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Myioborus pictus

Painted Redstart

SPANISH:
Pavito aliblanco,
Chipe ala blanca

The Painted Redstart is a common inhabitant of pine-oak woodlands in the foothills and mountains of the southwestern U.S. and Mexico. In the northern part of its range it prefers the bottoms of deeply shaded canyons with permanent water, while farther south it is more likely to be found in arid woodlands.

This bird is often heard before seen; its call is unlike that of any other North American wood-warbler and rather more reminiscent of a Pine Siskin (*Carduelis pinus*) call. Once seen, however, the Painted Redstart cannot be confused with any other species. It is easily identified by its bold black, red and white coloration and its conspicuous behavior of creeping along branches while spreading its wings and fanning its tail.

With its flashy habit of showing its broad, white wing patches and spreading its tail to reveal gleaming white outer rectrices, the Painted Redstart earns its place among *Myioborus* species, also known as whitestarts. The behavior may be connected to this redstart's method of feeding—startling prey into movement as it gleans, hover gleans, or hawks insects on the ground, on tree trunks, or among branches and twigs.

The Birds of North America
Life Histories for the 21st Century

The female is difficult to separate from her partner, as males and females share plumage characteristics in all seasons. In addition, research has determined that female Painted Redstarts sing; some forms of the song may be undetectable from the males' song.

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Two species of cowbirds (*Molothrus*) are known to parasitize this redstart's nest, especially in dry seasons.

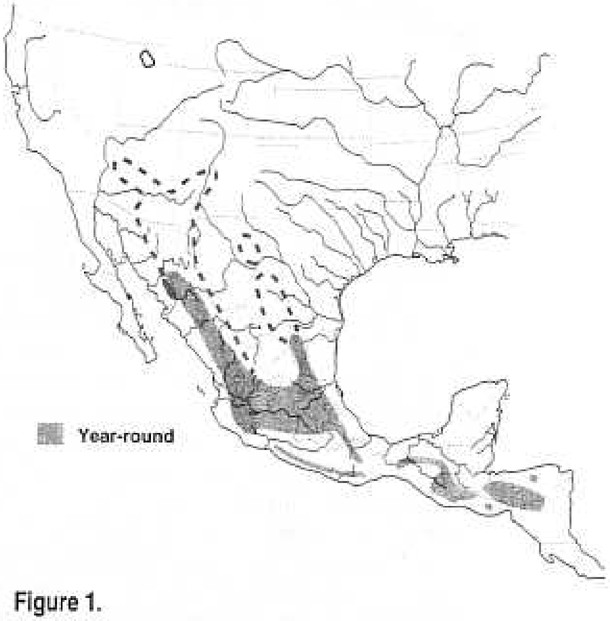

Figure 1.
Distribution of the Painted Redstart. This species breeds very patchily within the areas enclosed by the dashed line.

Despite its distinctiveness and abundance in appropriate habitat, relatively little is known about this engaging bird. A 1974 study by J. Marshall and R. P. Balda is the primary resource on the breeding ecology of the Painted Redstart; since 1992, Piotr G. Jablonski also has studied its foraging behavior in Arizona (e.g., Jablonski 1993, 1994, 1998, and 1999; Jablonski and Strausfeld 1998).

DISTINGUISHING CHARACTERISTICS

Large warbler: length 13.3–15 cm (Dunn and Garrett 1997, Curson et al. 1994), mass 9.7–9.9 g (*M. p. pictus* in Chiricahua Mtns., AZ; PGJ). Adult males and females essentially indistinguishable in appearance, and plumages alike throughout the year. Adults glossy black with large white wing patch (formed by median- and greater-coverts), white-edged tertials, mostly white outer rectrices, white crescent below eye, and red patch from lower breast through belly. Juveniles (observed May–Sep: Pyle 1997) similar to adults, but underparts entirely dark (without red) and overall color duller. Call is unlike any that of other North American wood-warbler; resembles Pine Siskin's (*Carduelis pinus*) call.

Adults unlikely to be confused with any other North American warbler. Slate-throated Redstart (*M. miniatus*) only other *Myioborus* represented in North America, but does not breed north of Mexico and is only accidental in sw. U.S. Northern subspecies of Slate-throated shares red and black pattern, but has no white in wings and less extensive white in rectrices. Juvenile Slate-throated sooty brown above and streaked cinnamon-brown below.

DISTRIBUTION

THE AMERICAS

Breeding range. Primarily pine-oak (*Pinus* spp.-*Quercus* spp.) and pinyon-juniper (*Juniperus* spp.) woodlands from Arizona and New Mexico south to s. Nicaragua, but very patchily distributed within this area (Howell and Webb 1995, Dunn and Garrett 1997; Fig. 1). In Arizona, common breeder in all southern and central mountains of upper Sonoran zone (with postbreeders moving into transition and Canadian zones). Found west to Baboquivari Mtns., north to Hualapai Mtns. and Mogollon Rim (Monson and Phillips 1981). In New Mexico, breeds locally in Mogollon highlands north to San Francisco and Magdalena Mtns., east to the Black Range and south to Peloncillo and Animas Mtns. Rare to fairly common in middle-elevation riparian woodlands and adjacent oak and pine-oak woodlands (Hubbard 1978). Uncommon, irregular, and very local summer resident in high canyons of Brewster Co., TX. Typically only encountered in the Chisos Mtns. of Big Bend National Park. Some years it is fairly common (4–6 seen per day), other years it is absent (G. Lasley pers. comm.). Has bred in Jeff Davis Co. (Texas Ornithol. Soc. 1995). Has also occurred rarely during summer in n.-central New Mexico, s. Nevada (especially Spring Mtns.) and in mountains of s. California, especially San Bernadino Mtns., with breeding documented there, and in Laguna Mtns. of San Diego Co. (Dunn and Garrett 1997). In Mexico, breeds (1,000–3,000 m) from e. Sonora and w. Chihuahua on the Pacific slope, and from n. Coahuila on the Atlantic slope south to Oaxaca. South of Isthmus of Tehuantepec, breeds from e. Oaxaca and central Chiapas, Mexico, south through s. Guatemala and from central Honduras to w.-central Nicaragua, and in ne. Honduras and central El Salvador (Howell and Webb 1995, Russell and Monson 1998).

Winter range. Winters primarily in Mexico and Central America from se. Sonora (Russell and Monson 1998) and sw. Chihuahua on the Pacific slope, and s. Nuevo León on the Atlantic slope south through the remainder of the Mexican and Central American breeding range (Howell and Webb 1995). Also winters sparingly in some lower canyons of the Santa Catalina, Huachuca, Santa Rita, Pajaritos and Baboquivari Mtns. in Arizona (Monson and Phillips 1981). A banded individual returned to the same feeder for at least 5 consecutive winters in Portal, AZ (Spofford 1976, Spofford 1983). One individual observed in Portal, AZ, in the winter of 1993 feeding at hummingbird feeders (PGJ). In 1999, 2 or 3 individuals wintered in Cave Creek Canyon, AZ, at elevation 1,600–1,700 m (B. Christman pers. comm., PGJ).

Other records. Frequent vagrant to California (about 107 records as of 1997), with all but 2 records in s. California, where recorded on coastal slope mainly fall/winter, and in mountains and intermountain lowlands mainly spring. Casual in sw. Arizona, sw. Utah, sw. Colorado, and s. Texas (including 2 spring records along upper coast). Accidental (including some sight reports) during fall in Baja California Sur, British Columbia, Montana, Michigan, s. Ontario, Ohio, New York, Massachusetts, Mississippi, and Alabama; during winter in Louisiana, and during spring in Wisconsin and Georgia (Dunn and Garrett 1997).

OUTSIDE THE AMERICAS

Not recorded.

HISTORICAL CHANGES

No recent changes in distribution are known.

FOSSIL HISTORY

No information.

SYSTEMATICS

GEOGRAPHIC VARIATION; SUBSPECIES

Little variation (if any) in size, although southernmost populations (south of Isthmus of Tehuantepec) said to average slightly smaller (Ridgway 1902).

Two subspecies recognized following Lowery and Monroe (1968). These distinguished mainly by pattern of white in tail and wings (Ridgway 1902, Curson et al. 1994, Dunn and Garrett 1997).

M. p. pictus (Swainson, 1829): Breeds from northern part of species' range (Arizona, New Mexico, w. Texas) south to Oaxaca and Veracruz. Migratory in northernmost part of range, wintering chiefly from s. Sonora, s. Chihuahua, s. Nuevo León, and s. Tamaulipas south. Vagrant records to north and east for species presumably are this race. Outer 3 rectrices (R4–R6) largely white, with R4 having outer web and large portion of inner web at tip white; innermost secondaries (sometimes referred to as tertials) with white edging.

M. p. guatemalae (Sharpe, 1885): Resident in mountains south of Isthmus of Tehuantepec from Chiapas, Mexico, to Guatemala, Honduras, and n. Nicaragua. Fourth rectrix (R4) entirely black or else with very little white on inner web at tip; innermost secondaries with little, if any, white edging.

RELATED SPECIES

Although formerly classified in same genus with American Redstart (*Setophaga ruticilla*), Painted Redstart displays many characteristics that ally it with the so-called whitestarts in the genus *Myioborus*, as pointed out by Parkes (1961). Similarities with other *Myioborus* include relatively long retention of Juvenal plumage, lack of sexual dimorphism, plumage pattern (especially white in tail), Definitive plumage attained immediately following Juvenal plumage, ground nesting, and more southern range (other *Myioborus* are Neotropical, mainly South American). Song and calls of Painted Redstart, however, and to some extent its plumage set it apart from other *Myioborus* (Curson et al. 1994, Dunn and Garrett 1997). Relationships among *Myioborus* unknown, and relationship of *Myioborus* to other wood-warblers not clearly understood either.

MIGRATION

NATURE OF MIGRATION IN THE SPECIES

Short-distance migrant. Most birds breeding in U.S. migrate to Mexico and Central America. A few individuals remain in se. Arizona through winter, at lower elevations (up to 1,700 m in the Chiricahua Mtns.; PGJ) than during warmer months. Seasonal movements within wintering regions depending on climate.

TIMING AND ROUTES OF MIGRATION

Fall. Rarely recorded during fall migration, even in lowland areas near breeding locations (Dunn and Garrett 1997). In Sonora, Mexico, some leave breeding areas in Aug, but many remain into Sep (Russell and Monson 1997). Most fall migrants recorded Sep (Dunn and Garrett 1997). Extreme late fall sightings include 29 Sep from San Luis Mtns. in New Mexico and 17 Oct from Oracle, AZ (Bent 1953).

Spring. Migration noted in Sonora, Mexico, by 3 Mar (Russell and Monson 1998). Extreme first-arrival dates 14 Mar in Arizona to 25 Mar in New Mexico (Bailey 1923, 1928, Bent 1953, PGJ).

MIGRATORY BEHAVIOR

In n. Arizona, males arrive 2–10 d before females (Marshall and Balda 1974). In Chiricahua Mtns., AZ, most males also arrive prior to females; some later-arriving individuals appear to be paired or pairing occurred immediately after male arrival, so that the males were not observed singly (PGJ).

CONTROL AND PHYSIOLOGY

No information.

HABITAT

BREEDING/WINTER RANGE

Occupies similar habitat during breeding and wintering season, but may move to lower altitudes during winter (see Migration, above). In n. Arizona, occupies oak and oak-pine riparian woodlands with dense overstories, thick undergrowth and permanent or semipermanent water (Marshall and Balda 1974). Found in oak-juniper woodland and riparian woodland of Chiricahua Mtns., AZ (Balda 1967). In Central America, inhabits arid to semihumid oak and oak-pine woodlands (Howell and Webb 1995). Most similar to Red-faced Warbler (*Cardellina rubrifrons*), Black-throated Gray Warbler (*Dendroica nigrescens*) and Hutton's Vireo (*Vireo huttoni*) in habitat distribution in Arizona during migration (Hutto 1985). Density in fall 1.4 birds/ha in riparian habitat in the Chiricahua Mtns. (Hutto 1985). In winter in s. Mexico, found exclusively in pine-oak-fir (*Pseudotsuga menziesii*) forests; in w. Mexico, in oak and oak-pine woodlands, pine and pine-oak-fir forests (Hutto 1980, 1992). In Veracruz, Jalapa region, Mexico, observed in pine forests (Keast 1980).

SPRING AND FALL MIGRATION

No information.

FOOD HABITS

FEEDING

Main foods taken. Primarily insects (Marshall 1957, Marshall and Balda 1974), but takes sugar water in summer (PGJ) and sugar water and peanut butter-suet mixture in winter at feeding stations in Arizona (Spofford and Fisk 1977, S. H. Spofford pers. comm.). Observed drinking sap from deciduous trees during spring (J. P. Cygan, I. Olejniczak, P. Boniecki pers. comm., PGJ). Some birds specialize at snatching insects from surface of water pools or from air above pool surface (PGJ).

Microhabitat for foraging. Generally forages in shady habitat, such as canyon bottom and densely wooded slopes (Marshall 1957, Marshall and Balda 1974). Observations in Chiricahua Mtns., however, do not show such a close association with shade; individuals often move out from canyon bottoms to forage on more open slopes (J. P. Cygan pers. comm., PGJ). Forages from ground level to tree tops predominantly on small and large twigs, trunks of trees, and to a lesser extent leaves (Bailey 1928, Bent 1953, Marshall and Balda 1974, Keast 1980).

Food capture and consumption. Typically feeds in 3 ways: (1) gleaning from surfaces of leaves, needles, trunks, branches, and twigs; (2) hover gleaning—picking insects from foliage, trunks, branches, and spider webs; (3) hawking—catching insects on the wing over water or near lights at dusk (Marshall and Balda 1974). Uses tail-fanning and wing-spreading during foraging (Marshall 1957, Wibble 1967, Marshall and Balda 1974), which evokes jump and flight in prey (Jablonski 1998, 1999, Jablonski and Strausfeld 1998). Additionally, foraging birds often move bodies from side to side, in a way often described as twitching, pirouetting, or pivoting, which also helps to flush insects (Marshall 1957; Jablonski 1998, 1999; Jablonski and Strausfeld 1998). Birds chase prey more often when foraging with spread wings and tail than with closed wings and tail (Jablonski 1999).

In pine-oak forests of Mexico in winter (Dec and Jan), 26% of foraging maneuvers were in Chihuahua pine (*Pinus leiophylla*), 48% in deciduous trees, and 25% in aerial capture (80 records from 18 individuals; Keast 1980). In Chiricahua Mtns., AZ, in May and Jun, most commonly employed strategies: gleaning insects from substrates and flush-pursue foraging (flushing insects and chasing them while they attempt to escape). Most foraging occurred in oaks (52.8% ± 4.7 SE of foraging time; $n = 12$ individually marked birds collecting food for nestlings in 1992; PGJ). Remaining tree substrates were junipers (13.7% ± 4.3 SE), Chihauhua pine (10.2 ± 4.7%), Arizona sycamore (*Platanus wrightii*; 2.1 ± 1.8%), and other substrates (14.3 ± 6.0%) represented mostly by ground foraging and some flycatching. Chasing rates (chases/100 hops) differed somewhat among tree species: oaks = 2.3 chases/100 hops, pines = 2.4, junipers = 2.7, ground = 1.2. Pecking rates (pecks/100 hops) for those substrates: oaks = 1.0 pecks/100 hops, pines = 1.2, junipers = 0.3, ground = 1.4. In one video sequence, a delay between insect-flight escape and start of pursuit by an individual was within 0.07–0.1 s.

DIET

Major food items. Predominantly insectivorous, but will drink sugar water and sap. In Chiricahua Mtns., AZ, May–Jun (PGJ), most chases in which an insect was seen were apparently after Dipterans, moths (Lepidoptera), and leafhoppers (Homoptera: Cicadellidae); also seen eating caterpillars. Diet of nestlings presented in Table 2; cicada (Homoptera: Cicadidae) pupae and freshly emerged cicadas may make up large portion of nestling diet (in terms of biomass) at time of emergence (H. Hespenheide, J. P. Cygan pers. comm., PGJ).

Quantitative analysis. No information.

FOOD SELECTION AND STORAGE

No information.

NUTRITION AND ENERGETICS

No information.

METABOLISM AND TEMPERATURE REGULATION

No data. During hot days, seen panting, with wings kept away from body (PGJ).

DRINKING, PELLET-CASTING, AND DEFECATION

No information.

SOUNDS

VOCALIZATIONS

Development. No evidence of vocal learning. Nestling calls begin at 4 d after hatching as a soft peep; develop into louder squeaks, given in response to presence of adults or when young are handled. At 7 d of age, a nestling is capable of calling as loudly as an adult (Marshall and Balda 1974).

Vocal array. SONG. Males and females sing a variable song, usually 2-parted syllables, concluding with ≥1 single-syllable inflected notes (Figs. 2A, B, and C). These can be represented by *weeta weeta weeta wee* (Fig. 2B) or *weeta weeta chilp chilp chilp* (Fig. 2C; Dunn and Garrett 1997).

Males use several (up to 10+) song types as defined by a researcher looking at the sonogram structure of the loudest second half of a song; songs may have 1 or 2 ending notes (an A-shaped note in Figs. 2B and C). Variability of song (number of different song types sung/number of all songs sung) and frequency of switching between song types (number of switches/number of songs) are low when males sing alone, high when males are countersinging with another male, and intermediate when a male sings in presence of a female (M. Ficken pers. comm., PGJ). Playback experiments also suggest that male mating status affects singing and aggressive behavior (T. Osiejuk and J. P. Cygan pers. comm., PGJ).

Call Notes. Used by both sexes and juveniles. Call described as harsh, whistled *sreeu*, richer *cheree*, or *chew-elee*, all said to be reminiscent of calls of Pine Siskin (Dunn and Garrett 1997; Fig. 2D). Presumably, if studied in more detail, call notes would be divided into at least 2 structurally and functionally different call types: aggressive call and "normal" call. When used during aggressive interactions, calls are stronger, harsher, and slightly longer than calls used on other occasions.

Alarm Call. Typically given when an avian predator is present, represented by high pitched *zeeeettt*. Both adults may immediately hide and remain still until predator is gone. Nestlings respond to alarm calls by flattening themselves down in bottom of nest and remaining still until an adult gives a call note (Marshall and Balda 1974). The same call may be given when a person approaches a nest site, often as a warning from male to a nest-building female (PGJ).

Courtship Call. A sharp, high-pitched call given during courtship flights; seldom heard and lasts only a few seconds (Marshall and Balda 1974). The sex of the bird which gives the call is usually not observed, but occasionally a male was seen giving it (J. P. Cygan pers. comm.).

Begging. Squeaky call given by nestlings and fledglings in response to adults with food, given continuously until young are fed (Marshall and Balda 1974).

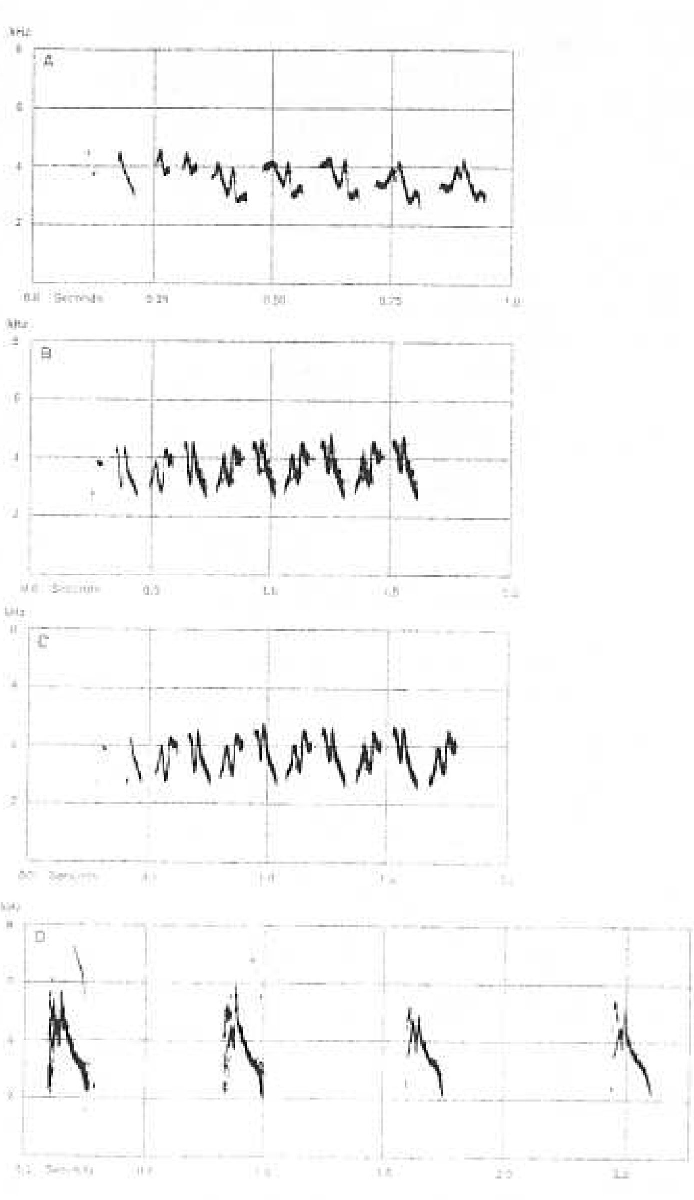

Figure 2. Painted Redstart song and call notes from recordings in the Library of Natural Sounds (LNS) collection, Laboratory of Ornithology, Cornell University. A. Female song (LNS #20873, Cave Creek, Arizona, 22 May 1977). B and C. Male song (from Peterson Field Guide to Western Bird Songs CD, Disc 2, track 32, cuts 1 and 2). D. Call notes (Peterson Field Guide to Western Bird Songs CD, Disc 2, track 32, cut 3). All sonograms prepared by the staff of the Borror Laboratory of Bioacoustics, The Ohio State University, using a Kay Elemetrics DSP 5500 Sona-Graph (with an effective frequency resolution of 150 Hz and a 200 point FFT transform size).

Phenology. Male singing decreases after onset of incubation (Cygan and Jablonski 1998, in press). Females sing mostly at beginning of first brood and near end of first brood or beginning of second brood; on average 3 songs/3 min (Cygan and Jablonski 1998, 2000). In Chiricahua Mtns., AZ, males sang most actively before mate acquisition (13.0 songs/3 min when alone; 16.3 songs/3 min in presence of other singing territorial male; 14.5 songs/3 min in the presence of a pair). Paired males sang less frequently (5.5 songs/3 min; 9.6 songs/3 min when another pair or a male present nearby). Males sang 2.5 songs/3 min when nestlings were in nest (Cygan and Jablonski 1998, in press). Over-wintering birds in the U.S. have been known to sing frequently (Dunn and Garrett 1997).

Daily pattern. During territorial establishment, males sing all morning and into afternoon, for 15–30 min at a time, sometimes >1 h, with 5-s intervals between songs (Marshall and Balda 1974). Unknown if males and females engage in a dawn chorus, but males in Chiricahua Mtns. may sing before sunrise (J. P. Cygan pers. comm., PGJ).

Places of vocalizing. Males may use certain perches in trees at boundaries of their territories (Marshall and Balda 1974), but often sing from various sites inside the territory (J. P. Cygan pers. comm.). During nest-building, females often call when leaving or entering the nest (PGJ).

Social context and presumed functions. Songs function both inter- and intrasexually. Males sing spring and summer. Females sing while dueting with their mates or answering the male during courtship and egg-laying. Female song, however, is often quieter and less complex than male song. Females do not sing in response to male song during nest-building; females sing a quiet version of the song when away from the nest (Marshall and Balda 1974). Females may sometimes sing a full song when in conflict with neighboring birds (J. P. Cygan pers. comm., PGJ). During interactions with other pairs, males countersing with each other and females often call and may sing (J. P. Cygan pers. comm., PGJ). Males sing a subtle song in vicinity of nest when female is incubating inside the nest. Females sometimes seen leaving the nest after males sing such a song. Calls thought to facilitate contact between pair members, especially when foraging. Often given before and after adults feed nestlings.

NONVOCAL SOUNDS

No information.

BEHAVIOR

LOCOMOTION

Walking, hopping, climbing, etc. Pivots and hops while foraging. Hops 10–30 cm long; hop speed 20–120 cm/s (N. Strausfeld pers. comm., PGJ).

Flight. For foraging flights, see Food habits: food capture, above. For courtship flights, see Sexual behavior: pair bond, below.

SELF-MAINTENANCE

Preening, head-scratching, bathing, anting. Adults use streams to bathe (PGJ). While standing in water, adults half-spread wings then shake body and wings.

Sleeping, roosting, sunbathing. Little information. An adult bird was flushed after sunset from a branch 170 cm above the ground where it was sleeping alone (PGJ). In Chiricahua Mtns., often sun-bath in the morning on top of trees. Males sit by the nest with incubating females up to 45 min (J. P. Cygan pers. comm., PGJ).

Daily time budget. Inactively sitting and/or preening birds appear to be more common during middle of a day than in the morning or afternoon (PGJ).

AGONISTIC BEHAVIOR

Agonistic encounters between males vary in their execution, often starting with countersinging until males are several meters apart, when singing rate may decrease; at very close range, males often silently display to each other. Display consists of wing- and tail-flicking and "nervous" jumping, with occasional chases; flicking is fast opening and closing of tail and wings. During each opening, wings are raised above the body, apparently to increase visibility of white wing patches to opponents. Similar flicking is performed when mobbing a predator. Sometimes singing continues at a close range. After ≤ 10 min of interactions at close range, males often fly away from each other to return to their territories and sing (PGJ); these encounters may be repeated between neighboring individuals many times. If a male is paired and his mate is not incubating, she often calls loudly during these interactions and may occasionally sing a song indistinguishable by ear from male song. During nest-building, both sexes observed to wing- and tail-flick, and to attack model (stuffed) Painted Redstarts in the vicinity of a nest (J. P. Cygan pers. comm., PGJ).

Birds (presumably males) seen physically fighting on a few occasions (PGJ).

SPACING

Territoriality. Pairs maintain all-purpose territories during the breeding season. Males establish territories by continuous singing at territory boundaries. In n. Arizona, territories established 2–5 d after arrival from wintering grounds and before female arrival. Territories used for courting, nesting and feeding (Marshall and Balda 1974). Mean territory size of pairs in n. Arizona 1.68 ha (range 1.58–1.90, n = 4 territories; Marshall and Balda 1974). Territory size may decrease with density of breeding pairs (Balda 1967). Territories in riparian habitat of the Chiricahua Mtns. were 0.61 ha ± 0.23 SD (n = 13), in oak-juniper woodland 1.16 ha ± 0.17 (n = 2; Balda 1967).

In n. Arizona, trios seen peaceably foraging together, possibly a polygynous male with 2 females. When a female initiated a second brood, she nested adjacent to her first territory; when young of the first brood were independent and left their natal territory, the male shifted his primary territory to include the area with the second brood (Marshall and Balda 1974).

Individual distance. Paired birds may occasionally forage very close to each other (≤ 1 m) especially prior to incubation. Later in nesting cycle, often forage separately (see also Sexual behavior: pair bond, below; PGJ).

SEXUAL BEHAVIOR

Mating system and sex ratio. Socially monogamous, occasionally polygynous (Marshall and Balda 1974). In n. Arizona, trios seen peaceably foraging together, possibly a polygynous male with 2 females (Marshall and Balda 1974).

Pair bond. One of the most familiar aspects of Painted Redstarts is their conspicuous tail-fanning behavior, similar to behavior of other *Myioborus* species, American Redstart, and some other warblers (Ficken and Ficken 1962, Jablonski 1999). Both males and females fan their tails. Tail-fanning appears in two contexts: as part of courtship and to flush prey during foraging (see Food habits: feeding, above). Tail-fanning used in courtship seems to be slower and less frequently associated with vigorous hops and body-pivoting than during foraging. At early stages of breeding (pair formation, looking for nest site), males fan their tails during flight and also on the ground when courting a female. During courtship and sometimes before onset of second brood, males perform a flight display: flying in a downward arc with stiffened wings and spread or half-spread tail, sometimes singing during flight. This display appears to be aimed at a female, who is often above the displaying male. Prior to nest-building, males sometime tail-fan while inspecting potential nest sites. The female follows her mate and inspects sites visited by him (PGJ). Young begin tail-fanning when they begin foraging for themselves, about 10 d prior to independence. At 20 d old, hand-raised Painted Redstarts, however, were observed tail-fanning even though their tail-feathers were not fully grown. Pair members continue tail-fanning until their young are independent and leave the territory. In the Chiricahua Mtns., AZ, foraging-related tail-fanning observed through spring, summer and early fall (PGJ). Double-brooded pairs continue to tail-fan until their second brood is independent or fails; so tail-fanning also may be a visual cue for family members to keep track of each other, in addition to increasing foraging efficiency (Marshall and Balda 1974).

As described by Marshall and Balda (1974), females appear to be attracted by singing males. After approaching resident male, an antiphonal duet begins; pair continue to sing throughout the morning and early afternoon. Observations from the Chiricahua Mtns. suggest that duetting also occurs after pairing (J. P. Cygan pers. comm.). Pair remain closely associated, flying and foraging together. Occasionally male dives at female; she may fly up to avoid contact. Male continues to chase the female through vegetation; she swerves and turns to evade him. During these short energetic flights, either males or females give courtship calls. After pair formation, male and female usually remain close together, < 45 m apart, with both individuals giving Contact Calls. Singing activity of paired birds is low (Cygan and Jablonski 1998, 2000). Observations suggest, however, that paired mates may sing very subtle "warbling" songs to each other, which are difficult to hear unless given nearby (PGJ).

Extra-pair copulations. No direct observations, or genetic data, but behaviors observed during the breeding season suggest males mate-guard and may be at risk of females engaging in extra-pair copulations (Marshall and Balda 1974, J. P. Cygan pers. comm., PGJ).

SOCIAL AND INTERSPECIFIC BEHAVIOR

Degree of sociality. Pairs solitary during breeding season. In w. Mexico, forage in mixed-species flocks following breeding (11.3 species, $n = 4$ flocks) and during winter in pine-oak woodlands (18.4 species, $n = 8$ flocks; Hutto 1987).

Play. No information.

Nonpredatory interspecific reactions. Tolerant of other bird species in territory but aggressive when other species approach the nest. A female Painted Redstart stopped incubating when a House Wren (*Troglodytes aedon*) landed about 1.5 m from her nest and chased the wren about 90 m (Marshall and Balda 1974), and a pair of Painted Redstarts chased away a Black-headed Grosbeak (*Pheucticus melanocephalus*; PGJ). Interactions also observed away from nest and include males attacking flycatchers (*Empidonax* spp.) and warbler (*Dendroica* spp.; J. P. Cygan pers. comm., PGJ) and adult chased by Dusky-capped Flycatcher (*Myiarchus tuberculifer*) twice (PGJ) and by Yellow-rumped Warbler, *Dendroica coronata* (Bailey 1923). On 2 occasions, an area where an adult was foraging was searched once by a Mexican Jay (*Aphelocoma ultramarina*) and once by a Black-throated Gray Warbler (PGJ). In spring in the Chiricahua Mtns., adults attempt to defend oak branches with sap against other birds, including Acorn Woodpeckers (*Melanerpes formicivorus*). In winter, joins mixed-species flocks: present in 8 of 15 flocks in oak and pine-oak woods in w. Mexico (Hutto 1987). Other species often seen in mixed flocks with Painted Redstart include: Tropical Parula (*Parula pitiayumi*), Warbling Vireo (*Vireo gilvus*), Black-throated Gray Warbler, Virginia's Warbler (*Vermivora virginiae*), Hepatic Tanager (*Piranga flava*), and Rufous-capped Warbler (*Basileuterus rufifrons;* Hutto 1987).

PREDATION

Kinds of predators and manner of predation. Direct observations of predators taking eggs or nestlings include chipmunk (*Eutamias dorsalis*), kingsnake (*Lampropellis pyromelana*), and Mexican Jay (J. P. Cygan pers. comm., PGJ). Other likely predators include Common Raven (*Corvus corax*) and small and medium-sized mammals (PGJ). Clay eggs in artificial nests imitating redstart nests were sometimes chewed on by small rodents, presumably mice and chipmunks (P. Keller and T. Keller pers. comm., PGJ). Two cases of incubating females killed in the nest, presumably by a medium-size mammal (feathers chewed) and probably at night. Kingsnake ate nestlings directly from nest cup, remaining there while swallowing the prey.

Response to predators. Adults observed mobbing Northern Pygmy-Owl (*Glaucidium gnoma*), Mexican Jay, Common Raven, Apache fox squirrel (*Sciurus apache*), kingsnake and black-tailed rattlesnake (*Crotalus molossus*). Mobbing involves quick tail and wing flicks, calls, energetic hops, and flights over the predator (J. P. Cygan pers. comm., PGJ). Distraction display by female observed in response to human observer approaching a nest: female moved on the ground shaking/trembling her half-spread wings, sometimes asymmetrically, and calling (PGJ).

BREEDING

PHENOLOGY

Pair formation. Once a male establishes a territory, usually attracts a mate within 4 d. Pair bonds established approximately 1 d after initiation of courtship (Marshall and Balda 1974). In Chiricahua Mtns., AZ, some individuals seem to arrive already paired (PGJ). For arrival times, see Migration, above.

Nest-building. In Chiricahua Mtns., AZ, nest building starts in the first half of Apr (PGJ). Nest constructed in 4 d to 2 wk.

First brood per season. Eggs (presumably from first nests) found mid to late May in Huachuca Mtns., AZ (Bent 1953). Peak of nest initiations around early May in n. Arizona (Marshall and Balda 1974). In Oaxaca, Mexico, a nest with eggs and laying female found in early May (Binford 1989).

Second brood per season. Peak of initiations around third week of Jun (Marshall and Balda 1974). One nest in Arizona contained eggs on 14 Jul (PGJ).

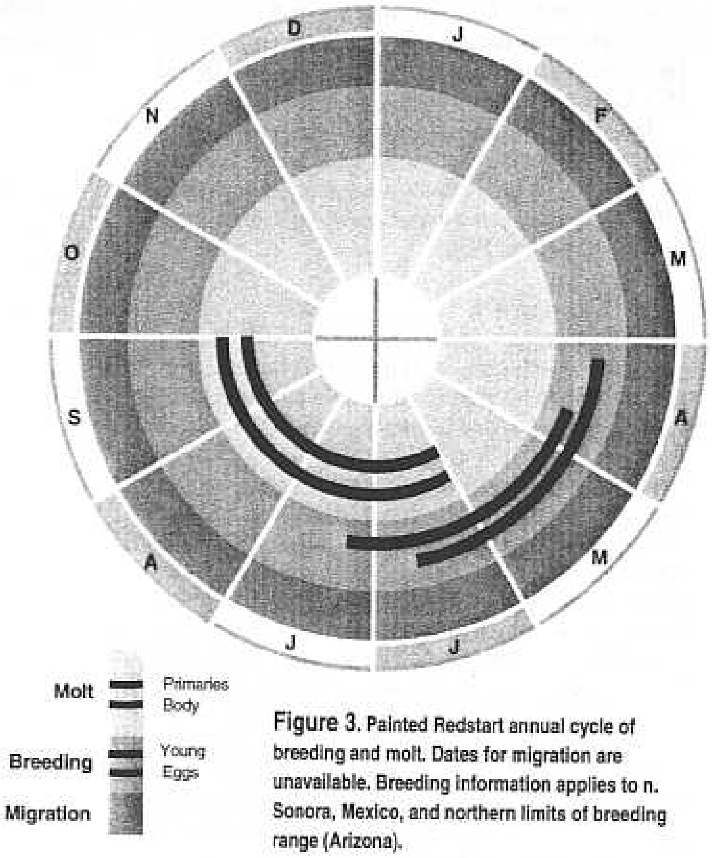

Figure 3. Painted Redstart annual cycle of breeding and molt. Dates for migration are unavailable. Breeding information applies to n. Sonora, Mexico, and northern limits of breeding range (Arizona).

NEST SITE

Selection process. Pair members appear to select nest sites together. Pair inspect depressions and sheltered areas together; spend up to a week searching for a nest site. Female signals a final decision by bringing nest material to the site (Marshall and Balda 1974).

Microhabitat. Typically nests on the ground, steep slopes, or rocky walls. Nests generally sheltered from above. In Chiricahua Mtns., AZ ($n = 157$ nests): 55% on slope of a canyon, 30% on steep vertical bank of a creek, 13% on flat or almost flat ground, and 2% in a root system of fallen tree. Based on 156 nests: 33% under tuft of grass, 31% in a ground cavity with good vegetation cover, 19% under layer of needles, 9% under/in a small bush, and 8% in a ground cavity without good cover. Four nests found in more unusual locations: 1 nest 1.2 m above the ground in a cavity in a Chihuahua pine trunk, 2 several meters up in a cavity in an Arizona sycamore branch (J. P. Cygan and F. Gehlbach pers. comm., PGJ) and 1 about 3 m high in an ivy vine growing on the side of a building (Bent 1953).

NEST

Construction process. Female builds entire nest. At 1 nest with no natural overhead shelter, female formed sides and back of nest higher than usual, creating a roof (Marshall and Balda 1974). Most construction during morning hours; female sometimes start >1 nest before deciding on one and completing it (J. P. Cygan pers. comm., PGJ). During bouts of nest-building, a female visits the nest with nest material up to 3 or 4 trips/min; often calls when leaving and entering the nest. Male often sings nearby when female is nest-building; occasionally absent from vicinity of nest. Some females gather oak leaves ≤10 m from nest site, but do not incorporate them into the nest. Females sometimes use leaves to form a path leading downslope from nest (up to about 200 leaves in a path; J. P. Cygan pers. comm., PGJ): about 70% of 151 nests in Chiricahua Mtns., AZ, had such a path, but only 30% had a well-developed path. Unknown if paths have any adaptive significance.

Structure and composition matter. Outer layer of nest is formed with coarse grass and pine needles, sometimes entwined with small leaves; nest lining fine grasses and hair (Marshall and Balda 1974). Some dead leaves are incorporated into side walls and bottom: Of 13 nests in Chiricahua Mtns, AZ (J. P. Cygan pers. comm., PGJ), 7 had 3–20 leaves directly under the cup, 5 had 4–20 leaves in side walls and 1 had 22 leaves between ground/rock and the back wall. In 11 of 13 nests, there were leaves under the front part of the nest, suggesting a structural role (e.g., preventing nest from sliding downhill). More leaves found under nests located on twigs/roots (i.e., nests that did not have solid support of ground).

Dimensions. From Marshall and Balda (1974), in n. Arizona. Inside diameter 51 mm (range 45–55), outside diameter 103 mm (range 80–120), inside depth 34 mm (range 30–40), outside height 66 mm (range 55–80; n = 7 nests). Nests in Chiricahua Mtns., AZ, typically had oval-shaped cups (J. P. Cygan pers. comm., PGJ).

Microclimate. Temperature probes in an artificial egg filled with water showed average nest temperature did not differ between day (33.8°C, range 25-38°C) and night (33.9°C, n = 4 nests; PGJ).

Maintenance or reuse of nests, alternate nests. On at least 4 occasions, a nest was placed in the same spot in which it was located the previous year (J. P. Cygan pers. comm., PGJ); on 1 occasion, a new nest was built on top of an old nest (1–3 yr old; PGJ).

Nonbreeding nests. None reported

EGGS

Shape. Oval to short oval (Bent 1953).

Size. In n. Arizona, mean length 17.1 mm (range 15.7–18.8), mean breadth 13.1 mm (range 12.3–14.2, n = 32 eggs; Marshall and Balda 1974). Mean length 16.5 mm (range 14.5–17.6), mean breadth 12.8 mm (range 11.7–13.5, n = 50 eggs; Bent 1953).

Mass. No information.

Color. White to cream-colored with brown speckles heavily concentrated at larger end (Marshall and Balda 1974).

Eggshell thickness. No information.

Clutch size. In n. Arizona, mean = 3.7, range 3–7, n = 9 (Marshall and Balda 1974). In Chiricahua Mtns., AZ, mean = 3.1 ± 0.7 SD (n = 108) from 1996–1999. In previous years (1992–1995), a few nests contained 5 eggs (PGJ). In dry years (1996, 1999) clutch size was smaller (2.9 ± 0.8; n = 70) than in more rainy years (1998, 1997) = 3.4 ± 0.6 (n = 38; J. P. Cygan pers. comm., PGJ).

Egg-laying. Generally early in morning at 1-d intervals (Marshall and Balda 1974).

INCUBATION

Onset of broodiness and incubation in relation to laying. Generally begins on day last egg is laid; sometimes a day earlier or later (Marshall and Balda 1974).

Incubation patch. Single medial abdominal patch in females only.

Incubation period. Thirteen days (n = 5); 14 d (n = 1; Nice 1954).

Parental behavior. Only female incubates. Female on nest about 75% of daylight hours. During later part of incubation, females tend to leave the nest less often but for longer periods of time than during earlier part. Foraging trips slightly longer in afternoon than morning (Marshall and Balda 1974). Male feeds female at the nest (PGJ).

Hardiness of eggs against temperature stress. No information.

HATCHING

Preliminary events and vocalizations. No information.

Shell-breaking and emergence. No information.

Parental assistance and disposal of eggshells. Female eats eggshells or carries them away (Marshall and Balda 1974).

YOUNG BIRDS

Condition at hatching. In n. Arizona, at hatching weighed 1.36 g, hallux length 3.0 mm (n = 10 birds; Marshall and Balda 1974). Feeble and helpless. Only response opening mouth, inside of which is deep tangerine-orange. Legs limp. Skin pink with a small amount of black down on dorsal portion of head and back (Marshall and Balda 1974).

Growth and development. Average growth of nestlings until day 9 is 10% of adult mass/day. See Table 1 from Marshall and Balda 1974.

Table 1. Average growth measurements of nestling Painted Redstarts. From Marshall and Balda 1974.

Age (days)	Number of birds measured	Weight (g)	Hallux length (mm)	Outer primary length (mm)	Tail feather length (mm)
0	10	1.4	3.0		
1	10	1.9	3.3		
2	14	3.1	4.2	1.1	
3	13	4.3	5.5	3.5	
4	13	5.9	6.1	6.2	0.2
5	13	6.5	6.5	9.5	2.4
6	13	7.9	7.1	12.9	4.4
7	13	8.6	7.2	15.8	6.8
8	12	8.8	7.3	19.2	9.3

According to Marshall and Balda (1974) in n. Arizona:

Day 1. See condition at hatching, above.

Day 2. Lifts head in response to noise or nest movement. Mouth open wide held upward. Feather tracts visible below pink skin as darker areas. Leg movements not coordinated.

Day 3. Feather shafts of alar tracts emerging. When handled, attempt to balance moving wings and legs slightly.

Day 4. Down still present, feather shafts emerging from all tracts. Eyes just beginning to open. Grasps when handled.

Day 5. Eyes open a slit. Peeps when handled. Grasps nest lining firmly.

Day 6. Eyes completely open. Flapped wings when handled. Bill and claws darkening. Can sit up and balance.

Day 7. Able to stand for short periods. Leg skin turning darker brown. Feathers emerging from sheaths.

Day 8. Sits up, looks around and appears very alert. Answers parents' Contact Call.

Day 9. Completely feathered. Stands and balances well. Calls as loudly as parents. Uses wings for balance; can walk short distances. Attempts to escape when handled.

Day 10. Can leave nest prematurely if forced. Cannot fly, but, once out of nest, flaps wings, hopping from branch to branch; can work its way off ground in shrubs or thick vegetation.

Day 13. Young leave nest if nest not disturbed after day 8 (Marshall and Balda 1974).

PARENTAL CARE

Brooding. Females brood at night. In early nests, females brood nestlings for 2 d, departing only to feed. At later nests, females left for several hours when young were only 1 d old (Marshall and Balda 1974). Female seen covering young from direct sunlight by slightly spreading her wings over the nest (PGJ).

Feeding. Both parents feed nestlings, and feeding is generally even, although occasionally only females feed young (J. P. Cygan pers. comm., PGJ), suggesting the possibility of polygynous males. When the male brings food and female is brooding, she either leaves to forage or takes the food from the male and feeds the nestlings. In n. Arizona, number of feeding trips was directly related to number and age of nestlings; varied from 2.8 to 5.6 trips/h ($n = 6$ nests, 8 h observations/nest; Marshall and Balda 1974). Nestlings fed primarily arthropods (Table 2); Diptera made up about 40% of diet (H. Hespenheide and J. P. Cygan pers. comm., PGJ), but varied with time of season, from 70% in early spring to about 26% in Jun.

Nest sanitation. Both parents remove fecal sacs. During first 4 d after hatching, female eats fecal sacs; afterward, carries them off. Male often carries fecal sacs to tree branch and drops them (Marshall and Balda 1974).

Carrying of young. Not known to occur.

COOPERATIVE BREEDING

No indication of cooperative breeding in Chiricahua Mtns., AZ (PGJ).

BROOD PARASITISM

Identity of the parasitic species. Brown-headed Cowbird (*Molothrus ater*) and Bronzed Cowbird (*M. aeneus*; Friedmann et al. 1977, Friedmann and Kiff 1985).

Frequency of occurrence, seasonal or geographic variation. Nest parasitism infrequent, but varies geographically. Nest parasitized by Brown-headed

Cowbird was found in Santa Rita Mtns., AZ; contained 3 Painted Redstart and 2 cowbird eggs (Friedmann and Kiff 1985). During 1996–1999, parasitism levels in Chiricahua Mtns., AZ, ranged from 4% in 1997 (*n* = 18) to 23 % in 1996 (*n* = 39; all parasitism here by Brown-headed Cowbirds). Nest parasitized by Bronzed Cowbird found in Madera Canyon, AZ; contained 3 redstart eggs and 1 cowbird egg (Friedmann et al. 1977). In Chiricahua Mtns., AZ, early nests (i.e., started in Apr) are generally not parasitized; cowbirds arrive after redstarts (PGJ). The frequency of parasitism seems to be related to weather: 23% in dry years (1996 and 1999 pooled) and 7% in more rainy spring seasons (1997 and 1998 pooled).

Timing of laying in relation to host's laying. Few data available; cowbird eggs often appear after redstart has laid 1 or 2 eggs, or a full clutch of 3 or 4 eggs (J. P. Cygan pers. comm., PGJ).

Response to parasitic mother, eggs, or nestlings. An incubating female chased a Brown-headed Cowbird; it landed above her nest (PGJ). In Chiricahua Mtns., AZ, 7 of 11 parasitized nests were abandoned by redstarts, apparently in response to cowbird parasitism. Nests were abandoned either during egg-laying or early incubation.

Effects of parasitism on host. In Chiricahua Mtns., AZ, nest failure rate due to cowbird parasitism was 11% in dry years (*n* = 68 nests), 5% in rainy years (*n* = 40). Parasitism caused approximately 10% of 84 nest failures; if predation rates were lower, failures due to parasitism might be more frequent. No direct observations of cowbirds removing eggs, but they probably do so.

Success of parasite with this host. Few data. Of 11 nests with well-known histories, Brown-headed Cowbirds caused death of redstart nestlings in 2, suggesting that at most 20% of attempts are successful; 7 nests were abandoned, and in 2 nests, cowbird eggs failed to hatch.

FLEDGLING STAGE

Departure from the nest. Can be forced to leave nests by age 10 d; cannot fly then, but flaps wings while leaving nest. If not disturbed, departs nest at age 13 d. After leaving nest, hops from branch to branch in shrubs or thick vegetation, where fledgling remains well hidden (Marshall and Balda 1974).

Growth. No information.

Association with parents or other young. Adults alternate between fledged young, feeding 1 up to 3 times, then feeding another. When fledglings begin making short flights, they form family groups with adults and travel within the territory (Marshall and Balda 1974).

Table 2. Diet of nestling (5–8 d old) Painted Redstart based on data using the ligature method from 22 nests in 1995 in the Chiricahua Mtns., AZ. Data shown as mean % of total diet, ± SE (PGJ and H. Hespenheide unpubl. data).

Prey	
Hymenoptera	1.6 ± 0.4
Diptera	42.9 ± 5.3
Ephemeroptera	6.3 ± 2.7
Neuroptera	1.9 ± 0.5
Lepidtoptera—imago	6.7 ± 1.8
Lepidoptera—caterpillar	1.4 ± 0.6
Cicada—imago	5.2 ± 2.9
Cicada—nymph	2.5 ± 1.3
Cicada—freshly emerged	1.5 ± 1.4
Homoptera—Aphididae	0.1 ± 0.1
Homoptera—imago	8.8 ± 2.0
Homoptera—nymph	1.3 ± 0.5
Hemiptera—imago	4.9 ± 1.4
Hemiptera—nymph	1.9 ± 1.0
Arachnida	5.5 ± 1.6
Coleoptera	3.4 ± 1.6
Mollusca	2.5 ± 0.6

Ability to get around, feed, and care for self. At 28–31 d of age, young begin feeding independently and usually leave the territory (Marshall and Balda 1974). Observations of 2 hand-raised individuals in an aviary in the Chiricahua Mtns., AZ, suggested that tail-fanning, wing-spreading and body-pivoting are not learned from parents. These birds started tail-fanning at 20 d; a few days earlier, they developed an interest in pecking and inspecting any spots contrasting with the background. At 25 d, they started chasing insects, catching and eating them. These young had difficulties removing wings of moths, but performed the stereotypic beating of the moth against substrate, used by adults to remove the wings (PGJ).

DEMOGRAPHY AND POPULATIONS

MEASURES OF BREEDING ACTIVITY

Age at first breeding; intervals between breeding. Presumably most breed for first time the first spring after hatching at 9–11 mo of age. Second broods are initiated after first brood fledges, but before completely independent.

Clutch. FIRST BROOD. 3.6 eggs/clutch ($n = 9$; n. Arizona; Marshall and Balda 1974).

SECOND BROOD. 4.0 eggs/clutch ($n = 3$; Marshall and Balda 1974).

Annual and lifetime reproductive success. Lifetime reproductive success not known. In n. Arizona, based on 12 active nests (9 first broods and 3 second broods), 75% of 44 eggs hatched: 91% of eggs ($n = 32$) from first broods and 33% of eggs ($n = 12$) from second broods (Marshall and Balda 1974). Twenty-six percent of eggs resulted in fledglings (59%; $n = 26$ young): 69% fledging success for first broods ($n = 44$ eggs) and 33% from second broods ($n = 12$ eggs; Marshall and Balda 1974). Average number of young fledged per nest was 2.2 ($n = 12$ nests): 2.4 young/nest for first broods and 1.3 young/nest for second broods (Marshall and Balda 1974). In Chiricahua Mtns., AZ, from 1996–1999, first broods fledged 1.2 young/nest ($n = 101$ nests) and second broods fledged 0.7 young/nest ($n = 15$ nests; J. P. Cygan pers. comm., PGJ).

Number of broods normally reared per season. In n. Arizona, 20% ($n = 10$) of females were double-brooded (Marshall and Balda 1974).

Proportion of total females that rear at least one brood to nest-leaving or independence. No information.

LIFE SPAN AND SURVIVORSHIP

No data, but 1 banded individual returned to the same feeder for 8 consecutive winters (S. H. Spofford pers. comm.), making it at least 7 yr old. At least 6 birds, banded as adults, have returned to Cave Creek Canyon, Chiricahua Mtns, AZ, for 1–2 consecutive breeding seasons; making them at least 2–3 yr old (PGJ).

DISEASE AND BODY PARASITES

Very little information. In Chiricahua Mtns., AZ, 2 broods of nestlings died as a result of an infestation of an unidentified Diptera (PGJ).

CAUSES OF MORTALITY

Exposure. No information.

Predation. Two females eaten on the nest by a mammalian predator (PGJ). Feathers of a Painted Redstart found at nest of Northern Pygmy-Owl in Chiricahua Mtns. (D. Fischer pers. comm.).

Competition with other species. No information.

RANGE

Initial dispersal from natal site. No information.

Fidelity to breeding site and winter home range. In Chiricahua Mtns., some ($n \geq 6$) color-marked males ($n = 35$) returned to the same territory the following year. This is likely an underestimate of male site fidelity in the Chiricahua Mtns. (PGJ).

Dispersal from breeding site or colony. No information.

POPULATION STATUS

Numbers. Density estimates vary with habitat. Hutto (1985) estimated 1.71 birds/ha along a creek bottom (1,631 m) in Chiricahua Mtns. Martin and Cody (1981) estimated 0.35 birds/ha in pine-oak woodlands (1,626 m) in the same area, but species was found only in years with high precipitation. Along Cave Creek Canyon in Chiricahua Mtns., Painted Redstart territories can range from 2.8 to 3.8 territories/km of canyon (PGJ). In riparian habitats, densities are lower in n. Arizona (0.25 birds/ha; Marshall and Balda 1974) than in the Chiricahua Mtns. (0.54 birds/ha; Balda 1967). Density in oak-juniper woodland 0.15 birds/ha (Balda 1967).

Trends. No information.

POPULATION REGULATION

No information.

CONSERVATION AND MANAGEMENT

EFFECTS OF HUMAN ACTIVITY

Classified with respect to its conservation status as a fairly common species of medium sensitivity and low conservation and research priority (Stotz et al. 1996).

Shooting and trapping. No information.

Pesticides and other contaminants/toxics. No information.

Collisions with stationary/moving structure or objects. No information.

Degradation of habitat. No information.

Disturbance at nest and roost sites. Female disturbed at very early stage of incubation or during egg-laying may abandon the nest.

Direct human/research impacts. Great care must be taken when close to nests. Chipping and other behavioral responses of adults to humans can provide cues for predators searching for nests. Nestlings may fledge early in response to vigorous scolding by adult Painted Redstarts directed at humans. In Chiricahua Mtns., AZ, a nest with eggs was abandoned when a human put a stone in it; another nest was abandoned presumably because tourists were walking along the trail 20–30 cm from the nest. One nest was abandoned due to research disturbance (PGJ). At later stages of incubation, females relatively insensitive to disturbance and may be caught on the nest without risk of nest abandonment.

APPEARANCE

MOLTS AND PLUMAGES

Hatchlings. Skin pink with a small amount of black down on dorsal portion of head and back (Marshall and Balda 1974).

Juvenal plumage. By day 2, feather tracts visible below pink skin as darker areas. By day 3, feather shafts of alar tracts emerging. By day 4, down still present, but feather shafts emerging from all tracts. By day 7, feathers emerging from sheaths. By day 9, completely feathered. Normally depart nest by day 13 (Marshall and Balda 1974).

Juvenal plumage similar to Definitive Basic (adult) plumage except black areas duller, breast dull slaty with feathers tipped dull gray-brown; lower breast and belly slaty, and irregularly spotted with dull grayish buff (no red); vent and undertail-coverts mottled grayish; sexes alike (Dunn and Garrett 1997).

Basic I plumage. Prebasic I molt partial; includes body-feathers and all median and greater wing-coverts, but not remiges, rectrices, or greater alula; molt occurs May–Sep on the summering grounds (Pyle 1997).

Basic I plumage similar to Definitive Basic plumage for each sex, except flight feathers somewhat more brownish and rectrices more tapered than in adults; these differences best noted in the hand (Dunn and Garrett 1997).

Definitive Basic plumage. Definitive Prebasic molt complete; occurs Jun–Sep on the summering grounds (Pyle 1997).

MALE. Head, throat, upper breast, and upperparts jet black with very slight gloss. Prominent white crescent below eye. Center and lower breast and upper belly bright red, contrasting with black breast, sides and upper flanks. Lower flanks slate gray. Longer underlying undertail-coverts mostly black, shorter overlying undertail-coverts white with broad black centers, thus undertail regions appears mixed slate and white. Lesser wing-coverts slaty. Median wing-coverts broadly tipped white and greater wing-coverts completely white on outer webs, these white areas forming prominent white patch on otherwise black wings. Tertials and inner secondaries also margined white on outer web (broadest on tertials). Remainder of remiges blackish. Rectrices black except visible portion of outer 2 pairs (R5, R6) pure white, and third pair (R4) white on outer web, and tipped white on inner web. Axillars and underwing-coverts white. In fresh (fall) plumage, white edges of tertials and inner secondaries cleaner and more prominent than when plumage more worn in spring and early summer (Dunn and Garrett 1997).

FEMALE. Plumage virtually indistinguishable from male except red on underparts averages very slightly paler and more orange. This difference occasionally noted in field between members of a pair but considerable overlap in red color occurs between the sexes (Dunn and Garrett 1997).

BARE PARTS

Bill and gape. Bill black.

Iris. Dark, brownish black.

Legs and feet. Black.

MEASUREMENTS

LINEAR

See Table 3. Females appear slightly smaller than males in wing and length in both subspecies. Subspecies *guatemalae* has slightly longer wings and tarsus. In Chiricahua Mtns., se. Arizona, males have longer wing-chord and appear to have longer tail.

MASS

See Table 3. No studies of geographical differences in mass. In Chiricahua Mtns., se. Arizona, females heavier than males (PGJ).

Body mass of females tends to decrease during the breeding season, from 10.3 g ± 0.8 SD ($n = 15$) early in season to 9.4 ± 0.7 ($n = 6$) in Jun; with intermediate values in middle of the season (PGJ). Body mass of males tends to increase slightly from 9.3 g ± 0.9 ($n = 4$) to 10.0 ± 0.6 ($n = 7$) throughout the breeding season, but trend is less clear.

PRIORITIES FOR FUTURE RESEARCH

The breeding biology of this species needs study; there are few data, for example, on its breeding success. What are the functions of the bright, nearly monomorphic plumage of this bird? Similarly, female singing behavior seems to be relatively frequent in this species in comparison with other warblers. The presence of a leaf path at many nests of this species is intriguing and worthy of further study; it may be an example of female display. Anecdotal evidence suggests that Painted Redstarts may be vulnerable to disturbance while breeding; studies of such effects are necessary to determine the potential severity of disturbance.

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Table 3. Linear body measurements (mm) and mass (g) of adult Painted Redstarts from Ridgway 1902, except as noted. Numbers in parentheses are either range or sample sizes.

	guatemalae[1]	*pictus*[1]	*pictus*[2]
Exposed culmen			
Male	8.5 ($n = 4$)	8.2 (8.0–8.5, 3)	
Female	8.2 (8.0–8.5, 3)	8.6 (8.5–9.0, 10)	
Wing-chord			
Male	68.5 (66.0–71.0, 4)	68.1 (68.0–71.0, 10)	72.0 (66.0–75.0, 46)
Female	67.8 (67.0–68.5, 3)	66.0 (67.0–70.0, 5)	68.2 (64.0–73.0, 81)*
Tail length			
Male	60.9 (60.0–61.5, 4)	63.3 (61.0–68.0, 10)	64.4 (60.0–68.0, 46)
Female	63.0 (62.0–65.0, 3)	62.4 (60.0–64.5, 5)	62.6 (59.0–68.0, 81)
Tarsus length			
Male	17.2 (17.0–17.5, 4)	16.5 (16.0–17.0, 10)	
Female	17.0 ($n = 3$)	16.5 (16.0–17.0, 5)	
Mass[2]			
Male			9.7 (8.5–11.0, 40)
Female			9.9 (8.5–11.5, 57)*

[1] Data are from museum specimens collected throughout species range.
[2] Measurements of live birds from the Chiricahua Mtns., se. Arizona (PGJ).
*Significant differences between sexes, $p < 0.05$, Student t-test.

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