown.

BILL. Upper mandible black. Lower mandible white to grayish white with a black tip. Mouth lining bluish gray.

FEET AND TARSII. Black. Toe pads reddish purple.

GONADS. ♂ Testes enlarged (9 \times 5.5 mm). ♀♀ Largest ova 2 mm diam in Oct. Mar ovary undeveloped.

MOLT. No.

STOMACH CONTENTS. Three with insect remains.

HABITAT. Forest.

NOTES. Found low in forest undergrowth and on ground, scratching in the leaf litter. One adult ♀ covered with hundreds of Mallophaga (bird lice) crawling everywhere.

***Sittasomus griseicapillus*: Olivaceous Woodcreeper**

SPECIMENS (USNM). ♂♂ 13: Jan (1), Feb (1), Mar (1), May (1), Aug (1), Sep (2), Oct (1), Nov (1), Dec (4). ♀♀ Jan (1), Feb (1), Mar (1), Oct (1), Dec (3). One Dec and 1 Jan ♂ and 2 Dec and 1 Feb ♀ with partly pneumatized skulls. All others with adult skulls.

MASS (G). ♂♂ \bar{X} = 12.4 (SD = 0.94, range = 11–14.3, N = 13). ♀♀ \bar{X} = 10.3 (SD = 0.69, range = 9.5–11.5, N = 6). Light fat in 1 Feb ♂.

IRIS. Brown or dark brown.

BILL. Upper mandible black or brownish black. Lower mandible gray, blue gray, or silver gray with black tip. Mouth lining and tongue pinkish flesh color.

FEET AND TARSII. Gray or blue gray. Toe pads gray tan or olive brown.

GONADS. ♂♂ Testes enlarged ($6 \times 4\text{--}9 \times 5.5$ mm) Aug through Nov; small ($1 \times 1\text{--}2 \times 1$ mm) Dec through May. ♀♀ Largest ovum = 1 mm in Oct; all others ovary tiny or, in birds with imm skulls, smooth and undeveloped.

MOLT. Prebasic molt including body and flight feathers recorded in Oct, Nov, Dec, Jan, Feb, Mar, May. First prebasic body molt recorded in Dec, Jan, Mar.

STOMACH CONTENTS. Ten with insect remains; 1 with a spider.

HABITAT. Forest, forest edge.

NOTES. A common species found 10–15 m up on trunks and large limbs of tall trees. It sometimes hangs with its body horizontal from the underside of limbs. Often moves in pairs and may join mixed-species flocks. Makes a variety of calls, including a loud trill reminiscent of a cicada that increases in intensity as it progresses; also a series of raucous *whees* in a descending pattern.

***Dendrocicla turdina*: Plain-winged Woodcreeper**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), Jun (3). ♀ Jun (1). Jan ♂ with immature skull; all other birds with adult skulls.

MASS (G). ♂♂ Adults $\bar{X} = 44.0$ (SD = 1.0, range = 43.0–45.0, $N = 3$), all with moderate fat. Imm ♂ = 36.0. ♀ = 37.8, moderate fat.

IRIS. Brown.

BILL. Upper mandible black, dark gray, gray brown, or brown. Lower mandible gray, gray with tan tomium and tip, or light greenish gray.

FEET AND TARS. Tarsi gray, gray brown, brown, or tan. Feet gray or gray brown.

GONADS. ♂♂ Testes small in adults ($2.0 \times 1.0\text{--}2.5 \times 1.5$ mm) and immature (1×1 mm). ♀ Ovary granular, ova minute.

MOLT. One adult ♂ molting the central rectrices (Jun); immature ♂ molting (Jan).

STOMACH CONTENTS. All with insect remains.

HABITAT. Tall forest.

***Dendrocolaptes platyrostris*: Planalto Woodcreeper**

SPECIMENS (USNM, MVZ). ♂♂ May (1), Sep (2), Dec (2), all with adult skulls. ♀♀ Mar (1, juv skull), Oct (1, ad skull).

MASS (G). ♂♂ $\bar{X} = 57.5$ (SD = 4.84, range = 52.0–64.0, $N = 5$). ♀♀ Adult, 61.0; immature, 59.5.

IRIS. Brown.

BILL. Black with narrow yellow tomium basally and at tip. Mouth lining yellow green or orange green.

FACIAL SKIN. Eyelids and bare skin below eyes pale greenish olive. Eye ring orange green.

FEET AND TARS. Gray, brown, olive brown, olive green, or greenish gray. Toe pads olive orange.

GONADS. ♂♂ Testes 3.5×2.0 (May), $8 \times 5\text{--}15 \times 9$ Sep and Dec; 1 Dec bird with an incubation patch. ♀♀ Largest ovum 2 mm (Oct); ovary of juvenile undeveloped.

MOLT. Extensive. Prebasic, including flight feathers, May and Dec. First prebasic in Mar.

STOMACH CONTENTS. All with insect remains, including large cicadas.

HABITAT. Forest, forest edge.

NOTES. Found on trunks and (often on the underside of) large limbs in moderate to large trees; begins 2–3 m off the ground and moves up the trunk to about 8 m and then flies down to a low perch on the trunk of an adjacent tree and starts up again. Call a loud, raucous series of notes, almost a trill.

***Xiphorhynchus fuscus*: Lesser Woodcreeper**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (2), Jun (1), Sep (1), Oct (1), Dec (2). ♀♀ Jan (1), Feb (1), Aug (1), Sep (1), Oct (1), Dec (1). Sex? Dec (1). Jan, Sep, and Oct ♂♂ and Sep ♀ with adult skulls. All others with partly pneumatized skulls.

MASS (G). ♂♂ $\bar{X} = 17.8$ (SD = 1.39, range = 17.5–19.0, $N = 6$). ♀♀ $\bar{X} = 17.1$ (SD = 1.96, range = 14.6–19.5, $N = 6$), Feb bird with light fat.

IRIS. Brown or dark brown.

BILL. Upper mandible black or blackish brown. Lower mandible pink, white, or cream. Mouth lining peach color.

FEET AND TARS. Gray, yellowish gray, or greenish with bright greenish toe pads.

GONADS. ♂♂ Testes small ($4 \times 2\text{--}2 \times 1$ mm) late Dec through Jun; enlarged in Sep (9×5 mm) and Oct (12×6 mm). ♀♀ Enlarged ova in Aug (3 largest ova = 2 mm diam, yellow orange; oviduct enlarged) and Sep (largest ovum = 2 mm, orange). Ovaries in other ♀♀ tiny, with ova ≤ 1 mm.

MOLT. In some Dec, Jan, and Feb birds.

STOMACH CONTENTS. Nine with insect remains.

HABITAT. Forest.

NOTES. In large trees, primarily on vertical surfaces. Complete skull pneumatization appears to take more than 1 year. Apparent juveniles/immatures were present in Dec, Jan, and Feb. Other apparently adult birds with only partially pneumatized skulls were collected in Jun, Aug, Oct, and Dec, and some were in breeding condition. The unsexed bird was found on the forest floor, dead of unknown causes.

***Campylorhamphus falcularius*: Black-billed Scythebill**

SPECIMENS (MVZ). ♂ Mar (1), adult skull. ♀ Jan (1), adult skull. Sex? Mar (1), skull windows.

MASS (G). ♂ 33.2. ♀ 36.0.

IRIS. Brown or dark brown.

BILL. Brownish black or black fading to dark olive brown at tip. Tongue and palate yellow orange. Mouth lining orange or pinkish flesh color.

FEET AND Tarsi. Olive green. Toe pads olive brown or greenish orange.

GONADS. ♂ Testis 2.5×1.5 mm. ♀ Ovary tiny.

MOLT. Prebasic molt Jan, Mar. First prebasic in Mar.

STOMACH CONTENTS. All with insect remains.

HABITAT. Forest.

NOTES. Forages on large trunks and heavy, woody vines in dense vegetation. Moves backward down bamboo vines using the tail extensively for support. Also forages on the undersides of horizontal limbs. Spends most of the time peering at surfaces rather than probing.

***Lepidocolaptes angustirostris*: Narrow-billed Woodcreeper**

SPECIMENS (MNHNP). ♂ Sep (1), fully pneumatized skull.

MASS (G). 13.0, no fat.

GONADS. Testis enlarged, 16×9 mm.

MOLT. No.

HABITAT. Tall forest.

***Xenops minutus*: Plain Xenops**

SPECIMENS (USNM, MVZ). ♂♂ Sep (1), Oct (1), Nov (1), Dec (3). All with fully pneumatized skulls except Nov ♂ with small skull windows and 1 Dec ♂ with juvenal skull. ♀ Jan (1), adult skull. Sex? Nov (1), juvenal skull.

MASS (G). ♂♂ $\bar{X} = 8.2$ (SD = 0.45, range = 7.4–8.6, $N = 6$); Dec juvenile with light fat. ♀ 6.8. Sex? = 8.3, moderate fat.

IRIS. Black or brown.

BILL. Upper mandible black. Lower mandible pale or white.

FEET AND Tarsi. Gray.

GONADS. ♂♂ Testes enlarged (5×3.5 – 7×4.5 mm) in Sep, Oct; small (≤ 1 – 1.5×0.75 mm) in Nov, Dec. ♀ Ovary tiny.

MOLT. All Dec and Jan birds.

STOMACH CONTENTS. Five with insect remains.

HABITAT. Forest, second-growth edge.

NOTES. Uses primarily vertical perches, 3–10 m up in trees and vines. Taps and hammers branches like a woodpecker; forages like a nuthatch. Makes a single note *pseuuut* call over and over, with the last half upwardly inflected. Juvenile moving with adult ♂ in Dec.

***Xenops rutilans*: Streaked Xenops**

SPECIMENS (MVZ). ♀ Nov (1), adult skull. Sex? Nov (1), with large skull windows.

MASS (G). ♀ 11.8. Sex? 12.0.

BILL. Upper mandible brownish black. Lower mandible pinkish white grading to brownish at tip. Mouth lining brownish yellow.

FEET AND Tarsi. Bluish gray. Toe pads greenish brown.

GONADS. ♀ Largest ova = 1 mm diam.

MOLT. No.

STOMACH CONTENTS. Both with insect remains, including larvae.

HABITAT. Old growth with vines.

NOTES. Perches 5–6 m up in vines; hangs from twigs. Much less common at El Tirol than *Xenops minutus*.

***Furnarius rufus*: Rufous Hornero**

SPECIMENS (USNM, MVZ). ♂♂ Feb (1), Mar (1), Dec (1). ♀♀ Feb (1), May (1). May ♀ with adult skull. All other birds, skulls $\leq 50\%$ pneumatized.

MASS (G). ♂♂ $\bar{X} = 54.1$ (SD = 2.08, range = 52.8–56.5, $N = 3$). ♀♀ 54.5, 56.0. Both Feb and Mar birds with light fat.

IRIS. Reddish or orangish brown.

BILL. Upper mandible black or brown. Lower mandible gray white at base and dark distally. Mouth lining light flesh blue or flesh green.

FEET AND Tarsi. Brown, dark brown, or slate gray brown. Toe pads tan.

GONADS. ♂♂ Testes small (1×1 – 2×1 mm) in all birds. ♀♀ Feb, largest ova ≤ 1 mm diam. May ovary smooth and undeveloped.

MOLT. Feb and Mar, only body or body and flight feathers.

STOMACH CONTENTS. Five with insect remains, including 2 with ants.

HABITAT. Tung orchards, scrubby pasture, edges of fields, and clearings.

NOTES. Move as pairs, duetting commonly. Also make a harsh *tcha* note, sometimes given repeatedly. Red dirt on ventral feathers of some.

***Lochmias nematura*: Sharp-tailed Streamcreeper**

SPECIMENS (USNM). ♀ Oct (1), skull 5% pneumatized.

MASS (G). 18.5.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible black with gray at base.

FEET AND Tarsi. Brown.

GONADS. Largest ovum 1 mm diam. Oviduct enlarging.

MOLT. No.

STOMACH CONTENTS. Insect remains.

***Philydor atricapillus*: Black-capped Foliage-gleaner**

SPECIMENS (MVZ). ♂♂ Dec (2), adult skull and juvenal skull.

MASS (G). 22.0 (adult); 23.0 (juv).

GONADS. Testis 2 mm (adult) and minute (juv).

MOLT. Juvenile in first prebasic molt, growing body and flight feathers.

STOMACH CONTENTS. Insect remains in both.

***Philydor rufum*: Buff-fronted
Foliage-gleaner**

SPECIMENS (MVZ). ♂ Dec (1). ♀♀ Feb (1), Sep (1), Nov (1). ♂ and Nov ♀ with adult skulls; others with partly pneumatized skulls.

MASS (G). ♂ 26.0. ♀♀ \bar{X} = 24.8 (SD = 1.25, range = 23.4–25.8, N = 3).

IRIS. Dark brown.

BILL. Upper mandible black. Lower mandible black, tinged brown. Mouth lining light green.

FEET AND TARSII. Pale green or olive green. Toe pads tan.

GONADS. ♂ Testes 5 × 3 mm. ♀♀ Largest ova ≤ 1 mm, Sep, Nov. Ovary of Feb ♀ smooth, undeveloped.

MOLT. Feb body molt.

STOMACH CONTENTS. Insect remains in 2.

HABITAT. Forest subcanopy, 6–9 m.

***Anabacerthia lichtensteini*: Ochre-breasted
Foliage-gleaner**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 13: Jan (3), Jun (1), Aug (1), Sep (3), Oct (3), Nov (1), Dec (1). ♀♀ Mar (1), May (1), Aug (1), Sep (1). Sex? Mar (1). Jun, Aug, Sep (2), and Dec ♂♂ with adult skulls. All other specimens with partly pneumatized skulls.

MASS (G). ♂♂ \bar{X} = 21.6 (SD = 1.16, range = 19.5–23.5, N = 13). ♀♀ \bar{X} = 19.6 (SD = 1.00, range = 18.3–20.5, N = 4); Aug ♀ with light fat.

IRIS. Brown or dark brown.

BILL. Upper mandible black, brown, brownish black, olive brown, or gray. Lower mandible black, brown, gray, grayish brown or white, bluish or greenish gray, or tan with brown tomentum and tip. Mouth lining gray green, flesh green, or flesh color.

FEET AND TARSII. Olive, olive brown, olive green, yellow green, or yellow gray. Toe pads yellow brown, dark greenish brown, or brown.

GONADS. ♂♂ Testes enlarged (7.5 × 4–10 × 6.5 mm) Sep, Oct; regressing Nov, Dec (2 × 1–3 × 2 mm); small (1 mm) in Mar; and enlarging (2 × 2–3 × 1.5 mm) again in Jun, Aug. ♀♀ All with granular ovaries or largest ova ≤ 1 mm diam.

MOLT. Prebasic molt of body and flight feathers in Dec and Mar.

STOMACH CONTENTS. Insect remains in 14.

HABITAT. Forest.

NOTES. Forages 1–10 m up in foliage or on stems 3–5 cm diam; often in areas of bamboo or moderately dense saplings. May join mixed-species flocks. Call note a single, shrill *scree*.

***Syndactyla rufosuperciliata*: Buff-browed
Foliage-gleaner**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 16: Feb (1), Mar (5), May (2), Sep (4), Oct (3), Nov (1). ♀♀ 10: Jan (1),

Feb (1), Mar (1), May (1), Jun (1), Aug (1) Sep (3), Oct (1). One Sep and 1 Oct ♂ with adult skulls. All other birds with only partly pneumatized skulls.

MASS (G). ♂♂ \bar{X} = 24.5 (SD = 1.59, range = 22.2–27.2, N = 16). ♀♀ \bar{X} = 23.1 (SD = 1.72, range = 20.3–26.9, N = 9); Feb bird with light fat.

IRIS. Brown, dark brown, and black.

BILL. Upper mandible black, blackish olive, or dark brown. Lower mandible gray, pinkish gray, grayish white, or white with brown, olive brown, or gray tomentum and tip. Mouth lining lemon yellow, greenish yellow, brownish orange, or dark flesh color. Tongue and palate brownish orange or orange flesh color.

FEET AND TARSII. Yellowish tan, gray tan, gray green, olive green, olive brown, or yellow olive gray. Toe pads greenish yellow or bright yellow.

GONADS. ♂♂ Testes enlarged (10 × 5–13 × 7 mm) with cloacal protuberances, Sep, Oct; regressing (8 × 5 mm) in Nov; small (1 × 1–2 × 1.5 mm), Feb–May. ♀♀ Largest ova (2 mm diam) in Sep. All other birds, largest ova ≤ 1 mm, although an Oct ♀ has a well-developed incubation patch. One ♀ with enlarging oviduct in Aug. Feb and Jun ♀♀ have smooth, undeveloped ovaries and are probably immatures that have not yet bred.

MOLT. Adults and juveniles with molt in Jan, Feb, and Mar. One May ♀ with light molt on the head.

STOMACH CONTENTS. Seventeen with insect remains.

HABITAT. Thickets, vines, and other dense vegetation in the forest understory.

NOTES. Occupies the understory (1–7 m) but often stays low in the vegetation, 1–2 m up. Visits small (2–3 cm DBH) trees, scooting up the stem in woodcreeper fashion. Position note a squeaky, loud *tschup*. Full skull pneumatization in the species requires at least 2 years; birds breed while still retaining large skull windows. Common at El Tirol.

***Automolus leucophthalmus*: White-eyed
Foliage-gleaner**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 11: May (1), Jun (1), Sep (1), Oct (4), Nov (1), Dec (3). ♀♀ 13: Jan (1), Jun (4), Sep (1), Oct (1), Nov (2), Dec (4). Sex? Feb (1), Jun (1). All birds with adult skulls except 1 Dec ♂ and 1 Dec ♀, 1 Jan ♀, and 1 Feb Sex?

MASS (G). ♂♂ \bar{X} = 32.8 (SD = 1.80, range = 29.2–35.5, N = 11). ♀♀ \bar{X} = 29.6 (SD = 2.11, range = 26.0–32.5, N = 12), Feb bird with light fat.

IRIS. Pearl, white, whitish brown, brown, gray, gray white, or golden white.

BILL. Upper mandible dark brown, brownish olive, or horn, with lighter tip. Lower mandible gray, yellow gray, gray green, ivory, or tan. Mouth lining and tongue pale pink.

FACIAL SKIN. Skin around eye greenish yellow.

FEET AND TARSII. Olive, yellow, or gray green; greenish or grayish tan; or yellowish gray.

GONADS. ♂♂ Testes enlarged ($10 \times 5\text{--}15 \times 8$ mm) in Oct, Nov, Dec; small ($1 \times 1\text{--}3 \times 1$ mm) Dec to Jun; enlarging (8×4 mm) in Sep. ♀♀ Enlarged ova, collapsed follicles, enlarged oviducts, and/or active incubation patches in Sep, Oct, Nov. Ovaries granular with ova ≤ 1 mm or ovaries undeveloped in birds with juvenal skulls in Dec, Jan, Feb, Jun.

MOLT. Prebasic and first prebasic molts in Dec, Jan, Feb, May.

STOMACH CONTENTS. Sixteen with insect remains, including caterpillars.

HABITAT. Heavy forest, old second growth.

NOTES. Low (1–4 m) in vegetation on the trunks and branches of small trees, in bamboo thickets, tree ferns, vines. Often move in pairs; counter call. Common at El Tirol.

***Cranioleuca obsoleta*: Olive Spinetail**

SPECIMENS (MVZ). ♂ Oct (1), skull ~25% pneumatized.

MASS (G). 12.5, light fat.

IRIS. Red brown.

BILL. Upper mandible black. Lower mandible flesh color.

FEET AND TARS. Yellowish gray.

GONADS. Testis enlarged (9×5 mm).

MOLT. No.

STOMACH CONTENTS. Insect remains.

NOTES. At edge in scrubby vegetation, with bamboo and small trees.

***Synallaxis cinerascens*: Gray-bellied Spinetail**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 18: Jan (2), Feb (2), Mar (1), May (2), Jun (2), Sep (2), Oct (3), Dec (4). ♀♀ Mar (3), Jun (1), Aug (1), Nov (1), Dec (1). One Dec ♂ with an adult skull. All others birds with partly pneumatized skulls.

MASS (G). ♂♂ $\bar{X} = 11.8$ (SD = 1.17, range = 10.0–14.0, $N = 18$). ♀♀ $\bar{X} = 11.4$ (SD = 0.94, range = 10.0–12.5, $N = 7$). One Mar ♀ and 1 May and 1 Sep ♂ with light fat.

IRIS. Red, red brown, or brown.

BILL. Upper mandible black. Lower mandible black, gray, gray brown, gray blue, or silver gray; may have a black tip. Mouth lining black, slate gray, or blue gray.

FEET AND TARS. Tan, brown, gray tan, gray blue, olive brown, or yellowish or greenish gray. Toe pads light green, flesh green, olive tan, or tan.

GONADS. ♂♂ Testes of some enlarged ($5 \times 3\text{--}8 \times 4$ mm) in Sep, Oct, Dec, and 1 bird in May. Testes medium size (4×2 mm) in Jan, Feb, Mar, and May and small ($1 \times 1\text{--}2 \times 1$ mm) in Oct, Dec, Jan, Feb, May, and Jun. ♀♀ Nov ♀ with ova 1.5 mm diam, enlarged oviduct, and brood patch; Aug ♀ with ova 1.5 mm diam. All other ♀♀ with ova ≤ 1 mm.

MOLT. Body and flight feather molt in Dec, Feb, Mar. Body only molt in Oct, Dec, Jan, and Mar.

STOMACH CONTENTS. Insect remains in 18.

HABITAT. Forest understory, especially in very dense tangles of bamboo and vines.

NOTES. Most commonly seen *Synallaxis* at El Tirol. One individual carrying nest material in Sep. Complete skull pneumatization appears to require at least 2 years, and many breeding birds have large skull windows. Bird begins foraging very low in vegetation, working its way up 1–2 m poking and probing; all stems 1–2 cm diam. Usually in pairs; 1 observation of foraging with a mixed-species flock. Call a long, ascending, reedy or nasal whistle followed by 2 short, abrupt notes at lower frequencies; *wheee buz whit*.

***Synallaxis ruficapilla*: Rufous-capped Spinetail**

SPECIMENS (USNM, MVZ). ♂♂ Feb (2), Mar (1), Oct (3), Dec (1). ♀♀ Jan (1), Mar (1), Sep (1), Oct (1). Sex? Sep (1). Skulls of all birds only partly pneumatized.

MASS (G). ♂♂ $\bar{X} = 12.7$ (SD = 0.80, range = 12.0–14.1, $N = 7$). ♀♀ $\bar{X} = 12.3$ (SD = 1.07, range = 10.9–13.5, $N = 4$).

IRIS. Brown, red, or red brown.

BILL. Upper mandible black. Lower mandible black, gray, blue gray, white, or pale pinkish gray at base with gray tip. Tongue and palate pale pinkish flesh color. Mouth lining pinkish flesh color, greenish flesh color, or light green.

FEET AND TARS. Yellowish gray, gray green, gray tan, brown, or olive green. Toe pads olive green or tan.

GONADS. ♂♂ Testes enlarged ($6 \times 4\text{--}9 \times 6$ mm) in Oct, regressing in Dec (5×2.5), and small ($1 \times 1\text{--}2 \times 1$ mm) in Feb, Mar. ♀♀ Enlarged ova (2–8 mm diam), enlarged oviduct, and/or developing incubation patch in Sep, Oct, Jan. Mar ovary postbreeding.

MOLT. Body or body and flight feather molt in Dec, Jan, Feb, Mar.

STOMACH CONTENTS. Insect remains in 9.

HABITAT. Thick forest undergrowth with vines and/or bamboo.

NOTES. Moves about in pairs. Skulls require more than 1 year to pneumatize if they ever do.

***Synallaxis spixi*: Spix's Spinetail**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Feb (1), May (1), Oct (1). ♀ Oct (1). Sex? Feb (1). Oct ♂ with adult skull. All others with partly pneumatized skulls.

MASS (G). ♂♂ $\bar{X} = 12.6$ (SD = 0.30, range = 12.3–13.0, $N = 4$); Feb and May with light fat. ♀ 12.3, with light fat. Sex? 11.7.

IRIS. Brown, red, brick red brown, or pinkish or grayish white.

BILL. Upper mandible black. Lower mandible gray or blue gray. Mouth lining flesh color.

FEET AND TARS. Olive tan, olive green, or greenish gray. Toe pads light green or grayish tan.

GONADS. ♂♂ Testes enlarged in May (6.5 × 4 mm) and Oct (5.5 × 4); small in Jan (3 × 2 mm) and Feb (1 mm). ♀ Largest ovum 1.5 mm diam.

MOLT. Tail molt in Jan, Feb, Oct.

STOMACH CONTENTS. Insect remains in 6.

HABITAT. Scrubby growth in abandoned pastures and fields. Frequents *Baccharis* shrubs, tall grass, and, especially, dense, tall (≤1 m) herbaceous growth.

NOTES. Stays low within the vegetation, only occasionally emerging. Skull pneumatization takes a year or more and is not complete in most breeding birds. Vocalizes frequently, either a single note or a repeated series of similar notes.

***Synallaxis frontalis*: Sooty-fronted Spinetail**

SPECIMENS (MVZ). ♀ Jun (1), with large skull windows.

MASS (G). 14.3, light fat.

IRIS. Light brown.

BILL. Upper mandible black. Lower mandible pinkish gray.

FEET AND TARS. Tan.

GONADS. Ovary granular, ova minute.

MOLT. No.

STOMACH CONTENTS. Insect remains.

NOTES. Netted in scrubby field.

FAMILY TYRANNIDAE: TYRANT FLYCATCHERS

***Phyllomyias burmeisteri*: Rough-legged Tyrannulet**

SPECIMENS (MVZ). ♂♂ Mar (1), skull windows; Sep (1), first-year skull.

MASS (G). 10.6, 11.0, respectively.

IRIS. Light brown.

BILL. Upper mandible black. Lower mandible pale pink with blackish tip. Mouth lining pinkish flesh color. Palate and tongue bright orange.

FEET AND TARS. Black with faint purplish cast. Toe pads pale gray with greenish cast.

GONADS. Testes enlarged (6 × 4, 5 × 2 mm).

MOLT. No.

STOMACH CONTENTS. Insect remains in 1.

HABITAT. Forest.

NOTES. Call and forage in the canopy.

***Myiopagis caniceps*: Gray Elaenia**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), May (1), Oct (1). ♀ Jun (1). All birds with large skull windows.

MASS (G). ♂♂ \bar{X} = 10.6 (SD = 0.86, range = 10.0–11.6, N = 3). ♀ 11.0.

IRIS. Brown or gray brown.

BILL. Upper mandible black. Lower mandible black with light area at base. Mouth lining greenish orange.

FEET AND TARS. Black or dark gray.

GONADS. ♂♂ Testes 3 × 2 (Jan), 7 × 3 (May), 5 × 3 mm (Oct). ♀ Ovary granular.

MOLT. Prebasic molt of body and flight feathers in Jan and May.

STOMACH CONTENTS. All with insect remains, including caterpillars.

HABITAT. Forest, forest edge.

NOTES. Calls while moving through the foliage, foraging. Occasionally forages with a mixed-species flock. Moves in the understory (3–4 m) and up through the canopy (18 m). Testis size in May specimen suggests that breeding and molt overlap in this species. Also, full skull pneumatization requires more than a year.

***Myiopagis viridicata*: Greenish Elaenia**

SPECIMENS (USNM, MVZ). ♂♂ 14: Jan (1), Mar (3), Oct (3), Nov (6), Dec (1). ♀♀ Jan (2), Feb (1), Oct (4). Two Mar ♂♂ and Jan ♀♀ with skull windows. All others with adult skulls.

MASS (G). ♂♂ \bar{X} = 11.7 (SD = 0.82, range = 10.3–12.9, N = 14). ♀♀ \bar{X} = 11.4 (SD = 1.20, range = 10.2–13.0, N = 7). Light fat in some Jan, Feb, and Mar birds.

IRIS. Brown or dark brown.

BILL. Upper mandible black, blackish brown, or brown. Distal half of lower mandible black, blackish brown, or brown; proximal half pinkish purple, pinkish white, brown, or tan with black tomium. Mouth lining, tongue, and palate greenish orange, orange, or orangish flesh color.

FEET AND TARS. Black, gray, bluish gray, slate gray, or brownish gray. Toe pads tan, gray, greenish gray, or gray brown.

GONADS. ♂♂ Testes enlarged (5 × 3–8 × 4 mm) Oct to Jan; small (1 × 1–3 × 2 mm) in Mar. ♀♀ Largest ova 0.5 to 1.5 mm diam, Jan and Oct; Feb female with postbreeding ovary.

MOLT. Prebasic molt in Nov, Dec, and Feb. First prebasic molt in Jan and Mar.

PLUMAGE. Immature birds (with skull windows) have a pale reddish tan crown and lack the yellow coronal stripe.

STOMACH CONTENTS. Nine with only insect remains, 9 with only fruit remains, and 1 with fruit and insect remains. Six in Oct and Nov with green caterpillars (to 3.8 cm long).

HABITAT. Forest, cutover forest.

NOTES. This northern austral migrant (Hayes et al., 1994) calls steadily and repeatedly at least from Sep through Mar. In early Oct 1980, 6 individuals spaced out in a relatively small area of forest called nonstop as if establishing territories. Loud, rather harsh, 2-note call, the second note increasing in frequency, reminiscent of that of *Lathrotriccus euleri*. The call is sometimes preceded by a single shrill buzz. Birds call from perches at 4–8 m but may forage higher in the vegetation.

***Elaenia flavogaster*: Yellow-bellied Elaenia**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), Mar (1), May (1), Jun (2), Sep (1). ♀♀ Jun (2), Aug (1), Sep (1). All specimens with adult skulls.

MASS (G). ♂♂ \bar{X} = 23.2 (SD = 2.07, range = 20.8–26.5, N = 6). ♀♀ \bar{X} = 23.4 (SD = 1.68, range = 21.5–25.5, N = 4). Mar, Jun, and Sep birds with light to moderate fat.

IRIS. Brown or dark brown

BILL. Upper mandible brown or dark brown with black tip. Lower mandible tan, brown, gray, or greenish flesh with dark brown or black tip. Mouth lining orange or yellow orange.

FEET AND TARS. Black or dark gray. Toe pads green.

GONADS. ♂♂ Testes 5 × 3 mm (Feb) and small (1 × 1–3 × 2 mm) in Mar through Sep. ♀♀ Ovaries granular, largest ova ≤ 1 mm.

MOLT. Prebasic molt in Feb, Mar.

STOMACH CONTENTS. Six with fruits, including *Cap-sicum* sp. (Solanaceae) and *Ocotea puberula* (Lauraceae).

HABITAT. Woodland edge, second-growth scrub, scrubby pasture; fence rows.

NOTES. First heard singing in Oct and continuing through Mar. Call a single-note whistle similar to that of the western wood pewee (*Contopus sordidulus*) [RMZ]. Hayes (2014) located eggs from 13 nests in Nov–Jan at Sapucá (Figure 1). Observed feeding on fruits of *Allophylus edulis* (Sapindaceae) and *Trema micrantha* (Cannabaceae).

***Elaenia spectabilis*: Large Elaenia**

SPECIMENS (MVZ). ♂♂ Jan (1), Sep (3), Oct (2). ♀ Oct (1). All birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 27.5 (SD = 1.05, range = 26.1–27.8, N = 6); light fat in Jan and 1 Sep ♂. ♀ 25.5.

IRIS. Brown or dark brown.

BILL. Black; lower mandible light at base. Mouth lining orange or greenish orange.

FEET AND TARS. Black.

GONADS. ♂♂ All testes enlarged (5 × 3–8 × 4 mm), Sep, Oct, and Jan. ♀ Three largest ova 1.5 mm diam; oviduct moderately enlarged.

MOLT. Jan ♂ in heavy prebasic molt.

STOMACH CONTENTS. Five with fruit, including *Ocotea puberula*.

HABITAT. Forest edge; second-growth scrub.

NOTES. Makes a mournful, wheezy, descending *preur* or *peow* call, similar to that of the western wood pewee, *Contopus sordidulus* (NKJ). Breeds in Paraguay and migrates north for the winter.

***Elaenia albiceps*: White-crested Elaenia**

SPECIMENS (MVZ). ♂♂ Sep (1), Oct (1). ♀ Mar (1). All birds with adult skulls.

MASS (G). ♂♂ 16.9, 17.0. ♀ 15.0. All birds with light to moderate fat.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible tan or gray at base and black distally. Mouth lining orange or flesh green.

FEET AND TARS. Black. Toe pads green.

GONADS. ♂♂ Testes small (2 × 1.5, 3 × 1.5 mm). ♀ Ova ≤ 1 mm.

MOLT. ♀ With body molt.

STOMACH CONTENTS. Two with *Ocotea puberula* fruits. Also observed feeding on *Allophylus edulis* pulp.

HABITAT. Second-growth scrub.

NOTES. An austral migrant that breeds in Paraguay and in temperate forests farther south in Argentina (Hayes, 1995; Jiménez et al., 2016). Winter birds may be resident breeders, winter residents from farther south, or both. The males we collected are likely passage migrants on their way south to the breeding grounds, although neither is in breeding condition. The female is likely a migrant on her way north to the wintering grounds.

***Elaenia parvirostris*: Small-billed Elaenia**

SPECIMENS (USNM, MVZ). ♂♂ Mar (1), May (2), Sep (5). ♀♀ May (2), Oct (2). Mar ♂ with skull windows. Others birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 16.3 (SD = 1.08, range = 14.75–18.0, N = 8). Light to moderate fat in some Mar, May, and Sep ♂♂. ♀♀ \bar{X} = 20.3 (SD = 5.21, range = 14.0–26.1, N = 4). Light fat in 1 May ♀; very fat in 1 May and 1 Oct ♀.

IRIS. Brown, dark brown, or black.

BILL. Upper mandible brown or black. Lower mandible brown or black distally and pale green, yellowish red, or flesh color basally. Mouth lining orange or yellow orange.

FEET AND TARS. Black. Toe pads green.

GONADS. ♂♂ Testes small (3 × 2–2 × 1 mm) in all birds. ♀♀ Ovaries granular or undeveloped.

MOLT. No.

PLUMAGE. Male with incompletely pneumatized skull lacks the white crown patch.

STOMACH CONTENTS. Two with insect remains. Five with fruit, including *Ocotea puberula*.

HABITAT. Forest along creeks; forest edge adjacent to pasture.

NOTES. Observed eating *Ocotea puberula*, *Allophylus edulis*, and *Trema micrantha*. Call note a *whit* or *pit*. Fairly common. Hayes (1995) and del Castillo et al. (2015) noted that this species is a breeding resident in Paraguay. However, populations that breed to the south in Argentina migrate north during the austral winter and pass through Paraguay (Capllonch and Lobo, 2005; Ridgely and Tudor, 2009). Thus, although the species is likely present at El Tirol year-round, whether winter birds represent the local breeding population, migrants from farther south, or both is not known.

***Suiriri suiriri**: Suiriri Flycatcher**

NOTES. The species occurs primarily in the Chaco in Paraguay, with El Tirol in the easternmost part of its range (Ridgely and Tudor, 2009). The bird was observed in Jan eating fruit in a tree in a clearing and was identified by its distinctive plumage and call (NKJ).

***Serpophaga subcristata*: White-crested Tyrannulet**

SPECIMENS (USNM). ♀ May (1), adult skull.

MASS (G). 5.5.

IRIS. Brown.

BILL. Black.

FEET AND TARSII. Black.

GONADS. Ovary granular.

MOLT. Light body molt in all tracts.

PLUMAGE. Olive above and yellow on the abdomen.

HABITAT. Scrubby second growth.

NOTES. Appeared to be eating fruit when collected, but stomach was empty. The migratory status of the species is uncertain (Ridgely and Tudor, 1994). Some birds breeding to the south may move north in the winter (Hayes, 1995).

***Serpophaga munda*: White-bellied Tyrannulet**

SPECIMENS (USNM). ♂ Aug (1), adult skull.

MASS (G). 6.5, light fat.

IRIS. Brown.

BILL. Black.

FEET AND TARSII. Black.

GONADS. Testis small (1.5 × 1 mm).

MOLT. Body molt.

PLUMAGE. Above, grayer than *S. subcristata*, and white on abdomen.

STOMACH CONTENTS. Full of insects.

NOTES. Not recorded by Hayes (1995) from his Alto Paraná geographic region or by Esquivel M. et al. (2007) from San Rafael Park. Breeds farther south than *S. subcristata*, migrating north and east for the austral winter (Ridgely and Tudor, 1994, 2009; Hayes, 1995). This flycatcher has been variously considered to be a species distinct from *S. subcristata*, a subspecies of *S. subcristata*, or a color morph of the latter (Short, 1975; Belton, 1985; Hayes, 1995; Stotz et al., 1996; Rheindt et al., 2008; Ridgely and Tudor, 2009; Krabbe, 2016; Remsen et al., 2016). A definitive resolution of its systematic status requires additional investigation.

***Capsiempis flaveola*: Yellow Tyrannulet**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 10: Feb (2), Jun (3), Sep (3), Oct (2). ♀♀ Feb (1), Mar (1) May (1), Jun (1), Sep (2). Sex? Jun (1). All with adult skulls except 1 Feb ♂ with 2 small windows.

MASS (G). ♂♂ $\bar{X} = 7.1$ (SD = 0.77, range = 5.5–8.0, N = 10). ♀♀ $\bar{X} = 7.8$ (SD = 0.98, range = 6.8–9.5, N = 6). Sex? 6.35. One Feb and 2 Jun birds with light fat.

IRIS. Brown, dark brown, or black.

BILL. Upper mandible black or brownish black. Lower mandible black, tan, or cream color with a black tip and broad black tomium. Mouth lining bright orange or orange olive. Tongue orange.

FEET AND TARSII. Dark gray, slate gray, brownish gray, or brown. Toe pads green, greenish gray, or olive tan.

GONADS. ♂♂ Testes enlarged (5 × 3–7 × 5 mm) Sep through Feb; small (3 × 2–1.5 × 1) Feb through Jun. ♀♀ Sep birds with enlarged (2–5 mm diam) yolked ova; 1 with enlarged oviduct. Mar birds also had enlarged ova and were with mates. Jun ♀ with granular ovary. Feb and May ♀♀ largest ova ≤ 1 mm; latter bird with a slightly enlarged oviduct.

MOLT. Prebasic molt in Sep, Oct, Feb, Mar, and May.

STOMACH CONTENTS. Nine with insect remains, including a caterpillar; 1 with insect and fruit remains.

HABITAT. Forest, forest edge, disturbed forest.

NOTES. Flitted from branch to branch in dense shrubby growth, tangles of vines and *Chusquea* sp., and small trees, usually 1–4 m up. Made a high-pitched, short, single-note, upwardly inflected ripping or buzz call, which was given by 1 bird or in duet with a mate, year-round. Molt and breeding overlap in some individuals. A Sep ♀ with scattered body molt had a 5-mm-diam yolked ovum and a greatly enlarged oviduct, and an Oct ♂ also with body molt had a 7 × 4 mm testis.

***Corythopsis delalandi*: Southern Antpitt**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jun (3), Sep (2), Oct (2), Dec (1). One Jun and 1 Sep ♂ with fully pneumatized skulls. Skulls of other ♂♂ with windows covering up to 60% of skull. ♀ Mar (1), juvenal skull.

MASS (G). ♂♂ $\bar{X} = 15.4$ (SD = 0.61, range = 14.75–16.5, N = 8); Jun birds with light to moderate fat. ♀ 11.9.

IRIS. Brown.

BILL. Upper mandible brown, brownish black, or black. Lower mandible tan, flesh color, orange, or pinkish purple (♀). Both mandibles edged orange or yellow. Tongue, palate, mouth lining, and gape bright orange.

FEET AND TARSII. Gray or pinkish gray. Other birds, tarsi gray, tan, or flesh color, with gray, blue gray, or tan toes. Toe pads gray brown.

GONADS. ♂♂ Testes small (1.5 × 1–2 × 1 mm) in Jun birds, large (7 × 4–10 × 4 mm) in birds from Sep to Dec. ♀ Ovary undeveloped.

MOLT. None recorded.

STOMACH CONTENTS. Six with insect remains. One bird observed with a caterpillar in its bill.

HABITAT. Forest.

NOTES. Many breeding males with incompletely pneumatized skulls. Birds hop around in open areas on the forest

floor and fallen logs. Perch on vines and saplings usually ≤ 0.5 m; occasionally up to 2 m. Call very loud.

***Euscarthmus meloryphus*: Tawny-crowned
Pygmy-tyrant**

SPECIMENS (MVZ). ♀ Oct (1), adult skull.

MASS (G). 8.8.

GONADS. Largest ova 1.5 mm; with incubation patch.

STOMACH CONTENTS. Insect remains.

MOLT. No.

NOTES. Pair calling repeatedly from dry thicket; acted as if they had a nest. Not reported from the Alto Paraná geographical region of Hayes (1995), but recorded subsequently from San Rafael National Park (Esquivel M. et al., 2007).

***Phylloscartes eximius*: Southern Bristle-tyrant**

SPECIMENS (USNM, MVZ). ♂♂ Mar (1), Jun (1), Sep (1), Oct (2), Nov (1). ♀♀ Mar (1) Sep (2), Oct (1), Nov (1). The Jun ♂ and 1 Sep ♀ have adult skulls. All other birds, skull pneumatization $\leq 50\%$.

MASS (G). ♂♂ $\bar{X} = 7.8$ (SD = 0.43, range = 7.3–8.2, N = 6). ♀♀ $\bar{X} = 7.0$ (SD = 0.64, range = 6.7–8.0, N = 4). Jun ♂ with light fat.

IRIS. Brown, dark brown, or red.

BILL. Upper mandible black or horn color. Lower mandible tan, pinkish tan, or pinkish white; some with black tip. Mouth lining and tongue flesh or greenish flesh color; palate gray.

FEET AND TARS. Gray, blue gray, or black. Toe pads light green or light olive brown.

GONADS. ♂♂ Testes Sep through Nov enlarged (4×2 – 6×3.5 mm); Mar and Jun small (1 mm diam). ♀♀ Sep birds breeding (enlarged ova and oviduct; 1 with shelled egg in oviduct). Oct and Nov largest ova ≤ 0.5 mm and postbreeding. Mar ovary undeveloped.

MOLT. Prebasic in Nov and Mar. First prebasic in Mar.

STOMACH CONTENTS. Ten with insect remains, including larvae and a 31-mm-long caterpillar.

HABITAT. Forest, especially with open understory.

NOTES. Several breeding individuals with large skull windows; complete pneumatization likely takes more than 1 year. Moderately common; seen and heard regularly. Call is a buzz of varying length. Foliage gleams in the understory, 3–6 m up. The International Union for Conservation of Nature (IUCN, 2015) listed this species as Near Threatened; a moderately rapid decline in numbers due to habitat loss is suspected.

***Phylloscartes ventralis*: Mottle-cheeked
Tyrannulet**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), May (1), Aug (1), Sep (2). ♀♀ May (2), Aug (1), Sep (2), Oct (4). All birds with partly pneumatized skulls.

MASS (G). ♂♂ $\bar{X} = 8.5$ (SD = 0.68, range = 8.0–9.5, N = 5); Aug ♂ with light fat. ♀♀ $\bar{X} = 7.8$ (SD = 1.0, range = 7.0–10.3, N = 9).

IRIS. Brown or brick red.

BILL. Upper mandible black. Lower mandible tan or tan with flesh color at base and black at tip. Mouth lining pale orange.

FEET AND TARS. Gray. Toe pads sandy brown.

GONADS. ♂♂ Testes enlarged (6×3 – 7×4 mm) in Aug, Sep, small (2×1 mm) in Jan, May. ♀♀ Aug ♀ with largest ova 2 mm diam, 1 collapsed follicle, and oviduct greatly enlarged. Ovaries small and granular or smooth and undeveloped in May, Sep, and Oct birds.

MOLT. No.

STOMACH CONTENTS. Ten with insect remains, including caterpillars.

HABITAT. Forest.

NOTES. Skull pneumatization clearly requires more than 1 year, if it is ever achieved. Foliage gleams among the dense leaves toward the tops of understory to midstory trees.

***Mionectes rufiventris*: Gray-hooded Flycatcher**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jun (1), Sep (1), Oct (2), Nov (1). ♀ Dec (1). All birds with large skull windows.

MASS (G). ♂♂ $\bar{X} = 15.0$ (SD = 0.57, range = 14.5–15.8, N = 5). ♀ 11.2.

IRIS. Brown, dark brown, or blackish brown.

BILL. Upper mandible black. Lower mandible with black or brownish black distal half; basal half yellowish tan or pinkish brown. Mouth lining black or grayish black; tongue grayish black with white tip.

FEET AND TARS. Gray or pale bluish brown. Toe pads greenish brown.

GONADS. ♂♂ Testes enlarged (6×3 – 8×3 mm) in Sep, Oct; regressing (4×2 mm) in Nov; and small (2.5×1.5 mm) in Jun. ♀ Largest ovum 2 mm diam.

MOLT. No.

STOMACH CONTENTS. Three with fruit and seeds.

HABITAT. Forest understory.

NOTES. Skull pneumatization apparently takes more than 1 year to complete in this species; however, birds with only partly pneumatized skulls had enlarged gonads and appeared to breed their first year. Bird observed feeding on *Allophylus edulis* and *Phoradendron piperoides* (Loranthaceae) fruits; chased away from the latter by *Euphonia violacea*.

***Leptopogon amaurocephalus*: Sepia-capped
Flycatcher**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 24: Jan (1), Feb (1), May (3), Jun (2), Aug (2), Sep (5), Oct (2), Nov (5), Dec (3). Some Jan, Feb, Sep, Oct, and Dec ♂♂ with adult skulls; others with partially (~40%–90%) pneumatized skulls. ♀♀ 15:

Jan (1), Mar (1), Jun (3), Aug (1), Sep (1), Oct (3), Nov (1), Dec (4). One Jan, 1 Mar, and 1 Dec ♀ with juvenal skull, i.e., no evidence of any pneumatization. Others with skulls partially (~40%–60%) pneumatized; none with adult skulls. Sex? May (1), skull 50% pneumatized.

MASS (G). ♂♂ \bar{X} = 11.9 (SD = 0.97, range = 10.0–13.2, N = 24). ♀♀ \bar{X} = 11.2 (SD = 0.91, range = 10.0–13.5, N = 15). Sex? = 12.75. Birds with light fat in Jan (1), Jun (3), Aug (1), and Dec (2).

IRIS. Brown, dark brown, or gray brown.

BILL. Upper mandible black. Lower mandible with distal two-thirds black and basal one-third light (gray, white, pinkish white, or tan); occasionally with light tip and/or tomium. Tongue and mouth lining flesh color.

FEET AND TARS. Gray, gray brown, brown, or slate. Toes same as tarsi or blue gray. Toe pads tan or greenish tan.

GONADS. ♂♂ Testes enlarging in Aug (4 × 2.5 mm), enlarged (6 × 3–8 × 4 mm) in Aug to Dec, regressing in Jan (4 × 2 mm), and small from Feb to Jun (1 × 0.5–3 × 1 mm). In one Dec ♂ with a juvenal skull, testis minute. Jan, Jun, Sep, and 1 Dec ♀♀ with undeveloped ovaries. Other Jun and some Oct and Dec ♀♀ with granular ovaries. Some ♀♀ with enlarged ova, collapsed follicles, enlarged oviducts, and/or incubation patches in Aug, Oct, and Dec.

MOLT. Prebasic molt in Nov, Dec, and Feb. First prebasic molt in Dec, Jan, and Mar.

STOMACH CONTENTS. Nineteen with insect remains, including caterpillars and grasshoppers. Two with mashed fruit or seeds.

HABITAT. Forest.

NOTES. One of the most common birds in the forest understory or midstory, sometimes in vine tangles, saplings, or bamboo thickets. Perches 2–10 m up. Skull pneumatization data suggest that the process takes 2 years to complete but that birds breed their first year. Call a series of short falling notes or soft buzzy trill. May hover-pluck insects; observed beating a caterpillar against a branch to subdue it.

***Myiornis auricularis*: Eared Pygmy-tyrant**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 14: Feb (1), Mar (1), May (2), Jun (2), Aug (2), Sep (1), Oct (4), Nov (1). ♀♀ Jan (1), Jun (1), Aug (2), Oct (1). All birds with skull windows of varying size; no skulls more than 50% pneumatized.

MASS (G). ♂♂ \bar{X} = 5.25 (SD = 0.24, range = 5.0–5.8, N = 14). ♀♀ \bar{X} = 5.3 (SD = 0.93, range = 4.0–6.5, N = 5). Some individuals with light to moderate fat in May, Jun, Aug, Oct.

IRIS. Red, brick red, red brown, or white.

BILL. Upper mandible black. Lower mandible whitish or tan with black tomium or black with tan, white, or yellow patch at base. Mouth lining orange or yellow green.

FEET AND TARS. Brown, tan, or flesh color (also pinkish green, grayish pink, greenish purple, yellowish, or maroon).

GONADS. ♂♂ Testes enlarged (3 × 1–7 × 3 mm) Aug through Nov. Small or undeveloped (0.5 × 0.5–1.5 × 0.75 mm) Feb through Jun. ♀♀ Two Aug birds breeding (enlarged yolked ova to 5 mm diam, collapsed follicle, enlarged oviduct). Ovaries small, undeveloped in Jan, Jun, and Oct specimens.

MOLT. Likely prebasic molt in Feb, Jun, and Nov. First prebasic molt in Mar. Crown molt only in late Sep breeding male may be a prealternate molt.

STOMACH CONTENTS. Fourteen with insect remains (including caterpillars).

HABITAT. Forest undergrowth; dense woodland; isolated trees in scrubby second growth.

NOTES. The species is fairly common and often heard rather than seen. Pairs move together, calling back and forth with high-pitched double *tsk* or *teek* notes. They also make a single-note, oft-repeated *dik, dik, dik*, sometimes followed by a short trill. The birds forage in thickets, at the tops of saplings or small trees, and in bamboo tangles, *Baccharis* shrubs, and vines, from 2 to 10 m. The skull in this species does not appear to pneumatize fully, so this character cannot be used to age individuals. Birds with unpneumatized skulls are in breeding condition.

***Hemitriccus diops*: Drab-breasted Pygmy-tyrant**

SPECIMENS (USNM, MVZ). ♂♂ Oct (3), Dec (2). ♀♀ Jan (2), Dec (2). Skulls only partially pneumatized in all birds.

MASS (G). ♂♂ \bar{X} = 8.8 (SD = 0.74, range = 8.0–9.5, N = 5). ♀♀ \bar{X} = 8.3 (SD = 1.64, range = 6.8–10.0, N = 4).

IRIS. Black, brown, or red.

BILL. Upper mandible black. Lower mandible gray.

FEET AND TARS. Gray.

GONADS. ♂♂ Oct birds with enlarged (7.5 × 3.5–8 × 4 mm) testes. Dec birds with small (1 × 1–3.5 × 2.5 mm) testes. ♀♀ Ovaries tiny or granular.

MOLT. All Dec and Jan birds molting.

STOMACH CONTENTS. Four with insect remains.

HABITAT. Dense growth in forest understory, near ground.

NOTES. Several males in breeding condition have incompletely pneumatized skulls.

***Hemitriccus margaritaceiventer*: Pearly-vented Tody-tyrant**

SPECIMENS (MVZ). ♂ Sep (1), with large skull windows.

MASS (G). 8.9.

IRIS. Pale gold.

GONADS. Testis 6 × 3 mm.

MOLT. No.

***Poecilatriccus plumbeiceps*: Ochre-faced
Tody-flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ Mar (1), Sep (1), Oct (2), Dec (1). ♀♀ Sep (1). All birds with skull windows of varying size; none more than 50% pneumatized.

MASS (G). ♂♂ \bar{X} = 5.8 (SD = 0.19, range = 5.5–6.0, N = 5). ♀♀ 5.5.

IRIS. Brown, chestnut brown, or red.

BILL. Black. Mouth lining, tongue, and palette pale flesh or yellowish flesh color.

FEET AND TARS. Gray or blue gray. Toe pads brownish gray.

GONADS. ♂♂ Testes enlarged (5 × 3–6 × 4 mm) in Sep, Oct, decreasing in size in Dec (4 × 2.5 mm), and small in Mar (1 × 1 mm). ♀ Largest ovum 1 mm, oviduct enlarging, and incubation patch developing.

MOLT. Mar ♂ in heavy body and tail molt.

STOMACH CONTENTS. Insect remains in 2.

HABITAT. Forest, forest edge.

NOTES. Birds often move as pairs. Birds without fully pneumatized skulls breed. Occupy dense undergrowth (1–2 m) of viny tangles and bamboo thickets, but also may call from higher perches 3–5 m up in saplings and small trees. Call a low-pitched guttural trill (repeated note). Birds calling everywhere in forest in May.

***Tolmomyias sulphureus*: Yellow-olive
Flycatcher**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jun (1), Sep (2), Oct (3). ♀♀ Feb (1), Oct (1), Nov (1). One Sep ♂ with an adult skull. All other birds with skull ≤ 50% pneumatized.

MASS (G). ♂♂ \bar{X} = 14.7 (SD = 0.86, range = 13.5–15.9, N = 5). ♀♀ \bar{X} = 16.2 (SD = 1.08, range = 15.0–17.1, N = 3); Nov ♀ with light fat.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible gray or white or pale greenish gray at base with double purple lines forming a diamond and bluish gray near tip. Mouth lining and tongue pink.

FACIAL SKIN. Bare skin below eye gray.

FEET AND TARS. Gray, dark blue gray, or brown with blue gray or purple gray tinge. Toe pads tan.

GONADS. ♂♂ Testes increasing in size in Sep (3 × 2–5 × 3 mm), enlarged in Oct (8 × 4–9 × 4 mm), and small in Jun (2 × 1 mm). ♀♀ Nov ♀ recently laid; Oct and Nov ♀♀ with active incubation patches. Ovary small in Feb.

MOLT. Feb ♀ with body molt.

PLUMAGE. Ear covert patch blackish as reported in Ridgely and Tudor (2009).

STOMACH CONTENTS. Seven with insect remains, including 2 with stink bugs (Pentatomidae, Hemiptera).

HABITAT. Forest.

NOTES. Birds with unpneumatized skulls in breeding condition. Female with juvenile in Oct. Call a full-bodied buzz.

***Platyrrinchus mystaceus*: White-throated
Spadebill**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jun (2), Aug (1), Sep (2), Oct (3). ♀♀ Feb (1), Mar (1), Jun (1), Sep (1), Dec (2). All but 1 bird with skull windows of varying size; none >50% pneumatized.

MASS (G). ♂♂ \bar{X} = 9.2 (SD = 1.26, range = 8.3–12.0, N = 8). ♀♀ \bar{X} = 7.25 (SD = 0.54, range = 6.4–8.0, N = 6). Slight or moderate fat in Jun birds.

IRIS. Dark brown or brown.

BILL. Upper mandible black. Lower mandible tan, cream color, flesh color, or yellow. Mouth lining and tongue yellow orange or orange flesh color.

FEET AND TARS. Tan, gray, pinkish gray, pinkish white, or flesh color. Toe pads yellowish white or pinkish or greenish tan.

GONADS. ♂♂ Testes enlarged (8 × 3–9 × 4 mm) in Sep–Oct; small (1 × 0.5–3.5 × 2 mm) in Jun, Aug, and 1 Sep bird. ♀♀ All ovaries small or minute; 2 in Feb–Mar, undeveloped.

MOLT. Feb ♀ with late body molt.

PLUMAGE. The yellow coronal patch was well developed in all males. The patch was either completely absent from females or consisted of a small buffy area on 1 or 2 crown feathers.

STOMACH CONTENTS. Ten with insect remains.

HABITAT. Forest undergrowth, shrubs, and vines.

NOTES. Rarely above 1.5–2 m. Many breeding birds with unpneumatized skulls.

***Lathrotriccus euleri*: Euler's Flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ (48): Feb (2), Mar (3), Aug (6), Sep (7), Oct (14), Nov (14), Dec (2). ♀♀ (27): Jan (2), Feb (2), Mar (2), Sep (6), Oct (2), Nov (9), Dec (4). Sex? Feb (1), Dec (1). Birds with juvenal skulls in Nov (4), Dec (1), Jan (2), Feb (1), and Mar (1). All other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 11.0 (SD = 0.81, range = 8.7–12.75, N = 48). ♀♀ \bar{X} = 10.9 (SD = 1.06, range = 9.0–13.8, N = 27). Sex? = 10.4, 9.0. Birds with light fat in Feb (3), Aug (1), Nov (5), and Dec (1); moderate to heavy fat in Mar (3).

IRIS. Brown, dark brown, or black.

BILL. Upper mandible black. Lower mandible orange, yellow, white, tan, or flesh color; tomium may be orange. Mouth lining, tongue, and palate bright orange, sometimes with an olive tinge or white.

FEET AND TARS. Black; brownish, grayish, or reddish black; blue gray; gray; or brown. Toe pads tan, brown, gray, or pinkish gray.

GONADS. ♂♂ Testes of 27 of 31 adult ♂♂ from mid-Sep to mid-Dec are enlarged (range 5 × 3–9.5 × 4.5 mm). Testes

decrease in size in Dec (4×2 mm), are small in Feb and Mar (1×1 – 1.5×1 mm), and increase in size again in Aug and Sep (2×1 – 3.5×1.5 mm). ♀♀ Nine of 10 adult females in Oct and Nov have enlarged ova, enlarged oviducts, and/or active brood patches. Ovaries small, granular, and postbreeding, and incubation patches refeathering in Nov, Dec, Jan, and Mar. Testes or ovaries of birds with juvenal skulls minute and undeveloped.

MOLT. Prebasic molt of adults in Dec, Jan, Feb, including body and flight feathers. Capllonch and Zelaya (2006) reported that Argentine birds begin the body molt on the breeding grounds but found no evidence of flight feather molt, which they speculated occurs during migration or on the wintering grounds. First prebasic molt in Jan, Feb, appeared to involve only body feathers.

STOMACH CONTENTS. Insect remains (predominantly beetles but also caterpillars) in 54; insect and fruit remains in 2; only fruits in 2.

HABITAT. Forest, forest edge, mature second growth.

NOTES. An austral migrant arriving from the north in mid- to late Aug. Some individuals stay to reproduce; others are likely in passage to breeding grounds in Argentina (Capllonch and Zelaya, 2006). Males arrive 7 to 10 days before ♀♀ and set up well-spaced territories, concentrated along creeks and ravines. May occupy thickets with dense sapling growth, vines, and thick ground cover of ferns. Perch from 1 to 10 m, usually at 3–5 m. Often seen in pairs or family groups. Calls of both males and females are heard from Aug through Mar. The primary call is a buzz followed by 2 (or 3) notes, the last at a higher frequency: *buzz pee wheet* or *buzz pee o wheet*. Feb and Mar birds make a 2-note descending call. The species was gone from El Tirol by the end of Mar. A primary focus of research of NKJ in Paraguay (see Zink and Johnson, 1984). Song recordings deposited at MVZ.

***Cnemotriccus fuscatus*: Fuscous Flycatcher**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Mar (1), May (1), Sep (4), Oct (2). ♀♀ Mar (1), May (1). Sex? Jan (1). All birds with adult skulls except Sex?, which has tiny skull windows.

MASS (G). ♂♂ $\bar{X} = 14.0$ (SD = 1.50, range = 12.0–16.3, $N = 8$); May ♂ with heavy fat. ♀♀ 10.5, 12.7. Sex? 15.8.

IRIS. Brown or dark brown.

BILL. All black or upper mandible black or brown and lower mandible dark brown with whitish area at base. Mouth lining orange or, along with palette and tongue, pinkish flesh color.

FEET AND Tarsi. Gray, bluish gray, or tarsi purplish gray and feet gray black. Toe pads light gray or grayish yellow.

GONADS. ♂♂ Testes enlarged (4×2 – 9×4 mm) Sep and Oct; small (2×1 mm) Mar and May. ♀♀ Mar ovary postbreeding; May ovary granular.

MOLT. Body molt in Jan Sex?.

STOMACH CONTENTS. Eight with insect remains; 2 with fruit remains; 1 with fruit and insect remains.

HABITAT. Forest, forest edge.

NOTES. On scrubby, viny bamboo, often low (1 m) in vegetation. This species is reportedly a rare breeder in Paraguay and even rarer in the winter, when it migrates to the north (Hayes et al., 1994; Hayes, 1995). However, the species occurred regularly at El Tirol, and we collected 2 winter specimens (8 and 21 May).

***Contopus cinereus*: Tropical Pewee**

SPECIMENS (USNM). ♂ Jun (1).

MASS (G). 13.5, very fat.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible yellow orange. Mouth lining bright orange.

FEET AND Tarsi. Black.

GONADS. Testis 2×1 mm.

MOLT. No.

PLUMAGE. Fits the description in Ridgely and Tudor (2009:450) of birds from southeastern Brazil, i.e., darker and grayer than birds in the rest of the range, with darker lores and weak wing bars.

STOMACH CONTENTS. Insect remains.

HABITAT. Forest.

***Colonia colonus*: Long-tailed Tyrant**

SPECIMENS (USNM, MVZ). ♂♂ Feb (3), 1 adult skull, 1 with skull windows, and 1 skull not pneumatized. ♀ Aug (1), adult skull.

MASS (G). ♂♂ $\bar{X} = 15.8$ (SD = 0.58, range = 15.5–16.5, $N = 3$), all with light fat. ♀ 16.5, heavy fat.

IRIS. Brown.

BILL. Black. Mouth lining yellow green or yellow orange.

FEET AND Tarsi. Black. Toe pads green or gray green.

GONADS. ♂♂ Testes of all = 1 mm. ♀ Ovary granular.

MOLT. Adult ♂ with prebasic body and flight feather molt; immature ♂♂ in first prebasic body molt.

PLUMAGE. Central rectrices of males with incompletely pneumatized skulls truncated; crown and nape black; white superciliary absent.

STOMACH CONTENTS. All with insects, including coleopterans.

HABITAT. Forest edge or dense second-growth scrub.

NOTES. Pairs and family groups on open branches or in dead trees. Once 3 observed moving with a mixed-species flock.

***Machetornis rixosa*: Cattle Tyrant**

SPECIMENS (MVZ). ♂ Mar (1). ♀ Sep (1). Both with adult skulls.

MASS (G). ♂ 37.5. ♀ 33.5.

IRIS. Brown.

BILL. Black. Mouth lining yellow green.
FEET AND Tarsi. Black. Toe pads tan.
GONADS. ♂ Testis 9 × 4 mm. ♀ Largest ovum 1 mm.
MOLT. ♂ With prebasic body and flight feather molt.
PLUMAGE. Tail feathers lack white tips.
STOMACH CONTENTS. One with Coleoptera.
HABITAT. Pasture edge. Isolated trees in scrubby pasture.

***Legatus leucophaeus*: Piratic Flycatcher**

SPECIMENS (MVZ). ♂♂ Nov (2), adult skulls.
MASS (G). 21.1, 22.9.
GONADS. Testes 4 × 3, 7 × 4 mm.
MOLT. No.
STOMACH CONTENTS. Fruit in 1.
HABITAT. Pasture adjacent to forest.
NOTES. Singing in small isolated trees near a natural spring in pasture. Breeds in Paraguay and migrates north for the winter (Hayes et al., 1994).

***Myiozetetes similis*: Social Flycatcher**

SPECIMENS (MVZ). ♀ Jun (1), adult skull.
MASS (G). 34.5, moderate fat.
IRIS. Light brown.
BILL. Black.
FEET AND Tarsi. Blackish.
GONADS. Ovary granular, ova minute.
MOLT. No.
STOMACH CONTENTS. Fruit pulp and seeds. Observed feeding in *Guarea* sp.
HABITAT. Forest edge, scrubby second growth, isolated trees in pastures, roadsides, around buildings.

***Pitangus sulphuratus*: Great Kiskadee**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), May (1), Sep (3), Nov (2), Dec (1). Dec ♂ with large skull windows; other ♂♂ with adult skulls. ♀♀ Feb (1), May (1), Jun (2), Sep (2), Oct (1), Dec (2). One Dec ♀ with immature skull; others with adult skulls.
MASS (G). ♂♂ \bar{X} = 62.8 (SD = 4.98, range = 56.5–70.5, N = 8). ♀♀ \bar{X} = 67.3 (SD = 5.89, range = 58.0–77.0, N = 8). Two Jun and 1 Sep ♀ with light to moderate fat.
IRIS. Brown.
BILL. Black. Mouth lining and gape yellow orange or yellow green.
FEET AND Tarsi. Black. Toe pads light green or olive brown.
GONADS. ♂♂ Testis of adults enlarged (8 × 4–9 × 3 mm) in Nov and small (2 × 1–3 × 2 mm) in Feb through Sep. Dec immature, testis small (3 × 1 mm). ♀♀ Oct ♀ breeding, largest ovum 12 mm diam, 1 collapsed follicle, with incubation

patch. Adults in Dec through Sep largest ova 1–2 mm diam; Feb ovary postbreeding. Ovary of Dec immature tiny.

MOLT. Prebasic molt in Nov, Dec, Feb, and May specimens. First prebasic molt in Dec.

STOMACH CONTENTS. Eight with fruit, 3 with insect remains, and 2 with insect and fruit remains.

HABITAT. Forest edge, tung orchards, scrubby second growth, trees around clearings, gardens, around buildings.

NOTES. Often in small groups. Noisy and conspicuous. Perches in the open. Observed feeding on the fruits of several species, including *Ocotea puberula*, *Trema micrantha*, *Allophylus edulis*, *Guarea* sp., and *Cupania vernalis* (Sapindaceae). Nest located 14 Sep 1978 in second-growth scrub. Bird carrying nest material 10 Oct 1979. Earliest egg clutch from Sapucá (Figure 1) on 10 Oct (Hayes, 2014). Body cavity of Nov ♂ filled with white nematodes (~150).

***Myiodynastes maculatus*: Streaked Flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Feb (1), Sep (2), Oct (2), Nov (3). ♀♀ Feb (1), Sep (1). Feb ♂ with immature skull; all other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 43.8 (SD = 3.95, range = 38.0–52.0, N = 9); Feb immature with light fat, 1 Oct bird with moderate fat. ♀♀ 57.0, heavy fat (Feb); 44.5, light fat (Sep).

IRIS. Brown or black.

BILL. Black. Mouth lining flesh color.

FEET AND Tarsi. Black or gray. Toe pads green.

GONADS. ♂♂ Testes enlarged or enlarging (6 × 2.5–12 × 5 mm) Sep through Nov; regressing (6 × 3 mm) in Jan; immature Feb ♂ small (3 × 1 mm). ♀♀ Ovaries developed; largest ova ≤ 1 mm diam.

MOLT. Jan, Feb.

STOMACH CONTENTS. Four with only insect remains; 5 with only fruit (including *Ocotea puberula*); 2 with fruit and insect remains.

HABITAT. Forest, forest edge.

NOTES. A northern austral migrant (Hayes et al., 1994). The species was not observed at El Tirol during the winter months. The birds occupy the forest canopy, often on bare branches at the very tops of the trees, from which they make long fly-catching sallies. They also fly down from high perches to pluck fruits (including *Allophylus edulis*) that they carry back up to their original sites. They are usually seen in pairs. Vocalize a lot in late Dec and still appear to be on territories; also seen carrying twigs in late Dec.

***Megarynchus pitangua*: Boat-billed Flycatcher**

SPECIMENS (USNM, MVZ, MNHNP). ♂ Feb (2), Mar (2), Jun (1), Oct (2), Dec (1). One Mar ♂ with skull windows. Other males with adult skulls. ♀♀ Jan (1), Feb (1), Dec (2). All with adult skulls.

MASS (G). ♂♂ \bar{X} = 62.4 (SD = 5.96, range = 54.5–72.5, N = 8), 1 Feb ♂ with light fat. ♀♀ \bar{X} = 63.8 (SD = 5.63, range = 58.5–70.7, N = 4).

IRIS. Brown or dark brown.

BILL. Black. Palate and mouth lining flesh color or yellow green.

FEET AND TARSII. Black or gray. Toe pads green or gray brown.

GONADS. ♂♂ Testis enlarged (10 × 4–12 × 6 mm) Oct to Dec, regressing (4 × 2–5 × 2 mm) in Feb, and small (2 × 1–3 × 1.5 mm) Mar to Jun. ♀♀ Jan ovary postbreeding; others, largest ova = 1–2 mm diam.

MOLT. Prebasic molt of body and flight feathers in Dec, Jan, Feb, Mar. First prebasic body molt in immature Mar ♂.

STOMACH CONTENTS. Five with only insect remains, 1 with only fruit, and 4 with insect and fruit remains. Insects include caddis flies, homopterans, ants, coleopterans, and lepidopterans.

HABITAT. Forest, disturbed forest, forest edge, tung orchard, scrubby second growth, roadsides.

NOTES. Often in small groups. Frequently observed feeding in fruiting trees. Males were displaying in Oct. Body cavity of Dec male full of nematodes.

***Empidonomus varius*: Variegated Flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ 12: Feb (2), Mar (1), Sep (4), Oct (3), Nov (2). All with adult skulls. ♀♀ Sep (1), Oct (1); adult skulls.

MASS (G). ♂♂ \bar{X} = 27.4 (SD = 2.89, range = 23.8–32.3, N = 12). ♀♀ Both = 26.5. Some Sep and Oct birds with light to moderate fat; a few with heavy fat in Feb, Mar, and Sep.

IRIS. Brown or dark brown.

BILL. Upper mandible black. Distal half of lower mandible black; basal half pale pinkish brown. Mouth lining, palate, and tongue pinkish flesh color.

FEET AND TARSII. Black or brownish black. Toe pads pale gray brown, tan, or green.

GONADS. ♂♂ Testes enlarging (4 × 2–7 × 2.5) in Sep, Oct; enlarged (9 × 3–10 × 4 mm) in Oct, Nov; and small (3 × 1–3 × 2 mm) in Feb, Mar. ♀ Largest ova 2 mm diam.

MOLT. Body molt in Feb ♂♂; 1 also molting the tail.

STOMACH CONTENTS. Four with only insect remains; 6 with only fruits; 3 with a mixture of fruits and insects.

HABITAT. Forest, forest edge, tung orchards, isolated trees in pastures, and cultivated fields.

NOTES. Generally seen in pairs, often perched and foraging at the tops of large trees and dead snags. Seen carrying nest materials in Oct and twice in Nov, and another pair seen building a nest in Nov. Observed feeding on *Allophylus edulis* and *Ocotea puberula* fruits. The birds with heavy fat probably represent migrants recently arrived from or about to depart to northern wintering areas.

***Tyrannus melancholicus*: Tropical Kingbird**

SPECIMENS (USNM, MVZ). ♂♂ Sep (2), Nov (2); all with adult skulls. ♀♀ Jan (1), Mar (1), Oct (1); Jan and Oct with adult skulls; Mar ♀ likely immature.

MASS (G). ♂♂ \bar{X} = 42.1 (SD = 1.76, range = 40.0–44.3, N = 4), 1 Sep bird with light fat. ♀♀ Adults: Jan 50 g, with light fat; Oct 47 g. Immature 38 g, with light to moderate fat.

IRIS. Dark brown, brown, or gray brown.

BILL. Black. Mouth lining and tongue pale pinkish flesh color or whitish, tinged beige.

FEET AND TARSII. Black. Toe pads green.

GONADS. ♂♂ Testis enlarging in Sep (4 × 2, 5 × 2 mm), enlarged in Nov (11 × 4, 11 × 6 mm). ♀♀ Oct, ovary with 3 collapsed follicles, and ♀ with incubation patch. Jan ♀ with 3 post-ovulatory follicles, an enlarged oviduct, and a well-developed incubation patch. Ovary of immature undeveloped.

MOLT. Body feather molt recorded in Jan, Mar, Sep, Nov.

PLUMAGE. Immature ♀ (Mar) lacks the orange crown patch.

STOMACH CONTENTS. Four with insect remains, including ants. One with insect and fruit remains. Two with only fruit remains. Fruits include *Solanum* sp. (Solanaceae) and *Ocotea puberula*.

HABITAT. Forest, forest edge, tung orchard, scrubby second growth, isolated trees in and around pastures, cultivated areas, and weedy fields around clearings.

NOTES. This austral migrant arrives from the north in Sep, occasionally in moderate- to large-size groups with most of the birds continuing on to the south. In early Mar smaller groups of birds begin to go through, migrating north. The species is gone by the end of the month. During the breeding season, one sees up to 4 birds perched together, chasing, and giving shrill, high-pitched trills. The birds prefer open trees, often without leaves, generally perching near the top.

***Tyrannus savana*: Fork-tailed Flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ Aug (1), Sep (2), Oct (1), Nov (1), Dec (1). ♀♀ Oct (2). All birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 35.4 (SD = 3.33, range = 32.0–39.5, N = 6). Two heaviest ♂♂ (Sep, Nov) moderately to extremely fat. ♀♀ 34.5, 34.7, both with moderate fat.

IRIS. Brown or black.

BILL. Upper mandible black. Lower mandible black or black with gray at base. Tongue and mouth lining pinkish flesh color.

FEET AND TARSII. Black or grayish black. Toe pads pale grayish brown.

GONADS. ♂♂ Testis Aug through Dec, range = 4 × 2–8 × 4 mm. ♀♀ Ova tiny, 0.5–1.0 mm diam.

MOLT. No.

STOMACH CONTENTS. Three with fruits (*Ocotea puberula*), 2 with insect remains, 1 with fruit and insect remains.

HABITAT. Second-growth scrub, tall trees at the edges of pasture and cultivated fields, and around buildings.

NOTES. The species began arriving at El Tirol in late Aug in small numbers. By mid-Sep and for the ensuing 3 weeks, large flocks of as many as 50 birds moved through, flying farther south. By mid-Oct only a few birds remained, and they persisted through the breeding season. In late Jan the northward migration began, with flocks of 10 to 80 birds moving through throughout Feb. While at El Tirol, the birds perch in the perimeter at the tops of dead trees or deciduous trees that have lost their leaves. These highly maneuverable birds swoop out from their perches, pluck insects from the air (or fruits from an adjacent tree), and return to their perches, often hovering in front of them before landing. The birds interact aggressively, chasing and displacing each other and giving a harsh, single-note, buzzy call. They eat a lot of *Ocotea puberula* fruits, which they pluck and swallow whole. A mated pair was collected in Oct.

***Sirystes sibilator*: Sibilant Sirystes**

SPECIMENS (MVZ). ♂ Feb (1), adult skull. ♀♀ Feb (1), juvenal skull; Sep (1), adult skull.

MASS (G). ♂ 30.8. ♀ 27.4 and 33.5, respectively.

IRIS. Brown or dark brown.

BILL. Upper mandible black; lower mandible dark brown. Mouth lining greenish orange.

FEET AND TARS. Grayish black. Toe pads brownish gray or grayish tan.

GONADS. ♂♂ Testis 1.5 × 1 mm. ♀♀ Adult with 7-mm-diam orange ovum and incubation patch. Ovary undeveloped in immature.

MOLT. Feb: ♂ rectrices 6-6 in sheath, growing; ♀ immature in first prebasic molt.

PLUMAGE. Upper wing coverts edged rufous buff in the immature; edging grayish buff in adults.

STOMACH CONTENTS. Insect remains in 2.

HABITAT. Forest, forest edge.

NOTES. In the canopy, sometimes in dead snags. Frequents riparian areas. In pairs or family groups; occasionally part of mixed-species flocks. Adult attending young in Feb. Begging young made *pip-pip-pip* or *pur-pur-pur* notes.

***Myiarchus swainsoni*: Swainson's Flycatcher**

SPECIMENS (USNM, MVZ). ♂♂ Mar (3), Sep (1), Oct (1). ♀♀ Jan (1), Oct (1), Nov (1). Sex? Mar (1). All with adult skulls except Sex?, with skull windows.

MASS (G). ♂♂ \bar{X} = 24.1 (SD = 1.68, range = 22.5–26.5, N = 5). Some Mar and Sep ♂♂ with light to moderate

fat. ♀♀ \bar{X} = 26.3 (SD = 2.15, range = 24.6–28.7, N = 3). Sex? = 21.3.

IRIS. Brown, dark brown, or red brown.

BILL. Upper mandible black or blackish brown. Lower mandible brown or dark brown at base, darkening to blackish brown or black at tip. Mouth lining, palate, and tongue bright orange or greenish orange.

FEET AND TARS. Black, brownish black, or grayish black. Toe pads greenish white, greenish black, grayish brown, or tan.

GONADS. ♂♂ Testes enlarging (4 × 2 mm) in Sep, large (11.0 × 4.5 mm) in Oct, and small (1.5 × 1–2 × 1 mm) in Mar. ♀♀ Old incubation patch, ova = 0.5 mm (Jan); active incubation patch, ova = 2 mm (Oct); and active incubation patch, recently laid (Nov).

MOLT. Prebasic molt recorded in Jan and Mar.

STOMACH CONTENTS. Four with insect remains, 4 with fruit remains (including *Ocotea puberula*), and 1 with fruit and insect remains.

HABITAT. Forest, second-growth scrub, isolated trees in fields and pastures.

NOTES. Perches at tops of open trees. Migrates to the north to winter. The extreme fall date reported by Hayes et al. (1994) is 1 Mar; we obtained a specimen on 10 Mar 1980 (MVZ 167435).

FAMILY COTINGIDAE: COTINGAS

***Pyroderus scutatus*: Red-ruffed Fruitcrow**

SPECIMENS (USNM, MVZ). ♂ Jun (1). ♀♀ Jun (1), Oct (1).

MASS (G). ♂ 540, very fat. ♀♀ 350 (light fat), 330, respectively.

IRIS. Brown.

BILL. Silvery gray or upper mandible gray, darker at base and whitish at tip, and lower mandible lighter gray, tinged purple, with whitish tip.

FEET AND TARS. Black or bluish gray.

GONADS. ♂ Testis 5 × 2 mm, black. ♀♀ Ovary granular (Jun); ova 0.5 mm (Oct).

MOLT. Primaries and body, Jun ♀.

STOMACH CONTENTS. Three with fruit and insects, including orthopteran and caterpillar. Fruits eaten by the Oct bird included 2 species of Sapindaceae, *Allophylus edulis* (6 whole fruits, 47 seeds [1 seed/fruit], and pulp) and *Cupania vernalis* (7 seeds and pulp).

HABITAT. Forest, including moderately disturbed areas and an area from which much of the understory had been cleared.

NOTES. Perch 10 to 15 m up. Regularly observed in Jun 2004. The Jun ♀ plucked an orthopteran from the ground and carried it to a tree to ingest. One mobbed and chased by a group of red-rumped caciques (*Cacicus haemorrhous*).

FAMILY PIPRIDAE: MANAKINS

***Chiroxiphia caudata*: Swallow-tailed Manakin**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 27: Jan (5), May (1), Jun (4), Aug (1), Sep (6), Oct (8), Dec (2). ♀♀ 14: Jan (2), Feb (1), Mar (1), May (1), Jun (3), Sep (2), Oct (3), Nov (1). Egg: Dec (1). Birds with partially pneumatized skulls in Feb, May, Jun, Aug, Sep, Oct.

MASS (G). ♂♂ \bar{X} = 22.6 (SD = 1.12, range = 20.0–25.0, N = 26); some individuals with light fat in Jan, Aug, Sep, Oct, Dec. ♀♀ \bar{X} = 22.6 (SD = 1.51, range = 21.0–26.0, N = 14); some with light fat in Jun, Sep.

IRIS. Brown.

BILL. Upper mandible dark brown, with or without yellowish tinge on tomium and tip, or horn color. Lower mandible horn color, with or without yellow tip; maroon; or brown with a light tip or purplish tinge. Tongue and palate dull olive green. Mouth lining flesh color, orange, or light green.

FEET AND TARS. Maroon. Toe pads sandy brown with greenish tinge.

GONADS. ♂♂ Testes enlarged (5 × 2–10 × 3 mm) in Sep, Oct, Dec, and Jan; regressing (3 × 2–4 × 3.75 mm) in Jan; small (1.5 × 1–3.5 × 1.5 mm) and sometimes black or dark green in May, Jun, and Aug. ♀♀ Ova enlarged (1.5–8.0 mm diam) and yellow orange, oviduct enlarged, and/or developing incubation patch in Sep, Oct, and Jan. Ovary granular with largest ova ≤ 1.0 mm in Nov, Jan, Feb, Mar, May, and Jun. Ovary smooth and undeveloped in Jun, Sep.

MOLT. Prebasic body and flight feather molt in Jan, Feb, Mar. Light scattered body molt only, in Sep, Oct, Dec, May, and Jun; in some individuals this likely represents the onset or end of a more substantial molt. Molt in spring months may be a limited prealternate molt. Body molt may be present in some breeding individuals.

PLUMAGE. Juvenal males are green like females. They maintain a green plumage following the first prebasic molt but add a well-developed bright red crown. Females sometimes have a red crown, although it is generally duller and considerably less extensive than that of males and often has a bronze cast. With the second prebasic molt, males acquire an immature or subadult plumage intermediate between that of the definitive plumages of males and females. It includes varying amounts of blue in the dorsal feathers and black in the ventral feathers and on the face. Males acquire the definitive male plumage with the third prebasic molt.

STOMACH CONTENTS. Thirty with only fruit, including *Allophylus edulis*, *Eugenia uniflora* (Myrtaceae), *Psychotria carthagenensis* (Rubiaceae), *Guarea* sp., *Trema micrantha*, *Trichilia catigua* (Meliaceae), *Casearia silvestris* (Salicaceae), *Dendropanax cuneatus* (Araliaceae), *Cecropia pachystachya* (Urticaceae), *Ficus* sp., and various others. One stomach contained fruit plus a spider.

NOTES. Moderately common in tall, old forest. Many leks present. Birds can breed before their skulls are fully pneumatized. For information on vocalizations, reproductive behavior, and social organization, see Foster (1981). Nest with 3 eggs located 4 Dec 1977, preyed on 6 Dec; 88 cm above ground in a 2-m-tall sapling (DBH = 13 mm). Inner and outer heights and diameters of the nest were 50 and 56 and 47 and 65 mm, respectively. One egg = 22 × 17 mm. A ♂ in definitive plumage observed foraging with a mixed-species flock (including *Hemithraupis guira*, *Trichothraupis melanops*, and other species) once in Mar and once in May.

***Pipra fasciicauda*: Band-tailed Manakin**

SPECIMENS (USNM, MNHNP). ♂ Oct (1). ♀ Jun (1). Both with adult skulls.

MASS (G). ♂ 14.0, ♀ 15.5, light fat.

IRIS. ♂ White. ♀ Gray.

BILL. Upper mandible black, lighter at base in ♀. Lower mandible maroon with gray tip (♂) or grayish tan at base with black tip (♀).

FEET AND TARS. Pinkish gray or maroon.

GONADS. ♂ Testis 4.5 × 2.0 mm; no cloacal protuberance. ♀ Ovary granular.

MOLT. No.

HABITAT. Forest.

NOTES. The male is in subadult plumage indicative of a 2-year-old male; his testes, although enlarged, are somewhat smaller than those normally present in breeding males (MSE, unpublished data). The species is more common in Cerro Corá National Park, Department of Amambay (~500 km N El Tirol) and Ybycuí National Park, Department of Ybycuí (~160 km to the NW) but uncommon in San Rafael National Park and rare this far south in Paraguay (Figure 1). No leks were located at El Tirol, nor were any birds heard calling.

FAMILY TITYRIDAE: TITYRAS

***Tityra inquisitor*: Black-crowned Tityra**

SPECIMENS (MVZ). ♂ Mar (1). ♀ Oct (1). Both with adult skulls.

MASS (G). ♂ 42.5, ♀ 44.0.

IRIS. Dark brown.

BILL. Upper mandible black. Lower mandible blue gray.

FACIAL SKIN. Bluish gray below eyes.

FEET AND TARS. Grayish black. Toe pads tan gray.

GONADS. ♂ Testis 5 × 2.5 mm. ♀ Ovary with 1 collapsed follicle, 1 ovum 10 mm diam, and other enlarged ova; oviduct huge; with mate.

MOLT. No.

STOMACH CONTENTS. Insects in both, including a large orthopteran.

HABITAT. Forest, forest edge, forest clearing.

NOTES. Perches at the top of canopy trees. One Feb adult accompanied by a juvenile. Another Feb bird moving with a mixed-species canopy flock.

***Tityra cayana*: Black-tailed Tityra**

SPECIMENS (USNM, MVZ). ♂♂ Mar (1), Oct (4), all with adult skulls. ♀ Feb (1), skull immature.

MASS (G). ♂♂ \bar{X} = 77.9 (SD = 5.92, range = 72–87, N = 5), 3 Oct birds with light fat. ♀ = 82.0, heavy fat.

IRIS. Brown.

BILL. Both mandibles rosy to wine red at base. Distal part of upper mandible black. Distal part of lower mandible gray with a black tip. Tongue, palate, and mouth lining orange or dark orangish flesh color.

FACIAL SKIN. Pale gray green or rosy red above and below eyes; rosy to wine red in front of and behind eyes. Flesh at gape red to wine red.

FEET AND Tarsi. Gray, slate gray, or black. Toe pads light green or brownish yellow.

GONADS. ♂♂ Testis enlarged (12 × 7–15 × 6 mm) in Oct, small (3 × 2 mm) in Mar. One Oct ♂ with an active brood patch. ♀ Ova ≤ 1.0 mm.

MOLT. March ♂ in heavy prebasic molt.

STOMACH CONTENTS. Two with only fruit, 1 with only insects, and 2 with fruit and insect remains. Insects include 5-cm-long sphinx moth (Sphingidae), caterpillar, 6.4-cm katydid, and praying mantis. Fruit includes *Cupania vernalis* and *Ocotea puberula*. Other birds observed feeding in *Ficus* sp. in Jan.

HABITAT. Forest, forest edge.

NOTES. Often seen in pairs perching and moving together; 3 birds together in Mar, possibly parents and young. Observed in Feb as part of a mixed-species canopy flock. Occupy the tops of the tallest trees, often on bare branches. Call like a grinding, unwinding spring, similar to that of *Tityra semifasciata*.

***Schiffornis virescens*: Greenish Schiffornis**

SPECIMENS (USNM, MVZ). ♂♂ 14: Jan (2), Aug (1), Sep (2), Oct (6), Dec (3). Birds with small skull windows found in Sep, Dec, and Jan. The former appear to have hatched in the previous year and the latter 2 to have hatched in the previous few months. ♀♀ Oct (1), Dec (1), both with adult skulls.

MASS (G). ♂♂ \bar{X} = 22.1 (SD = 1.64, range = 18.5–25.5, N = 14); 1 breeding Oct bird with extensive fat along pterylae and in furculum. ♀♀ 28.75 (contains multiple enlarged ova) and 22.0, respectively.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible gray or black with gray at base.

FEET AND Tarsi. Black, gray, or tarsi black and feet gray.

GONADS. ♂♂ Testis enlarged (6 × 4–10 × 6 mm) in Aug, Sep, Oct and small (2 × 1–3 × 2 mm) in Dec, Jan. ♀♀ Oct

bird with 8- and 13-mm-diam, vascular, yellow-orange ova and well-developed incubation patch. Ova minute in Dec.

MOLT. Body and flight feather molt in Oct, Dec, Jan. First prebasic body molt in Dec.

STOMACH CONTENTS. Six with insect remains, including 3 with only caterpillars (up to 38 mm long). Only fruit remains in 2. Breeding ♀ (Oct) with pieces of egg shell in stomach.

HABITAT. Tall old forest.

NOTES. Usually seen in the understory moving inconspicuously 1–4 m up in saplings or vines. Oct ♂ in breeding condition (testis = 9 × 6.5 mm) but molting flight feathers. Call with a sibilant quality; 4 notes, *whoo whoo tui tui*.

***Pachyramphus polychopterus*: White-winged Becard**

SPECIMENS (MVZ). ♂♂ Oct (2). ♀♀ Feb (1), Mar (1), Oct (1), Nov (1). All birds with adult skulls.

MASS (G). ♂♂ Both 21.5. ♀♀ \bar{X} = 24.2 (SD = 1.55, range = 23.1–26.5, N = 4).

IRIS. Dark brown.

BILL. Upper mandible black. Lower mandible whitish blue or pinkish white with brown sides and bluish gray tip. Mouth lining yellow orange.

FEET AND Tarsi. Gray or purplish slate gray. Toe pads light gray or tan.

GONADS. ♂♂ Testes enlarged (both 8 × 5 mm), 1 ♂ with mate. ♀♀ Largest ova = 2 mm, ♀ with incubation patch (Oct); ≤ 1 mm (Feb, Mar); and ≤ 1 mm, postbreeding (Nov).

MOLT. ♀♀ Molting in Feb, Mar.

PLUMAGE. Ridgely and Tudor (2009:482) noted that except in western Amazonia, males have a gray nuchal collar, rump, and underparts; 2 bold white wing bars; and white edging on the scapulars and flight feathers. In addition, they reported that males in all areas lack the white or pale gray lores characteristic of other members of the genus. The gray nuchal collar is limited or absent from the males from El Tirol, and some pale gray is present in the lores.

STOMACH CONTENTS. Three with only insect remains, 1 with only fruits, and 1 with remains of both fruit and insects. Insect remains include grubs and caterpillars.

HABITAT. Forest, forest edge, tung orchard.

NOTES. In the canopy or tree tops of tall and medium-height forest. Mated pair collected in Oct; both birds calling. Song a rather long run of triple or quadruple notes: *whew, whew, whew, whew*, or *chuck, chuck, chuck, chuck*. Birds call regularly Oct through Mar. Paul Smith photographed a nest of this species at El Tirol in Jan (Smith, 2006).

***Piprites chloris*: Wing-barred Piprites**

SPECIMENS (USNM, MVZ). ♂♂ Sep (2), Oct (2). ♀ Aug (1). One Sep ♂ with an adult skull. All other birds, skull partly pneumatized.

MASS (G). ♂♂ \bar{X} = 16.8 (SD = 0.85, range = 16.0–17.9, N = 4). ♀ 19.0, light fat.

IRIS. Brown.

BILL. Upper mandible black, gray, or blue gray. Lower mandible gray or blue gray. Mouth lining black.

FEET AND TARSI. Gray or blue gray.

GONADS. ♂♂ Testis enlarged (7×3 – 8×4 mm), 1 with cloacal protuberance. ♀ Largest ovum 1.5 mm, yellow orange.

MOLT. One Oct ♂ with extensive body but no flight feather molt.

STOMACH CONTENTS. Three with insect remains, including caterpillars (one 5 cm long) and a tick.

NOTES. The development of the gonads indicates that these birds breed before skull pneumatization is complete. The molting Oct ♂ (testis 7×3 mm) suggests that molt-breeding overlap may also occur in this species. The call of 1 Sep male consisted of a rising series of 7–8 “pip-like” whistles (NKJ).

FAMILY VIREONIDAE: VIREOS

Cyclarhis gujanensis: Rufous-browed Peppershrike

SPECIMENS (MVZ). ♂♂ Jan (1), Mar (1), Sep (1), Oct (1), Nov (1). ♀♀ Feb (1), Mar (1), Sep (1). Mar ♂ with juvenal skull; all other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 28.1 (SD = 1.97, range = 25.8–30.1, N = 5). ♀♀ \bar{X} = 30.3 (SD = 1.91, range = 28.5–32.3, N = 3). Sep ♂ with moderate fat.

IRIS. Red, red brown, or chestnut brown.

BILL. Upper mandible blue gray or gray with pale brown base. Lower mandible blue gray, grayish white, or pinkish gray. Mouth lining pinkish flesh color. Tongue pinkish gray.

FEET AND TARSI. Blue gray. Toe pads tan or greenish tan.

GONADS. ♂♂ Testes enlarged (6×4 mm) Oct–Nov, regressing in Jan (4×2 mm), and small in Mar and Sep (2×1 mm). ♀♀ All with largest ova ≤ 1 mm.

MOLT. Prebasic molt of body and flight feathers in Jan, Feb, and Mar. First prebasic molt in Mar.

STOMACH CONTENTS. Seven with insect remains.

HABITAT. Forest.

NOTES. Males singing year-round from the tree tops in mature forest.

Hylophilus poicilotis: Rufous-crowned Greenlet

SPECIMENS (USNM, MVZ). ♂♂ Aug (1), Sep (2), Oct (1). ♀♀ Jan (1), Oct (1), Nov (1), Dec (1). Jan ♀ with large skull windows. All other birds with adult skulls.

MASS (G). ♂♂ 9.6, 10.0. ♀♀ \bar{X} = 10.6 (SD = 0.70, range = 9.9–11.5, N = 4). Jan ♀ with moderate fat.

IRIS. Brown.

BILL. Upper mandible black, dark gray, or brown. Lower mandible pale pinkish gray, pale gray, or brown. Mouth lining pale greenish yellow.

FEET AND TARSI. Gray or blue gray. Toe pads pale greenish tan.

GONADS. ♂♂ Testis enlarged (4×3.5 – 6×4 mm) Aug–Oct. ♀♀ Oct and Nov birds, largest ova ≤ 2.0 and ≤ 1.5 mm, respectively. Dec and Jan birds with tiny ovaries.

MOLT. Dec and Jan.

STOMACH CONTENTS. Four with insect remains, including a 2.5-cm spiny caterpillar. One with fruit.

HABITAT. Forest, tung orchard.

NOTES. Family groups in Mar. Foliage glean, foraging singly or in pairs; may join mixed-species flocks.

Vireo olivaceus: Red-eyed Vireo

SPECIMENS (USNM, MVZ). ♂♂ 22: Feb (3), Sep (5), Oct (4), Nov (10). ♀♀ Jan (1), Feb (1), Mar (1), Oct (1), Nov (4). All birds with adult skulls except Mar ♀, with immature skull.

MASS (G). ♂♂ \bar{X} = 15.3 (SD = 0.86, range = 13.9–17.1, N = 20). ♀♀ \bar{X} = 14.9 (SD = 1.31, range = 12.8–17.0, N = 8). Light or moderate fat in 1 bird each in Feb, Mar, Sep, and Nov.

IRIS. Brown or dark brown.

BILL. Upper mandible black, brownish black, or gray brown with paler tomium. Lower mandible gray or blue gray; sometimes whitish at base. Mouth lining yellow green or pinkish gray.

FEET AND TARSI. Gray, blue gray, or tan. Toe pads tan, grayish, or greenish.

GONADS. ♂♂ Testis moderately to greatly enlarged from Sep to Nov (5×3 – 11×6 mm); several birds with large cloacal protuberances, singing, or with a mate. Small in Feb (1×1 – 3×2 mm). ♀♀ Oct and Nov birds with enlarged ova, collapsed follicles, enlarged oviducts, and/or incubation patches. Jan and Feb, largest ova ≤ 1 mm diam. Mar immature, ovary small and undeveloped.

MOLT. Only Jan ♀.

STOMACH CONTENTS. Thirteen with insect remains, including caterpillars, beetles, and a praying mantis. Three with fruit and insect remains, and 4 with only fruit remains, including *Ocotea puberula*.

HABITAT. Forest, forest edge, tung orchard. In winter, in viny-shrub thickets at margins of abandoned fields.

NOTES. Common at El Tirol, calling steadily from Sep through Mar at midstory to canopy levels. Female laid an egg in a holding bag in Oct. Family groups seen in Jan and Feb, with adults feeding juveniles. Flocks of ~10 birds begin to appear in Jan. It is not clear whether these are young or postbreeding adults from the area mobilizing to migrate north or migrants arriving from farther south. Birds observed feeding on fruits of various species, including *Allophylus edulis*; also acrobatically foraging for insects, including spending several minutes pulling

apart a large silky cocoon and extracting the pupa. See Johnson and Zink (1985) for discussion of the taxonomic status of this species in Paraguay.

FAMILY CORVIDAE: JAYS

Cyanocorax chrysops: Plush-crested Jay

SPECIMENS (USNM, MVZ). ♂♂ Oct (1), Dec (1), both with adult skulls. ♀♀ Mar (2), Sep (2), Oct (1), Dec (2). All females with adult skulls except 1 Mar bird with juvenal skull.

MASS (G). ♂♂ 149.0 (Oct); 165.0 (Dec). ♀♀ \bar{X} = 160 (SD = 7.30, range = 148–169, N = 7). Masses of 3 birds (MVZ 165668, 165669, 165670) collected and prepared on the same day by the same individual were listed as 64, 65, and 67 g. The birds were full grown and had completely pneumatized skulls. We assume that the masses were recorded incorrectly and have included them in our sample as 164, 165, and 167 g, respectively.

IRIS. Bright yellow.

BILL. Black or grayish black. Palate and mouth lining grayish black or whitish flesh color. Tongue gray or whitish flesh color.

FEET AND Tarsi. Black or brownish black. Toe pads greenish yellow or reddish brown.

GONADS. ♂♂ Testes 12 × 6 mm (Oct), 4 × 1 mm (Dec). ♀♀ Adults, ovaries tiny (Dec) or postbreeding (Mar); largest ova ≤ 1 mm (Sep) or 1–2 mm diam (Sep, Oct). Ovary of juvenile undeveloped.

MOLT. Prebasic molt in Dec, Mar. First prebasic molt in Mar.

STOMACH CONTENTS. Three birds with insect remains, including a grasshopper; 3 with insect remains and seeds from fruits; 1 with fruit pulp and skin.

HABITAT. Forest, forest edge, woods, tung orchards.

NOTES. Noisy, conspicuous, and common in midcanopy, 11–13 m. Usually seen in groups of 2–15 individuals at any time of year. However, pairs and small groups are most common in Sep–Nov, followed by family groups (3–5) in Dec–Jan, and then larger groups. Observed eating *Allophylus edulis* and *Eugenia uniflora* fruits but also being mobbed by small birds in Sep, suggesting that they may also rob nests. Many varied calls.

FAMILY HIRUNDINIDAE: SWALLOWS

Progne chalybea: Gray-breasted Martin

SPECIMENS (MVZ). ♀ Nov (1), adult skull.

MASS (G). 51.0, light fat.

GONADS. Largest ovum 4 mm, yellow orange.

MOLT. None.

STOMACH CONTENTS. Insect remains.

HABITAT. Commonly seen flying overhead, above pastures, cultivated fields, and scrubby second growth; occasionally over forest; around buildings.

NOTES. The female was netted as she left a nest under the roof at the hotel, where the birds nested commonly from 1976 to 1978. Sometime during the winter of 1979, entries to the attic were blocked. Although the birds were observed around the hotel in subsequent years, their numbers were greatly reduced, although the species is still common at El Tirol between Sep and Mar. In Mar, flocks of 5 to 30 individuals of this migratory species can be seen flying north. These birds often forage in heavy rain in loose mixed flocks with *Chaetura cinereiventris*.

Petrochelidon pyrrhonota: Cliff Swallow

SPECIMENS (MVZ). ♀ Mar (1), adult skull.

MASS (G). 19.5, light fat.

IRIS. Brown.

BILL. Black. Mouth lining flesh green.

FEET AND Tarsi. Dark purple. Toe pads pink.

GONADS. ♀ Largest ova ≤ 1 mm.

MOLT. Body and flight feathers.

STOMACH CONTENTS. Insect remains, including coleopterans.

NOTES. Loose flocks (4–60+ individuals) of this migrant were seen regularly from Nov to Mar flying high over pastures, cultivated areas, and clearings. Nearctic migrant present during the austral spring, summer, and fall, although a few individuals may be found in winter (Hayes, 1995; Hayes et al., 1994). Not recorded by Hayes (1995) from his Alto Paraná geographic region but known from San Rafael National Park (Esquivel M. et al., 2007).

FAMILY TROGLODYTIDAE: WRENS

Troglodytes aedon: House Wren

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), Mar (1), May (1), Jun (1), Aug (1), Oct (1), Nov (2), Dec (1). ♀♀ Mar (1), Jun (2), Sep (1), Dec (1). Sex? Dec (3 nestlings). Birds with juvenal skulls recorded in Nov (1), Feb (1), Mar (1), and May (1); 2 Jun birds with small skull windows.

MASS (G). ♂♂ \bar{X} = 12.2 (SD = 1.20, range = 10.6–13.75, N = 8). ♀♀ \bar{X} = 12.4 (SD = 0.90, range = 11.3–13.8, N = 5). Sex? All = 11.0. Light to moderate fat in Feb, Jun, Aug, and Dec ♂♂ and Jun (2), Sep, and Dec ♀♀.

IRIS. Brown.

BILL. Upper mandible black or dark brown. Basal half of lower mandible whitish cream, pale gray, or tan with gray or brown distal half. Tongue and palate dull greenish orange. Mouth lining dull greenish orange or yellow orange. Nestling bill with dark tip; mouth lining bright orange.

FEET AND Tarsi. Olive orange, brown, tan, or gray brown. Toe pads tan, gray tan, or brown. Nestling feet and tarsi gray.

GONADS. ♂♂ Testes enlarged (4 × 2.5–7 × 4 mm) from Aug through Nov and small (1 × 0.5–3 × 1 mm) from Nov

through Jun. ♀♀ Ovary of Mar juvenile undeveloped; Jun ovaries smooth. Largest ovum of Sep ovary 2.5 mm diam, yellow orange; Dec ovary granular.

MOLT. Feb and Mar ♂♂ with prebasic body and flight feather molt.

STOMACH CONTENTS. Twelve with insect remains.

HABITAT. Tung orchard, scrubby fields, edges of cultivated fields, around buildings, and in gardens.

NOTES. The progression of skull pneumatization suggests that birds complete the process in their first year. A nest with 3 nestlings was located on 28 Dec 1977 in the hollow stub of a limb in a tung tree ~1 m above ground. One nestling had 3 and another nestling 5 large botfly larvae in the tissue on the head. An adult with stub-tailed young was located at another nest in a stump surrounded by a pile of branches on 8 Nov 1981. Hayes reported egg sets from Sapucáí (Figure 1) from Sep through Feb. The males sing year-round, even when not in breeding condition. Birds often with red dirt on ventral feathers.

FAMILY POLIOPTILIDAE: GNATCATCHERS

Polioptila lactea: Creamy-bellied Gnatcatcher

SPECIMENS (USNM). ♂ Mar (1), adult skull.

MASS (G). 5.8, light fat.

IRIS. Dark brown.

BILL. Upper mandible black. Lower mandible blue gray basally and black distally.

FEET AND TARS. Slate gray blue. Toe pads light green.

GONADS. Testes 1 mm.

MOLT. Prebasic body and flight feather molt.

STOMACH CONTENTS. Insect remains.

HABITAT. Forest.

NOTES. The IUCN (2015) designates this Atlantic Forest endemic species as Near Threatened. Esquivel M. et al. (2007) noted that it was fairly common at several locations in San Rafael National Park. Willis and Bosso (1997) recorded a pair building a nest in Iguazú National Park, Misiones Province, Argentina, in mid-August.

FAMILY TURDIDAE: THRUSHES

Turdus leucomelas: Pale-breasted Thrush

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 14: Jan (1, skull imm), Feb (1), Mar (2, skulls imm), May (2), Jun (4), Sep (4). ♀♀ 10: Jan (1, juv skull), Mar (1, imm skull), Jun (5), Sep (1), Oct (2).

MASS (G). ♂♂ $\bar{X} = 70.9$ (SD = 4.95, range = 61–79, N = 14). ♀♀ $\bar{X} = 71.0$ (SD = 4.19, range = 65–78, N = 9). Some with light fat in Mar, May, Jun.

IRIS. Brown or reddish brown.

BILL. Upper and lower mandibles brown, dark olive brown, gray, or black with light green or yellow tomium. Mouth lining yellow or yellow green.

FACIAL SKIN. Eye ring pale olive brown.

FEET AND TARS. Gray, gray green, or brown. Toe pads brownish green or tan.

GONADS. ♂♂ Testes enlarging to enlarged (4 × 2–10 × 6 mm) in Sep; small (1 × 1–3 × 2 mm) in Jan through Jun and occasionally dark gray or black. ♀♀ Largest ova 1.5 mm diam in Oct; adults in other months with granular ovaries or largest ova ≤ 1.0 mm diam. Ovaries of immature birds smooth and undeveloped.

MOLT. Adults with prebasic molt in Feb, May, Jun. All immature birds (Jan, Mar) with first prebasic body molt.

STOMACH CONTENTS. Twelve with fruits or fruit remains, including *Trema micrantha*, *Psychotria carthagenensis*, *Allophylus edulis*, *Cupania* sp., *Solanum* sp., and unidentified others. Birds often had more than 1 species of fruit in their stomachs. One with only insects, and 1 with insects and fruit.

HABITAT. Forest, forest edge, dense second-growth scrub, tung orchard.

NOTES. Common. Often in pairs in austral spring and family groups in summer. Two nests located in Nov, 1 under the eaves at the hotel and one 3 m up on the top of a cut tung tree in which new shoots formed a bowl. Birds observed feeding on fruits in all months. Ventral feathers of many stained with red soil. One bird with nematodes in kidneys and body cavity.

Turdus rufiventris: Rufous-bellied Thrush

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 15: Feb (2), May (2), Jun (2), Sep (5), Oct (2), Dec (2). ♀♀ 17: Feb (3), Mar (3), Jun (4), Aug (1), Sep (1), Oct (4), Nov (1). Sex? Jun (1). Two Feb and 1 Mar ♀ with juvenal skulls. All other birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 68.4$ (SD = 4.25, range = 61.0–75.0, N = 15). ♀♀ $\bar{X} = 73.9$ (SD = 5.0, range = 64.0–80.0, N = 15). Birds with light or moderate fat recorded in Feb (2), Mar (1), Jun (4), and Aug (1).

IRIS. Brown or black.

BILL. Yellow, grayish yellow, olive brown, or brownish horn color with brighter yellow or greenish yellow tomium; mandibles darker at base. Mouth lining bright orange yellow, yellow green, or olive green. Tongue bright orange.

FACIAL SKIN. Eyelid and fleshy eye ring orange or orange yellow.

FEET AND TARS. Olive green, gray, tan, or brown. Toe pads light brown, red brown, or olive tan.

GONADS. ♂♂ Testes enlarged (10 × 7–19 × 9 mm) in Sep, Oct, Dec; small (1 × 1–4 × 2.5 mm) and sometimes gray in Feb, May, Jun. ♀♀ Ovaries granular, ova ≤ 1 mm (Mar, Jun); ova and oviducts beginning to enlarge (Aug, Sep); ova and oviducts greatly enlarged (Oct, Nov); ovary postbreeding, old incubation patch (Feb). Ovaries of juveniles smooth and undeveloped.

MOLT. Prebasic in Dec, Feb, Mar. First prebasic in Feb, Mar.

STOMACH CONTENTS. Sixteen with only fruit, including *Psychotria carthagenensis* and *Allophylus edulis*; 5 with only insects; and 4 with fruit and insects. Observed feeding in *Cupania vernalis*.

HABITAT. Forest, forest edge, second-growth woodland, around buildings. Frequent at fruiting trees.

NOTES. Most common thrush at El Tirol; seen most days. Nest located 10 Oct 1980; female incubating 1 blue-green egg with brown specks but had been about to lay another. The nest was in the terminal crotch of a small (DBH = 2 cm) tree that had been topped at ~151 cm; 5 new branches grew from the top and 1 side of the trunk to form a basketlike structure in which the nest was sitting. Inner dimensions of the nest were 10 × 7 cm by 10 cm deep; outer dimensions were 15 × 13 cm by 14 cm high (cf. de la Peña, 2010). Plant debris (leaves, pieces of vines, fungal hyphae, etc.) hung another 10 cm below the nest, making the entire structure look like a pile of debris that had fallen and caught on the branches. The 6- to 10-mm-thick inner layer of the nest was composed of tiny twigs, leaf veins, vine tendrils, rootlets, hyphae of *Marasmius* sp. (Marasmiaceae) fungus, and grass fibers. Surrounding this was a 10- to 20-mm layer of mud containing a lot of grass fibers and forming a sort of adobe; there were also thin strips of papery bark and dabs of moss. The thicker (20–30 mm) outermost layer of the nest consisted of larger twigs, stems, pieces of bark (3.5 × 5 cm), and whole leaves. Some of the nest material was interwoven, but most of the pieces were simply laid around in a coil. Not observed in large flocks as were the other *Turdus* spp. Several individuals had red dirt on their ventral feathers.

***Turdus amaurochalinus*: Creamy-bellied Thrush**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Aug (1), Sep (4). ♀♀ Jun (1), Sep (2), Oct (1). All with adult skulls.

MASS (G). ♂♂ \bar{X} = 62.5 (SD = 5.63, range = 59.0–72.5, N = 5); birds with light or moderate fat in Aug, Sep. ♀♀ \bar{X} = 66.8 (SD = 10.44, range = 53.0–78.0, N = 4). Jun and Oct ♀♀ with heavy fat (without the latter 2 birds, \bar{X} = 59.5).

IRIS. Brown.

BILL. Upper and lower mandibles brown, yellow, or brownish yellow.

FEET AND TARS. Gray, grayish brown, or tan.

GONADS. ♂♂ Testes small (1 × 1–3 × 1 mm) in all males and gray, dark green, or black in some. ♀♀ Ovary granular (Jun); largest ova ≤ 1 mm (Jun, Sep) or 1.5 to 2 mm (Oct).

MOLT. None.

STOMACH CONTENTS. Three with fruit, including *Psychotria carthagenensis* and *Ocotea puberula*; 1 with fruit and insects. Observed feeding in *Allophylus edulis*.

HABITAT. Forest.

NOTES. Present year-round, although some breeders may move farther north in winter. Winter birds may include local

breeders as well as some breeding birds from populations farther to the south. Nematodes in body cavity of 1 bird.

***Turdus nigriceps*: Slaty Thrush**

SPECIMENS (USNM). ♂ Oct (1). ♀ Oct (2). All with adult skulls.

MASS (G). ♂ 51. ♀♀ 48, light fat; 65.0, moderate fat.

IRIS. Brown.

BILL. ♂ Yellow. ♀♀ Brownish, 1 with yellow at corners of gape.

FACIAL SKIN. Fleshy eye ring orange.

FEET AND TARS. Tan or light brown.

GONADS. ♂ Testis 9 × 6 mm. ♀♀ Largest ova = 1.5 mm diam.

MOLT. No.

PLUMAGE. Ridgely and Tudor (1989) recognized the birds in the eastern part of the range, *T. n. subalaris*, as a separate species, *Turdus subalaris* (eastern slaty-thrush), which they noted differed in plumage and song from *T. nigriceps*. The plumages of our specimens fit the description of *subalaris* except for the absence of a prominent white crescent on the upper chest of females.

STOMACH CONTENTS. Fruit in 2.

HABITAT. Forest.

NOTES. This rare species may be a northern austral migrant (Hayes, 1995; Ridgely and Tudor, 2009). It was observed at El Tirol only in Oct (6–18); the male was in breeding condition.

***Turdus albicollis*: White-necked Thrush**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), May (2), Jun (3), Aug (1). Jun and Aug ♂♂ with adult skulls; Feb and May ♂♂, skulls partially pneumatized. ♀♀ 10: Feb (2), Mar (2), May (1), Jun (4), Aug (1). Two Feb, 1 Mar, and 1 Jun ♀♀ with juvenal or immature skulls; other ♀♀ with adult skulls.

MASS (G). ♂♂ \bar{X} = 62.1 (SD = 2.23, range = 59.5–65.0, N = 7). ♀♀ \bar{X} = 62.1 (SD = 3.78, range = 55.8–67.5, N = 10). Some birds with light or moderate fat in Feb, Mar, Jun.

IRIS. Brown or red brown.

BILL. Upper mandible black, brownish black, brown, or olive brown with narrow yellow, olive yellow, or orange yellow tomium; some with yellowish tip (cf. Ridgely and Tudor, 2009:543). Lower mandible olive brown, yellow, or yellow orange with dark tip and olive-yellow tomium. Mouth lining greenish yellow or dark flesh color. Tongue greenish yellow or bright orange. Palate olive with orange ridges.

FACIAL SKIN. Fleshy eye ring yellow orange to orange.

FEET AND TARS. Gray, gray brown, olive brown, or pink brown. Toe pads flesh green, brown, or tan.

GONADS. ♂♂ Testes small (1 × 1–2 × 1 mm) in all males and gray or black in some. ♀♀ Ovaries of adults postbreeding (Mar), granular (May, Jun), or early reproductive, i.e., largest

ova 0.5 mm (Aug). Ovaries of ♀♀ with immature skulls smooth and undeveloped (Feb, Mar) or granular (Jun).

MOLT. First prebasic molt in Feb.

PLUMAGE. Rufous flanks, as described by Ridgely and Tudor (2009:543) for birds from southeastern Brazil.

STOMACH CONTENTS. Only fruit (including *Allophylus edulis* and *Psychotria carthagenensis*) in 12; fruit and insects in 1.

HABITAT. Forest, old second growth.

NOTES. Birds were recorded regularly at El Tirol from Feb through Aug but not during the austral spring, and none was in breeding condition. In May they formed single-species flocks (≤ 10 individuals). These birds, which have partially yellow bills and rufous flanks (see Ridgely and Tudor, 2009), perched from 2 m up into the canopies of the tallest trees. Often seen feeding in fruit trees (including *Trema micrantha*) and once following and feeding at an ant swarm.

FAMILY MIMIDAE: MOCKINGBIRDS

Mimus saturninus: Chalk-browed Mockingbird

SPECIMENS (MVZ, MNHNP). ♂♂ Feb (1), Mar (1), Jun (1). ♀ Jun (1). Jun birds with adult skulls; Feb and Mar ♂♂ with immature skulls.

MASS (G). ♂♂ 58.2 (Feb), 72.5 (Mar), 72.0 (Jun); all with light fat. ♀ = 71.0, moderate fat.

IRIS. Brown, brownish green, or whitish.

BILL. Upper mandible black. Lower mandible black, in some with gray or blue gray at base. Mouth lining yellow green.

FEET AND TARS. Black or dark brown. Toe pads brown.

GONADS. Testes not enlarged ($1 \times 1\text{--}3.5 \times 2$ mm); left testis of Jun ♂ black. ♀ Ovary granular, ova minute.

MOLT. First prebasic body molt in Feb and Mar ♂♂.

PLUMAGE. The Feb ♂ is in juvenal plumage, heavily spotted brown on the breast and flanks. The Mar ♂ has already replaced those feathers and resembles the adult. The younger age of the Feb bird may explain its lower body mass.

STOMACH CONTENTS. One with only insect remains, including Coleoptera; 1 with insects and seeds; 2 with fruits and seeds of several species.

HABITAT. Small trees in scrubby pasture or at edges of fields.

NOTES. In small family groups in Feb and Jun.

FAMILY THRAUPIDAE: TANAGERS

*Cissopis leverianus**: Magpie Tanager

NOTES. In Oct perched quietly 2–3 m up in a tree in a closed-canopy, wooded area from which the undergrowth had been removed (MSF). Hayes (1995) designated this species as

common in his Alto Paraná geographic region, but this was the only time we recorded it.

*Neothraupis fasciata**: White-banded Tanager

NOTES. Perched 10 m up in a patch of light in a forest tree on 22 Nov 1981 (NKJ). The southernmost locality for the species recorded by Hayes (1995), who reported it from humid tall forest, is about 200 km to the north of El Tirol. Not recorded from San Rafael National Park (Esquivel M. et al., 2007). Ridgely and Tudor (2009) noted that the species is usually found at higher elevations and in the cerrado rather than forest habitat. Designated as Near Threatened by IUCN (2015).

Nemosia pileata: Hooded Tanager

SPECIMENS (MVZ, MNHNP). ♂ Nov (1). ♀♀ Jun (1), Nov (1). All birds with adult skulls.

MASS (G). ♂ 15.2. ♀♀ 19.5, moderate fat (Jun); 20.7 (Nov).

IRIS. Yellow.

BILL. Upper mandible black, brownish black, or gray brown. Lower mandible pale pinkish flesh color or with basal half pinkish gray or pinkish tan and distal half black. Mouth lining and tongue glossy black.

FEET AND TARS. Dull orange or orange yellow; toe pads also.

GONADS. ♂ Testes enlarged (7×4 mm), with mate. ♀♀ Nov bird with egg forming in oviduct and incubation patch; with mate and carrying a 15.5-cm-long plant fiber (nest material?). Jun bird with granular ovary, largest ovum ≤ 1 mm.

MOLT. No.

STOMACH CONTENTS. All with insect remains, although also reported to eat fruit (Isler and Isler, 1987).

HABITAT. Forest edge, orchard.

NOTES. Jun ♀ moving with a mixed-species flock including *Hemithraupis guira* and *Conirostrum speciosum*. Nov birds a mated pair. Male sang from 5–9 m up, a listless series of high-pitched notes; ♀ perched nearby with the plant fiber in her bill.

Pyrrhocomma ruficeps: Chestnut-headed Tanager

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 28: Jan (2), Feb (1), Mar (1), May (2), Jun (1), Aug (1), Sep (6), Oct (10), Dec (4). ♀♀ 19: Jan (1), Feb (2), Mar (4), May (2), Jun (1), Sep (1), Oct (7), Dec (1). Birds with only partly pneumatized skulls in Jan, Mar, and May likely represent birds of the year. Birds with small skull windows and developed gonads in Feb, Aug, and Oct are likely in their second year.

MASS (G). ♂♂ $\bar{X} = 14.4$ (SD = 1.50, range = 12.2–18.5, N = 27). ♀♀ $\bar{X} = 14.7$ (SD = 2.01, range = 12.0–19.5, N = 18). Birds (5) with light fat in Jan, Mar, Jun, Oct, and Dec; with moderate fat in Sep (1), Oct (1).

IRIS. Brown, dark brown, or reddish brown.

BILL. Upper mandible brown, black, or grayish black with narrow pale gray tomium. Lower mandible lighter than upper mandible: gray (whitish gray, blue gray, purplish gray), white, tan, flesh color. Mouth lining flesh color, gray, slate gray blue. Tongue flesh color or purplish at base and white distally; palate purplish pink.

FEET AND Tarsi. Gray, brownish gray, or blue gray. Toe pads green, tan, yellowish tan, or greenish brown.

GONADS. ♂♂ Males with adult skulls had enlarged testes (6×4 – 12×8 mm) from Aug into Dec, when they began to regress. Testes were regressed (1×1 – 2.5×1.5 mm) from late Dec through Jun. Males with skulls $\geq 50\%$ pneumatized or with only small skull windows had enlarged (7.5×5.5 – 10×5 mm) testes and apparently bred. Males with juvenal skulls (Oct, Mar, May) had tiny ($\geq 1 \times 1$ mm) testes. ♀♀ in Oct, Nov, and Dec had enlarged ova (2–10 mm, many yolked), enlarged oviducts, incubation patches, and/or were accompanied by juveniles. From Jan through Jun and Sep, ovaries were granular, had largest ova ≤ 1 mm, or were postreproductive. Ovaries of all females with juvenal skulls were smooth and undeveloped.

MOLT. Prebasic molt recorded in Oct, Dec, Jan, Feb, and Mar. First prebasic molt recorded in Jan and May. Two adult Sep birds (♂, ♀) with body molt; possibly prealternate. Molt in the Sep ♂ (testis 7×3 mm) may overlap with breeding.

PLUMAGE. Birds in juvenal plumage resemble the female, but with lax rufous feathers on the upper back and breast. Following the first prebasic molt, males acquire a plumage closely resembling the adult female or one that is a mixture of adult male and adult female characteristics. In males with mixed plumage the crown is yellowish chestnut, the throat about half chestnut and half yellow, and the black foreface has olive feathers scattered through it; the dorsal and ventral body feathers range from one- to two-thirds gray, with the rest of the feathers olive. The variation in the plumage may reflect the date of hatching and the relative ages of the males, with older individuals looking more like adult males. Males with a mixed plumage have only partly pneumatized skulls, whereas those with the definitive plumage have fully pneumatized skulls. Birds in mixed plumage had enlarged testes and apparently breed (Belton, 1985).

STOMACH CONTENTS. Only insects, including a caterpillar and ticks, in 14; only fruit remains in 7; a mix of fruit and insect remains in 2. Observed feeding on fruits of *Allophylus edulis* (Foster, 1987, 1990).

HABITAT. Forest, old second growth.

NOTES. Common in forest undergrowth, thickets, and bamboo patches, using both horizontal and vertical perches, usually below 4 m. Some males in immature plumage have developed testes and may breed. Small groups (3–4) of birds seen from Jan to Mar are likely family groups. The birds fly up to pluck fruits, rapidly returning to their perches, or they foliage glean on terminal branches and twigs. The birds flit around, rarely still, giving a single high-pitched *psheet* note or soft *chup* like glass beads colliding. Their calls are whistle-like *whewhes* or *tsee*

tsees with a rising inflection. One individual with nematodes in the body cavity, 1 with ticks on the eyes, and 3 with scaly legs and feet.

***Trichothraupis melanops*: Black-goggled Tanager**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 38: Jan (2), Feb (3), Mar (3), May (3), Jun (7), Aug (2), Sep (4), Oct (9), Nov (1), Dec (4). ♀♀ 22: Feb (1), Mar (2), May (3), Jun (3), Aug (4), Sep (3), Oct (3), Nov (2), Dec (1). Birds with only partly pneumatized skulls in Oct, Dec, Feb, Mar, May, and Jun likely represent birds of the year. Birds with small skull windows in Oct and Dec are likely in their second year.

MASS (G). ♂♂ $\bar{X} = 20.8$ (SD = 1.98, range = 16.6–25.7, N = 35). ♀♀ $\bar{X} = 22.2$ (SD = 1.43, range = 17.75–24.5, N = 20). Birds with light fat in Feb, May, Jun, and Aug; with moderate or heavy fat in Jun and Aug.

IRIS. Brown or black.

BILL. Upper mandible black, dark gray, or blue gray, with blue-gray or silver-gray tomium. Lower mandible gray, silver gray, or blue gray, sometimes with white or gray tomium. Mouth lining ochre or flesh color. Tongue flesh color.

FEET AND Tarsi. Gray or blue gray. Toe pads light green, tan gray, or sandy brown.

GONADS. ♂♂ Males with adult skulls had enlarged testes (12×8 – 5×4.5 mm) from Aug through Jan and regressed testes (2×1 – 1×1 mm) from Feb through Aug. Some males breed before skull pneumatization is completed. All males with juvenal skulls had tiny testes (2×1 – 1×0.5 mm). ♀♀ Granular ovaries or those with largest ova ≤ 1 mm were recorded in most months, although many of the Aug through Dec birds were likely about to breed or postbreeding. Birds with enlarged, yellow-orange ova and enlarged oviducts were recorded in Aug, Sep, Oct, and Nov. Ovaries of all ♀♀ with juvenal skulls were smooth and undeveloped.

MOLT. Prebasic molt recorded in Dec, Jan, Feb, and Mar. First prebasic molt recorded in Oct, Feb, Mar, and May.

PLUMAGE. Birds in juvenal plumage resemble the female. Following the first prebasic molt, males acquire a plumage with characteristics of the definitive-male plumage, but the extent of those characteristics varies widely. Some first-year birds have a fully definitive plumage. However, most first-year males lack the black mask (or goggles) and have dusky wings and tail and a limited yellow crown patch. A single female (MVZ 165627) with a moderately well-developed yellow crown may have been missexed.

STOMACH CONTENTS. Only insects in 25 birds; only fruit in 8; a mix of fruit and insect remains in 6. One ♂ had remains of a snail shell, and 1 ♀ had remains of an egg shell.

HABITAT. Forest, disturbed forest, occasionally in open scrub.

NOTES. One of the most common birds at El Tirol. Usually 2–8 m up in understory (often fruiting) trees, but

sometimes in viny bamboo tangles. During the breeding season, birds occur mostly in pairs or, later, in family groups. First-year males, including those with female-like plumage, appear to breed. For example, 5 males (2 with small skull windows) collected in Oct and Nov had testes ranging from 8×5 to 9.5×6 mm. Four males in full adult plumage from the same period had testes ranging from 8×6 to 10×7 mm. From Mar through August female-plumaged birds (both ♀♀ and young ♂♂) form small flocks of 4–7 birds. Males in adult plumage seem to be solitary. The *Trichothraupis* in the flocks seem to be the nuclear species for the formation of mixed-species understory flocks that may include *Basileuterus culicivorus* and *Hemithraupis guira*. Whether solitary or part of a flock, both ♂♂ and ♀♀ repeatedly give a harsh, single-note *chup* or *chuck* as they move around in the vegetation. When perched, a bird may flick its tail up and down vertically. The species was observed feeding on *Allophylus edulis* and *Trema micrantha* fruits (Foster, 1987, 1990) and following an ant swarm.

***Tachyphonus coronatus*: Ruby-crowned Tanager**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 33: Jan (1), Feb (1), Mar (3), May (1), Jun (7), Aug (4), Sep (4), Oct (7), Nov (4), Dec (1). ♀♀ 17: Jan (1), Feb (1), Mar (1), May (3), Jun (3), Aug (2), Sep (4), Nov (1), Dec (1). Birds with juvenile/immature skulls in Jan (1), Feb (1), Mar (2), Jun (3). One Oct and 1 Nov bird with small skull windows and greatly enlarged testes likely represent birds in their second year. All other specimens with completely pneumatized skulls.

MASS (G). ♂♂ $\bar{X} = 26.3$ (SD = 2.88, range = 22.0–35.0, $N = 32$). ♀♀ $\bar{X} = 26.2$ (SD = 1.99, range = 23.0–29.0, $N = 15$). Light or moderate fat present in some birds in Feb (1), Mar (1), May (1), Jun (6), Aug (3), Sep (1). One very fat bird in Sep.

IRIS. Brown, dark brown, or black.

BILL. Upper mandible black. Lower mandible gray or white with black tip. Mouth lining lemon yellow, yellow orange, or pink. Soft gape tissue in juveniles yellow orange.

FEET AND TARS. Black, various shades of dark gray, or dark purple. Toe pads green or tan.

GONADS. ♂♂ Testes of adults small ($\leq 2.5 \times 1.5$ mm) from Mar to Aug, enlarging in Sep (3×2 – 6×4 mm), and enlarged from Sep through Feb (8×4 – 15×9 mm), often with a large cloacal protuberance. Testes of immature ♂♂ $\leq 1.5 \times 1.0$ mm, sometimes black. ♀♀ Ovaries granular, May into early Sep. Sep ♀♀, ova = 1 mm diam; Nov ♀ laying, with incubation patch. Ovaries of ♀♀ in their first year, smooth and undeveloped.

MOLT. Prebasic molt in Jan (1), Feb (1), Mar (1), and Jun (1). First prebasic molt in Jan (1), Feb (1), Mar (1).

PLUMAGE. First-year males that have completed their first prebasic molt may retain yellowish brown feathers on the flanks, rump, and lower abdomen and occasionally on the upper wing coverts or breast. The primaries are also dull and browner

than in older birds. The birds breed in this plumage and also may retain small skull windows.

STOMACH CONTENTS. Thirteen with only insect remains (including ants); 8 with only fruit, including *Ficus* sp.; 8 with mixed insect, fruit, and plant remains.

HABITAT. Forest and forest edge, occasionally in orchards or thick scrub adjacent to forest.

NOTES. Occupy the densest growth in the forest understory, including bamboo, dense stands of saplings, and dense brush, as well as trees 6–8 m up. Prebasic molt may begin in some males while they are still in breeding condition. Males and females often move and forage together or with mixed-species flocks. Known to feed on *Allophylus edulis* and *Eugenia uniflora* and to follow ant swarms from low perches (1–1.5 m).

***Stephanophorus diadematus**: Diademed Tanager**

NOTES. A male of this species was observed clearly while it fed on *Eugenia uniflora* fruits in an isolated 3-m-tall tree near the hotel (MSF). This species is distributed primarily to the east and south of Paraguay in Argentina and Brazil (Ridgely and Tudor, 2009). Hayes (1995) suggested that it may be a southern austral migrant to Paraguay, whereas R. P. Clay (Western Hemisphere Shorebird Reserve Network, Manomet, Inc., personal communication, 18 January 2016) speculated that it may “invade” Paraguay only during periods of population irruption. Del Castillo et al. (2015) considered it a “vagrant” to Paraguay. A single individual of this species was recorded by Smith et al. (2005) but may have been misidentified (P. Smith, FAUNA Paraguay, personal communication, 8 Sep 2016).

***Pipraeidea melanonota*: Fawn-breasted Tanager**

SPECIMENS (USNM, MNHNP). ♂♂ Jun (1), Sep (2). ♀ Aug (1). All birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 22.9$ (SD = 2.43, range = 20.3–25.0, $N = 3$), Jun bird with light fat, Nov bird with moderate to heavy fat. ♀ 21.0, light fat.

IRIS. Brown or red.

BILL. Upper mandible black. Lower mandible gray; with black tip in some birds.

FEET AND TARS. Black, gray brown, or gray.

GONADS. ♂♂ Testes enlarged (7×3.5 , 5.5×4 mm) in Sep; small (2×1 mm) in Jun. ♀ largest ovum = 0.5 mm, oviduct beginning to enlarge.

MOLT. Body molt in Aug ♀.

STOMACH CONTENTS. Insect remains in 2; plant remains in 1; plant and insect remains in 1.

HABITAT. Forest.

NOTES. May join mixed-species flocks including such birds as *Setophaga pitiayumi*.

***Thraupis sayaca*: Sayaca Tanager**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (2), Jun (3), Aug (1), Sep (1), Oct (2). ♀♀ Jan (1), Feb (2), Jun (1), Sep (2), Nov (1). Birds with juvenal skulls in Feb (3) and Jun (3). One Oct ♂ with tiny skull windows and breeding is likely in his second year.

MASS (G). ♂♂ $\bar{X} = 32.1$ (SD = 1.81, range = 30.0–35.2, $N = 8$). ♀♀ $\bar{X} = 32.9$ (SD = 1.35, range = 31.5–35.0, $N = 7$). Light or moderate fat recorded in Feb (2), Jun (2), Sep (2), Oct (1), and Nov (1).

IRIS. Brown.

BILL. Upper mandible black distally with gray or blue gray at base. Lower mandible gray or blue gray, some with black tip. Mouth lining flesh color.

FEET AND Tarsi. Gray or gray blue. Toe pads tan or green.

GONADS. ♂♂ Testes enlarged ($8.5 \times 5\text{--}9 \times 6$ mm) Sep–Oct; 1 ♂ with large cloacal protuberance. Testes of immatures and adults small ($1 \times 0.5\text{--}2 \times 1$ mm), Feb through Aug. ♀♀ Ovaries with enlarged ova (≥ 2 mm diam) or collapsed follicles, oviduct enlarged, and/or incubation patch (Sep, Nov, Jan). Adults and immatures largest ovum ≤ 1 mm (Feb, Jun, Sep).

MOLT. Prebasic molt in Jan (1) and Feb (4); first prebasic molt in Feb (1).

STOMACH CONTENTS. Seven with fruits and seeds; 2 with insects and plant material (e.g., flowers); 1 with only insect remains. Feeds routinely on *Allophylus edulis*, *Cupania vernalis*, *Eugenia uniflora*, and *Ocotea puberula* fruits.

HABITAT. Forest, forest edge, open woodland, tung orchard, forest clearings.

NOTES. Generally in pairs or in family groups following breeding (Jan–Mar), usually from 2 to 7 m up. Birds were found in the same areas over and over through the breeding season, as if on territories, although agonistic interactions with conspecifics were not observed. Birds were observed bathing in water in a hole in the crotch of a tall tree in the forest. A bird entered the water, fluttered its wings and tail, and flipped water all over its body several times and then left. That bird or another returned to bathe again after about 1 min. Bathing was observed on 22 Sep and 23 Oct 1980 and in earlier years at the same tree hole.

***Tangara seledon*: Green-headed Tanager**

SPECIMENS (USNM, MVZ). ♂♂ Jan (4), May (1), Dec (1). ♀♀ Feb (1), Oct (1). One Jan ♂ with juvenal skull; all other birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 18.5$ (SD = 1.18, range = 16.5–20.0, $N = 6$). ♀♀ Both 20.5. One Jan ♂, 1 Oct ♀ with light fat.

IRIS. Dark brown or brown.

BILL. Black. Mouth lining black.

FEET AND Tarsi. Gray, blue gray, or slate gray. Toe pads gray or tan.

GONADS. ♂♂ Testes enlarged in Dec (6.5×4 mm) and Jan (8×6 , 6×4 mm) or beginning to decline in Jan (4×3 mm) and small in May (2×1.5 mm). ♀♀ Feb ovary postreproductive, incubation patch old. Oct largest ovum 1.5 mm diam.

MOLT. Prebasic molt in Jan, Feb; first prebasic molt in Jan.

STOMACH CONTENTS. Four with fruits, including *Allophylus edulis* and *Eugenia uniflora*; 2 with “plant material.”

HABITAT. Forest, forest edge, woodland, gardens.

NOTES. Perches in the canopy, often on bare branches. May join mixed-species foraging flocks. Birds give a single *pseet* note. Isler and Isler (1987) reported that the species has a sub-adult plumage in which the birds probably breed. We did not encounter any birds in this plumage.

***Tersina viridis*: Swallow Tanager**

SPECIMENS (USNM, MVZ). ♂♂ Sep (3), Nov (1). ♀♀ Oct (3). All with adult skulls.

MASS (G). ♂♂ $\bar{X} = 33.4$ (SD = 1.60, range = 31.0–34.5, $N = 4$). ♀♀ $\bar{X} = 34.9$ (SD = 0.81, range = 34.0–35.5, $N = 3$). Light or moderate fat in 1 Sep ♂ and 2 Oct ♀♀.

IRIS. Brown.

BILL. Black. Palate and tongue pale pinkish purple. Floor of mouth dull yellowish pink.

FEET AND Tarsi. Black or brownish black. Toe pads gray.

GONADS. ♂♂ Testes enlarging ($4 \times 3\text{--}6 \times 4$ mm) in Sep and enlarged in Nov (10×5 mm). Reproductive states of Oct ♀♀ varied from largest ovum $\leq 1\text{--}5$ mm with oviduct moderately enlarged to shelled egg in oviduct.

MOLT. No.

PLUMAGE. The nonmolting Nov male (MVZ 168911) had an adult skull and a mixture of adult female and male plumages. Although males breed at age 1 year, they do not acquire the full adult plumage until their second or even later prebasic molt (Schaefer, 1953).

STOMACH CONTENTS. Six with only fruit, including *Alchornea iricurana* and *Ocotea puberula*; 1 with an orthopteran.

HABITAT. Forest, forest edge, woodland.

NOTES. Frequently observed in pairs or small groups feeding in fruiting trees and occasionally making fly-catching sallies. Use generally bare perches from 2 to 15 m up. A pair observed on 11 Oct 1978 was going in and out of a hole in a bank adjacent to a creek through undisturbed forest. The hole was ~3 m above the streambed in an area of soft sandstone. In 1979, a female gathered and carried away moss (possibly for lining a nest?) from ~3 m up on the trunk of a tree in the vicinity of the nest hole located the previous year. The species is reported to breed in holes in banks (Schaefer, 1953; J. C. Chebezas in Ortiz, 2009) as well as in tree holes (Canevari et al., 1991). The species is reportedly migratory in Venezuela (Schaefer, 1953). Hayes (1995) also regarded it as a migrant, breeding in Paraguay and moving north in the austral winter. Ridgely and Tudor (1989),

in contrast, described it as nomadic, appearing erratically from 1 place and 1 year to the next. We recorded it only during the breeding season (Sep–Nov) and only in 1978, 1979, and 1981, although someone was present and collecting during the breeding seasons of 1976–1977, 1980, 1982, and 1983.

***Dacnis cayana*: Blue Dacnis**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 10: Feb (2), Mar (1), May (1), Jun (3), Sep (1), Oct (1), Dec (1). With juvenal skulls in Dec, Feb (1), May, and Jun (1). ♀♀ Jan (1), May (2), Jun (3), Oct (2). With small skull windows in May (1), Jun (1), and Oct (1), and 1 bird with juvenal skull in Jun.

MASS (G). ♂♂ \bar{X} = 16.1 (SD = 0.80, range = 15.0–17.5, N = 9). ♀♀ \bar{X} = 16.0 (SD = 1.04, range = 14.5–17.6, N = 8). Occasional birds with light or moderate fat Jan (1), May (1), Jun (2), Dec (1).

IRIS. Brown, reddish brown, or brick red.

BILL. Upper mandible black. Lower mandible black or gray with black tip. Mouth lining green, yellow, or flesh color. Tongue yellow flesh color.

FEET AND TARS. Gray, maroon, tan, or dull red. Toe pads tan or pink.

GONADS. ♂♂ Testes of adults enlarged in Sep (5 × 3 mm) and Oct (8 × 5 mm, ♂ with moderate cloacal protuberance); small (≤2 × 1 mm) from Feb through Jun. Testes of juveniles small (1 × 0.5–1.5 × 1 mm) Dec to Jun. ♀♀ Largest ova 2 mm diam in Oct (2); 1 bird with a developing brood patch. ♀ with an enlarged oviduct and brood patch in Jan. Ovaries granular in May, Jun. Jun juvenile with smooth, undeveloped ovary.

MOLT. Some birds with prebasic molt in Feb, Mar, May. First prebasic molt in Dec, Feb, May.

STOMACH CONTENTS. Fifteen with fruit pulp and seeds, including *Trema micrantha*; 1 with fruit and insect remains, including a 27-mm-long caterpillar; 1 with only insect remains.

HABITAT. Forest, disturbed forest, forest edge, isolated fruit trees in fields.

NOTES. Commonly observed during the austral winter moving with mixed-species flocks high in the forest canopy and in fence row trees between pastures. Also seen in small flocks (5–6) of conspecifics. Foliage glean for insects and feed on fruits of *Allophylus edulis* and *Trema micrantha*. Ridgely and Tudor (2009) reported that these birds feed mainly on insects and, to a lesser extent, small fruits, in contrast to the results from the stomach contents we analyzed. One breeding male (MVZ 166356) with a healed broken leg. Juvenile being attended by female in May.

***Hemithraupis guira*: Guira Tanager**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 14: Jan (1), Feb (1), May (1), Jun (2), Aug (2), Sep (2), Oct (3), Nov (1), Dec (1). ♀♀ 10: Jan (1), May (1), Jun (3), Aug (1), Sep (2),

Nov (2). All birds with adult skulls except a Sep ♀ = skull 60 % pneumatized and 1 Nov ♀ = juvenal skull.

MASS (G). ♂♂ \bar{X} = 12.5 (SD = 1.09, range = 9.5–14.0, N = 14). ♀♀ \bar{X} = 13.4 (SD = 1.15, range = 11.8–15.5, N = 8). Light to moderate fat present in some birds in Jan, Feb, May, Jun, Sep, Oct, and Nov.

IRIS. Brown or dark brown.

BILL. Upper mandible black (or brown) with yellow-orange tomiium. Lower mandible yellow orange or greenish yellow. Mouth lining and tongue pinkish flesh color.

FEET AND TARS. Black, gray, or blue gray. Toe pads pale gray, light green, or pale greenish tan.

GONADS. ♂♂ Testes small ≤ 1.5 mm diam in May and Jun; enlarged (8 × 5.5–5 × 4 mm) in Aug to Feb, some ♂♂ with large cloacal protuberances. ♀♀ Aug bird, largest ovum yellow orange and 3 mm diam, 1 collapsed follicle, and oviduct enlarging. Bird with juvenal skull (Nov), ovary undeveloped. All other ♀♀ with granular ovaries and largest ova ≤ 1.0 mm.

MOLT. Prebasic molt in Jan (1), Feb (2), and May; first prebasic molt in Nov.

STOMACH CONTENTS. Nine with only insect remains, including 4 with caterpillars (to 3 cm long); 4 with only fruit; 3 with insect, fruit, and other plant remains.

HABITAT. Forest, forest edge, disturbed forest with a cleared understory; occasionally in orchard near forest.

NOTES. Occur in pairs year-round in the canopies of forest trees or in family groups in the latter half of the breeding season. In Feb a pair was followed by and attended to a fully grown juvenile. During the austral winter (Mar–Aug), pairs may join subcanopy, mixed-species flocks, which include *Nemosia pileata*, *Hemithraupis guira*, *Basileuterus culicivorus*, and *Trichothraupis melanops*. The birds foliage glean like warblers, hopping, flitting, and hanging upside down while probing among flowers and leaves. They also appear to take nectar and have been observed feeding on fruits of *Allophylus edulis* and *Trichilia catigua*.

***Conirostrum speciosum*: Chestnut-vented Conebill**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), May (1), Jun (2), Oct (1). ♀ Jun (1). Feb ♂ with unpneumatized skull; all others with adult skulls.

MASS (G). ♂♂ \bar{X} = 9.0 (SD = 0.14, range = 8.8–9.2, N = 5), Feb specimen with light fat. ♀ 8.4, light fat.

IRIS. Brown.

BILL. Upper mandible black with gray or blue gray tomiium. Lower mandible gray or blue gray. Mouth lining flesh color.

FEET AND TARS. Gray or blue gray.

GONADS. ♂♂ Testes enlarged (5 × 4 mm) in Oct; small (3 × 2–1 × 0.5 mm), Feb through Jun. ♀ Ovary granular.

MOLT. Prebasic molt in May; first prebasic molt in Feb.

STOMACH CONTENTS. Four with insect remains, including a caterpillar; 1 with seeds and plant material.

HABITAT. Forest, forest edge, orchards, scrubby fields adjacent to forest.

NOTES. Inhabits forest canopy and tops of small fruiting trees. Visits flowers from which it appears to be taking insects. Joins mixed-species flocks including *Hemithraupis guira* and *Nemosia pileata*.

***Haplospiza unicolor*: Uniform Finch**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ May (1), Sep (2), Oct (2). ♀♀ Jun (1), Sep (6), Oct (1). Birds with juvenal/immature skulls in Sep (2 ♂♂ and 2 ♀♀) and Oct (1 ♂). All other specimens with skulls completely pneumatized.

MASS (G). ♂♂ \bar{X} = 14.9 (SD = 1.60, range = 13.0–16.8, N = 5). ♀♀ \bar{X} = 15.0 (SD = 1.89, range = 12.1–18.3, N = 8). Light fat in May (1) and Sep (1), and moderate to heavy fat present in Sep (3).

IRIS. Brown.

BILL. Upper mandible black or brown. Lower mandible black or brown distally, yellow or yellow tan at base.

FEET AND TARS. Brown, tan, grayish tan, or flesh color.

GONADS. ♂♂ With adult skulls, 5 × 3.5 mm (May, 1) and 3.5 × 2 mm (Oct, 1); with immature skulls, 2 × 1 mm (Sep) and 3.5 × 3–2.5 × 2 mm (Oct). ♀♀ Ova of 1 Sep bird >1 mm; all other ♀♀ with ova ≤ 1 mm diam. A Sep bird with an unpneumatized skull had a smooth, undeveloped ovary and likely had recently hatched. In contrast, a Sep bird with a 70% pneumatized skull and a granular ovary likely hatched during the previous breeding season.

MOLT. None noted.

PLUMAGE. Immature males that have completed their first prebasic molt have a plumage somewhat intermediate between those of adult males and females. Females are yellowish ventrally and heavily streaked with dusky on the throat, breast, and flanks and with gray on the abdomen. Young males (e.g., USNM 599171, MVZ 167499) are pale gray ventrally (less yellow than females) with darker gray or dusky streaks on the throat, breast, and flanks. The abdomen is whitish, streaked gray. Dorsally, young males are paler gray than adult males with irregular spots and blotches of dusky olive brown. They have some darker streaking on the crown and nape. Tail is brown as in females.

STOMACH CONTENTS. Insect remains in 2 birds, seeds in 2. One of the birds with insects, both of those with seeds, and an additional 3 birds whose stomachs lacked food remains had grit in their stomachs.

HABITAT. Brush and dense bamboo low in the forest understory.

NOTES. Has a harsh, sharp, single-note call.

***Sicalis flaveola*: Saffron Finch**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Sep (1), Oct (1), Nov (1), Dec (1). Oct bird with small skull windows; all others, adult skulls. ♀♀ Mar (2), juvenal skulls.

MASS (G). ♂♂ \bar{X} = 16.0 (SD = 0.52, range = 15.4–16.75, N = 5); Dec bird with light fat. ♀♀ 16.5, 15.8.

IRIS. Brown or black.

BILL. Upper mandible brown. Lower mandible brown, in some birds yellow or grayish white at base. Mouth lining flesh pink.

FEET AND TARS. Brown or green with tan toe pads.

GONADS. ♂♂ Testes enlarged (6 × 4–9 × 6 mm) Sep through Jan. ♀♀ Ovaries small, undeveloped.

MOLT. Prebasic molt in 2 Mar ♀♀. Oct male replacing entire tail (possibly adventitious loss).

PLUMAGE. Adult plumage conforms to the “southern form” described by Ridgely and Tudor (2009). Males are more olive above and on the breast and have less orange on the crown than birds from northern and northwestern South America. Females are more brownish above and whiter below. Both sexes have more streaking. One adult male from El Tirol had considerable dusky streaking on the breast and flanks. The Oct and Dec males, with adult skulls (95% and 100% pneumatized, respectively), are in full female plumage.

STOMACH CONTENTS. Six with seeds.

HABITAT. Tung orchards, cultivated fields, scrubby pastures, along roadsides.

NOTES. Males singing regularly in Oct through Feb. One ♂ displaying to a ♀ and juveniles being fed by adults in Feb. Males appear to require 2 years to complete skull pneumatization and acquire the adult male plumage but are in breeding condition (testes 8 × 4 and 7.5 × 6.5 mm) and singing after their first year. Observed in flocks of up to 20 individuals (mostly young) beginning in Mar. Abdominal feathers of all individuals soiled with red dirt.

***Volatinia jacarina*: Blue-black Grassquit**

SPECIMENS (MVZ). ♂♂ Feb (2), 1 with adult skull and plumage; 1 with a juvenal skull and immature plumage (like female).

MASS (G). Adult 10.5, light fat; juvenile 8.8.

IRIS. Brown.

BILL. Adult: Upper mandible black, lower mandible blue. Immature: Upper mandible brown, lower mandible gray blue. Mouth lining dull yellow.

FEET AND TARS. Black or dark brown (juvenile). Toe pads tan.

GONADS. Testis of adult, 6 × 4 mm; juvenile, 1 × 1 mm.

MOLT. Adult with body molt.

STOMACH CONTENTS. Both with seeds.

HABITAT. Scrubby pasture, tall grass with scattered bushes.

***Sporophila angolensis*: Chestnut-bellied Seed-finch**

SPECIMENS (USNM). ♀ Oct (1), skull partly pneumatized.

MASS (G). 13.25.

IRIS. Brown.

BILL. Black.

FEET AND TARSII. Dark gray.

GONADS. Ovary smooth and undeveloped.

MOLT. No.

STOMACH CONTENTS. Seeds in crop and stomach.

HABITAT. Scrubby second growth in abandoned clearing.

***Sporophila caerulescens*: Double-collared Seedeater**

SPECIMENS (MVZ, MNHNP). ♂♂ Feb (2), Mar (1), Jun (1), Nov (2). One Nov bird with tiny skull windows; all others, skulls fully pneumatized. Sex? Mar (1), juvenal skull.

MASS (G). ♂♂ \bar{X} = 10.3 (SD = 1.36, range = 8.8–12.0, N = 6). Nov bird with skull windows, very fat. Sex? 7.8.

IRIS. Dark brown to brown.

BILL. Greenish yellow or greenish gray with yellow at base and along tomia. Or upper mandible gray brown or gray green and lower mandible paler bluish gray brown with yellow orange at base and along tomia. Mouth lining pale red brown or yellow.

FEET AND TARSII. Dark brownish black, dark gray, or grayish brown. Toe pads tan, gray brown, or gray. In juvenile, pinkish green with pink toe pads.

GONADS. Testis sizes suggest breeding from Nov through Mar, although gonad enlargement does not appear to be synchronous in the population. ♂♂ Testes in Nov = 5 × 4 and 3 × 2 mm; Feb = 9 × 5 mm, with large cloacal protuberance, male singing, and 2 × 1 mm; Mar = 6 × 5 mm, large cloacal protuberance; and Jun = 1 × 0.5 mm.

MOLT. Body molt in Feb (1), Mar (1), and Nov (1); body and flight feather molt in Mar Sex? bird. Molting and breeding in Mar ♂ may overlap.

PLUMAGE. Two Nov males in first-year plumage with only a hint of the pectoral band, upper throat with only a few black feathers, and white malar stripe limited; brown dorsally. Degree of skull pneumatization indicates that the birds hatched the previous year, and their testes sizes suggest that they may breed in this plumage. The Sex? bird from Mar is in lax juvenal plumage: brown dorsally; throat buff, breast pinkish brown grading into whitish belly.

STOMACH CONTENTS. Four birds with only seeds, 1 with seeds and grit, and the juvenile with seeds and white eggshell fragments. One bird with small insects.

HABITAT. Orchards, shrubby pasture, dense grass scrub, open fields, and roadsides.

NOTES. Usually found in small groups in bushes or small trees, from 1 to 3 m, or on the ground. Ventral feathers often soiled with red dirt.

***Coryphospingus cucullatus*: Red-crested Finch**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 27: Jan (1), Feb (1), Mar (3, all with juvenal skulls), May (1), Jun (4), Aug (1), Sep (4), Oct (5), Nov (5), Dec (2). ♀♀ 13: Jan (1), May

(1), Jun (1, juvenal skull), Aug (2), Sep (2), Oct (2), Nov (2), Dec (2). Sex? Sep (1, nestling; MSF 2069). Nest Sep (1); MSF 2073. One Oct and 1 Nov ♂ and May, Jun, and 1 Sep ♀♀ with small skull windows. One Nov ♂ with large skull windows.

MASS (G). ♂♂ \bar{X} = 14.9 (SD = 1.34, range = 11.8–17.3, N = 22). ♀♀ \bar{X} = 14.8 (SD = 1.87 range = 10.9–17.0, N = 13). Some birds with light fat in almost every month. One Jun and 1 Nov bird with moderate to heavy fat.

IRIS. Brown or dark brown.

BILL. Upper mandible black or dark brown. Lower mandible gray or gray blue, with black tip in some. Mouth lining flesh color, reddish, or pale yellowish white. Tongue and palate pale yellowish white.

FEET AND TARSII. Gray, brown, or black. Toe pads brown or reddish brown.

GONADS. ♂♂ Testes enlarging in Aug–Oct (4 × 2.5–5 × 3 mm), enlarged in Sep–Jan (6 × 4.5–10 × 5 mm), including in ♂♂ with small skull windows. Regressed in May–Jun (≤2 × 1 mm, some black). Mar juveniles with tiny testes (1 mm diam). ♀♀ Ovaries granular or largest ova ≤ 1 mm in Dec through Sep plus 1 Oct bird. An Oct ♀ and a Nov ♀ with enlarged (2–2.5 mm diam), yellow-orange ova, and 1 with an enlarged oviduct. Another Nov bird with postbreeding ovary.

MOLT. Two Mar ♂♂ in first prebasic molt. One Jan, 2 Oct, and 1 Dec adults with light scattered body molt. Birds observed (but not captured) in Feb appear to be molting heavily.

STOMACH CONTENTS. Eleven with only insects, Aug–Dec; 10 with only seeds, Dec–Jun; suggests a seasonal shift in diet. Known to feed in *Allophylus edulis*.

HABITAT. Scrubby second growth with many small trees, thickets at the edges of forests and fields, tung orchard, weedy road sides.

NOTES. Very common at El Tirol. Birds generally in pairs or family groups but may form flocks (10–15 birds) in the nonbreeding season. They frequent small trees, shrubs, and vine tangles a few meters off the ground, although singing males may perch on bare limbs 10–12 m up in large trees. Copulation observed in Oct; nest located Sep; pairs feeding young in Nov, Jan, Feb.

Nest (cf. de la Peña, 2010) located 19 Sep 1982, 18 days earlier than the earliest egg date reported by Hayes (2014) for Sapucái (Figure 1). The nest was in a vine (*Relbunium hypocarpium*, Rubiaceae) tangle hanging from a small tree (4 m tall) in second-growth-edge scrub. The viny mass hung to about 75 cm above the ground, which was covered with weedy annuals and some woody perennials 75 to 100 cm tall. The bottom of the nest was 111 cm above ground, 13 cm from the tree trunk, and easily accessible to climbing mammalian or reptilian predators. The nest incorporated 5 vertical vine stems that ran through it and held it up. Its outer height was 6.0 cm, and inner depth was 4.5 cm; the outer diameter at the rim was ~8.0 cm, and the inner diameter was 5.5 cm, although the outer (somewhat) and inner (especially) diameters decreased toward the bottom (inner diameter = 3.6 cm). The nest was essentially round at the rim. The

bulk of the nest consisted of an inner layer (10–12 mm thick) of circularly but irregularly interwoven very fine pale fibers, smooth and round in cross section. An outer layer (3–5 mm thick) consisted of a hodgepodge of materials, including strips of bark (4–5 mm wide), small twigs (to 55 mm long \times 1 mm diam) pieces of leaf and grass blades (dry and brown), leaf midribs, and lots of moss woven together and sometimes anchored with spider web.

The 2 eggs were white with no external markings and measured 19.2×13.6 mm, 1.5 g and 20.0×13.8 mm, 1.6 g. They were rounded at 1 end and narrowed to a point at the other. The eggs likely hatched on 23 Sep. On 25 Sep the nestlings weighed 4.3 and 4.0 g (their bellies were enormous and full of food) and had completely sheathed primaries ~2 mm long; their eyes were closed. The bill was brown with a white tomium and yellow at the corners of the gape; the mouth lining was yellow gold. No egg tooth was apparent. The skin was dark gray with the maroon of muscles showing through. Very fluffy grayish white down was present in the superciliary region, in a horizontal line across the back of the head, in the scapular region, in the femoral tract (with a few around the ankles), in the posterior two-thirds of the spinal tract, in the posterior ventral tract (a few), and at the site of the secondaries. The down feathers lacked a rachis, with the barbs emerging directly at the skin surface. Down feathers were 8–10 mm long except in the ventral tract, where they were only 1 to 2 mm. A few tiny wisps of down were also present in the tail or tail-covert region. All feather tracts were well defined with barely emerging pin feathers or pin feathers visible under the skin.

When the nest was next checked on 28 Sep, the feathers of the adult female were on the ground everywhere around it. One nestling was half eaten (bitten through) suggesting a mammalian predator, and the other was dead. The conditions of the nestlings suggested that predation occurred on the night of 27 Sep.

***Coereba flaveola*: Bananaquit**

SPECIMENS (USNM). ♂ Jun (1), adult skull.

MASS (G). 9.7.

IRIS. Brown.

BILL. Black.

FEET AND TARS. Gray.

GONADS. Testis 2×1 mm.

MOLT. No.

PLUMAGE. Dusky olive gray above with yellow-olive rump. Crown darker blackish gray. Lacks a white wing speculum.

NOTES. Observed on several occasions in Jun feeding in blossoms of ornamental *Malvaviscus* sp. shrubs, abutting the forest.

***Saltator similis*: Green-winged Saltator**

SPECIMENS (MVZ). ♂ Jun (1), immature skull with large windows.

MASS (G). 62.0, light fat.

IRIS. Brown.

BILL. Black.

FEET AND TARS. Dark gray.

GONADS. Testis 2×1 mm.

MOLT. No.

HABITAT. In a field.

STOMACH CONTENTS. Full of seeds and other plant material.

FAMILY EMBERIZIDAE: SPARROWS

***Zonotrichia capensis*: Rufous-collared Sparrow**

SPECIMENS (USNM, MVZ). ♂♂ 22: Feb (1, imm skull), Mar (1), Aug (1), Sep (7), Nov (11, one with small skull windows), Dec (1). ♀♀ Jan (1, imm skull), Feb (1, imm skull), Mar (1), Oct (1), Nov (3). Sex? Mar (1).

MASS (G). ♂♂ $\bar{X} = 21.0$ (SD = 1.33, range = 16.7–23.0, N = 22), no fat. ♀♀ $\bar{X} = 21.2$ (SD = 1.36, range = 20.4–22.8, N = 3 ad); slight fat in 2 Nov birds. Sex? 20.8.

IRIS. Brown or red brown.

BILL. Upper mandible dark brown or brown. Lower mandible gray or green gray. Mouth lining flesh color.

FEET AND TARS. Brown. Toe pads brown or tan.

GONADS. ♂♂ Testes enlarged (5×4 – 10×6 mm) Aug through Dec; many ♂♂ with a large cloacal protuberance. Testis small (1×1 mm) in Mar. ♀♀ Oct–Nov birds with various combinations of enlarged ova (to 6 mm diam), collapsed follicles, enlarged oviducts, and active incubation patches; 2 with unshelled eggs in their oviducts. Mar adult, largest ova ≤ 1 mm. Jan and Feb immatures with small, undeveloped ovaries.

MOLT. Feb and Mar birds with body and flight feather molt.

PLUMAGE. Head striping bold and conspicuous (cf. Ridgely and Tudor, 2009). Jan ♀ in juvenal plumage: yellowish tan on throat, breast, anterior abdomen, and flanks densely streaked dusky; posterior abdomen buffy; dorsally brown with bold dusky streaks but lacking the rufous collar. None of the specimens has a noticeable yellow bend to the wing (cf. Chapman, 1940; Bó, 1972; Hayes, 1995).

STOMACH CONTENTS. Seven with only seeds; 11 with only insects, including a caterpillar; 4 with seeds and insects.

HABITAT. Tung orchard, pastures, cultivated fields, clearings, around buildings.

NOTES. On the ground and in shrubs and small trees. Ventral feathers frequently soiled with red dirt. Observed feeding on *Allophylus edulis* fruits, but it was not clear whether it was eating the pulp or extracting the seed.

FAMILY CARDINALIDAE: CARDINAL GROSBEAKS

***Habia rubica*: Red-crowned Ant-tanager**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), Jun (2), Sep (2), Oct (3), Nov (1). ♀♀ Jun (2), Oct (3). Sex?

Sep (1, fledgling). Nest, egg shell Sep (1). All birds except fledgling with adult skulls.

MASS (G). ♂♂ \bar{X} = 34.6 (SD = 2.30, range = 31.5–37.0, N = 9). ♀♀ \bar{X} = 31.2 (SD = 2.36, range = 28.0–34.0, N = 5). Fledgling = 24.5. Three Jun birds with light fat.

IRIS. Brown or gray.

BILL. All black or blackish brown or with lower mandible gray at base; upper mandible black with tan tomium, lower mandible blackish brown; bill mottled brown and yellowish tan with tan tomium.

FEET AND TARS. Dark gray, brown, reddish brown, or tan.

GONADS. ♂♂ Testes enlarged (8 × 4–13 × 6.5 mm) from Sep to Jan; small ($\leq 2 \times 1$ mm, 1 blackish) in Jun. ♀♀ One Oct bird with multiple yellow-orange ova (2–6 mm diam) and a greatly enlarged oviduct; 2 other Oct ♀♀, largest ovum ≤ 1 mm. Jun ♀♀, ovaries granular (1) or smooth and undeveloped (1).

MOLT. Jan (1) and Jun (1), prebasic molt.

STOMACH CONTENTS. Nine with insect remains, including a cicada; 1 with fruit remains.

HABITAT. Forest.

NOTES. An understory species that moves in pairs or small groups, often as part of mixed-species flocks. Skull pneumatization in this species appears to be completed rapidly. A Jun ♀ with an adult skull had the smooth, undeveloped ovary of a bird that has never bred. Likewise, 1 nonmolting ♂ in complete female plumage that was collected on 11 Nov 1981 had a completely pneumatized skull and was seemingly in breeding condition (testis 8 × 4 mm). A nest and an egg shell were collected from the forest in Sep 1982 along with a just-fledged nestling (see Foster et al., 1989).

***Amaurospiza moesta*: Blackish-blue Seed eater**

SPECIMENS (MVZ). ♀ (by plumage) Jun (1), adult skull.

MASS (G). 13.5, slight fat.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible tan with brown tomium.

FEET AND TARS. Gray, feet slightly paler.

GONADS. Not located.

MOLT. No.

STOMACH CONTENTS. Insect parts.

HABITAT. Forest understory.

NOTES. Listed as Near Threatened on the IUCN (2015) Red List.

***Cyanoloxia glaucocaeerulea*: Glaucous-blue Grosbeak**

SPECIMENS (USNM, MNHNP). ♂♂ May (1) Aug (1), Sep (2), Oct (3). May and 1 Oct bird with partly pneumatized immature skulls. Others with adult skulls.

MASS (G). \bar{X} = 18.1 (SD = 0.86, range = 17.0–19.5, N = 7). Oct immature with light fat.

IRIS. Brown.

BILL. Upper mandible black. Lower mandible gray or gray at base with black tomium and tip.

FEET AND TARS. Brown or black.

GONADS. Testes of adults small (2 × 1–3 × 2 mm, some black) in Aug, Sep and somewhat enlarged (4 × 3–6.5 × 3.5 mm) in Oct. Testes of immature ♂♂ small (1 × 1–3 × 2 mm).

MOLT. Light body molt in Sep ♂♂.

PLUMAGE. The May immature ♂ has a female-type plumage. The Oct immature has a mixed plumage resembling that of a female except for a few blue feathers on the breast and throat and blue feathers covering about two-thirds of the chin, the sides of the face, the forecrown, and most of the top of the head. Neither bird was molting.

STOMACH CONTENTS. One with fruit and seeds of *Trema micrantha*; 2 with seeds of other species; 1 with seeds and insects; 1 with only insects; 1 with corn. Seeds crushed.

HABITAT. Scrubby forest-pasture edge in shrubs and vine and bamboo tangles.

NOTES. Birds usually ≤ 1 m from the ground. Locals report that this species is a pest on corn crops. The immature Oct ♂ with mixed plumage had a small testis (3 × 2 mm) relative to the Oct adults. Males apparently require at least 2 molts to acquire the definitive plumage. Hayes et al. (1994) considered this species to be a “southern austral migrant,” breeding in more temperate areas to the south and migrating to Paraguay during the colder months. The absence of records of females from El Tirol suggests that wintering locations of the sexes may differ. Hayes et al. (1994) reported an extreme date of 4 Oct. We collected 3 males in mid-Oct (15–19).

***Cyanoloxia brissonii*: Ultramarine Grosbeak**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Feb (1), Sep (1), Oct (1). ♀♀ Feb (1), May (1), Jun (1), Sep (1), Oct (1). Jun ♀ with partly pneumatized skull. All other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 21.5 (SD = 1.26, range = 20.5–23.2, N = 4). ♀♀ \bar{X} = 21.0 (SD = 1.24, range = 19.5–22.5, N = 5).

IRIS. Brown or dark brown.

BILL. Upper mandible black. Lower mandible black, gray, or black distally and gray basally. Mouth lining flesh color.

FEET AND TARS. Black, brown, or dark brown. Toe pads light green.

GONADS. ♂♂ Testes enlarged (7 × 4–12 × 7 mm) Sep through Feb; large cloacal protuberance in some. ♀♀ Largest ova of Feb, Sep, and Oct birds ≤ 1 mm. May and Jun ♀♀ had smooth, undeveloped ovaries indicating first-year birds.

MOLT. Prebasic molt of body and flight feathers in Feb adults.

PLUMAGE. The Sep and Oct males have a female-type plumage, although the latter bird has a trace of blue on the crown feather.

STOMACH CONTENTS. Three with only seeds, 1 with only insects, and 4 with seeds and insects.

HABITAT. Forest edge, woodland, tung orchard.

NOTES. Occupies the scrubby edge between field and forest, thickets, bamboo tangles, small trees, and shrubs (e.g., *Baccharis*), often low to the ground. Sometimes forages in the debris captured in leaf axils. The Sep and Oct ♂♂ have enlarged testes and apparently breed in an immature, female-like plumage.

FAMILY PARULIDAE: WOOD-WARBLERS

Geothlypis aequinoctialis: Masked Yellowthroat

SPECIMENS (MVZ). ♂♂ Feb (1), Mar (1), Nov (1). ♀ Feb (1). Nov ♂ with adult skull. All other birds with juvenal skulls.

MASS (G). ♂♂ \bar{X} = 11.8 (SD = 0.47, range = 11.3–12.2, N = 3). ♀ 11.4. Nov ♂ and ♀ light fat.

IRIS. Dark brown or brown.

BILL. Upper mandible black or brownish black. Lower mandible gray white or pinkish gray with black tip. Mouth lining flesh color.

FEET AND TARSI. Brown or pale gray brown. Toe pads green or pale brownish gray.

GONADS. ♂♂ Testis of adult 5 × 3 mm; of juveniles 1 × 1 mm. ♀ Ovary undeveloped.

MOLT. Feb ♂ First prebasic body molt.

STOMACH CONTENTS. All with insect remains.

HABITAT. Second-growth scrub, pasture.

NOTES. In small, isolated trees, tall grass. Calling in March.

Setophaga pitiayumi: Tropical Parula

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), May (1), Jun (2), Aug (1), Sep (2). ♀♀ Feb (2), Mar (1), Jun (2), Sep (2), Nov (1). Sex? Jun (1). Two Feb and 1 Jun ♀ with skulls only partly pneumatized. All other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 8.5 (SD = 0.68, range = 7.4–9.5, N = 7). ♀♀ \bar{X} = 7.9 (SD = 4.3, range = 7.3–8.5, N = 7). Sex? = 6.5. Light or moderate fat in some birds in Jan, Mar, Jun, Aug, Sep.

IRIS. Brown or dark brown.

BILL. Upper mandible black or brownish black. Lower mandible yellow, yellowish tan, or flesh color, some with black or dusky tip. Mouth lining light green or flesh color.

FEET AND TARSI. Dark brown, tan, or orange; toes lighter than tarsi. Toe pads tan or orange yellow.

GONADS. ♂♂ Testes enlarged (6 × 4–7 × 5 mm), with pronounced cloacal protuberance, in Sep, Jan; small (1 × 0.5–2.5 × 1.5 mm) in May, Jun, Aug. ♀♀ Breeding in Sep (largest ovum 1.5 mm, early incubation patch) and Nov (enlarged yolked ova, huge oviduct, incubation patch). Other Sep ♀ largest ovum 1 mm. Feb and Jun immatures with small, undeveloped ovaries.

MOLT. Two Feb ♀♀ first prebasic molt of body feathers.

STOMACH CONTENTS. Twelve with insect remains, often caterpillars. Two with fruit remains.

HABITAT. Forest, forest edge, dense secondary growth scrub.

NOTES. Usually in the forest canopy, often moving as part of mixed-species flocks through the tops of the tallest trees, but sometimes feeding with understory flocks (including *Pipraeidea melanonota* and *Trichothraupis melanops*) or alone, only 3 to 4 m up or in shrubs. Gleans insects from bare branches of trees; moves down limbs head first, hangs upside down, probes flowers and moss on tree trunks and large limbs. Makes a chattering, buzzy call or loud trill. Juvenile seen following adult in Feb.

Myiothlypis leucoblephara: White-browed Warbler

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 31: Jan (1), Feb (3), Mar (2), May (2), Jun (3) Aug (3), Sep (5), Oct (6), Nov (1), Dec (5). ♀♀ 19: Feb (3), Mar (2), May (2), Jun (4), Aug (1), Sep (2), Oct (2), Nov (1), Dec (2). Sex? Nov (1). Birds with only partly pneumatized skulls present in Dec, Feb, Mar, and May. Nest/egg Oct (1).

MASS (G). ♂♂ \bar{X} = 14.2 (SD = 1.09, range = 11.4–16.0, N = 31). ♀♀ \bar{X} = 13.4 (SD = 0.89, range = 12.0–15.0, N = 18). ♀♀ With light fat in Feb (1), Jun (1), Aug (1), and Oct (1) and with moderate or heavy fat in Jun (3).

IRIS. Brown, dark brown, or black.

BILL. Upper and lower mandibles black; lower mandible browner at base in some. Mouth lining and tongue pinkish flesh or dark flesh color. Palate yellow white.

FEET AND TARSI. Tan; tan, olive, or orange brown; orange; yellow; yellow tan; or flesh color. Toe pads brighter yellow orange, yellow green, yellow tan, tan, or greenish brown.

GONADS. ♂♂ Testes enlarged (6 × 3–10 × 7 mm) Aug through Nov; many birds with large cloacal protuberances. Testes small (1 × 1–3 × 3 mm) Jan through Jun. ♂♂ with juvenal skulls, testes ≤ 2 mm. ♀♀ Most adults with enlarged ova, shelled eggs, enlarged oviducts, and/or active incubation patches in Sep, Oct, Nov; a few with largest ova ≤ 1 mm. Ova not enlarged Feb through Aug. Ovaries of ♀♀ with immature skulls undeveloped.

MOLT. First prebasic molt noted in some Dec, Feb, Mar, and May birds.

STOMACH CONTENTS. Insect remains in 29.

HABITAT. Forest, late second growth.

NOTES. Common in the lowest levels of the forest understory, ≤1.5 m, in shrubs, vine tangles, and *Chusquea* sp.; usually in the stratum below that used by *Basileuterus culicivorus*. Also pokes through the leaf litter when foraging. Males sing year-round, although less frequently in winter. Both sexes make a single whistle-like note. Most often move as pairs or occasionally in small groups. Bird collecting nest material in late Sep. Nest with 1 egg located 2 Oct; accompanying ♀ had

a shelled (20×15 mm) egg and a large unshelled ovum (4×4 mm) in the oviduct, suggesting a clutch size of at least 3. Massive nematode infection in body cavity of 1 Aug ♀. Feet of 1 Oct male with heavy “scaly leg” disease likely caused by an infection of mites. Feathers of a Nov bird heavily infested with parasite eggs.

***Basileuterus culicivorus*: Golden-crowned Warbler**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ 37: Jan (1), Feb (2), Mar (3), May (3), Jun (6), Aug (3), Sep (3), Oct (7), Nov (4), Dec (5). ♀♀ 12: Jan (1), Feb (1), Jun (1), Aug (1), Sep (1), Oct (1), Nov (3), Dec (3). Sex? Mar (2), Oct (2, nestlings). Nest (1, Nov). Birds with juvenal skulls in Nov, Dec, Feb, Mar, and Jun. An Oct bird with small skull windows, presumably hatched the previous year. All other birds with adult skulls.

MASS (G). ♂♂ $\bar{X} = 9.2$ (SD = 0.85, range = 7.0–11.0, $N = 37$). ♀♀ $\bar{X} = 8.5$ (SD = 1.11, range = 7.0–11.5, $N = 12$). Sex? 7.7, 8.8; nestlings 7.5, 8.1. Light to moderate fat in Feb, Jun, Nov, and Dec.

IRIS. Dark brown or brown.

BILL. Upper mandible black, dark brown, or brown. Lower mandible brown, tan, horn color, or flesh color; often lighter at base with dark tip. Mouth lining flesh color, tongue pinkish flesh, and palate yellowish. Juveniles' mouths and fleshy gapes yellow or orange.

FEET AND TARSII. Brown, olive brown, tan, orange, or yellow. Toe pads greenish, brownish, or yellow.

GONADS. ♂♂ Testes of adults enlarged (4.5×3 – 10×8 mm, with cloacal protuberances) Aug through Nov; small (1×0.5 – 2.5×1.5 mm) Nov through Jun. Testes of juveniles ≤ 1 mm. ♀♀ Adults with enlarged ova, collapsed follicles, enlarged oviducts, or at nest in Oct (1), Nov (1). Oct ♀ with shelled egg in cloaca; mass = 1.75 g. Eggshell white, marked with small purplish brown dots and splotches, densest at the large end. Other adults from all months, largest ova ≤ 1 mm. Females with juvenal skulls, ovaries smooth and undeveloped.

MOLT. Prebasic molt of body and flight feathers in Nov, Dec, and Jan. First prebasic molt of body feathers in Nov, Dec. Two Oct nestlings in prejuvenal molt.

PLUMAGE. Juvenal feathers soft and lax; olive green on back; yellowish brown or khaki color on breast and scattered over the abdomen. Lacking orange crown and black coronal stripes. Upper wing coverts edged khaki.

STOMACH CONTENTS. Thirty-four with insect remains, including an ant and 35- and 38-mm-long caterpillars.

HABITAT. Forest, woodland.

NOTES. One of the most common birds at El Tirol. Generally seen in pairs or family groups but also joins mixed-species flocks (with *Trichothraupis melanops*). Birds foliage glean in understory vegetation but also poke in ground cover and leaf litter. One pulled an 8-cm-long earthworm from the litter, carried it to a branch, and after much effort, swallowed it. Birds sing at least from Aug through Mar, although with reduced frequency

toward the end of summer, when they also may form small flocks of 4–7 individuals. When not singing, the birds chup, chip, and chatter continuously. Bird gathering fibers for nest material on 10 Nov. Pair of birds carrying food (caterpillars and large grasshoppers) 21–24 Oct 1980 to a nest finally located on 26 Oct. One adult did a broken wing display along the ground to draw the observer from the nest. Holding its open wings, tail, and head down, it hopped along as if injured until about 10 m from the nest and then flew away. The nest held 4 downy nestlings with short pin feathers. However, the nestlings were able to locomote rapidly on foot and tumbled out of the nest when disturbed. They stayed in the vicinity of the nest peeping continuously. By 29 Oct they could almost fly, lifting ~10 cm off the ground and flying for ~75 cm. The nest was on the ground in a depression ~6 cm deep at the edge of a small man-made drainage channel. The nest was angled at about 15° with the horizontal, the opening directed laterally. It was conical, 6.0–6.8 cm deep, with outer and inner diameters of 9.0 and 4 cm, and made of twigs and coiled plant fibers. The nest was under a pile of leaf litter, itself beneath a loose network of fallen sticks and branches. A large nematode was present in the body cavity of 1 May adult. Red dirt was present on the breast and belly of some birds.

FAMILY ICTERIDAE: BLACKBIRDS

***Cacicus haemorrhous*: Red-rumped Cacique**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Jan (1), Mar (2), Jun (2), Sep (3), Oct (1). Eight with adult skulls; 1 Jun bird with small skull windows.

MASS (G). Adults $\bar{X} = 100.6$ (SD = 8.36, range = 91.0–113, $N = 8$). Light or moderate fat in 2 Jun and 1 Sep birds. Bird with immature skull = 83.5, light fat.

IRIS. Blue, purplish blue, blue gray, or brown.

BILL. Lime green, greenish yellow, yellowish ivory, ivory, yellow basally fading to white, or lime brown fading to gray at tip. Mouth lining bluish or dark flesh color. Palate dark blue gray; tongue pinkish at base fading to gray in center and whitish gray at tip.

FEET AND TARSII. Black. Toe pads brown or yellowish brown.

GONADS. Testes enlarged (9×6 – 12×8 mm) in most birds in Sep, Oct; 1 Sep ♂ testis small (2.5×2.0 mm). Testes small (1.5×1.0 – 3×2 mm) Jan through Jun.

MOLT. Prebasic molt of body and flight feathers in Jan and Mar.

STOMACH CONTENTS. Three with insect remains, including larvae; 3 with fruit pulp and seeds, including *Alchornea glandulosa*. Observed tearing open pods of *Inga marginata* (Fabaceae) to extract the aril-covered seeds; also seen eating *Cupania vernalis* and *Allophylus edulis*.

HABITAT. Forest, forest edge, second-growth scrub. Nests in isolated trees (especially palms) in clearings, pastures, and around buildings.

NOTES. Occurs in noisy groups of 4–10 individuals. Nests in colonies in Sep, Oct. A nest colony active in Oct was completely empty by late Dec. Birds observed pulling large masses of fibers off the rachises of palm fronds in early Oct and flying away with them; presumably the fibers were used to build their long, pendulous nests (see de la Peña 2010). The birds are extremely aggressive toward one another when incubating eggs and feeding young. A group mobbed a *Pyroderus scutatus* and chased it away from a fruit tree.

***Icterus cayanensis*: Epaulet Oriole**

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), May (1), Aug (1), Oct (3), Nov (1). ♀♀ Jan (1), Feb (1), Mar (3), May (1), Jun (1). Feb ♂ and ♀ and 1 Mar ♀ with immature skulls; all others with adult skulls.

MASS (G). ♂♂ $\bar{X} = 31.4$ (SD = 2.11, range = 28.0–34.0, $N = 7$). ♀♀ $\bar{X} = 29.9$ (SD = 1.54, range = 27.0–31.9, $N = 7$). All Feb and Mar birds with light fat.

IRIS. Brown, reddish brown, or chestnut brown.

BILL. Black. Mouth lining black, dark purplish black, or pale greenish flesh color. Palate gray; tongue brownish gray.

FEET AND TARS. Gray, brown gray, blue gray, or deep slate gray. Toe pads light green or gray tan.

GONADS. ♂♂ Testes enlarged (6 × 4–11 × 7.5 mm) and vascular in Oct–Nov; small Jan through Aug (1 × 1–3 × 2 mm), sometimes black. ♀♀ Adult ovaries postbreeding in Jan, Mar; Jan bird with old incubation patch; ovaries granular in May, Jun. ♀♀ Immatures with undeveloped ovaries.

MOLT. Prebasic molt in Mar and May. First prebasic molt recorded in Feb and Mar.

PLUMAGE. Feb ♂ and ♀ in dull brownish juvenal plumage.

STOMACH CONTENTS. Eight with insect remains, including caterpillars and other larvae; 2 with insect and fruit remains; 2 with only fruit.

HABITAT. Forest, forest edge, tung orchard, second-growth scrub, pasture.

NOTES. In pairs. Found in bushes and small trees in pasture and high in the canopy in forest and forest edge. Feeding on fruit of *Trema micrantha* and *Ficus* sp. Birds appear to impale a fig, open the bill to split the fruit, and then take bites of the soft center pulp and larvae. Makes a single-note whistle.

***Gnorimopsar chopi*: Chopi Blackbird**

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Oct (1). ♀♀ Jan (1), Sep (2). All with adult skulls.

MASS (G). ♂♂ 79.0 (Jan), 84.0 (Oct). ♀♀ $\bar{X} = 71.2$ (SD = 2.57, range = 69.0–74.0, $N = 3$). Sep birds with light fat.

IRIS. Black or brown.

BILL. Black.

FEET AND TARS. Black.

GONADS. ♂♂ Testes 12 × 7 (Dec) and 12 × 8 mm (Jan). All ♀♀ with tiny ovaries, largest ova ≤ 1.0 mm.

MOLT. Jan ♀ molting.

STOMACH CONTENTS. Four birds with insect remains; 1 with insect remains and seeds.

HABITAT. Forest edge, tung orchard, second-growth scrub, pasture, cornfields.

NOTES. Frequents tops of dead snags in pasture and scrub. Flocks of 15–50 seen in Feb and Mar. Males still singing in March.

***Agelaioides badius*: Grayish Baywing**

SPECIMENS (MVZ). ♀♀ Jan (2), skulls not pneumatized.

MASS (G). 39.5, 42.0 (slight fat).

IRIS. Black.

BILL. Brown; lower mandible lighter at base.

FEET AND TARS. Brown.

GONADS. Ovaries tiny, not developed.

MOLT. One ♀ in first prebasic molt.

STOMACH CONTENTS. Both with insect and plant remains.

NOTES. Hayes (1995) did not report this species from the Department of Itapúa. These individuals may represent post-breeding season wanderers.

***Molothrus rufoaxillaris*: Screaming Cowbird**

SPECIMENS (MVZ). ♂ Sep (1), adult skull.

MASS (G). 62.0.

BILL. Black.

FEET AND TARS. Blackish brown.

GONADS. Testis 8 × 5 mm.

MOLT. No.

NOTES. Several observed in Oct.

***Molothrus bonariensis*: Shiny Cowbird**

SPECIMENS (USNM, MVZ). ♂♂ Oct (2), adult skulls. ♀♀ Sep (3), Oct (2), Nov (2). One Nov ♀ with juvenal skull; other ♀♀ with adult skulls.

MASS (G). ♂♂ 53.0, 54.0. ♀♀ $\bar{X} = 44.7$ (SD = 2.37, range = 42.0–49.0, $N = 7$); light or moderate fat in 1 Sep and 1 Nov ♀.

IRIS. Brown.

BILL. Black. Juvenal ♀ with yellow at fleshy corners of gape.

FEET AND TARS. Black.

GONADS. ♂♂ Testes 9 × 5, 8 × 5 mm. ♀♀ One Sep adult with largest ova ≤ 1 mm. Other adult ♀♀ with multiple enlarged (2–11 mm diam) yellow or orange ova and enlarged oviducts. Juvenile with minute ova.

MOLT. First prebasic molt in Nov.

STOMACH CONTENTS. Two with only insect remains; 3 with insect and seed remains; 1 with insect and fruit remains.

HABITAT. Second-growth scrub, pasture, fence rows.

NOTES. Feeds on ground. Occupies isolated trees and may perch high up in large trees. Pairs displaying and courting in Oct. Fully grown juvenile begging from a pair of *Vireo olivaceus* “parents” in Nov.

FAMILY FRINGILLIDAE: FINCHES

Spinus magellanicus: Hooded Siskin

SPECIMENS (MVZ). ♂ Jun (1), adult skull.

MASS (G). 13.0.

IRIS. Brown.

BILL. Upper mandible dark gray with black tip. Lower mandible gray.

FEET AND TARS. Black.

GONADS. Testis small (1 × 0.5 mm).

MOLT. Trace body molt.

STOMACH CONTENTS. Throat, crop, and stomach full of tiny (~1 mm) seeds.

HABITAT. In a field.

NOTES. Bird was in a flock of conspecifics.

Euphonia chlorotica: Purple-throated Euphonia

SPECIMENS (USNM, MVZ, MNHNP). ♂♂ Feb (1), Sep (1), Oct (1). ♀♀ Jun (1), Oct (1). All specimens with adult skulls.

MASS (G). ♂♂ \bar{X} = 11.6 (SD = 1.20, range = 10.3–12.7, N = 3); Oct bird with light fat. ♀♀ 11.2, 12.0, both with light fat.

IRIS. Brown.

BILL. Both mandibles black centrally and at tip; blue gray or light gray area on each side at base.

FEET AND TARS. Gray, dark gray, or black. Toe pads light green.

GONADS. ♂♂ Testes enlarged (5 × 3–6 × 4 mm). ♀♀ Ovaries granular, ova minute.

MOLT. Prebasic molt in Feb; trace of body molt (Jun).

STOMACH CONTENTS. Two birds with mistletoe (*Phoradendron piperoides*) berries and seeds.

HABITAT. Forest, forest edge, scrubby field.

NOTES. Birds move in pairs or occasionally in small groups year-round. They are frequent members of mixed-species flocks including *E. violacea*. They use a wide range of heights in the forest vegetation, from 3 to 18 m, in part determined by the location of the plant material they consume. In addition to eating mistletoe berries, they have been observed taking fruits of epiphytic cacti (*Rhipsalis cereuscula*, *R. shaferi*) and *Allophylus edulis*. It appears that they also eat flower petals, although they may merely be robbing nectar. A ♂ carried sticks and displayed for and interacted with a female at ~13 m up under the crown

of a large tree on 21 Jan 1980. Another pair was observed with 3 juveniles on 22 Feb 1980. The male of the latter pair was displaying for the female, moving along a branch in front of her and forcefully dropping his rear end. The males and females of both pairs gave 2-note calls.

Euphonia violacea: Violaceous Euphonia

SPECIMENS (USNM, MVZ). ♂♂ Sep (2), Oct (3). ♀♀ Sep (1), Oct (4). Two Oct (♂, ♀) specimens with skulls about 75% pneumatized. Other birds with adult skulls.

MASS (G). ♂♂ \bar{X} = 14.1 (SD = 0.70, range = 13.5–15.0, N = 4); 1 Sep bird with light fat. ♀♀ \bar{X} = 15.6 (SD = 1.30, range = 14.0–16.75, N = 4).

IRIS. Brown.

BILL. Upper mandible black. Basal half of lower mandible gray or silver gray, distal half black, and tomium black.

FEET AND TARS. Gray.

GONADS. ♂♂ Testes enlarged (8.5 × 6.5–11 × 6 mm), including in ♂ with skull windows. ♀♀ Largest ovum 2 mm diam, oviduct slightly enlarged (Sep). Three Oct ♀♀ with multiple enlarged (4–8 mm diam) orange-yellow, vascularized ova, collapsed follicles, and/or an enlarged oviduct; 2 of these birds with eggs (15, 18 mm long) in the oviduct, shells forming. ♀ With skull windows, ovary granular.

MOLT. Sep ♀ with light body molt.

STOMACH CONTENTS. Three with *Allophylus edulis* (Sapindaceae) fruits and seeds.

HABITAT. Forest.

NOTES. Fed commonly on mistletoe (*Phoradendron piperoides*) berries, which seem to be available over several months. They grab the berries whole, whereas they merely remove bites from *A. edulis* fruits that remain attached to the tree (Foster, 1987). They were also observed feeding on *Eugenia uniflora* and *Rhipsalis shaferi* fruits. The birds are extremely acrobatic while feeding, as well as aggressive, chasing away other species of birds (e.g., *Mionectes rufiventris*) that attempt to feed. They sometime join mixed-species foraging flocks. The birds are generally in pairs. Copulation was observed toward the end of Sep, and a ♂ and ♀ built a nest in a very dense clump of epiphytic orchids on the side of a tree trunk.

Euphonia pectoralis: Chestnut-bellied Euphonia

SPECIMENS (USNM, MVZ). ♂♂ Jan (1), Feb (1), Sep (1), Oct (1). ♀ Sep (1). All specimens with adult skulls.

MASS (G). ♂♂ \bar{X} = 13.8 (SD = 0.80, range = 13.0–14.9, N = 4); Feb and Sep birds with light fat. ♀ 13.8.

IRIS. Brown or dark brown.

BILL. Upper mandible black with gray at base; lower mandible gray or blue gray. Mouth lining yellow orange.

FEET AND TARS. Gray or gray green. Toe pads green.

GONADS. ♂♂ Testes enlarged (8 × 5 mm) Sep through Feb (5 × 3 mm). ♀ Largest ovum 1.5 mm diam.

MOLT. Prebasic molt in Feb. One ♂ undergoing the first prebasic molt at the end of Jan.

STOMACH CONTENTS. One bird with tiny seeds of *Phoradendron piperoides*. Observed feeding on *Allophylus edulis*.

HABITAT. Forest, woodland.

NOTES. Birds occur in pairs. Feed on fruits but also poke around in the bases of leaves, presumably searching for insects.

***Chlorophonia cyanea*: Blue-naped Chlorophonia**

SPECIMENS (USNM, MVZ). ♂♂ Sep (1), Oct (1). ♀♀ Sep (1), Oct (1). All specimens with adult skulls.

MASS (G). ♂♂ 13.5 (Sep), 14.0 (Oct). ♀♀ 14.5 (Sep), moderate fat; 16.0 (Oct), light fat.

IRIS. Brown.

BILL. Upper mandible dark gray, gray at base with black at tip, black, or black with silver gray spot on each side at base. Lower mandible dark gray, gray, or silver gray at base with black tip.

FEET AND TARSI. Gray.

GONADS. ♂♂ Testes 6 × 4 (Sep), 4 × 4 (Oct) mm. ♀♀ Largest ova 0.5 (Sep) and 2.0 (Oct) mm diam. Oct ♀ with enlarged oviduct.

MOLT. No.

STOMACH CONTENTS. Two with fruit pulp and seeds.

HABITAT. Forest, forest with cleared understory.

NOTES. Move as pairs. Eat *Allophylus edulis* fruits and *Phoradendron piperoides*; also nibble around blossoms in large flowering trees, presumably taking nectar. On 30 Oct a ♂ and ♀ gathered moss growing about 1.5 m up on a tree trunk (for nest lining?).

HYPOTHETICALS

The following species are represented only by sight records. These birds flew very high overhead or were observed only briefly. Unlike the species whose sight records are included in the species accounts, we cannot positively confirm their identities and, consequently, list them as hypotheticals. They are not included in any of the species numbers or calculations. Every species, however, is listed by Hayes (1995) as occurring in the area, and all except *Aratinga nenday* and *Amazona aestiva* have been recorded at San Rafael National Park (Esquivel M. et al., 2007; Figure 1).

FAMILY TINAMIDAE: TINAMOUS

***Nothura maculosa*: Spotted Nothura**

Seen repeatedly over several months (NKJ) in grass and weeds along the road, in tung orchard, and in scrubby pasture.

Seems to prefer the shorter grasses, although occasionally seen in tall growth. Whistles on flushing. Also reported by Smith et al. (2005) from the fields surrounding El Tirol.

FAMILY THRESKIORNITHIDAE: IBISES

***Mesembrinibis cayennensis*: Green Ibis**

RMZ observed a flock of 3 flying overhead on 24 Feb 1980; all dark brown with fairly sharply decurved bills.

FAMILY RECURVIROSTRIDAE: AVOCETS AND STILTS

***Himantopus mexicanus*: Black-necked Stilt**

One flying high overhead on 7 Feb 1980 (RMZ). Often treated as a separate species, *H. himantopus* (Rensen et al., 2016).

FAMILY STRIGIDAE: OWLS

***Pulsatrix koeniswaldiana*: Tawny-browed Owl**

On 30 Oct 1976 MSF flushed a medium to large owl, light brown ventrally without obvious markings, from a perch about 4 m up in a forest tree. Smith et al. (2005) reported possibly seeing this owl at El Tirol in the early 2000s and have since confirmed its presence (Smith, pers. comm., 8 Sep 2016). On 1 Jan 1980 NKJ observed a nestling high up in a nest in a forest tree near Villarrica, ~42 km NE of El Tirol. Known from several localities farther to the north in eastern Paraguay (Hayes, 1995).

FAMILY PSITTACIDAE: NEW WORLD AND AFRICAN PARROTS

***Pionopsitta pileata*: Pileated Parrot**

Observed 11 Mar 1980 (RMZ). *Pionus* build and tail, but not *maximiliani*; smaller and browner.

***Amazona aestiva*: Turquoise-fronted Parrot**

Flock flew high overhead on 8 Jan 1978 (MSF). One or 2 individuals flushed from large trees in the forest/forest edge on 21–24 Sep (MSF).

***Forpus xanthopterygius*: Blue-winged Parrotlet**

Large flock flying overhead 1 Sep 1978 (MSF).

***Aratinga nenday*: Nanday Parakeet**

Large green parrot with a dark, charcoal head, flying over scrubby pasture, 1 Sep 1978 (MSF).

***Psittacara leucophthalmus*: White-eyed Parakeet**

Large flock flying over scrubby pasture 25 Oct 1982 (MSF). Several flocks sighted this month.

DISCUSSION

SKULL PNEUMATIZATION

Skull pneumatization in north temperate birds follows a fairly standard pattern (Pyle et al., 1987; Ralph et al., 1993). At hatching, the frontals and parietals are thin and single layered; gradually, a second layer forms underneath, with reinforcing trabeculae between the layers. Skull pneumatization in most of the El Tirol species for which young of the year were collected followed this pattern. Pneumatization took several months and was generally completed prior to the onset of the next breeding season, which marks the beginning of the “second year.” Because pneumatization was completed between March and May, it was possible to age birds in their first year well into the austral summer months or later.

In a number of species, however, the pneumatization process differed from this pattern, extending into the second year. These birds, recognized by the presence of obvious “windows” (areas where the skull is single layered and/or lacks trabeculae) in the posterior frontal and dorsal parietal regions as well as fully developed, active reproductive organs, fall into two groups. In the first group, individuals with completely pneumatized skulls are also present, and only a few breeding individuals with incompletely pneumatized skulls (small to tiny skull windows) were recorded, indicating that the pneumatization process is eventually completed, likely early in year 2. The birds with skull windows may have hatched later in the breeding season than those with completely pneumatized skulls. This group included oscine taxa such as *Tachyphonus coronatus*, *Thraupis sayaca*, and *Pyrhocomia ruficeps*.

In the second group, in contrast, birds with completely pneumatized skulls were rare or absent, and pneumatization rarely exceeded 50% of the skull in any individuals. This suggests that a full 2 years or more are required to complete the pneumatization process, if indeed it is completed at all. This group comprised primarily suboscine taxa that align in particular clades. For example, *Corythopsis delalandi*, *Phylloscartes ventralis*, *P. eximius*, *Mionectes rufiventris*, *Leptopogon amaurocephalus*, *Tolmomyias sulphurescens*, *Myiornis auricularis*, *Hemitriccus diops*, *H. margaritaceiventer*, and *Poecilotriccus plumbeiceps* are all placed in the same family (Rynchocyclidae by Tello et al., 2009 and Ohlson et al., 2013; Pipromorphidae by Cracraft, 2014 and Dickinson and Christidis, 2014), subfamily, or other taxonomic unit (see Remsen et al., 2016: note 1 in the Tyrannidae section) and are separated from the rest of the flycatcher genera. The taxonomic placements of *Piprites*

chloris and *Platyhincus mystaceus* are disputed, although their close relationship to the abovementioned group of species is not (Tello et al., 2009; Ohlson et al., 2013; Dickinson and Christidis, 2014). In these two species also, skull pneumatization is only partial.

A number of species in the Furnariidae (as delineated by Cracraft, 2014 and Dickinson and Christidis, 2014) also exhibited only partial skull pneumatization. These included the four species of *Synallaxis* (i.e., *spixi*, *cinereus*, *ruficapilla*, *frontalis*) and *Cranioleuca obsoleta* in the Synallaxinae as well as *Syndactyla rufosuperciliata* and *Anabacerthia lichtensteini* in the Philydorinae. In the latter two species, however, many breeding birds had pneumatized skulls. On the other hand, skull pneumatization in *Automolus leucophthalmus*, *Philydor rufum*, and *P. atricapillus*, also in the Philydorinae, was complete, as it was in the species of *Xenops* in the Xenopinae. Our collections were insufficient to allow us to draw conclusions about the patterns of skull pneumatization for species in the Furnariinae which require additional study.

The speed and degree of skull pneumatization in other unrelated species, a piculet (*Picumnus temminckii*), an antbird (*Thamnophilus caerulescens*), a flycatcher (*Myiopagis caniceps*), and a manakin (*Chiroxiphia caudata*), in which breeding individuals frequently lack fully pneumatized skulls, also require additional examination. A better understanding of the distribution of incomplete skull pneumatization across all suboscine taxa may help us to explain the evolution and function of the different degrees and patterns of pneumatization.

REPRODUCTION

The percentage of species for which collected specimens show evidence of breeding (e.g., enlarged gonads, active brood patch, nest building or attendance, feeding of fledglings) is plotted for biweekly intervals in Figure 8. This curve is closely tracked by the percentages of specimens collected that represent breeding individuals but eliminates the influence of differences among species in numbers of individuals collected.

Breeding is seasonal, beginning in early to mid-August, continuing through September and October, and gradually declining from late November through May. Some species, such as *Phylloscartes ventralis*, *Leptopogon amaurocephalus*, and *Myiornis auricularis*, appear to be “early” breeders, with large gonads and nests in August, whereas most species begin breeding in September. Other species, such as *Baryphthengus ruficapillus*, appear to have short breeding seasons, whereas those of species such as *Thamnophilus caerulescens* are extended. The breeding periods of some pigeons and doves also appear to be especially long. Active nests of *Patagioenas picazuro*, for example, were located in October, November, and March. A female *Columbina talpacoti* had an 11-mm-diameter ovum on 4 September, indicating incipient laying, and active nests of the species were located in November and February. Although we have no sample from July, some species of pigeons appear to be reproductively active

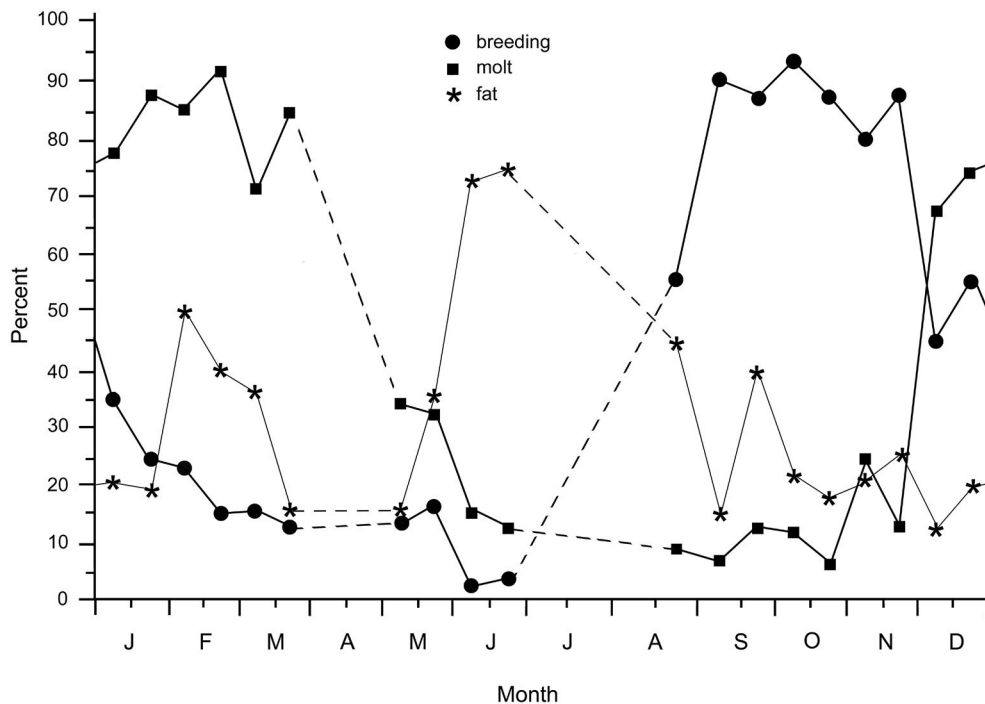


FIGURE 8. Timing of events in the annual cycles of birds at Hotel El Tirol, Department of Itapúa, Paraguay, as indicated by percentages of species for which collected specimens show evidence of breeding (circles), molting (squares), or fat deposition (stars), during each 2-week calendar period. Dashed lines cross periods (April, July, and early August) during which no specimens were collected.

through the austral winter. Females of both *Columba livia* and *Leptotila verreauxi* had enlarged (5 and 6 mm diameters, respectively), yolked ova in June (one of the coldest months), and males of the latter species had greatly enlarged testes (to 13.5 × 7 mm) in the same month. Hayes (2014) reported a comparable breeding season for 63 species of birds from the humid forest around Sapucái (Department of Paraguari; ~200 km NNW of El Tirol; Figure 1) based on 454 clutches of eggs collected by William T. Foster from 1900 to 1908. All the eggs were collected between September and February. The peak of breeding was in October and November, with many fewer species reproducing in September and February.

Ovaries of young of the year are easily distinguished from those of older females in most species. Although generally tiny, ovaries may reach lengths of 4–7 mm before the birds' skulls are completely pneumatized. However, the surface of the ovary is smooth and white, and incipient ova are not distinguishable. Consequently, females with only partially pneumatized skulls but with well-developed ova are assumed to be at least in their second year. Testes of males of the year are tiny, generally only 1–2 mm long. The fibrous capsule surrounding the immature

testes is sometimes black or dark green (which it also may be in adult males with regressed testes).

PLUMAGE

Males of a number of species replace the juvenal plumage with an immature or subadult plumage easily distinguishable from the definitive or adult form, which they acquire with the second or third prebasic molt, depending on the species. The immature plumage may resemble that of the female, or it may be intermediate between those of the adult male and female. In several species, including *Pipra fasciicauda*, *Chiroxiphia caudata*, *Cyanoloxia brissonii*, *Habia rubica*, *Sicalis flaveola*, *Trichothraupis melanops*, *Tachyphonus coronatus*, *Tersina viridis*, and *Pyrrhocomma ruficeps*, the testes of males in the immature plumage were enlarged to breeding size. Some of those males also had large cloacal protuberances and/or brood patches. We do not know, of course, whether they were successful at obtaining mates. The presence of a subadult plumage was not necessarily linked to the degree of skull pneumatization. Immature-plumaged male *Pipra fasciicauda*, *Cyanoloxia brissonii*, *Habia rubica*, and

Tersina viridis had pneumatized skulls, whereas the immature-plumaged male *Pyrrhocomma ruficeps*, *Sicalis flaveola*, and *Tachyphonus coronatus* did not. Males with and without pneumatized skulls were found among immature-plumaged *Chiroxiphia caudata* and *Trichothraupis melanops*. These observations suggest that the definitive states of these traits are acquired independently and that the timing of acquisition of each is responding to different selective forces.

MOLT

The percentages of species collected that were molting are plotted in Figure 8 for biweekly intervals. Because it was not always possible to distinguish between the first and subsequent prebasic molts, data for the two were combined. The percentages of species with molting individuals rose sharply in early December to high levels that continued through March and probably into April. By May, the numbers of species with molting individuals had decreased by nearly two-thirds, dropping even lower in June with the tail end of most prebasic molts.

Molt and breeding overlapped in some individuals of 16 species. In eight species only body molt was involved (e.g., *Picumnus temminckii*, *Capsiempis flaveola*, *Thraupis sayaca*, *Sporophila caerulea*) and ranged from limited (e.g., *Coryphospingus cucullatus*, *Guiraca guiraca*) to extensive (e.g., *Coccyzus melacoryphus*, *Piprites chloris*) replacement. In other species (e.g., *Leptotila verreauxi*, *Crotophaga ani*, *Myiopagis caniceps*, *Tachyphonus coronatus*, *Pyriglena leucoptera*), wing and sometimes tail feathers were also being replaced. The overlap in some of these individuals likely represents the onset of prebasic molt before the completion of a late reneesting attempt following the loss of a brood. In other species (e.g., *Chiroxiphia caudata*, *Schiffornis virescens*, *Pyrrhocomma ruficeps*), however, overlap occurred at the beginning of the breeding season, long after prebasic molts would be expected to have been completed. Such molts may be prealternate molts, although it is somewhat surprising that they occur only in some individuals and involve anywhere from limited numbers of body feathers to all body and flight feathers.

DIET

The birds at El Tirol were predominantly insectivores, with an average of 78% (range = 62%–95%) of the species in any 2-week period eating insects (including noninsect arthropods). Ants were recorded in the diets of nine of those species (13 individuals), including four woodpeckers (*Colaptes campestris*, *C. melanochloros*, *Dryocopus lineatus*, *Picumnus temminckii*) and an ovenbird (*Furnarius rufus*). Frugivory was much less common, with an average of only 28% (range = 14%–40%) of the species in any 2-week period eating fruit. Multiple species of birds congregated to feed in medium to large trees such as *Allophylus edulis*, *Ocotea puberula*, *Trichilia catigua*, and *Ficus* spp. that were heavily laden with fruit. Birds also removed fruits from many

smaller trees, shrubs, and vines (e.g., *Cecropia pachystachya*; *Sorocea bonplandii*, Moraceae), most of which we did not identify. The percentage of species eating insects is high from October through December, whereas the percentage eating fruits is lower. This likely reflects an increase in insect availability in response to the warmer temperatures, increased rainfall, and associated leaf flush. It also coincides with the period when adults are feeding nestlings, which may require more protein for growth than is generally contained in fruit.

A quarter of the species ($N = 49\%$, 26.1%), including 13 species of Tyrannidae, 8 of Thraupidae, 4 of Turdidae, and 3 each of the Cuculidae, Picidae, Tityridae, and Icteridae, ate both fruit and insects. Some of these taxa are primarily insectivorous but occasionally take fruits (e.g., *Lathrotriccus euleri*: 54 of 56 stomach samples [N] contained insect [I] remains and 4 contained fruit [F]; *Leptopogon amaurocephalus*: $N = 21$, $I = 19$, $F = 2$); others are primarily frugivorous but occasionally take insects or other arthropods (e.g., *Chiroxiphia caudata*: $N = 30$, $I = 1$, $F = 30$; *Dacnis cayana*: $N = 17$, $I = 2$, $F = 16$), and some appear to be truly omnivorous (e.g., *Myiopagis viridicata*: $N = 19$, $I = 10$, $F = 10$; *Myiodynastes maculatus*: $N = 11$, $I = 6$, $F = 7$).

Relatively few of the birds collected were eating seeds ($\bar{X} = 5.3\%$ of the species in any 2-week period, range 0%–14%). This result reflects the focus of our work on forest birds rather than on those in pastures, grasslands, and other open habitats. *Columbina talpacoti*, *C. picui*, and a few other species ate only seeds, but other species consumed a mixed diet. Some were primarily granivorous, only occasionally taking an insect (e.g., *Sporophila caerulea*: $N = 7$, S [seeds] = 6, $I = 1$); others appeared to be primarily insectivorous but occasionally taking seeds (e.g., *Conirostrum speciosum*: $N = 5$, $S = 1$, $I = 4$), and some appeared to be truly omnivorous (e.g., *Coryphospingus cucullatus*: $N = 22$, $S = 10$, $I = 13$; *Zonotrichia capensis*: $N = 22$, $S = 10$, $I = 15$).

Stomachs of three species of owls (*Aegolius harrisii*, *Athene cunicularia*, *Glaucidium brasilianum*) and two raptors (*Milvago chimachima*, *Micrastur ruficollis*) contained mammal remains. The latter four species also contained insect remains. No other vertebrate remains were found in any stomachs, but we did observe a *Baryphthengus ruficapillus* eating a snake and a *Coccyzus americanus* eating a lizard, and we captured a *Glaucidium brasilianum* attempting to remove a bird from a mist net.

A parrot (*Pionus maxamilliani*), three pigeon species (*Columba livia*, *Leptotila verreauxi*, *Patagioenas picazuro*), two woodpeckers (*Melanerpes candidus*, *Colaptes campestris*), and a grosbeak (*Cyanoloxia glaucocaeerulea*) had eaten corn and are considered pests by the local farmers. The stomachs of six species contained grit, which is not surprising for species such as *L. verreauxi* (3 individuals), *Haplospiza unicolor* (5), *Sporophila caerulea* (1), and *Chamaeza campanisona* (1), which are at least partially granivorous. However, *Nyctibius griseus* (1) and *Thamnophilus caerulea* (1) also contained grit but are not known to eat grain, and the stomach of one *Micrastur ruficollis* contained a stone.

One breeding female each of *Schiffornis virescens* (October) and *Trichothraupis melanops* (November) and a juvenile (sex undetermined) of *Sporophila caerulescens* (March) had remains of eggshells in their stomachs; breeding female *Pyriglena leucoptera* (September) and *Piaya cayana* (September), a breeding male *T. melanops* (November), and a juvenile female *Thamnophilus caerulescens* (March) had remains of snail shells in their stomachs, and a postbreeding female *Mackenziaena leachii* (March) had eaten a millipede (Diplopoda). Eggshells, snail shells, and millipedes are high in calcium and may be important sources of this mineral for shell formation in laying females or bone pneumatization in growing young (Foster, 2014).

FAT DEPOSITION

About 24% ($N = 444$) of the specimens distributed among 72% ($N = 134$) of the species had noticeable body fat. The percentages of species with fat are shown for biweekly intervals in Figure 8. Individuals with fat were not evenly distributed throughout the year; numbers peaked in June when 56% and 61% of all specimens taken in the two 2-week periods carried fat and 73% and 75% of the species collected in those same periods included individuals with fat. Lesser peaks were present from February to mid-March (ranges = 27%–39% of individuals and 36%–49% of species) and in the latter halves of August (35% and 44%) and September (26% and 40%). The fat was designated as light in 44% ($N = 194$) of the individuals, moderate in 50% ($N = 220$), and heavy in just 7% ($N = 30$). About a third of the birds with moderate fat (30%) and more than a third (37%) with heavy fat were taken in June.

Despite the broad representation of birds with fat among species, some species seemed more inclined to deposit fat than others. Considering only species for which we had 10 or more specimens ($N = 59$ species), more than 25% of individuals of 25 species were designated with fat, and of those, in seven species 50% or more of individuals were so designated: *Elaenia flavogaster* (70%, $N = 10$), *Elaenia parvirostris* (67%, $N = 12$), *Empidonamus varius* (64%, $N = 14$), *Guirra guirra* (60%, $N = 10$), *Colaptes campestris* (55%, $N = 11$), *Thraupis sayaca* (50%, $N = 16$), and *Leptotila verreauxi* (50%, $N = 12$). Only *Elaenia parvirostris* and *Empidonamus varius* are migrants, but all of the species except *Guirra guirra* ate large quantities of fruit. Conversely, individuals in four species with samples of 10 or more showed no evidence of fat at any time of the year: *Automolus leucophthalmus* ($N = 26$), *Syndactyla rufosuperciliata* ($N = 26$), *Synallaxis ruficapilla* ($N = 12$), and *Euphonia violacea* ($N = 10$). Samples of the former three species included eight, eight, and four specimens, respectively, taken during the peak periods of fat occurrence in the avifauna. In this group, only *E. violacea* is a frugivore. The others ate only insects.

Peaks of fat deposition among migrants (252 specimens among 25 species) were in February to mid-March, when 77% of migrant species present included individuals with fat, and mid-September to mid-October, when the percentage was

73. Presumably, these birds were depositing fat in anticipation of migration or had retained fat after arriving on their breeding grounds. Nevertheless, they do not account for the fall and spring peaks of fat deposition in the avifauna because so few migrant species were present in the samples at those times. For example, from February to mid-March, representatives of 60 species were recorded with fat. However, only 10 of those species were migrants. Likewise, in mid-September to mid-October, only 11 of 44 species recorded with fat were migrants.

MIGRATION AND LOCAL MOVEMENTS

Twenty-seven of the species that we recorded, including two that we did not collect (*Calidris subruficollis* and *Elanoides forficatus*), are migrants (Appendix A). The bulk of these species (19), designated northern austral migrants (BN) by Hayes (1995), breed in Paraguay, after which all or part of the population migrates north for the winter (Ridgely and Tudor, 1989, 1994, 2009; Hayes, 1995). Other populations of these same species that breed to the south of El Tirol also migrate north for the winter. Consequently, birds wintering at El Tirol may have bred there, or they may have bred in areas to the south. In contrast, *Patagioenas picazuro*, *Serpophaga munda*, and *S. subcristata* are southern austral migrants (BS), including some birds that breed and winter in Paraguay and others that winter in Paraguay but migrate farther south to breed (Hayes, 1995). Both *P. picazuro* specimens (October, January) had enlarged testes, and active nests of the species were located in October, November, and March. The *Serpophaga* species were taken in winter, and neither individual was in breeding condition. Two other species, *Cyanoloxia glaucocaeerulea* and *Elaenia albiceps*, reside in Paraguay only in winter (WR), migrating south to breed (Hayes, 1995). We collected three mid-October males of *C. glaucocaeerulea* with enlarging testes. None of the *E. albiceps* was in breeding condition. The remaining three migrant species, *Calidris subruficollis*, *Coccyzus americanus*, and *Petrochelidon pyrrhonota*, are long-distance Nearctic migrants (NM) that breed in North America and on Caribbean Islands and winter in South America.

The nature of the seasonal movements of five other species remains in question. Canevari et al. (1991), Sick (1993), and Hayes (1995) reported that *Tersina viridis* was a partial or irregular northern migrant, appearing in widely varying numbers in some years and being totally absent in others. The designation of this species by Ridgely and Tudor (1989) as nomadic may be more accurate. We recorded it only in the breeding season and in only 3 of 8 years. The migratory status of *Stephanophorus diadematus* is equally enigmatic. The species may be a southern migrant (Hayes, 1995), although its irregular occurrences in Paraguay have also been interpreted as population irruptions (Clay, pers. comm., 18 January 2016).

Hylocharis chrysura and *Thalurania furcata* are not known to be migratory, but we recorded them at El Tirol for only limited periods. Specimens of *H. chrysura* were taken during the breeding season (September, October, December), and birds were

observed feeding in flowers of *Malvaviscus* sp., planted as an ornamental around the hotel, only during that same time period, although we routinely observed other hummingbird species feeding in those shrubs at other times of year. The timing of these observations suggests that the species may be migratory or that it may wander during the nonbreeding season, exploiting other local food resources. We collected *T. furcata* and observed it feeding in *Malvaviscus* sp. flowers only in June, suggesting that it also may migrate or at least wander during the nonbreeding season. Individuals of *Stephanoxis lalandi* were present at El Tirol year-round, although Sick (1993) has reported that some populations in Brazil may undergo elevational migrations, seeking lower elevations in winter.

ANNUAL CYCLE

The annual cycle of the avifauna in the austral subtropical humid forest at El Tirol follows a pattern closely resembling that found among birds at north temperate and subtropical latitudes (Figure 8). Breeding is seasonal (cf. Hayes, 2014), with gonads developing and the first signs of reproduction appearing in early spring (latter half of August); testes generally remain enlarged through midsummer, when they begin to regress in some species. Testis size continues to decrease through the austral fall. A few species maintain enlarged and seemingly active gonads (*Columba livia*, *Leptotila verreauxi*) into the winter months.

Birds entering their reproductive phase are likely responding to changes in photoperiod and lengthening days. At El Tirol, the shortest (21 June) and longest (21 December) days of the year differ by 3 h and 27 min (U.S. Naval Observatory, 2015). Breeding also coincides with the rainiest part of the year. Although rain falls consistently in every month, it increases to a high in October, followed by slight decreases in November and December. However, rainfall in every month is highly variable between years (Figure 6), which could advance or delay the onset of breeding in any given year. Breeding also coincides with the warmest months of the year, from October through March (Figure 7).

As breeding wanes, the numbers of individuals and species in molt increase, so that breeding and molt are inversely timed. This temporal separation reinforces the general observation that these two resource-demanding activities are incompatible (but see Foster, 1975a). Individuals in a few species seem to deviate from this pattern with molt and breeding overlapping, as has been reported for some tropical areas (Foster, 1974, 1975b). In *Pyriglena leucoptera* and *Sporophila caerulea*, for example, the prebasic molt begins before breeding is completed, whereas in *Piprites chloris* and *Capsiempis flaveola* an apparent prealternate molt overlaps the beginning of the breeding season.

Deposition of body fat seems to be of regular occurrence in the El Tirol species. Southern Hemisphere migrants store energy for migration, as do their Northern Hemisphere counterparts. Fat present in migrants in February–March likely represents fat deposited in anticipation of fall migration. In September–October it is likely present in migrants in transit to breeding sites

farther south or as a residuum of fat in those that have already arrived on their breeding grounds. Perhaps of greater interest is the regular presence of body fat in nonmigratory species in the late fall and especially during winter that disappears as breeding activity increases in the spring. It is generally assumed that breeding and molt are confined to periods of food abundance, suggesting that food availability during winter is insufficient to support those resource-demanding activities, particularly if the cost of thermoregulation increases at that time. Even so, available food may exceed requirements for maintenance during winter. For any organism experiencing such circumstances, deposition of fat reserves in anticipation of prospective breeding activities would be advantageous. Our data suggest that fat deposition may be associated with a frugivorous diet (see “Fat Deposition” section above), an observation that merits additional study.

OTHER RECORDS FROM HOTEL EL TIROL

In 2005, Smith et al. published an avifaunal inventory of Hotel El Tirol. According to Smith (pers. comm., 2 September 2016), the inventory was intended to provide a basis for future studies, combining the results from the inventory team, reports from any ornithologists and birdwatchers who had visited the site over the years, and an earlier species list maintained by Guyra Paraguay, a conservation group; it was not meant to be a scientific document but rather a working list subject to modification. In the publication, the earlier species list was erroneously attributed to MSF. Although the list may include some of MSF's records, she was not involved in its compilation, and the source(s) of its contents remains unknown.

With additions and corrections from 2006 to 2009 (added directly to the online publication by Smith or in Smith, pers. comm., 8 September 2016), the Smith et al. (2005) amended list now includes 236 species, although the occurrence of *Lepidocolaptes falcinellus* still requires confirmation (Smith et al., 2005). We recorded 194 (82%) of their 236 species (195 if we include *Nothura maculosa*, a species on our hypothetical list whose presence at Tirol they confirmed). Of the 42 species that we did not record (Appendix B), 33 were recorded by Smith and his colleagues (Smith et al., 2005, and updates), and 9 species are attributable only to the earlier Guyra Paraguay list. That we both had probable sightings of *P. koeniswaldiana* strengthens the likelihood that it also is present at El Tirol.

Conversely, we recorded 11 species not included in the Smith et al. updated list. Ten of these species are represented by only one or two specimens or sight records and are likely rare at the site. However, the absence of the 11th species, *Sittasomus griseicapillus*, from their list is surprising. Between 1976 and 1983, we collected 20 specimens of the species, which was common in the El Tirol forest, and sighted it numerous additional times. We did not record it in 2004, although Smith recorded it once in August 2004 and noted (pers. comm., 8 September 2016) that it is still present at the site but rare, a change in abundance for which we have no explanation.

Combining our list and the updated list of Smith et al. (2005, plus additions; Smith, pers. comm., 8 September 2016), 247 species, including 45 Atlantic Forest endemics, have been recorded from the El Tirol forest and adjacent orchards, fields, and second-growth scrub. Confirmation of the presence of *Pulsatrix koeniswaldiana* would bring the totals to 248 and 46, respectively. This number is impressive, especially given the limited size of the forest patch and its lack of formal protection. However, an avifaunal list is always in flux, and we anticipate that additional species will be recorded and, unfortunately, that rare or uncommon species may be lost as the level of disturbance increases.

COMPARISONS WITH AVIFAUNAS AT OTHER SITES

The Atlantic Forest ecosystem originally spanned 28° of latitude in Brazil from Rio Grande do Norte to Rio Grande do Sul, extending westward from the Atlantic coast to the cordilleras separating the Paraná and Paraguay river basins in eastern Paraguay (Ribeiro et al., 2009). Eighty-five percent or more of this biome has been cleared for cattle ranches and sugar cane, oil palm, and soybean plantations, and destruction and degradation continue (Galindo-Leal and de Gusmão Câmara, 2003; Silveira et al., 2003). The largest remnant of this habitat in Paraguay is located in San Rafael National Park in the departments of Itapúa and Caazapá, some 83 km north (heading ~4.21°) of El Tirol (Figure 1). The park is located in the “Cordillera San Rafael” (elevation up to 500 m above sea level) and covers an area of approximately 748 km² distributed among seven types of habitat. Lowen (Lowen et al., 1996), Madroño (Madroño N. et al., 1997), and their collaborators surveyed birds in the park in the mid-1990s. Together, they recorded a total of 295 species (Madroño N. et al., 1997; they reported a total of 294 species but included 295 on their list). Additional bird surveys carried out between 1996 and 2006 brought the species total to 406 (Esquivel M. et al., 2007).

Combining our data and the updated information from Smith et al. (2005; Smith, pers. comm., 8 September 2016), we recorded 230 (~57%) of those species at El Tirol, plus another 17 species that they did not record in San Rafael. Ninety-nine of the species we did not record occupy aquatic, marshland, or grassland habitats that are not associated with El Tirol and that we did not sample, which brings our total to about 75% of the rest of the San Rafael avifauna. The remaining 77 species, representing 30 families, were regularly observed in or above forest habitats at San Rafael. Nearly a third (23 = 30%) of those species belong to groups that generally fly or soar high overhead (Cathartidae, 2 sp.; Accipitridae, 8; Psittacidae, 6) or are active at night (Tytonidae, 1 sp.; Strigidae, 4; Nyctibiidae, 1; Caprimulgidae, 1). We spent little time trying to identify such birds at Tirol, and it is likely that many were actually present. The three cracid and two tinamou species (5 = 6%) missing from El Tirol may have succumbed to hunting pressure. Of the remaining 49 species, 25 (32%) belong to four families that are among the most diverse in

the park: Tyrannidae (11 sp. = 18% of tyrannid species recorded at San Rafael), Picidae (5 sp. = 42% of picids), Thraupidae (5 sp. = 30% of thraupids), and Furnariidae (4 sp. = 15% of furnariids). The remaining 24 species are scattered among 17 families. Again, it is likely that some of these species, several of which are rare in Itapúa or Paraguay as a whole (Guyra Paraguay, 2004, 2005), were simply overlooked.

On the other hand, El Tirol is located at the southwestern limit of the Atlantic Forest habitat, and species absences may reflect faunal attenuation as species reach the limits of their ecological ranges. It may also be that the lower species numbers simply reflect the lower diversity supported by a forest fragment, even one connected to other fragments along riparian or other corridors (cf. dos Anjos, 2001). Most of the fragments where we worked comprised fewer than 100 ha, and the majority of those probably ranged from 40 to 50 ha. Nevertheless, both *Penelope supercilialis* and *Crypturellus tataupa* were seen regularly, as were at least two species of grassland tinamous, which are usually vulnerable to overhunting. Forest hawks were present, but we did not record the largest raptors and eagles. Large frugivores, such as *Pyroderus scutatus*, *Pteroglossus castanotis*, *Ramphastos toco*, and *Ramphastos dicolorus*, apparently can persist in fragments, although the latter two species were rare. We also recorded two of the large woodpeckers (*Dryocopus lineatus*, *Campephilus robustus*). *Dendrocincla turdina* was observed regularly, as was *Lepidocolaptes fuscus*, another forest specialist. Eighty of the ~200 species of Atlantic Forest endemics (Stotz et al., 1996) are known from Paraguay (Fragano and Clay, 2003; Esquivel M., 2006). Forty-five of them were recorded at El Tirol plus an additional two if we include hypotheticals. We also recorded four species (*Phylloscartes eximius*, *Poliophtila lactea*, *Neothraupis fasciata*, *Amaurospiza moesta*) designated by the IUCN (2015) as Near Threatened.

The 17 species recorded at El Tirol that were not included on the San Rafael list are as follows (names followed by a dagger [†] are from Smith et al., 2005, and Smith, pers. comm., 8 September 2016; others are from this study): *Calidris subruficollis*, *Coccyzus americanus*, *Aegolius harrisi*, *Heliomaster furcifer*†, *Thaluranina furcata*, *Batara cinerea*, *Thamnophilus ruficapillus*, *Phacellodromus rufifrons*†, *Schoeniophylax phryganophilus*†, *Elaenia obscura*†, *Serpophaga munda*, *Xolmis irupero*†, *Paroaria capitata*†, *Neothraupis fasciata*, *Coereba flaveola*, *Piranga flava*†, and *Agelaioides badius*. Most of these species are rare, uncommon, or previously unrecorded in the Alto Paraná region (Hayes, 1995; Guyra Paraguay, 2004). Although the birds recorded may simply have been wandering individuals, the species are likely to appear again in the Alto Paraná Region.

CONCLUSIONS

The highly diverse Atlantic Forest biome has been reported to house between 21,300 and 21,700 species of trees, shrubs, and terrestrial vertebrates (Mittermeier et al., 1999; Ministério

do Meio-Ambiente, 2000; de Gusmão Câmara, 2003) and some 6% to 7% of all currently recognized bird species (Goerck, 1997; BirdLife International, 2015), about 20% of which are endemics (Tabarelli et al., 2003). It originally covered some 1.0 to 1.5 million km² of Brazil, Argentina, and Paraguay, but only about 7.5% to 15% of that area remains (Myers et al., 2000; Galindo-Leal and de Gusmão Câmara, 2003; Ribeiro et al., 2009). Ribeiro et al. (2009) reported that the Atlantic Forest remaining in Brazil is distributed among 245,173 forest fragments, 83.4% and 97% of which are smaller than 50 and 250 ha, respectively. Although similar habitat surveys and calculations have not been done for Paraguay, the situation is likely similar. Currently, only two large fragments of Atlantic Forest in Paraguay enjoy some level of protection (Figure 1), the San Rafael National Park, of which about 80% is forest (Esquivel M. et al., 2007), and the Mbaracayú Forest Nature Reserve, covering ~644 km², of which about 87% is terra firme forest (Keel et al., 1993).

Several authors have suggested that the Atlantic Forest avifauna is resistant to the effects of forest fragmentation (Benke and Kindel, 1999; Protomastro, 2001). Brooks et al. (1999) disputed this, suggesting rather that this is a false impression resulting from the lag time between fragmentation and extinction. Additional time will be required to evaluate these alternative views. Regardless of the outcome, it is clear that forest fragments will be important in the maintenance of the Atlantic Forest avifauna, if not as breeding refuges for given species (e.g., Aguilar et al., 1999), then as parts of a network of corridors linking larger areas (e.g., Dornelas de Andrade and Marini, 2001). It is important that we obtain as much information as possible about the biology of species in these fragments as a basis for future management and that owners of these small patches be apprised of their importance and encouraged to protect and maintain them.

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Appendix A

This appendix includes the species of birds recorded at El Tirol, Department of Itapúa, Paraguay, and the numbers of months (in parentheses) in which each species was collected. Species known only from sight records are indicated by an asterisk. AFE indicates Atlantic Forest endemic (after Brooks et al., 1999). Note that for *Turdus nigriceps*, only the subspecies *T. n. sublaris*, which is considered by some to be a separate species (Ridgely and Tudor, 2009), is an Atlantic Forest endemic. Designations of breeding or migrant status (modified from Hayes, 1995) are as follows: BR = breeding permanent resident; BN = breeding resident, less abundant or absent during winter when birds migrate north; BS = breeding resident but some birds migrate farther south to breed; WR = winter resident that migrates south of Paraguay to breed; NM = Nearctic migrant that breeds in North America and/or the Caribbean but winters in South America.

TINAMIDAE

Crypturellus tataupa (3) BR

CRACIDAE

Penelope superciliaris (1) BR

ODONTOPHORIDAE

Odontophorus capueira (1) AFE, BR

ARDEIDAE

Syrigma sibilatrix (1) BR

CATHARTIDAE

*Cathartes aura** BR

Coragyps atratus (1) BR

ACCIPITRIDAE

*Elanus leucurus** BR

*Elanoides forficatus** BN

Harpagus diodon (1) BN

Ictinia plumbea (1) BN

Rupornis magnirostris (2) BR

*Buteo brachyurus** BR

RALLIDAE

Aramides saracura (2) AFE, BR

CHARADRIIDAE

Vanellus chilensis (1) BR

SCOLOPACIDAE

*Calidris subruficollis** NM

COLUMBIDAE

Columba livia (1) BR
Patagioenas picazuro (2) BS
Geotrygon violacea (1) BR
Leptotila verreauxi (6) BR
Leptotila rufaxilla (1) BR
Columbina talpacoti (4) BR
Columbina squammata (1) BR
Columbina picui (4) BR

CUCULIDAE

Guira guira (5) BR
Crotophaga ani (8) BR
Tapera naevia (1) BR
*Dromococcyx phasianellus** BR
Piaya cayana (6) BR
Coccyzus melacoryphus (3) BN
Coccyzus americanus (2) NM

STRIGIDAE

Megascops choliba (3) BR
Glaucidium brasilianum (2) BR
Athene cunicularia (1) BR
Aegolius harrisii (1) BR

NYCTIBIIDAE

Nyctibius griseus (1) BR

CAPRIMULGIDAE

Nyctidromus albicollis (2) BR
Setopagis parvula (4) BR
Hydropsalis torquata (1) BR
Antristomus rufus (1) BR

APODIDAE

Chaetura cinereiventris (1) BR

TROCHILIDAE

Phaethornis eurynome (6) AFE, BR
Stephanoxis lalandi (8) AFE, BR
Thalurania furcata (1) BR
Amazilia versicolor (3) BR
Hylocharis chrysura (3) BR

TROGONIDAE

Trogon surrucura (4) AFE, BR
Trogon rufus (2) BR

ALCEDINIDAE

*Megaceryle torquata** BR

MOMOTIDAE

Baryphthengus ruficapillus (5) AFE, BR

BUCCONIDAE

Nystalus chacuru (1) BR
Nonnula rubecula (4) BR

RAMPHASTIDAE

*Ramphastos toco** BR
*Ramphastos dicolorus** AFE, BR
Pteroglossus castanotis (6) BR

PICIDAE

Picumnus temminckii (9) AFE, BR
Melanerpes candidus (4) BR
Veniliornis spilogaster (7) AFE, BR
Colaptes melanochloros (2) BR
Colaptes campestris (4) BR
Dryocopus lineatus (2) BR
Campephilus robustus (2) AFE, BR

FALCONIDAE

Micrastur ruficollis (3) BR
*Caracara plancus** BR
Milvago chimachima (1) BR
*Milvago chimango** BR
Falco sparverius (4) BR
*Falco femoralis** BR

PSITTACIDAE

Myiopsitta monachus (1) BR
Pionus maximiliani (1) BR
Pyrrhura frontalis (1) AFE, BR

THAMNOPHILIDAE

Hypoedaleus guttatus (1) AFE, BR
*Batara cinerea** BR
Mackenziaena leachii (4) AFE, BR
Mackenziaena severa (4) AFE, BR
Thamnophilus ruficapillus (1) BR
Thamnophilus caerulescens (10) BR
Dysithamnus mentalis (10) BR
Herpsilochmus rufimarginatus (2) BR
Drymophila malura (4) AFE, BR
Pyriglena leucoptera (8) AFE, BR

CONOPOPHAGIDAE

Conopophaga lineata (10) AFE, BR

FORMICARIIDAE

Chamaeza campanisona (2) BR

FURNARIIDAE

Sclerurus scansor (2) AFE, BR
Sittasomus griseicapillus (9) BR
Dendrocincla turdina (2) AFE, BR
Dendrocolaptes platyrostris (5) BR
Xiphorhynchus fuscus (6) AFE, BR
Campylorhamphus falcularius (2) AFE, BR
Lepidocolaptes angustirostris (1) BR
Xenops minutus (4) BR
Xenops rutilans (1) BR
Furnarius rufus (4) BR
Lochmias nematura (1) BR
Philydor atricapillus (1) AFE, BR
Philydor rufum (4) BR
Anabacerthia lichtensteini (9) AFE, BR
Syndactyla rufosuperciliata (9) BR
Automolus leucophthalmus (8) AFE, BR
Cranioleuca obsoleta (1) AFE, BR
Synallaxis cinerascens (10) BR
Synallaxis ruficapilla (6) AFE, BR
Synallaxis spixi (4) BR
Synallaxis frontalis (1) BR

TYRANNIDAE

Phyllomyias burmeisteri (2) BR
Myiopagis caniceps (3) BR
Myiopagis viridicata (6) BN
Elaenia flavogaster (5) BR
Elaenia spectabilis (3) BN
Elaenia albiceps (2) WR
Elaenia parvirostris (4) BN
*Suiriri suiriri** BR
Serpophaga subcristata (1) BS
Serpophaga munda (1) BS
Capsiempis flaveola (6) BR
Corythopsis delalandi (4) BR
Euscarthmus meloryphus (1) BR
Phylloscartes eximius (5) AFE, BR
Phylloscartes ventralis (5) BR
Mionectes rufiventris (5) AFE, BR
Leptopogon amaurocephalus (10) BR
Myiornis auricularis (9) AFE, BR
Hemitriccus diops (3) AFE, BR
Hemitriccus margaritaceiventer (1) BR
Poecilotriccus plumbeiceps (4) BR
Tolmomyias sulphureus (5) BR
Platyrinchus mystaceus (7) BR
Lathrotriccus euleri (8) BN
Cnemotriccus fuscatus (4) BN
Contopus cinereus (1) BR
Colonia colonus (1) BR
Machetornis rixosa (2) BR
Legatus leucophaeus (1) BN
Myiozetetes similis (1) BR

Pitangus sulphuratus (7) BR
Myiodynastes maculatus (5) BN
Megarynchus pitangua (6) BR
Empidonomus varius (5) BN
Tyrannus melancholicus (5) BN
Tyrannus savana (5) BN
Sirystes sibilator (2) BR
Myiarchus swainsoni (5) BN

COTINGIDAE

Pyroderus scutatus (2) AFE, BR

PIPRIDAE

Chiroxiphia caudata (10) AFE, BR
Pipra fasciicauda (2) BR

TITYRIDAE

Tityra inquisitor (2) BR
Tityra cayana (3) BR
Schiffornis virescens (5) AFE, BR
Pachyramphus polychopterus (4) BN
Piprites chloris (2) BR

VIREONIDAE

Cyclarhis gujanensis (6) BR
Hylophilus poicilotis (6) AFE, BR
Vireo olivaceus (6) BN

CORVIDAE

Cyanocorax chrysops (4) BR

HIRUNDINIDAE

Progne chalybea (1) BN
Petrochelidon pyrrhonota (1) NM

TROGLODYTIDAE

Troglodytes aedon (9) BR

POLIOPTILIDAE

Polioptila lactea (1) AFE, BR

TURDIDAE

Turdus leucomelas (7) BR
Turdus rufiventris (9) BR
Turdus amaurochalinus (4) BR
Turdus nigricaps (1) AFE, BR
Turdus albicollis (5) BR

MIMIDAE

Mimus saturninus (3) BR

THRAUPIDAE

*Cissopis leverianus** BR
*Neothraupis fasciata** BR

Nemosia pileata (2) BR
Pyrrhocomma ruficeps (9) AFE, BR
Trichothraupis melanops (10) BR
Tachyphonus coronatus (10) AFE, BR
*Stephanophorus diadematus** BR
Pipraeidea melanonota (3) BR
Thraupis sayaca (7) BR
Tangara seledon (4) AFE, BR
Tersina viridis (3) BN
Dacnis cayana (8) BR
Hemithraupis guira (9) BR
Conirostrum speciosum (4) BR
Haplospiza unicolor (4) AFE, BR
Sicalis flaveola (6) BR
Volatinia jacarina (1) BR
Sporophila angolensis (1) BR
Sporophila caerulescens (4) BR
Coryphospingus cucullatus (10) BR
Coereba flaveola (1) BR
Saltator similis (1) BR

EMBERIZIDAE

Zonotrichia capensis (8) BR

CARDINALIDAE

Habia rubica (5) BR
Amaurospiza moesta (1) AFE, BR
Cyanoloxia glaucocaeerulea (4) WR
Cyanoloxia brissonii (6) BR

PARULIDAE

Geothlypis aequinoctialis (3) BR
Setophaga pitaiyumi (8) BR
Myiothlypis leucoblephara (10) AFE, BR
Basileuterus culicivorus (10) BR

ICTERIDAE

Cacicus haemorrhous (5) BR
Icterus cayanensis (8) BR
Gnorimopsar chopi (3) BR
Agelaioides badius (1) BR
Molothrus rufoaxillaris (1) BR
Molothrus bonariensis (3) BR

FRINGILLIDAE

Spinus magellanicus (1) BR
Euphonia chlorotica (4) BR
Euphonia violacea (2) BR
Euphonia pectoralis (4) AFE, BR
Chlorophonia cyanea (2) BR

HYPOTHETICALS

TINAMIDAE

*Nothura maculosa**

THRESKIORNITHIDAE

*Mesembrinibis cayennensis**

RECURVIROSTRIDAE

*Himantopus mexicanus**

STRIGIDAE

*Pulsatrix koeniswaldiana** AFE

PSITTACIDAE

*Pionopsitta pileata** AFE
*Amazona aestiva**
*Forpus xanthopterygius**
*Aratinga nenday**
*Psittacara leucophthalmus**

Appendix B

This appendix includes bird species ($N = 42$) recorded by Smith et al. (2005) at Hotel El Tirol, Department of Itapúa, Paraguay, that we did not record during our study. Note that *Synallaxis albescens* (pale-breasted spinetail) and *Elaenia chiriquensis* (lesser elaenia) have been deleted from the Smith et al. (2005) list at the request of Smith (pers. comm., 8 September 2016), who indicated that they likely represent misidentifications. Smith et al. also noted sightings of owls tentatively identified as *Pulsatrix koeniswaldiana* (tawny-browed owl; an Atlantic Forest endemic), which needs confirmation. Names have been updated to follow Remsen et al. (2016). AFE indicates Atlantic Forest endemic (after Brooks et al., 1999).

TINAMIDAE

Crypturellus obsoletus: Brown Tinamou

Nothura maculosa: Spotted Nothura

ARDEIDAE

Nycticorax nycticorax: Black-crowned Night-heron

Bubulcus ibis: Cattle Egret

Ardea cocoi: Cocoi Heron

Ardea alba: Great Egret

THRESKIORNITHIDAE

Plegadis chihi: White-faced Ibis

Phimosus infuscatus: Bare-faced Ibis

ACCIPITRIDAE

Leptodon cayanensis: Gray-headed Kite

Rostrhamus sociabilis: Snail Kite

Accipiter striatus: Sharp-shinned Hawk

COLUMBIDAE

Patagioenas cayennensis: Pale-vented Pigeon

Geotrygon montana: Ruddy Quail-dove

Zenaida auriculata: Eared Dove

CUCULIDAE

Crotophaga major: Greater Ani

Dromococcyx pavoninus: Pavonine Cuckoo

CAPRIMULGIDAE

Lurocalis semitorquatus: Short-tailed Nighthawk
Antrostomus sericocaudatus: Silky-tailed Nightjar

APODIDAE

Chaetura meridionalis: Sick's Swift

TROCHILIDAE

Anthracothorax nigricollis: Black-throated Mango
Helimaster furcifer: Blue-tufted Starthroat
Chlorostilbon lucidus: Glittering-bellied Emerald

ALCEDINIDAE

Chloroceryle americana: Green Kingfisher

RAMPHASTIDAE

Selenidera maculirostris: Spot-billed Toucanet, AFE

FALCONIDAE

Herpetotheres cachinnans: Laughing Falcon
Falco rufigularis: Bat Falcon

FURNARIIDAE

Lepidocolaptes falcinellus: Scalloped Woodcreeper, AFE
Phacellodomus rufifrons: Rufous-fronted Thornbird
Schoeniophylax phryganophilus: Chotoy Spinetail

TYRANNIDAE

Elaenia obscura: Highland Elaenia
Myiophobus fasciatus: Bran-colored Flycatcher
Xolmis irupero: White Monjita
Conopias trivirgatus: Three-striped Flycatcher
Myiarchus ferox: Short-crested Flycatcher

OXYRUNCIDAE

Oxyruncus cristatus: Sharpbill

TITYRIDAE

Pachyrhamphus validus: Crested Becard

HIRUNDINIDAE

Pygochelidon cyanoleuca: Blue-and-white Swallow
Progne tapera: Brown-chested Martin
Tachycineta leucopyga: Chilean Swallow

THRAUPIDAE

Paroaria capitata: Yellow-billed Cardinal
Saltator coerulescens: Grayish Saltator

CARDINALIDAE

Piranga flava: Hepatic Tanager

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Index

Page numbers in *italics* indicate figures and captions.

- Acanthaceae, 15
Accipiter striatus, 71
Accipitridae (Hawks), 8, 64, 67, 71
Aegolius harrisii, 13, 61, 64, 68
African Parrots (Psittacidae), 20–21, 58–59, 64, 68, 70
Agelaioides badius, 56, 64, 70
Alcedinidae (Kingfishers), 16, 68, 72
Alchornea
 glandulosa, 55
 iricurana, 48
Allophylus edulis, 61
 Cacicus haemorrhous, 55
 Chiroxiphia caudata, 39
 Chlorophonia cyanea, 58
 Coryphospingus cucullatus, 51
 Cyanocorax chrysops, 42
 Dacnis cayana, 49
 Elaenia, 30
 Empidonomus varius, 37
 Euphonia, 57, 58
 Hemithraupis guira, 49
 Mionectes rufiventris, 32
 Myiodynastes maculatus, 36
 Pitangus sulphuratus, 36
 Pyroderus scutatus, 38
 Pyrrhocomma ruficeps, 46
 Tachyphonus coronatus, 47
 Tangara seledon, 48
 Thraupis sayaca, 48
 Trichothraupis melanops, 47
 Turdus, 43, 44, 45
 Vireo olivaceus, 41
 Zonotrichia capensis, 52
Alto Paraná region, 45, 64
Ammaurospiza moesta, 53, 64, 70
Amazilia versicolor, 16, 68
Amazona aestiva, 58, 70
American Ornithologists' Union's
 South American Classification
 Committee, 6
Anabacerthia lichtensteini, 27, 59, 69
Ani
 Greater (*Crotophaga major*), 71
 Smooth-billed (*Crotophaga ani*), 11, 61, 68
Antbirds (Thamnophilidae), 21–24, 68
Anthracothorax nigricollis, 72
Antpipit, Southern (*Corythopsis delalandi*), 31–32, 59, 69
Antrostomus
 rufus, 14, 68
 sericocaudatus, 72
Antshrike
 Giant (*Batara cinerea*), 21, 64, 68
 Large-tailed (*Mackenziaena leachii*), 21, 62, 68
 Rufous-capped (*Thamnophilus ruficapillus*), 22, 64, 68
 Spot-backed (*Hypoedaleus guttatus*), 21, 68
 Tufted (*Mackenziaena severa*), 21–22, 68
 Variable (*Thamnophilus caerulescens*), 22, 59, 61, 62, 68
Ant-tanager, Red-crowned (*Habia rubica*), 52–53, 60–61, 70
Anthrushes (Formicariidae), 24, 68
Antvireo, Plain (*Dysithamnus mentalis*), 22–23, 68
Antwren, Rufous-winged (*Herpsilochmus rufimarginatus*), 23, 68
Apodidae (Swifts), 14–15, 68, 72
Araçari, Chestnut-eared (*Pteroglossus castanotis*), 17–18, 64, 68
Araliaceae, 39
Aramides saracura, 8–9, 67

- Aratinga nenday*, 58, 70
Ardea
alba, 71
cocoi, 71
Ardeidae (Heron), 7, 67, 71
armadillo
nine-banded armadillo
(*Dasypus novemcinctus*), 3
Asteraceae, 12
Asunción, map, 2
Athene cunicularia, 13, 61, 68
Atlantic Forest ecosystem,
64–65
Automolus leucophthalmus,
27–28, 59, 62, 69
Avocets and Stilts
(Recurvirostridae), 58, 70
- Baccharis* sp., 12, 21, 29, 33, 54
Bananaquit (*Coereba flaveola*),
52, 64, 70
Band-tailed Manakin (*Pipra*
fasciicauda), 39, 60–61, 69
Bare-faced Ibis (*Phimosus*
infuscatus), 71
Barred Forest-falcon (*Micrastur*
ruficollis), 20, 61, 68
Baryphthengus ruficapillus, 17,
59, 61, 68
Basileuterus culicivorus, 22, 47,
49, 54, 55, 70
Batara cinerea, 21, 64, 68
Bat Falcon (*Falco rufigularis*), 72
Baywing, Grayish (*Agelaioides*
badius), 56, 64, 70
Becard, Crested (*Pachyrhamphus*
validus), 72
Becard, White-winged
(*Pachyrhamphus*
polychopterus), 40, 69
Black-billed Scythebill
(*Campylorhamphus*
falcularius), 25–26, 69
Blackbird, Chopi (*Gnorimopsar*
chopi), 56, 70
Blackbirds (Icteridae), 55–57,
61, 70
Bosso, A., 43
breeding, *see* reproduction
Bristle-tyrant, Southern
(*Phylloscartes eximius*), 22,
32, 59, 64, 69
Bromeliaceae, 3, 15
Broms, K., 13
Brooks, T., 6, 65
brown capuchin monkeys, 3
Bubulcus ibis, 71
Bucconidae (Puffbirds), 17, 68
Buteo brachyurus, 8, 67
- Caazapá (department). *see* San
Rafael National Park
Cacicus haemorrhous, 38,
55–56, 70
- Cacique, Red-rumped (*Cacicus*
haemorrhous), 38, 55–56,
70
Calidris subruficollis, 9, 62,
64, 68
Calliandra foliolosa, 15
Campephilus robustus, 19–20,
64, 68
Campylorhamphus falcularius,
25–26, 69
Canevari, M., 62
Cannabaceae, 30
Capitán Miranda, Paraguay,
5, 21
Capllonch, P., 35
Caprimulgidae (Nightjars), 14,
64, 68, 72
Capsicum sp., 30
Capsiempis flaveola, 31, 61,
63, 69
capuchin monkeys, 3
Caracara
Chimango (*Milvago*
chimango), 20, 68
Southern (*Caracara plancus*),
20, 68
Yellow-headed (*Milvago*
chimachima), 20, 61, 68
Caracara plancus, 20, 68
Cardinal, Yellow-billed
(*Paroaria capitata*), 72
Cardinal Grosbeaks
(Cardinalidae), 52–54,
70, 72
Cardinalidae (Cardinal
Grosbeaks), 52–54, 70, 72
Casearia silvestris, 39
Cathartes aura, 7, 67
Cathartidae (New World
Vultures), 7–8, 64, 67
Cecropia pachystachya, 39, 61
Cercocyon thous, 3
Cerro Corá National Park, 2,
39
Chaco region, 31
Chaetura
cinereiventris, 14–15, 42, 68
meridionalis, 72
Chamaeza campanisona, 24,
61, 68
Charadriidae (Plovers), 9, 68
Chiroxiphia caudata, 39, 59,
60, 61, 69
Chloroceryle americana, 72
Chlorophonia, Blue-naped
(*Chlorophonia cyanea*),
58, 70
Chlorophonia cyanea, 58, 70
Chlorostilbon lucidus, 72
Chusquea sp., 3, 12, 22, 31, 54
Cissopsis leverianus, 45, 69
Citrus sp., 11
Ciudad del Este, 2
Clay, R. P., 47
- Cnemotriccus fuscatus*, 35, 69
Coccyzus
americanus, 12–13, 61, 62,
64, 68
melacoryphus, 12, 61, 68
Coereba flaveola, 52, 64, 70
Colaptes
campestris, 19, 61, 62, 68
melanochloros, 19, 61, 68
Colonia colonus, 35, 69
Columba livia, 9, 60, 61, 63, 68
Columbidae (Pigeons)
annual cycle, 63
diet, 61
reproduction, 59–60
species list, 9–11, 68, 71
Columbina
picui, 10–11, 61, 68
squammata, 10, 68
talpacoti, 4, 10, 11, 59, 61, 68
Conebill, Chestnut-vented
(*Conirostrum speciosum*),
45, 49–50, 61, 70
Conirostrum speciosum, 45,
49–50, 61, 70
Conopias trivirgatus, 72
Conopophaga lineata, 24, 68
Conopophagidae (Gnateaters),
24, 68
Contopus
cinereus, 35, 69
sordidulus, 30
Coragyps atratus, 7–8, 67
Cordillera San Rafael, 64
Corvidae (Jays), 42, 69
Coryphospingus cucullatus,
51–52, 61, 70
Corythopsis delalandi, 31–32,
59, 69
Cotingas (Cotingidae), 38, 69
Cotingidae (Cotingas), 38, 69
Cowbird
Screaming (*Molothrus*
rufoaxillaris), 56, 70
Shiny (*Molothrus*
bonariensis), 56–57, 70
crab-eating fox (*Cercocyon*
thous), 3
Cracidae (Guans), 7, 64, 67
Cranioleuca obsoleta, 28, 59,
69
Crotophaga
ani, 11, 61, 68
major, 71
Crypturellus
obsoletus, 71
tataupa, 7, 64, 67
Cuckoo
Dark-billed (*Coccyzus*
melacoryphus), 12, 61, 68
Guira (*Guira guira*), 4, 11,
61, 62, 68
Pavonine (*Dromococcyx*
pavoninus), 71
- Pheasant (*Dromococcyx*
phasianellus), 12, 68
Squirrel (*Piaya cayana*), 12,
62, 68
Striped (*Tapera naevia*), 11, 68
Yellow-billed (*Coccyzus*
americanus), 12–13, 61,
62, 64, 68
Cuckoos (Cuculidae), 11–13,
61, 68, 71
Cuculidae (Cuckoos), 11–13,
61, 68, 71
Cupania sp., 43
Cupania vernalis, 36, 38, 40,
44, 48, 55
Cyanocorax chrysops, 42, 69
Cyanoloxia
brissonii, 53–54, 60–61, 70
glaucocaeerulea, 53, 61, 62, 70
Cyatheaaceae, 3
Cyclarhis gujanensis, 41, 69
- Dacnis, Blue (*Dacnis cayana*),
49, 61, 70
Dacnis cayana, 49, 61, 70
Dasypus novemcinctus, 3
de la Peña, M. R., 11
del Castillo, H., 30, 47
Dendrocincla turdina, 25, 64,
69
Dendrocolaptes platyrostris,
25, 69
Dendropanax cuneatus, 39
Didelphis albiventris, 3
diet, 6, 61–62
Dove
Eared (*Zenaidura macroura*), 71
Gray-fronted (*Leptotila*
rufaxilla), 10, 68
Picui Ground (*Columbina*
picui), 10–11, 61, 68
Ruddy Ground (*Columbina*
talpacoti), 4, 10, 11, 59,
61, 68
Scaled (*Columbina*
squammata), 10, 68
Violaceous Quail- (*Geotrygon*
violacea), 9, 68
White-tipped (*Leptotila*
verreauxi), 9–10, 60, 61,
62, 63, 68
Dromococcyx
pavoninus, 71
phasianellus, 12, 68
Dryomphila malura, 23, 68
Dryocopus lineatus, 19, 61,
64, 68
Dysithamnus mentalis, 22–23,
68
- eggs, 7, 52, 59–60
Egret
Cattle (*Bubulcus ibis*), 71
Great (*Ardea alba*), 71

- Elaenia
 Gray (*Myiopagis caniceps*), 29, 59, 61, 69
 Greenish (*Myiopagis viridicata*), 29, 61, 69
 Highland (*Elaenia obscura*), 64, 72
 Large (*Elaenia spectabilis*), 30, 69
 Lesser (*Elaenia chiriquensis*), 71
 Small-billed (*Elaenia parvirostris*), 30, 62, 69
 White-crested (*Elaenia albiceps*), 30, 62, 69
 Yellow-bellied (*Elaenia flavogaster*), 30, 62, 69
- Elaenia
albiceps, 30, 62, 69
chiriquensis, 71
flavogaster, 30, 62, 69
obscura, 64, 72
parvirostris, 30, 62, 69
spectabilis, 30, 69
- Elanoides forficatus, 8, 62, 67
 Elanus leucurus, 8, 67
 El Tirol. see Hotel El Tirol del Paraguay
- Emberizidae (Sparrows), 52, 70
- Emerald
 Glittering-bellied (*Chlorostilbon lucidus*), 72
 Versicolored (*Amazilia versicolor*), 16, 68
- Empidonomus varius, 37, 62, 69
- Encarnación, Paraguay, 2, 3
- Esquivel M., 12, 43
- Eugenia uniflora, 39, 42, 47, 48, 57
- Euphonia
 Chestnut-bellied (*Euphonia pectoralis*), 57–58, 70
 Purple-throated (*Euphonia chlorotica*), 57, 70
 Violaceous (*Euphonia violacea*), 32, 57, 62, 70
- Euphonia
chlorotica, 57, 70
pectoralis, 57–58, 70
violacea, 32, 57, 62, 70
- Euphorbiaceae, 3
- Euscarthmus meloryphus, 32, 69
- Fabaceae, 15
- Falco
femoralis, 20, 68
rufigularis, 72
sparverius, 8, 20, 68
- Falcon
 Aplomado (*Falco femoralis*), 20, 68
 Barred Forest- (*Micrastur ruficollis*), 20, 61, 68
- Bat (*Falco rufigularis*), 72
 Laughing (*Herpetotheres cachinnans*), 72
- Falconidae (Falcons), 20, 68, 72
- Falcons (Falconidae), 20, 68, 72
- Faramea cyanea, 15
- fat deposition, 60, 62, 63
- Ficus sp., 39, 40, 47, 56, 61
- Finch
 Chestnut-bellied Seed- (*Sporophila angolensis*), 50–51, 70
 Red-crested (*Coryphospingus cucullatus*), 51–52, 61, 70
 Saffron (*Sicalis flaveola*), 4, 50, 60, 61, 70
 Uniform (*Haplospiza unicolor*), 50, 61, 70
- Finches (Fringillidae), 57–58, 70
- Fire-eye, White-shouldered (*Pyrglena leucoptera*), 23–24, 61, 62, 63, 68
- Flycatcher
 Boat-billed (*Megarynchus pitangua*), 36–37, 69
 Bran-colored (*Myiophobus fasciatus*), 72
 Euler's (*Lathrotriccus euleri*), 29, 34–35, 61, 69
 Fork-tailed (*Tyrannus savana*), 37–38, 69
 Fuscous (*Cnemotriccus fuscatus*), 35, 69
 Gray-hooded (*Mionectes rufiventris*), 32, 57, 59, 69
 Piratic (*Legatus leucophaius*), 36, 69
 Sepia-capped (*Leptopogon amaurocephalus*), 32–33, 59, 61, 69
 Short-crested (*Myiarchus ferox*), 72
 Social (*Myiozetetes similis*), 36, 69
 Streaked (*Myiodynastes maculatus*), 36, 61, 69
 Suiriri (*Suiriri suiriri*), 31, 69
 Swainson's (*Myiarchus swainsoni*), 38, 69
 Three-striped (*Conopias trivirgatus*), 72
 Variegated (*Empidonomus varius*), 37, 62, 69
 Yellow-olive (*Tolmomyias sulphurens*), 34, 59, 69
- Foliage-gleaner
 Black-capped (*Philydor atricapillus*), 26, 59, 69
 Buff-browed (*Syndactyla rufosuperciliata*), 27, 59, 62, 69
 Buff-fronted (*Philydor rufum*), 27, 59, 69
- Ochre-breasted (*Anabacerthia lichtensteini*), 27, 59, 69
 White-eyed (*Automolus leucophthalmus*), 27–28, 59, 62, 69
- Forest-falcon
 Barred (*Micrastur ruficollis*), 20, 61, 68
- Formicariidae (Antthrushes), 24, 68
- Forpus xanthopterygius, 58, 70
- Foster, William T., 60
- fox, crab-eating (*Cerdocyon thous*), 3
- Fringillidae (Finches), 57–58, 70
- Fruitcrow, Red-ruffed (*Pyroderus scutatus*), 38, 56, 64, 69
- Fuchsia sp., 15
- Furnariidae (Ovenbirds), 24–29, 59, 64, 69, 72
- Furnariinae, 59
- Furnarius rufus, 26, 61, 69
- Galictis cuja, 3
- Geothlypis aequinoctialis, 54, 70
- Geotrygon
montana, 71
violacea, 9, 68
- Glaucidium brasilianum, 13, 24, 61, 68
- Gnatcatcher, Creamy-bellied (*Poliophtila lactea*), 43, 64, 69
- Gnatcatchers (Poliophtilidae), 43, 69
- Gnateater, Rufous (*Conopophaga lineata*), 24, 68
- Gnateaters (Conopophagidae), 24, 68
- Gnorimopsar chopi, 56, 70
- gonads, enlarged, 59–60, 63
- Grassquit, Blue-black (*Volatinia jacarina*), 50, 70
- Greenlet, Rufous-crowned (*Hylophilus poicilotis*), 41, 69
- grison, lesser (*Galictis cuja*), 3
- Grosbeak
 Glaucous-blue (*Cyanoloxia glaucoacaerulea*), 53, 61, 62, 70
 Ultramarine (*Cyanoloxia brissonii*), 53–54, 60–61, 70
- Ground Dove
 Picui (*Columbina picui*), 10–11, 61, 68
 Ruddy (*Columbina talpacoti*), 4, 10, 11, 59, 61, 68
- Guan, Rusty-margined (*Penelope supercilialis*), 7, 64, 67
- Guans (Cracidae), 7, 64, 67
- Guarea sp., 36, 39
- A Guide to the Birds of South America (Meyer de Schauensee), 1
- Guira Cuckoo (*Guira guira*), 4, 11, 61, 62, 68
- Guira guira, 4, 11, 61, 62, 68
- Guyra Paraguay (conservation group), 63
- Habia rubica, 52–53, 60–61, 70
- Haplospiza unicolor, 50, 61, 70
- Harpagus diodon, 8, 67
- Hawk
 Roadside (*Rupornis magnirostris*), 8, 67
 Sharp-shinned (*Accipiter striatus*), 71
 Short-tailed (*Buteo brachyurus*), 8, 67
- Hawks (Accipitridae), 8, 64, 67, 71
- Hayes, F. E.
Batara cinerea, 21
 on breeding season, 60
Cissopis leverianus, 45
Colaptes campestris, 19
Columbina talpacoti, 10, 11
Coryphospingus cucullatus, 51
Crypturellus tataupa, 7
Cyanoloxia glaucoacaerulea, 53
Elaenia flavogaster, 30
Elaenia parvirostris, 30
 hypotheticals, 58
Megascops choliba, 13
 on migrants, 62
Neothraupis fasciata, 45
Stephanophorus diadematus, 47
Tersina viridis, 48
Troglodytes aedon, 43
Helimaster furcifer, 64, 72
- Hemiptera, 21, 24, 34
- Hemithraupis guira, 39, 45, 47, 49, 50, 70
- Hemitriccus
diops, 33, 59, 69
margaritaceiventris, 33, 59, 69
- Hermit, Scale-throated (*Phaethornis eurynome*), 15, 68
- Heron
 Black-crowned Night- (*Nycticorax nycticorax*), 71
 Cocoi (*Ardea cocoi*), 71
 Whistling (*Syrigma sibilatrix*), 7, 67
- Hérons (Ardeidae), 7, 67, 71
- Herpetotheres cachinnans, 72
- Herpsilochmus rufimarginatus, 23, 68

- Himantopus*
himantopus, 58
mexicanus, 58, 70
Hirundinidae (Swallows), 42, 69, 72
Hornero, Rufous (*Furnarius rufus*), 26, 61, 69
Hotel El Tirol del Paraguay, 2, 2–4, 5
Hummingbird, Gilded (*Hylocharis chrysura*), 16, 62–63, 68
Hummingbirds (Trochilidae), 15–16, 62–63, 68, 72
Hydropsalis torquata, 14, 68
Hylocharis chrysura, 16, 62–63, 68
Hylophilus poicilotis, 41, 69
Hypoedaleus guttatus, 21, 68
hypotheticals, 58–59, 70
Ibis
Bare-faced (*Phimosus infuscatus*), 71
Green (*Mesembrinibis cayennensis*), 58, 70
White-faced (*Plegadis chihi*), 71
Ibises (Threskiornithidae), 58, 70, 71
Icteridae (Blackbirds), 55–57, 61, 70
Icterus cayannensis, 56, 70
Ictinia plumbea, 8, 67
Iguazú National Park, Argentina, 43
Inga marginata, 55
International Union for Conservation of Nature (IUCN)
Near Threatened species, 32, 43, 45, 53, 64
Isler, M. L., 48
Isler, P. R., 48
Itapúa (department), Paraguay. *see* San Rafael National Park
IUCN. *see* International Union for Conservation of Nature
Ixodidae, 20
Jay, Plush-crested (*Cyanocorax chrysops*), 42, 69
Jays (Corvidae), 42, 69
Johnson, Ned K., 42
Kestrel, American (*Falco sparverius*), 8, 20, 68
Kingbird, Tropical (*Tyrannus melancholicus*), 37, 69
Kingfisher
Green (*Chloroceryle americana*), 72
Ringed (*Megaceryle torquata*), 16, 68
Kingfishers (Alcedinidae), 16, 68, 72
Kiskadee, Great (*Pitangus sulphuratus*), 8, 36, 69
Kite
Gray-headed (*Leptodon cayanensis*), 71
Plumbeous (*Ictinia plumbea*), 8, 67
Rufous-thighed (*Harpagus diodon*), 8, 67
Snail (*Rostrhamus sociabilis*), 71
Swallow-tailed (*Elanoides forficatus*), 8, 62, 67
White-tailed (*Elanus leucurus*), 8, 67
Lapwing, Southern (*Vanellus chilensis*), 9, 68
Lathrotricus euleri, 29, 34–35, 61, 69
Lauraceae, 30
Leaftosser, Rufous-breasted (*Sclerurus scansor*), 24, 69
Legatus leucophaeus, 36, 69
leks, 15, 39
Lepidocolaptes angustirostris, 26, 69
falcinellus, 63, 72
fuscus, 64
Leptodon cayanensis, 71
Leptopogon amaurocephalus, 32–33, 59, 61, 69
Leptotila rufaxilla, 10, 68
verreauxi, 9–10, 60, 61, 62, 63, 68
Lochmias nematura, 26, 69
Loranthaceae, 32
Lowen, J. C., 64
Lurocalis semitorquatus, 72
Machetornis rixosa, 35–36, 69
Mackenziaena leachii, 21, 62, 68
severa, 21–22, 68
Madroño N., A., 64
Mallophaga, 24
Malvaceae, 15
Malvaviscus penduliflorus, 15
sp., 15, 16, 52, 63
Manakin
Band-tailed (*Pipra fasciicauda*), 39, 60–61, 69
Swallow-tailed (*Chiroxiphia caudata*), 39, 59, 60, 61, 69
Manakins (Pipridae), 39, 69
Manettia luteorubra, 15
Mango, Black-throated (*Anthracothonax nigricollis*), 72
Manihot esculenta, 3
Marasmiaceae, 44
Marasmius sp., 44
Martin
Brown-chested (*Progne tapera*), 72
Gray-breasted (*Progne chalybea*), 14, 42, 69
Mbaracayú Forest Nature Reserve, 2, 65
Megaceryle torquata, 16, 68
Megarynychus pitangua, 36–37, 69
Megascops choliba, 13, 68
Melanerpes candidus, 18, 61, 68
Meliaceae, 39
Mesembrinibis cayennensis, 58, 70
Meyer de Schauensee, R., 1
Micrastur ruficollis, 20, 61, 68
migration and local movements, 62–63
Milvago chimachima, 20, 61, 68
chimango, 20, 68
Mimidae (Mockingbirds), 45, 69
Mimus saturninus, 45, 69
Mionectes rufiventris, 32, 57, 59, 69
Misiones, Argentina, 21
Mockingbird, Chalk-browed (*Mimus saturninus*), 45, 69
Mockingbirds (Mimidae), 45, 69
Molothrus bonariensis, 56–57, 70
rufocapillaris, 56, 70
molt, 61
annual cycle, 60, 63
breeding overlap, 11, 31, 41
methods, 5
Momotidae (Motmots), 17, 68
Monjita, White (*Xolmis irupero*), 64, 72
monkey, brown capuchin (*Sapajus cay*), 3
Moraceae, 61
Motmot, Rufous-capped (*Baryphthengus ruficapillus*), 17, 59, 61, 68
Motmots (Momotidae), 17, 68
Myers, J. P., 9
Myers, L. P., 9
Myiarchus ferox, 72
swainsoni, 38, 69
Myiodynastes maculatus, 36, 61, 69
Myiopagis caniceps, 29, 59, 61, 69
viridicata, 29, 61, 69
Myiophobus fasciatus, 72
Myiopsitta monachus, 20–21, 68
Myiornis auricularis, 33, 59, 69
Myiothlypis leucoblephara, 54–55, 70
Myiozetetes similis, 36, 69
Myrtaceae, 21, 39
Near Threatened species (IUCN), 32, 43, 45, 53, 64
Nemosia pileata, 45, 49, 50, 70
Neothraupis fasciata, 45, 64, 69
Nephelea setosa, 3
nestlings, 52, 55
nests
Basileuterus culicivorus, 55
Cacicus haemorrhous, 56
Chiroxiphia caudata, 39
Coryphospingus cucullatus, 51–52
Patagioenas picazuro, 9
Trogon surrucura, 16
Turdus leucomelas, 43
Turdus rufiventris, 44
Veniliornis spilogaster, 19
New World and African Parrots (Psittacidae), 20–21, 58–59, 64, 68, 70
New World Quails (Odontophoridae), 7, 67
New World Vultures (Cathartidae), 7–8, 64, 67
Nighthawk, Short-tailed (*Lurocalis semitorquatus*), 72
Night-heron, Black-crowned (*Nycticorax nycticorax*), 71
Nightjar
Little (*Setopagis parvula*), 14, 68
Rufus (*Antrostomus rufus*), 14, 68
Scissor-tailed (*Hydropsalis torquata*), 14, 68
Silky-tailed (*Antrostomus sericocaudatus*), 72
Nightjars (Caprimulgidae), 14, 64, 68, 72
nine-banded armadillo (*Dasyus novemcinctus*), 3
Nonnula rubecula, 17, 68
Nothura, Spotted (*Nothura maculosa*), 58, 63, 70, 71
Nothura maculosa, 58, 63, 70, 71
Nunlet, Rusty-breasted (*Nonnula rubecula*), 17, 68
Nyctibiidae (Potoos), 13–14, 64, 68
Nyctibius griseus, 13–14, 61, 68
Nycticorax nycticorax, 71
Nyctidromus albigollis, 14, 68
Nystalus chacuru, 17, 68
Ocotea puberula, 61
Elaenia, 30
Empidonomus varius, 37

- Myiarchus swainsoni*, 38
Myiodynastes maculatus, 36
Pitangus sulphuratus, 36
Tersina viridis, 48
Thraupis sayaca, 48
Tityra cayana, 40
Turdus amaurochalinus, 44
Tyrannus melancholicus, 37
Tyrannus savana, 38
Vireo olivaceus, 41
 Odontophoridae (New World Quails), 7, 67
Odontophorus capueira, 7, 67
 Onagraceae, 15
 opossum, white-eared (*Didelphis albiventris*), 3
 Oriole, Epaulet (*Icterus cayanensis*), 56, 70
 ovaries, 60
 Ovenbirds (Furnariidae), 24–29, 59, 64, 69, 72
 Owl
 Buff-fronted (*Aegolius harrisi*), 13, 61, 64, 68
 Burrowing (*Athene cunicularia*), 13, 61, 68
 Ferruginous Pygmy- (*Glaucidium brasilianum*), 13, 24, 61, 68
 Tawny-browed (*Pulsatrix koeniswaldiana*), 58, 63, 64, 70, 71
 Tropical Screech- (*Megascops choliba*), 13, 68
 Owls (Strigidae), 13, 58, 61, 64, 68, 70
 Oxyruncidae, 72
Oxyruncus cristatus, 72
Pachyrhamphus polychopterus, 40, 69
validus, 72
 Paraguay, map, 2
 Parakeet
 Maroon-bellied (*Pyrhura frontalis*), 21, 68
 Monk (*Myiopsitta monachus*), 20–21, 68
 Nanday (*Aratinga nenday*), 58, 70
 White-eyed (*Psittacara leucophthalmus*), 59, 70
Paroaria capitata, 64, 72
 Parrot
 Pileated (*Pionopsitta pileata*), 58, 70
 Scaly-headed (*Pionus maximiliani*), 21, 61, 68
 Turquoise-fronted (*Amazona aestiva*), 58, 70
 Parrotlet, Blue-winged (*Forpus xanthopterygius*), 58, 70
 Parrots (Psittacidae), 20–21, 61, 64, 68, 70
 Parula, Tropical (*Setophaga pitayumi*), 47, 54, 70
 Parulidae (Wood-warblers), 54–55, 70
 Patagioenas cayennensis, 71
 picazuro, 4, 9, 59, 61, 62, 68
 Pauraque, Common (*Nyctidromus albicollis*), 14, 68
 Penelope supercilialis, 7, 64, 67
 Pentatomidae, 34
 Peppershrike, Rufous-browed (*Cyclarhis gujanensis*), 41, 69
 Petrochelidon pyrrhonota, 42, 62, 69
 Pewee
 Tropical (*Contopus cinereus*), 35, 69
 Western Wood (*Contopus sordidulus*), 30
 Phacellodromus rufifrons, 64, 72
 Phaethornis eurynome, 15, 68
 Phasmatodea, 8
 Philydor atricapillus, 26, 59, 69
 rufum, 27, 59, 69
 Philydorinae, 59
 Phimosus infuscatus, 71
 Phoradendron piperoides, 32, 57, 58
 Phyllomyias burmeisteri, 29, 69
 Phylloscartes eximius, 22, 32, 59, 64, 69
 ventralis, 32, 59, 69
 Piaya cayana, 12, 62, 68
 Picidae (Woodpeckers), 18–20, 61, 64, 68
 Piculet, Ochre-collared (*Picumnus temminckii*), 18, 59, 61, 68
 Picumnus temminckii, 18, 59, 61, 68
 Pigeon
 Pale-vented (*Patagioenas cayennensis*), 71
 Piacazuro (*Patagioenas picazuro*), 4, 9, 59, 61, 62, 68
 Rock (*Columba livia*), 9, 60, 61, 63, 68
 Pigeons (Columbidae)
 annual cycle, 63
 diet, 61
 reproduction, 59–60
 species list, 9–11, 68, 71
 Pinaceae, 7
 Pinus sp., 7
 Pionopsitta pileata, 58, 70
 Pionus maximiliani, 21, 58, 61, 68
 Pipraeidea melanonota, 47, 54, 70
 Pipra fasciicauda, 39, 60–61, 69
 Pipridae (Manakins), 39, 69
 Piprites, Wing-barred (*Piprites chloris*), 40–41, 59, 61, 63, 69
 Piprites chloris, 40–41, 59, 61, 63, 69
 Pipromorphidae, 59
 Piranga flava, 64, 72
 Pitangus sulphuratus, 8, 36, 69
 Pizo, M. A., 15
 Platyrinchus mystaceus, 34, 59, 69
 Plegadis chihi, 71
 Plovercrest, Green-crowned (*Stephanoxis lalandi*), 15, 63, 68
 Plovers (Charadriidae), 9, 68
 plumage, 5, 6, 11, 60–61
 pneumatization, skull, 5, 6, 59, 60–61
 Poaceae bamboo, 3
 Poecilotriccus plumbeiceps, 34, 59, 69
 Poliophtila lactea, 43, 64, 69
 Poliophtilidae (Gnatcatchers), 43, 69
 Potoo, Common (*Nyctibius griseus*), 13–14, 61, 68
 Potoos (Nyctibiidae), 13–14, 64, 68
 Progne
 chalybea, 14, 42, 69
 tapera, 72
 Psittacara leucophthalmus, 59, 70
 Psittacidae (New World and African Parrots), 20–21, 58–59, 61, 64, 68, 70
 Psychotria carthagenensis, 39, 43, 44, 45
 Pteroglossus castanotis, 17–18, 64, 68
 Puffbird, White-eared (*Nystalus chacuru*), 17, 68
 Puffbirds (Bucconidae), 17, 68
 Pulsatrix koeniswaldiana, 58, 63, 64, 70, 71
 Pygmy-owl, Ferruginous (*Glaucidium brasilianum*), 13, 24, 61, 68
 Pygmy-tyrant
 Drab-breasted (*Hemitriccus diops*), 33, 59, 69
 Eared (*Myiornis auricularis*), 33, 59, 69
 Tawny-crowned (*Euscarthmus meloryphus*), 32, 69
 Pygochelidon cyanoleuca, 72
 Pyriglena leucoptera, 23–24, 61, 62, 63, 68
 Pyroderus scutatus, 38, 56, 64, 69
 Pyrhocomma ruficeps, 45–46, 59, 60, 61, 70
 Pyrhura frontalis, 21, 68
 Quail, Spot-winged Wood- (*Odontophorus capueira*), 7, 67
 Quail-dove
 Ruddy (*Geotrygon montana*), 71
 Violaceous (*Geotrygon violacea*), 9, 68
 Quails, New World (*Odontophoridae*), 7, 67
 Rail, Slaty-breasted Wood- (*Aramides saracura*), 8–9, 67
 Rails (Rallidae), 8–9, 67
 rainfall patterns, 3–4, 5
 Rallidae (Rails), 8–9, 67
 Rampastidae (Toucans), 17–18, 68, 72
 Ramphastos dicolorus, 17, 64, 68
 toco, 17, 64, 68
 Recurvirostridae (Avocets and Stilts), 58, 70
 Relbunium hypocarpium, 51
 Remsen, J. V., Jr., 71
 reproduction, 59–60, 60
 annual cycle, 63
 methods, 5
 molt-breeding overlap, 11, 31, 41
 terminology and aging, 6
 Reynaerts, Armando, 4
 Rhipsalis cereuscula, 57
 shaferi, 57
 Rhynchocyclidae, 59
 Ricinus communis, 3
 Ridgely, R. S.
 Batara cinerea, 21
 Contopus cinereus, 35
 Dacnis cayana, 49
 Neothraupis fasciata, 45
 Pachyrhamphus polychopterus, 40
 Sicalis flaveola, 50
 Tersina viridis, 48–49, 62
 Tolmomyias sulphureus, 34
 Turdus albicollis, 45
 Turdus nigricaps, 44
 Rohwer, S., 13
 Rostrhamus sociabilis, 71
 Rubiaceae, 15, 39, 51
 Ruellia angustifolia, 15, 16
 Rupornis magnirostris, 8, 67
 Rutaceae, 11
 Salicaceae, 39
 Saltator
 Grayish (*Saltator coerulescens*), 72

- Saltator (*continued*)
 Green-winged (*Saltator similis*), 52, 70
Saltator
 coerulescens, 72
 similis, 52, 70
 Sandpiper, Buff-breasted (*Calidris subruficollis*), 9, 62, 64, 68
 Sandpipers (Scolopacidae), 9, 68
 San Rafael National Park
 comparisons with other sites, 64, 65
 Dromococcyx phasianellus, 12
 Euscarthmus meloryphus, 32
 hypotheticals, 58
 map, 2
 Petrochelidon pyrrhonota, 42
 Pipra fasciicauda, 39
 Poliophtila lactea, 43
Sapajus *cay*, 3
 Sapindaceae, 30, 36, 38, 57
 Sapucaí, Paraguay
 breeding season, 60
 Colaptes campestris, 19
 Crypturellus tataupa, 7
 Dryocopus lineatus, 19
 Elaenia flavogaster, 30
 map, 2
 Megascops choliba, 13
 Pitangus sulphuratus, 36
 Troglodytes aedon, 43
 Schiffornis, Greenish (*Schiffornis virescens*), 40, 61, 62, 69
Schiffornis virescens, 40, 61, 62, 69
Schoeniophylax
 phryganophilus, 64, 72
Sclerurus scansor, 24, 69
 Scolopacidae (Sandpipers), 9, 68
 Screech-owl, Tropical (*Megascops choliba*), 13, 68
 Scythebill, Black-billed (*Campylorhamphus falcularius*), 25–26, 69
 Seed-eater
 Blackish-blue (*Amaurospiza moesta*), 53, 64, 70
 Double-collared (*Sporophila caerulescens*), 51, 61, 62, 63, 70
 Seed-finch, Chestnut-bellied (*Sporophila angolensis*), 50–51, 70
Selenidera maculirostris, 72
Serpophaga
 munda, 31, 62, 64, 69
 subcristata, 31, 62, 69
Setopagis parvula, 14, 68
Setophaga pitiayumi, 47, 54, 70
 Sharpbill (*Oxyruncus cristatus*), 72
Sicalis flaveola, 4, 50, 60, 61, 70
 Sick, H., 62, 63
Sirystes, Sibilant (*Sirystes sibilator*), 38, 69
Sirystes sibilator, 38, 69
 Siskin, Hooded (*Spinus magellanicus*), 57, 70
Sittasomus griseicapillus, 24–25, 63, 69
 skull pneumatization, 5, 6, 59, 60–61
 Smith, P., 40, 47, 58, 63–64, 71
 Solanaceae, 30, 37
Solanum sp., 37, 43
Sorocea bonplandii, 61
 Spadebill, White-throated (*Platyrinchus mystaceus*), 34, 59, 69
 Sparrow, Rufous-collared (*Zonotrichia capensis*), 52, 61, 70
 Sparrows (Emberizidae), 52, 70
 Spinetail
 Chotoy (*Schoeniophylax phryganophilus*), 72
 Gray-bellied (*Synallaxis cinerascens*), 28, 69
 Olive (*Cranioleuca obsoleta*), 28, 59, 69
 Pale-breasted (*Synallaxis albescentis*), 71
 Rufous-capped (*Synallaxis ruficapilla*), 28, 59, 62, 69
 Sooty-fronted (*Synallaxis frontalis*), 29, 59, 69
 Spix's (*Synallaxis spixi*), 28–29, 59, 69
 Spinus magellanicus, 57, 70
Sporophila
 angolensis, 50–51, 70
 caerulescens, 51, 61, 62, 63, 70
 Starthroat, Blue-tufted (*Helimaster furcifer*), 64, 72
Stephanophorus diadematus, 47, 62, 70
Stephanoxis lalandi, 15, 63, 68
 Stilt, Black-necked (*Himantopus mexicanus*), 58, 70
 Stilts and Avocets (Recurvirostridae), 58, 70
 Streamcreeper, Sharp-tailed (*Lochmias nematura*), 26, 69
 Strigidae (Owls), 13, 58, 61, 64, 68, 70
Suiriri suiriri, 31, 69
 Swallow
 Blue-and-white (*Pygochelidon cyanoleuca*), 72
 Chilean (*Tachycineta leucopyga*), 72
 Cliff (*Petrochelidon pyrrhonota*), 42, 62, 69
 Swallows (Hirundinidae), 42, 69, 72
 Swift
 Gray-rumped (*Chaetura cinereiventris*), 14–15, 42, 68
 Sick's (*Chaetura meridionalis*), 72
 Swifts (Apodidae), 14–15, 68, 72
Synallaxis
 albescentis, 71
 cinerascens, 28, 69
 cinereus, 59
 frontalis, 29, 59, 69
 ruficapilla, 28, 59, 62, 69
 spixi, 28–29, 59, 69
Syndactyla rufosuperciliata, 27, 59, 62, 69
Syrigma sibilatrix, 7, 67
Tachycineta leucopyga, 72
Tachyphonus coronatus, 47, 59, 60, 61, 70
 Tanager
 Black-goggled (*Trichothraupis melanops*), 46–47, 70
 Chestnut-headed (*Pyrrhocomma ruficeps*), 45–46, 59, 60, 61, 70
 Diademed (*Stephanophorus diadematus*), 47, 62, 70
 Fawn-breasted (*Pipraeidea melanonota*), 47, 54, 70
 Green-headed (*Tangara seledon*), 48, 70
 Guira (*Hemithraupis guira*), 39, 45, 47, 49, 50, 70
 Hepatic (*Piranga flava*), 64, 72
 Hooded (*Nemosia pileata*), 45, 49, 50, 70
 Maggie (*Cissopis leverianus*), 45, 69
 Ruby-crowned (*Tachyphonus coronatus*), 47, 59, 60, 61, 70
 Sayaca (*Thraupis sayaca*), 48, 59, 61, 62, 70
 Swallow (*Tersina viridis*), 48–49, 60, 61, 62, 70
 White-banded (*Neothraupis fasciata*), 45, 64, 69
 Tanagers (Thraupidae), 45–52, 61, 64, 69–70, 72
Tangara seledon, 48, 70
Tapera naevia, 11, 68
Tersina viridis, 48–49, 60, 61, 62, 70
 testes, 60, 63
Thalassidroma furcata, 15–16, 62–63, 64, 68
 Thamnophilidae (Antbirds), 21–24, 68
Thamnophilus
 caerulescens, 22, 59, 61, 62, 68
 ruficapillus, 22, 64, 68
 Thornbird, Rufous-fronted (*Phacellodromus rufifrons*), 64, 72
 Thraupidae (Tanagers), 45–52, 61, 64, 69–70, 72
Thraupis sayaca, 48, 59, 61, 62, 70
 Threskiornithidae (Ibises), 58, 70, 71
 Thrush
 Creamy-bellied (*Turdus amaurochalinus*), 44, 69
 Pale-breasted (*Turdus leucomelas*), 43, 69
 Rufous-bellied (*Turdus rufiventris*), 43–44, 69
 Slaty (*Turdus nigriceps*), 44, 67, 69
 White-necked (*Turdus albicollis*), 44–45, 69
 Thrushes (Turdidae), 43–45, 61, 69
Tillandsia
 stricta, 15
 usneoides, 3
 Tinamidae (Tinamous), 7, 58, 64, 67, 70, 71
 Tinamou
 Brown (*Crypturellus obsoletus*), 71
 Tataupa (*Crypturellus tataupa*), 7, 64, 67
 Tinamous (Tinamidae), 7, 58, 64, 67, 70, 71
 Tityra
 Black-crowned (*Tityra inquisitor*), 39–40, 69
 Black-tailed (*Tityra cayana*), 40, 69
Tityra
 cayana, 40, 69
 inquisitor, 39–40, 69
 semifasciata, 40
 Tityras (Tityridae), 39–41, 61, 69, 72
 Tityridae (Tityras), 39–41, 61, 69, 72
 Tody-flycatcher, Ochre-faced (*Poecilatriccus plumbeiceps*), 34, 59, 69
 Tody-tyrant, Pearly-vented (*Hemitriccus margaritaceiventer*), 33, 59, 69
Tolmomyias sulphurescens, 34, 59, 69
 Toucan
 Red-breasted (*Ramphastos coloratus*), 17, 64, 68
 Toco (*Ramphastos toco*), 17, 64, 68

- Toucanet, Spot-billed (*Selenidera maculirostris*), 72
- Toucans (Ramphastidae), 17–18, 68, 72
- tree ferns, 3
- Trema micrantha*
- Chiroxiphia caudata*, 39
- Cyanoloxia glaucoacaerulea*, 53
- Dacnis cayana*, 49
- Elaenia*, 30
- Icterus cayanensis*, 56
- Pitangus sulphuratus*, 36
- Trichothraupis melanops*, 47
- Turdus*, 43, 45
- Trichilia catigua*, 39, 49, 61
- Trichothraupis melanops*, 46–47, 70
- diet, 62
- mixed-species flocks, 22, 39, 49, 54, 55
- plumage, 60, 61
- predators, 13, 24
- Trochilidae (Hummingbirds), 15–16, 62–63, 68, 72
- Troglodytes aedoni*, 4, 42–43, 69
- Troglodytidae (Wrens), 42–43, 69
- Trogon
- Black-throated (*Trogon rufus*), 16, 68
- Surucua (*Trogon surrucura*), 16, 68
- Trogon
- rufus*, 16, 68
- surrucura*, 16, 68
- Trogonidae (Trogons), 16, 68
- Trogons (Trogonidae), 16, 68
- Tudor, G.
- Batara cinerea*, 21
- Contopus cinereus*, 35
- Dacnis cayana*, 49
- Neothraupis fasciata*, 45
- Pachyramphus polychopterus*, 40
- Sicalis flaveola*, 50
- Tersina viridis*, 48–49, 62
- Tolmomyias sulphurescens*, 34
- Turdus albicollis*, 45
- Turdus nigriceps*, 44
- tung trees (*Vernicia fordii*), 3, 4
- Turdidae (Thrushes), 43–45, 61, 69
- Turdus*
- albicollis*, 44–45, 69
- amaurochalinus*, 44, 69
- leucomelas*, 43, 69
- nigriceps*, 44, 67, 69
- nigriceps sublaris*, 44, 67
- rufiventris*, 43–44, 69
- Tyrannidae (Tyrant Flycatchers), 29–38, 59, 61, 64, 69, 72
- Tyrannulet
- Mottle-cheeked (*Phylloscartes ventralis*), 32, 59, 69
- Rough-legged (*Phyllomyias burmeisteri*), 29, 69
- White-bellied (*Serpophaga munda*), 31, 62, 64, 69
- White-crested (*Serpophaga subcristata*), 31, 62, 69
- Yellow (*Capsiempis flaveola*), 31, 61, 63, 69
- Tyrannus*
- melancholicus*, 37, 69
- savana*, 37–38, 69
- Tyrant
- Cattle (*Machetornis rixosa*), 35–36, 69
- Drab-breasted Pygmy- (*Hemitriccus diops*), 33, 59, 69
- Eared Pygmy- (*Myiornis auricularis*), 33, 59, 69
- Long-tailed (*Colonia colonus*), 35, 69
- Pearly-vented Tody- (*Hemitriccus margaritaceiventer*), 33, 59, 69
- Southern Bristle- (*Phylloscartes eximius*), 22, 32, 59, 64, 69
- Tawny-crowned Pygmy- (*Euscarthmus meloryphus*), 32, 69
- Tyrant Flycatchers (Tyrannidae), 29–38, 59, 61, 64, 69, 72
- Tytonidae, 64
- Urticaceae, 61
- Vanellus chilensis*, 9, 68
- Veniliornis spilogaster*, 19, 68
- Vernicia fordii*, 3, 4
- Villarrica, Paraguay, 58
- Vireo, Red-eyed (*Vireo olivaceus*), 41–42, 57, 69
- Vireonidae (Vireos), 41–42, 69
- Vireo olivaceus*, 41–42, 57, 69
- Vireos (Vireonidae), 41–42, 69
- Volatinia jacarina*, 50, 70
- Vulture
- Black (*Coragyps atratus*), 7–8, 67
- Turkey (*Cathartes aura*), 7, 67
- Vultures, New World (Cathartidae), 7–8, 64
- Warbler
- Golden-crowned (*Basileuterus culicivorus*), 22, 47, 49, 54, 55, 70
- White-browed (*Myiothlypis leucoblephara*), 54–55, 70
- white-eared opossum (*Didelphis albiventris*), 3
- Willis, E. O., 43
- Woodcreeper
- Lesser (*Xiphorhynchus fuscus*), 25, 69
- Narrow-billed (*Lepidocolaptes angustirostris*), 26, 69
- Olivaceous (*Sittasomus griseicapillus*), 24–25, 63, 69
- Plain-winged (*Dendrocincla turdina*), 25, 64, 69
- Planalto (*Dendrocolaptes platyrostris*), 25, 69
- Scalloped (*Lepidocolaptes falcinellus*), 63, 72
- Woodnymph, Fork-tailed (*Thalurania furcata*), 15–16, 62–63, 64, 68
- Woodpecker
- Green-barred (*Colaptes melanochloros*), 19, 61, 68
- Lineated (*Dryocopus lineatus*), 19, 61, 64, 68
- Robust (*Campephilus robustus*), 19–20, 64, 68
- White (*Melanerpes candidus*), 18, 61, 68
- White-spotted (*Veniliornis spilogaster*), 19, 68
- Woodpeckers (Picidae), 18–20, 61, 64, 68
- Wood-quail, Spot-winged (*Odontophorus capueira*), 7, 67
- Wood-rail, Slaty-breasted (*Aramides saracura*), 8–9, 67
- Wood-warblers (Parulidae), 54–55, 70
- Wren, House (*Troglodytes aedoni*), 4, 42–43, 69
- Wrens (Troglodytidae), 42–43, 69
- Xenopinae, 59
- Xenops
- Plain (*Xenops minutus*), 26, 69
- Streaked (*Xenops rutilans*), 26, 69
- Xenops*, 59
- minutus*, 26, 69
- rutilans*, 26, 69
- Xiphorhynchus fuscus*, 25, 69
- Xolmis irupero*, 64, 72
- Ybycuí National Park, 2, 39
- Yellowthroat, Masked (*Geothlypis aequinoctialis*), 54, 70
- yuca (*Manihot esculenta*), 3
- Zelaya, P., 35
- Zenaida auriculata*, 71
- Zink, Robert M., 42
- Zonotrichia capensis*, 52, 61, 70

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