

Five instances of bird mimicry suggested for Neotropical birds: a brief reappraisal

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RESUMO: Cinco exemplos de mimetismo propostos para aves Neotropicais: uma breve reavaliação. Exemplos de mimetismo são raros entre aves e as espécies dos Neotrópicos não são exceção. Cinco casos de associação mimética propostos para aves que vivem no Brasil são aqui reavaliados. Os conjuntos *Cathartes aura-Buteo albonotatus* (Cathartidae e Accipitridae), *Ramphastos tucanus-Ramphastos vitellinus* (Ramphastidae), *Accipiter bicolor-Harpagus diodon* (Accipitridae), *Philydor rufus-Orchesticus abeillei* (Furnariidae e Thraupidae), bem como *Chondrohierax uncinatus* (Accipitridae) e um subconjunto de falconídeos e acipitrídeos, são ilustrados e observações de campo e literatura são apresentadas. Os conjuntos *Cathartes aura-Buteo albonotatus* e *Ramphastos tucanus-R. vitellinus* parecem ter boas evidências funcionais. O primeiro seria mimetismo agressivo e o segundo seria mimetismo alimentar. As evidências funcionais dos conjuntos *Accipiter bicolor-Harpagus diodon* e *Philydor rufus-Orchesticus abeillei* são menos evidentes que nos dois casos anteriores, porém estudos adicionais de campo poderiam fortalecer as hipóteses propostas. Entretanto, o conjunto *Chondrohierax uncinatus*-espécies de falconídeos e acipitrídeos permanece sem evidências funcionais suficientes. A semelhança no padrão de plumagem e a sobreposição parcial de habitats deste último conjunto também indicam mimetismo, plausivelmente do tipo agressivo.

PALAVRAS-CHAVE: Mimetismo agressivo, mimetismo protetivo, mimetismo alimentar, táticas de caça, táticas de forrageamento, táticas de evasão.

ABSTRACT: Examples of mimicry among birds are rare worldwide and the Neotropics are no exception. Five cases of mimetic associations suggested for Neotropical birds are here reappraised. The sets *Cathartes aura-Buteo albonotatus* (Cathartidae and Accipitridae), *Ramphastos tucanus-Ramphastos vitellinus* (Ramphastidae), *Accipiter bicolor-Harpagus diodon* (Accipitridae), *Philydor rufus-Orchesticus abeillei* (Furnariidae and Thraupidae), as well as *Chondrohierax uncinatus* (Accipitridae) and a subset of falconid and accipitrid raptors are illustrated and field and literature data are presented. The sets *Cathartes aura-Buteo albonotatus* and *Ramphastos tucanus-R. vitellinus* seem to have good functional evidences. The first case would qualify as aggressive mimicry, and the second one would qualify as foraging mimicry. The functional evidences of the sets *Accipiter bicolor-Harpagus diodon* and *Philydor rufus-Orchesticus abeillei* are less evident than in the first two ones, but additional field studies may strengthen the suggested hypotheses. However, the set *Chondrohierax uncinatus*-falconid and accipitrid species remains without adequate functional evidences. The resemblance in the plumage pattern and the partial habitat overlap of this latter set indicate mimicry as well, plausibly of the aggressive type.

KEY-WORDS: Aggressive mimicry, protective mimicry, foraging mimicry, hunting tactics, foraging tactics, evasive tactics.

Proposed instances of mimicry among birds are rare worldwide and the Neotropics are no exception. Some illustrative examples include birds of prey that resemble raptors harmless to the potential prey of the former (e.g. Willis 1963, Negro 2008), birds of prey that resemble more dangerous raptors and lessen or avoid mobbing by other birds (Willis 1976a) or lower predation and/or harassment by raptors (Negro 2008), petrels that resemble skuas and enhance their kleptoparasitism on other seabirds (Spear and Ainley 1993), a toucan that resembles a larger toucan and lower or avoid harassment by the latter while feeding on the same fruiting tree (Sick 1997), a tanager that resembles and joins mixed flocks of a foliage-gleaner with other birds and benefits when the flock

is attacked by a raptor (Willis 1976b, 1989), friarbirds that resemble orioles and lower harassment by these latter while foraging (Diamond 1982), and toxic pitohuis that resemble each other and enhance their mutual protection (Dumbacher and Fleischer 2001). As is the case with most instances of mimicry suggested for vertebrates and even invertebrates, the above mentioned instances of bird mimicry remain mostly speculative (but see Spear and Ainley 1993) although a few seem strengthened by field observations on their presumed functions (e.g. Willis 1966, 1989, Sick 1997).

Five cases of mimetic associations suggested for Neotropical birds are here briefly reappraised. These include the pairs *Cathartes aura-Buteo albonotatus* (Cathartidae and

Accipitridae) (Willis 1963), *Ramphastos tucanus*-*Ramphastos vitellinus* (Ramphastidae) (Sick 1997), *Accipiter bicolor*-*Harpagus diodon* (Accipitridae) (Willis 1976a), as well as the sets *Philydor rufus*-*Pachyramphus castaneus*-*Orchesticus abeillei* (Furnariidae, Tyrannidae and Thraupidae) (Willis 1976b, 1989), and *Chondrohierax uncinatus* (Accipitridae) and a subset of accipitrine and buteonine raptors (Edelstam 2005). Thus, here I provide 1) field observations on most of the birds species involved in the five mimicry instances with exception of one of them, on which I draw from literature; 2) pictures of the bird species involved in the five cases; 3) an additional species for one of the proposed mimicry complexes. I note that two of the proposed instances have good functional evidences, whereas for the remainder these evidences seem to be less evident. One of them still awaits further data to disclose which may be its function(s). To better understand the function of the five mimicry sets, I stress the need for additional natural history-oriented studies, as bird mimicry associations in the Neotropics (and elsewhere, see Dumbacher and Fleischer 2001) still remain elusive and poorly known.

MATERIAL AND METHODS

The birds and their behaviours were recorded at several localities in eastern and south-eastern Brazil, including the areas of Mucuri, Bahia (~ 18°04'S, 39°33'W) in eastern Brazil; Itatiaia, Rio de Janeiro (~ 22°43'S, 44°61'W); Campinas, São Paulo (~ 22°48'S, 47°11'W) and Ubatuba, São Paulo (~ 23°21'S, 44°53'W) in south-eastern Brazil. The birds were observed with naked eye, through 10 × 50 binoculars and a 70-200 or 70-300 telephoto zoom lens mounted on a SLR camera at a distance of about 5-30 m. "Ad libitum" and "behaviour" sampling rules (Martin and Bateson 1986), both of which are adequate for opportunistic observations and rare behaviours, were used throughout. Additionally, I briefly interviewed professional biologists, and amateur and professional photographers who recorded some of the birds presented here. Their and my digital or digitalised photographs are here further used for illustration of the birds and description of their behaviours. Voucher digital copies of photographs (when copyright allowed) are on file at the Museu de Zoologia da Universidade Estadual de Campinas (ZUEC).

RESULTS

Zone-tailed-Hawk (*Buteo albonotatus*)

I recorded this hawk in the Mucuri area on 25 July 1991 at midday. A group of Turkey Vultures (*Cathartes aura*) was soaring and gliding over a small tract of lowland 'restinga' forest where a caterpillar tractor was working.

As the tractor activity disturbed and unearthed litter and soil-dwelling vertebrates, the vultures landed to prey on these. Adjacent to the area worked by the tractor was a clearing where a few lizards (*Tropidurus* sp.) were basking on logs, seemingly undisturbed by the vultures gliding low over the area. As I was watching the lizards, one of the gliding vultures suddenly half-folded the wings and dived towards them. A lizard was snatched by the bird still on the wing, and only after it flapped the wings to rise I realised that the 'vulture' was a blackish hawk I latter identified as *B. albonotatus*. On the wing this hawk resembles the larger Turkey Vulture, especially when soaring and/or gliding (Figures 1-4). After catching the lizard, the hawk flew off with its prey held in talons in much the same way as recorded by C. Albano (*pers. comm.*) in the Salto da Divisa town, Minas Gerais, south-eastern Brazil (Figure 5). I recorded again a hunting Zone-tailed Hawk, this time in the Ubatuba area on 23 September 2010 in late morning. One to two Turkey Vultures were soaring low over a tract of lowland forest and soon were out of sight. Bare-throated Bellbirds (*Procnias nudicollis*) were vocalising all the time I was there, one of which I sighted on a branch of a leafless tree near the forest edge. While observing the immature bellbird I perceived a vulture gliding low near the forest edge, but paid no special attention to it. Only after the bird half-folded its wings and dived towards the bellbird that I realised it was a Zone-tailed Hawk. The hawk snatched the bellbird from the branch and flew off with its prey in talons, this time harassed by a pair of Tropical Kingbirds (*Tyrannus melancholicus*). Harassment by this kingbird on a flying Zone-tailed Hawk was also recorded by E. Felix Jr. (*pers. comm.*) at the Fazenda Santa Clara, Mata de São João, Bahia, eastern Brazil (Figure 6).

Bicolored Hawk (*Accipiter bicolor*)

I recorded this hawk in the Ubatuba area on 19 January 2006 at mid morning within a lowland forest tract by a stream. The hawk was perched on a branch about 5-6 m high and was plucking the feathers of what seemed a woodcreeper. However, it almost immediately took off and flew into the understorey with its prey in talons.

Rufous-thighed Kite (*Harpagus diodon*)

This hawk is a common sight at forest edges in the Ubatuba and Itatiaia areas. Its colour greatly resembles that of the larger Bicolored Hawk (Figure 7). In Ubatuba I observed this kite on 12 November 2009 in early morning, sitting on a branch about 4-5 m high and scanning its surroundings. Suddenly it dived with folded wings towards a low vegetation clump, snatched what appeared to be a thin branch and landed on the same perch. The

'branch' turned out to be a large stick-insect (Phasmatodea), which the kite held in its left talons for a while (Figure 8) before flying off.

**White-throated Toucan (*Ramphastos tucanus cuvieri*)
and Channel-billed Toucan
(*Ramphastos vitellinus culminatus*)**

I have no field experience with these two Amazonian toucans and rely on the account given by Sick (1997)

instead. These two species are very similar to every plumage colour detail, including the yellow uppertail coverts (Figures 9-10). The Channel-billed Toucan is smaller and has a shorter bill, however. According to Sick (1997), the smaller toucan is not driven off by the larger White-throated Toucan while feeding on the fruits of a tree occupied by the latter. In Caraguatatuba, south-eastern Brazil I observed a Red-breasted Toucan (*Ramphastos dicolorus*) driving off an individual of the slightly larger Channel-billed toucan (*Ramphastos vitellinus ariel*) that was feeding on the fruits of a palm tree (*Euterpe edulis*).



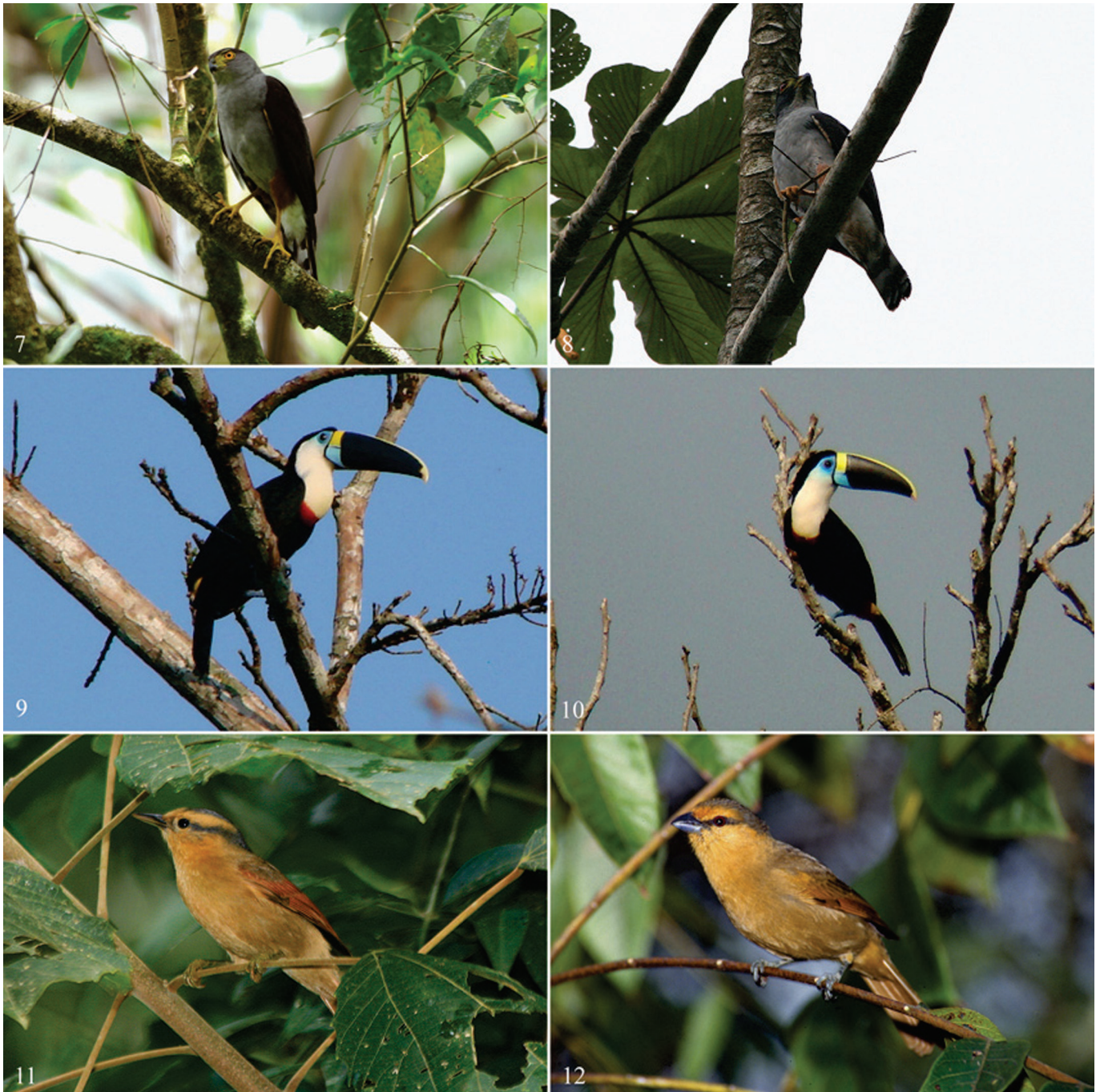
FIGURES 1-6: (1) The Turkey Vulture (*Cathartes aura*) with slightly bend wings; (2) the aggressive mimic Zone-tailed Hawk (*Buteo albonotatus*) with similar wing bend; (3) the vulture with wings in strong dihedral; (4) the hawk with similar wing position; (5) the hawk with a lizard (*Tropidurus* sp.) in its right talons; (6) the hawk harassed by a Tropical Kingbird (*Tyrannus melancholicus*). Photographs by Ivan Szazima (1), Wilfred Rogers (2), Marcos Melo (3), Evair Legal (4), Ciro Albano (5) and Edésio Felix Junior (6).

These two species differ mostly in their throat, breast, and bill colours.

Buff-fronted Foliage-gleaner (*Philydor rufum*)

I observed this bird several times in the Itatiaia and Ubatuba areas. It foraged singly or in pairs most of the time, but in the Itatiaia area it sometimes formed groups of up to 10 individuals. When suddenly disturbed, the

flocking birds noisily scattered to the adjacent vegetation. In the Itatiaia area I observed this foliage gleaner twice (08 May 1997 and 19 September 2008) in mixed flocks with up to about five Olive-green Tanagers (*Orthogonys chloricterus*), one to two Chestnut-crowned Becards (*Pachyrampus castaneus*), one to two Brown Tanagers (*Orchesticus abeillei*) and a few individuals of one to three species of unidentified thamnophilids. In one of these two occasions (19 September 2008) a Dusky-legged Guan (*Penelope obscura*) dashed into the foraging passerine flock,



FIGURES 7-12: (7) The Bicolored Hawk (*Accipiter bicolor*) on which may be a hunting perch; (8) the smaller Rufous-thighed Kite (*Harpagus diodon*) on a hunting perch, with a large stick insect (Phasmatodea) in its left talons; (9) the White-throated Toucan (*Ramphastos tucanus cuvieri*) showing black bill and yellow supracaudals; (10) the smaller Channel-billed Toucan (*Ramphastos vitellinus culminatus*) showing very similar colours; (11) the Buff-fronted Foliage-gleaner (*Philydor rufum*) forages for insects; (12) the similarly coloured and sized Brown Tanager (*Orchesticus abeillei*) on a perch. Photographs by Cláudia Komesu (10), Ivan Szazima (8, 11, 12), Sidnei de Melo-Dantas (9) and Diana Bradshaw (10).

which noisily scattered to the adjacent vegetation with the exception of the Brown Tanager that hid under a large leaf. The flock soon reassembled and proceeded foraging, but I was unable to spot again the tanager in the flock. The foliage-gleaner, the tanager, and the becard show overall size and plumage colour similarity, especially the two former species (Figures 11-12) but not much so the latter one (Figure 20).

Collared Forest-falcon (*Micrastur semitorquatus*)

I sighted a buff juvenile of this falcon on 24 August 2007 at midday perched on a branch about 5-6 m high within a lowland forest in the area of Ubatuba. The raptor was at the end of swallowing an unidentified lizard, and flew off after briefly rubbing its bill on the branch.

Hook-billed Kite (*Chondrohierax uncinatus*)

I observed an adult female on 21 August 2008 in late afternoon perched on a branch about 3-4 m high within a lowland forest in the area of Ubatuba. It held a terrestrial snail (*Megalobulimus* sp.) in its left talons and was feeding on it. After a while, the kite discarded the shell, picked what seemed pieces of the snail from the talons, rubbed the bill against the branch and appeared to doze briefly. After the bird flew off I recovered the discarded shell, which had the inner lip and columella broken.

The Collared Forest-falcon and the Hook-billed Kite bear a resemblance to each other, especially the juveniles of both species (Figures 13-14). Additionally, the falcon buff juveniles bear a superficial resemblance to the kite adult females (Figures 15-16). On the other hand, the smaller White-rumped Hawk (*Buteo nitidus*) bears a still more superficial resemblance to adult Hook-Billed Kite males (Figures 17-18).

Roadside Hawk (*Rupornis magnirostris*)

I recorded this ubiquitous hawk on hunting perches several times in the Ubatuba and Campinas areas. I recorded it preying on katydids (Tettigoniidae) and other large insects, a leiosaurid lizard (*Enyalius iheringi*), an immature Striated Heron (*Butorides striata*), and an unidentified passerine nestling (Figure 19). In Ubatuba I recorded it twice associated to army ants raids. In one of these occasions (03 August 2007 in late afternoon) a hawk perched on a branch about 2 m high at the forest edge and watched the disturbance caused by the raiding ants. From this perch it dived twice to the ground to snatch a katydid and a juvenile *Enyalius* lizard, and appeared not to pay attention to several army ant passerine

followers that were in the understorey and near the forest edge preying on insects disturbed by the ants. However, after eating the lizard, the hawk dashed into the understorey and returned with what appeared a thamnophilid bird. This time, however, it did not perch again and flew off instead. This hawk species bears a superficial resemblance to Hook-billed Kite adult females (Figure 16).

DISCUSSION

From the five instances of mimicry suggested for Neotropical birds, and for which I was able to provide pictures and some field data, the most convincing ones seem to be the sets *Cathartes aura-Buteo albonotatus* and *Ramphastos tucanus cuvieri-Ramphastos vitellinus culminatus*.

The two hunting episodes I recorded for the vulture-mimicking Zone-tailed Hawk agree well with previous descriptions both in North and South Americas, including their association with soaring Turkey Vultures and/or soaring over areas in which the vultures are a common sight (Willis 1963, 1966, Zimmerman 1976). The hunting success of this hawk is substantially higher while it soars with vultures (30%) than while it flies alone (6.7%) (Snyder and Snyder 1991). The main prey types of the Zone-tailed Hawk are lizards, birds and small mammals such as squirrels (Hiraldo *et al.* 1989, Thiollay 1994, Kennedy *et al.* 1995, Stoleson and Sadoti 2010). As most lizards, all birds, and squirrels have good visual acuity (*e.g.* Robinson 1980, de Juana 1992, Pough *et al.* 2004), the resemblance of the hawk to the vulture seems to have good functional evidences. Thus, the set *Cathartes aura-Buteo albonotatus* qualifies well as an instance of aggressive mimicry as originally suggested by Willis (1963). The view that a Zone-tailed Hawk soaring with wings in a dihedral is more related to aerodynamics than to mimicry (Mueller 1972) does not mean that the hawk takes no advantage from its vulture-like resemblance, as aerodynamics and mimicry are not mutually exclusive. The harassing of the hawk by kingbirds (Zimmerman 1976, Stoleson and Sadoti 2010, present paper) does not mean much for the mimicry issue, as several species of tyrant-flycatchers are renowned for their propensity to pursue raptors and other large birds (Amadon 1961, Fitzpatrick 2004).

The almost perfect resemblance of the Channel-billed Toucan to the larger White-throated Toucan is compelling and there is no a good reason to believe that this convergence is due to any cause other than mimicry. As stated by Sick (1997) this resemblance allows the smaller toucan to forage in the same fruiting tree occupied by the larger toucan. Were not for this resemblance, both from above and below, the smaller bird would be expelled by the larger one (Sick 1997). For the proper functioning of this disguise, the smaller toucan cannot vocalize

(Sick 1997), as it ‘croaks’ whereas the larger toucan ‘yelps’ (Patané *et al.* 2009). As the range of *Ramphastos tucanus cuvieri* and *Ramphastos vitellinus culminatus* overlaps extensively (Patané *et al.* 2009), and the two toucans belong to different phylogenetic lineages (Haffer 1974, Patané *et al.* 2009), the most likely and parsimonious explanation for their resemblance is mimicry. Additional field observations would strengthen the function of this proposed mimicry instance. Although Sick (1997) classified this resemblance as aggressive mimicry, I think that it fits better in foraging mimicry (*sensu* Spear and Ainley 1993).

For the two following sets, evidences for mimicry are not as compelling as for the two preceding ones but are impressive nevertheless. Willis (1976a) suggests that the Rufous-thighed Kite benefits from its resemblance to the Bicolored Hawk by scaring mobbing birds that would hamper its hunting for humming cicadas and other alert prey such as lizards. The particular assumption on cicadas would rely on the premise that the kite hunts these insects guided acoustically rather than visually and there is no such evidence in the account given by Willis (1976a). However, the main prey types of the kite are indeed insects



FIGURES 13-18: (13) The Collared Forest-falcon (*Micrastur semitorquatus*), whitish juvenile morph; (14) the similarly-sized Hook-billed Kite (*Chondrohierax uncinatus*) juvenile on a hunting perch with a snail in its left talons; (15) the Collared Forest-falcon, buff juvenile morph; (16) Hook-billed Kite adult female; (17) the smaller Grey Hawk (*Buteo nitidus*) on a hunting perch, with a cicada in its bill; (18) Hook-billed Kite adult male. Photographs by Ciro Albano (13), Beatriz Lopes (14), Matusalém Miguel (15), Paulo Guerra (16), Rafael Bessa (17) and Rodolfo Eller Viana (18).

and lizards (Amadon 1961, Thiollay 1994), and its resemblance to a bird-eating specialist does frighten small birds that would lessen its hunting success on alert insects and lizards (Willis 1976a). Although Amadon (1961) points out that the Bicolored Hawk mimicking the Rufous-thighed Kite is unlikely based on the wider range of the former (e.g. Ferguson-Lees and Christie 2005), I think that the bird-specialised hawk may actually benefit from its resemblance to the insectivorous kite where they are sympatric, as bird prey might not recognise the hawk as a danger. Anyway, further field observations may clarify the functions of the resemblance between *Accipiter bicolor* and *Harpagus diodon*.

The similarity between the Buff-fronted Foliage-gleaner and the Brown Tanager, both in colour and size, led Willis (1976b) to suggest that the latter is a mimic of the former. While associated, the two birds would divide their foraging zones in a semiaggressive way (Willis 1976b). Later, the same author added the Chestnut-crowned Becard (*Pachyramphus castaneus*) to the *Philydor rufus*-*Orchesticus abeillei* set and argued that the resemblance of these birds in a mixed flock would make difficult for the predator to single out a prey (Willis 1989). Additionally, Willis (1989) pointed out that the tanager



FIGURES 19-20: (19) The Roadside Hawk (*Rupornis magnirostris*) with an unidentified passerine nestling in its left talons; (20) the Chestnut-crowned Becard (*Pachyramphus castaneus*) forages for insects. This hawk species may belong in the *Chondrohierax*-falconid and accipitrid mimetic association, whereas the becard belongs in the *Philydor*-*Orchesticus* one. Photographs by Ivan Sazima.

would benefit from its resemblance to the foliage-gleaner due to the different evasive tactic of the former (hiding instead of noisily scattering). My own record lends support to the latter suggestion, but further field observations may strengthen or change the suggestions for the functions of resemblances in the mixed flocks of *Philydor rufus*, *Orchesticus abeillei*, *Pachyramphus castaneus*, and other species (Willis 1989).

The resemblance between the Hook-billed Kite and the subset of falconids and accipitrids (Edelstam 2005) seems the hardest one to explain from the five instances reappraised herein. There is a suggestion that this kite mimics falcons and a few buteonine raptors, all of which fly faster and have stronger talons than the kite (Edelstam 2005). In this sense, the resemblance between the kite and the other raptors would be similar to the mimicry type suggested for the Rufous-thighed Kite and the Bicolored Hawk (Willis 1976a). However, I suggest that it is more likely that the resemblance favours the falconid and the accipitrid raptors, not the Hook-billed Kite. For instance, juvenile Collared Forest-falcons may benefit from their resemblance to the kite juveniles and females, as the falcon preys mostly on birds, mammals, and lizards (Thiollay 1994), and this prey type might not flee from a snail-eating bird. The other way round is less likely, as forest-dwelling raptors are seldom mobbed by birds (Willis 1976a) and, thus, the snail-eating kite would not benefit from its resemblance to a dangerous raptor for securing its prey as suggested for the insect and lizard-eating Rufous-thighed Kite (Willis 1976a). While hunting at forest edges, the White-rumped Hawk (*Buteo nitidus*) may also benefit from its superficial resemblance to Hook-billed Kite males in a way similar to that here suggested for the Collared Forest-falcon. As the hawk preys mostly on lizards and snakes (Thiollay 1994), the former prey type might not flee or be overly cautious in the presence of a snail-eating raptor. Likewise, I suggest that the Roadside Hawk may also benefit from its superficial resemblance to Hook-billed Kite females while hunting at forest edges, as the hawk preys mostly on insects, lizards, mammals, and birds (Thiollay 1994). The observation that this hawk is able to snatch a forest-dwelling bird (this paper) would lend some support to my suggestion that it may mimic the kite. The resemblance between the Hook-billed Kite and the subset of falconids and accipitrids may plausibly qualify as aggressive mimicry. As is the case with the two preceding instances, this presumed mimicry complex would greatly benefit from additional field observations on the raptor species supposedly involved (Edelstam 2005).

Resemblances between unrelated or distantly related bird species often are difficult to explain and seem to have more than one functional explanation in most cases (e.g. Willis 1963, Mueller 1972, Willis 1976b, Spear and Ainley 1993, Negro 2008), especially for birds that flock

together (e.g. Moynihan 1968, Willis 1989, Diamond 1987, Thiollay 1999). Even a superficial resemblance between models and mimics is deemed functional (e.g. Pough 1988, Edmunds 2000), which make the supposed mimicry associations a challenging issue and in need for further field studies, sometimes a very difficult task (see Dumbacher and Fleischer 2001).

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