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JABIRU: *Jabiru mycteria* of South America; in the Old World the name is sometimes applied to the Saddlebill *Ephippiorhynchus senegalensis* or the Black-necked Stork *E. asiaticus*. For all these species of Ciconiidae see STORK.

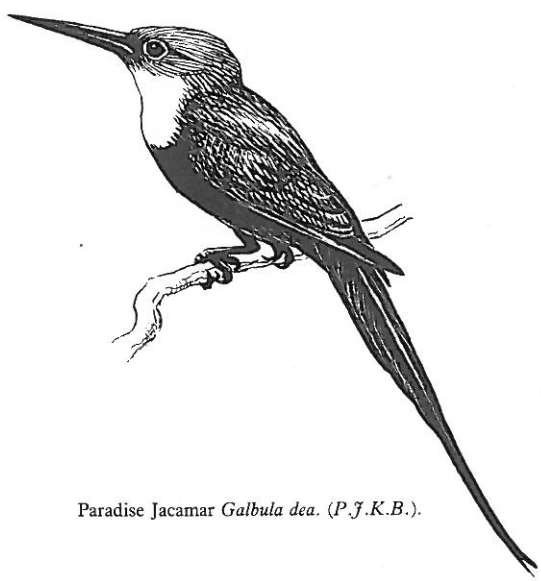
JACAMAR: substantive name of species of Galbulidae (Piciformes, suborder Galbulae): in the plural, general term for the family. This consists of 5 genera and 15 species of small or middle-sized birds (15–31 cm long).

Characteristics, distribution and habitat. Jacamars are confined to the wooded regions of continental tropical America, chiefly at low altitudes. Jacamars have long, pointed, usually slender bills. Their legs are short, and in the 4-toed species 2 toes are directed backward. The inner hind toe of the Three-toed Jacamar *Jacamaralcyon tridactyla* has been lost. The more typical species have glittering metallic plumage and, with their long, thin bills, are reminiscent of overgrown hummingbirds. Perhaps even more than hummingbirds, they seem charged with vitality and intensely alive. They are among the most exciting of all birds to meet.

One of the most widespread and familiar members of the family is the Rufous-tailed Jacamar *Galbula ruficauda*, which ranges from southern Mexico to north-eastern Argentina. Its upper plumage, including the wings and central feathers of the long tail, is glittering metallic green, over which play golden, coppery, and bronzy glints. A broad green band across the chest separates the white throat from the rufous-chestnut of the posterior underparts and the outer tail feathers. The female differs from the male only in having the throat pale buff instead of white. In both sexes, the long, sharp bill is black. *Galbula*, the largest genus, contains 7 other species, including the lovely Paradise Jacamar *G. dea*, distinguished by narrow, greatly elongated central tail feathers.

The stoutest member of the family is the Great Jacamar *Jacamerops aurea*, a long-tailed bird (in all 30 cm in length) that ranges from Costa Rica to the Amazon valley. The top of the male's head is bright metallic green, which merges into rich metallic golden or reddish-bronze on the back and shoulders; this in turn becomes bright golden-green on the rump and central tail feathers. The outer tail feathers are violet–blue. The sides of the head and upper throat are metallic green, the lower throat is white, and the remaining under plumage is rufous-tawny. The female is like the male, except that her throat is tawny instead of white. The black bill is only moderately long and slightly curved.

A less graceful and glittering member of the family is the Chestnut Jacamar *Galbalcyrhynchus leucotis* of Amazonia. Its plumage is largely dark chestnut, with white or chestnut ear coverts. A long, thick, pink or whitish bill and short tail give it a topheavy aspect. Plainest and smallest of the jacamars are the 4 species of *Brachygalba*, which have largely brown or dusky plumage with white on the under parts, short tails, and long, sharp, usually black bills.



Paradise Jacamar *Galbula dea*. (*P.J.K.B.*).

Food. Jacamars appear to be wholly insectivorous and, at least in the best-known genera, *Galbula* and *Brachygalba*, their prey is captured on the wing. They rest on an exposed perch, turning their heads from side to side, until they spy a suitable flying insect, which they overtake by means of a rapid sally. Morphos and large swallow-tails *Papilio*, which most flycatching birds eschew, are often captured by jacamars. With the victim fluttering in its slender bill, the captor returns to its perch, against which it beats the insect long and loudly until the brilliant wings flutter earthward, after which the body is swallowed. Skipper butterflies (Hesperiidae), dragonflies (Odonata), wasps and bees (Hymenoptera), beetles (Coleoptera), and other insects are also captured in large numbers; heliconian butterflies (Heliconiinae) are avoided. The feeding habits of jacamars have been compared to those of Old World bee-eaters.

Voice. The Rufous-tailed Jacamar is a voluble bird whose sharp calls, sounding afar through the woodland, suggest that it lives at a high pitch of excitement. When mated birds are together, and especially when two males compete for a female, their animated vocal performances include an accelerated series of high-pitched notes that may merge into a prolonged, clear, soft trill. The Pale-headed Jacamar *Brachygalba goeringi* has a similarly elaborate song, but in a weaker voice. At their best, jacamars' songs are delightfully melodious.

Behaviour and breeding. Solitary rather than colonial, jacamars nest chiefly in burrows, which they dig in roadside or streamside banks, in steep wooded hillsides, or in the wall-like root-plate of a great fallen tree. Breeding in cavities in termites' nests has been observed in the Great Jacamar and several species of *Galbula*, including the Rufous-tailed Jacamar, which usually nests in earthen burrows. Both sexes of this species loosen the soil with fine-pointed bills, and remove it from the tunnel by kicking vigorously backwards as they enter. The Rufous-tailed Jacamars' burrows range from about 28–50 cm in length. At the inner end, they dilate into a chamber that is not lined. The same burrow may be occupied in successive years.

The Rufous-tailed Jacamar lays 2–4 white, glossy eggs. Few records are available for other species. The Rufous-tailed female incubates through the night, and by day she and her mate sit alternately. Intervals of neglect are short, and the eggs are almost constantly attended. While sitting, the parents regurgitate many shards of beetles and other chitinous parts of insects, which accumulate on the floor of the chamber. The incubation period is 20–23 days.

In contrast to the perfectly naked nestlings of most piciform birds, newly hatched jacamars bear copious, long, whitish down. Their heels are covered with prominent callous pads that are nearly smooth instead of strongly papillate like those of woodpeckers, toucans and other birds that breed in unlined holes in trees. Both parents bring the young a variety of insects, but they fail to clean the nest. As they grow older, the loquacious nestlings repeat weak-voiced versions of their parents' calls, including pleasant little trills.They leave the burrow when from 19 to (in wet weather) 26 days of age, wearing plumage much like that of adults of the same sex. Fledgling Rufous-tailed Jacamars seem never to return to their natal burrow; but 4 juvenile Pale-headed Jacamars continued for several months to return each evening to sleep with both parents in their 79 cm-long burrow in a vertical bank. A.F.S.

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SHRIKE-VIREO: substantive name of species of the subfamily Vireolaniinae (Passeriformes, suborder Oscines); in the plural, general term for the subfamily. The shrike-vireos are a small group of arboreal song-birds confined to the forested regions of continental tropical America. The 2 genera and 3 species are sometimes placed in a separate family, the Vireolaniidae, but are now often included, as here, in the Vireonidae. The shrike-vireos differ from typical vireos in having a heavier bill, which is hooked at the tip (see VIREO; also PEPPER-SHRIKE). They feed mainly upon caterpillars and mature insects which they glean from the foliage of trees but vary their diet with berries. Like typical vireos and pepper-shrikes, they hold large objects beneath a foot while they tear them apart with the bill.

Characteristics, habitat, distribution and behaviour. The Chestnut-sided Shrike-Vireo *Vireolanius melitophrys*—the only member of its genus—is a stout, long-tailed bird about 17 cm long. The largest member of the subfamily, it is also the northernmost and the only one of which the sexes, although similar in plumage, are readily distinguished in the field. Its upper plumage in plain olive-green, with the top and back of the head slate-grey, bordered on each side by a yellow superciliary stripe, below which a black band stretches from the lores to the ear coverts. The ventral plumage is white, with black malar streaks and a chestnut band that crosses the breast and continues along the sides and flanks. This little-known bird is found, chiefly in forests of pine, oak, and other broad-leaved trees, from central Mexico to the volcanic highlands of Guatemala and from 1,200 to 3,000 m. It forages, often in pairs, amid the foliage of trees and shrubs at all heights, where it moves slowly and deliberately, peering from side to side, sometimes hanging inverted to pluck an insect from a leaf. Among its notes are a low, nasal rattle and a peculiar, long-drawn, high-pitched, far-carrying, whistled screech. The two known nests, built by both sexes, were hemispheric cups, attached by their rims to the arms of horizontal forks, in the usual manner of vireos. Situated amid foliage at heights of 7–8 m, they were composed largely of filamentous lichens and vegetable fibres. Eggs, incubation and care of young remain undescribed.

The 2 species of *Smaragdolanius* inhabit heavier, more humid forests at low and middle altitudes. The Green Shrike-Vireo *S. pulchellus* is about 14 cm long. Its upper plumage is bright parrot-green with more or less blue on the crown. The throat is yellow, and the remaining under parts light greenish yellow. From south-eastern Mexico to Colombia and north-western Venezuela, this bird lives in the upper levels of the forest, from which it sometimes ventures into neighbouring clearings with scattered trees. Although its loud, clear, tirelessly repeated whistles, grouped in trios or more rarely quadruplets, are often heard, its nest has apparently never been found. Equally unknown are the breeding habits of the Slaty-capped Shrike-Vireo *S. leucotis*, widespread in tropical South America. Both sexes are olive-green above, mostly bright yellow below, with the head boldly marked with a yellow superciliary band, a black streak through the eye to the hindhead, and below this a white streak.

A.F.S.

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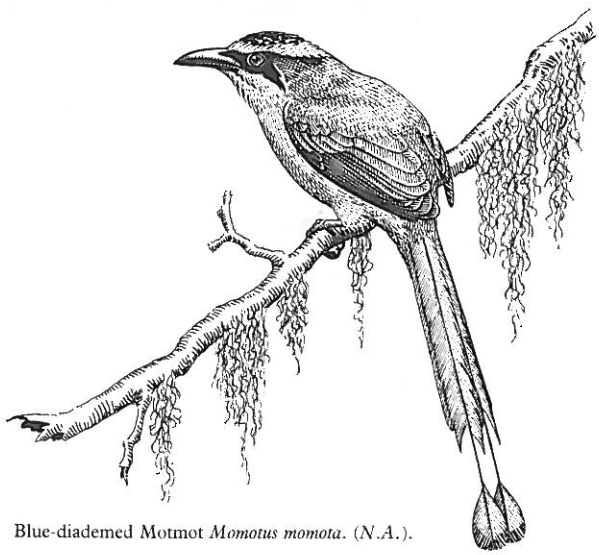
MOTMOT: substantive name of species of Momotidae (Coraciiformes, suborder Alcedines); in the plural, general term for the family. The motmots are allied to the kingfishers (Alcedinidae) and even more closely to the todies (Todidae). The 6 genera and 9 species of motmots (*Momotus*, *Electron*, and *Baryphthengus* have 2 each) are confined to continental tropical America, chiefly at low altitudes; but the family was once far more widely distributed, as the fossil bird *Protornis glarniensis* from the lower Oligocene of Switzerland is now ascribed to it.



Blue-diademed Motmot *Momotus momota*. (*N.A.*).

Characteristics, distribution and habitat. At the present time, the Momotidae are best represented in northern Central America and southern Mexico, where in certain regions of lighter vegetation these birds are abundant and conspicuous. Among the noteworthy structural peculiarities of the motmots are the serrated edges of their broad bills, which are about as long as their heads and downcurved at the end, and their feet, of which the outer toe is united to the middle one for most of its length and only one toe is directed backward, as in kingfishers.

These beautiful birds (16–50 cm in total length) are clad in softly blended shades of green, olive-green, and rufous rather than in brilliant spectral colours; although the head is often adorned with bright blue, and a black patch is usually present on the chest or throat. The most arresting feature of motmots is the tail, which is long and strongly graduated. In typical motmots, the central rectrices far exceed the others in length, and, when they first expand, the vanes may be narrower in the subterminal region than elsewhere. In this subterminal portion the barbs are loosely attached and fall away as the bird preens, and probably also in consequence of rubbing against the vegetation through which it moves, leaving a length of naked shaft which supports a spatulate or raquetlike tip where the vanes remain intact. The length of denuded shaft varies considerably from genus to genus, and in some genera it is lacking. While perching, motmots often swing their tails, pendulum-wise, from side to side, and sometimes hold them tilted sideways. When they about-face on a perch, they lift the tail over it with a graceful flourish.

One of the most beautiful members of the family is the Turquoise-browed Motmot *Eumomota superciliosa*, which is found from southern Mexico to northern Costa Rica in semi-arid country and in clearings in rain forest. Well over half of its 35 cm is accounted for by its long tail. As in other motmots, the sexes are alike in coloration. The upper plumage is largely bright olive-green, with a patch of cinnamon-rufous in the centre of the back. Above each eye is a broad band of pale turquoise, the bird's brightest colour. The lores and ear tufts are black; and on the throat is an elongated, wedge-shaped patch of black, bordered on each side with turquoise. The remaining under plumage is greenish olive and cinnamon-rufous. The middle feathers of the greenish-blue tail have a much greater length of denuded shaft than in other motmots, so that the spatulate, blue and black ends hardly appear to be connected with the rest of the bird. This makes the Turquoise-browed Motmot more airily graceful than its relatives.

The largest member of the family is the Rufous Motmot *Baryphthengus martii*, which inhabits heavy forests from Nicaragua to Amazonia and western Ecuador. This 46-cm bird has the head, neck, and most of the underparts tawny, the back and rump and undertail coverts green. There is a black patch on each side of the head and one in the centre of the chest. Each of the central tail feathers has a short length of naked shaft. At the other extreme of size is the Tody Motmot *Hylomanes momotula*, an elusive, little-known inhabitant of forests from southern Mexico to northwestern Colombia. About 17 cm long, clad in dull green and rufous, with black ear-tufts, this small motmot has a short tail without racquet tips.

An aberrant member of the family is the Blue-throated Motmot *Aspatha gularis*, which in northern Central America and extreme southern Mexico inhabits forests of oaks, pines, and cypress from about 1,200 to 3,000 m above sea level. Here it resides throughout the year, despite the severe frosts of the winter months. About 28 cm long, this motmot is almost wholly clad in green, with a blue throat, black ear-tufts, and a black patch on the foreneck. The feathers of the long tail are strongly graduated, but the central ones have continuous webs rather than racquet tips.

Habits and food. When foraging, motmots perch motionless until their keen eyes detect a beetle, caterpillar, spider, butterfly, cicada, small frog, lizard, or snake, on foliage, on the ground, or in the air. Then they dart swiftly, seize the victim, and carry it to a perch, against which, if large, they beat it before gulping it down. Small fruits, including those of palms, plucked while the bird hovers, enter conspicuously into the diets of some of the bigger motmots. These large species often forage with the mixed flocks that follow the army ants *Eciton*, catching small fugitive insects and other creatures rather than the ants themselves.

Voice. Although the utterances of motmots are all structurally simple, they vary immensely in tone from species to species. The Turquoise-browed Motmot voices a dull, wooden *cawaak cawaak*. The call of the

widespread Blue-diademed Motmot *Motmotus momota* is a full, froglike, not unmelodious *coot coot*. At dawn, the rain-forest of southern Caribbean Central America is filled with the hollow hooting of the Rufous Motmot, a mysterious sound often difficult to trace to its source, for these motmots stay high in trees. The most melodious of the motmots is the Blue-throated, whose delightfully clear and mellow notes are heard chiefly at dawn, when the members of a pair often sing in unison just after they emerge from the burrow where they slept.

Behaviour. In courtship, two or more motmots call back and forth, often continuing for surprisingly long intervals. Sometimes, while so engaged, they hold pieces of green leaf or other fragments of vegetation in their bills—a puzzling habit, since such material is not carried into the nest burrow. The Blue-diademed, or Blue-crowned Motmot dust-bathes, sometimes on roadways in the evening twilight.

Breeding. Motmots nest chiefly in burrows, which are dug by both sexes of the species for which information is available. They loosen the earth with their bills and remove it by kicking backward with their feet each time they enter to resume digging. The female Turquoise-browed Motmot seems to do the greater share of the work, but her mate sometimes gives her an insect. Often the burrow is in the vertical bank of a watercourse or road; but the Blue-diademed Motmot may dig its tunnel in the side of a mammal's burrow or a narrow pit in level ground, which makes its nests very difficult to find. In this species, as in the Blue-throated Motmot, the burrow may be crooked, with one or several sharp turns; but that of the Turquoise-browed Motmot is often only slightly curved. Motmots' tunnels up to 4.3 m long have been recorded, but most are much shorter. Along the bottom of an occupied tunnel are two distinct parallel grooves, made by the birds' short legs as they shuffle in and out. In limestone regions, motmots sometimes nest in caverns or in niches in the sides of wells.

Two to 4, rarely more, broad, roundish, pure white eggs are laid on the bare floor of the enlarged chamber at the end of the burrow. They are incubated by both parents. One member of a pair of Blue-diademed or Broad-billed Motmots enters the burrow early in the morning and sits for 6–8 hours, rarely longer. At midday or later, the other replaces it and remains in the burrow until the following dawn. While incubating, motmots regurgitate many chitinous fragments from their insect food and an occasional seed, all of which are trampled into the floor of their chamber. The incubation period of the Blue-throated Motmot is 21–22 days; that of the Turquoise-browed Motmot, 15–19 days.

Nestling motmots, hatched blind and with no trace of down on their pink skins, are brooded and fed by both parents, who do not try to keep the nest clean. Young Blue-throated and Turquoise-browed Motmots leave the burrow at 28–31 days of age, and young Blue-diademed Motmots at 29–38 days, but those of the small Broad-billed Motmot fly when only 24–25 days old. They remain in the nest until they are well feathered, much in the pattern of the adults, and fly well. Their stubby tails, of course, still lack the racquet tips. Blue-diademed Motmots and Turquoise-browed Motmots are single-brooded.

Turqoise-browed Motmots start to dig their burrows as the spring or early summer breeding season approaches. Blue-diademed Motmots often begin in the autumn to dig burrows in which they will breed 4 or 5 months later. Blue-throated Motmots dig their burrows even earlier, in June or July, soon after their young are fledged. These tunnels are soon finished, and are then used as dormitories by the constantly mated pair throughout the winter months, when nights are cold and frosty. Even after eggs are laid in these old burrows in the following spring, both parents continue to sleep in them, as they do with the nestlings. After the latter emerge, they do not return to sleep in the burrow; but the parents sometimes continue to lodge in it until a new burrow is completed nearby. The motmots of the lowlands, however, appear not to use their burrows as dormitories, and only one parent sleeps with the eggs and young, until the latter are about 5 days old. A.F.S.

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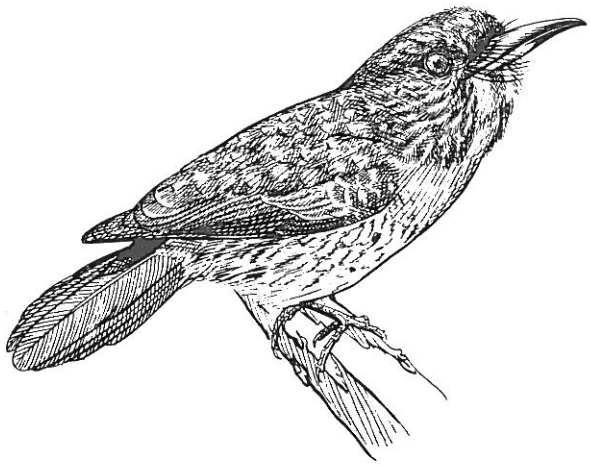

White-whiskered Puffbird *Malacoptila panamensis*. (*C.E.T.K.*).

PUFFBIRD: substantive name of some species of Bucconidae (Piciformes, suborder Galbulae); in the plural, general term for the family. This consists of 10 genera and 33 species of small or medium-sized arboreal birds (14–29 cm long) confined to continental tropical America.

Characteristics, distribution and behaviour. The puffbirds are closely related to the jacamars (Galbulidae). Their large heads, abundant, lax, often dull-coloured plumage, and short tails make them appear stout and 'puffy', whence their name. The bill, of short or medium length, often notably stout, is decurved or hooked at the tip. The feet are zygodactylous, with two toes directed backward. The family is best represented in the Amazon Valley and Colombia, and is largely confined to warm lowlands. Its ancestors appear to have been much more widely distributed, and may have been the dominant small perching birds during the Eocene in North America, where at least 5 genera of the fossil family Primobucconidae have been found in deposits of this age in Wyoming.

One of the largest and most widespread extant members of the Bucconidae is the handsome, 25 cm long White-necked Puffbird *Notharchus macrorhynchus*, which ranges from southern Mexico to north-eastern Argentina. Both sexes are largely black on the dorsal surface. The forehead, nuchal collar, sides of the head, and under parts are white, with a broad black band across the breast. The thick, tapering bill is black.

Slightly smaller is the White-whiskered Puffbird, or Softwing, *Malacoptila panamensis*, which is found from southern Mexico to western Ecuador. The male is largely chestnut-brown and cinnamon, with the posterior under parts pale buff or whitish. Both above and below the female is more olive and greyish. Both sexes are liberally spotted and streaked with tawny and buff on the upper parts and streaked with brown and dusky on the breast and sides. Both sexes wear the long, slender, slightly curved, white malar tufts which are indicated by their name. Their large eyes are dull red.

Both the White-necked Puffbird and the White-whiskered Puffbird are found singly or in pairs, or sometimes in family groups of 3 or 4, but never in flocks. They rest motionless for long periods on a more or less exposed lookout perch at no great height, apparently lethargic but actually keeping a sharp watch for suitable food. By means of a surprisingly sudden dart, they snatch a caterpillar, winged insect, spider, or small lizard from a neighbouring bough, or sometimes they drop down to seize it amid low herbage. Then they carry it back to a perch and devour it at leisure.

A very different type of puffbird is the Swallow-wing *Chelidoptera tenebrosa*, widespread in tropical South America. This is a stout, large-headed bird about 15 cm in length. When folded, its long wings reach almost to the end of its short tail. Both sexes are largely blackish, with a patch of white on the lower back and rump. The abdomen is rufous-chestnut, which pales to white on the under tail coverts. The voyager along the Amazon and its great tributaries often sees these graceful birds perching in pairs on the topmost naked twigs of tall riverside trees, whence they make long, spectacular darts to snatch insects (including many winged ants) from the air, much in the fashion of some of the bigger American flycatchers (Tyrannidae).

Because of their very plain attire, the 4 species of the genus *Monasa* are called 'nunbirds'. The Black-fronted Nunbird *M. nigrifrons* of the Amazon valley is about 29 cm long. In both sexes, the upper plumage, wings, and tail are dull black and the ventral surface is dark grey. The bill, which tapers from a broad base to a sharp point, is bright orange—whence the name 'pico de lacre' ('sealingwax bill') sometimes applied to birds of this genus. More gregarious than other puffbirds, nunbirds travel in small flocks, and at least one species breeds co-operatively.

The 6 small species of the genus *Nonnula* are known as 'nunlets'. Both sexes of the 14-cm-long Grey-cheeked Nunlet *N. frontalis* are plain brown above and ochraceous or tawny below. This species is found in the lowlands of Colombia and eastern Panama, and little is known of its habits.

Voice. Puffbirds show the same contrasts in voice as in plumage. The loudest utterance of the White-whiskered Puffbird is a high, thin whistle or 'peep'. The Swallow-wing has a weak, appealing whistle. The sociable nunbirds have a surprising range of utterances from soft, musical murmurs to far-carrying shouts. From 3 to 10 White-fronted Nunbirds *Monasa morphoeus*, often perching in a row on a high, horizontal branch or liana, join their almost soprano voices in a chorus that rings through the rain forest for 15–20 min. While calling, puffbirds often twitch their tails from side to side.

Breeding. The breeding habits of puffbirds are poorly known, but two main types of nests have been discovered: cavities which they carve in the hard, black, arboreal nests of termites, and burrows in the ground. Less frequent sites include hollow trees, holes made by woodpeckers, burrows made by small mammals, and oven-shaped nests of clay built by the Pale-legged Hornero *Furnarius leucopus*. Both sexes of the Black-breasted Puffbird *Notharchus pectoralis* take turns at digging with their bills into the side of a large, roughly globular termitary. Their narrow, horizontal tunnel expands at its inner end into a neatly rounded chamber, on the hard floor of which the eggs rest.

Burrows of the White-whiskered Puffbird have been found in the gently or at times steeply sloping, leaf-strewn ground in rain forest. From a round opening, the tunnel descends with a slight inclination for about 50 cm. At the lower end it widens into a chamber, which is lined on the bottom and sides with brown dead leaves. Around the opening of the burrow, which is flush with the ground, the birds arrange twigs, petioles, and the like to form a low collar, through which they enter and leave, and which makes the aperture less conspicuous. This feature is far more strongly developed in the Black Nunbird *Monasa atra* of northern South America, which above the entrance to its descending burrow in level ground raises a large pile of coarse dead sticks; the birds reach their burrow through a rounded tunnel that runs along the surface of the

ground beneath the heap of sticks. Probably the chamber at the inner end is lined with dead leaves, like that of the White-fronted Nunbird, which, however, arranges only a low collar around the mouth of its 100–125 cm long burrow. The Swallow-wing, however, places no sticks or other material around the entrance to its burrow, which may be in a bank or in level ground. Like the tunnels of other puffbirds, those of the Swallow-wing are downwardly inclined and straight, but they are longer than those of other species, up to 200 cm in length. The eggs rest on a slight lining of dry grass.

Puffbirds lay 2 or 3, rarely 4, white, glossy eggs that resemble the eggs of woodpeckers. These are incubated by both parents, at least in the Black-breasted and the White-whiskered Puffbird. The latter incubates according to a simple but unusual schedule; the male sits continuously from early afternoon to the following dawn, then the female takes one long session of 5–8 h. The eggs are unattended for a half hour or more between these sessions. Black-breasted Puffbirds take shorter sessions, entering and leaving the nest a number of times in a day. The incubation period is unknown.

Newly hatched puffbirds are blind and perfectly naked, without natal down. The prominent callous pads on their heels are smooth, as in jacamars and motmots. The male White-whiskered Puffbird does all the brooding and his duller mate nearly all the feeding, an arrangement that may have some slight protective value. When only a day or two old, the blind nestlings move up the tunnel to take food from their mother at the burrow's mouth. This consists of large, badly mangled insects, with an occasional spider or small lizard, carried in the parent's bill, one item at a time. Waste is not removed from the burrow. After the father ceases to brood them by night, the nestlings, now with open eyes and becoming feathered, at nightfall somehow raise up the fragmented leaves from the bottom of the chamber to form a screen between themselves and the entrance tunnel. They leave the burrow at the age of 20–21 days, when they are well feathered and have 'whiskers' like their parents. Blind, naked nestlings of the White-fronted Nunbird toddle up to the mouth of their longer burrow to receive food from the 3 or 4 adults—parents plus helpers—who often attend them. After emerging at the age of about 30 days, juvenile nunbirds rise high into the trees. Soon they take their food in a spectacular manner, flying up from a distance to snatch it from an attendant's bill as they shoot past. This provides practice for nunbirds' habitual mode of foraging. A.F.S.

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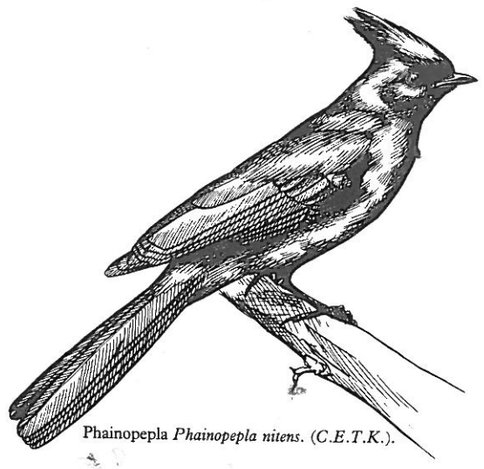
SILKY-FLYCATCHER: substantive name of certain species of the family Ptilogonatidae (Passeriformes, suborder Oscines); in the plural, general term for the family. The relationship of the 3 genera and 4 species, ranging from south-western United States to western Panama, has long been disputed; often they have been classified as a subfamily of the Bombycillidae; but evidence from egg-white proteins, as well as other features, fails to uphold this treatment. Their closest relatives may be the solitaires *Myadestes* (family Turdidae).

Characteristics, habitat and distribution. Silky-flycatchers range from about 17–23 cm in length. They have short, rather broad bills, relatively short wings, and short tarsi. The Phainopepla *Phainopepla nitens*, which ranges from deserts and arid woodlands of south-western United States to the highlands of Mexico, is a slender, long-tailed, crested bird with silky plumage, shining black with white wing patches on the male, grey on the female. The 2 species of *Ptilogonys* are also slender, long-tailed, and prominently crested. The males are grey or blue-grey with yellow flanks and crissum, black wings, and black-and-white tails; the females are similar but more olivaceous. The Grey Silky-flycatcher *P. cinereus* inhabits pine-oak woodlands in the highlands of Mexico and Guatemala. The Long-tailed Silky-flycatcher *P. caudatus*, which has elongated central tail feathers, is confined to the high mountains of Costa Rica and western Panama. The Black-and-yellow Silky-flycatcher *Phainoptila melanoxantha*, with the same range as the Long-tailed, is crestless and more thrushlike in aspect. The male is mostly glossy black, with bright yellow rump, sides, and crissum; the female is more olive.

Food, voice and behaviour. *Phainopepla* and the 2 species of *Ptilogonys* associate in loose, wandering flocks. They perch on high, exposed treetops, from which they make long, spectacular sallies to catch insects. *Phainoptila* lives in pairs amid lower, denser montane vegetation and seizes insects on less spectacular darts. All members of this family eat many berries. *Ptilogonys* and *Phainopepla* use their voices freely but sing sparingly and not brilliantly.

Breeding. The only species that have been carefully studied, the Phainopepla and the Long-tailed Silky-flycatcher, breed in monogamous pairs. Nuptial feeding is frequent. All 4 species build compact open cups in shrubs and trees, often high. Those of the Long-tailed Silky-flycatcher are composed almost wholly of grey beard-lichen *Usnea*; those of the Black-and-yellow largely of green moss; those of the other 2 species of more varied materials. Building is done chiefly or exclusively by the male Phainopepla, but by both sexes of the Long-tailed Silky-flycatcher. *Phainopepla* lays 2–3 (rarely 4) eggs; *Ptilogonys*, 2; and *Phainoptila*, 2 (1 record). The eggs of all 4 species are grey or greyish white, heavily marked with brown or lilac. Both sexes of *Phainopepla* incubate, but only the female *Ptilogonys*. The incubation period of the former is 14–15 days;



Phainopepla *Phainopepla nitens*. (*C.E.T.K.*).

of the latter, 16–17 days. Nestlings have abundant white down, long in *Phainopepla*, in short, compact tufts in *Ptilogonys*. Both sexes feed the young, which remain in the nest for 18–19 days in *Phainopepla*, 24–25 days in *Ptilogonys*. A.F.S.

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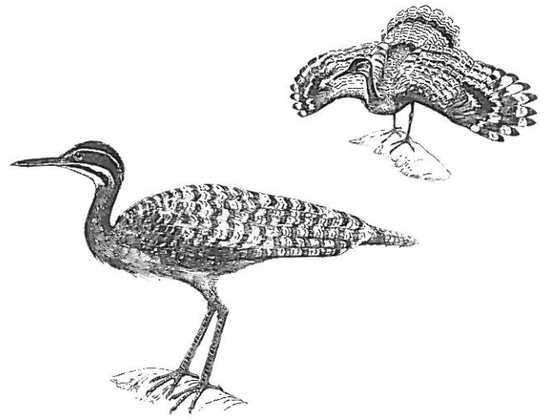

Sunbittern *Eurypyga helias*. (*C.J.F.C.*).

represented by three races. About 46 cm long, this graceful, stout-bodied, long-necked, long-legged, largely ambulatory bird is most intricately barred, spotted, and mottled. The sexes are alike. The head is almost black, with a narrow white superciliary stripe and a broader white stripe along the lower edge of each cheek. The neck, shoulders, and breast are brown. The throat, abdomen, and under tail coverts are white and pale buff. The remaining plumage is largely grey and olive in general tone, with prominent black bars and white spots; and the long tail is crossed by two broad black bands. Only when the Sunbittern spreads its wings does it reveal its brightest colour, a large round shield of deep orange-chestnut set in an area of pale orange-buff in the middle of each wing, like a sun darkly glowing in a sunset-tinted sky. The upper mandible of the long, straight bill is largely black and the lower is orange. The eyes are deep red, and the long, naked legs are bright orange.

Habitat. Singly or in pairs, Sunbitterns forage along watercourses that traverse the forests, up to an altitude of 1,000 m (rarely 1,800 m in northern Venezuela). With slow, sedate steps, they walk along the muddy shores of sluggish streams and over the exposed rocks in rushing mountain torrents, where they fly across the deeper pools but wade through shallow water. They also frequent swampy areas in woodland.

Food. Their food, which consists largely of insects, spiders, small crustacea, minnows and the like, is caught beneath shallow water or gathered from exposed mud and rocks, with heronlike jabs.

Voices. Generally silent, the Sunbittern is reported to utter soft, long-drawn whistles, low trills, plaintive pipings, and a loud, ringing *ko wáy*.

Behaviour. From the nature of their habitat, it seems that Sunbitterns must pass most of their lives in the shade, but they are said to seek sunny openings in the forest, where they sometimes display. Widely spreading their wings with the richly coloured upper surface tilted forward, they fan out the raised tail to fill the gap between them, thereby forming a semicircle of plumage, in the midst of which the head stands.

Breeding. Although there are reports of Sunbitterns breeding on the ground, usually the nest is built in a tree or bush. One beside a Costa Rican mountain stream was precariously saddled upon a 5 cm branch about 6 m above the ground. The dark, roughly globular structure, about 30 cm in diameter, was composed of decaying leaves and stems, some green moss, and apparently also mud. In the top of the bulky mass was a shallow depression lined with green leaves, on which 2 eggs rested, apparently the usual number. The nearly oval eggs are buffy or clay-coloured, with darker spots and blotches. The most complete available account of the nesting of this bird is that of a pair who bred in the Gardens of the Zoological Society of London more than a century ago. Both sexes built the nest of vegetable materials and mud, and they alternately incubated an egg which hatched after 27 days. The newly hatched young was thickly covered with short down and resembled the chicks of plovers (Charadriidae) and snipe (Scolopacidae). Fed by both parents with food carried in the bill, it remained in the nest until, at the age of 21 days, its wing feathers had expanded and it could fly to the ground. It is remarkable that, although the young Sunbittern resembled a precocial chick, it was attended like an altricial nestling; but it is not known whether the behaviour of this captive pair was typical. A.F.S.

SUNBITTERN: *Eurypyga helias*, sole member of the family Eurypygidae (Gruiformes, suborder Eurypygae).

Characteristics and distribution. It is found in the forested regions of America from southern Mexico to Bolivia and central Brazil and is

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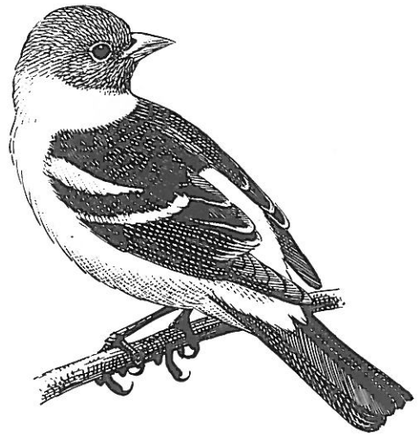
TANAGER: substantive name of species of Thraupinae and, in the plural, general term for the group—here treated as a subfamily of the Thraupidae (Passeriformes, suborder Oscines) but commonly given separate familial rank. The name comes from 'tangará' in the language of the Tupi Indians of Brazil. The tanagers are 9-primaried arboreal song-birds, confined to the Western Hemisphere (including the Antilles) and very largely to its tropical portion. Systematists now usually include in this subfamily certain genera of honeycreepers but for the present purpose it is convenient to give separate treatment to these small birds with bills and tongues highly modified for drawing nectar from flowers (see HONEYCREEPER, ORANGEQUIT). Another distinct genus, *Tersina*, which is here also included in the subfamily Thraupinae, is also given separate treatment (see SWALLOW-TANAGER). With these exclusions, the subfamily contains 54 genera and 215 species.

Characteristics. The tanagers, ranging in size from about 10 cm to (rarely) 28 cm in length, contribute more than any other family to the brilliant colour displayed by tropical American birds; although hummingbirds are more numerous in species and individuals, they are smaller and their bright metallic colours can be appreciated only in special conditions. For variety of colours and diversity of patterns, the 46 species of small tanagers of the genus *Tangara* (the largest genus) are outstanding even in this highly endowed family. One of the most gorgeous of these is the Paradise Tanager *T. chilensis*, the *siete colores* of South Americans. This 14-cm bird has the head largely golden-green. Its upper plumage is largely black, with a bright red lower back and red or yellow rump; the chin and throat are light purple; and the remaining under plumage is chiefly turquoise blue. The sexes are alike, or nearly so, as seems to be true throughout this brilliant genus, in which adults wear the same bright colours at all seasons.

The genus *Euphonia* also contains a number of small and colourful species, the 'euphonias'. Less varied in coloration than the aforementioned group, the males are mostly black, glossed with violet, blue, or green, on the upper parts and sometimes also on the throat; the forehead and more or less of the crown, and the underparts, are chiefly bright yellow. Female euphonias are usually greenish and yellowish, far duller than the males. *Ramphocelus* is a genus of larger and stouter tanagers, of which the males, but not the females, are richly coloured. The male Scarlet-rumped Tanager *Ramphocelus passerinii* of Central America is everywhere velvety black except the vivid rump, but the female is clad in shades of brown and olive. Both sexes of the widespread



Western Tanager *Piranga ludoviciana*. (*R.G.*).

Blue, or Blue-grey Tanager *Thraupis episcopus* have blue-grey body plumage with bright sky-blue wings and tails. Some races have a large white patch on each wing.

The male Summer Tanager *Piranga rubra* of southern United States is wholly red; the female, yellowish. The male of the Scarlet Tanager *P. olivacea*, which breeds in the United States and southern Canada, is brilliant scarlet with black wings and tail. It is of interest that this, the most migratory species in a generally nonmigratory family, is the only one known to undergo great seasonal changes in coloration; in the months of the northern winter, which the species spends in South America, the males are clad in greenish and yellow, much like the females. In the Western Tanager *P. ludoviciana*, which breeds on the Pacific side of temperate North America and migrates to Central America in winter, the annual changes of the males are less pronounced.

Among the less usual types of coloration in this extremely varied subfamily may be mentioned the Magpie-tanager *Cissopis leveriana*, widely distributed in South America, in which both sexes are largely white, with the whole head, upper back, and breast blue-black. The wings and the long, graduated tail of this exceptionally large tanager are black and white. Both sexes of the Orange-eared Tanager *Chlorochrysa calliparaea* of the eastern foothills of the Andes are largely brilliant metallic green, with a bright orange spot on the crown, a metallic orange patch on the rump, and a black gorget bordered with orange. By no means all tanagers are brightly coloured. The prevailing colour of the bush-tanagers of the genus *Chlorospingus* is olive-green, with white or blackish marks on the heads of some species. These plain little tanagers are found chiefly in the high mountains, where a few brilliant species also occur; but the subfamily is best represented at low and middle altitudes.

Habitat. Relatively few tanagers dwell in the dark depths of heavy forest. Many wander in mixed flocks through the upper levels of the forests and, like other treetop birds, they may forage and even nest in scattered trees and shrubbery of neighbouring clearings, plantations, and gardens. Many tanagers inhabit low, bushy growth; but only a few atypical members of the family, including the widespread Rose-breasted Thrush-tanager *Rhodinocichla rosea* and the Chat-tanager *Calyptophilus frugivorus* of Hispaniola, are primarily ground foragers.

Food. Tanagers as a whole are largely frugivorous, but probably all of them vary their diet with insects, which are sometimes captured on the wing, especially by the Summer Tanager. This species frequently tears open nests of small wasps to extract larvae and pupae. Grey-headed Tanagers *Eucometis penicillata* and some populations of *Habia* follow army ants (*Eciton*) in company with antbirds (Formicariidae), woodcreepers (Dendrocolaptidae), and many other small forest-dwellers, capturing the insects and spiders driven from concealment by the hunting ants rather than the ants themselves. The euphonias feed largely on the berries of mistletoes (Loranthaceae), the seeds of which pass through their alimentary tracts enclosed in a viscid envelope which attaches them to trees, so that these birds are important disseminators of the parasites. Tanagers are readily attracted to feeding trays where bananas and halved oranges are offered; over the years, 11 kinds have visited a single tray in southern Costa Rica.

Behaviour. Many species of tanagers remain mated throughout the year, but others travel in flocks in which pairs are not evident. In those that are constantly mated, the male sometimes feeds his partner, especially as the nesting season approaches. Nuptial feeding has been observed in species of *Tangara*, *Thraupis*, *Eucometis*, *Piranga*, *Euphonia*, and *Chlorophonia*.

Tanagers roost in trees and bushes, never in holes, as far as known; although euphonias snuggle into dense masses of moss, liverworts, or small orchids on epiphyte-laden boughs. Mated individuals rest near their partners rather than in contact with them. At times a number of pairs gather to roost in an attractive tree.

Voice. The tanagers as a whole are poorly endowed with song, and this is especially true of the most brilliant genus, *Tangara*, some of whose members are quite devoid of melody. A few species in other genera are known to have pleasing songs, among them the Scarlet Tanager, Grey-headed Tanager *Eucometis penicillata*, and the ant-tanagers of the genus *Habia*, which sing most persistently at dawn. Vocal mimicry has been reported for several species of euphonias. The poorly developed voices of many tanagers appear to be correlated with year-long pairing and weak territorial defence or absence of territoriality.

Breeding. Most tanagers build open, cup-shaped nests, high in trees, in low shrubs, rarely on the ground; no species (except the SWALLOW-TANAGER) is known to build habitually on or in the ground. The chief exceptions to this rule are the euphonias and chlorophonias, which construct covered nests with an opening in the side, embedded in moss on a trunk, in a cranny in a tree or post, or even in a tunnel in the ground. The Palm Tanager *Thraupis palmarum* builds its cup-shaped nest in a hole in a tree or other cranny. The versatile Blue Tanager may nest in an open shed, and sometimes it wrests a nest from some smaller bird and hatches its eggs and feeds its young along with those of the dispossessed builder. The nest is built by both sexes in numerous species of *Tangara*, *Thraupis*, *Eucometis*, *Euphonia*, and *Chlorophonia*; by the female alone in *Ramphocelus*, *Piranga*, and *Habia*.

Tanagers' eggs may be bright blue, blue-green, blue-grey, grey, cream, or white, and they are nearly always spotted, blotched, or scrawled with brown, lilac, or black. They are usually laid early in the morning, before or soon after sunrise, on consecutive days. The clutch consists of 2 or, more rarely, 3 eggs. Larger clutches, up to 4 or 5, are laid by the euphonias and chlorophonias, and by the migratory species of *Piranga* which breed beyond the tropics. The eggs are incubated by the female alone, who through the day takes a number of short sessions, often lasting from 20–30 min and rarely exceeding an hour. She keeps her eggs covered for about 60–80% of the daytime. Two female Blue Tanagers, attached to the same male, alternately incubated a double set of eggs. In another of the rare cases of bigamy recorded in this family, a male Red-crowned Ant-tanager *Habia rubica* had 2 mates and 2 nests simultaneously. Although there is no well-authenticated instance of incubation by a male tanager, he is actually attentive to his mate, sometimes bringing her food, or else, as in *Rhamphocelus*, presenting it to the eggs while she is absent, seeming thereby to anticipate the hatching of the nestlings. Recorded incubation periods of species with open nests range from 12–14 (rarely 15) days; but in the closed nests of euphonias they are often 16–18 days.

The nestlings hatch with tightly closed eyes and sparse (very sparse in *Euphonia*), loose down. The interior of the mouth is red. Brooded by the female only, they are fed by both parents, the chief known exceptions to this rule being certain nests of the Scarlet-rumped Tanager and the related Silver-beaked Tanager *Rhamphocelus carbo*, in which females are more numerous than males, with the result that some of the former rear their young without a mate's help. Food is brought to the nest in the parent's bill or mouth, except in the euphonias and chlorophonias, which regurgitate to the nestlings. Droppings are swallowed or carried away in the bill, and the nest is kept clean.

Juvenile or adult nest helpers have been found in a number of species. Immature Red-throated Ant-tanagers *Habia gutturalis* feed nestlings, probably their younger siblings, and they may even help to build. Likewise, first-brood young of the Golden-masked Tanager *Tangara larvata*, still in immature plumage, may help to feed a later brood of the same season. In this and several related species (e.g. Plain-coloured Tanager *T. inornata*, Speckled Tanager *T. guttata*, and Turquoise

Tanager *T. mexicana*) 3 to 5 individuals in adult plumage sometimes attend 1 or 2 young. At least 3 of a group of 7 apparently adult Dusky-faced Tanagers *Mitrospingus cassinii* fed 2 nestlings.

The nestling period varies in an interesting manner according to the form and site of the nest. It is shortest, 10 (rarely 8–9) to 13 days, in species that build low, open nests, including *Rhamphocelus*, *Eucometis*, and *Habia*. In the higher, open nests of *Tangara* and *Thraupis* it is longer, 14–20 days. In the covered, often high nests of *Euphonia* and *Chlorophonia* it is longest, 17–24 days. Tanagers scarcely ever give distraction displays when their nests or young are, or appear to be, in danger; but such displays have been witnessed in the ant-tanagers *Habia* spp. Euphonias and chlorophonias may take more than a year to acquire adult plumage, and the males sometimes breed in transitional attire. Many species of tanagers have more than one brood. A.F.S.

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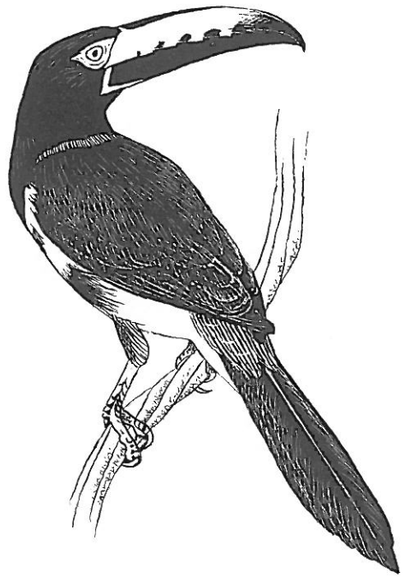

Collared Araçari *Pteroglossus torquatus*. (*P.J.K.B.*).

TOUCAN: substantive name of species of Ramphastidae (Piciformes, suborder Galbulae); in the plural, general term for the family. The name comes from 'tucano' in the language of the Tupi Indians of Brazil. The family consists of 6 genera and 42 species.

Characteristics. Toucans are middle-sized or large birds (34–66 cm long) confined to the tropical parts of the American continents. Wholly arboreal, they occur only in wooded regions, chiefly at low and middle altitudes. The outstanding feature of these ungraceful birds is the bill, which in all species is enormously enlarged, while in some it almost equals the body in length and bulk. Nearly always it is coloured with several bright and contrasting hues. Although in some species it appears almost too heavy for the bird to support, lightness combined with strength is obtained by a network of bony fibres ramifying through the space within the horny outer shell. Nevertheless, these bills are sometimes conspicuously broken; birds lacking half the mandible or maxilla often survive a long while in the free state. In size the toucan's bill compares with that of the hornbills of the Old World tropics, but it always lacks the dorsal out-growth or casque; the 2 families are not closely related.

The toucan's tongue is also remarkable. It is a long, narrow, horizontally flattened, thin lamina, which may attain a length of 15 cm in the largest species. Its distal part is on both sides obliquely notched by indentations that become progressively deeper toward the apex, where it has a bristly aspect. The wings are short and rounded; the tail tends to be long; the legs are strong and the feet zygodactylous. Each eye is surrounded by an area of bare skin that is usually brightly coloured.

Distribution and habitat. The largest toucans belong to the genus *Ramphastos*, which contains 12 species, up to 66 cm long. The Rainbow-billed or Keel-billed Toucan *R. sulfuratus* ranges through the forests from southern Mexico to northern South America. As in most toucans, the sexes are alike in coloration, but the males average larger than the females, with considerably longer bills. About 43–50 cm long, this stout bird is largely black, slightly glossed with green on the upper parts and washed with maroon on the hindneck. The upper tail coverts are white. The cheeks, throat, and foreneck are bright yellow, and the under tail coverts are bright poppy red. The coloration of the great, swollen bill varies somewhat with individuals and, with the exception of violet, all the colours of the rainbow are found on it. The tints blend rainbowlike into each other, and the basal margin of the bill is deep black. Other members of this genus have fewer but more strongly contrasting colours on their bills.

The genus *Pteroglossus* consists of 13 long-tailed, middle-sized or small toucans usually called araçaris. The Collared Araçari *P. torquatus* is a slender bird, about 42 cm long, which is found in wooded country at lower altitudes from southern Mexico to Colombia and Venezuela. In both sexes, the upper plumage is generally blackish, glossed with green on the back, with a bright red rump and upper tail coverts. The throat and foreneck are black, and the more posterior under plumage is largely yellow, with a band of black and red across the upper abdomen. The bill, less vividly coloured than in certain other araçaris, is whitish, grey, and black. The cutting edge of the maxilla has widely spaced, toothlike projections. The bright yellow eyes are surrounded by red bare skin. In this genus the curious Curl-crested Toucan *P. beauharnaesii* of the upper Amazon valley is sometimes placed. The feathers of its head consist largely of the broadly expanded horny shafts. Those on the pileum are curled forward and resemble shavings of glossy black horn.

The 7 toucanets of the genus *Aulacorhynchus* are largely green in plumage and reach higher altitudes than the 2 preceding genera, to about 3,000 m in the Andes and the highlands of Middle America. The Blue-throated Toucanet *A. prasinus caeruleogularis*, confined to the mountains of Costa Rica and western Panama, is about 30 cm long. In both sexes, the green plumage which covers most of the body lacks metallic lustre. The cheeks, chin, and throat are dark blue, and the under tail coverts are chestnut. The bill is yellow, white, red, and black, with yellow predominating. Toucanets perform vertical migrations, but other members of the family seem not to migrate.

Likewise found at high altitudes are the 4 species of the Andean genus *Andigena*, known as mountain toucans. The 56 cm long Black-billed Mountain Toucan *A. nigrirostris* is glossy black on crown and hindneck and olive-brown on back and wings. The rump is yellow, throat white, under tail coverts crimson, rest of under parts light blue, and thighs chestnut. The 5 small toucanets of the genus *Selenidera* have intricately patterned plumage and are the only members of the family in which the sexes differ in coloration. They inhabit warm forests of the Tropical Zone. The Saffron Toucanet *Baillonius bailloni* of south-eastern Brazil is the only member of its genus.

Food. Toucans eat many berries, arillate seeds, and other small fruits, and they vary their diet with such insects, spiders, small lizards, small snakes, and the like as they can catch, including slowly fluttering termites on evenings when the air is full of the winged sexual brood. Seizing the food in the tip of its great bill, the toucan tosses its head upward to throw the piece backward into its throat. Large items are first torn by the bill while held against the perch with a foot. The toucan that Humboldt and Bonpland carried on their historic canoe voyage up the Río Orinoco liked to fish in the river. Species of *Ramphastos*, *Pteroglossus*, *Aulacorhynchus*, and doubtless other genera, devour eggs and nestlings of small birds.

It is in connection with the toucans' feeding habits that their peculiar bills must be considered. The long bill enables these heavy, rather clumsy birds to reach fruits that grow at the slender tips of branches while they perch farther inward, where they find more adequate support. But to give a longer reach, the bill need be neither thick nor brightly coloured.

Behaviour. Toucans are sociable birds that are often found in small flocks of a few to more than a dozen individuals, yet they are almost devoid of group impulses. When they travel, one flies away and then another follows; and so they straggle on, one by one, until the whole flock has moved. The larger species fly with alternate flapping and gliding, tracing undulatory courses; but the flight of some of the smaller kinds is swift and direct. Toucans bathe in water that collects in hollows in crotches of trees or in the upper side of thick horizontal limbs, often high above the ground. They evince curiosity, and in remote forests they may look down with interest at the activities of a botanical collector or other human intruder. They are frolicsome birds, jumping about and sometimes playfully striking their great bills together in a sort of fencing, or grasping each other's bills and pushing, with no display of antagonism. Sometimes they preen one another's plumage with the tips of their bills. At least in *Ramphastos*, *Pteroglossus*, and *Aulacorhynchus*, one individual often passes food to another, doubtless its mate. Sometimes pair members feed each other reciprocally. Like other piciform birds, toucans scratch their heads by raising a foot outside the closed wing rather than over the drooped wing, as passerines commonly do.

The size and vividness of toucans' bills probably serve them well when they make predatory visits to the nests of other birds; they are so intimidating that even small hawks and the boldest of the American flycatchers (Tyrannidae) fear to attack a toucan perching beside its nest. But when the pirates are flying and cannot turn their heads to defend their backs, the outraged parents sometimes buffet them. Since the bills of conspecifics often differ more strikingly in coloration than their plumage, they probably serve for specific recognition among sympatric forms. The vivid bill may also enter into courtship, although little is known about toucans' nuptial displays. It has been suggested that the long bill may also help an incubating or brooding toucan to repel enemies from the doorway of its hole, but toucans hurry forth from their nests at the first hint of danger.

Sleeping. Araçaris roost throughout the year in holes of woodpeckers or other cavities, usually high in trees. Each flock seems to have a number of these lodgings; if their suspicions are aroused as they approach one, they may retire into another. Five or 6 adults may sleep in the same hole, folding their tails over their backs to save space in crowded quarters. In captivity, *Ramphastos* spp. roost with the bill laid among the plumage of the back and the tail folded forward over the bill, so that they become featureless balls of feathers. Bourne (1974) noticed 5 Red-billed Toucans *R. tucanus* sleeping side by side in close contact high in a tree in Guyana. As far as known, only *Pteroglossus* spp. and (at least occasionally) the Guianan Toucanet *Selenidera culik* sleep in holes when not nesting.

Voice. Toucans are poorly endowed vocally. Their monotonous calls have been compared to the croaking of frogs, the mewing of gulls, and the yelping of puppies. They produce rattling, castanetlike notes that seem to be mechanical but are actually vocal. Araçaris utter high, sharp notes, surprisingly weak for such large birds. The *dios te de, te de, te de* of the Chestnut-mandibled Toucan *Ramphastos swainsonii* is, however, not unmelodious as it floats down from distant treetops. These birds sing much at nightfall, swinging their heads up and down as they emit their notes.

Breeding. Toucans nest in trees, in hollows resulting from decay or, in the smaller species, in woodpeckers' holes, of which they may dispossess the makers. They may remove rotten wood from a hole, or enlarge the doorway if the surrounding wood is soft; but their occasional attempts to carve a nest cavity seem always to be ineffectual. *Ramphastos* spp. prefer living trees and may nest in the same cavity in successive years, but smaller toucans are often content with dead trees. Toucans' nests are often at a great height, but exceptionally they choose one near the ground. Rainbow-billed Toucans take a few green leaves into their holes and may carry them away after they wither. Otherwise, toucans take no lining into their nests; but the many large seeds which they regurgitate while they sit soon form a pebbly bed beneath the eggs. These number 2–4 in a clutch; they are broadly ovate, white or pinkish, and unmarked.

Incubation is performed by both parents, who are surprisingly restless for such large birds. They seldom sit for more than an hour at a stretch; and often they leave the eggs uncovered for up to an hour or more, while both attendants go off to forage. Even if, as in the araçaris, both parents had slept in the nest hole before laying began, only one stays with the eggs at night. A male Red-billed Toucan incubated by night and also brooded the young on most nights, but the female sometimes brooded through the night. However, only the female of a pair of Blue-throated Toucanets was seen to occupy a nest with eggs at night. Nocturnal incubation and brooding by the male is usual in the related woodpeckers and has also been found in puffbirds, but it is not invariable in the order Piciformes. The incubation period of the Red-billed Toucan is approximately 15.5 days; that of the Blue-throated Toucanet, 16 days.

Toucans are hatched perfectly naked, with no trace of down. Their eyes are tightly closed, and the mandible is both longer and broader than the maxilla. Their heels are equipped with prominent thickened pads, from which project a number of strong tubercles, arranged in a peripheral ring in species of *Ramphastos*. These heel pads, along with the abdomen, bear the nestling's weight; their function appears to be to prevent abrasion of the heel joint by the nest's rough floor. The nestling's uropygium is extraordinarily long and prominent and is often held with a strong upward tilt. Young toucans develop with extreme slowness. They are over 2 weeks old before their eyes begin to open, and at this age they are still naked.

Both parents brood and feed the young, nourishing them largely with fruits, insects especially while they are younger, and occasionally a lizard, small snake, or the nestling of some other bird. Much of the food is carried to the nest in the throat or stomach, but usually a final item is held prominently in the parent's bill and given to a nestling before the remainder of the load is brought forth. Waste material is removed from the nest in the parents' bills. In the Blue-throated Toucanet and species of *Ramphastos*, a single parent sleeps with the nestlings until a few days before their departure, but in the araçaris both parents pass the night with them. In Panama, 6 Collared Araçaris roosted in a very high hole that was afterward used for breeding. Only one parent slept in it while incubation was in progress, but after the eggs hatched 5 adults roosted in the nest hole each night. All 5 of them fed the nestlings, of which there were at least 3. The nestling period of this species is 43–46 days; that of the Blue-throated Toucanet, 43 days; and that of *Ramphastos* spp., about 47–49 days. Fledgling araçaris return to sleep in the nest hole with their parents, and the helpers when these are present; but apparently young of *Ramphastos* spp. and *Aulacorhynchus* spp. do not return. In the highlands, Blue-throated Toucanets rear 2 broods in a season, but the larger toucans of the lowlands apparently attempt only a single brood. A.F.S.

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