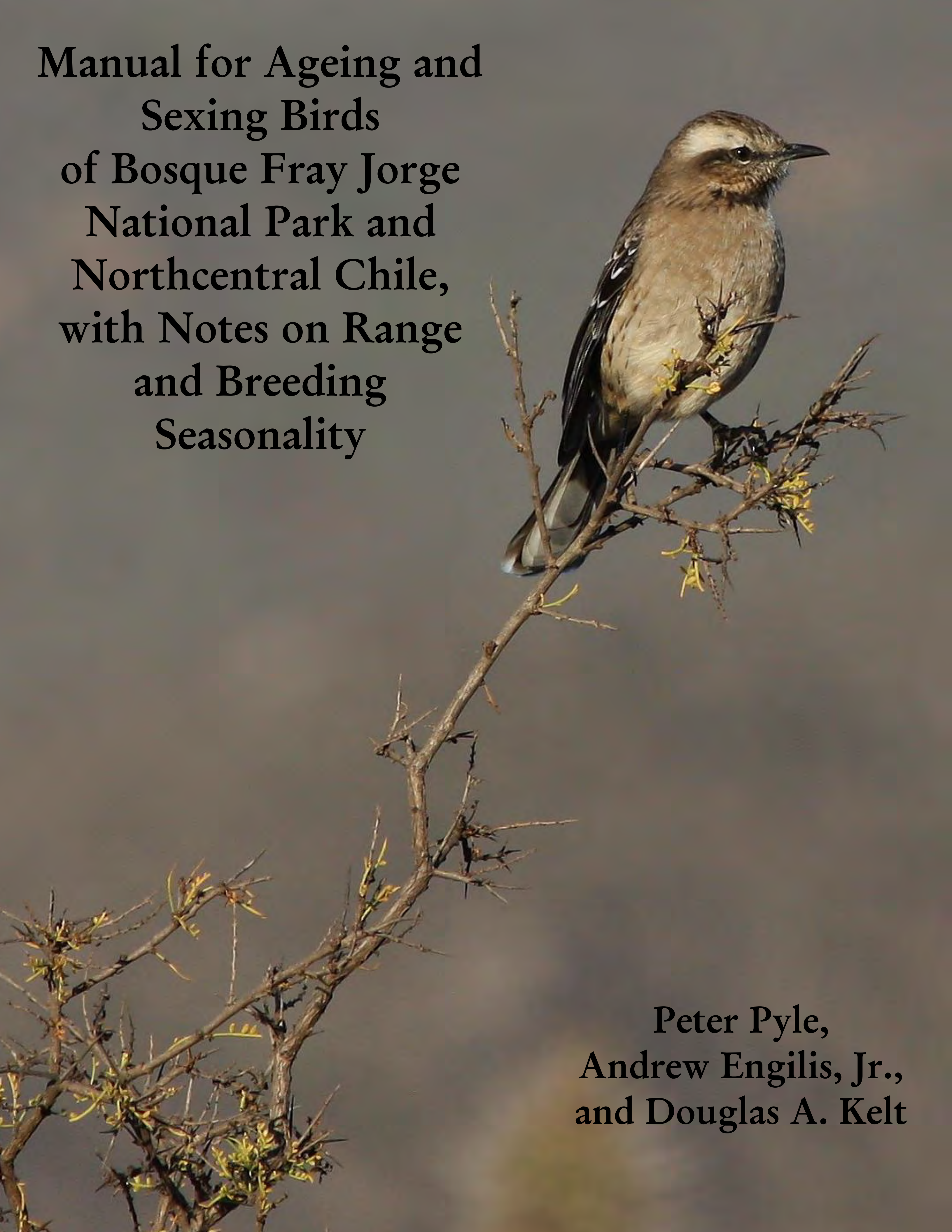
Manual for Ageing and Sexing Birds of Bosque Fray Jorge National Park and Northcentral Chile, with Notes on Range and Breeding Seasonality



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Manual for Ageing and Sexing the Landbirds of Bosque Fray Jorge National Park and North-central Chile, with Notes on Occurrence and Breeding Seasonality

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INTRODUCTION

Bosque Fray Jorge National Park (hereafter "Fray Jorge") comprises 9,959 ha on the coast of Chile's Region IV (Coquimbo), approximately 400 km north of Santiago and 100 km south of La Serena (30°41'S, 71°40'W) (Fig. 1). It is a Biosphere Reserve and has been protected from grazing and disturbance since 1941 (Squeo et al. 2004). As such, it is a biotic oasis surrounded by agricultural and increasingly disturbed terrain (Bahre 1979). The climate is Mediterranean, with ca. 130 mm of annual precipitation measured since 1989 at an on-site meteorological station, 90% falling in winter (May-Sept). Summers are warm and dry, although fog and coastal clouds are common. Vegetation is characterized as coastal matorral steppe (Gajardo 1994), generally spiny and drought-deciduous or evergreen, with heavy shrub cover (ca. 50-60%; Meserve et al. 2009) and understory herbs on a primarily sandy substrate (Gutiérrez et al. 2010).

Long-term research of abiotic effects on productivity of organisms in the matorral habitat of Fray Jorge commenced in 1989 with emphasis on small mammals, plants and, to a lesser degree, insects (Gutiérrez et al 2010). In 2005 we initiated transect counts for birds in the park to help track diversity and abundance in winter, spring, and late summer (Kelt et al 2012). In 2008 we began monitoring avian productivity at the site using captured and banded birds. We used protocols developed for the Monitoring of Avian Productivity and Survivorship (MAPS) program (DeSante et al. 2013) to look for ecological relationships between bird population parameters and biotic and abiotic factors in the park.

The MAPS program assesses bird population sizes and trends as well as vital rates such as reproductive success and survivorship (DeSante et al. 2013). To assess vital rates in the park it was essential to develop criteria for ageing and sexing captured birds, as no such manual exists for Chilean species. Accurate age determination for birds in their first year of life, allowing estimation of productivity, first-year survival, and recruitment, relies on information of molting patterns, a subject that is likewise poorly known for Chilean birds. Avian diversity in Fray Jorge is low owing to the arid environment. Since 2002, our surveys have documented 67 species of birds in the park's matorral habitat. The unofficial checklist for the entire park, as provided by the Corporación Nacional Forestal (CONAF 1998), lists 123 species, including many coastal and water dependent birds. The park is home to 38 species of passerines or near-passerines (or "landbirds"), the focal group of birds for productivity studies. We selected the 29 most-common species, according to point-count data, for inclusion in this manual.

This manual is formatted for use in the field during future years of banding in Fray Jorge. We anticipate that it will evolve as more data are collected, especially on between-year recaptures of known-age birds. Since this is the first banding manual for the country of Chile, we also hope it will serve as a template for future studies beyond the park. Many of the species treated in this manual, or closely related species, are found throughout the country, as well as in Argentina. As biologists at banding stations learn more about ageing criteria of captured birds, we hope that additional species accounts can be added to this manual, expanding its usefulness as a resource throughout Chile and Argentina. As mentioned above, geographic variation in the timing and extents of molts is poorly understood across the southern cone of South America (south of the Tropic of Capricorn), as complicated by the effects of large latitudinal differences in species distribution, ranging from 23 - 67 degrees. This manual represents an introduction to our understanding of molt strategies, timing, and adaptations in the southern cone, as well as age-determination criteria, and will assist not only with productivity studies but also studies in avian migration, diet, ecology, and general life history.

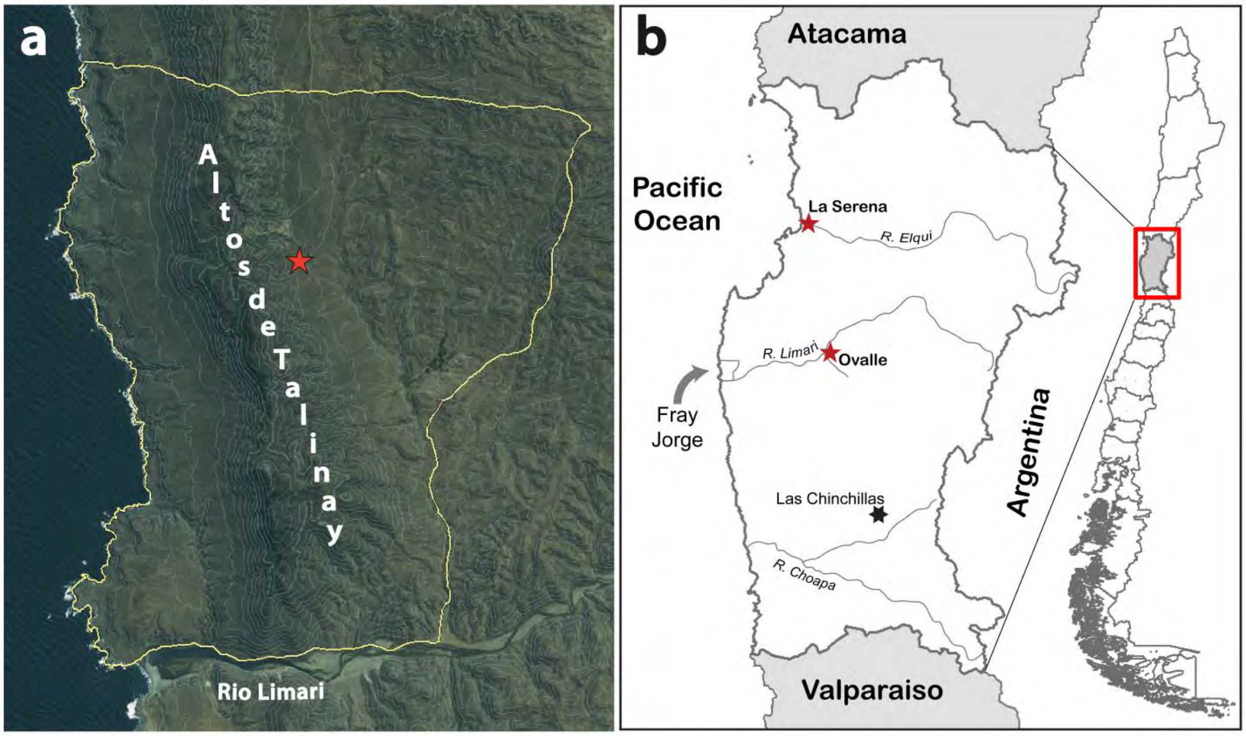

Figure 1. Map of Fray Jorge and environs. a. Aerial image of Fray Jorge superimposed with 50-m topographic lines (the 500-m contour is dashed and thickened for context). Housing within the park is at the red star, which sits at the northern end of the Quebrada de las Vacas. The entrance road can be seen approaching the park at the center of the northern border, and the park administrative offices are in the wooded region that is visible where the eastern park border makes a southwestern diagonal jag. b. Locator map of Chile (right side) and the IV Región de Coquimbo. Red stars indicate two key cities in this region, and Fray Jorge and the Chinchillas National Reserve are indicated. Provinces to the north (Atacama) and south (Valparaiso) are indicated.

METHODS

Protocols for netting and banding birds followed the MAPS program methodology established in North America (http://www.birdpop.org/maps.htm; DeSante et al. 2013). The timing of MAPS banding in Fray Jorge would ideally be within the period 01 October through 31 January of each calendar year, which is the primary breeding season for most species. This can be adjusted according to latitude and elevation of a banding station in other regions of Chile.

Data on molt patterns and age/sex-determination criteria for the 29 target landbird species found at Fray Jorge were obtained from an examination by Pyle of museum skins collected in Chile (and occasionally Argentina). Collections visited included: the Museum of Wildlife and Fish Biology (MWFB), Davis, California; the Field Museum of

Natural History (FMNH), Chicago Illinois; the Museum of Comparative Zoology (MCZ), Cambridge Massachusetts; the Yale-Peabody Museum (YPM), New Haven, Connecticut; the National Museum of Natural History (USNM), Washington, D.C.; the Museum of Vertebrate Zoology (MVZ), Berkeley, California; the California Academy of Sciences (CAS), San Francisco, California; and the Louisiana State University Museum of Natural History (LSUNM), Baton Rouge, Louisiana. All or most specimens of these 29 species were examined at these museums; in certain cases not all specimens were examined form more-commonly collected species, after it was decided that we had sufficient information on molt, age, and sex for the species. Most specimens were sexed by collectors, presumably by gonadal examination, although a small proportion of apparent mis-sexed specimens were encountered. Further information for specimens used in this manual (including collection dates) is available from the research institutions or from on-line databases such as Ornis (http://www.ornisnet.org/) or Vertnet (http://vertnet.org/).

We complemented information obtained from museum specimens with data gathered from mist-netting and banding efforts in Fray Jorge. Six MAPS stations were set up in the park by Engilis and his research team in Oct 2008. They were operated during 15 Oct - 20 Dec 2008 and again from 10 – 20 Sep 2013. During these periods over 1,350 captures were recorded, of which over 1,000 individuals were banded. Standard banding data were collected, including those on breeding characters (brood patch and/or cloacal protuberance), standard measurements (wing chord, tail length, exposed culmen, and weight), molt, plumage, and physical condition of each bird (DeSante et al. 2013). Particular attention was paid to ageing and sexing criteria, based on preliminary evidence from specimen examination along with criteria presented for North American landbirds by Pyle (1997). Over 1,000 images of hand-held birds were obtained, primarily of open wings, to help document molt and age/sex-determination criteria. Many of these were used to develop the 178 figures on bird plumages found in this manual.

Species Accounts

Species taxonomy, sequence, and English names follow those of the South American Classification Committee (SACC 2014). Chilean (Spanish) names follow those of Jaramillo (2003). We have also derived four-letter alpha codes for each species, based on the Chilean name, for use on banding or other data sheets. We recognize that these four-letter codes may not be applicable throughout South America but, in the absence of standardized Spanish names and codes, we have provided these for use at Fray Jorge. Ideally, a full set of four-letter codes (based on Spanish names) and six-letter codes (based on the updated taxonomy of the SACC) can be developed for use by South American ornithologists, as they have in North America (Pyle and DeSante 2014).

For each species we determined numbers of flight feathers from specimens, and we recorded wing chord and tail (from insertion to tip of longest rectrix) lengths on specimens and captured birds following methods of Pyle (1997). Molt information requires precise reference to individual flight feathers in the wing and tail. Many of our species undergo partial preformative molts, and it is important to learn the feather tracts and feather numbering system used for North American birds (Fig. 2); primaries **(pp)** are numbered distally, from innermost **(p1)** to outermost **(p9** or **p10**, depending on the species at Fray Jorge), secondaries **(ss)** are numbered proximally, from outermost **(s1)** to innermost (**s6**, **s9**, or **s10**, depending on the species at Fray Jorge), and rectrices **(r)** are numbered from innermost **(r1)** to outermost (**r5** or **r6**, depending on the species at Fray Jorge) on each side of tail. Among our target species at Fray Jorge, the two hummingbirds have only 6 secondaries (and no or 1 tertial), Striped Woodpecker has 10 secondaries including three tertials (numbered **s8-s10**) and the remaining 26 passerine species have nine secondaries including three tertials (numbered **s7-s9**). An alternative numbering scheme would be to number the tertials from innermost (**t1**) to outermost (**t3**) to preserve feather homology (see Pyle 2013a) but these feathers are not referenced sufficiently enough in this manual to necessitate this scheme.

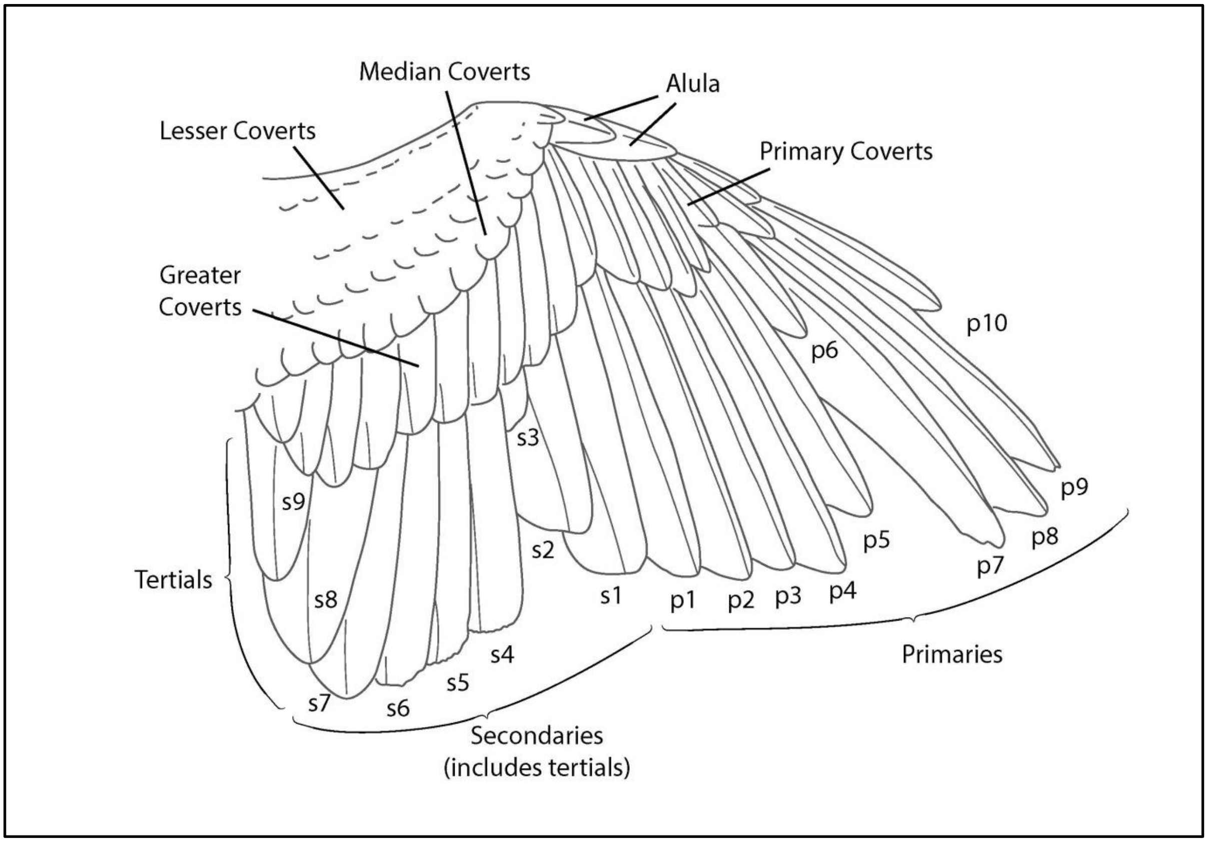

Figure 2. Wing feather topology and numbering of remiges. Redrawn from Pyle 1997.

Age coding using the WRP molt/plumage-based system

Most researchers from north-temperate regions use a calendar-based age classification system to age birds (Pyle 1997, 2008) but this is impractical in tropical or Southern Hemisphere regions where breeding and fledging can occur across calendar years. Therefore, this manual adopts the molt-cycle-based ageing system ("WRP" system) developed by Wolfe et al. (2010), refined by Johnson et al (2011), and based on the molt terminology of Humphrey and Parkes (1959) as revised by Howell et al. (2003). We encourage the reader to be familiar with WRP terminology and age-coding so as to understand their use in this manual (Table 1, Figure 3). Feather-tract terminology, flight-feather numbering (see above), molt terminology, and some abbreviations follow those of Pyle (1997, 2008). Molts referred to in this manual include the Preformative (**PF**), Prealternate (**PA**), and Prebasic (**PB**) molts. Information regarding geographic variation, range and breeding seasonality, movements, molt, age/sex, and biometrics from Hellmayr (1932), Jaramillo (2003), and other species-specific sources (as cited) are summarized in the accounts.

The landbirds of Chile follow two basic molting strategies, the Complex Basic Strategy and the Complex Alternate Strategy (Howell et al. 2003). For species in this manual, the differences between the two regard the number of inserted molts that occur in the first (1 or 2, respectively) and definitive (no or 1, respectively) molt cycles. Understanding this is critical to ageing birds using the WRP system (Table 1, Figure 3).

Table 1. Comparison of cycle-based (WRP) age-classification system codes used in this manual and common equivalents using the calendar-based age-classification system, for the first, second, and definitive molt cycles. Calendar-based age codes are currently recognized by the U. S. Bird Banding Laboratory (BBL) for north-temperate breeding birds. The BBL (http://www.pwrc.usgs.gov/BBL/MANUAL/index.cfm) is currently adopting WRP classification codes as well.

Molt-based age-classification system		Calendar-based age-classification system
FCJ	First molt cycle, juvenile plumage	HY; Hatching year
FPF	First molt cycle, undergoing PF Molt	HY; Hatching year
FCF	First molt cycle, formative plumage	HY/SY; Hatching year/2nd year
FAJ	First or later molt cycle, FCF or DCB	U/AHY; Unknown/After hatching year
FPA	First molt cycle, undergoing 1st PA Molt	SY; 2nd year
FCA	First molt cycle, alternate plumage	SY; 2nd year
SPB	Second molt cycle, undergoing 2nd PB Molt	SY; 2nd year
SCB	Second molt cycle, basic plumage	SY/TY; 2nd year/3rd year
TPB	Third molt cycle, undergoing 3rd PB Molt	TY; 3rd year
DCB	Definitive molt cycle, basic plumage	AHY/ASY; After hatch year/after 2nd year
DPA	Definitive molt cycle, undergoing DPA Molt	ASY; After 2nd year
DCA	Definitive molt cycle, alternate plumage	ASY; After 2nd year
SAB	After 2nd Molt Cycle, basic plumage	ASY/ATY; After 2nd year/After 3rd year
UPB	Unknown molt cycle, SPB or DPB	AHY; After hatching year
UCB	Unknown molt cycle, SCB or DCB	AHY/ASY; After hatch year/after 2nd year
UPA	Unknown molt cycle, FPA or DPA	AHY; After hatching year
UCA	Unknown molt cycle, FCA or DCA	AHY; After hatching year
UPU	Unknown molt cycle, FPF, SPB, or DPB	U/AHY; Unknown/After hatching year
UCU	Unknown molt cycle, FCF, SCB, or DCB	U/AHY; Unknown/After hatching year
UUU	Unknown molt cycle, unknown molt status	U/AHY; Unknown/After hatching year

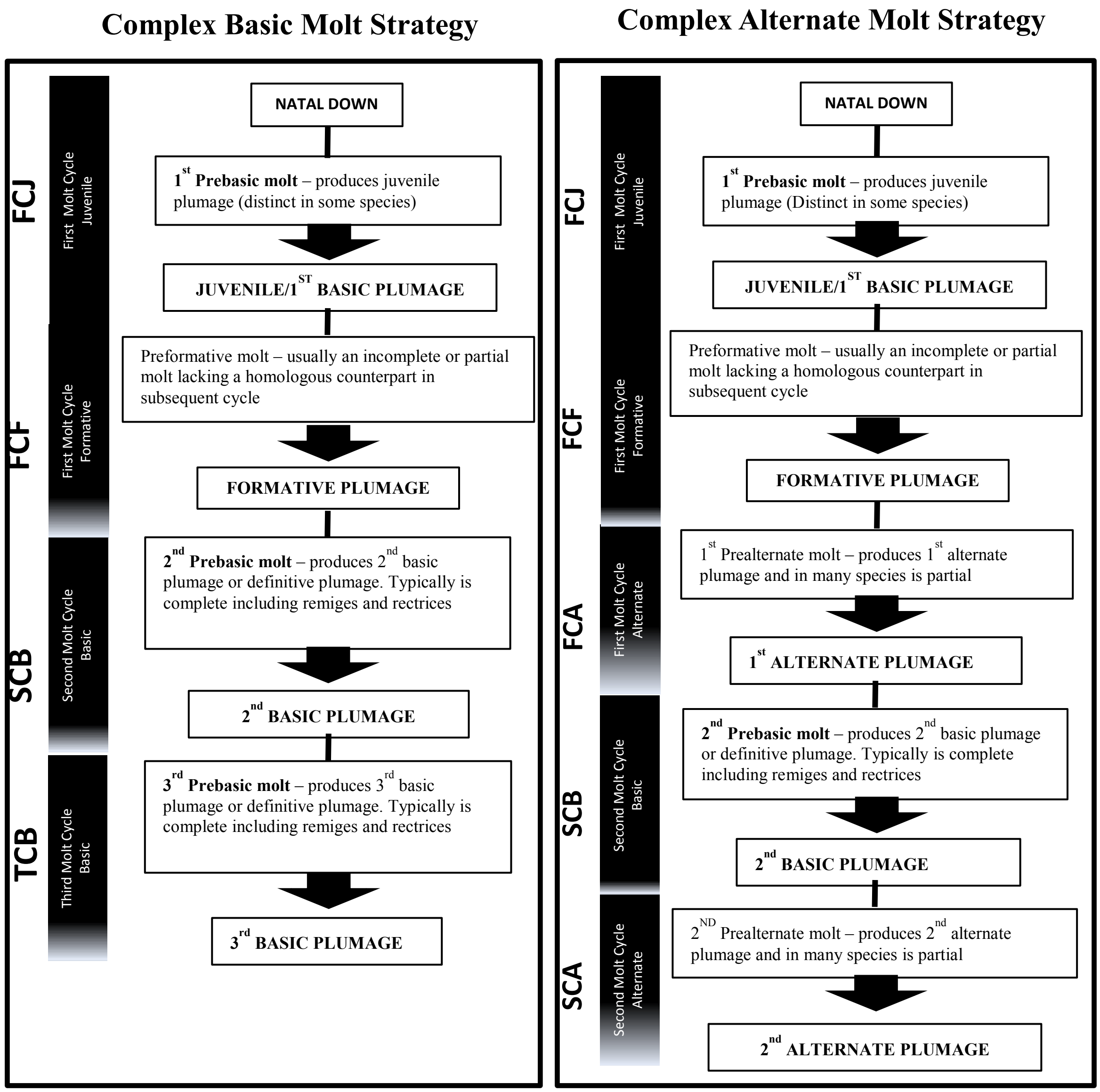

Figure 3. Molt sequence of Complex Basic vs Complex Alternate strategies found in Chilean landbirds. This figure shows the Howell et al. (2003) Modified Humphrey-Parks Molt Cycle terminology (text boxes) aligned with the corresponding molt-based (WRP) plumage terms (black bars). Figure adapted from Wolfe et al (2010).

To age birds with WRP terminology it must first be ascertained whether or not the bird is undergoing a molt. This is best determined in the hand by examining birds for active feather replacement or pin feathers on the body, head, wings, and tail. Second, the plumage sequences and extent of preformative and prebasic molts have to be understood to correctly determine acceptable coding and age bracketing for each species. Species showing the Complex Basic Strategy have a different set of acceptable codes than those showing the Complex Alternate Strategy, species with complete preformative molts have a different set of acceptable codes than those with less-than-complete preformative molts, and species with incomplete prebasic molts have a different set of acceptable WRP codes than those that have complete prebasic molts.

The 29 species treated in this guide can be divided among 4 groups showing different sets of acceptable WRP codes, as follows:

The most common group (Group 1) includes 19 species which exhibit the Complex Basic Strategy (lacking prealternate molts) and have less-than-complete preformative molts and complete prebasic molts. Acceptable WRP codes for these species, in chronological order (Table 1), are FCJ, FPF, FCF, SPB, DCB, and DPB. For these species, FCFs can be distinguished from DCBs by molt limits and flight-feather criteria due to at least some juvenile feathers being retained during preformative molts. Birds undergoing body and/or flight-feather molt between FCJ and FCF are coded FPF, those molting primaries as part of the complete molt from FCF (at about one year of age) are SPBs, and those molting primaries from DCB (at least two years of age) are DPBs. After the complete second prebasic molt (in SPB birds) definitive plumage is reached and SCB cannot be distinguished or coded. Codes UPB and UCU can be used for birds that cannot be distinguished between FPF and DPB, or between FCF and DCB, during and after the prebasic molt, respectively; UPBs are commonly used for birds just completing molt (e.g., the last feathers replaced in typical molt sequence, p10 and/or s6, are growing) when no older-generation feathers remain to distinguish SPB from DPB. Code UPU should be avoided since it is assumed that a partial or incomplete preformative molt (in FPFs) should not be confused with a complete molt (in SPBs, DPBs, or UPBs).

The second-most common group (Group 2) includes 6 species which exhibit the Complex Alternate Strategy (including prealternate molts), and have less-than-complete preformative molts and complete prebasic molts. Acceptable codes for these species, in chronological order (Table 1), are FCJ, FPF, FCF, FPA, FCA, SPB, DCB, DPA, DCA, and DPB. These species follow the same acceptable coding and coding strategies as Group 1 but with the addition of codes covering prealternate molts and alternate plumages. The same molt-limit and flight-feather criteria used to distinguish FCFs from DCBs and SPBs from DPBs in Group 1 species can be used to distinguish FPAs from DPAs and FCAs from DCAs in this group. Codes UPA and UCA are also acceptable, along with codes UCU and UPB as in Group 1.

Three species (Group 3) exhibit the Complex Basic Strategy and have complete preformative and prebasic molts. Acceptable codes for these species, in chronological order (Table 1), are FCJ, FPF, FAJ, and UPB. Following the complete preformative and prebasic molts, FCFs and DCBs cannot be distinguished and should be coded FAJ, a code that should only be used for species with complete preformative molts. Birds molting from FCJ can still be recognized by un-molted juvenile feathers and can be coded FPF; those molting from FAJ can be recognized by un-molted formative or basic feathers and can be coded UPB (unknown between SPB or DPB). Code UCU should only be used for birds not determined between FCJ and FAJ, and code UPU can be used for birds that cannot be distinguished between FPF and UPB.

One species (Group 4), the Striped Woodpecker, exhibits the Complex Basic Strategy (lacking prealternate molts) and has less-than-complete preformative molts and less-than-complete or complete prebasic molts. Acceptable codes for this species, in chronological order (Table 1), are FCJ, FPF, FCF, SPB, SCB, TPB, DCB, SAB, and DPB. This species follows the same acceptable coding and coding strategies as Group 1 but with the addition of codes for distinguishing Second Basic (SCB) and After Second Basic (SAB) plumages. The same molt-limit and flight-feather criteria used to distinguish

FCFs from DCBs and SPBs from DPBs in Group 1 species can be used here, along with codes for SCB, TPB (for birds molting primaries from SCB), and SAB, because second-basic and older birds are identifiable by patterns of retained juvenile or basic feathers in the wing. Codes UCU and UPB are acceptable as in Group 1, code UCB can be used when SCB and DCB are not distinguished, and code UPB can be used for birds where TPB and DPB are not distinguished. Birds following a complete prebasic molt (no juvenile or basic feathers retained) can be coded SAB or DPB, assuming that the SPB is never complete (see Pyle 1997:163-166 for a summary of molt patterns in woodpeckers). Code UPU should be avoided for Group 4 species since it is assumed that a bird undergoing the FPF should not be confused with one undergoing later prebasic molts (SPB, TPB, or DPB) due to the replacement of primaries but not secondaries or primary coverts during the FPF.

As a rule, WRP codes SPB, DPB, and UPB are only applied to birds undergoing symmetrical molt of primaries, whereas codes FPB, FPA, and DPA can be applied to birds undergoing body molt, whether or not flight-feather molt is also occurring. This is because primary molt usually encompasses all or almost all of the body-molting period, and adherence to this rule helps distinguish birds undergoing complete PBs from those undergoing partial or incomplete PFs or PAs, during which body-feather or wing-covert molt but no primary molt (or outer primary but not primary covert molt during eccentric preformative molts) occurs. In the following accounts, note that two migratory species, White-crested Elaenia and Dark-faced Ground-Tyrant, have more-restricted coding at Fray Jorge Park than found in the species as a whole, due to seasonal distributions; certain plumages and molts occur entirely outside of Fray Jorge. They have been assigned to one of the four Groups above based on their overall molting strategy, rather than what is strictly found at Fray Jorge.

The following summary is intended to help define the plumages, molts, and WRP-coding for birds at Fray Jorge, along with expected dates for application of the codes there.

<u>Plumages – No sign of active molt in the bird</u>

FCJ – First-cycle birds in full juvenile plumage. This plumage is found in all four Groups (see above), is distinctive in landbirds, and is held for a short period of time (as short as one month); expected during various periods within Oct-Feb for our target species at Fray Jorge, occasionally in Sep or Mar.

FCF – First-cycle birds in formative plumage. This code is acceptable for Groups 1, 2, 3, and 4, where formative plumage can be distinguished by retained juvenile feathers in the wing and/or tail; expected Jan–Dec (occasionally Dec-Nov, Feb-Jan, or Mar-Feb) for Groups 1 and 4, or Feb–Aug for Group 2 of our target species at Fray Jorge. Note that in Dec (Nov–Jan in certain species) it is important to separate birds in fresh FCF plumage from those in worn FCF plumage as these represent different cohorts (e.g., HY or SY in north-temperate calendar-based coding). For FCFs it is important also to fill out the "feather wear" code (see DeSante et al. 2013) which allows us to estimate whether or not FCF birds are less than (as in HY) or more than (as in SY) six months old at capture, and allowing us to assign these as young or "adult" birds, respectively.

FAJ – After first-cycle juveniles. This code is acceptable only with Group 3 of our target species, which have a complete preformative molt resulting in FCFs and DCBs being indistinguishable by plumage alone; expected Oct–Sep or Mar–Feb for species at Fray Jorge.

FCA – First-cycle birds in first alternate plumage. This code is only acceptable for target species of Group 2 which can be identified by retained juvenile feathers, as in FCF; expected Sep–Jan (occasionally Feb-Mar) at Fray Jorge.

SCB – Second-cycle birds in second basic plumage. This code is only acceptable for target species of Group 4, which can be identified by retained juvenile wing feathers after the second prebasic molt; expected Feb–Dec in one species (Striped Woodpecker) at Fray Jorge.

DCB - Definitive-cycle birds in basic plumage ("adults") that have undergone at least one complete molt; this plumage is then repeated annually in winter for all species and is also the breeding plumage for birds showing the complex basic strategy; it can be distinguished from FCF in all but Group 3 of our target species by uniform wing and tail, lacking retained juvenile feathers. This code is acceptable with our target species of Groups 1 and 2, and as somewhat of an "unknown" code for Group 4, when SCB and SAB cannot be distinguished. DCBs are expected Jan–Dec or Feb–Jan (most species of Groups 1 and 4) or Feb-Aug (Group 2) at Fray Jorge.

DCA – Definitive-cycle birds in alternate plumage. This code is only acceptable for target species of Group 2 which can be distinguished from FCA by the lack of juvenile feathers, as in DCB; expected Sep–Jan at Fray Jorge.

SAB – After second-cycle birds in definitive basic plumage. This code is only acceptable for species of Group 4, as distinguished from SCBs by either uniform or mixed basic feathers in the wing, and lacking retained juvenile feathers found in SCBs. We do not have a code for an SAB that has commenced the next prebasic molt; we code such birds SAB as opposed to DPB to prioritize information on age over that of molt; be sure to fill out the "flight-feather molt" column (see DeSante et al. 2013) for all SABs, to indicate whether or not the bird was undergoing active molt when captured. SAB is expected Feb–Dec only for Striped Woodpecker among our target species at Fray Jorge.

UCB – Unknown cycle, basic plumage. This code is only acceptable for species of Group 4 of our target species (Striped Woodpecker), for birds in which SCB could not be distinguished from DCB; expected Feb–Dec at Fray Jorge.

UCA – Unknown cycle, alternate plumage. This code is only acceptable for species of Group 2 of our target species, for birds in which FCA could not be distinguished from DCA; expected Aug–Jan at Fray Jorge.

UCU – Unknown cycle and plumage. This code is acceptable for all target-species Groups at Fray Jorge, for non-molting birds for which neither cycle nor plumage was distinguished; can be used in all months at Fray Jorge but should be avoided unless birds escape before being examined for molt and age criteria.

UUU – Unknown cycle and plumage, and unknown whether molting or not. This code is acceptable for all species Groups and all months at Fray Jorge for birds that escape before both molt and plumage status are recorded.

Molts – Birds showing active molt, transitioning between plumages

FPF – Birds undergoing the preformative molt, transitioning from an FCJ to an FCF. Acceptable for all four Groups of our target species, for birds undergoing partial or incomplete eccentric preformative molts in Groups 1 and 2 species, birds undergoing complete preformative molts in Group 3 species, and for birds undergoing primary and rectrix molt in Group 4 species (Striped Woodpecker). Note for birds of Groups 3 and 4, FPF should only be assigned to birds undergoing molt of primaries or secondaries other than tertials. FPF is expected in periods within Nov–Apr, occasionally through Jun, at Fray Jorge.

FPA - Birds undergoing the first prealternate molt, transitioning from FCF to FCA. Acceptable only for target species of Group 2 undergoing partial prealternate molts; expected Aug–Sep at Fray Jorge.

SPB, **TPB**, **and DPB** – Birds undergoing the second, third, or definitive prebasic molts, respectively. SPB and DPB are acceptable with species of Groups 1, 2, and 4, and TPB is acceptable with species of Group 4 (Striped Woodpecker) only, for birds undergoing complete or incomplete (Group 4) prebasic molts. These codes should only be used for birds replacing primaries or secondaries other than tertials. These codes are expected Dec–Mar in most species at Fray Jorge; for some species in Nov and/or Apr or later, as well.

DPA – Birds undergoing the definitive prealternate molt, transitioning from DCB to DCA. Acceptable only for target species of Group 2 undergoing partial prealternate molts; expected Aug–Sep at Fray Jorge.

UPB – Birds of unknown cycle undergoing a prebasic molt. Acceptable for all four of our target-species Groups, for molting birds not determined between SPB and DPB or between SPB, TPB, and DPB for Group 4 species; often used at completion of molt when last feathers (e.g., p10 or s6) are still growing. For Group 3 birds this code is used for birds molting from FAJ. Expected Jan–Mar in most species at Fray Jorge; for some species Nov and/or Apr as well.

UPA – Birds of unknown cycle undergoing a prealternate molt. Acceptable for Group 2 of our target species only for molting birds not determined between FPA and DPA; expected Jul–Sep at Fray Jorge.

UPU – Birds of unknown cycle undergoing molt. Acceptable for all four target-species Groups, for molting birds not determined between FPF and DPB; should be avoided for species of Groups 1, 2, and 4 as molting patterns should allow separation of these two age groups; used more often for Group 3 birds, in which both the preformative and the prebasic molts are complete. Expected Jan–Mar in most species at Fray Jorge; for some species Nov and/or Apr as well

UUU – Unknown cycle and plumage, and unknown whether molting or not. See plumage codes, above.

Reproductive cues for determining sex

Banders use many cues other than plumage to help age birds. Cloacal protuberances (**CP**) and brood patches (**BP**) are particularly useful for sexing breeding adults of monochromatic passerines during the breeding season. CPs and BPs are physiological conditions indicating that a bird is actively in its reproductive period (Pyle 1997). A large and swollen CP is only found in males of our target species and indicate that they are reproductively active. Cloacal protuberances can be scored as inactive, partial, or full (Fig. 4; DeSante et al. 2013); note that during non-breeding seasons the cloacal region is similar in males and females and birds cannot be sexed by this trait at these times (Fig. 4). A well-developed BP is usually indicative of an actively incubating female. Some male birds can exhibit a partial BP as well, but it is uncommon in passerines and typically is not as well-developed as that of females (the potential for partial BPs in males of species is noted in this manual). Brood patches typically go through five phases as the breeding season progresses (Fig. 5): 1) feathers are lost on the abdomen; 2) the abdomen becomes swollen and blood vessels become visible; 3) the brood patch reaches the height of its development; 4) the swelling recedes and the skin becomes wrinkled; 5) the abdomen becomes re-feathered. These five codes can be entered in banding data to reflect the progress of the brood patch (DeSante et al. 2013).

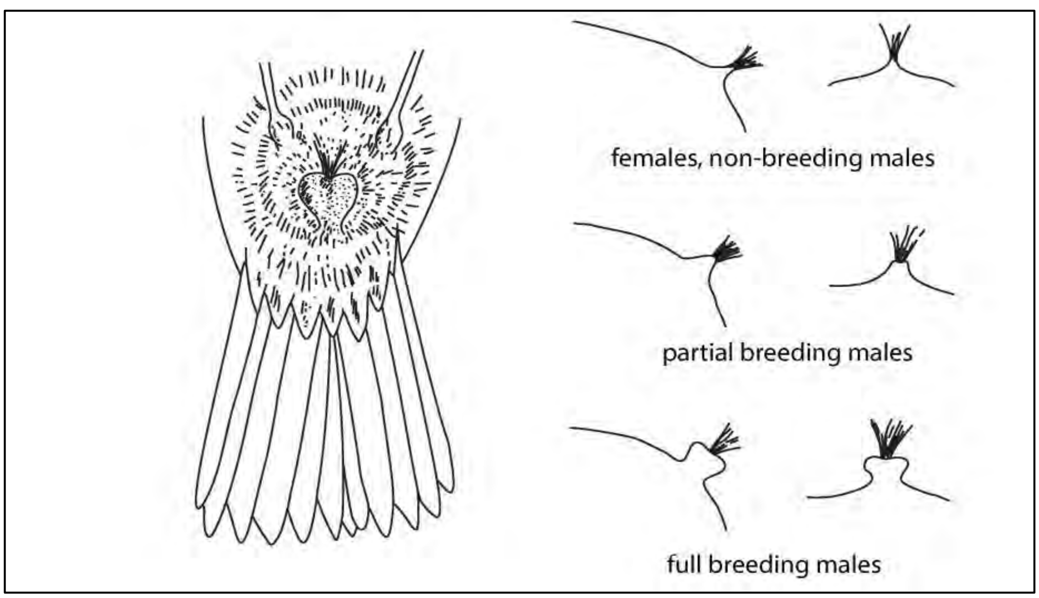

Figure 4. State of cloacal protuberance in birds. Redrawn from Pyle 1997.

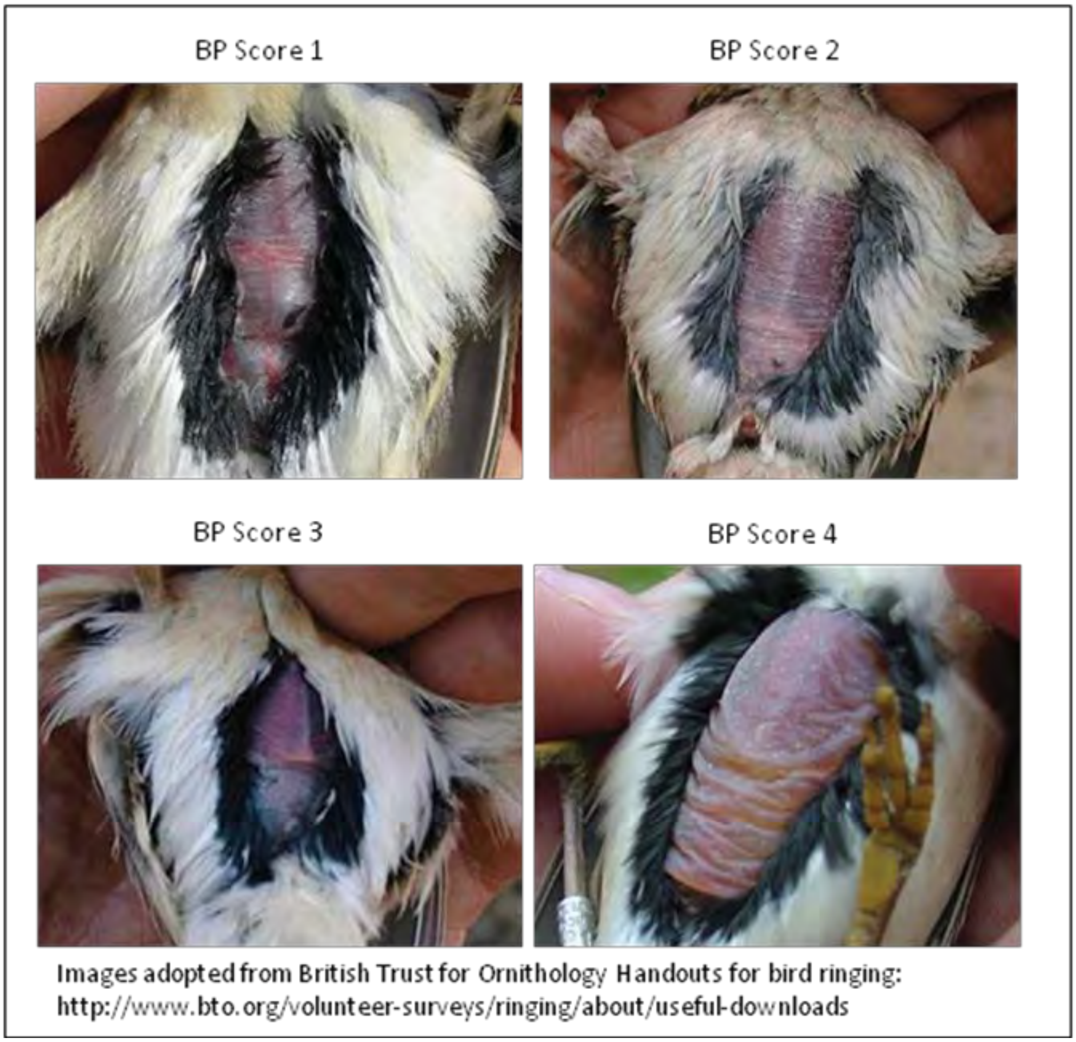

Figure 5. State of brood patches in birds.

Skull Ossification for age determination

"Skulling" is now recognized as being the most reliable technique for ageing passerines in the first 4-6 months after fledging, and in some cases throughout the first year. Banders are encouraged to become proficient at skulling and to skull birds throughout the year to add to our knowledge.

When a fledgling passerine leaves the nest, the section of the skull overlaying the brain (frontals and parietals) consists of a single layer of bone. From this time until the bird is four to 12 months old, a second layer develops underneath the first. The process by which this second layer develops is called skull ossification. The pattern and rate of skull ossification varies both within and among passerine species. The pattern generally follows one of the two progressions (peripheral or median line) illustrated in Figure 6.

Most passerines found with large windows in the ossification of the skull (Fig. 3a-c) can be reliably aged as a

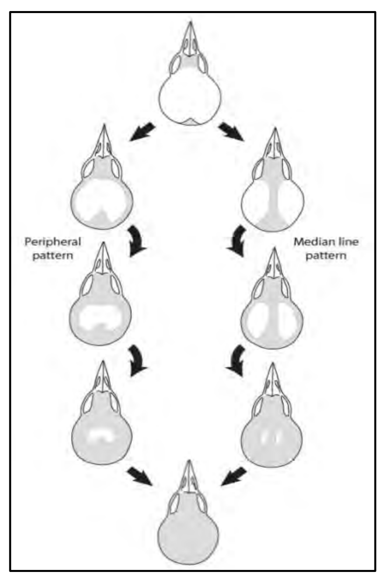

Figure 6. Skull ossification patterns. From Pyle (1997).

bird in the first year of life; however, more-primitive passerines such as ovenbirds (Furnariidae), antbirds (Thamnophilidae), and New World flycatchers (Tyrannidae) may show larger or smaller windows in the skull (Fig. 3c-d) throughout life. Fully ossified skulls (Fig. 3d) are found in adult birds and in first-year birds for various times beginning, typically, 4 to 6 months after fledging, with smaller passerines and those in more-advanced families generally completing ossification earlier than larger and more-primitive species (Pyle 1997). The rate and timing of skull ossification in Chile is poorly understood, and more data from differing times of the year must be gathered to develop timing for reliable ageing of each species based on completion of skull ossification.

ACKNOWLEDGEMENTS

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SPECIES ACCOUNTS

Giant Hummingbird
Patagona gigas

Chilean Name: (Picaflor Gigante)
Banding Code: PIGI

Individuals Examined: 93 specimens (MWFB 3, FMNH 58, MCZ 29, CAS 3); 20 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate and depict two subspecies: *P. g. gigas* of Chile and *P. g. peruviana* of extreme northern Chile, Peru, Ecuador, and Bolivia. *P. g. peruviana* is larger and averages more rufous to the underparts; the nominate *gigas* is found at Fray Jorge and treated here.

Structure and Measurements: 10 primaries, 6 secondaries (1 tertial?), 10 rectrices. For nominate *gigas*: Female (n=12) Wing chord 117-132, tail 65-75, tail fork 14-20, exposed culmen 32-40; Male (n=14) Wing chord 117-131, tail 66-75, tail fork 18-28 exposed culmen 31-40.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate breeding of *gigas* in Chile in the foothills and up to 2,000 m elevation, in Aug–Feb. They depart breeding grounds for most of Mar–Aug, perhaps moving coast-ward, and north and/or east into arid habitats. At Fray Jorge, *P. gigas* is relatively common from Jul–Dec and also are present in Jan to at least Mar, but we lack data to determine their status from Mar–Jul. Park biologists have indicated it is found year round in the park. Nest with single white egg found at Fray Jorge Sep 2013.

Molt: Few or no specimens or captures from Chile occurred during wing molt, suggesting that this part of molt takes place on winter grounds. Specimens from outside of Chile indicate wing molt during much of year but this likely includes subspecies *peruviana*. Based on breeding season of Aug-Feb, *gigas* would likely undergo wing molt from Mar-Aug and this is supported by relative freshness of adults collected or captured in Chile (fresher in Sep-Oct, more worn in Jan-Feb). The PF appears to be partial (unlike smaller migratory North American species with complete PFs) and includes the upperwing secondary coverts and sometimes the tertial (s6) but no other secondaries and no primaries or rectrices (beware some may have complete PFs, especially in more-tropical *peruviana*). One FCJ captured 18 Nov was undergoing moderately heavy body molt but undetermined if this was part of prejuvenile or preformative molt. Sequence of complete molt confirmed as p1 to p8-p10-p9 (p9 last) as in other hummingbirds and secondaries in order s6-s1-s2-s3-s5-s4, so s4 or s5 generally last to be replaced, at about the time p9 is being replaced.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Sep-Mar); FPF (Nov-May); FCF (Jan-Aug); SPB (Mar-Aug); DCB (May-Feb); DPB (Mar-Aug); UCU, UPB, and UUU also acceptable. Bill grooving useful as in other hummingbirds (Pyle 1997:121), generally with deep grooving extending 70-90% of bill length in FCJs, deep to shallow grooving extending 70% to 20% (and declining during Feb-Jan) in FPFs and FCFs, shallow grooving extending 10-25% in some SPBs, and no grooving or shallow grooving of up to 15% in DCBs and DPBs (Fig. 7). Juvenile primaries and secondaries have white tips in distinctive pattern (Figs. 8, 11) that wear off to form distinctly-shaped tips in FCFs by Sep-Jan (Figs. 9, 11) and these likely can be used to age some SPBs (through at least May?). In one-year-old FCFs on breeding grounds there is also no apparent cline in freshness from more-worn p1 to fresher p9-p10 (Fig. 9) as is found in DCBs (Fig. 10). Molt limits among wing feathers, with greener and fresher secondary coverts and sometimes greener s6 contrasting with browner primary coverts and remiges (Fig. 9), can also be used to identify FCFs, whereas DCBs have uniformly fresh wing coverts and inner secondaries (Fig. 10). No differences in shape of rectrices by age detected but tail fork may average deeper in DCB males than in FCJ/FPF/FCFs and females (Fig. 12). Extent of rufous to the underparts seems to average stronger in FCJs than in FCF/DCBs and in females than in males (Fig. 12), but geographic variation in this feature (see above) likely renders this only a supportive rather than a definitive character among *P. g. gigas*. Rectrix shape and pattern appeared to show subtle differences by age/sex group, at best (Fig. 12).

Sex Determination: Tail fork may average deeper and underparts less rufous in DCB males than in FCJ/FCF males and females but these characters may overlap too much to be of use (study needed). Measurements relatively unhelpful for sexing (see above) although tail fork averages deeper in males.

Further Study: Extent of the PF needs confirmation – can it be complete in some individuals? How long into spring can SPBs be aged by bill grooving and/or retention of juvenile primaries? Reliability of tail fork criteria for sexing and ageing needs to be confirmed. A better understanding in variation in rufous wash to underparts by age, sex, season, and population (e.g., within nominate *gigas* or at Fray Jorge) is needed. Can brood patch be used to sex females?

Notes:

Figure 7. Bill grooving on juvenile (FCJ, left, 6 Dec), ~one-yr-old (FCF, center, 21 Oct) and adult (DCB, right, 20 Oct) Giant Hummingbirds. The FCJ individual shows 75% grooving, the FCF individual 35% grooving, and the DCB <5% grooving (as shown by red arrows).

Figure 8. Juvenile (FCJ) Giant Hummingbird (18 Nov) showing fresh wing feathers and white tips to juvenile secondaries and inner primaries (see Figs. 9-12).

Figure 9. One-year-old (FCF) Giant Hummingbird (21 Oct) showing molt limit between greener formative greater coverts and browner juvenile primary coverts, primaries, and secondaries; and uniformly worn primaries and secondaries (compare DCB in Fig. 10). Notches in secondaries and primaries, where white tips used to be, can be seen in some primaries; these can be more prominent in other FCFs (cf. Fig. 11).

Figure 10. Adult (DCB) Giant Hummingbird (20 Oct) showing uniformly green and fresh basic wing coverts, primaries, and secondaries (without molt limits); distal freshness cline in primaries and centripetal (outsides in) cline in secondaries reflects previous protracted molt (compare FCF, Fig. 9).

Figure 11. From left to right, fresh FCJ (6 Dec), medium-worn FCF (May), worn FCF (16 Sep) and worn DCB (Sep) Giant Hummingbirds showing wing patterns by age. Note the highly notched inner primaries on the worn FCF reflecting where the white tips of these juvenile feathers have worn off.

Figure 12. Juvenile (FCJ, left, 18 Nov), FCF female (center, 21 Oct), and DCB male (right, 20 Oct) Giant Hummingbirds. Underparts appear to average more rufous in FCJs than in FCF/DCBs and in females than males but there is overlap, and individuals of northern populations are more rufous overall than those of southern populations. Note also deeper tail fork of DCB male. Differences in shape and pattern of rectrices by age/sex are subtle at best.

Green-backed Firecrown
Sephanoides sephanoides

Chilean Name: Picaflor Chico
Banding Code: PICH

Individuals Examined: 76 specimens (MWFB 14, FMNH 40, MCZ 29, MVZ 2, CAS 1); 36 captures.

Geographic Variation: None (Hellmayr 1932).

Structure and Measurements: 10 primaries, 6 secondaries (1 tertial?), 10 rectrices. Female (n=7): Wing chord 56-62, tail FCJ 30-34, DCB 37-42, exposed culmen 15-18; Male (n=22): Wing chord 60-65, tail FCJ 31-35 DCB 37-43, exposed culmen 14-17.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate breeding throughout most of Chile, from sea level to 2,000 m elevation. At least some populations are partially migratory, undergoing seasonal or elevational movements, while other populations may be resident (Hellmayr 1932, A. Jaramillo pers. comm). In Fray Jorge, males are highly territorial in Jul–Sep, suggesting a resident population. Many fresh juvenile specimens and captures in Oct-Mar, along with other capture data, suggest higher incidence of breeding in spring but breeding may occur at some level year-round at northern latitudes in Chile. In addition, breeding seasonality may be linked to flower phenology which is highly dependent on rainfall patterns, perhaps protracting breeding season in Fray Jorge until spring and early summer. Re-nesting might also occur in the park during wet conditions and resulting abundance of food.

Molt: No captures and only three specimens examined in flight-feather molt (one female 31 Jan at p6, one female 24 Feb from Argentina at p7, one DCB male collected 17 May mid-molt from Patagonia). Freshness of feathers and breeding information otherwise indicates most molt may take place in Nov-Jul, perhaps with some aseasonal flight-feather molting at any time of year. Many captures of FCJ/FCFs undergoing body molt in Nov may indicate that body molt occurs prior to primary molt, or that a PA may be involved (as in Ruby-throated Hummingbird *Archilochus colibri*; Pyle 2013b), although we do not assume this in age coding. Lack of apparent pre-definitive (FCF, non-FCJ) breeding males in late fall/winter suggests that the PF is complete, as in other small hummingbirds, and that breeding males may be either FCF or DCB (and thus should be age-coded FAJ). There is no reason to suspect that wing molt does not proceed in typical sequence for hummingbirds, as described under Giant Hummingbird.

Age Determination (Group 3, pp. 7-8): Tentative acceptable age coding: FCJ (primarily Oct-Dec); FPF (primarily Nov-Jul); FAJ (Oct-Sep); UPB (primarily Nov-Jul); UCU, UPU, and UUU also acceptable. Bill grooving appears to be useful as in other hummingbirds (Pyle 1997:121, Fig. 7), generally with deep grooving extending 70-90% of bill length recorded in FCJs (Nov-Dec), deep to shallow grooving extending 70% to

20% (and declining during Nov-Apr) in FPFs; and no grooving or shallow grooving of up to 10% in FAJs and DPBs. FCJs lack red feathers on head and have rufous-fringed juvenile crown, back, and throat feathers (Fig. 13; males and females similar). FAJ females are similar but have little or no rufous fringing to upperpart feathers and have throat more heavily spotted and without rufous wash (Fig. 14). FPF males (recorded Nov-Jan but likely occur through Jul) with partial red crown (Fig. 15) that may molt in slowly. FAJ males have full red crown (Fig. 15). Males molting wing feathers with old red crown feathers or molting old to new red crown feathers can be aged DPB. Juvenile and female rectrices paler gray with dark band, whereas these feathers greenish and with little or no band in formative/basic male rectrices (Fig. 16).

Sex Determination: FCJ males and females lack red in crown (Figs. 13-15); FPF, FAJ, and DPB males have red in crown (Fig. 15). FPFs and FAJs without rufous-fringed juvenile feathers and without red in crown can be sexed female. Standard measurements marginally helpful for sexing (see above); females also can appear to have more elongated foreheads and bills in the field (A. Jaramillo, pers. comm.).

Further Study: A better understanding of molt timing and how it affects age/sex coding is needed.

Notes:

Figure 13. Juvenile (FCJ, 2 Nov) Green-backed Firecrown showing rufous fringed upper-part (particularly crown) feathers and rufous wash to the throat (compare FAJ F, Fig. 14). Males and females indistinguishable until crown feathers begin to molt.

Figure 14. Adult (FAJ, 3 Nov) female Green-backed Firecrown showing lack of rufous fringed upperpart feathers or rufous wash to the throat (compare Fig. 13). Birds in this plumage can be reliably sexed as females.

Figure 15. Molting (FPF) males (18 Nov upper left, 25 Nov upper right, and 2 Nov lower left), showing different progressions of crown replacement, and FAJ male (30 Nov, lower right) Green-backed Firecrowns.

Figure 16. Undertail pattern in FAJ female (left, 3 Mar), FCJ/FCF male (center, 4 Mar), and FAJ male (right, 13 Mar). This pattern overlaps broadly in female and FCJ male rectrices, but differ in formative/basic rectrices of FAJ males.

Striped Woodpecker
Veniliornis lignarius

Chilean Name: Carpinterito
Banding Code: CARP

Individuals Examined: 36 specimens (MWFB 2, FMNH 17, MCZ 17); 5 captures.

Geographic Variation: Not substantial (Hellmayr 1932).

Structure and Measurements: 10 primaries (p10 reduced), 10 secondaries (3 tertials), 12 rectrices (r6 reduced). Female (n=11): Wing chord 86-94, tail 55-61, exposed culmen 19-22; Male (n=20): Wing chord 87-97, tail 54-62, exposed culmen 21-24.

Range and Breeding Seasonality: Ranges throughout central and southern Chile, from sea level to 2,000 m elevation (Hellmayr 1932, Jaramillo 2003). Not known to be migratory. Feather wear patterns of specimens and capture data indicated expected (given range) austral breeding season in Oct-Dec. It is a resident and breeds in Fray Jorge.

Molt: One specimen collected in primary molt (p5 growing, 29 Feb) and wear patterns on other specimens indicate molt occurs following breeding (as expected), probably spanning Dec-Mar. Molt extent and sequence during PF, SPB, and DPB appear typical of woodpeckers (Pyle 1997:163-166), perhaps averaging more complete than in most North American species. The PF includes primaries, rectrices, usually all greater coverts (but up to 7 outer feathers can be retained in about 20% of birds), and usually no tertials (but up to the 2 inner tertials, s9-s10, can be replaced). The SPB appears usually to be complete (including all secondaries replaced, as opposed to incomplete in many North American woodpeckers) except for inner or medial primary coverts retained while 3-4 outer coverts are replaced (n=4). The DPB appears often complete, all secondaries replaced and all primary coverts replaced in most birds, with about 40% retaining some primary coverts in "mixed basic" patterns (Pyle 1997:165).

Age Determination (Group 4, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Dec-Mar); FCF (Feb-Dec); SPB (Dec-Mar); SCB (Feb-Dec); TPB (Dec-Feb); DCB (Feb-Dec); DPB (Dec-Mar), SAB (Feb-Dec); UCU, UPU, UPB, UCB, and UUU also acceptable. Ageing generally follows Pyle (1997:163-166) for North American woodpeckers. FCJ has diffuse, scattered red feathers in forecrown (Figs. 17-18), probably in both sexes but averaging more in males than females (Pyle 1997:184, but confirmation needed), and longer and more blunt p10 (Pyle 1997:172), although this difference is not as substantial for Striped Woodpecker as for North American species (Figs. 18, 20, 22). Juvenile rectrices also appear to have more white than basic rectrices (Fig. 19) but variation in each case needs to be documented. FCF has molt limits between juvenile (with more irregular white markings) and formative (with more regular circular white spots) greater coverts in some individuals and uniformly juvenile primary coverts (Fig. 20); occasionally molt limits may also occur in the tertials. Iris color in this genus is typically grayish-brown to dull red in FCJs, FPFs, and FCFs but deeper red in DCBs and iris color in these plumages and SCBs should be investigated for this species. SCBs can be identified by having 3-4 (probably 2-5 overall) replaced second-basic outer primary coverts contrasting with a block of at least 3-4 retained juvenile proximally (Fig. 21); birds molting out of this plumage can be aged TPB. Older birds have uniform wing coverts and secondaries (DCBs, Fig. 22), or sometimes have two generations of basic primary coverts not markedly contrasting and not in the retention positions described above (SABs); birds molting out of either of these plumages should be coded DPB. Some birds may be hard to distinguish between FCF and DCB and should be aged UCU, or between SCB and DCB and should be aged UCB.

Sex Determination: FCJs may not be reliably sexed, although red feather tipping in crown (Figs. 17-18) may average more in males than females, as in North American species (Pyle 1997:184). Thereafter, FPF (with crown pattern sufficiently developed) and all subsequent plumages have a patch of red feathers at the nape in males whereas females have this area completely black (Fig. 17). Measurements largely unhelpful for sexing, male averaging larger wing and bill lengths (see above).

Further Study: Variation in crown pattern in juveniles by sex needs to be investigated. Eye color variation by age needs to be confirmed.

Notes:

Figure 17. Crown patterns in FCJ male (left, 15 Dec), FCF male (center, 3 Feb), and FCF female (right, 6 Feb) Striped Woodpeckers. Crown patterns by sex are similar in FCF, SCB, and DCB individuals.

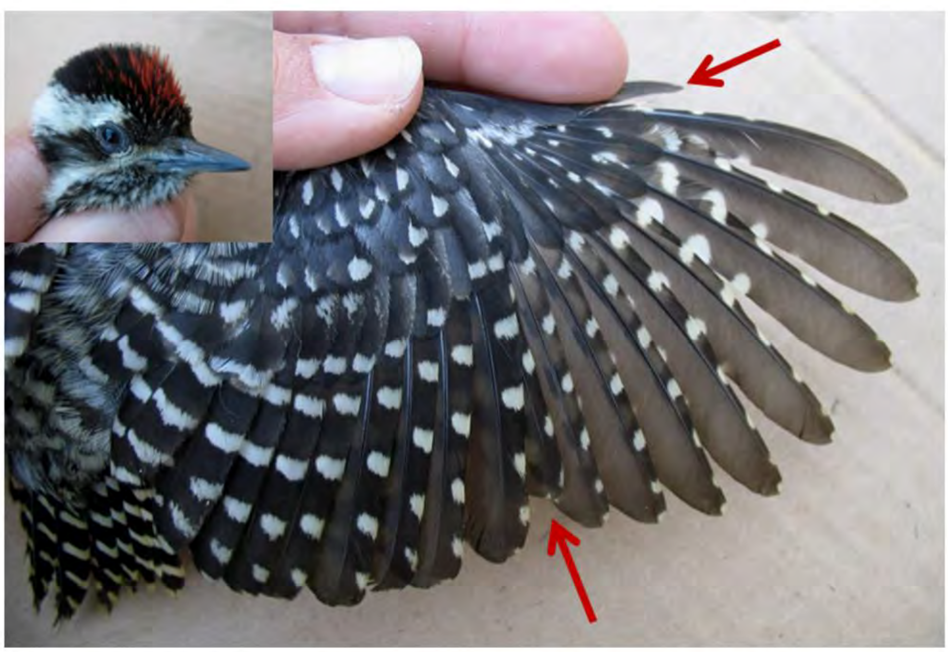


Figure 18. Crown pattern and wing of FPF (30 Nov) Striped Woodpecker, just beginning PF molt (p1 growing). Note juvenile secondary coverts (compare molt limits in Fig. 14) and longer and blunter p1, not shown well in this image.

Figure 19. Rectrices of DCB (left, 3 May) and FCJ (right, 15 Dec) Striped Woodpecker showing more white in juvenile than in basic rectrices.

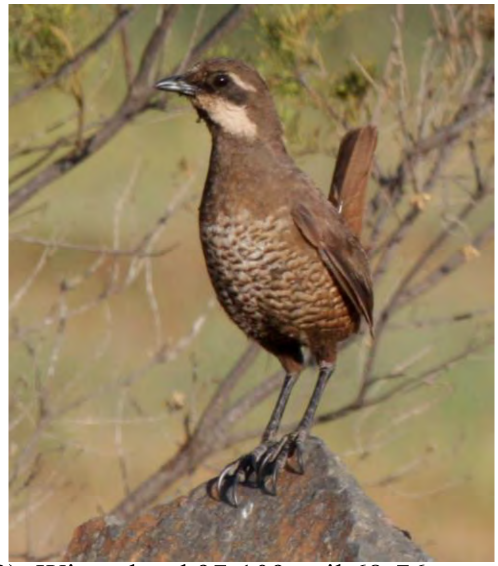
Figure 20. Wing of FCF (30 Oct) Striped Woodpecker, showing inner replaced 3-4 greater coverts, contrasting with more-worn outer 6-7 juvenile greater coverts, and uniformly brown and juvenile primary coverts. Note also the spikier p10 as compared with that of the FCJ in Fig. 18.

Figure 21. Wing of SCB Downy Woodpecker from North America, showing uniformly basic greater coverts and outer 3 primary coverts replaced, contrasting with at least 4 medial juvenile primary coverts. This pattern is also shown by SCB Striped Woodpeckers, which have shown 3-4 replaced outer primary coverts (n = 4).

Figure 22. Wing of DCB (2 Nov) Striped Woodpecker, showing uniform greater coverts, primary coverts, and secondaries.

Moustached Turca

Pteroptochos megapodius



Chilean Name: Turca
Banding Code: TURC

Individuals Examined: 36 specimens (LSUMN 1, FMNH 10, MCZ 25); 2 captures.

Geographic Variation: None indicated by Hellmayr (1932) and Jaramillo (2003).

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=14): Wing chord 94-105, tail 65-73; Male (n=13): Wing chord 97-109, tail 68-76.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be mostly resident up to 2,500 m elevation, with some down-slope migration from areas of snow in winter. Eggs of one nest were collected in early Oct (Hellmayr 1932). It is resident in Fray Jorge with nesting occurring in Oct (two nests observed with young). *P. megapodius* is endemic to Chile.

Molt: Wear patterns on adult specimens indicate PBs take place primarily in Dec-Feb, after breeding, as expected; no specimens examined that were collected during this complete molt. One DCB specimen (MCZ 287961) had retained basic s4 on left wing – could indicate an occasional incomplete molt or it may have been anomalous. Molt limits in wing and tail indicate the PF is partial-incomplete, probably mostly Nov-Mar (one Mar specimen with tertials being replaced). FCFs had replaced the inner 2 to all greater coverts, 0-3 tertials, and it appears all rectrices in most individuals. Replacement of underpart feathers may also be protracted or incomplete as some FCFs have mixed or scattered feathers with juvenile patterns, perhaps retained juvenile feathers, but perhaps more likely early-replaced formative feathers showing juvenile characters. Some newer-looking rufous feathers on the upper breast of some birds might indicate a limited PA but could well also be result of protracted and suspended molts. Acceptable age coding assumes that retention of secondaries during PBs is anomalous and that no PA occurs.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Dec); FPF (Nov-Mar); FCF (Jan-Nov); SPB (Dec-Feb); DCB (Jan-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJ has buffier underparts with indistinct scalloped pattern and rufous tips to tertials (Fig. 23) and pale bases of the bill (Fig. 24). The PF appears to be protracted or perhaps does not include all underpart feathers, so presence of underpart feathers with juvenile pattern (Fig. 24) indicates FCF in Apr-Nov, whereas DCB has distinct brown-and-white bars (Fig. 23). The pale base to the bill is useful for FPF and FCF but for an unknown length of time. FCFs also show molt limits among the greater coverts and/or tertials (Fig. 25) and/or may have all three tertials juvenile and showing rufous tips (Fig. 23), if not worn off. Wings of DCB are uniform and show no molt limits, and outer primaries are broader and fresher than in FCF (Fig. 26). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Sex Determination: Males and females appear to be similar in all plumages. Measurements largely unhelpful for sexing, males averaging slightly longer wing and tail lengths than females (see above).

Further Study: Underpart pattern in FCFs – is it mixed juvenile and formative feathers or a unique formative plumage? How long do FCFs retain a pale base to the bill?

Notes:

Figure 23. FCJ Moustached Turca (17 Dec) showing juvenile underpart pattern (left bird in left image) and rufous tipped tertials (right image). Throat and lower underparts of DCB (6 Jul) quite distinct (right bird in left image).

Figure 24. FPF Moustached Turca (9 Nov) showing mixed juvenile (wavy buff-and-brown bars) and formative (straight white-and-brown bars) feather patterns to the underparts; some may keep juvenile-like feathers through Mar-Nov. Note also the pale-based bill characteristic of FCJ and FCF.

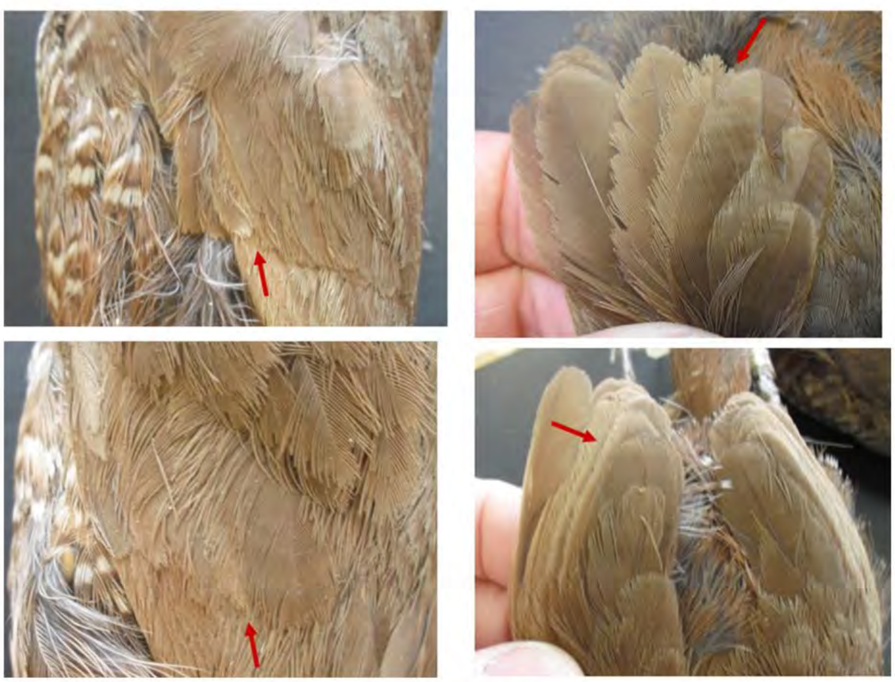


Figure 25. FCJ Moustached Turcas showing molt limits (indicated by red arrows) in greater coverts (left,14 Nov upper and 8 Aug lower) and tertials (right, 6 Jul upper and 15 Aug lower).

Figure 26. Outer primary shape in FCF (above, 8 Aug) and DCB (below, 8 Aug) Moustached Turcas showing more pointed and worn feathers in FCF than in DCB, on the same date of collection.

White-throated Tapaculo
Scelorchilus albicollis

Chilean Name: Tapaculo
Banding Code: TAPA

Individuals Examined: 35 specimens (MWFB 3, FMNH 15, MCZ 14, MVZ 3); 3 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate and depict two subspecies; *S. a. atacamae* to the north and nominate *albicollis* to the south. The northern *atacamae*, found at Fray Jorge, is smaller and shows grayer upperparts; measurement data (above) are for this subspecies.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=9): Wing chord 70-78, tail 66-72; Male (n=7): Wing chord 75-80, tail 68-75.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species is resident and that eggs are laid in Oct-Nov. In Fray Jorge it is found year-round and has been documented nesting in Sep–Nov, with young observed being fed through Dec. As with other matorral adapted species, nesting season is dependent on rainfall patterns. *S. albicollis* is endemic to Chile.

Molt: Wear patterns on adult specimens indicate PBs probably take place in Dec-Feb, after breeding, as expected; no specimens collected during this complete molt were examined. Molt limits in wing and tail difficult to infer due to soft feathers but differences in patterns between presumed FCFs and DCBs (see Age Determination) indicate the PF is partial, with all greater coverts and rectrices replaced, and 1-3 tertials replaced in most birds. The PF probably also occurs in Dec-Mar, or so, as in other austral-breeding resident species.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Jan); FPF (Dec-Mar); FCF (Feb-Dec); SPB (Dec-Feb); DCB (Feb-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJ has more finely barred underparts and buff/white tips to tertials, wing coverts, and rectrices (Fig. 27). FCFs appear to replace all greater coverts but retain the primary coverts and 1-2 tertials (usually) and the well-marked juvenile pattern on these feathers can be used for ageing (Figs. 28-29). Beware, though, that some DCBs appear to show remnants of these juvenile tertial patterns and some FCFs may show juvenile tertials without markings, while others may show formative feathers with more markings than found in DCBs; study needed. DCBs seem to consistently lack markings to primary coverts (Figs. 28, 30) and show weaker or no markings to tertials (Fig. 29-30; see above). Greater coverts show distinct black subterminal bands and white tips on both FCFs and DCBs (Fig. 30). Outer primary shape, as in Moustached Turca (Fig. 26), also appears to be of use in separating FCF from DCB. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers; beware many may need to be aged UCU or UPB.

Sex Determination: Males and females appear to be similar in all plumages. Measurements largely unhelpful for sexing, males averaging slightly longer wing and tail lengths than females (see above).

Further Study: How variable are tertial and primary coverts on juvenile, formative, and basic feathers? How often is alula retained during PF and can differences in markings be used in ageing (all groups have marked alula).

Notes:

Figure 27. Underparts of FCJ (left bird in upper left image, 26 Nov) and DCB (right bird, 8 Feb) and rectrices (lower left) and wing (right) of FCJ (4 Nov) White-throated Tapaculos. The wing and tail markings may be variable in both age groups and the greater coverts and rectrices appear to be replaced at the PF, so not useful for ageing FCF.

Figure 28. Primary coverts of FCF (left) and DCB (right) White-throated Tapaculos (both 16 Sep) showing juvenile markings on former but not latter. Beware this might be variable in both age groups and that the pale markings can wear off.

Figure 29. Tertials of presumed FCF (left, 2 Jun) and DCB (right, 16 Sep) White-throated Tapaculo. Most FCFs may retain 1-3 tertials with juvenile patterns but beware that DCBs can also show similar but remnant patterns to tertials (and rectrices).

Figure 30. Wing of DCB White-throated Tapaculo (17 Nov) showing more distinct brown-and-white pattern to greater coverts (similar in replaced formative feathers of FCF) and lacking markings to primary coverts (compare Fig. 27).

Dusky Tapaculo
Scytalopus fuscus

Chilean Name: Churrín del Norte
Banding Code: CHNO

Individuals Examined: 43 specimens (MWFB 4, FMNH 29, MCZ 15, USNM 5); 6 captures.

Geographic Variation: Hellmayr (1932) treats *fuscus* as a subspecies of *S. magellanicus*, which ranges to the south of *fuscus*. Hellmayr indicates that *fuscus* averages slightly darker and larger than *magellanicus* but that both taxa are variable and have individuals showing traits of the other taxon. Jaramillo (2003) and others elevate both to full species and we follow this here, although molt, age, and sex criteria appear to be similar in the two taxa and specimen examination included both species. A separate taxon (species or subspecies?) related to *magellanicus* may occur at high elevations of the Andes (>2,500 m) separated geographically from *fuscus* (A. Jaramillo, pers. comm.). Otherwise no variation within *fuscus* has been reported, though it likely clines toward *magellanicus* (becoming paler) in the southern portion of its range.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=8): Wing chord 45-53, tail 28-37; Male (n=16): Wing chord 47-56, tail 30-40.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that this species is resident and that eggs are laid in Oct-Nov. In Fray Jorge this is a secretive breeding species; yearlings have been netted in Nov. It occurs both in higher-elevation forests and in matorral washes lined with shrubs such as *Baccharis*.

Molt: Wear patterns on adult specimens indicate that the PBs take place in Dec-Feb, after breeding, as expected; no specimens collected during this complete molt were examined. Molt limits generally indicate that the PF is partial, probably occurring mostly in Nov-Mar, but limits appear to be subtle. FCFs appeared to have replaced few if any wing coverts or tertials, although one specimen (MCZ 18146 of *magellanicus*) appeared to have retained the outer three greater coverts (Fig. 35). Otherwise, FCFs appeared to have brown retained wings for the most part. One DCB male (MCZ 287946) appeared to have replaced tertials on both wings, maybe indicating a PA but study needed (age coding does not assume a PA).

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Dec); FPF (Dec-Mar); FCF (Feb-Dec); SPB (Dec-Feb); DCB (Feb-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJ is overall brown, with male similar to female in plumage (Fig. 31). FCF is highly variable, with upperparts varying from FCJ-like to DCB-like in females and FCJ-like to mixed brown and slate or mostly slate in males (Fig. 31-32). Underparts show similar trends but tend to be more FCJ-like in both sexes (Fig. 31). FPFs and FCFs are best aged by very brown wings including buff-brown tips or markings to greater coverts and tertials, contrasting with darker brown (female) or blackish (male) scapulars and back (Figs. 31-33). DCBs are dark brown overall in females and blackish overall in males (Figs. 31-32). DCBs do not have buff tips to wing coverts and tertials but can have some markings in some birds (Fig. 34). Some individuals appear to be DCB except to have some brown markings to the ventral region; these could be SCBs (not assumed in coding) or just represent variation in plumage among DCBs including older birds. Look also for some FCFs with molt limits within greater coverts, and beware that tertials may get replaced in DCBs as part of a DPA (not assumed in age coding) or suspended DPB (Fig. 35). Also, occasional individuals of *S. magellanicus* show white in the crown (Fig 35; see Hellmayr 1932 and Jaramillo 2003), and this could also occur in *fuscus*. Specimen evidence indicates that these may occur in DCBs only and that it can occur in both sexes. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers; beware many will need to be coded UCU and UPB. Study needed. Measurements largely unhelpful for sexing, males averaging slightly longer wing and tail lengths than females (see above).

Further Study: Can first-year birds and/or adults have a PA1/DPA and if so how prevalent is this? Can some SCBs be identified by looking like DCBs but with brown bars in ventral region? Does white in the crown occur in *S. fuscus* and, if so does it only occur in DCBs?

Notes:

Figure 31. Underparts and upperparts of Dusky Tapaculos (collected Dec-Mar): from right to left: FCJ female, FPF male, DCB female, FCF female, two FCF males (showing variation), and DCB male.

Figure 32. Back and tertial patterns of DCB female (left, 12 May), FCF male (center, 26 May), and DCB male (right, 2 Jun) Dusky Tapaculos; note especially retained juvenile tertials in FCF male as compared with basic tertials in DCB female.

Figure 33. Wing of FCF male Dusky Tapaculo (15 Nov) showing retained juvenile greater coverts with black subterminal band and brownish tip, contrasting with some replaced slaty median coverts (compare Fig. 34).

Figure 34. Wing of DCB male Dusky Tapaculo (15 Nov) showing basic greater coverts and tertials with less-distinct contrasts to those of juvenile feathers (compare Fig 33). DCB female is similar but dark brown instead of blackish.

Figure 35. FCF male Dusky Tapaculo (left, undated) showing apparent molt limit among greater coverts, the 3 outer coverts retained; DCB male (center, Jan) showing replaced tertials, perhaps part of a PA or suspended PB; and DCB female (Dec) showing white in crown. Study needed on the regularity of these patterns regarding age and sex determination.

Common Miner
Geositta cunicularia

Chilean Name: Minero
Banding Code: MINE

Individuals Examined: 35 specimens (FMNH 15, MCZ 20); 0 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate four subspecies in Chile and specimens of six others from other countries examined. Most specimens (all at MCZ) were of *G. c. fissirostris*, the subspecies occurring at Fray Jorge. The paler subspecies *deserticolor* occurs to the north of Fray Jorge and may influence the appearance of birds in the park or, possibly, disperse into the park post-breeding. Measurement data below are based on *fissirostris*.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=12): Wing chord 87-97, tail 46-52, exposed culmen 17-20; Male (n=7): Wing chord 88-99, tail 47-54, exposed culmen 17-20.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that this species is resident. *G. c. fissirostris* breeds primarily in Oct-Jan in xeric habitats of the coastal slope, with two clutches often attempted, one peaking in early Oct and the second in mid-Dec (Hellmayr 1932). This species is rare inside the park but is regular outside the park in grazed and fallow fields with low vegetation. It is a resident species.

Molt: Wear patterns on adult specimens indicate that PBs probably take place primarily in Feb-Mar, after breeding, as expected, but evidence from wear clines indicate protracted molt may take place in Feb-May or even Feb-Aug, spanning non-breeding season. However, two specimens at MCZ were collected in mid wing molt 16 Sep and 27 Oct (Fig. 36) – both appear to be molting from FCF to SCB – are puzzling in respect to timing. Possibly these were non-breeders that commenced molt early due to lack of breeding constraints or, alternatively, this may be completion of protracted and complete or incomplete PF as in some North American *Empidonax* flycatchers (e.g., Pyle 1997:220). We suspect the former, as resident species usually do not show this sort of protracted and suspended molt (but see DCB). Molt limits and juvenile rectrices on many FCF specimens indicate that the PF is usually partial, probably occurring primarily in Jan-Apr; worn FCFs were also collected in Oct-Jan. All FCFs had replaced all greater coverts and at least s8, and most had replaced all three tertials (s7-s9). One FCF specimen was replacing the entire tail in sequence (but no other flight feathers) on 5 Apr, indicating that the PF can include all rectrices, but most individuals appear to replace none or just the central two feathers.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Jan-Apr); FCF (Mar-Dec); SPB (Sep-May); DCB (Mar-Jan); DPB (Feb-May); UCU, UPB, and UUU also acceptable. FCJs have pale rufous fringes to back feathers and FCJ/FPF/FCFs are generally paler and more bleached than DCB/DPBs due to both baseline plumage coloration and increased wear (Fig. 23). Molt limits between newer formative greater coverts and 1-3 tertials, and older primary coverts, primaries, and remaining secondaries indicate FCF (Fig. 37-38). Rectrix shape and wear is also useful (Fig. 39), but beware at least occasional FCFs can replace all rectrices during PF in Mar-May and cannot be aged by this character. Molting SPBs can be aged by worn formative wing feathers being replaced. DCBs show relatively fresh and uniform wing feathers (Fig. 38) and darker patterns to the tail by sex (Fig. 39). Some DCBs also have wear clines apparent, based perhaps on protracted molts, from more worn p1 to fresher p10, s1 appearing fresher than p1 (Pyle 2008:21), and s6 appearing much fresher than s7 as in Red-eyed Vireo (Pyle 1997:288-290). Birds molting out of this plumage are DPBs. FCJ/FPF/FCFs have more uniform-looking (worn in FCFs) primaries and secondaries, with inner secondaries and outer primaries more worn simply due to greater exposure.

Sex Determination: Once aged, it appears that distinctness and tone to the dark rectrix tips is sex-related, FCJ/FPF/FCF/SPB females showing the palest and least distinct tips, followed by FCJ/FPF/FCF/SPB males and DCB/DPB females, and then DCB/DPB males showing the darkest and most distinct tips (Fig. 39). Range of variation within each class and degree of overlap between classes require further study, and beware of FCF/SPBs that have replaced all rectrices (see Molt). Measurements unhelpful for sexing (see above).

Further Study: What subspecies occur at Fray Jorge? How often are all rectrices replaced during the PF and how variable is the number replaced? How reliable are rectrices for sexing once age (generation of the rectrices) has been determined? Is the PF partial and primarily in Jan-Apr or can it be protracted through summer/fall and be incomplete to complete (why were two apparent SPBs molting in Sep-Oct)?

Notes:

Figure 36. From left to right, fresh FPF female (24 Nov), worn SPB female (27 Oct), fresh DCB female (27 Apr), and worn DCB male (8 Jan) Common Miners, showing relative color and freshness of upperparts and shape/pattern of rectrices by age, sex, and season.

Figure 37. FCF Common Miner (5 Apr) showing molt limit between replaced tertials (s7-s9) and older secondaries (e.g., s6). FCFs can replace one (s8), two (s8-s9) or all three (s7-s9) tertials during the PF.

Figure 38. FCF (left, 27 Oct) and DCB (right, Jun) Common Miner showing differences in primary covert wear, although note the FCF is also more worn than the DCB based on season of collection.

Figure 39. Rectrices of fresh FPF female (upper left, 24 Nov), worn FCF female (upper right, 27 Oct), fresh DCB female (lower left, 27 Apr), and worn DCB male (lower right, 8 Jan) Common Miners showing shape/pattern of rectrices by age, sex, and season. FCF males (not shown) might be expected to show narrow feathers as in the FCF females but a pattern more like the DCB female.

Patagonian Forest Earthcreeper
Upucerthia saturatior

Chilean Name: Bandurilla de los Bosques
Banding Code: BAND

Individuals Examined: 27 specimens (FMNH 2, MCZ 24, USNM 1); 1 capture.

Geographic Variation: *U. saturatior* was formerly considered one of 3-4 subspecies of Scale-throated Earthcreeper *U. dumetaria* (Hellmayr 1932, Jaramillo 2003) but has now been elevated to full species status (Areta and Pearman 2009). Populations are migratory, populations wintering to the north and/or down-slope from breeding areas.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=12): Wing chord 95-105, tail 72-80, exposed culmen (chord) 28-35; Male (n=10): Wing chord 95-104, tail 73-79, exposed culmen (chord) 28-36.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that southern and Andean populations of *U. dumetaria* (including *saturatior*) breed in Oct-Jan and migrate to non-breeding grounds for Feb-Sep. In Fray Jorge, *U. saturatior* is a winter resident, occurring in May–Sep. Breeding occurs to the north and uplsope of the park but is undocumented in the park; the species is unrecorded in eight years of Oct-Jan point counts, but is regular in Aug point counts.

Molt: No specimens collected while in molt were examined, but wear patterns indicate PBs take place primarily in Feb-May or possibly Feb-Aug spanning non-breeding season in some birds (although several Jun DCBs were fresh). Some evidence from wear clines indicates that these molts are protracted and therefore likely take place after migration on non-breeding grounds. Molt limits and juvenile rectrices on many FCF specimens indicate that the PF is usually partial, probably occurring mostly Jan-Apr. All FCFs had replaced all greater coverts and most had replaced 1-3 tertials. Several were replacing rectrices in Apr; one FCF apparently had replaced all rectrices, but most worn FCFs appeared to have replaced none or just the central two (as in *Geositta*).

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Jan-Apr); FCF (Mar-Jan); SPB (Feb-May); DCB (Apr-Jan); DPB (Feb-Jun); UCU, UPB, and UUU also acceptable. FCJs are paler and have faint streaks to the nape (Fig. 40). FCFs best separated from DCBs by molt limits between newer formative greater coverts and often 1-3 tertials, and older primary coverts, primaries, and remaining secondaries (Figs. 41-42). Rectrix shape and wear also useful (Figs. 43-44), but beware at least occasional FCFs may replace all rectrices during the PF in Mar-May and cannot be aged by these. Molting SPBs can be aged by very worn formative wing feathers being replaced. DCBs show relatively fresh and uniform wing feathers (Figs. 41, 44). Some DCBs also may have wear clines apparent based on protracted molts (Fig. 44), such that there are clines from more worn p1 to fresher p10 and more-worn s1 to fresher s6, with s1 appearing fresher than p1 and s6 appearing much fresher than s7 (Pyle 1997:288-290, 2008:21). Birds molting from this plumage are DPBs. FCJ/FCFs have more uniform-looking (worn) primaries and secondaries, without molt clines or contrasts, and with inner secondaries and outer primaries more worn due to greater exposure (Figs. 41-43).

Sex Determination: Males and females appear to be similar in all plumages. Measurements unhelpful for sexing (see above).

Further Study: How often are all rectrices replaced during the PF and how variable is the number replaced? How long into spring can SPBs be aged by retention of juvenile primaries?

Notes:

Figure 40. FCJ (left, Dec) and FCF (right, Aug) Patagonian Forest Earthcreepers, showing difference in upperpart color and pattern; DCBs are similar to FCFs in this respect.

Figure 41. Primary coverts and wing of more worn FCF (left, 13 Aug), fresher FCF (center, 23 Jun), and fresh DCB (right, 23 Jun) Patagonian Forest Earthcreepers, showing differences by age.

Figure 42. FCF (10 Apr) Patagonian Forest Earthcreeper, showing molt limit in the tertials, the inner two (s8-s9) fresher than the outer tertial (s7).

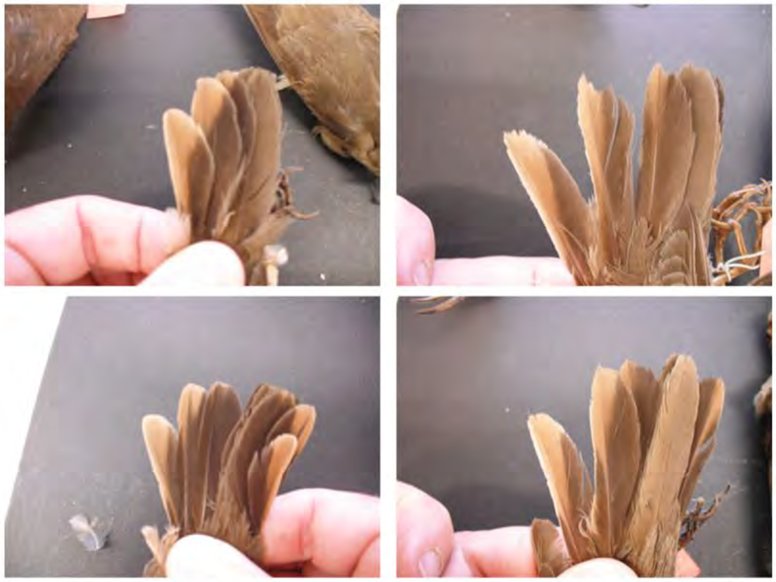
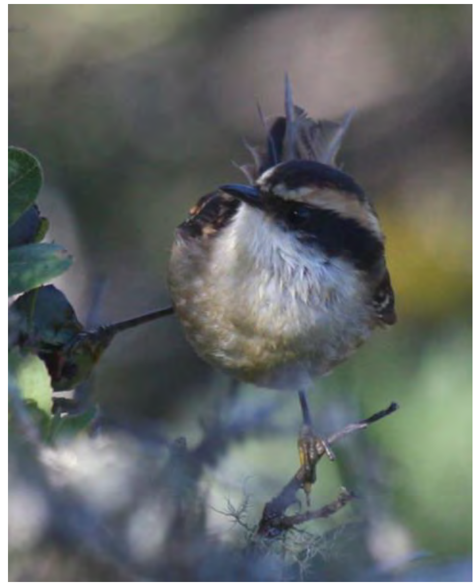


Figure 43. Outer rectrices shape and wear in FCJ (upper left, Dec), FCF (upper right, 13 Aug), fresh DCB (lower left, 23 Jun), and worn DCB (lower right, 18 Nov) Scale-throated Earthcreepers. Occasional FCFs replace rectrices during the PF, which resemble those of DCBs.

Figure 44. DCB (13 Sep) Patagonian Forest Earthcreeper showing uniform basic wing and tail feathers. Note molt clines in wing, the feathers appearing fresher and darker from p1 to p10 and from s1 to s6; s6 also appears much fresher than s7. This indicates a previous protracted molt of remiges which is not the case in FCFs.

Thorn-tailed Rayadito
Aphrastura spinicauda



Chilean Name: Rayadito
Banding Code: RAYA

Individuals Examined: 76 specimens (MWFB 4, FMNH 34, MCZ 20, USNM 18); 0 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate most of Chilean population is of nominate form, with 1-2 insular populations that show darker underparts. The nominate *spinicauda* is found at Fray Jorge and treated here.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=14): Wing chord 54-60, tail (excluding spine) 53-62; Male (n=15): Wing chord 58-64, tail (excluding spine) 55-65.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that this species is largely resident but that there may be some movement to the north for the non-breeding season of Apr-Sep. This species breeds primarily in Oct-Jan, with two clutches often attempted, one in mid-Oct and the second in mid-Dec (Hellmayr 1932). In Fray Jorge this species is generally restricted to the beech forest remnants at higher elevations in the park where it is sedentary and common; it is very rarely encountered in matorral scrub. Some birds visit ornamental *Eucalyptus* plantings around park dwellings.

Molt: Two collected molting middle primaries on 11 Jan and 11 Feb, and wear patterns on adult specimens indicate PBs take place primarily in Dec-Feb, earlier than some other resident breeding species, and perhaps reflecting quicker breeding or molting on or near breeding grounds, as opposed to on non-breeding grounds. Some FCFs undergoing tertial molt in Jan indicate that this molt takes place shortly after fledging as well. The PF appears to include 2-7 greater coverts and 1-2 tertials but no other flight feathers.

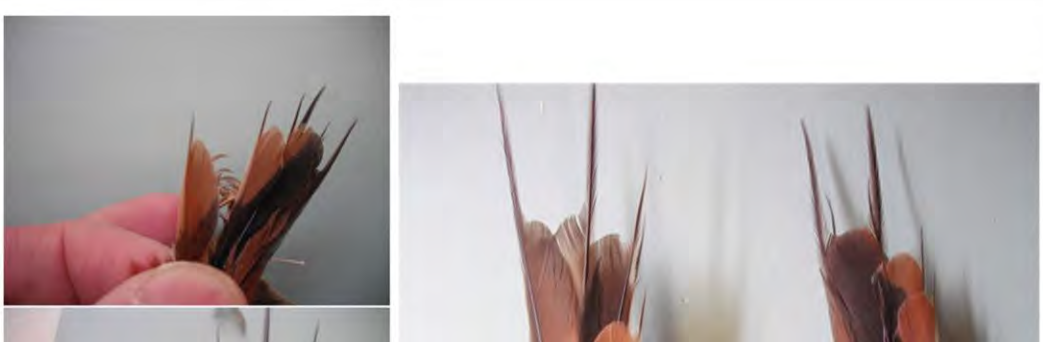
Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Dec); FPF (Dec-Feb); FCF (Jan-Dec); SPB (Dec-Feb); DCB (Jan-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJs are similar in appearance to later plumages and probably best aged by other criteria (feather freshness, skull, gape, etc.). Molt limits occur in FCFs but these are subtle (feathers are soft) and pseudolimits among tertials make molt limits difficult to infer in this tract (Fig. 45-46). Primary coverts average slightly paler and browner in FCFs than in DCBs (Fig. 45). Shape of rectrices also appears to be subtly narrower on juvenile feathers of FCFs than on basic feathers of DCBs, and become paler in FCFs by Sep-Dec (Fig. 47). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Many may have to be left un-aged (UCU or UPB) based on plumage criteria alone.

Sex Determination: Males and females appear to be similar in all plumages. Wing chord appears useful for determining sex in half or more of individuals (see above).

Notes:

Figure 45. Outer greater coverts and primary coverts of FCF (upper, 1 Mar) and DCB (lower, 8 Mar) Thorn-tailed Rayadito showing weaker juvenile greater coverts and slightly paler brown primary coverts in FCF.

Figure 46. Molt limit in tertials of FCF Thorn-tailed Rayadito after replacement of inner two secondaries (s8-s9). Beware that these feathers are naturally darker forming pseudolimit in DCBs, so confirm this limit on quality differential, as shown here, not just on coloration.



Plain-mantled Tit-Spinetail
Leptasthenura aegithaloides

Chilean Name: Tijeral
Banding Code: TIJE

Individuals Examined: 62 specimens (MWFB 8, FMNH 15, MCZ 30, MVZ 2, USNM 7); 76 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate four subspecies in Chile varying primarily in shades of upperpart and underpart coloration. Nominate *aegithaloides* most common, is found at Fray Jorge, and is treated here.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=12): Wing chord 53-61, tail 75-96; Male (n=14): Wing chord 54-62, tail 77-100.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that this species is resident. *L. a. aegithaloides* breeds primarily in matorral areas of the foothills (sea level to 2200 m) and breeds in Oct-Jan, with two broods, one peaking in mid-Oct and the second in late Dec (Hellmayr 1932). In Fray Jorge, it is resident and breeds, young birds netted and observed from late Sep to early Nov. Occurs in family groups in the post-breeding period (Engilis and Kelt 2011)

Molt: Wear patterns on adult specimens and molting birds (e.g., both fresh basic and birds completing molt 1 and 17 Mar) indicate that the PBs probably take place primarily in Feb-Mar, after breeding. Molt limits and juvenile rectrices on many FCF specimens indicate that the PF is usually partial, probably mostly in Jan-Apr. All FCFs had replaced all greater coverts and at least s8, and most had replaced s7-s9. Juvenile rectrices appear to be retained; look for the central pair to occasionally be replaced.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Jan-Apr); FCF (Feb-Jan); SPB (Feb-Mar); DCB (Mar-Jan); DPB (Feb-Mar); UCU, UPB, and UUU also acceptable. FCJs have brown crowns with little or no rufous streaking (Fig. 48). Molt limits between newer formative greater coverts and 1-3 tertials, and older primary coverts, primaries, and remaining secondaries can be used for ageing FCF but this can be subtle and some intermediates will be difficult or impossible to age by these characters (Figs. 49-51). DCBs may also show a pseudolimit in tertials. Rectrix shape and wear more pointed and worn in FCF than DCB, may be the best criteria for ageing (Fig. 52). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Sex Determination: Males and females appear to be similar in all plumages. Measurements unhelpful for sexing (see above).

Notes:

Figure 48. FCJ (left, 16 Feb) and DCB (right, 17 Mar) Plain-mantled Tit-Spinetail, showing difference in crown plumage. FCF birds resemble DCB in this feature.

Figure 49. Worn FCF (3 Nov) Plain-mantled Tit-Spinetail showing older primary coverts and most remiges, contrasting with newer formative greater coverts and s8 (probably).

Figure 50. Worn DCB (28 Oct) Plain-mantled Tit-Spinetail showing uniform wing feathers and no contrast between greater and primary coverts or within tertials (s9 may have been replaced adventitiously).

Figure 51. Primary coverts of worn FCF (left, 2 Dec) and moderately worn DCB (right, 30 Aug) Plain-mantled Tit-Spinetails showing differences in wear and pattern.

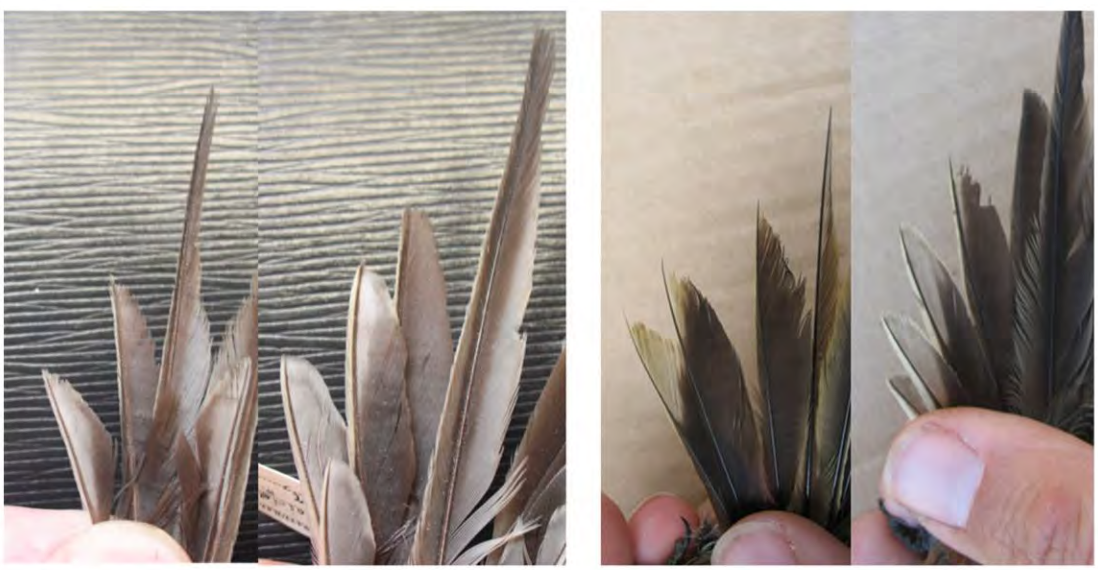


Figure 52. Rectrices of moderately fresh FCF (left, 11 Apr) and DCB (second from left, 18 Apr), and worn FCF (second from right, 3 Nov) and DCB (right, 17 Nov) Plain-mantled Tit-Spinetails showing differences in shape and wear.

Dusky-tailed Canastero
Pseudasthenes humicola

Chilean Name: Canastero
Banding Code: CANA

Individuals Examined: 51 specimens (MWFB 4, LSUMN 1, FMNH 20, MCZ 22, USNM 4); 49 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate and depict two subspecies, northern *P. h. humicola* and southern *polysticta*, differing only slightly and clinally in color (the latter slightly paler). *P. h. humicola* is found at Fray Jorge but both subspecies are combined in this account.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=13): Wing chord 56-65, tail 63-77; Male (n=10): Wing chord 58-66, tail 68-79.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate that this species is resident and Hellmayr indicates that eggs are laid in Sep. In Fray Jorge, it is resident and breeds, eggs have been documented by mid Sep, and young being fed in mid-Oct. *P. humicola* is endemic to Chile.

Molt: Wear patterns on adult specimens indicate PBs take place primarily in Dec-Feb, after breeding, as expected; no specimens examined were collected during this complete molt. Molt limits in wing and tail indicate that the PF is partial-incomplete, probably occurring mostly in Nov-Apr (two Apr specimens were completing rectrix molt). FCFs had replaced the inner 6 to all greater coverts, 0-3 tertials, and apparently all rectrices in most individuals, although partial rectrix molt might also be expected. Worn rectrices can be more pointed imparting a “spine-tail” appearance (characteristic of related species of genus *Asthenes*).

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Dec); FPF (Nov-Apr); FCF (Dec-Nov); SPB (Dec-Feb); DCB (Jan-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJ has a rufous rump, rufous-edged greater coverts, and more extensive rufous to the outer rectrices, r5-r6 (Fig. 53). The greater coverts and rectrices are usually replaced during the PF so these criteria are not useful for ageing FCF, although look for some FCFs to retain some outer coverts and rectrices. Molt limits between newer formative greater coverts and 1-3 tertials, and older primary coverts, primaries, and remaining secondaries useful for ageing FCF (Figs. 54-56). DCBs have more uniform wing feathers including more rufous to the edge of the primary coverts, and lack limits among wing coverts and tertials (Fig. 55). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Sex Determination: Males and females appear to be similar in all plumages. Measurements are unhelpful for sexing; the tail perhaps averaging slightly longer in males (see above). Care should be taken in assessing brood patch as birds of both sexes exhibit BP-like skin on the belly even during the winter and non-breeding months.

Further Study: Can rectrices be retained during the PF, especially the more distinct juvenile r5 and r6? BP and CP criteria need to be confirmed to help refine their use in determining sexes.

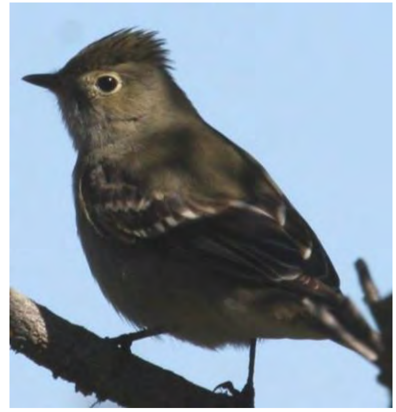
Notes:

Figure 53. FCJ Dusky-tailed Canasteros (captured or collected in Oct-Nov) showing rufous rump (left bird in left image), rufous-edged greater coverts (upper right), and increased rufous in outer rectrices (left bird in lower left). These feathers are entirely or largely replaced during the PF.

Figure 54. FCF Dusky-tailed Canastero (29 Oct) showing worn juvenile primary coverts and other wing feathers and replaced formative s8 (red arrow).

Figure 55. FCF Dusky-tailed Canastero (no date) showing all three tertials replaced, formative, contrasting with juvenile secondaries and primaries (compare Fig. 56).

Figure 56. DCB Dusky-tailed Canastero (28 Nov) showing uniformly fresh secondary and primary coverts and no limit here or among the tertials (compare Fig. 55).



White-crested Elaenia
Elaenia albiceps

Chilean Name: Fío-fío
Banding Code: FIFI

Individuals Examined: 59 specimens (MWFB 15, FMNH 38, MCZ 16); 28 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate and depict two subspecies in Chile, *E. a. chilensis* of most of the country and *modesta* of extreme northern Chile and other countries, which is slightly larger and shows darker and duller crown and wing bars and may be resident, whereas *chilensis* is migratory. The latter is found at Fray Jorge and treated here.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=17): Wing chord 70-76, tail 55-64; Male (n=30): Wing 73-80, tail 58-68.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate subspecies *chilensis* to be a long-distance migrant, being absent from Chile in Mar-Sep, and breeding there in Nov-Feb. In Fray Jorge, it is found from mid-Sep to Mar, settling on territories by early Oct; birds netted in Sep were not reproductively active. Birds with high fat loads have been recorded in Oct, perhaps migrants moving southward through the park; similar possible northward migrants have not been recorded in Mar-Apr. Breeds in thickets and ornamental plantings in the park.

Molt: No specimens collected during molt, or captures of molting birds in Chile observed; all evidence points to molt on the non-breeding grounds in the Amazon Basin, and thus northward migration occurs during FCJ and worn FCA and DCA plumages, and arrival into Chile occurs in fresher FCA and DCA plumages. Specimens from non-breeding grounds (some labeled *chilensis* but most not identified to subspecies) indicate that some can complete the primary molt in Apr-Jun whereas others are molting primaries as late as Aug-Sep (see below). All birds in Chile have fresh outer primaries and rectrices indicating that these feathers are replaced during the PF. The only feathers not replaced during the PF appear to be the primary coverts, and at least in some birds, inner primaries (among p1-p4) and outer secondaries among (s1-s3) in eccentric pattern (Fig. 59). Molt patterns thus appear similar to some North American *Empidonax* flycatchers and it might be possible that birds completing molt in Apr-Jun are undergoing the DPB whereas those completing it in Aug-Sep are undergoing the PF, as in Willow (*E. traillii*) and Yellow-bellied (*E. flavescens*) flycatchers (Dickey and van Rossem 1938; Pyle 1997:220-228). Most birds had replaced 1-3 tertials for a second time (Figs. 58-61), indicating a PA of at least these feathers, as is also the case with *Empidonax* flycatchers. It is assumed that most or all migrants to Chile are in alternate plumage.

Age Determination (Group 2, pp. 7-8): Acceptable age coding at Fray Jorge: FCJ (Dec-Mar); FPF (Mar-Apr); FCA (Oct-Mar); DCA (Sep-Mar); UCA also acceptable. Outside of Chile, FPFs are found through Aug, FCFs can occur in Jul-Aug, SPBs in Feb-Jun, DCBs in May-Aug, and DPBs in Feb-Jun; with UCU, UPB, and UUU also acceptable. In Chile, FCJ is fresher than other plumages at this time, has a yellower wash to the upperparts and underparts, darker mustard-tinged wing bars (whitish in other plumages), faint streaks to the back, and a darker orange lower mandible, and lacks the whitish crown patch (Fig. 57). Otherwise, ageing to FCA and DCA is best accomplished with molt limits in the wings. FCAs show contrasts between browner juvenile primary coverts and fresher formative greater coverts (Fig. 58) but beware that this can be hard to decipher in some individuals. Some FCAs will also show up to 7 juvenile inner remiges (up to 4 inner primaries and 3 outer secondaries) retained in a block (Fig. 59). DCAs have uniform wing coverts and remiges (Fig. 60). Beware both age groups can or may not replace tertials during the PAs (Figs. 58-61), so this cannot be used for ageing. The color of the wing bars may average yellower in FCA than in DCA (Figs. 58-61) but confirmation needed that this can be used for age determination.

Sex Determination: Males and females appear to be similar in all plumages. Measurements helpful for sexing some birds, males averaging longer wing and tail lengths than females (see above).

Further Study: Do FCAs average yellower wing bars (on formative coverts) and DCAs whiter (on basic coverts)?

Notes:

Figure 57. FCJ (left in each image, 28 Feb) and DCA (right in each image, 16 Dec) White-crested Elaenias showing fresher and yellower plumage, lack of crown patch, faint streaks to the back, and darker lower mandible in FCJ.

Figure 58. Wing of FCA White-crested Elaenia (29 Oct) showing all flight feathers replaced except the primary coverts, which are contrastingly brown (compare Fig. 60). All three tertials (s7-s9) and the inner 4-6 greater coverts have been replaced as part of the first PA.

Figure 59. Wing of FCA White-crested Elaenia (4 Nov) showing juvenile primary coverts along with p1-p2 and s1 (red arrows) in eccentric pattern. The inner two tertials (s8-s9) and inner three greater coverts have been replaced as part of the first PA.

Figure 60. Wing of DCA White-crested Elaenia (22 Oct) showing uniformly basic wing feathers, including primary and greater coverts, except for the inner two tertials (s8-s9) which had been replaced during the DPA.

Figure 61. Wings of DCB White-crested Elaenias showing no replaced wing feathers (25 Nov, left) and replaced tertials and inner three greater coverts as part of the DPA (19 Nov, right). It is assumed that body feathers are also replaced during the PAs, so all breeding birds in Chile should be aged either FCA or DCA.

Tufted Tit-Tyrant
Anairetes parulus

Chilean Name: Cachudito
Banding Code: CACH

Individuals Examined: 48 specimens (MWFB 12, FMNH 18, MCZ 18, USNM 15); 49 captures.

Geographic Variation: Hellmayr (1932) indicates that darker *A. p. lippus* occurs in Tierra del Fuego and also treats *fernandezianus* as a subspecies. Jaramillo (2003) does not mention *lippus* and treats *fernandezianus* as a separate species. Nominate *parulus* is found at Fray Jorge and treated here.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=11): Wing chord 44-48, tail 43-48; Male (n=14): Wing chord 46-50, tail 47-52.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be mostly resident, although Hellmayr mentions the possibility of migratory individuals. Breeding occurs in Sep-Dec with broods in Oct and Dec (Hellmayr 1932). In Fray Jorge, this species is resident, with similar densities recorded in winter and summer (Engilis and Kelt 2009, Kelt et al. 2012). Breeding occurs from Oct through Nov in the park, with chick provisioning observed as late as Dec.

Molt: Captured birds and specimens collected in molt indicate the DPB to occur in Jan-early Mar, with one individual initiating the SPB as early as 4 Jan, and several completing the DPB during 1-5 Mar. Molt limits in wing indicate that the PF is partial and possibly incomplete (eccentric) in some birds. FCFs had replaced all greater coverts and 2-3 tertials; one individual replacing s6 (Fig. 64) suggests that the PF can include this feather, as in some North American passerines (Pyle 1997). One specimen (MWFB 6830 collected 6 Mar) may have undergone an eccentric PF, retaining the juvenile p1-p4 and s1-s4 but confirmation of this pattern needed. Rectrices appeared to be retained. The DPB appears to be invariably complete.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Dec-Mar); FCF (Feb-Jan); SPB (Jan-Mar); DCB (Mar-Jan); DPB (Jan-Mar); UCU, UPB, and UUU also acceptable. FCJ is fresh and lacks olive to rump and yellow to breast found in DCBs, and has finer streaking to breast (Fig. 62). FCFs are best aged by molt limits in wing (especially among tertials/inner secondaries; Fig. 63) and shape and condition of rectrices (Figs. 65). Look also for eccentric patterns (Pyle 1997, p. 206). Wing feathers are broader and more uniform and rectrices are broader and fresher in DCB than in FCF (Figs. 64-65). FCFs in general may appear more worn (paler yellow below and paler gray above) and average shorter crests than DCBs. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Eye color also differs between FCJ and DCB, the iris being uniformly whitish gray in FCJs, and light-yellow with the upper third deep maroon in DCB males and females (Fig. 66). The rate at which the upper third darkens in FPF/FCF/SPBs is not yet determined; study needed.

Sex Determination: Males and females appear to be similar in all plumages. Measurements may be helpful for sexing some birds, males averaging longer wing and (especially) tail lengths than females (see above).

Further Study: Confirm or not that PF can be eccentric. Confirm rate at which iris color changes in FCFs and the use of this for ageing.

Notes:

Figure 62. FCJ Tufted Tit-Tyrant (20 Oct) showing lack of olive and yellow coloration and fine streaks to the breast.

Figure 63. FCF Tufted Tit-Tyrant (14 Nov) showing thin and brown juvenile primary coverts, contrasting with fresher formative greater coverts, and molt limits between tertials and other secondaries; s6 (red arrow) is growing, either part of the PF (in which case code would be FPF) or due to adventitious replacement (FCF).

Figure 64. DCB Tufted Tit-Tyrant (21 Oct) showing broad primary coverts and outer primaries and lack of molt limits among coverts or tertials/inner secondaries (cf. Fig. 63).

Figure 65. Rectrices by age when fresh (left image, FCF 6 Mar left and DCB 4 Mar right) and worn (FCF 2 Nov center image, and DCB 15 Nov right image) in Tufted Tit-Tyrant. Note broader shape and relative freshness in spring of basic DCB rectrices compared with juvenile rectrices of FCF.

Figure 66. Eye color in FCJ (left, 25 Oct) and DCB (right, 21 Oct) Tufted Tit-Tyrant. FCJs have pale iris with upper 1/3 either pale or with faint wash of red. DCBs have pale iris with upper 1/3 a deep maroon. Can FCF and SCBs be aged by eye color and, if so, for how long?

Fire-eyed Diucon
Xolmis pyrope

Chilean Name: Diucón
Banding Code: DIUN

Individuals Examined: 68 specimens (MWFB 4, FMNH 42, MCZ 22); 25 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate little or no geographic variation.

Structure and Measurements: 10 primaries, 6 secondaries (3 tertials), 10 rectrices. Female (n=22): Wing chord 97-107, tail 78-85; Male (n=26): Wing chord 106-116, tail 84-90.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate breeding in southern Chile, in the foothills and up to 2,200 m elevation, in Oct-Dec, with two broods recorded in some populations (early Oct and mid Dec). Southern populations (at least) are migratory, with winter range extending north of breeding range. At Fray Jorge it breeds Oct-Dec but status in fall and winter needs confirmation. Males on territory have been observed in Oct, and birds provisioning food to young have been observed in Nov.

Molt: Hellmayr (1932) and data from captured birds and specimens indicate molting occurs primarily in Jan-Feb, beginning as early as mid to late Dec (one specimen, MWFB 6656 collected at Fray Jorge 24 Nov, may have dropped p1-p2) and completing as late as early Mar. Whether the PF and/or the DPB occur on breeding grounds or winter grounds for migratory populations requires study. The PF is partial and includes 2-9 greater coverts, often 1-3 tertials, and often 1-2 central rectrices. The DCB appears to be invariably complete. An adult female captured 30 Oct and an adult male captured 6 Nov appeared to have replaced the innermost tertial (s9; Fig. 72), perhaps indicating a DPA, but several others (e.g., Fig. 71) had not replaced tertials so perhaps these tertials were replaced adventitiously (a PA is not assumed in age coding). Rectrices were being replaced proximally (Fig. 67) in three DCB specimens (FMNH 61301 and 61302 collected 1 Feb and 61307 collected 20 Feb) and presumably this atypical sequence is followed for this species and Great Shrike-Tyrant (Fig. 74).

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Jan); FPF (Nov-Mar); FCF (Feb-Dec); SPB (Dec-Feb); DCB (Feb-Dec); DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJ is fresh and lacks coloration to underparts, the breast washed grayish (Fig. 68) and with grayish-brown streaks in some birds (according to Hellmayr 1932). FCFs are best separated from DCBs by outer primary shape (Figs. 69-72). Molt limits among greater coverts and tertials also indicate FCF (Fig. 70), whereas DCBs have uniform wings (Figs. 71-72; although beware possibility of tertials being replaced during a DPA; Fig. 72). Eye color is also useful, being dull, dark red in FCJs and FPFs, orange-red to scarlet-red in older FCFs, and brilliant red in DCBs (Fig. 73). Rectrix shape also varies as in other passerines but can become very worn in breeding DCBs, especially females. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Sex Determination: Plumage of males and females appear to be similar in FCJs, FPFs, and FCFs, although shape of outer juvenile primaries may possibly vary by sex (cf. Fig. 69); study needed. Outer primary shape can easily be used to sex DCBs, being highly notched in males and only slightly notched or nipple-shaped in females (Figs. 69, 71-72). Measurements also show little or no overlap between males and females (see above); expect FCJs, FPFs, and FCFs to fall in the bottom half of the range of each sex and DCBs in the top half, likely allowing sexing of all birds by wing and tail lengths.

Further Study: Does molt occur on breeding or winter grounds (or molting grounds) for migratory populations? Does juvenile outer primary shape differ by sex in FCJs, FPFs, and FCFs (see Fig. 68) and can some birds of these ages be sexed? More study on variation in eye-color change for ageing; can SPBs or even SCBs be aged by eye color? Photos of eyes in worn FCFs (Sep-Dec) and fresh SPB/SCBs (Jan-Mar) are needed. Is there a DPA that includes 1-2 tertials in some birds? This might be possible since migratory species are more likely to undergo PAs.

Notes:

Figure 67. Molting (DPB or SPB) Fire-eyed Diucon (FMNH 61301, 1 Feb), one of three specimens in which this was noted, showing that rectrices are being replaced proximally during the PB in this species. The same replacement pattern occurs in Great Shrike-Tyrant (Fig. 74).

Figure 68. FCJ Fire-eyed Diucon (30 Oct right, 25 Nov left) showing fresh plumage and lack of coloration to underparts (note also blunt outer primaries; Fig. 69). Hellmayr (1932) also mentions grayish-brown streaks to breast of some FCJs.

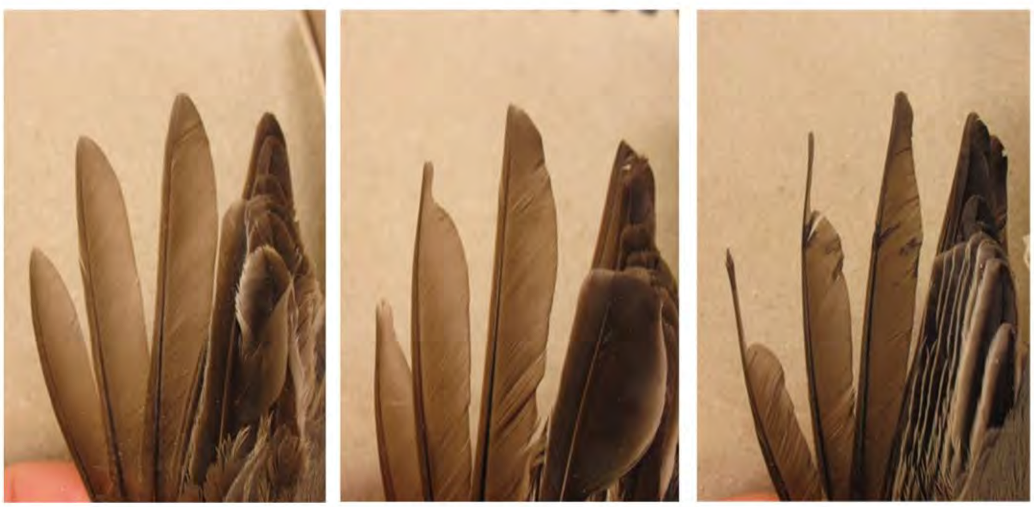


Figure 69. Outer primaries of FCF (left, 20 Oct). DCB female (center, 24 Nov), and DCB male (right, 16 Mar) showing distinctive shapes by age/sex. Look for some variation in juvenile primary shape in FCF females vs. males, the latter perhaps averaging narrower and more pointed, as found in some North American kingbirds (e.g., Pyle 1997, p. 267). The FCF specimen above was a female by gonads.

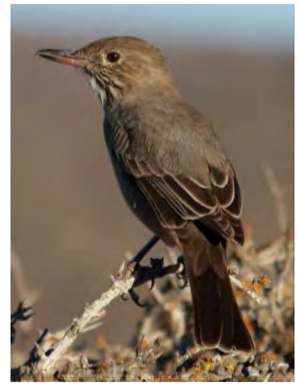
Figure 70. FCF Fire-eyed Diucon (20 Oct) showing blunt outer primaries and molt limits; note retained outer 2 median coverts, replaced 1-3 inner greater coverts, and replaced middle tertial (s8). Others can replace up to 9 greater coverts and all three tertials.

Figure 71. DCB female Fire-eyed Diucon (30 Oct) showing slightly notched (“nippled”) outer primaries and lack of molt limits in wing (cf. Fig. 70). No tertials appear to have been replaced (cf. Fig. 72).

Figure 72. DCB male Fire-eyed Diucon (6 Nov) showing highly notched outer primaries and lack of molt limits in wing (cf. Fig. 70). The innermost tertial appears to have been replaced, either indicating a DPA or replaced adventitiously (study needed).

Figure 73. Eye color in FCJ (left, 24 Nov) and DCB (right, 6 Nov) Fire-eyed Diucon. FCJs have dull and dark red eyes, DCBs have brilliant red eyes, and FCFs in Sep-Dec have scarlet-red to orange-red eyes. Can SCBs be aged by eye color and, if so, for how long?

Great Shrike-Tyrant
Agriornis lividus



Chilean Name: Mero
Banding Code: MERO

Individuals Examined: 56 specimens (FMNH 24, MCZ 18, YPM 8, MVZ 1, USNM 6); 0 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate little or no Geographic variation within most or all of Chile. Populations in extreme southern Patagonia ("*fortis*") average larger and grayer, and likely warrant subspecific status (Hellmayr 1932, A. Jaramillo pers. comm.).

Structure and Measurements: 10 primaries, 6 secondaries (3 tertials), 10 rectrices. Female (n=12): Wing chord FCJ/FPF/FCF 122-130, DCB 129-142, tail FCJ/FPF/FCF 98-105, DCB 104-112; Male (n=17): Wing chord FCJ/FPF/FCF 124-131, DCB 130-145, tail FCJ/FPF/FCF 100-107, DCB 106-115.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this is basically a resident species, though Hellmayr suggests possibility of some down-slope movements of birds breeding at higher elevations, up to 2,000 m in Chile. Little data on breeding season but all indications are that it occurs in Nov-Feb; Hellmayr mentions one record in Feb of a worn adult with full-grown young. In Fray Jorge it appears to be resident; birds on territory have been observed in late Oct but nesting has not yet been confirmed.

Molt: Data from specimens indicate that the DCB occurs primarily in Feb and the PF can begin in Jan and extend to Apr at least. The PF is partial to incomplete and includes some to all greater coverts (up to six outer coverts can be retained), 1-3 tertials, and no to all rectrices. In some birds (perhaps a small percentage) the PF can be eccentric (molting primaries in Feb-Apr) and include p4-p10 (MCZ 287411) or p6-p10 (MCZ 287415). It appears that rectrices are replaced in these birds. As in Fire-eyed Diucon (Fig. 67), rectrices can be replaced proximally, at least during the DPB, as shown by one DCB specimen in molt (FMNH 61458, 26 Feb, Fig. 74).

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Dec-Apr); FCF (Feb-Jan); SPB (Jan-Mar); DCB (Mar-Jan); DPB (Jan-Mar); UCU, UPB, and UUU also acceptable. No FCJs examined - presumably plumage is weak and gape may be fleshy and yellowish. The strength of the rufous coloration to the ventral region and undertail coverts appears to be related to age and sex (Fig. 75); this probably should not be relied upon alone but can supplement other criteria. Outer primary shape shows variation (Fig. 76), with some DCB males showing notched p10 and some DCB females with attenuated p10s. However, notched primaries appear to occur in only a small proportion of adults (Hellmayr considered it "rare," occurring in only 4 of 32 specimens) and many specimens with un-modified outer primaries appear to be DCB by lack of molt limits and/or broad rectrices. Hence, more study is needed on this; it may be possible that it occurs in older birds only as related to flight displays; however, specimen MCZ 287411 appeared to be an FPF undergoing eccentric molt with a notched p10 growing in. In any case, strongly notched p10 seems to indicate DCB male in most or all cases. Otherwise, contrasts due to molt limits in the wing - among greater coverts, between greater and primary coverts, and (especially) among tertials (Fig. 77) can be used to separate FCF from DCB, as can shape and condition of the rectrices (Fig. 78) but both of these criteria can be subtle. Some FCFs appear also to undergo eccentric molt and will show contrasts between older and more faded inner 3-5 pp and outer 3-5 ss, and newer outer pp and inner ss (Pyle 1997, pp. 208-209). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers, but beware basic-like outer primaries can occur in SPBs that had undergone an eccentric PF.

Sex Determination: The strength of the rufous coloration to the ventral region and undertail coverts appears to be related to age and sex (Fig. 75). This probably should not be relied upon alone but can supplement other criteria; e.g., once a bird is aged the shade of rufous may help with sex (study needed). Outer primary (p10) shape also appears to vary with sex, and those DCBs with attenuated (Fig. 76D) or notched (Fig. 76E) outer primaries appear to be reliably sexed as females or males, respectively. Shape of juvenile outer primaries in FCJ, FPF, and FCF may also vary slightly by sex (Fig. 76A-C) but this should not be relied upon yet, and beware that some DCBs may show juvenile-like outer primaries. Measurements are largely unhelpful for sexing, with males averaging slightly longer wing and tail lengths than females, and FCJ/FPF/FCFs with juvenile flight feathers averaging shorter lengths than DCBs (see above); both age and sex should be factored in when considering measurement data.

Further Study: Need to understand significance and relation to age/sex of notched outer primaries in some birds. Eccentric molts need to be confirmed, or could these apparent patterns be related to suspended prebasic molts?

Notes:

Figure 74. Molt of rectrices in Great Shrike-Tyrant (FMNH 61458, 26 Feb) showing proximal order of replacement. The same sequence was observed in Fire-eyed Diucon (Fig. 67).

Figure 75. Underparts of (from left to right) FCF female (27 May), DCB female (26 Feb), FCF male (11 Feb), and DCB male (18 Oct) Great Shrike-Tyrants showing relative strength of rufous coloration to ventral region. This appears to vary in each age/sex group, so should be used as an “average character” supplementing other criteria.

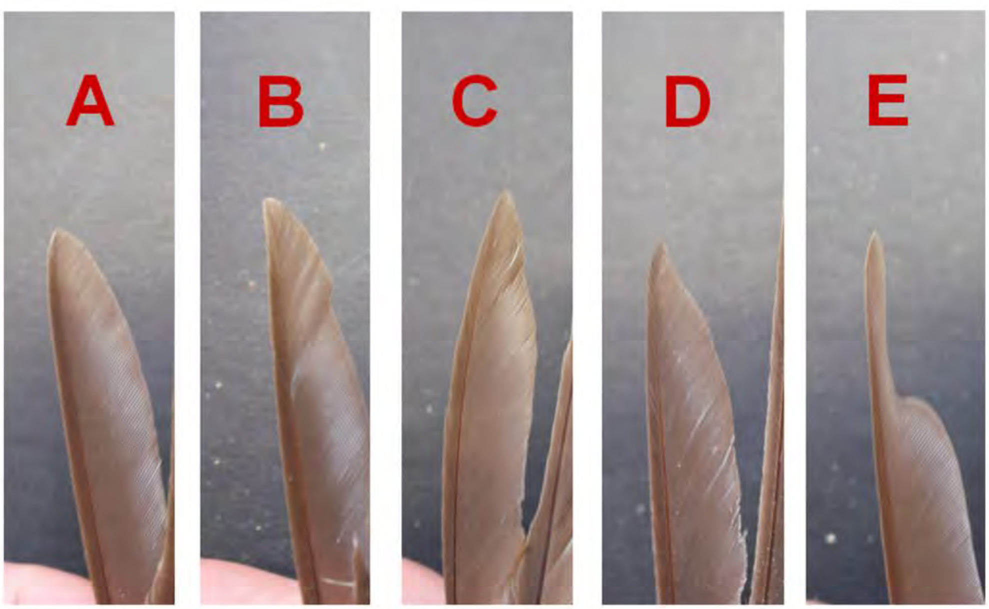


Figure 76. Variation in outer primary shape in Great Shrike-Tyrant. Generally shape appears to be blunt in FCF females (A), moderately pointed in FCF males (B-C), pointed in DCB females (C-D) and highly notched in at least some DCB males (E; see text) but exceptions seem to occur, especially among DCBs showing blunter or non-notched shapes as in A-C. More study is needed.

Figure 77. FCF Great Shrike-Tyrant (19 Jul) showing molt limit among the tertials, s8-s9 having been replaced during the PF.

Figure 78. Shape and condition of rectrices in worn FCF (left, 11 Feb) and DCB (right, 26 Feb) Great Shrike-Tyrants showing broader and more truncate shape of basic rectrices. Beware some FCFs appear to have replaced rectrices and will show shapes like DCB; these may also show eccentric replacement patterns in the wing. Beware also that this criterion can be subtle and intermediates can be difficult.

Dark-faced Ground-Tyrant
Muscisaxicola maclovianus

Chilean Name: Dormilona Tontita
Banding Code: DOTO

Individuals Examined: 34 specimens (FMNH 24, MCZ 10); 0 captures.

Geographic Variation: Hellmayr (1932) indicates Chilean population of subspecies *M. m. mentalis* and that the larger nominate subspecies occurs on Falkland Islands.

Structure and Measurements: 10 primaries, 6 secondaries (3 tertials), 10 rectrices. Female (n=15): Wing chord 94-101, tail 57-65; Male (n=16): Wing 98-106, tail 61-68.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this to be a migratory species, breeding only in the southern third of Chile and wintering to the north and/or down-slope of breeding areas. It breeds in Sep-Jan but details are lacking. In Fray Jorge it occurs only in Mar-Aug, during migration and in winter. This species is more common in surrounding open agricultural areas than in the dense matorral habitats.

Molt: Data from specimens indicate DCB occurs primarily in Jan-Feb and PF probably occurs then as well. The DPB does not take place on the breeding grounds but location relative to wintering grounds unknown. Molt limits are very subtle (if present) in this species so it is difficult to know range in extent of PF - it is possible that limits only occur among lesser and median coverts or it could be that PF is complete; study needed. No molt limits among greater coverts, tertials, or rectrices detected. Given migratory and open-country habits it might be best to assume that the PF is complete, as we have below.

Age Determination (Group 3, pp. 7-8): Acceptable age coding in central Chile (Fray Jorge): FAJ (Mar-Sep). In southern Chile, FCJ (Oct-Jan), FPF (Dec-Feb), and UPB (Jan-Feb) are also acceptable, as is UPU and UUU; it may be possible that some of these codes can be applied to birds at Fray Jorge. No FCJs examined but presumably these can be identified by fresh plumage, lack of rufous to the chin (Fig. 79), and probably a fleshy and yellowish gape. Should PF prove to be partial more criteria may be identified (cf. Fig. 80) and FCF, SPB, DCB, and DPB codes assigned, but confirmation on molt extent and ageing criteria needed.

Sex Determination: Extent of the rufous wash to the chin may be stronger in DCB males than in DCB females (Fig. 79; Hellmayr 1932) although Jaramillo (2003) indicates it is more of an age-related than a sex-related difference. Study needed on this variation. Measurements appear helpful for sexing some to many birds, males averaging longer wing (especially) and tail lengths than females (see above).

Further Study: Extent of PF - is it limited to partial, or complete? Even if primaries and secondaries replaced the replacement of primary coverts should be confirmed. Variation in rusty chin wash by age/sex needs more work - is it reliable for FCF, DCB female, and/or DCB male?

Notes:

Figure 79. Variation in the strength of rufous wash to the chin in Dark-faced Ground-Tyrants. According to the literature FCFs lack rufous (A, 3 May), DCB females have some rufous (B, 2 May), and DCB males have stronger rufous wash (C, 28 Feb). Confirmation of this variation and use in age/sex determination desirable.

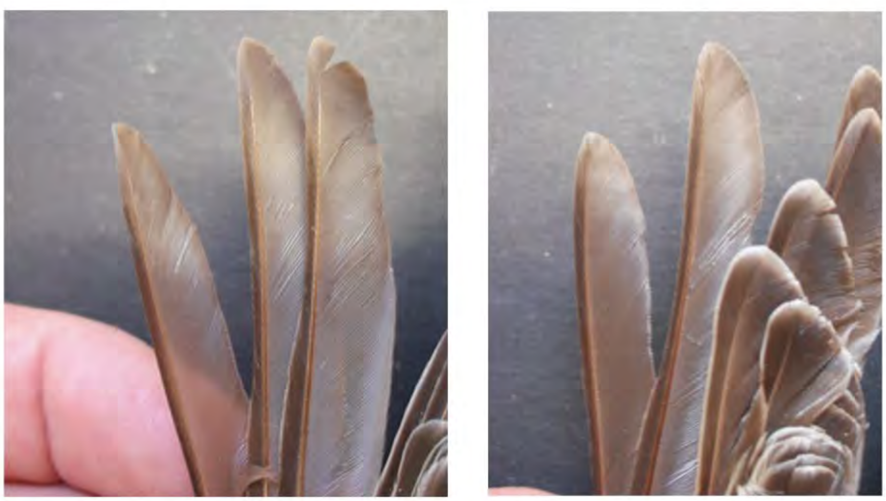


Figure 80. The PF may be complete in Dark-faced Ground-Tyrants, in which case ageing by wing-feather criteria may not be possible. If the PF is partial, shape of the outer primaries likely differs between that of left image (FCF?, 3 May) and that of right image (DCB, 2 May). Whether or not primary coverts are replaced during the PF and if this can also be used for ageing also requires more study.

Rufous-tailed Plantcutter
Phytotoma rara

Chilean Name: Rara
Banding Code: RARA

Individuals Examined: 41 specimens (MWFB 4, FMNH 21, MCZ 14, MVZ 2); 2 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate little to no geographic variation.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=7): Wing chord 85-94, tail 69-75; Male (n=10): Wing chord 88-92, tail 72-78.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be resident through most of range but with southernmost and highest-elevation populations migratory. It is generally a lowland species, with few records as high as 2,000 m. Breeding takes place in Oct-Jan, with two broods reported, in Oct and in Dec (Hellmayr 1932). In Fray Jorge observations are restricted to Sep-Mar, but breeding status unclear. There is a spring passage of migrants, some captured birds in Oct having higher fat loads. During this spring movement, presumably southward, birds are quiet and move in the understory of thickets in the park. Fall and winter occurrences are undocumented in Fray Jorge.

Molt: Data from captured birds and specimens indicate that the DPB occurs primarily in Jan-Feb and the PF can extend into Mar and perhaps Apr, when outer primaries can be replaced. Whether the PF and/or DPB occur on breeding grounds or winter grounds in migratory populations requires study. Sequence of plumages in males suggests the possibility of an auxiliary PF (PFa) with FCJ being plain on the breast and the auxiliary formative plumage (FCFa) being streaked (Fig. 81), but study needed (acceptable age coding does not assume a PFa). The PF is partial to incomplete and includes most to all greater coverts (the outer 1-2 can be retained), 2-3 tertials, and no to all rectrices. More than half appear to at least commence eccentric molt, with the outer 4-6 primaries and inner 3 to all 9 secondaries replaced; at least one bird (MWFB 7612) had replaced p5-p10 and all secondaries. One individual (FMNH 154413) had replaced p7-p8 (and s7-s9) only, indicating arrested eccentric molt. Those with eccentric molt had apparently replaced all rectrices whereas some without eccentric molt appeared to have replaced no rectrices. During eccentric molt two specimens (MWFB 7604 and FMNH 316729) were clearly replacing secondaries from s6 distally to s3 or s4, indicating distal replacement during this molt, something thus far poorly documented (Pyle 1997).

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Jan); FPF (Dec-Feb), FCF (Jan-Dec); SPB (Dec-Feb); DCB (Feb-Jan); DPB (Jan-Feb); UCU, UPB, and UUU also acceptable. All age/sex groups (except sexes in FCJs) can be distinguished for the most part by body plumage (Figs. 81-83) although there may be slight overlap in some cases; underparts typically lack rufous in FPF and FCF females, are washed rufous in DCB females, are variably mottled brown and rufous in FPF and FCF males, and are uniformly bright rufous in DCB males (Fig. 81). Older (non-FCJ) males also show mostly white median coverts whereas females of all ages have dark median coverts with white tips (Fig. 83). Most FCFs show eccentric molt-limit patterns in the wings and this can be especially useful for ageing females (Figs. 84-85); DCBs have uniform primaries and secondaries. Some individuals without eccentric patterns can also be aged by molt limits within greater coverts (Fig. 86) or between greater and primary coverts (Figs. 84-85). The size of the rufous spots in the rectrices (especially r2) also appears to vary (Fig. 87) but this is complicated by the fact that most individuals appear to replace the rectrices during the PF, and these likely overlap substantially with those of DCBs. Males average moderately longer wing and tail than females (see above). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers, but beware basic-like outer primaries and rectrices can occur in SPBs following eccentric PFs.

Further Study: Where does PF occur in migratory populations?

Notes:

Figure 81. Variation in underpart plumage of Rufous-tailed Plantcutters by age/sex: from left to right, FCF female (12 Jan), DCB female (24 Jun), FCJ male (11 Jan), FPF male (27 Feb), FCF male (25 Aug), and DCB male (8 Jan). See also Figure 82.

Figure 82. Variation in upperpart plumage of Rufous-tailed Plantcutters by age/sex: from left to right, FCF female (12 Jan), DCB female (24 Jun), FCJ male (11 Jan), FPF male (27 Feb), FCF male (25 Aug), and DCB male (8 Jan). See also Figure 81.

Figure 83. Sides of FCF female (22 Oct), FCF male (2 Dec) and DCB male (2 Dec) Rufous-tailed Plantcutters showing largely white median coverts in males (both formative and basic coverts) but not females.

Figure 84. FCF female (22 Oct) Rufous-tailed Plantcutter showing eccentric replacement pattern, with the juvenile s1 and p1-p4 retained. Note also contrast between formative greater coverts and juvenile primary coverts, all of which appear to have been retained.

Figure 85. FCF female (20 Oct) Rufous-tailed Plantcutter showing eccentric replacement, with the juvenile s1 and p1-p4 retained. Note also contrast between formative greater coverts and juvenile primary coverts; p5 is growing (asymmetrically), presumably adventitiously.

Figure 86. FCF female (12 Jan) Rufous-tailed Plantcutter showing molt limit between replaced inner greater coverts and retained juvenile outer coverts; the two outer feathers had been retained. Note also the brown and worn juvenile primary coverts.

Figure 87. Variation in size of rufous patches in the rectrices (r6 right and r2 left shown in each image) of Rufous-tailed Plantcutters by age/sex: from left to right, FCF female (12 Jan), DCB female (24 Jun), FCF male (25 Aug), and DCB male (8 Jan). Beware that rectrices often are replaced during the PF; the FCF female above appears to show juvenile rectrices whereas the FCF male shows formative rectrices.

House Wren
Troglodytes aedon

Chilean Name: Chercán
Banding Code: CHER

Individuals Examined: 95 specimens (MWFB 14, FMNH 53, MCZ 28, MVZ 3, USNM 12); 50 captures.

Geographic Variation: House Wrens in South America are part of the broader, Southern House Wren (*T. a. musculus*) subspecies group. Hellmayr (1932) and Jaramillo (2003) indicate that House Wrens in Chile can vary in tone, being paler and smaller to the north and darker and larger to the south, but differences appear to be clinal. It may be best to refer to all South American House Wrens to *T. a. musculus* but more genetic and vocal data are needed to conclude this. Hellmayr (1932) separated the population breeding at Fray Jorge as "*atacamensis*", darker than both "*tecellatus*" of extreme northern Chile and "*chilensis*" to the south, and also less barred on the back (see also Jaramillo 2003), and it is quite possible that these subspecies are valid.

Structure and Measurements: 10 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=12): Wing chord 46-52, tail 41-47; Male (n=13): Wing 49-56, tail 42-49.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be migratory, though some southern and central Chilean populations (including those of Fray Jorge) may be less so. Breeding occurs to 2,200 m elevation, with higher-elevation populations showing down-slope migration for winter. In Fray Jorge it occurs year-round, though some seasonal movements may be possible. Males begin territorial singing in mid Sep and nests have been observed in early Oct. Adults provisioning young, male with enlarged CP and females with BPs have been documented from birds netted and collected in Sep through early Nov.

Molt: Data from captured birds and specimens indicate that the DPB occurs primarily in Jan-Mar, especially in southern and higher-elevation breeding populations. Two specimens (MWFB 6657 and 6684) and some captured birds from Fray Jorge had begun DPB primary molt in Nov (2nd and 26th, respectively) and covert molt of PF on 21 Oct (Fig. 89), supporting an earlier breeding season than reported for other parts of Chile (Dec–Feb). Birds collected from differing latitudes indicated that House Wrens from Fray Jorge (30^{o}S) had already begun molt while House Wrens from 49^{o}S, collected only one week later, were still in relatively fresh plumage and had reproductive organs not yet fully developed. Thus, timing of molt and nesting varies by latitude, a common pattern among Chilean passerines. Location of molt relative to breeding grounds in migratory populations is unknown, though it could occur before migration and/or involve upslope dispersal, as in Northern House Wren (Pyle 1997:365). Among 20 FCF specimens examined, the PF was partial and included 3 to all 9 greater coverts, 0-3 tertials, and 0-2 central rectrices. No eccentric patterns were observed although they might be expected as occurs in some (~20% of) Northern House Wrens (Pyle 1997:365).

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Dec-Feb); FPF (Oct-Mar); FCF (Jan-Dec); SPB (Nov-Mar); DCB (Feb-Dec); DPB (Nov-Mar); UCU, UPB, and UUU also acceptable. Ageing appears to be fairly difficult and based on subtle differences between juvenile and basic wing and tail feathers, as found in Northern House Wren (Pyle 1997:365-366). FCJs appear to have indistinct bars on upperparts and very indistinct or no bars on underparts than found at later ages (Fig. 88). Fresh individuals in Oct-Dec undergoing molt of greater coverts but not primaries can be aged FPF (Fig. 89) and FCFs also can show molt limits in the greater coverts and/or tertials (Figs, 90-91). FCFs also show thinner rectrices with wavier bar patterns and with bars lining up among primaries, secondaries, and rectrices (Figs. 89-91, 93). DCBs show uniform wing feathers (Fig. 92) and broader rectrices with straighter bars (Fig. 93); bars do not line up as well among primaries, secondaries, and rectrices (Figs. 92-93). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers, but beware many may need to be aged UCU or UPB.

Sex Determination: Males and females appear to be similar in all plumages. Measurements largely unhelpful for sexing, males averaging slightly longer wing and tail lengths than females (see above).

Further Study: Can eccentric molts occur in some birds, especially those breeding earlier in northern lowland populations?

Notes:

Figure 88. FCJ (left, 3 Jan) and DCB (right, 29 Dec) Southern House Wrens (both of subspecies “chilensis”) showing increased barring to underparts of DCB.

Figure 89. Fresh FPF (21 Oct) Southern House Wren replacing greater coverts but not primaries; DPBs replace both tracts at the same time. Note also that the bars line up among the juvenile secondaries and primaries.

Figure 90. FCF (22 Nov) Southern House Wren showing 5-6 inner greater coverts and s8 replaced. Note also the brown and weak juvenile primary coverts and that the bars line up among the juvenile secondaries (other than s8) and primaries.

Figure 91. Worn FCF (28 Oct) Southern House Wren showing most or all greater coverts and s6-s9 replaced. Note also the juvenile primary coverts, and that the bars line up between the juvenile outer secondaries and primaries.

Figure 92. Worn DCB (9 Nov) Southern House Wren showing uniformly basic wing coverts and tertials. Note also the broader and darker, less-worn basic primary coverts and that the bars do not line up as well among the basic secondaries and primaries.

Figure 93. Juvenile (left, 28 Oct) and basic (right, 7 Nov) rectrices of FCF and DCB Southern House Wrens, respectively, showing differences in width, shape, and pattern; note that the bars line up better on the FCF than on the DCB.

Austral Thrush
Turdus falcklandii

Chilean Name: Zorzal
Banding Code: ZORZ

Individuals Examined: 72 specimens (MWFB 9, FMNH 29, MCZ 31, MVZ 3); 1 capture.

Geographic Variation: Hellmayr (1932) indicates that Chilean (including Fray Jorge) populations are of subspecies *T. f. magellanicus* and differ from nominate Falkland Island birds in being paler, browner, and with a smaller bill.

Structure and Measurements: 10 primaries (p10 reduced, 2-6 mm< longest p cov), 9 secondaries (3 tertials), 12 rectrices. Female (n=14): Wing chord 122-130, tail 87-95; Male (n=11): Wing chord 125-135, tail 90-101.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be mostly resident, with some limited migration to winter grounds occurring slightly to the north of breeding range. Juveniles were reported from late Dec through early Mar (Hellmayr 1932), indicating breeding in Nov-Feb. In Fray Jorge this species is more common and widespread in winter and spring than at other times, occurring in forests and wooded canyon bottoms. Breeding has not yet been confirmed in the park, but suspected.

Molt: Hellmayr (1932) and data from captured birds and specimens indicate that both the DPB and the PF occur primarily in Feb-Mar. Location of molt relative to breeding grounds requires study. The PF is partial and includes most to all median coverts (the outer 1-3 often retained) and 0-7 greater coverts but no tertials or rectrices.

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Dec-Feb); FPF (Jan-Mar); FCF (Feb-Jan); SPB (Feb-Mar); DCB (Mar-Feb); DPB (Feb-Mar); UCU, UPB, and UUU also acceptable. Ageing and sexing criteria very similar to those of American Robin (Pyle 1997:403-405). FCJ has distinct black spots to the underparts and black spots and buff streaks to the upperparts (Figs. 94-95). FCFs best separated from DCBs by molt limits among the wing coverts, often among the greater coverts (Figs. 96-97), and the narrower and more rounded rectrices (Fig. 99). DCBs have uniform wing feathers (Fig. 98) and more truncate rectrices (Fig. 99). In addition, DCBs and males average blacker throat streaks and crowns and richer clay-colored breasts than FCFs and females (Figs. 94-95). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Differences between the sexes appear to be stronger than that between the ages; e.g., FCF males appear richer-colored than DCB females. Most or all birds should be reliably aged and sexed when all criteria are combined. Males average moderately larger than females (see above), and measurements could assist with ageing and sexing some birds.

Further Study: Where do molts occur relative to breeding grounds?

Notes:

Figure 94. Underparts of FCJ (left, 4 Dec), DCB female (center, 22 Nov), and DCB male (right, 24 Nov) Austral Thrushes showing variation in plumage by age and sex. See also Fig. 95.

Figure 95. Upperparts of FCJ (left, 4 Dec), DCB female (center, 22 Nov), and DCB male (right, 24 Nov) Austral Thrushes showing variation in plumage by age and sex. See also Fig. 94.

Figure 96. Wing of worn FCF (11 Sep) Austral Thrush showing one inner replaced (formative) greater covert contrasting with retained juvenile coverts. Note the buff tips to the distal greater coverts and that the proximal greater coverts and tertials are very worn due to the more exposed position of these juvenile feathers (compare Fig. 98).

Figure 97. Wing of fresh FCF American Robin (California, Oct) showing molt limit in the greater coverts (red arrow); five inner feathers had been replaced (formative) and four outers were retained (juvenile). Austral Thrush shows similar molt limits to this in appearance and position.

Figure 98. Wing of worn DCB (2 Nov) Austral Thrush showing lack of molt limits in the wing. Some variation in the appearance of the basic greater coverts is expected; note also that proximal greater coverts and tertials are more worn due to more exposed position of these basic feathers (compare with more worn wing of FCF in Fig. 96).

Figure 99. Outer rectrices of FCF (above, 5 Jan) and DCB (below, 29 Dec) Austral Thrush showing differences in shape.

Chilean Mockingbird
Mimus thenca

Chilean Name: Tenca
Banding Code: TENC

Individuals Examined: 45 specimens (MWFB 5, LSUMN 1, FMNH 13, MCZ 6, YPM 20, MVZ 1); 9 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate little or no geographic variation.

Structure and Measurements: 10 primaries (p10 reduced, 16-19 mm > longest p cov), 9 secondaries (3 tertials), 12 rectrices. Female (n=15): Wing chord 108-117, tail 109-120; Male (n=19): Wing chord 111-124, tail 112-124.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be resident and occurring up to 2,200 m elevation. Specimen and banding data on wear and molt suggest breeding during the austral summer but details need to be confirmed. In Fray Jorge it is a resident. Juveniles were observed 22 Nov and 3 Mar (MFWB 6811) suggesting an extended spring, summer, and fall breeding season at this location. Well developed BP on females were documented in mid-Sep. Timing of breeding and territorial behavior strongly linked to the presence and fruiting phenology of the mistletoe *Tristerix aphyllus,* which in turn is driven by variable rainfall patterns. This species is near-endemic to Chile, also occurring at one site in Argentina.

Molt: Data from captured birds and specimens indicate molting occurs primarily in Feb-early Apr, with the PF extending into May. The PF is partial and includes 3 to all 9 greater coverts, sometimes 1-2 inner tertials (s9 can be replaced before s8), and occasionally 1-2 central rectrices. One DCB (MWFB 6816) had retained p4 on the right wing and one captured bird (22 Nov) had retained s2 on the right wing, probably anomalously in both cases (age coding assumes so); otherwise, DPBs were all complete.

Age Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Mar); FPF (Jan-May); FCF (Mar-Feb); SPB (Feb-Apr); DCB (Mar-Feb); DPB (Feb-Apr); UCU, UPB, and UUU also acceptable. FCJ is fresh, has streaks across the breast, and has a gray iris (Fig. 100). FCFs best separated from DCBs by combination of molt limits among the greater coverts or tertials (Fig 101; if all greater coverts replaced at least one tertial should be replaced), and by narrower and more rounded outer rectrices (Fig. 103). Iris is likely grayish to dull olive through most of first cycle (cf. Fig. 100). DCBs have uniform wings (Fig. 102) and broader and more squared outer rectrices (Fig. 103). Eye color also becomes olive-green by DCB (Fig. 100); study needed on how iris color changes in FCFs and SCBs. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Sex Determination: Females and males similar in all plumages. Measurements largely unhelpful for sexing, males averaging slightly longer wing and tail lengths than females (see above).

Further Study: How long does it take iris to change color in FCFs and SCBs? Do some DCBs have eye color resembling FCJ/FCF, as in Northern Mockingbird?

Notes:

Figure 100. juvenile Chilean Mockingbird (left and upper right, 28 Oct) and basic (right, 22 Nov) showing streaks to breast and gray iris. The lower right bird is a DCB (7 Nov) showing typical olive-colored iris.

Figure 101. FCF Chilean Mockingbirds showing molt limits among greater coverts (left, 23 Jul) and tertials (right, 4 Apr). The inner four greater coverts had been replaced in the left-hand image and the inner two tertials (s8-s9) in the right-hand image.

Figure 102. DCB Chilean Mockingbird (27 Oct) showing uniform wing feathers without molt limits.

Grassland Yellow-Finch
Sicalis luteola

Chilean Name: Chirihue
Banding Code: CHIR

Individuals Examined: 65 specimens (MWFB 2, FMNH 44, MCZ 19); 20 captures.

Geographic Variation: The subspecies occurring of this widespread Neotropical species in Chile is *S. l. luteiventris* (Hellmayr 1932). Other more northern subspecies differ in size and the extent to which the outer rectrix shows white (see **Age/Sex Determination**).

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=14): Wing chord 68-76, tail 48-55; Male (n=20): Wing chord 70-77, tail 49-57.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to be resident at lowland elevations in Chile (< 1,500 m) but that they congregate into large flocks post-breeding, suggestion post-breeding dispersal patterns of some sort. In Fray Jorge this species is common and breeds during Sep–Feb, but is local and rare in Mar-Jun, when it assembles in large flocks in agricultural lands outside the park. Females with well developed BPs have been captured in Fray Jorge in late Oct and early Nov, and chick provisioning has been observed in late Nov and early Dec.

Molt: Data from captured birds and specimens indicate that the DPB and PF probably occur in Feb-Apr, suggesting that it occurs away from the breeding grounds. However, one captured individual was just beginning the second PB on 26 Nov, indicating that it can occur earlier in some birds and perhaps suggesting a prolonged molting season. One DCB (Mar) had what looked to be suspension limits between p6 and p7, suggesting that molt can be suspended for dispersal (or maybe for a second breeding attempt) in some birds. The PF is incomplete and includes most or all median and greater coverts, 2-3 tertials, and usually all 12 rectrices, but no other secondaries or primaries (replacement of s6 might be expected in some birds, and watch for eccentric patterns of outer primaries). Specimens indicate a PA in Aug-Sep that includes some to most body feathers, some lesser coverts, and sometimes up to 3-4 inner median and greater coverts and s8; the brighter yellow appearance in both sexes appears to be gained by both molt and feather wear.

Age/Sex Determination (Group 2, pp. 7-8): Acceptable age coding: FCJ (Nov-Feb); FPF (Feb-Apr); FCF (Apr-Aug); FPA (Aug-Sep); FCA (Sep-Jan); SPB (Dec-Apr); DCB (Mar-Aug); DPA (Aug-Sep); DCA (Sep-Feb); DPB (Dec-Apr); UCU, UPA, UCA, UPB, and UUU also acceptable. FCJs have weak plumage, heavy streaks to the breast, pale-fringed and filamentous tertials and greater coverts, and weak and pointed rectrices (Figs. 104, 107). Both underpart and upperpart plumage appears to vary slightly by age, sex, and season (Figs. 105-106), with FCF/FCAs and females generally showing more streaks and less yellow to the underparts than DCB/DCAs and males; underpart differences by age appear to be greater in Mar-Aug (in FCFs and DCBs) than in Sep-Feb (FCAs and DCAs), but the opposite is true of underpart differences by sex (greater in Sep-Feb). Molt limits between the greater coverts and primary coverts and among the tertials and inner secondaries occur in FCF/FCAs (Figs. 107-108) whereas DCB/DCAs have uniform wing feathers (Figs. 109-110), although some may have replaced a few inner median and greater coverts. Rectrices appear to be replaced at the PF so shape is not reliable except in FCJs (Fig. 104), though more pointed and worn outer primaries is useful for FCF/FCAs, vs. broader and fresher outer primaries in DCB/DCAs. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. When combining wing-feather criteria with underpart plumage, all birds should be reliably sexed and most birds readily aged in both seasons following the PF. Measurements unhelpful for sexing (see above).

Further Study: Can the PF occasionally be eccentric and include outer primaries? How do apparently prolonged breeding and molting seasons interact? Need more information on plumage variation in first-cycle females.

Notes:

Figure 104. FCJ Grassland Yellow-Finch (15 Nov) showing heavily streaked breast, weak and buff-edged greater coverts and tertials (these will be replaced during the PF), and very weak and pointed juvenile rectrices (usually replaced at PF).

Figure 105. Underparts and upperparts of fresh DCB female (left in each image, 15 Feb) and worn DCA female (right, in each image, Jan) Grassland Yellow-Finches. The streaked breast is apparently lost and most of the yellow to the underparts is gained through both feather wear and molt. More study is needed on plumages of FCF and FCA females but these undoubtedly average more brown streaking and less yellow to the underparts than DCBs and DCAs, respectively. See also Fig. 106.

Figure 106. Underparts of, from left to right, FCJ male (4 Jan), FCF male (17 Apr), FCA male (5 Jan), DCB male (28 Mar), and DCA male (5 Jan) Grassland Yellow-finches showing variation in plumage.

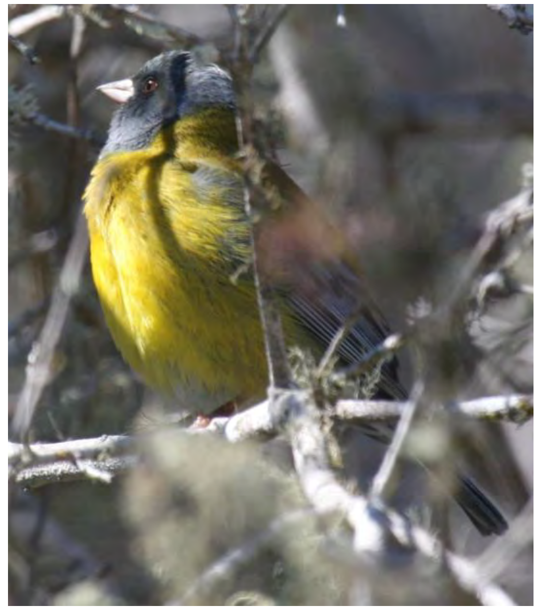
Figure 107. Wing of FCA female Grassland Yellow-Finch (26 Nov) showing molt limits between the greater and primary coverts (arrow) and among the tertials (s8-s9 replaced but hard to see). Note the worn and brown juvenile primary coverts (compare Figs. 109-110) contrasting with the replaced formative greater coverts.

Figure 108. Wing of FCA male Grassland Yellow-Finch (14 Sep) showing molt limits between the greater and primary coverts and among the inner secondaries (tertials s8-s9 replaced). Note the worn and brown juvenile primary coverts (compare Figs. 109-110) contrasting with the replaced formative greater and median coverts.

Figure 109. Wing of DCA female Grassland Yellow-Finch (17 Nov) showing uniform wing feathers without molt limits and fresher primary coverts with grayish and yellowish edging (compare Figs. 107-108).

Figure 110. Wing of DCA male Grassland Yellow-Finch (30 Oct) showing uniform wing feathers without molt limits and fresher primary coverts with grayish and yellowish edging (compare Figs. 107-108).

Gray-hooded Sierra-Finch
Phrygilus gayi



Chilean Name: Cometocino de Gay
Banding Code: COGA

Individuals Examined: 73 specimens (MWFB 4, FMNH 23, MCZ 46, MVZ 2); 37 captures.

Geographic Variation: Hellmayr (1932) considers Black-hooded Sierra-Finch to be a subspecies of *gayi* whereas Jaramillo (2003) separates Black-hooded as *P. atriceps*. Otherwise, *gayi* appears to show little variation within Chile. Black-hooded, Patagonian (*P. patagonicus*), and Gray-hooded sierra-finches are similar and may be sister taxa.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=22): Wing chord 70-85, tail 53-64; Male (n=23): Wing chord 77-92, tail 55-66.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to breed at higher elevations (1,500-3,350 m) during the austral summer (Sep-Mar) and descend into the lowlands (occasionally as far as sea level) during winter (Mar-Sep). In Fray Jorge it breeds in Sep-Jan and numbers increase during winter, from Mar-Sep. Birds observed on territory completing DPA, netted birds show BP and CP in Sep, and nesting documented in late Oct; small post-breeding flocks with juvenile birds observed in Feb-Mar.

Molt: Hellmayr (1932) and data from captured birds and specimens indicate that the DPB probably occurs primarily in Dec-Mar, the PF primarily in Feb-Jun, and a PA of body plumage has been confirmed in wintering cohort of birds in the park, in Aug-Sep. The PF is partial and includes most or all median coverts (up to three outer feathers can be retained) and no to 6 inner greater coverts, but no tertials and no or perhaps 1-2 central rectrices. The PAs involve head, back, rump, and breast feathers but few if any greater coverts, tertials, or rectrices.

Age/Sex Determination (Group 2, pp. 7-8): Acceptable age coding: FCJ (Dec-Feb); FPF (Feb-Jun); FCF (Mar-Aug); FPA (Aug-Sep); FCA (Sep-Dec); SPB (Dec-Mar); DCB (Feb-Aug); DPA (Aug-Sep); DCA (Sep-Dec); DPB (Dec-Mar); UCU, UPA, UCA, UPB, and UUU also acceptable. Hellmayr (1932) describes FCJs as largely grayish with only muted olive and yellow coloration to the back and underparts; juvenile greater coverts are also tipped white. It is possible that FCJ males average brighter body plumage and grayer wing and tail feathers than FCJ females but study needed. In Dec-Sep, all four age groups

(FCFs and DCBs) are duller than in Sep-Dec (FCAs and DCAs), with FCF females dullest and DCB males brightest during each season (Figs. 111-114). In all months it is best to age birds first by flight-feather criteria; FCFs and FCAs show molt limits within the greater coverts and between greater and primary coverts along with broader and squarer outer primaries (Figs. 115-117), and show narrow and worn outer rectrices (Fig. 120), while DCBs and DCAs show uniform greater and primary coverts and broader and squarer outer primaries (Figs. 118-119), and broader and fresher outer rectrices (Fig. 120). Eye color appears also to be helpful for ageing, varying from gray-brown in FCJ/FCF to reddish brown in DCB (Fig. 121); rate of change in FCFs, FCAs, and SPBs requires study. Once aged, FCFs and FCAs can be sexed by body feather coloration in formative or first alternate plumages (Figs. 111-114) and color of replaced formative wing feathers throughout year, brown in females and blue in males (Figs. 115-117). Likewise, DCBs and DCAs can be rather easily sexed by body feather coloration in definitive basic and alternate plumages (Figs. 111-114) and by wing-feather coloration throughout year, brown in females (Fig. 118) and blue in males (Fig. 119). Note that in Aug-Sep all eight age-sex-plumage groups may occur concurrently (Figs. 113-114). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Males average moderately larger than females (see above), especially in wing length, and measurements could assist with ageing and sexing some birds.

Further Study: How long does eye-color variation remain useful for ageing?

Notes:

Figure 111. Underparts of, from left to right, FCF female (29 Aug), DPA female (16 Aug), FCA male (19 Nov), and DPA male (19 Aug) Gray-hooded Sierra-Finches showing variation in plumage. FCF female and DCA male plumages are fairly distinct but DCB female and FCF male can vary. See also Figs. 112-113.

Figure 112. Upperparts of, from left to right, FCF female (29 Aug), DCB female (16 Aug), FCA male (19 Nov), and DPA male (19 Aug) Gray-hooded Sierra-Finches showing variation in plumage. Note browner tertials of FCF male compared with DPA male. See also Fig. 111.

Figure 113. FCF or FPA female (upper left, 13 Sep), DCB or DPA female (upper right, 13 Sep), FCF or FPA male (lower left, 11 Sep), and DCB or DPA male (lower right, 13 Sep), showing variation in body plumage by age and sex in FCF and DCB plumages (Dec-Sep).

Figure 114. FPA or FCA female (upper left), FPA or FCA male (middle and upper right), DPA or DCA female (lower left and lower middle, left), and DPA or DCA male (middle lower, right, and lower right), showing variation in body plumage by age and sex in FCA and DCA plumages (Sep-Dec). All images taken 13 Sep.

Figure 115. Wing of FCF male Gray-hooded Sierra-Finch (4 Nov) showing molt limits between the inner four (formative) and outer five (juvenile) greater coverts. Note also the brown and tapered primary coverts, which would contrast with the greater coverts when all of these are replaced (about 50% of individuals). The replaced s9 is adventitious.

Figure 116. Wing of FCF male Gray-hooded Sierra-Finch (11 Sep) showing molt limits between the inner 3 (formative) and outer 7 (juvenile) greater coverts. Note that replaced formative coverts can be bluer than juvenile feathers, indicating male in FCFs.

Figure 117. Wing of FCF male Gray-hooded Sierra-Finch (2 Nov) showing molt limits in median coverts but no greater coverts replaced.

Figure 118. Wing of DCB female Gray-hooded Sierra-Finch (27 Nov) showing brown wings and lack of molt limits. Note molt cline in secondaries from s1 to s6, the latter contrasting with the more-worn basic tertials.

Figure 119. Wing of DCB male Gray-hooded Sierra-Finch (30 Nov) showing bluer wings and lack of molt limits. Note molt cline from s1 to s6, the latter contrasting with the more-worn basic tertials. Also note duskier and bluer primary coverts (compare Figs. 117-118).

Figure 120. Outer rectrices of FCF female (left, 4 Nov) and DCB female (right, 27 Nov) Gray-hooded Sierra-Finches showing difference in shape.

Figure 121. Head plumage and eye color of FCF female (left, 4 Nov) and DCB female (right, 27 Nov) Gray-hooded Sierra-Finches showing duller head plumage and duller and browner eye color of FCF.

Mourning Sierra-Finch
Phrygilus fruticeti

Chilean Name: Yal
Banding Code: YAL

Individuals Examined: 59 specimens (MWFB 4, LSUMN 7, FMNH 23, MCZ 24); 44 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate that nominate *P. f. fruticeti* is the primary subspecies inhabiting Chile, with extralimital *peruvianus* being smaller and more-broadly streaked in males. A blackish form (adult males) has been collected on the Bolivian Slope in extreme northern Chile, which Hellmayr (1932) seems to consider a morph and Jaramillo (2003) considers a subspecies (*coracinus*). Birds of Fray Jorge are typical of the nominate subspecies.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=26): Wing chord 88-97, tail 69-78; Male (n=23): Wing chord 91-103, tail 73-83.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to breed at higher elevations (1,500-4,500 m) during the austral summer (Sep-Mar) and descend into the lowlands (occasionally to sea level) during winter (Mar-Sep). At Fray Jorge it breeds uncommonly in Aug-Jan, with some post-breeding withdrawal, occurring in lower numbers in Feb–Jun. Populations also fluctuate based on rainfall patterns (Kelt et al. 2012). Males are on territory and singing as early as Aug and nest-building and eggs have been observed in Sep; adults have been captured with enlarged CP (males) and well developed BP (females); provisioning has been observed in Oct; and juveniles have been captured as early as 26 Oct (Fig. 122).

Molt: No specimens collected or captured birds observed undergoing DPB molt but feather wear indicates that it takes place in Dec-Feb. Altitudinal migration for molt possible, as in some species in the Sierra Nevada of California (Pyle 1997). The PF can begin as early as mid-Nov (banding data) and is partial, typically including all median and greater coverts, 2-3 tertials, sometimes s6 and occasionally up to 4-6 rectrices among r1-r3. One specimen (LSUMNS 162481, FCF female) showed eccentric replacement, with s4-s9 and p6-p9 replaced on each wing, leaving s1-s3 and p1-p5 juvenile, and one captured bird showed p8 replaced on each wing, indicating an arrested eccentric molt (Fig. 128). Proportion undergoing eccentric replacement (5-8% of FCFs examined) appears to be low. The DCB is invariably complete. No evidence of PAs was observed in specimens or birds captured in Aug-Sep; forehead and breast plumage in males appears to become blacker from fall to spring due to buff feather fringes wearing off, rather than resulting from a DPA.

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Dec); FPF (Nov-Mar), FCF (Feb-Jan); SPB (Dec-Feb); DCB (Feb-Dec), DPB (Dec-Feb); UCU, UPB, and UUU also acceptable. FCJs of both sexes resemble females but have fresh plumage and finely streaked breasts and heads (Fig. 122). Both underpart and upperpart plumage varies by both age and sex in FCFs and DCBs (Figs. 123-124), although females differ only subtly by age, DCBs being grayer on crown, breast, and nape than FCFs, and usually showing thicker black malar streaks by season. Molt limits between the greater and primary coverts and among the tertials or inner secondaries (Figs. 125, 127-128), along with narrower and more tapered rectrices (Fig. 130) indicate FCFs, whereas DCBs have uniform wing feathers (Figs. 126, 129) and broader and squarer rectrices (Fig. 130). A small proportion of birds may also show replaced outer primaries in eccentric patterns (see above, Fig. 128). Replaced wing coverts of FCF males and these and flight feathers of DCB males are blacker than juvenile feathers in males and juvenile or basic feathers in females (Figs. 127-129). Some FCF females can be difficult to separate from DCB females but most birds should be readily aged and sexed. Males average moderately larger than females (see above), especially in wing length, and measurements could assist with ageing and sexing some birds. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Further Study: Confirm that seasonal plumage change in this species occurs due to wear as opposed to molt. Investigate whether or not altitude migration for molt may occur.

Notes:

Figure 122. FCJ Mourning Sierra-Finch (26 Oct) showing finely streaked breast and head. Note also the fresh (for Oct), narrow and tapered outer rectrices.

Figure 123. Underparts of, from left to right, FCF female (2 Jun), DCB female (Jul), FCF male (3 May), and DCB male (Jun) Mourning Sierra-Finches showing variation in plumage. Females can be difficult to age by plumage (rely on wing and rectrix criteria) but males are readily aged. Note black of DCB male can be mottled buff in fall and early winter, until feather fringing wears off. See also Fig. 124.

Figure 124. Upperparts of, from left to right, FCF female (2 Jun), DCB female (Jul), FCF male (3 May), and DCB male (Jun) Mourning Sierra-Finches showing variation in plumage. Females can be difficult to age by plumage (rely on wing and rectrix criteria) but males are readily aged. See also Fig. 123.

Figure 125. Wing of FCF female Mourning Sierra-Finch (28 Oct) showing molt limits between the greater and primary coverts and among the secondaries (s6-s9 replaced). Note the brown and worn primary coverts (compare Fig. 126).

Figure 126. Wing of DCB female Mourning Sierra-Finch (3 Nov) showing uniform wing feathers without molt limits. Note the broader and fresher primary coverts than in FCF female (compare Fig. 125).

Figure 127. Wing of FCF male Mourning Sierra-Finch (29 Oct) showing molt limits between the greater and primary coverts and tertials (s9 replaced). Replaced median and greater coverts are blacker in FCF male than in FCF female, making molt limits more distinct.

Figure 128. Wing of FCF male Mourning Sierra-Finch (13 Sep) showing replaced p9 (present on both wings) indicating arrested eccentric molt; note corresponding primary covert not replaced. All greater coverts and 3 tertials (s7-s9) also have been replaced.

Figure 129. Wing of DCB male Mourning Sierra-Finch (11 Sep) showing uniform blackish wing feathers without molt limits. Note the broader and fresher primary coverts and broad outer primaries (compare Fig. 127).

Figure 130. Outer rectrices of FCF female (left, 18 Nov) and DCB male (right, 11 Sep) Mourning Sierra-Finches showing difference in width and shape. Note the rectrices in DCB males are also blacker than in the other three age/sex groups.

Band-tailed Sierra-Finch
Phrygilus alaudinus

Chilean Name: Platero
Banding Code: PLAT

Individuals Examined: 35 specimens (MWFB 4, FMNH 14, MCZ 17); 60 captures.

Geographic Variation: Hellmayr (1932) considered the nominate subspecies *P a. alaudinus* to be endemic to Chile and other subspecies to occur in Bolivia and Ecuador.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=22) Wing chord 68-77, tail 50-59; Male (n=25): Wing chord 72-82, tail 53-62.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to either be resident, or to breed at higher elevations (up to 1,500 m) during the austral summer (Sep-Mar) and descend into the lowlands (occasionally to sea level) during winter (Mar-Sep). In Fray Jorge it breeds commonly in Sep-Jan and appears to occur in lower numbers in Feb–Jun; populations also fluctuate based on rainfall patterns (Kelt et al. 2012). Males are on territory and singing as early Sep; adults have been captured with enlarged CP (males) and well developed BP (females) in Sep-Oct; and provisioning of young has been observed in late Oct. As in Gray-hooded Sierra-Finch, non-breeding, both wintering birds and breeding residents confirmed in the park in Sep.

Molt: Data from captured birds and specimens indicate that males of this species have two distinct plumages per year (Fig. 132), as in Gray-hooded Sierra-Finch, including a PA involving head, back, and breast feathers (in all four age-sex groups) in Aug-Sep. Timing of PF and DPB unknown but it appears to be in Feb-Mar (MWFB 6827 completing DCB 6 Mar and FMNH 62062 had begun but arrested molt, after p1-p2 replaced, 12 Feb). FMNH 316755 was undergoing and had nearly completed the DPA on 18 Sep (Figs. 130-131). The PF is partial, including all median and greater coverts and 2-3 tertials on most or all birds but few or no other secondaries or primaries; replacement of s6 on one captured FCA may have occurred during the FPA (Fig. 134). The central rectrices may or may not be replaced. The DPB can be suspended, showing eccentric-like patterns in DCBs and DCAs (Figs. 136, 141); also, FMNH 62061 (31 Oct) had replaced p1-p3 on both wings (but otherwise looked like an FCF) resulting from early suspended PB2. Suspended DPBs can be distinguished from eccentric PFs (which appear not to occur in this species) by whether or not the primary coverts show corresponding molt limits to those of the primaries (Figs. 136, 141). The PA1 and DPA appear to be similar in extent and are limited primarily to feathers of the head, back, and breast. Occasionally 1-2 tertials may be replaced (confirmation needed), including s6 during the PA1 (e.g., Fig. 134) and s8 or s8-s9 during the DPA (e.g., Fig. 135).

Age/Sex Determination (Group 2, pp. 7-8): Acceptable age coding: FCJ (Nov-Feb); FPF (Feb-Mar); FCF (Mar-Aug); FPA (Aug-Sep); FCA (Sep-Feb); SPB (Feb-Mar); DCB (Mar-Aug); DPA (Aug-Sep); DCA (Sep-Feb); DPB (Dec-Mar); UCU, UPA, UCA, UPB, and UUU also acceptable. FCJs are similar in plumage to females but are fresher at this time of year (Nov-Jan) and have more-distinct wing bars, whiter underparts, and warmer upperpart fringing (Fig. 131). In basic plumage (Mar-Aug) all age/sex groups are fairly similar in body plumage but in Sep-Feb males acquire distinct black head and breast and bright yellow bills (Fig. 132). In both sexes FCFs and FCA females appear to average more streaks and less gray to the breast than DCBs and DCA females (Figs. 133, 137-138). FCF males may average more streaking on the nape, contrasting with a solid gray forecrown, than FCF females. DCB males but not DCB females also typically have grayer-fringed median coverts (Fig. 133); we suspect that some FCF males will show this as well, but probably averaging less-distinct gray than in DCBs. In both basic and alternate plumages, ageing best accomplished by wing-feather criteria, FCFs and FCAs showing browner and more worn primary coverts, molt limits between greater and primary coverts, and limits among the tertials and inner secondaries (Figs. 134, 139), whereas DCBs and DCAs show broader and grayer-edged primary coverts and uniform wing feathers (Figs. 135, 140). Some individuals show an eccentric-like pattern in the wing (Figs. 136, 141) but it appears to indicate DCB/DCAs after suspended DPBs rather than FCF/FCAs after an eccentric PF (see Molt and Figs. 136, 141). The size of the white spots in the rectrices also appear to vary by age/sex and feather (Fig. 142), similar to what is found in Magnolia Warbler (Pyle 1997:465), but ranges of variation and reliability need to be confirmed. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Males average slightly to moderately larger than females (see above), and measurements could assist with ageing and sexing a few birds.

Further Study: Can the PAs include the tertials? Confirm gray fringing to median coverts as criteria for males or at least DCB males in basic plumage. Confirm details of rectrix spot size by age and sex. How does bill color change with season in both sexes?

Notes:

Figure 131. FCJ Band-tailed Sierra-Finch (20 Nov) showing plumage resembling older females but with fresher and more filamentous plumage (for Nov), whiter underparts, and darker and warmer brown feathers to upperparts.

Figure 132. From left to right, DCB female (6 Mar), DCB male (6 Mar), and DCA male (28 Oct) Band-tailed Sierra-Finches showing female-like basic-plumages and distinct alternate plumage of male. The gray median coverts may be a good character for DCB male; otherwise ageing best accomplished with wing criteria (Figs. 134-135 and 139-140)

Figure 133. Underparts of, from left to right, FCF female (23 Aug), FCA female (8 Jul), and DCA female (30 Jun) Band-tailed Sierra-Finches. Breast plumage varies in both age groups but appears to average more gray and less streaking in DCA than in FCA. Upperparts are similar in all groups and seasons, being slightly grayer in some FCA/DCAs. At all times females best aged by molt-limit criteria (Figs. 134-135).

Figure 134. Wing of FCA female Band-tailed Sierra-Finch (30 Oct) showing molt limits between the greater and primary coverts and among the secondaries (s6-s9 replaced). Note especially the brown and worn primary coverts contrasting with fresher greater coverts (compare Fig. 135). s6 may have been replaced during the PA1.

Figure 135. Wing of DCA female Band-tailed Sierra-Finch (29 Oct) showing lack of molt limits except for the middle tertial (s8, red arrow), replaced possibly during the DPA. Note especially the grayer-edged primary coverts, not contrasting with the greater coverts in quality (compare Fig. 134).

Figure 136. Wing of DCA female Band-tailed Sierra-Finch (13 Sep) after suspended DPB, showing newer-looking p5-p9 and s4-s6. This pattern should not be confused with an eccentric pattern of FCFs; note the broader and fresher inner primaries and outer secondaries; rectrix pattern (Fig. 142) also confirmed this as a DCA.

Figure 137. Underparts of, from left to right, FCF male (1 Jun), FCA male (31 Oct), DCB male (undated), DPA male (18 Sep), and DCA male (15 Nov) Band-tailed Sierra-Finches. As with spring females, breast plumage appears to vary in both age groups in fall-winter males but averages more gray and less streaking in DCB than in FCF. See also Fig. 138. Ageing best confirmed with wing criteria (Figs. 139-140).

Figure 138. Upperparts of, from left to right, FCF male (1 Jun), FCA male (31 Oct), DCB male (undated), DPA male (18 Sep), and DCA male (15 Nov) Band-tailed Sierra-Finches. See also Fig. 137. Ageing in both basic and alternate plumages best confirmed with wing criteria (Figs. 139-140).

Figure 139. Wing of FCA male Band-tailed Sierra-Finch (30 Nov) showing molt limits between the greater and primary coverts and among the tertials (s8-s9, replaced at the PF). Note especially the brown and worn primary coverts contrasting with fresher greater coverts (compare Fig. 140). No tertials were replaced at the PA1.

Figure 140. Wing of DCA male Band-tailed Sierra-Finch (28 Oct) showing lack of molt limits. Note especially the grayer-edged primary coverts, not contrasting with the greater coverts in quality (compare Fig. 139). No tertials were replaced at the DPA.

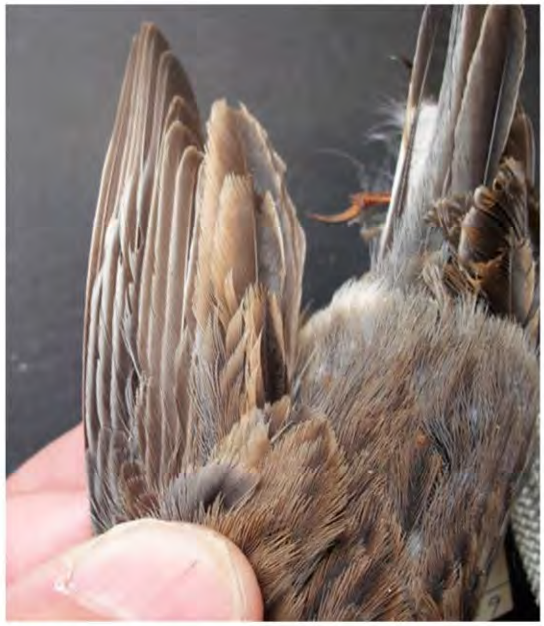


Figure 141. Wing of DCB male Band-tailed Sierra-Finch (6 Jul) showing molt suspension (p1-4 and s1-4 older); this simulates the look of an eccentric molt in an FCF but note corresponding molt limit among the primary coverts indicating DCB (most or all primary coverts are retained during eccentric molts). See also Fig. 136.

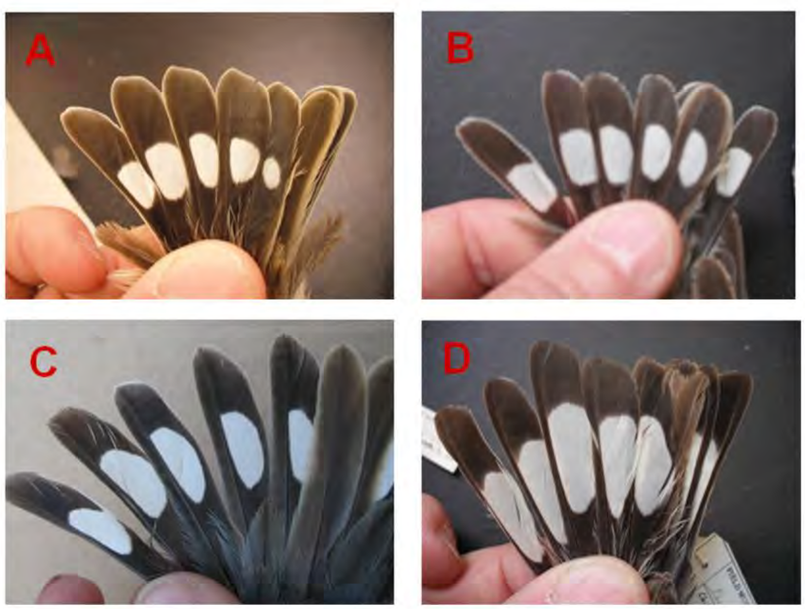


Figure 142. Rectrices of Band-tailed Sierra-Finches that appear to show patterns reflecting age and sex, but confirmation of details needed. Note especially the size of the white spot in r2 (see also Magnolia Warbler in Pyle 1997:465). Images are FCA female, 6 Mar (A); DCA female, 30 Jun (B); FCA male, 30 Nov (C); and DCA male, 15 Nov (D).

Common Diuca-Finch
Diuca diuca

Chilean Name: Diuca
Banding Code: DIUC

Individuals Examined: 83 specimens (MWFB 17, FMNH 29, MCZ 29 MVZ 8); 62 captures.

Geographic Variation: Hellmayr (1932) indicates the populations of central and southern Chile, including Fray Jorge, to be of the nominate subspecies. He described subspecies *D. d. crassirostris* as occurring north of Coquimbo and having a larger bill (this also stressed by Jaramillo 2003) and perhaps averaging a greater amount of white to the rectrices. There is also a smaller subspecies described from southern Argentina (*minor*), but supposed subspecific differences may be clinal. Measurement data here are for the nominate subspecies.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=16): Wing chord 81-91, tail 63-74; Male (n=44): Wing chord 82-92, tail 64-75.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) do not mention that this species is migratory, although Hellmayr mentions an apparent extralimital record of the nominate subspecies from the Cape Horn region, that could indicate migratory capability. Neither Hellmayr nor Jaramillo indicate breeding seasonality. Data from specimens and captured birds indicate heavy molt in adults in Nov-Dec, suggesting earlier spring breeding than in most other species. In Fray Jorge, the Common Diuca-Finch is resident and adult males have been observed on territory and with swollen CP and females with well developed BP in Sep-Oct; nest building has been observed in early Sep and chick provisioning observed in mid-Oct through Nov. Two juveniles were also collected in Feb in Valdivia (FMNH 62138-39) suggestion a later summer austral breeding season in more-southern latitudes, as would be expected.

Molt: Both first-year birds and adults are in heavy molt in Nov-Dec according to specimens and capture data, but one bird (MWFB 6853) was just completing the DPB on 15 Mar, so it could be protracted, suspended, or variable (see also below regarding MWFB 7614). A proportion of specimens collected in all months were not in molt, so molt could vary inter-annually perhaps with habitat condition as linked to rainfall patterns. FPFs in molt were found in Dec-Mar, perhaps indicating a protracted PF during this period, but it could vary inter-annually. The PF is partial, usually including most to all greater coverts (two outer coverts retained on one wing of one specimen, may have been anomalous) but no tertials or rectrices (the "block pattern" of Pyle 1997, Fig. 134, p. 207), although a very small proportion of birds may have replaced the middle tertial (s8) as well. One specimen (MWFB 7614) may have been initiating an eccentric molt (p7 replaced) but this more likely (given lack of tertial molt in other FCFs) may have resulted from a suspended/protracted PB; study needed. One bird netted in Sep had signs of light molt in the crown and face, perhaps indicating a limited PA, but confirmation of this is needed given variable molting patterns at other seasons; a PA is not assumed in age coding.

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Oct-Feb); FPF (Dec-Mar); FCF (Feb-Dec); SPB (Nov-Mar); DCB (Dec-Nov); DPB (Nov-Mar); UCU, UPB, and UUU also acceptable. FCJs are paler, average more brown to the upperparts and underparts, and have uniformly fresh wing feathers (Figs. 143-146). Both underpart and upperpart plumage varies by both age and sex in FCFs and DCBs (Hellmayr 1932; Figs. 145-146), with some overlap between age/sex groups, especially among females and FCF males. Molt limits within the greater coverts or (more commonly) between these and the primary coverts are useful in separating FCFs (Fig. 147), whereas DCBs have uniform wing feathers with fresher and grayer primary coverts by sex (Figs. 148-149). Shape, amount, and distinctness of white to the outer rectrices also appears to vary by age and sex (Fig. 150) but differences are subtle and should only be used in support of other criteria. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Within age groups, males are grayer than females, perhaps with little or no overlap, so it is best to attempt age determination first, and then sex determination, particularly among FCF males and DCB females. Feather wear needs also to be factored in: fresh birds in Jan-Mar are browner than worn birds in Apr-Dec, in all four age/sex groups, and wearing of brown feather fringes results in grayer worn plumage appearance. Measurements unhelpful for sexing (see above).

Further Study: More on timing of breeding and molt - could it vary inter-annually? Confirm that DPB can be suspended and protracted rather than PF be eccentric. Might there be a PA?

Notes:

Figure 143. FCJ Common Diuca-Finches (all from Nov) showing variation but generally pale and brown-washed coloration. Note fault bars in tail in right-hand image and see also Fig. 131.

Figure 144. Wing of FCJ Common Diuca-Finch (7 Nov) showing fresh feathers and brown edges to greater coverts (to be replaced at PF). Note the subtle paler fault bar through the middle of the remiges corresponding to that of the rectrices in the same bird in the left-hand image of Fig. 143.

Figure 145. Underparts of, from left to right, FCJ male (15 Feb), FCF female (1 Jan), DCB female (Jan), FCF male (3 Jan), and DCB male (Apr) Common Diuca-Finches showing variation in plumage, generally browner in younger birds and females becoming grayer in older males. See also Fig. 146.

Figure 146. Upperparts of, from left to right, FCJ male (15 Feb), FCF female (1 Jan), DCB female (Jan), FCF male (3 Jan), and DCB male (Apr) Common Diuca-Finches showing variation in plumage, generally browner in younger birds and females becoming grayer in older males. See also Fig. 145.

Figure 147. Wing of FCF male Common Diuca-Finch (20 Oct) showing molt limits within the greater coverts the outer two (marked with red arrows) retained juvenile feathers. Most will have replaced all greater coverts during the PF; note the worn and brown juvenile primary coverts (compare Fig. 149) contrasting with the replaced formative greater coverts (all but outer two).

Figure 148. Wing of worn DCB female Common Diuca-Finch (29 Oct) showing uniform wing feathers without molt limits and duller gray coloration of females (vs. DCB males; Fig. 149). Note also the fresher primary coverts with brownish-gray edging.

Figure 149. Wing of worn DCB male Common Diuca-Finch (2 Nov) showing uniform wing feathers without molt limits and brighter gray coloration of males (vs. DCB females; Fig. 148). Note also the fresher primary coverts with grayish edging (compare Fig. 147).

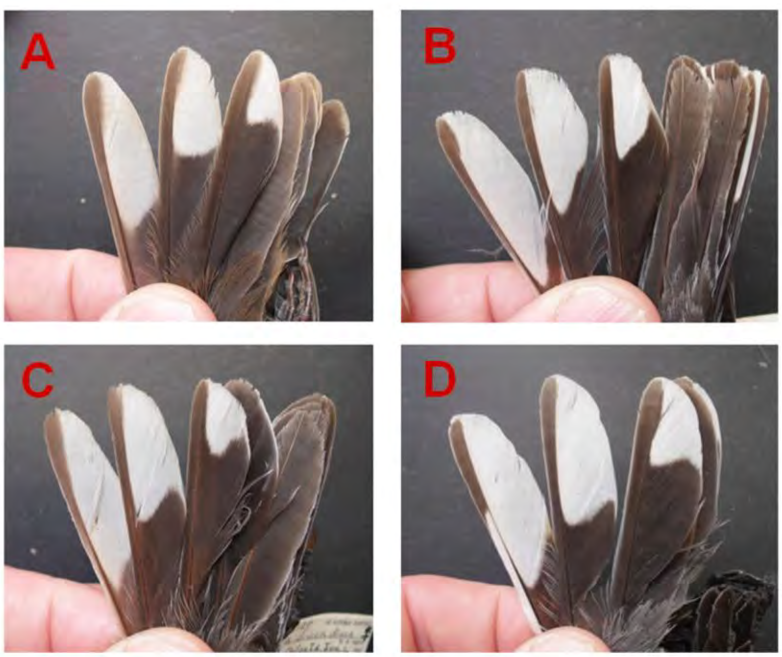


Figure 150. Rectrices of FCF female (A, 1 Jan), DCB female (B, Jan), FCF male (C, 3 Jan), and DCB male (D, Apr) Common Diuca-Finches showing subtle variation in shape and amount/distinctness of white.

Rufous-collared Sparrow
Zonotrichia capensis

Chilean Name: Chincol
Banding Code: CHIN

Individuals Examined: 166 specimens (MWFB 23, LSUMN 5, FMNH 78, MCZ 60); 222 captures.

Geographic Variation: Within Chile, Hellmayr (1932) lists five subspecies of this widespread and polytypic Latin American species, including two occurring only along the northern border (*Z. c. peruviensis* and *pulacayensis*), widely distributed *chilensis* of coastal southern and central Chile (up to 2,200 m elevation), *sanborni* of higher elevations in central Chile, and *australis* of Patagonia and along the southern high-mountain border with Argentina. Differences involve size, general coloration, and extent of dark to the head; *australis* and *sanborni* are larger, paler, and have more dark to the face than *chilensis*. The breeding subspecies of Fray Jorge is *chilensis* and it is possible that *sanborni* may occur in winter (Mar-Sep); see below.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=41): Wing chord 66-73, tail 53-62; Male (n=66): Wing chord 71-79, tail 55-66.

Range and Breeding Seasonality: Hellmayr (1932) does not indicate movement patterns and Jaramillo (2003) indicate this species to exhibit short-distance down-slope and northward movement for the austral winter. It is possible that higher-elevation breeding *sanborni* might move to a greater extent than lower-elevation *chilensis*, including occurrence at Fray Jorge in migration and winter. A few individuals banded at Fray Jorge in Oct had high fat scores possibly indicating migratory birds. The species otherwise appears to be resident in the park and undertakes a prolonged breeding season (Aug-Feb), including possible double clutching if habitat and rainfall conditions are favorable. Territorial males are singing by Aug with nest building occurring in Sep and birds with developed BP (females) and swollen CP (males) documented in Oct–Nov.

Molt: Molt in this species has been described by Miller (1961; equatorial Colombia), Wolf (1969; Costa Rica), Davis (1971; Peru), and King (1972; northwestern Argentina). Miller claimed that adults underwent two complete molts per year in Colombia whereas Wolfe and Davis found that the molt preceding breeding (PA) was partial (Costa Rica) to incomplete (Peru) and molt following breeding (PB) was complete. Davis reported that a PA could include a variable number of inner primaries (often 2-6) before arresting for breeding, and that the complete DPB then began again at p1. King (1972) reported no evidence of a PA in northwestern Argentina.

Data from captured birds and specimens in this study indicate PFs and PBs probably occur primarily in Jan-Mar in Chile, with the DPB commencing in some birds as early as Nov. We found evidence for PAs in both age groups, probably occurring in Aug-Oct and including up to three inner greater coverts, 1-2 tertials (s9 or s8-s9), and 1-2 central rectrices (r1); about half the individuals showed no greater coverts, tertials, or rectrices replaced. No DCA individuals showed suspension limits among primaries indicating arrested or suspended molts. The PF is partial and includes all greater coverts, 0-3 tertials, and sometimes 1-2 central rectrices (r1s), as reported by other authors. Thus it appears as though Rufous-collared Sparrows in Chile show very similar molt patterns to those of North American *Zonotrichia* sparrows, e.g. the well-studied White-crowned Sparrow *Z. leucophrys* (Pyle 1997: 590).

Age Determination (Group 2, pp. 7-8): Acceptable age coding: FCJ (Oct-Feb); FPF (Jan-Mar); FCF (Mar-Aug); FPA (Aug-Oct); FCA (Sep-Jan); SPB (Jan-Mar); DCB (Mar-Aug); DPA (Aug-Oct); DCA (Sep-Feb); DPB (Jan-Mar); UCU, UPA, UCA, UPB, and UUU also acceptable. FCJs lack rufous and the distinct head pattern of later plumages, and show heavily streaked underparts (Fig. 151). As with most North American *Zonotrichia* (Pyle 1997:587-593) the best way to age Rufous-collared Sparrow is by wing and tail criteria. In particular, the primary coverts are paler brown, more frayed, and lack pale or brown edging when worn in FCF/FCAs (Figs. 152-154) whereas in DCB/DCAs they are duskier, less worn, and show broader pale or brownish edging into spring (Figs. 155-157). The rectrices are also more pointed and seasonally more worn in FCF/FCAs than in DCB/DCAs (Fig. 158). In FCF/FCAs the juvenile primary coverts contrast with the replaced formative greater coverts (Figs. 152-154) whereas in DCB/DCAs outer greater coverts and primary coverts are uniformly basic; pseudolimits (Pyle 1997:207-208) between these feather tracts in DCB/DCAs (Figs. 155-157) can make this distinction difficult, as in North American *Zonotrichia*. Likewise, molt limits among the tertials and inner secondaries can be found in FCFs but not DCBs, but caution is advised in Sep-Feb, as both age groups can show replaced alternate inner coverts and tertials (Figs. 152-157). With experience, the differences between juvenile, formative, basic, and alternate tertials can be recognized and used to help separate FCAs from DCAs (Figs. 152-157). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. All criteria can be subtle and intermediates will be found that are best aged UCU (Mar-Aug) or UCA (Sep-Feb).

Sex Determination: Males and females are similar in all plumages. Measurements appear helpful for sexing many birds, males averaging longer wing (especially) and tail lengths than females (see above).

Further Study: Look for incomplete PFs and/or PAs, including primaries, as reported for Peruvian and other populations, though we suspect that reported incomplete PAs were actually the result of prolonged and/or suspended PBs. Do higher elevation *sanborni* winter in the coastal region of the country?

Notes:

Figure 151. FCJ Rufous-collared Sparrow (22 Oct) showing lack of distinct head plumage and rufous collar of subsequent plumages, and showing streaked breast.

Figure 152. Wing of FCA Rufous-collared Sparrow (2 Nov) showing molt limit between the greater and primary coverts (compare Figs 155-157). In this individual no tertials were replaced during the PF and no tertials or greater coverts were replaced during the first PA (see also Figs. 153-154).

Figure 153. Wing of FCA Rufous-collared Sparrow (28 Oct) showing molt limit between the greater and primary coverts (compare Figs 155-157). In this individual the innermost tertial (s9) was replaced during the PF and no tertials or greater coverts were replaced during the first PA (see also Figs. 152, 154).

Figure 154. Wing of FCA Rufous-collared Sparrow (28 Oct) showing molt limit between the greater and primary coverts (compare Figs 155-157), although the contrast is subtle. In this individual two tertials (s8-s9) were replaced during the PF and one inner greater covert was replaced during the first PA (see also Figs. 152-153).

Figure 155. Wing of DCA Rufous-collared Sparrow (21 Oct) showing no molt limit in quality (color pseudolimit only) between the greater and primary coverts (compare Figs 152-154). In this individual no tertials or greater coverts were replaced during the DPA (see also Figs. 156-157).

Figure 156. Wing of DCA Rufous-collared Sparrow (20 Oct) showing no molt limit between the greater and primary coverts (compare Figs 152-154). In this individual the innermost tertial (s9) and perhaps 2-3 inner greater coverts were replaced during the DPA (see also Figs. 155-156).

Figure 157. Wing of DCA Rufous-collared Sparrow (2 Nov) showing no molt limit between the greater and primary coverts (compare Figs 152-154). In this individual two tertials (s8-s9) but no greater coverts were replaced during the DPA (see also Figs. 155-156).

Figure 158. Fresh juvenal (left bird in left image; 6 Mar) and basic (right bird in left image; 6 Mar) and worn juvenal (upper right, 1 Dec) and basic (lower right, 24 Nov) rectrices in FCF, DCB, FCA, and DCA Rufous-collared Sparrows, respectively, showing differences in shape and wear by season.

Austral Blackbird
Curaeus curaeus

Chilean Name: Tordo
Banding Code: TORD

Individuals Examined: 85 specimens (MWFB 1, LSUMN 3, FMNH 11, MCZ 27, YPM 25, MVZ 5, USNM 13); 0 captures.

Geographic Variation: Hellmayr (1932) and Jaramillo (2003) indicate little variation within Chile, where it is nearly endemic.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=16): Wing chord FCJ/FCF 113-124 DCB 122-131, tail FCJ/FCF 90-100, DCB 99-108, exposed culmen FCJ/FCF 28-30, DCB 29-32; Male (n=25): Wing chord FCJ/FCF 122-132 DCB 128-139, tail FCJ/FCF 98-108, DCB 107-117, exposed culmen FCJ/FCF 30-33, DCB 32-35.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species to breed at lower elevations (to 1,350 m), to be partially migratory, and to congregate in flocks during winter. Jaramillo indicates slight northward extension of breeding range in winter. In Fray Jorge it is fairly common year-round, traveling in small flocks through the scrub, especially in tree-lined washes. We have not confirmed breeding in the park, but it is suspected.

Molt: Data from captured birds and specimens indicate that the PF and DPB occur primarily in Jan-Mar. Relatively late molt following the breeding season may indicate that it occurs following fall migrations or dispersal events. The PF is partial to incomplete, most birds replacing all median and greater coverts, 2-3 tertials, often the central rectrices (r1), and sometimes s6. One FCF specimen (YPM 22064) showed eccentric molt, with replaced p6-p9 and s6-s9 on both wings, all rectrices, and the outermost primary covert on the left wing only.

Age/Sex Determination (Group 1, pp. 7-8): Acceptable age coding: FCJ (Nov-Feb); FPF (Jan-Mar); FCF (Feb-Jan); SPB (Jan-Mar); DCB (Feb-Jan); DPB (Jan-Mar); UCU, UPB, and UUU also acceptable. FCJs were not examined and appearance is undescribed, but likely they are browner or grayer than FCF females, as in other blackbirds. Plumage and measurements should be combined to age and sex all individuals. Females are smaller than males (see above) and show browner bills and browner plumage, within each age group (Fig. 159). Modified crown feathers are spikier in DCBs and males than in FCFs and females (Fig. 159). FCFs can also be identified by molt limits in the wings, the greater coverts and 2-3 tertials replaced and blacker than the retained juvenile primaries, primary coverts, and outer secondaries (Fig. 160). Juvenile underwing primary coverts are retained in FCFs, and are very weak and brownish compared with replaced underwing greater coverts, whereas DCBs show uniformly replaced underwing coverts (Fig. 161), as in North American blackbirds (Pyle 1997:629). Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers.

Further Study: How often do eccentric PFs occur?

Notes:

Figure 159. From left to right, FCF female (Jan), DCB female (Feb), FCF male (Dec), and DCB male (Feb) Austral Blackbirds showing browner plumage and less distinct crown plumes in FCFs and females than in DCBs and males, and showing browner bills of females than males.

Figure 160. FCF female (4 Mar) Austral Blackbird showing molt limits in the wing, all greater coverts and alula and two tertials (s8-s9) having been replaced during the PF, darker and contrasting with the browner juvenal primary coverts and other remiges.

Figure 161. FCF male (left) and DCB male (right) Austral Blackbirds (both 6 Dec) showing retained underwing primary coverts contrasting with replaced formative underwing greater coverts of FCF, vs. uniformly basic underwing covs of DCB, as found in North American blackbirds (Pyle 1997:629).

Long-tailed Meadowlark
Sturnella loyca

Chilean Name: Loica
Banding Code: LOIC

Individuals Examined: 47 specimens (MWFB 1, FMNH 30, YPM 16); 5 captures.

Geographic Variation: Hellmayr (1932) considers Peruvian Meadowlark (*S. bellicosa*) a subspecies of *loyca* (which he refers to as *Pezites militaris*) whereas Jaramillo (2003) and all recent authorities split these. There is little to no variation noted within *loyca*.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=16): Wing chord 104-122, tail 74-87, exposed culmen 27-32; Male (n=23): Wing chord 118-133, tail 86-99, exposed culmen 31-36.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate little to no migration in this species. It breeds up to 2,500 m elevation; molt and wear patterns indicate breeding during the austral summer. It is resident at Fray Jorge though nomadic and gregarious most of the year. Birds have been netted in the park with developed BP in Sep-Nov, and males observed on territory in Sep–Oct.

Molt: Data from captured birds and specimens indicate molting occurs primarily in Feb-Mar (extending to Apr in some, perhaps those undergoing the PF). The PF is complete with the possible exception of the underwing primary coverts, which may be retained as in other blackbirds (Pyle 1997:629); see Fig. 163.

Age Determination (Group 3, pp. 7-8): Acceptable age coding: FCJ (Nov-Feb); FPF (Feb-Apr); FAJ (Mar-Feb); UPB (Feb-Apr); UCU, UPU, and UUU also acceptable. FCJs lack brighter red feathering to lores and underparts (Figs. 162). Otherwise, ageing is not reliable, though it may be possible by the condition of the underwing primary coverts, which are possibly retained (juvenile) feathers in FCFs and replaced (basic) feathers in DCBs, being paler and more frayed in the former and grayer and less frayed in the latter (Fig. 163); study needed. Even if juvenile underwing coverts are retained intermediates may be difficult and should be aged FAJ in any case. Birds undergoing complete molt can be aged FPF or DPB based on condition of older, unmolted feathers, weaker, more pointed, and relatively fresher in FPFs than in DPBs.

Sex Determination: Females are nearly diagnostically smaller than males (see above) and this can be used to sex FCJs (Fig. 162), which should show measurements in the bottom third of each range; otherwise, FCJs appear to be similar in plumage by sex. In subsequent plumages females show duller and substantially less red to the underparts than males in both fresh and worn plumages (Figs. 164-165).

Further Study: The possibility of underwing covert criteria for ageing needs to be further investigated.

Notes:

Figure 162. FCJ Long-tailed Meadowlark showing lack of bright red feathering to the lores and breast.

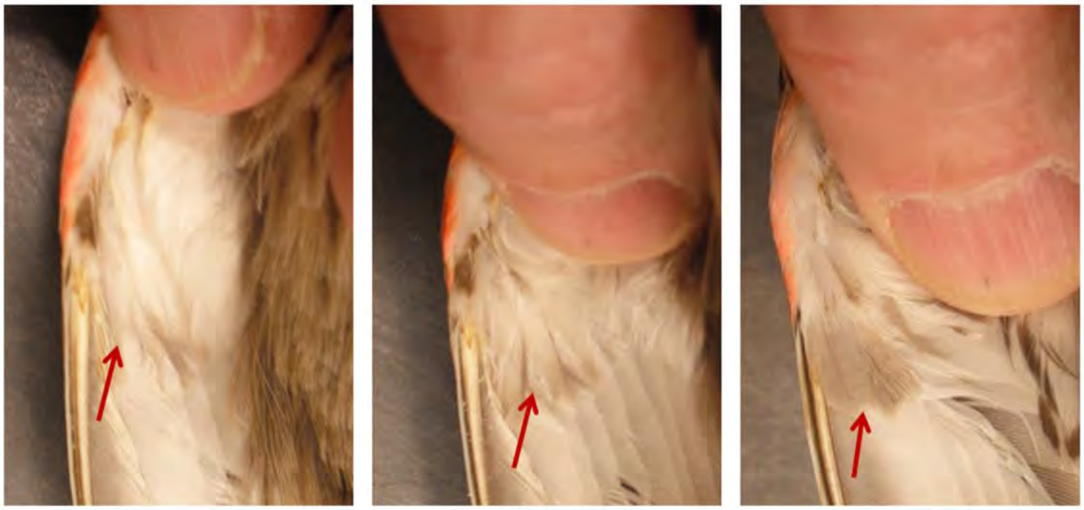


Figure 163. Variation in the underwing primary coverts which may reflect age in Long-tailed Meadowlarks. From left to right, possible worn FCF showing juvenal coverts (Sep), possible fresh FCF showing juvenal coverts (Mar), and possible fresh DCB showing basic coverts (May). Study is needed on the reliability of this criterion for ageing this species and other meadowlarks (see Pyle 1997:632-635).

Figure 164. From left to right, molting FCF (from FCJ) female (Jan), fresh FAJ female (Mar), worn FAJ male (Feb) and fresh FAJ male (Mar) Long-tailed Meadowlarks showing more extensive red in FAJ males than in FCJs and females.

Figure 165. Worn FAJ female (above, 26 Nov) and FAJ male (below, 30 Oct) Long-tailed Meadowlarks showing sex-specific differences in lore and underpart coloration.

Black-chinned Siskin
Sporagra barbata

Chilean Name: Jilguero
Banding Code: JILG

Individuals Examined: 56 specimens (MWFB 11, FMNH 44, CAS 1); 73 captures.

Geographic Variation: Hellmayr (1932) indicates little to no geographic variation.

Structure and Measurements: 9 primaries, 9 secondaries (3 tertials), 12 rectrices. Female (n=39): Wing chord 68-80, tail 44-50; Male (n=42): Wing chord 66-80, tail 45-52. Pox lesions on the feet, legs, and bill commonly detected in Fray Jorge.

Range and Breeding Seasonality: Hellmayr (1932) and Jaramillo (2003) indicate this species can breed up to 1,650 m elevation and shows some movement or post-breeding dispersal patterns, at which time they can occur in flocks. These sources and molt/plumage information indicate breeding during the austral summer (Oct-Feb). It is found year-round and breeds at Fray Jorge with nesting confirmed in Oct–Nov and provisioning of young observed as late as Dec.

Molt: Hellmayr (1932) indicates that males are in worn breeding plumage in Dec-Feb. No specimens or captured birds were examined undergoing molt, but plumage and wear indicate that a partial PF and complete DPB occur in Jan-Mar and a limited-to-partial PA occurs in Aug-Sep. The PF includes the inner 4 to all 9 greater coverts, often 1-3 tertials, often the central rectrices, and sometimes other (to all) rectrices. One bird captured on 7 Nov showed evidence of an arrested-eccentric PF, with most primaries among p5-p9 and most or all secondaries among s4-s9 replaced (Fig. 173), along with all rectrices (Fig. 178D); such arrested-eccentric molts have also been noted in Pine Siskin *Spinus pinus* (Pyle 1997:681). The PA includes some to all body feathers, some to most secondary coverts (including up to six inner greater coverts), often 1-3 tertials (s9 or s8-s9), and sometimes 1-2 central rectrices. It may be more extensive in FCA males, especially in the head; DCA males may acquire some of their breeding aspect through wear of basic feathers.

Age/Sex Determination (Group 2, pp. 7-8): Acceptable age coding: FCJ (Oct-Jan); FPF (Jan-Mar); FCF (Feb-Aug); FPA (Aug-Sep); FCA (Sep-Jan); SPB (Jan-Mar); DCB (Feb-Aug); DPA (Aug-Sep); DCA (Sep-Jan); DPB (Jan-Mar); UCU, UPA, UCA, UPB, and UUU also acceptable. FCJs resemble females but with a variable dusky wash to the crown and elsewhere (Fig. 166); study needed on whether or not the extent of dusky is sex-specific and would allow separation of some or all FCJ males from FCJ females. Both underpart and upperpart plumage varies by both age and sex in FCF/FCAs and

DCB/DCAs (Figs. 167-171), with most females and males separable to both age and sex in both basic and alternate plumage. In particular, females show no blackish in the throat in all plumages except some DCBs and most DCAs, whereas males of all post-FCJ plumages show a variable extent of black mottling, to a full black patch (Figs. 167-169, 158). Post-juvenile males but not females also show black in the crown (Figs. 169-170). In both sexes the amount of blackish to throat and/or crown and yellowish to the underparts average greater in DCBs than FCFs, and greater in DCAs than in FCAs (Figs. 167-171); Jaramillo (2003) describes gray and yellow "morph" females that could simply represent FCF/FCAs and DCB/DCAs, respectively, or if they are morphs could complicate ageing and sexing of females. Males of each age group also appear, on average, to have blacker flight feathers than females (cf. Figs. 172-178). Birds showing intermediate body plumages can also be aged by wing-feather criteria (Figs. 170, 172-176) and shape and condition of the rectrices (Figs. 168, 178). In FCF/FCAs molt limits between replaced formative and retained juvenile feathers can be found within the greater coverts, between the greater and primary coverts, and among the tertials and inner secondaries (Figs. 170, 159-160, 162-163). Some individuals appear also to show limits in the primaries and secondaries in eccentric or arrested-eccentric patterns (Fig.173). DCBs show no molt limits whereas DCAs often show limits between alternate and basic feathers among the inner greater coverts and tertials (Figs. 170, 174, 177). The limits between formative and juvenile feathers usually remain visible in FCAs, and FCAs at this time can also be identified by narrower and browner (within each sex) primary coverts (Figs. 172-176) and more pointed and more worn rectrices (Figs. 168, 178), although beware that individuals showing eccentric patterns (e.g., that of Fig. 173) and some other FCF/FCAs will have replaced all rectrices during the PF and are not separable by this alone. The extent of yellow to the base of the rectrices (cf. Fig. 173) likely also relates to age and sex (as in Pine Siskin; Pyle 1997:680) and this should be further evaluated. Birds undergoing complete molt can be aged SPB or DPB based on condition of older, unmolted feathers. Measurements unhelpful for sexing (see above).

Further Study: Does dusky in crown of FCJs relate to sex - can some FCJs be sexed? How often do eccentric or arrested-eccentric PFs occur? How does the extent and distinctness of yellow at the bases of the rectrices relate to age/sex - juvenile, formative (especially when all replaced) and basic. Do the yellow and gray morph females mentioned by Jaramillo (2003) merely reflect older and younger females, or basic and alternate plumages?

Notes:

Figure 166. FCJ Black-chinned Siskins (30 Oct and 2 Nov). The amount of dusky to the crown appears to vary and may indicate sex (e.g., left image is of a female and right image is of a male) but study needed.

Figure 167. From left to right, FCF female, DCB female, FCF male, and DCB male Black-chinned Siskins (all Aug) showing progression of underpart plumage by age/sex in formative and basic plumages (Feb-Aug). See Fig. 168 for comparative alternate plumages Sep-Feb.

Figure 168. From left to right, FCA female, DCA female, FCA male, and DCA male Black-chinned Siskins (all Dec) showing progression of underpart plumage and rectrix shape and condition by age/sex in alternate plumages (Sep-Feb; see also Figs. 169-170). See Fig. 167 for comparative formative and basic plumages (Feb-Aug).

Figure 169. From left to right, FCA female, DCA female, FCA male, and DCA male Black-chinned Siskins (all Dec) showing progression of plumage by age/sex in alternate plumages (Sep-Feb; see also Figs. 168 and 170).

Figure 170. From left to right, FCA female, DCA female, FCA male, and DCA male Black-chinned Siskins (all Dec) showing progression of upperpart plumage by age/sex in alternate plumages (Sep-Feb; see also Figs. 168-169). Among tertials, note 3 formative in the FCA female, 3 alternate in the DCA female, two formative and an alternate on the right wing of the FCA male, and 2 or 3 alternate on the DCA male.

Figure 171. Variation in throat plumage of alternate-plumaged (Sep-Feb) male Black-chinned Siskins (all Dec). The left four individuals are FCA males and the right three individuals are DCA males.

Figure 172. Wing of FCA female Black-chinned Siskin (5 Nov) showing molt limit in the greater coverts, the inner seven replaced formative and outer two retained juvenal (red arrows). Two to 3 inner greater coverts were replaced during the first PA and no tertials were replaced during either the PF or PA (cf. Figs. 170, 173-177).

Figure 173. Probable FCA female Black-chinned Siskin (7 Nov) showing apparent arrested-eccentric molt limits, with all greater coverts, the inner six secondaries (s4-s9), and four primaries (p5-p8) replaced during the PF; all juvenal primary coverts and the juvenal p9 were retained. Note that the inner 2-3 greater coverts and all three tertials were replaced again at the first PA (cf. Figs. 170, 172, 174-177). The other wing indicated s3-s9, p5-p7 and p9 replaced at the PF and s7-s9 at the PA. Pine Siskin can show similar arrested-eccentric PF molts in occasional individuals (Pyle 1997:681).

Figure 174. Wing of DCA female Black-chinned Siskin (2 Nov) showing uniformly basic greater and primary coverts and tertials; no tertials or inner greater coverts (apparently) were replaced at the DPA (cf. Figs. 170, 172-173, 175-177).

Figure 175. Wing of FCA male Black-chinned Siskin (5 Nov) showing molt limit in the greater coverts (red arrow), the inner four replaced formative and outer five retained juvenal. No tertials were replaced by this individual (cf. Figs. 170, 172-174, 176-177).

Figure 176. Wing of FCA male Black-chinned Siskin (5 Nov) showing molt limit between the greater and primary coverts and between the tertials and secondaries; all greater coverts and all three tertials were replaced during the PF and one tertial (s9) and the inner 2-3 greater coverts were replaced at the first PA (cf. Figs. 170, 172-175, 177).

Figure 177. Wing of DCA male Black-chinned Siskin (2 Nov) showing uniformly basic greater and primary coverts and tertials; it appears that the inner 3-4 greater coverts and inner two tertials (s8-s9) were replaced at the DPA (cf. Figs. 170, 172-176).

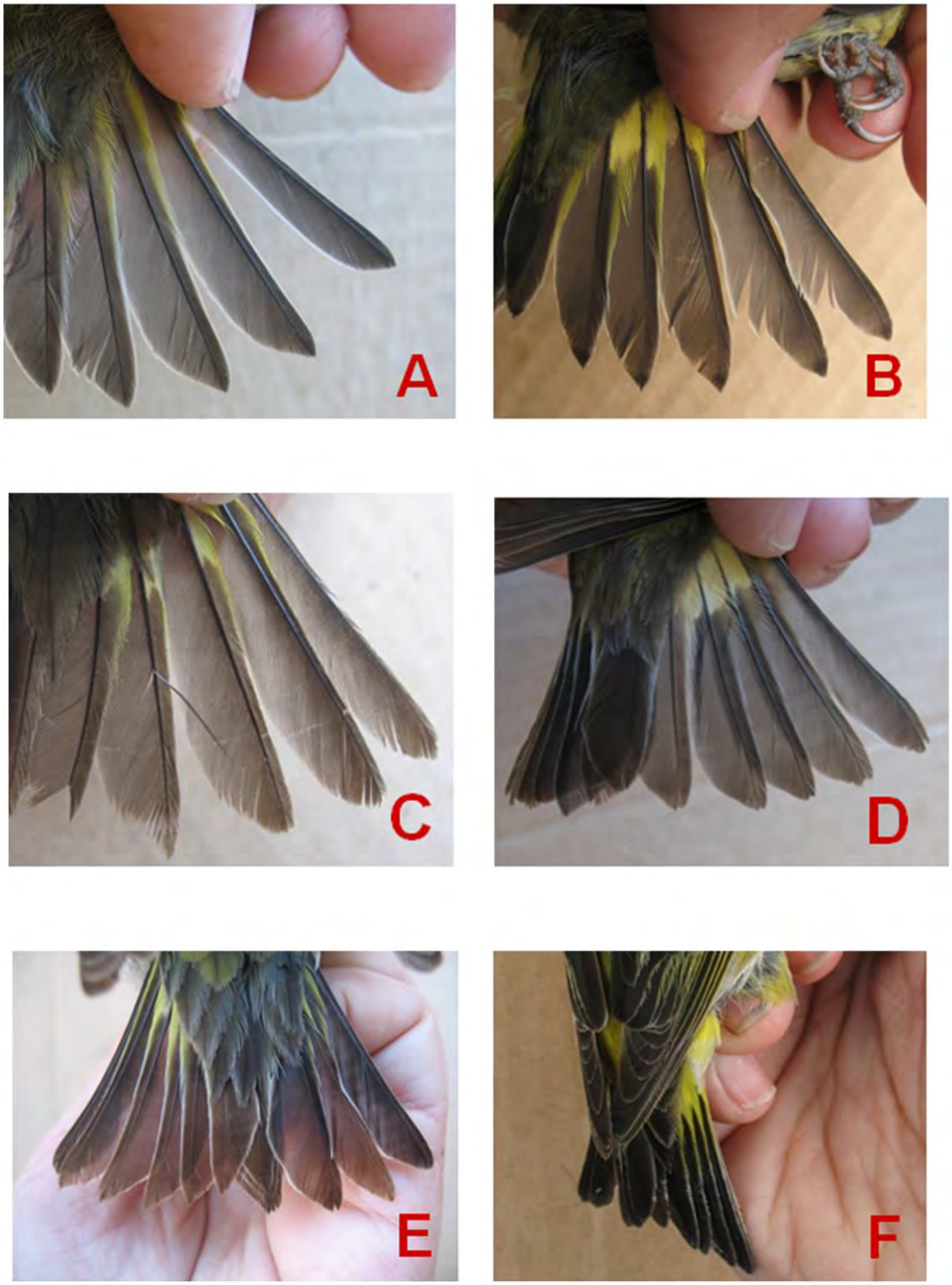


Figure 178. Rectrices of, from left to right, FCJ female (A, 24 Nov), FCJ male (B, 3 Nov), FCA female with juvenal rectrices (C, 30 Nov), FCA female with formative rectrices (D, 7 Nov), DCA female (E, 5 Nov) and DCA male (F, 30 Oct) showing differences in shape, wear, and coloration, including blacker feathers with more yellow at the bases in males; study needed on variation in the amount of yellow by age and sex.

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