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FRONTISPÍCIO. Macho adulto (abaixo) e fêmea (acima) de *Stymphalornis acutirostris*. Desenho de Rafael A. Dias.

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Fruit eating by birds in a forest fragment in southeastern Brazil

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RESUMO. **Consumo de frutos por aves em um fragmento de mata no sudeste do Brasil.** Neste estudo registramos as espécies de frutos utilizadas como alimento por aves em um fragmento de mata semidecídua (250 ha) alterada e isolada, localizada no município de Campinas -SP. Registramos 32 espécies de aves alimentando-se dos frutos de 36 espécies de plantas. As espécies de aves mais comumente registradas foram pequenos passeriformes (*Tachyphonus coronatus, Chiroxiphia caudata, Trichothraupis melanops, Vireo olivaceus, Manacus manacus,* e *Saltator similis*) que caracteristicamente sobrevivem em áreas degradadas no sudeste do Brasil. Aves frugívoras de grande porte, por outro lado, foram raramente observadas, o que reflete o atual grau de empobrecimento da avifauna na área de estudo. Aves migrantes foram frequentemente observadas alimentando-se de frutos. Estas aves podem ter um papel importante como dispersoras de sementes na área estudada.

PALAVRAS-CHAVE: dispersão de sementes, floresta semidecídua, fragmentação de florestas, ornitocoria, sudeste brasileiro.

ABSTRACT. In this study we surveyed fruits eaten by birds in a 250 ha highly disturbed and isolated forest fragment in southeastern Brazil. We recorded 32 bird species eating the fruits of 36 plant species. The birds most frequently recorded eating fruits were small passerines (*Tachyphonus coronatus, Chiroxiphia caudata, Trichothraupis melanops, Vireo olivaceus, Manacus manacus,* and *Saltator similis*) that thrive in a variety of disturbed forests in southeastern Brazil. Large frugivorous birds were rarely recorded which reflect the impoverished avifauna of the area. Migrant birds were often observed eating fruits. These birds may play an important role as seed dispersers in such a disturbed habitat.

KEY WORDS: forest fragmentation, ornithochory, seed dispersal, semideciduous forest, southeastern Brazil.

Two broad subjects involving birds received special attention in tropical ecological studies during the last twenty years: the multiple effects of forest fragmentation on avian populations (Willis 1979, Bierregaard and Lovejoy 1989), and the interactions between avian frugivores and their food plants (McKey 1975, Howe and Estabrook 1977). Since both issues are of special interest for conservation and management (Terborgh and Winter 1980, Howe 1984) and given the present rate of tropical forest conversion (Myers 1984, 1989), they must figure as priorities for future studies (Terborgh 1992).

Forest fragments are exposed to long-term alterations in vegetation structure and floristic composition, mainly due to changes in abiotic conditions or human disturbance, which have immediate consequences for the animal community (Janzen 1983, Laurence 1990). Large frugivorous birds, for example, may fail to subsist in fragmented areas where their food resources have diminished following unusual climatic conditions or logging (Willis 1979, Terborgh and Winter 1980), triggering a series of extinctions in a "domino effect" as predicted by Howe (1984).

In this study we surveyed fruits eaten by birds in a 250 ha forest fragment in southeastern Brazil. We were especially interested in identify which bird species inhabiting the fragment perform the bulk of seed dispersal in such a disturbed habitat.

STUDY SITE AND METHODS

We studied the diet of frugivorous birds from April 1988 to December 1991 at Santa Genebra Reserve, a 250 ha forest fragment (22°49'S, 47°06'W, 640 m a.s.l.) located in Campinas, São Paulo State, southeastern Brazil. The reserve is surrounded by field crops and isolated by several kilometers from other forest tracts (see aerial photograph in Chiarello and Galetti 1994). Mean annual temperature is 20,6° C and mean annual rainfall around 1360 mm (Morellato 1991), with a rainy-hot season extending from November to February, and a dry-cold season from May to August.

Santa Genebra forest, classified as low subtropical moist forest (Holdridge 1967) or tropical semideciduous forest (Longman and Jenik 1987), is nowadays a mosaic of early and old secondary vegetation. The early secondary areas are dominated by species of Solanaceae, Cecropiaceae, and Piperaceae, by liana species (mostly Bignoniaceae and Malpighiaceae) (Morellato 1991), and also by *Celtis* shrubs (Ulmaceae) (Matthes 1992). The old secondary forest has trees 15-20 m high and is characterized by a discontinuous canopy with emergent trees, such as *Cariniana legalis* (Lecythidaceae) and *Hymenaea courbaril* (Caesalpiniaceae), reaching up 30 m. The most common families are Lauraceae, Rutaceae and Meliaceae. Logging in the past created large gaps in the forest interior and edges which were rapidly occupied by lianas and bamboo tickets.

According to Willis (1979), the forested area was reduced to its present size in 1969 by logging about 145 ha. After that, the area has suffered selective logging mainly along its edges and trail margins. The present avian species composition of Santa Genebra is quite different from that before isolation. One of the most striking changes is the disappearance of large frugivorous birds such as cotingas (Cotingidae), toucans (Ramphastidae) and trogons (Trogonidae) (Willis 1979, Aleixo and Vielliard 1995).

We recorded the diet of birds along the forest edges and trails by walking on one to three days a week along a 5 km transect. Transects were carried out mostly in the mornings between 06:00 and 13:00, when weather permitted. The field work was the same for both seasons. Whenever we found a bird species (one bird or a flock) eating fruits we recorded one feeding bout irrespective of the length of time it fed. If the bird (or flock) moved to another fruit source, a new bout was recorded. The use of transects to survey the fruits eaten by birds may favor the most common bird and plant species (Wheelwright *et al.* 1984). Since our general goal was to detect the most important potential seed dispersers (in terms of number of fruit species eaten and visitation rates to fruiting plants), this method of data gathering seems to be adequate. It is important to notice that the data presented here is neither a complete measure of fruit diet breadth of the species of concern nor a measure of their impact on plant species fitness through seed dispersal.

In order to cover massive crops of some individual plants or fruiting of uncommon and rare species, we watched seven plant species (*Chamissoa altissima* - Amaranthaceae, *Dendropanax cuneatum*- Araliaceae, *Protium heptaphylum* - Burseraceae, *Cabralea canjerana* and *Trichilia clauseni*- Meliaceae, *Ixora venulosa*- Rubiaceae, and *Trema micrantha* - Ulmaceae) during observation sessions conducted between 06:00 and 13:00 totalling 36 h of observation (table 1). During each observation session, that lasted from 15 to 110 min, we recorded the identity of bird species visiting the plants and the number of visits made by them. Observations were made from an unobstructed viewing point aproximately 8-15 m from the focal plant. *Trichilia clauseni* is the most abundant tree occurring in the forest interior, while *T. micrantha* is one of the most common species of the forest edges. *Chamissoa altissima* is one of the few fleshy-fruited species to produce fruits during the winter period (pers. obs.).

We did not consider Emberizinae in our analysis because they usually feed on weed seeds at the edge of the forest. We also did not consider the two psittacid species occurring at Santa Genebra (*Pionus maximiliani* and *Forpus xanthopterygius*) because they usually act as seed predators instead of seed dispersers (Galetti and Rodrigues 1992). Bird nomenclature used here follows Ridgely and Tudor (1989, 1994). Plant taxonomy follows Cronquist (1981).

RESULTS

We recorded 399 feeding bouts of 29 bird species (9 families) eating 36 plant species (26 families) along the transects at Santa Genebra (table 2). The diaspores of these plants varied from 1.9 to 15.0 mm in diameter. However, plants with small diaspores (diameter < 10 mm) predominated in our sample (75%; 27 out of 36 plant species), including *T. micrantha*, *C. altissima*, *C. pachystachia*, and *P. glabrata*, consumed by the largest bird assemblages (table 2). The group of plants with small diaspores included very common species (*T. micrantha* and *C. pachystachia*), rare species (*P. glabrata* with only two individuals in our transect), and also species with prolonged fruiting seasons (*T. micrantha* fruits from October to June, and *C. pachystachia* from October to April), and those that bear mature fruits during a relatively short period (*C. altissima* fruits in June and July, and *P. glabrata* in November and December). Plants with large diaspores

Table 1. Number of visits made by birds recorded during focal observations on fruiting plants at Santa Genebra Reserve, southeastern Brazil. Plant families and species are arranged in alphabetical order.

Plant species	Observation time (h)	No. plants observed	Bird species[a] (migrating species indicated by an asterisk)																		Total number of visits
			1	2	3*	4*	5*	6*	7	8	9	10	11	12	13	14*	15	16	17	18	
AMARANTHACEAE																					
Chamissoa altissima	1,7	1	3	1														1	5		10
ARALIACEAE																					
Dendropanax cuneatum	1,7	1		2							1									3	6
BURSERACEAE																					
Protium heptaphyllum	2,5	1	1	6								2						1		6	16
MELIACEAE																					
Cabralea canjerana	14,5	1	4	1	2	1	1	12	9	1			8			11	1				51
Trichilia clauseni	3,6	2	2												1	10		3	1	2	19
RUBIACEAE																					
Ixora venulosa	1,7	1	2	3										1						1	7
ULMACEAE																					
Trema micrantha	10,3	5	14	13												2		7		5	41
Total	36,0	12	26	26	2	1	1	12	9	1	1	2	8	1	1	23	1	12	6	17	150

[a] - 1. *Chiroxiphia caudata*, 2. *Manacus manacus*, 3. *Tyrannus savanna*, 4. *T. melancholicus*, 5. *Empidonomus varius*, 6. *Myiodynastes maculatus*, 7. *Pitangus sulphuratus*, 8. *Myiarchus ferox*, 9. *Myiophobus fasciatus*, 10. *Turdus rufiventris*, 11. *T. leucomelas*, 12. *T. amaurochalinus*, 13. *Cyclarhis gujanensis*, 14. *Vireo olivaceus*, 15. *Dacnis cayana*, 16. *Tachyphonus coronatus*, 17. *Trichothraupis melanops*, 18. *Saltator similis*.

(diameter ≥ 10 mm; e.g., *Pereskia aculeata, Copaifera langsdorffii, Ocotea* spp.) invariably were consumed by a small bird assemblage (one to five species).

The number of bird species observed eating the fruits of a given plant species in the transect varied from one to 16. The birds most commonly observed eating fruits were *Tachyphonus coronatus* (61 feeding bouts, 14 fruit species), *Chiroxiphia caudata* (44, 18), *Trichothraupis melanops* (38, 9), *Vireo olivaceus* (38, 6), *Manacus manacus* (32, 15), and *Saltator similis* (32, 10). These six species combined were responsible for 61.4% of the feeding bouts recorded. Large frugivores such as *Ramphastos toco* and *Penelope superciliaris* were rarely observed (two feeding bouts each) (table 2). A total of 150 visits were recorded during direct observations to fruiting plants, and the most frequent visiting birds recorded were also the six species previously mentioned (73% of the visits recorded) (table 1). A considerable proportion of the feeding bouts (16.2%, N = 399), and visits (26.0%, N = 150) recorded respectively during transects and focal observations were made by migrant bird species.

DISCUSSION

Second-growth habitats in tropical areas generally have a great abundance of fleshy fruits (Martin 1985, Martin and Karr 1986, Levey 1988), mainly due to the presence of colonizing plant species whose small-seeded fruits attract a great variety of small passerines (Wheelwright *et al.* 1984). Not surprisingly the plant species that attracted the larger number of bird species at Santa Genebra were either colonizer species (e.g., *T. micrantha* and *C. pachystachia*) or species typical of old-secondary forests (e.g., *C. canjerana*). These species present some features which might have contributed to their attractiveness to birds. *Trema micrantha* and *C. pachystachia* are both abundant species with prolonged fruiting seasons which gave the plants the opportunity to be exploited by resident, migrant, as well as vagrant (i.e., those species that occurr irregularly at Santa Genebra; see Aleixo and Vielliard 1995) bird species. *Chamissoa altissima* is one of the few species to bear fleshy fruits during the dry season, a period of general fleshy fruit scarcity at Santa Genebra (Morellato 1991). *Cabralea canjerana* and *P. glabrata* produce seeds covered with lipid-rich arils that are in general highly prefered by birds (Stiles 1993, Pizo 1994).

Summing data from transects and focal observations, we recorded 32 bird species eating fruits at Santa Genebra, which represent 24% of the 133 bird species recently recorded in the reserve (Aleixo and Vielliard 1995). However, only six species (see above) were in conjunction responsible for the most part of the feeding bouts and visits recorded. As number of visits made by a particular bird species to fruiting plants is often positively correlated with the number of seeds dispersed (Schupp 1993), we can thus assert that the above species performed much of the potential seed dispersal events recorded during this study. These species are among the most abundant at Santa Genebra (Aleixo and Vielliard 1995), and thrive in a variety of disturbed forests in southeastern Brazil (Willis 1979, Willis and Oniki 1981). Furthermore, these species are relatively narrow gaped ones (the most robust of them - *Saltator similis* - has a mean gape width of 11.4 mm, N = 10), which should set limits to the fruit diameter they can swallow whole (Wheelwright 1985). Possibly as a consequence, plant species with large diaspores (diameter ≥ 10 mm) invariably had a small feeding assemblage (one to five bird species). Particularly instructive is the case of the "Copaíba" (*Copaifera langsdorffii* - Caesalpiniaceae, mean diameter of the diaspores 10 mm, N = 10) which have a typical ornithochoric fruit with the conspicuous yellow aril contrasting with the black seed. In a large non-fragmented forest and in cerrado vegetation in southeastern Brazil their fruits are eaten by a large bird assemblage (Motta and Lombardi 1990, pers. obs.). At Santa Genebra, however, we recorded only two bird species eating the fruits of *C. langsdorffii* along transects. Additionally, Pedroni (1993) observed only seven bird species doing so during 87 h of direct observation on five *C. langsdorffii* trees. Of these seven species, only three (*Ramphastos toco, Pitangus sulphuratus*, and *Turdus rufiventris*) were able to swallow the diaspores whole and thus could be regarded as potential seed dispersers. The other species are either seed predators (*Pionus maximiliani*), or seed "wasters", i.e., ate only the aril discarding the seeds beneath parent trees (*Tyrannus melancholicus, Dacnis cayana and Thraupis sayaca*). Paradoxically, the most efficient seed disperser of *C. langsdorffii* seeds at Santa Genebra seems to be the howler monkey (*Alouatta fusca*) (Pedroni 1993, Galetti *et al.* 1994).

Howe (1984) suggested that plants with large seeds dispersed by large birds (e.g., toucans, guans, cotingas) are the first to loose their seed dispersers in depauperate habitats, and consequently become more vulnerable to extinction. The above example of *C. langsdorffii* may be illustrative of this process, but future studies are needed to monitor the long-term consequences of a reduced seed-disperser assemblage to the population structure of *C. langsdorffii* (see Keeler-Wolf 1988).

Second-growth habitats in the neotropics are important to house migrant birds during migration and often have a great abundance of these birds (Leck 1972, see papers included in Hagan and Johnston 1992). At Santa Genebra migrant species represent 14% of the avifauna (Aleixo and Vielliard 1995). Most of them are summer migrants that stay in the reserve from September to March. Their presence coincides with the fruit maturation period of most flesh-fruited species occurring at Santa Genebra (Morellato 1991). Thus, the frequent record of migrant birds eating fruits was not entirely surprisingly. Although migrant birds are opportunist frugivores (Poulin and Lefebvre 1996), they can also play an important role as seed dispersers as well (Howe and de Steven 1979, Blake and Loiselle 1992). *Vireo olivaceus*, for example, arrives at the studied area in

Table 2. Number of feeding bouts involving birds and fruits recorded at Santa Genebra Reserve, southeastern Brazil. Plant families and species are arranged in alphabetical order.

Plant species	Bird species[a] (migrating species indicated by an asterisk)																													Total number of bird species
	1	2	3*	4	5	6*	7*	8*	9*	10	11	12	13	14	15*	16	17*	18	19	20	21*	22	23	24	25	26	27	28	29	
AMARANTHACEAE																														
Chamissoa altissima				2	2							2							1	1		2	1		1	5	11		2	11
ANNONACEAE																														
Xylopia brasiliensis								1		1																				2
ARALIACEAE																														
Dendropanax cuneatum				2	5						4			1			4												8	6
BORAGINACEAE																														
Cordia sp.																										1				1
BURSERACEAE																														
Protium heptaphyllum				3																										1
CACTACEAE																														
Pereskia aculeata				1																						1			1	3
Rhipsalis sp.																										1				1
CAESALPINIACEAE																														
Copaifera langsdorffii		1											1																	2
CECROPIACEAE																														
Cecropia pachystachia				1	2					1		1		1				2	3				5	2		16	2			11
CELASTRACEAE																														
Maytenus aquifolium					2																									1
CUCURBITACEAE																														
Momordica charantia																								1	1	1			1	4
EUPHORBIACEAE																														
Pera glabrata				1	2	1					1						3		3				1			7	1		2	10

Table 2. (continued)

Plant species	Bird species[a] (migrating species indicated by an asterisk)																													Total number of bird species
	1	2	3*	4	5	6*	7*	8*	9*	10	11	12	13	14	15*	16	17*	18	19	20	21*	22	23	24	25	26	27	28	29	
LAURACEAE																														
Ocotea corimbosa	2							1		2																	1			4
Ocotea cf. *macropoda*				4	2					1					1												1			5
Ocotea sp.		1	1	1					1																					4
Persia cf. *major*								2		1																				2
MAGNOLIACEAE																														
Talauma ovata					1			1		3		6			1				2					2						7
MELASTOMATACEAE																														
Miconia elegans				2																			1							2
Miconia discolor				5																										1
Miconia sp.					2																									1
MELIACEAE																														
Cabralea canjerana				1				2	4	6							8		3											6
Trichilia clauseni				1												3	7								1	3	2	3	2	8
MORACEAE																														
Chlorophora tinctoria																							1							1
Ficus luschnatiana				1																										1
MYRTACEAE																														
Gomidesia affinis				6	1							6							1							1				5
PIPERACEAE																														
Piper sp.																											1			1
ROSACEAE																														
Rubus sp.				1	1																					1				3
RUBIACEAE																														
Palicourea sp.				1	1																									2

Table 2. (continued)

Plant species	Bird species[a] (migrating species indicated by an asterisk)																													Total number of bird species
	1	2	3*	4	5	6*	7*	8*	9*	10	11	12	13	14	15*	16	17*	18	19	20	21*	22	23	24	25	26	27	28	29	
RUTACEAE																														
Zanthoxylum hyemale																1	9		5			1						1		5
SAPINDACEAE																														
Paullinia rhomboidea					1																									1
Paullinia sp.								1	1																					2
SOLANACEAE																														
Cestrum sp.																		1								1			2	3
ULMACEAE																														
Trema micrantha				5	5		2	1	1			2					7		6			2	3	1	1	10	12	2	12	16
URTICACEAE																														
Urera baccifera					4													1			1			2	6	12	7			7
VERBENACEAE																														
Citharexylum mirianthum				6	1				4					8										1					1	6
Lantana sp.																										1				1
Total	2	2	1	44	32	1	2	9	11	15	5	17	1	10	2	4	38	4	24	1	1	5	12	9	10	61	38	6	31	

[a] 1. *Penelope superciliaris*, 2. *Ramphastos toco*, 3. *Tityra cayana*, 4. *Chiroxiphia caudata*, 5. *Manacus manacus*, 6. *Sirystes sibilator*, 7. *Tyrannus savanna*, 8. *T. melancholicus*, 9. *Myiodynastes maculatus*, 10. *Pitangus sulphuratus*, 11. *Myiophobus fasciatus*, 12. *Elaenia flavogaster*, 13. *Cyanocorax cristatellus*, 14. *Turdus rufiventris*, 15. *T. amaurochalinus*, 16. *Cyclarhis gujanensis*, 17. *Vireo olivaceus*, 18. *Coereba flaveola*, 19. *Dacnis cayana*, 20. *Conirostrum speciosum*, 21. *Pipraeidea melanonota*, 22. *Tangara cayana*, 23. *Thraupis sayaca*, 24. *Ramphocelus carbo*, 25. *Habia rubica*, 26. *Tachyphonus coronatus*, 27. *Trichothraupis melanops*, 28. *Thlypopsis sordida*, 29. *Saltator similis*.

September, then becoming one of the most abundant bird species there. This species is among the most frequent fruit-eating birds recorded during this study, and is the most important seed disperser of *C. canjerana* at Santa Genebra (Pizo in press).

Populations of migrant birds may be influenced by climatic and habitat changes occurring along their migratory routes which can affect the number of birds arriving at a given stopover site (Martin and Karr 1986, Hagan and Johnston 1992). Variation in the population of migrant birds in turn is likely to alter the number of seeds these birds can disperse (Malmborg and Willson 1988). Thus, a special attention should be paid to migrant birds at Santa Genebra, not only due to their general importance as seed dispersers but also due to the possible impact that interannual variation in their populations can have on seed dispersal spectra of plants.

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Nestling development, size and juvenile survival in *Donacobius atricapillus* (Passeriformes: Troglodytidae)

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RESUMO. Desenvolvimento dos ninhegos e sobrevivência dos jovens em *Donacobius atricapillus* (Passeriformes: Troglodytidae). *Donacobius atricapillus* caracteriza-se por apresentar reprodução cooperativa, viver e nidificar em brejos. Neste estudo avaliei o desenvolvimento dos ninhegos de *D. atricapillus*, e o impacto da massa corporal, 15 dias após a eclosão dos ovos, na sobrevivência pós-ninho. A massa dos ninhegos no dia 15 variou de 20,0 a 32,0 g ($\bar{x} \pm$ dp; 26,7 ± 2,7 g; N = 82). As ninhadas foram constituidas por 2 ou 3 ninhegos, atendidos por 2 ou 3 adultos. A eclosão foi menos assincrônica em ninhadas com 2 ninhegos, cuja massa média no dia 15 foi de 27,5 ± 3,1 g (N = 34). Nas ninhadas maiores, mais assincrônicas, a massa média foi significativamente menor (26,2 ± 5,4 g; N = 48; ANOVA, duas variáveis de classificação, F = 3,71; p < 0,05). O número de adultos atendendo os ninhos não apresentou relação com a massa dos ninhegos. No entanto, ninhos atendidos por 3 adultos foram mais produtivos (χ^2 = 12,11; p < 0,05). Do conjunto de ninhegos (N = 72) que deixaram os ninhos, verifiquei que a massa no dia 15 correlacionou-se significativamente com a sobrevivência pós-ninho (coeficiente de correlação de Spearman, r = 0,90; p < 0,05; N = 5). Com o propósito de minimizar o efeito do número de adultos sobre a sobrevivência, a massa dos ninhegos foi avaliada em relação à dos demais parceiros de ninho. Com isto, verifiquei que apenas 4 de 17 jovens apresentavam, quando ninhegos, massa inferior à dos irmãos (χ^2 = 4,76; p < 0,05). Estes resultados reafirmam as baixas chances de sobrevivência dos ninhegos menores. Além disso, os resultados indicam que a presença de auxiliares aumentam as chances de sobrevivência pós-ninho.

PALAVRAS-CHAVE: aves, *Donacobius atricapillus*, ninhegos, reprodução cooperativa, sobrevivência juvenil, tamanho das ninhadas.

ABSTRACT. *Donacobius atricapillus* is a cooperatively breeding marsh-living bird. I examined nestling development and the impact of nestling size on juvenile survival. Nestling mass at day 15 ranged from 20.0 to 32.0 g ($\bar{x} \pm$ sd; 26.7 ± 2.7 g; N = 82). In nests, 2 or 3 nestlings developed, reared by 2 or 3 adults. Hatching was less asynchronous in broods of 2 nestlings, which achieved a higher mean mass (27.5 ± 3.1 g, N = 34) at day 15, in relation to nestlings in broods of 3 (26.2 ± 5.4 g, N = 48, two-way ANOVA, F = 3.71, p < 0.05). The number of adults attending had no effect on nestling mass. However, nests attended by 3 adults were more productive (χ^2 = 12.11; p < 0.05), as a result of better survival during the month after fledging. Nestling mass Day 15 (N = 72) were significatively correlated with juvenile survival 30 days after fledging (Spearman's rank correlation coefficient, r = 0.90, p < 0.05, N = 5). For the purpose of removing the effect of adult number on juvenile survival, a within-brood analysis was employed. Only 4 of 17 surviving juveniles were lighter than their nest mates (χ^2 = 4.76; p < 0.05). As in other studies, small nestling survive less well, whereas presence of a helper seems to aid post-fledging survival.

KEY WORDS: brood size, cooperative breeding, *Donacobius atricapillus*, juvenile survival, nestlings, nestling mass.

Nestling growth may be affected by such factors as environmental conditions, parental experience, territory quality, brood size and hatching synchrony (for a review, see Ricklefs 1983). The effect of nestling size on juvenile survival up to acquisition of nutritional independence has been the subject of some studies (Martin 1987), partly because of the difficulties of monitoring broods after fledging (but see Sullivan 1989, Magrath 1991).

The Black-Capped Donacobius (*Donacobius atricapillus*) is a territorial, marsh-living species with cooperative breeding. Young stay in the natal territory with parents at least until the next breeding season (Kiltie and Fitzpatrick 1983). In cooperatively breeding birds, survival of young may result from better feeding or from protection by several adults (reviewed in Brown 1987, Stacey and Koenig 1990). If the masses of nestlings that

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survive are compared to the average mass of nest mates, the effect of adult number in rearing can be minimized (Mumme 1992). In this way, it is possible to evaluate more precisely the consequences of nestling size on young survival. In this study, I examined nestling development and juvenile survival in *D. atricapillus* in relation to brood size, and number of attending adults.

STUDY SITE AND METHODS

Field studies were conducted near Cerquilho (São Paulo State), in marshes (length 5.6 Km, 40-200 m in wide) on two ranches, Mato Dentro (23°11'S, 47°41' W, altitude 508 m) and São Pedro (23°13'S, 47°45' W, altitude 532 m). Grasses and *Typha* sp. are the dominant vegetation. In the breeding seasons of 1989-1990 and 1990-1991, I studied breeding biology in *D. atricapillus*. Nest building starts with heavy rainfall in October. I visited each site at least every 3 days, to find nests and study nestling development. Observations lasted from 06:00 to 10:00, when the chances of visual contact with birds were maximal. Nests found before the first egg were revisited 17-18 days after the last egg was laid [incubation and nestling phases are 16-18 days each: Kiltie and Fitzpatrick (1983)]. Nests found with eggs were visited every two days up to hatching. The masses of nestlings were taken daily, between 12:00 and 14:00. I used a 50-g Pesola spring balance for measurements, which extended up to Day 15 (hatching = Day 0). At this time a plateau in nestling mass was evident (see results), so nestling mass on Day 15 was used for analysis of relationships between nestling size and juvenile survival. Adults strongly defended nests while I handled nestlings, coming within 1 m. Using this response, I determined the exact number of adults at a given nest. For initial identification, nestlings were marked with non-toxic paint. From Day 10, a pair of color rings enabled recognition. To confirm successfull fledging, nests were visited again on Day 17.

Juveniles feed themselves 30 days after leaving the nest. At this time, I visited study sites daily between 06:00 and 10:00 to check juvenile survival.

Statistical procedures follow Sokal and Rohlf (1981), and Zar (1984).

RESULTS

In the two breeding seasons, I found 74 nests in which two or three eggs were laid. I evaluated the possibility of correlation between clutch size and adult number at the nest. From 53 nests found before the first egg (this sample was used to avoid bias caused by the possibility of partial nest predation and/or egg removal), I verified that the proportion of 3-egg clutches was almost the same for nests attended by two (22 of 36 nests) or three adults (11 of 17).

In 33 nests, 82 nestlings were measured from hatching to Day 15. In the two following days 10 nestlings were lost, two by drowning below the nest. Eight (in three broods) were depredated, judging by feathers left in the nest. Broods had two or three nestlings (N = 17 and N = 16, respectively), with 10 broods of two nestlings attended by two adults, and seven by three adults; 13 broods of three nestlings were attended by two adults, and three broods by three adults.

Nestling mass at day 15 ranged from 20.0 to 32.0 g, with average ($\bar{x} \pm$ sd) mass 26.7 ± 2.7 g. A two-way ANOVA was employed to evaluate the effects of brood size and adult number attending nests, over nestling mass at Day 15. Adult number had no effect (F = 0.057, n.s.). On the other hand, brood size had a significant effect on nestling mass (mean mass 27.5 ± 3.1 g in broods of 2 and 26.2 ± 5.4 g in broods of 3, F = 3.71, $p < 0.05$, figure 1). Figure 2 illustrates nestling growth curves in the two kinds of broods. Nestlings were larger in broods of two by about day three.

Hatching was more asynchronous in the 3-egg clutches, where the time span between hatching of the first and third egg reached 30 h. In these broods a nestling mass hierarchy was evident in every nestling growth phase (for nestling mass Day 15, first-hatched nestling = 28.0 ± 1.9g and last-hatched nestling = 25.0 ± 2.3 g, ANOVA, F = 4.80; $p < 0.05$). In smaller broods, nestlings did not show significant differences in mass (first-hatched nestling = 27.7 ± 3.0 g; last-hatched nestling = 27.1 ± 3,3 g, paired t test, t = 0.51, n.s.; one tail, figure 3).

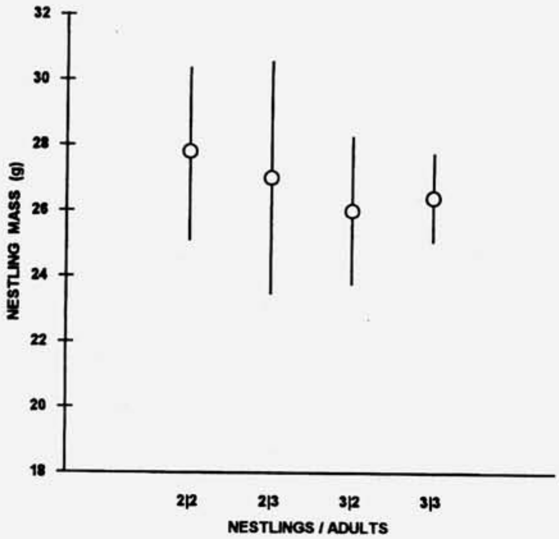

Figure 1. Nestling mass Day 15 after hatching in the four growth situations. Open circles are the mean, vertical lines standard deviation. 2/2- two nestlings (N = 20) attended by two adults; 2/3- two nestlings (N = 14) attended by three adults; 3/2- three nestlings (N = 39) attended by two adults; 3/3- three nestlings (N = 9) attended by three adults.

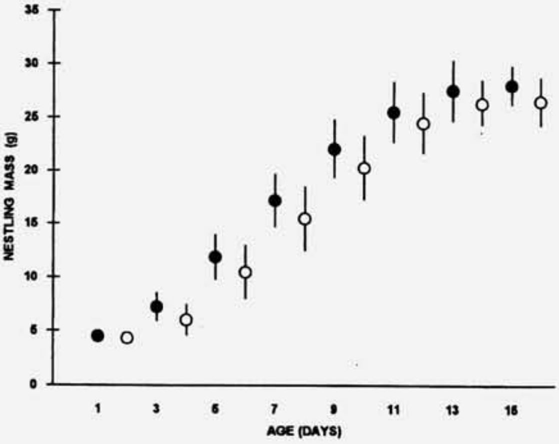

Figure 2. Nestling growth curves in broods of different sizes. Full circles, means for nestlings (N = 34) in broods of 2. Open circles for nestlings (N = 48) in broods of 3. Standard deviations on both sides of mean are also given.

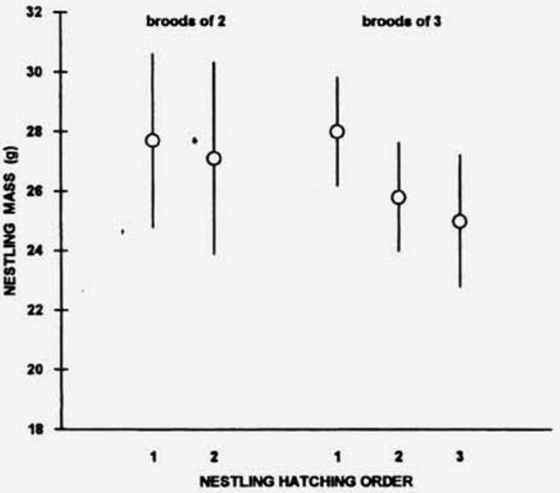

Figure 3. Nestling mass Day 15, following hatching order in broods of 2 and 3 nestlings (N = 34 and N = 48, respectively). Symbols as in figure 1.

A total of 72 nestlings left nests successfully. After fledging, 42 young disappeared before independence. Nestling mass Day 15 were assigned in five classes and checked for the percent of juveniles surviving 30 days after fledging. Thus, I found a significant correlation (Spearman's rank correlation coefficient, $r_s = 0.9$, $p < 0.05$, figure 4). This analysis is a first evidence of the relationship between size as nestling and juvenile survival. However, other factors might influence survival independently of the mass as nestling.

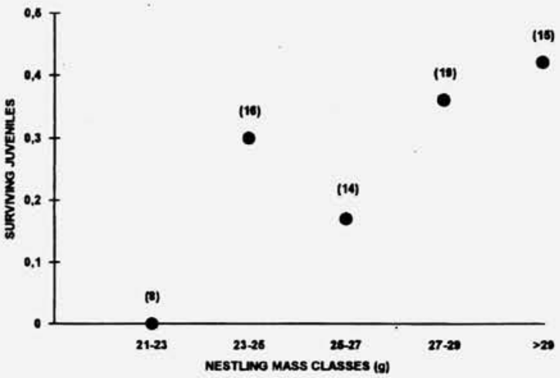

Figure 4. Correlation between nestlings mass Day 15 (in classes) and percent of surviving juveniles 30 days after fledging. In brackets the number of nestlings in each class.

Predation rates on nests attended by 2 or 3 adults, as well in broods of 2 or 3 nestlings, were not significantly different (Ragusa-Netto 1994). However, to check if some social factor may have influenced juvenile success, these data were analysed by a 3-way χ^2 (table 1). Juvenile survival was correlated with social factors ($\chi^2 = 10.08$, $p < 0.05$). Brood size was not correlated with juvenile survival ($\chi^2 = 7.26$, $p > 0.10$). Adult number had a significant correlation ($\chi^2 = 12.11$, $p < 0.05$). Because adult number had no effect on nestling mass, some other variable (probably better protection of fledglings when there were three adults in the group) influenced young productivity.

To analyze the influence of nestling mass on juvenile survival independently of the effect of adult number, a within-brood analysis was performed (Mumme 1992). In

Table 1. Surviving juveniles in relation to brood size and number of attending adults.

Brood	Number of attending adults			
	2		3	
size	surviving	disappeared	surviving	disappeared
2	4	12	6	3
3	13	24	7	3

some broods all fledglings (N = 13) survived to independence. These juveniles were excluded from the analysis. I found only four surviving juveniles whose nestling masses were lower. Thus, 13 of 17 survivors had larger masses as nestlings than their nest-mates ($\chi^2 = 4.76$, $p < 0.05$).

DISCUSSION

Nestling mass was related to brood size. Larger broods, more asynchronous, produced on average smaller nestlings. Whatever the selective pressuresthat mantain asynchronous hatching in *D. atricapillus*, one effect was that nestlings were sorted into a hierarchy of size. This probably resulted from more intense food competition (Stouffer and Power 1991). Martin (1987) reviewing this theme, reported studies of natural changes in brood size that have influenced nestling mass. In most cases the larger broods have produced small nestlings. In manipulated broods, (Patterson *et al.* 1980, Nur 1984, Husby 1986, Slagsvold 1986, Stouffer and Power 1991), the smaller broods produced nestlings with higher masses. Crossner (1977) manipulated broods of *Sturnus vulgaris* and food availability in some territories. The enlarged broods in territories with low food availability produced smaller nestlings.

Many studies indicate positive relationships between nestling size and post-fledging survival (Perrins 1965, Perrins *et al.* 1973, Jarvis 1974, Loman 1977, Garnett 1981, Drent 1984, Coulson and Porter 1985, Davies 1986, Gustafsson and Sutherland 1988, Smith*et al.* 1989, Magrath 1991, Mumme 1992). However, these relationships were tested for a small number of species (review by Magrath 1991). The results for *D. atricapillus* are similar to the above-cited results, even thogh *D. atricapillus* differs by being a cooperatively breeding tropical species.

An analysis of survival chances for juveniles, relative to nestlings mass, is necessary before checking other variables that affect juvenile success. Rabenold (1984) found that larger groups of *Campylorhynchus nuchalis* are six times more productive than the small ones. Austad and Rabenold (1985) verified in *Campylorhynchus griseus* a less dramatic difference, although significant, in which breeding pairs plus a helper are three times more productive than unassisted pairs. In these studies, adult numbers attending nests were unrelated to amount of food delivered to nestlings. Instead, large groups provided better protection at nests. Kiltie and Fitzpatrick (1983) verified in *D. atricapillus* a greater production of young when a breeding pair was assisted by helpers. Mumme (1992)experimentally verified higher reproductive success in groups of *Aphelocoma coerulescens* linked to helper presence and activity. Larger groups of these species are correlated with both higher nestling food delivery and to better protection. He also found higher survival by larger nestlings after leaving the nests.

The reasons that larger nestlings are more likely to survive to independence are unclear. As pointed by Magrath (1991) and Mumme (1992), it may be that well-fed and well-developed young acquire critical motor skills more rapidly than poorly-fed and poorly-developed young. Thus, the amount of time in which fledglings are vulnerable to predators is reduced. Well-fed young may beg less frequently and attract fewer predators than undernourished young. Other possibilities are that large young may be better able to survive brief periods of post-fledging food shortage.

All of these hypotheses may be applied to *D. atricapillus*. Their nests are placed in marshes that are flooded in the rainy season, exposing fledglings to the risk of drowning. In addition, predation on nests and fledglings can be severe in the tropics (see reviews, Ricklefs 1969, Skutch 1985). The majority of *D. atricapillus* nests were lost to predation (Ragusa-Netto 1994), making clear the effect of this factor in early phases of development. In this way, well-fed and well-developed young may display skills that enable them to adopt behaviors less risky to predator actions and other environmental threats. Also, an extra adult helping the pair may incrase vigilance for fledglings reducing the risk of predation.

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Feeding ecology of two *Cacicus* species (Emberizidae, Icterinae)

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RESUMO. **Ecologia alimentar de duas espécies de *Cacicus* (Emberizidae, Icterinae).** Estudei a dieta de *Cacicus haemorrhous* e *C. chrysopterus* ao longo de um ano em uma reserva de Mata Atlântica no sudeste do Brasil. A variação na composição da dieta em função da época do ano e da associação em bandos monoespecíficos ou em bandos mistos de aves foi analisada. Embora ambas as espécies sejam omnívoras, pois alimentaram-se de artrópodes, frutos e néctar, *C. haemorrhous* mostrou-se mais frugívora, alimentando-se de frutos especialmente na época chuvosa (verão) quando há uma maior abundância de frutos carnosos na área de estudo. *Cacicus chrysopterus* alimentou-se predominantemente de artrópodes, tanto na época seca quanto na chuvosa. *Cacicus chrysopterus* associou-se mais frequentemente a bandos mistos que sua congênere e, nesta situação, alimentou-se principalmente de artrópodes. A utilização de frutos por *C. chrysopterus* ocorreu apenas quando indivíduos alimentavam-se solitariamente ou em grupos monoespecíficos, o que pode ser explicado pela tendência em explorar o mesmo tipo de alimento procurado pela maioria dos participantes dos bandos mistos (predominantemente insetívoros na área de estudo), e a incompatibilidade entre a exploração de frutos e o acompanhamento de tais bandos.

PALAVRAS-CHAVE: Bandos mistos de aves, *Cacicus*, dieta, ecologia alimentar, frugivoria, Mata Atlântica.

ABSTRACT. A one-year study focusing on the diet and flocking behavior of *Cacicus haemorrhous* and *C. chrysopterus* was conducted in an Atlantic forest reserve in southeastern Brazil. I was especially interested in the influence of season and association with monospecific or mixed-species flocks on the diet of both *Cacicus* species. Although both species included arthropods, fruits, and nectar in their diets, *C. haemorrhous* relied more heavily upon fruits than its congener, especially during the rainy season, a period of general fruit abundance in the study area. *Cacicus chrysopterus* participated more often in mixed-species flocks than *C. haemorrhous.* When in mixed-species flocks, *C. chrysopterus* ate mainly arthropods, while fruits were exploited only by solitary individuals or those associated with monospecific flocks. The differential utilization of food resources by *C. chrysopterus* as a function of flock composition may be viewed as the outcome of the tendency of caciques to explore the same food resource exploited by most mixed-species flock participants (mainly insectivorous bird species in the study area). The incompatibility between the relatively time-consuming exploitation of fruits and the rapid movements of mixed-species flocks through the forest may also play a role.

KEY WORDS: Atlantic forest, *Cacicus*, diet, feeding ecology, flocking, frugivory, mixed-species flocks.

Diet studies are crucial to the comprehension of the ecology and behavior of a bird species (Wiens 1992), as well as to complement community studies (Remsen *et al.* 1993). The diet of a bird species, however, frequently present considerable flexibility, varying not only temporally and spatially in response to the availability of food resources (Wiens 1992), but also according to flock composition in response to social interactions (Valburg 1992).

I studied the diet of the Red-rumped (*Cacicus haemorrhous*) and Golden-winged (*C. chrysopterus*) Caciques in an Atlantic forest reserve in southeastern Brazil. Orians (1985) classified *C. haemorrohous* as an omnivorous species, and *C. chrysopterus* as an insectivorous one. However, the diet of both species in nature is poorly known, and the few reports cite arthropods, fruits and probably nectar (Belton 1985, Sick 1985, Ridgely and Tudor 1989). Both species follow mixed-species flocks (Machado 1991). I was especially interested in: (a) examine the seasonal variation in the diet composition of the two species, and (b) determine the influence of association with mixed-species flocks on food selection by these species.

STUDY SITES AND THE *CACICUS* SPECIES

The study was carried out in two sites located in the Parque Estadual Intervales (hereafter PEI) (24°16'S, 48°25'W), a 49,000 ha reserve located at the Serra de Paranapiacaba mountains of São Paulo State, southeastern Brazil. The study sites, Sede and Carmo, were 9 km from each other and located at an altitude of 850 and 700 m, respectively. At both sites the vegetation consists primarily of old-secondary forest (in the sense of Clark 1996) with trees reaching up 30 m tall, and a great abundance of bamboo tickets (particularly *Guadua angustifolia*, *Chusquea* spp., and *Merostachis* spp.). Extensive forested areas surround the study sites. Climate is generally wet, with rain or fog occurring frequently. Annual precipitation is around 1,600 mm, and mean annual temperature for the study period was 17.6°C. There is a dry-cold season from April to August, when temperature often drops below 5°C and frosts may occur, and a wet-hot season from September to March.

Cacicus haemorrhous is larger than *C. chrysopterus* (males weight 39g in *C. haemorrhous,* and 93 g in *C. chrysopterus*; data from Belton 1985), and the sexes of both species are indistinguishable in the field. The distribution of the two species differs markedly along the elevational gradient represented by the study sites at PEI. *Cacicus haemorrhous* was rarely seen at Sede, being much more common at Carmo. *Cacicus chrysopterus*, on the other hand, was more commonly found at Sede, but frequently reached Carmo.

METHODS

The study was conducted from January to December 1993 through monthly visits to the study sites (1-3 days at Sede, 3-8 days at Carmo). Data were collected along several trails and unpaved roads that crossed the study sites totalling approximately 10 km. Sampling was concentrated between 06:00 and 12:00, and between 15:00 and 18:00.

Every time I found a foraging *Cacicus*, I recorded the group size and if the individual(s) was associated with mixed-species flocks or not. The diet of *Cacicus* was quantified by recording only the first foraging maneuver observed for the focal individual (or group).

In an attempt to quantify the availability of fleshy fruits throughout the study, I censused all the fleshy-fruited trees bearing mature fruits along the trails and roads at the study sites each month. Although this method does not provide an estimate of fruit production, it nevertheless reflects the temporal pattern of fleshy fruit availability in the study area (see Blake *et al.* 1990). As the *Cacicus* species under consideration do not (or rarely do) forage in the understory, understory treelets, shrubs, and herbs were not surveyed.

I used Chi-square to test for difference in the association with mixed-species flocks between both species. Due to small sample sizes, G-test was employed to evaluate the effect of season and association with monospecific and mixed-species flocks on the diet of each species, as well as to test for heterogeneity in the number of mature fleshy-fruited plant species along the year. Mann-Whitney U-test with normal approximation was used to compare monospecific flock size between both species. All tests followed Zar (1984).

RESULTS

When in monospecific flocks, *C. chrysopterus* foraged in small groups ($\overline{x} \pm sd = 1.9 \pm 0.8$ individuals, n = 42, range = 1-4), often in pairs (52,4 % of the records). The mean flock size of *C. haemorrhous* (2.0 ± 2.3 individuals, n = 97, range = 1-20) was significantly different from *C. chrysopterus* (U = 1.98, P = 0.04). The former species occurred in a wider range of flock size (figure 1).

I recorded 65 feeding bouts for the *Cacicus* eating arthropods, fruits and also visiting flowers probably in search of nectar (tables 1 and 2). The birds glean for arthropods most often in living foliage, but frequently look

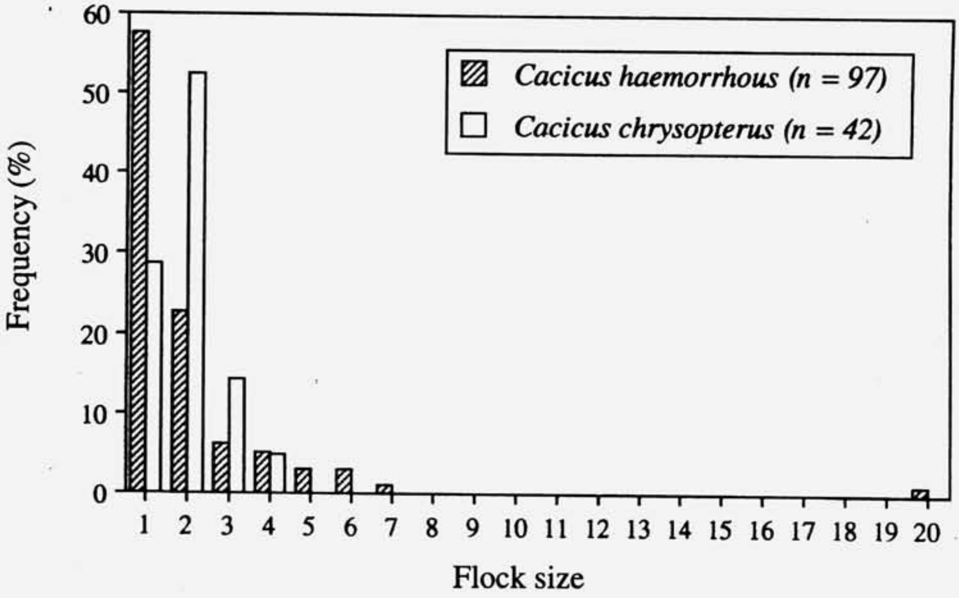

Figure 1. Monospecific flock size distribution of *Cacicus haemorrhous* and *C. chrysopterus* at Parque Estadual Intervales, southeastern Brazil, during 1993.

for them in dead leaves suspended in the vegetation (27.3 % and 18.5 % of the 11 and 27 insectivorous foraging maneuvers recorded for *C. haemorrhous* and *C. chrysopterus*, respectively). Additionaly, *C. chrysopterus* also captured arthopods in the air and in twigs (one capture each), and frequently inspected dry fruits (e.g., *Cassia* sp., Caesalpiniaceae; *Cedrela fissilis*, Meliaceae; *Pithecoctenium* sp., Bignoniaceae; *Tibouchina mutabilis*, Melastomataceae; 25,9 % of its insectivorous foraging maneuvers, n = 27) in search of hiden arthropods. Arilate fruits were frequently eaten by both species (33.3 % of the records on fruits, n = 18), but the infructescences of *Cecropia glaziovii*, heavily exploited by *C. haemorrhous*, were the fruit item most frequently recorded (55.5 %).The flowers visited by the *Cacicus* were either bat- or bird-pollinated ones (table 1).

The *Cacicus* species significantly differed in the proportion of food items eaten. Overall, *C. haemorrhous* ate more fruits than its congener, while *C. chrysopterus* preyed more heavily upon arthropods (table 2).

Effect of season. There was a great number of fleshy-fruited plant species bearing fruits during the wet when compared to the dry season ($G = 20.77$, $P < 0.05$; figure 2).

The diet of *C. haemorrhous* varied in a seasonal basis. Fruits were more often eaten during the wet season, whereas arthropods and nectar predominated in the dry season (table 2). *Cacicus chrysopterus*, on the other hand, did not change the diet throughout the year, and arthropods represented its staple food in both seasons (table 2).

Effect of the association with mixed-species flocks. *Cacicus chrysopterus* was a common species (in the sense of Powell 1985) in the mixed-species flocks recorded at Sede, where the occurrence of *C. haemorrhous* in these associations was rare (14.1 % and 1.4 % of the flocks recorded, respectively, n = 71, $\chi^2 = 7.98$, $P = 0.001$). At Carmo, however, both species occurred in the same frequency in mixed-species flocks (3.2 %, n = 311). Overall, *C. chrysopterus* could be equally encountered either associated with mixed-species flocks or not ($\chi^2 = 0.22$, $P > 0{,}50$), but *C. haemorrhous* was more frequently found solitary or in monospecific flocks ($\chi^2 = 37.45$, $P < 0.001$).

While associated with mixed-species flocks *C. chrysopterus* fed almost exclusively on arthropods (n = 15). This species was never observed eating fruits when accompanying the flocks, and three out of four instances of nectar feeding were observed when the birds were out of these flocks (table 2). The diet of *C. haemorrhous* did not differ with mixed-species flock association (table 2).

DISCUSSION

In his monograph about icterids, Orians (1985) designated *C. haemorrhous* as an omnivorous species, and *C.*

Table 1. Plant species from which *Cacicus* took fruits and nectar at Parque Estadual Intervales, southeastern Brazil. Plant families and species are arranged in alphabetical order.

Plant family/species	Item eaten[a]	Fruit/flower type[b]	*Cacicus* species[c]
BOMBACACEAE			
Pseudobombax sp.	ne	q	Ch
Spirotheca passifloroides	ne	o	Ch
CECROPIACEAE			
Cecropia glaziovii	fr	n	Ch
ELAEOCARPACEAE			
Sloanea monosperma	fr	a	Cc
EUPHORBIACEAE			
Alchornea glandulosa	fr	a	Ch, Cc
Tetrorchidium rubrivenium	fr	a	Cc
MELIACEAE			
Cabralea canjerana	fr	a	Ch, Cc
MIMOSACEAE			
Inga sp.	ne	q	Ch
ONAGRACEAE			
Fuchsia sp.	ne	o	Cc

[a] ne = nectar, fr = fruits.

[b] o = ornitophilous (i.e., bird-pollinated) or q = quiropterophilous (i.e., bat-pollinated) flowers, and a = arilate or n = non-arilate fruits.

[c] Ch = *Cacicus haemorrhous*, Cc = *Cacicus chrysopterus*.

Table 2. Number of records of *Cacicus chrysopterus* and *C. haemorrhous* eating arthropods, fruits and nectar at Parque Estadual Intervales, southeastern Brazil. The effects of season and association with mixed-species flocks on the diet of both species are analyzed.

	C. chrysopterus			*C. haemorrhous*		
	Arthropods	Fruits	Nectar	Arthropods	Fruits	Nectar
Season						
Wet	11	4	2	2	8	0
Dry	16	2	2	9	4	5
G-test	G = 1.36, P > 0.50			G = 10.79, P < 0.005		
Mixed-species flock association						
In	14	0	1	3	5	1
Out	13	6	3	8	7	4
G-test	G = 8.06, P < 0.02			G = 0.97, P > 0.50		
Overall[a]	27	6	4	11	12	5

[a] The overall diet of both species differed: G = 7.85, P < 0.025.

chrysopterus as an insectivorous one. Although they differ in the proportion of food items eaten at PEI, I found both species eating arthropods, fruits, and probably nectar in a regular basis, implying that both can be viewed as omnivorous species. In fact, Ridgely and Tudor (1989) have already noted that *C. chrysopterus* "also comes to flowering trees and eat some fruits". However, *C. haemorrhous* seems to be more frugivorous than its congener which in turn relies more heavily upon arthropods.

I could not identify the arthropods captured by the birds, but Robinson (1986) found mainly lepidopteran larvae, orthopterans, and spiders in the diet of the Yellow-rumped Cacique (*C. cela*). Schubart *et al.* (1965) in addition found alated ants in the stomach of a *C. haemorrhous* specimen. In the present study, the arthropods were captured mainly in living foliage, but birds probe so frequenly into dead leaves that at least *C. haemorrhous* may be regarded as a regular user (in the sense of Remsen and Parker 1984) of this kind of substrate. This foraging habit may not be uncommon in the genus *Cacicus* since other species (e.g., *C. cela* and *C. holosericeus*) have already been observed searching for arthopods in suspended dead

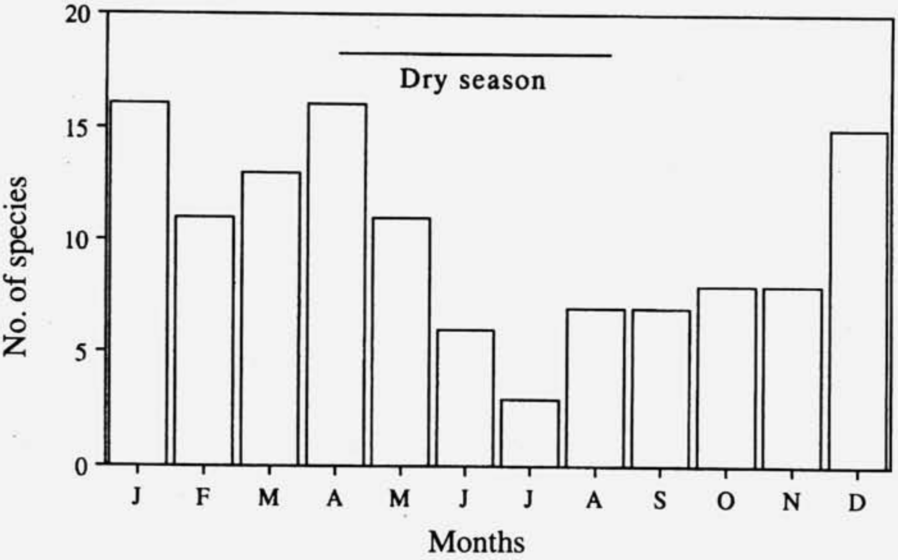

Figure 2. Monthly variation in the number of plant species bearing mature fleshy fruits in the study area during 1993. Plants were sampled along a 10 km-long transect. The horizontal line above the bars indicates the dry season.

leaves (Remsen and Parker 1984, Robinson 1986). Even the less common habit of inspecting dry fruits has also already been observed for *C. cela* (Robinson 1986), although much less frequently than recorded here for *C. chrysopterus*.

I suspect that the birds visited the flowers primarily in search of nectar although, as observed by Skutch (1972) for *C. uropygialis*, arthropod eating is also a possibility. Bat- and bird-pollinated flowers like those recorded here produce copious quantity of nectar (Faegri and Van der Pijl 1971) which may be the cue for the attraction of non-nectarivorous birds (see Sazima *et al.* 1993). In fact, the flowers of*Pseudobombax* sp. and*Spirotheca passifloroides* are visited by birds other than hummingbirds at PEI (pers. obs.). Thus, the supply of nectar may be the crucial feature for the attaction of *Cacicus* species to flowers. For instance, Skutch (1972) observed *C. uropygialis* visiting the bat-pollinated flowers of a *Marcgravia* species (Marcgraviaceae), and Berla (1944) recorded *C. haemorrhous* in the bird-pollinated flowers of an*Erythrina* species (Fabaceae).

Changes in the diet of birds in response to seasonal fluctuations of food resource abundance are common (see examples in Wiens 1992). The decrease in availability of fleshy fruits during the dry season at the study area certainly played a role in the seasonal change of food exploitation by *C. haemorrhous*. Instead of fruits, which predominate in the wet season, arthropods and nectar were favored by *C. haemorrhous* in the dry season. *Cacicus chrysopterus*did not show such a change, which reinforces the label of a predominantely insectivorous species. The frequent association of *C. chrysopterus* with mixed-species flocks, which in the study area are composed primarily by insectivorous species (Machado 1991), probably helps this species to maintain its insectivorous diet even in the dry season when arthropods are likely to be scarce (Janzen 1973, Buskirk and Buskirk 1976, Wolda 1978), but mixed-species flocks are very common (Machado 1991).

The association with mixed-species flocks may direct, in a convergent way, the attention of foraging birds toward the food items sought by most flock participants (Buskirk 1976, Valburg 1992). Valburg (1992) found that the diet of the Common Bush-tanager (*Chlorospingus ophtalmicus*) changed from predominantely frugivorous to chiefly insectivorous whether the birds foraged solitarily and in single-species flocks or associated with predominantely insectivorous mixed-species flocks. *Cacicus chrysopterus* showed the same pattern, eating fruits only when individuals foraged solitarily or in monospecific flocks. When both *Cacicus* species ate fruits, especially large to medium arilate fruits (e.g., *Cabralea canjerana*), they made use of the feet to hold the fruit against a branch and then pick the pulp or aril piecemeal (pers. obs). This is a time-consuming activity, incompatible with the rapid movement of mixed-species flocks, and which probably precludes fruit-eating by *C. chrysopterus* during its participation in mixed-species flocks. *Cacicus haemorrhous*, in contrast, did not change its diet with mixed-species flock association. This species is a rare participant of mixed-species flocks at PEI (Machado 1991, this study), but can occur in large monospecific flocks where birds can forage not only for insects but also for fruits and nectar. In fact, mixed- and single-species flocks may not present the same foraging opportunities (Valburg 1992), since the foraging behavior of birds is likely to differ between these both situations, possibly as a consequence of social interactions occurring most frequently in single-species flocks (Moriarty 1977).

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Ecological correlates of ectoparasitism on Atlantic Forest birds, Brazil

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RESUMO. **Correlações ecológicas de ectoparasitismo em aves da Floresta Atlântica, Brasil.** Populações de espécies nativas podem ser completamente ou parcialmente destruídas por doenças naturais ou transmitidas por animais domésticos. Avaliamos aqui a prevalência de ectoparasitas em aves da região da Serra do Mar da Floresta Atlântica, Paraná, Brasil, procurando por potenciais vetores de doenças, como carrapatos hematófagos (Acari), malófagos (Phthiraptera) e ácaros de penas (Acari: Analgoidea). A prevalência destes ectoparasitas foi analisada em relação a: (1) variáveis ambientais (sazonalidade e altitude); (2) ecologia das aves (participação em bandos mistos, tipo de ninho e guilda de forrageamento, e (3) taxonomia e massa corporal. Examinamos aves durante dois invernos (Julho-Agosto de 1991 e Julho de 1995) e dois verões (Fevereiro de 1992 e 1993) em duas florestas de montanha. Durante os mesmos invernos também examinamos aves em uma floresta baixo-montana. A prevalência de ectoparasitas foi maior durante os invernos do que durante os verões, mas foi geralmente semelhante nas florestas de montanha e de baixada. A prevalência de carrapatos e de malófagos em Passeriformes variou consideravelmente, e independentemente uma da outra, entre as famílias de aves. Dieta foi um fraco preditor da prevalência de carrapatos, entretanto a prevalência de carrapatos para insetívoros de casca de árvores (84.2 %) foi pelo menos duas vezes maior do que de qualquer outra guilda de forrageamento. Participantes regulares de bandos mistos possuiram maiores prevalências de carrapatos (57.8 %) do que participantes irregulares (35.0 %). Nenhuma diferença na prevalência de carrapatos foi detectada entre espécies que fazem ninhos abertos ou fechados. A massa corporal não esteve significativamente correlacionada com intensidade de infestação por carrapatos em quatro espécies de aves testadas. Várias espécies de aves endêmicas da Floresta Atlântica tiveram altas prevalências de ectoparasitas demonstrando um grande potencial de infestação por doenças.

PALAVRAS-CHAVE: bandos mistos, carrapatos, dieta, ectoparasitas, ninho, Floresta Atlântica, Paraná.

ABSTRACT. Wildlife populations may be completely or partially destroyed by naturally borne or diseases transmitted by domestic animals. Here, we evaluate ectoparasite prevalence on birds from the Serra do Mar region of the Atlantic Forest, in the state of Paraná, Brazil. We searched for potential disease vectors, such as hematophagous ectoparasitic ticks (Acari), chewing lice (Phthiraptera) and feather-mites (Analgoidea). The prevalence of these ectoparasites was analyzed in relation to: (1) environmental variables (seasonality and altitude); (2) host ecology (participation in mixed-species flocks, nest type and foraging guild); and (3) host taxonomy and body mass. We examined birds during two winters (July-August 1991 and July 1995) and two summers (February 1992 and 1993) at two mountain forest sites. During the same winters we also examined birds in a lowland forest. Ectoparasite prevalence was higher during winters than during summers but was usually similar in montane and lowland forests. Tick and chewing lice prevalence on Passeriformes varied considerably, independently of each other, among bird families. Diet alone is a poor predictor of tick prevalence, but prevalence on bark insectivores (84.2 %) was at least twice as high as any other foraging guild. Regular mixed-species flock participants had higher tick prevalence (57.8 %) than irregular participants (35.0 %). No difference in tick prevalence was detected between open and closed nesting species. Body mass was not correlated with infestation intensity in the four species tested. Several endemic birds of the Brazilian Atlantic Forest region showed high ectoparasite prevalence with a strong potential for infestation by diseases.

KEY WORDS: Atlantic Forest, diet, ectoparasites, mixed-species flocks, nests, Paraná, ticks.

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The neotropical region is being deforested rapidly before several basic aspects of the ecology of its organisms are documented. With high deforestation rates, there is an increase in contact between domestic and wild organisms potentially exposing all species to new diseases. Snyder *et al.* (1985), for example, reported that the Mauritius Pink Pigeon (*Columba mayeri*) can contract the fatal herpes virus from apparently healthy Domestic Pigeons (*Columba livia*). Among mammals, populations of the Black-footed Ferret (*Mustela nigripes*) (Thorne and Williams 1988) and lions from the Serengeti National Park in Tanzania (Morell 1994) have already been affected by the canine distemper, which can be transmitted by domestic dogs. The lion example shows that organisms living in protected areas are not immune to infections by parasites.

Ectoparasites may decrease birds' reproductive success (review in Lehmann 1993) by increasing mortality rates or decreasing development rates of nestlings (Foster 1968, Moss and Camin 1970, Chapman and George 1991), or increasing nest desertion by parents (Moss and Camin 1970, Feare 1976, Duffy 1983), or decreasing the ability to attract mates (Clayton 1990). A decrease in survival or body condition of adult birds may also occur, causing death by the loss of sight (Thomas 1941, Worth 1942), anemia (Olson 1935), or general condition (Putzig 1939). Besides such direct effects, ectoparasites may serve as disease vectors for birds (Feare 1976, Clifford *et al.* 1980, Bennett *et al.* 1987) or as intermediate hosts for endoparasites (review in Clayton 1990). Several Neotropical passerines, for example, have been found to host blood haemoproteids (Bennett and Borrero 1976, Bennett *et al.* 1987).

Also, parasite infestations have been correlated with several factors, including climatic seasonality, bird body size or mass, foraging behavior, home range size, living group size, and taxonomy (Randolph 1975, Davies *et al.* 1991, Pruett-Jones and Pruett-Jones 1991).

The ectoparasites of Neotropical birds are poorly studied. Guimarães (1945) described ectoparasites of birds and mammals from the lowlands of Paraná, Brazil. Perez and Atyeo (1984) studied feather mites of Mexican parrots, and Berla (1958, 1973) described feather mites of Brazilian birds. A study of chewing lice on birds of the Neotropical region was conducted in Amazonian Peru by Clayton *et al.* (1992). Oniki and Willis (1991, 1993) reported ectoparasites of birds from Colombia and Minas Gerais, Brazil. Within the Atlantic Forest region of Brazil, ectoparasites have been studied mostly on mammals (see references in Linardi *et al.* 1991 and Barros *et al.* 1993), and to a lesser extent on birds (Arzua *et al.* 1994 and references). More studies of the region are needed, especially considering the high levels of bird endemism and deforestation (McNeely *et al.* 1990).

In this paper, our primary objective is to evaluate the potential danger of disease infestation of birds by estimating ectoparasitism levels by hematophagous ectoparasitic ticks (Acari), chewing lice (Insecta: Phthiraptera, formerly Mallophaga), feather-mites (Analgoidea) and hummingbird flower mites (Gamasida) on Atlantic Forest birds.

Previous studies in the Atlantic Forest region (Linardi *et al.* 1991, Barros *et al.* 1993, Arzua *et al.* 1994 and references) lacked comparisons between ectoparasite prevalence and host ecology. Our second objective, thus, is to evaluate which group of birds would be most likely to be infested by correlating tick prevalence with: 1) environmental variables (seasonality and altitude), 2) host ecology (participation in mixed-species flocks, nest type and foraging guild) and 3) host taxonomy. Also, the potential negative effect of tick infestations on bird fitness is evaluated by correlating bird body mass with tick infestation intensity.

METHODS

Study sites. The first study site where we sampled birds is in Mananciais da Serra (25°30'S, 48°57'W), within the "Área Especial de Interesse Turístico do Marumbi," Piraquara county, in Paraná, Brazil. This study site (a dense montane cloud forest), located at ≈ 1,000 m (a.s.l.), lies on the western slope of the 'Serra do Mar' mountain ridge, within a ≈ 70,000 ha mostly contiguous forest (ITCF 1987). Here, we sampled two areas 500 m apart: (1) a patch of primary forest with a continuous 25-m high canopy, open understory, patches of 10-m high bamboo (Poaceae) and high numbers of epiphytes; and (2) a patch of disturbed 15-m high forest dominated by *Tibouchina sellowiana* (Melastomataceae) with canopy broken by emergents, and dense understory dominated by small bamboo (*Chusquea* sp.: Poaceae).

The second study site we sampled is at Banestado Reflorestadora (25°38'S, 48°30'W), Paranaguá county, also in Paraná. It consists of a 488 ha lowland (≈ 50 m a.s.l.) dense forest, with a 15-m high continuous canopy, and open understory managed for palm-heart (*Euterpe edulis*: Arecaceae).

Mist-netting and ectoparasite sampling. Birds were captured with mist-nets (mostly between 07:00 and 14:00) during two summers (February 1992 and 1993), and two winters (July-August 1991 and August 1995) at Mananciais da Serra, and during the same two winters at Banestado Reflorestadora. We used 15 to 17 mist-nets (mesh 36 mm, 2.5 m high x 12 m long) on linear transects within each area. At the montane forest we sampled birds at a small patch of primary forest and at a patch of disturbed forest. During the winter of 1995 we also sampled birds at the montane forest at a third site. This area was 1.5 km away from the others, similar, but more disturbed, than the primary forest site.

Each captured bird received a metal band (provided by CEMAVE/IBAMA, Brazil), was weighed with 50 or 100 g Pesola spring scales and measured. Hematophagous ectoparasitic ticks were sampled quantitatively more intensively on the birds' neck and head by blowing on feathers. We considered as new records ticks on banded birds recaptured at an interval of at least 30 days, because ticks usually do not stay on their hosts for more than two-three weeks

(Pruett-Jones and Pruett-Jones 1991). Tick prevalence (proportion of individuals of a taxon infested) and infestation intensity (mean number of ticks among the individuals of a taxon, including individuals not infested) was calculated for all species and bird families for the winter study periods (Appendix).

Feather-mites were sampled qualitatively by inspecting the birds' head feathers and viewing the wing and tail feathers backlit against the sky. Chewing lice occurred mostly on the neck and head where we concentrated our qualitative samples. Chewing lice and hummingbird flower mites were sampled only during the winter of 1995. Ectoparasites were collected with forceps from the body and feathers of 54 birds of 32 species during 1991 and 1992 and preserved in 70 % alcohol.

Species' diet, nesting behavior, and participation in mixed species flocks followed the literature (Davis 1946, Sick 1985, Ridgely and Tudor 1989) and personal observations by the authors. Bird names follow Sibley and Monroe (1990).

Statistical analyses. The random distribution of ectoparasites on the birds was compared between the variables tested with a contingency test for χ^2 with Yates correction for continuity (χ_Y^2) whith one degree of freedom. The Mantel-Haenszel χ^2 test ($\chi_{M\text{-}H}^2$) was applied in cases when two samples of the same treatment were not homogeneous. We conducted Spearman rank correlations (r_s) between body mass and tick infestation intensity for species with more than 10 records and a high range of ticks per host species.

RESULTS

Non-Passeriformes were rare in our captures (four captures during winter, 10 captures during summer), with the exception of hummingbirds, which had 44 individuals of five species sampled during the winter of 1995. For this reason we analyze Passeriformes and hummingbirds separately, excluding the other species. We sampled a total of 313 individuals of 53 species of Passeriformes during winter, and a total of 184 individuals of 51 species during summer (Appendix).

Ectoparasite identification. Ticks (n = 129) collected on 54 birds during the winter of 1991 showed a high abundance (n = 120) of *Amblyomma* sp. larvae, and one nymph of *Ixodes* sp. Of the eight collected during the summer of 1992, seven were *Ixodes* sp. nymphs and one was an *Amblyomma* sp. larvae. Feather-mites belonged to the super-family Analgoidea (Proctophyllodidae).

Even though we did not search systematically for haematophagous diptera (Hippoboscidae), some occurred sporadically on the birds (White-browed Foliage-gleaner, *Anabacerthia amaurotis*, Buff-browed Foliage-gleaner, *Syndactyla rufosuperciliata,* Rufous-capped Spinetail, *Synallaxis ruficapilla*, Greenish Manakin, *Schiffornis virescens* and Golden-crowned Warbler, *Basileuterus culicivorus* in 1991, Barred Forest-Falcon, *Micrastur ruficollis*, White-shouldered Fire-eye, *Pyriglena leucoptera*, Rufous Gnateater, *Conopohaga lineata,* and *Schiffornis virescens* in 1992 and Plain Antvireo, *Dysithamnus mentalis* in 1995) and are not considered further here.

Year-to-year variations. Ectoparasite prevalence differed significantly between years during the summers but not during the winters. Both tick ($\chi_Y^2 = 4.158$; df = 1; P = 0.041) and feather-mite ($\chi_Y^2 = 18.725$; df = 1; P = 0.000) prevalence varied significantly between years at the montane forest during the summer (table 1). Tick prevalence, however, had similar values during the winters, both at the lowland ($\chi_Y^2 = 2.415$; df = 1; P = 0.120) and at the montane ($\chi_Y^2 = 1.519$; df = 1; P = 0.218) forests.

Seasonality. Ectoparasite prevalence was higher during the winters than during the summers. For Passeriformes, tick prevalence was significantly higher, on the average, during the winter than during the summer ($\chi_{M\text{-}H}^2 = 53.436$; df = 1; P < 0.000) at the montane forest (table 1). Tick prevalence was 3.5 times higher and tick prevalence on species was nearly two times as high during the winter than in the summer (table 1).

Feather-mites were also significantly ($\chi_{M\text{-}H}^2 = 17.888$; df = 1; P < 0.000) more prevalent during the winter of 1995 than the average of the summers at the montane forest.

Altitude. Lowland and montane forests usually had similar ectoparasite prevalence. The average tick prevalence at the montane forest was not different ($\chi_{M\text{-}H}^2 = 0.852$; df = 1; P = 0.356) from the average tick prevalence at the lowland forest during the winters (table 1). The same pattern was observed for feather-mites (Fisher Exact test, P = 0.764), but chewing lice showed significantly higher ($\chi_Y^2 = 10.502$; df = 1; P = 0.001) prevalence at the lowland than at the montane forest during the winter of 1995 (table 1).

Tick infestations during winters

We combined the 311 winter samples from the lowland and montane forests to conduct comparisons of tick prevalence with diet, type of participation in mixed-species flocks and nest type. The restricted samples of the other ectoparasites and of our summer samples limit statistical analysis and weaken conclusions for these data sets.

Taxonomy. Since only 10 species had more than 10 individuals sampled we restrict our taxonomic analysis to the family level. The number of species and individuals infested by ticks differed considerably among bird families (Appendix) during the winter. The highest prevalences were recorded for Dendrocolaptidae (85.3 %) and Furnariidae (61.4 %), and the lowest for Parulidae (5.6 %). All other families had intermediate values or too little data to justify conclusions. Infestation intensity at the family level followed the same pattern of prevalence with the highest mean infestations for Dendrocolaptidae (7.4 ticks/bird) and Furnariidae (3.9 ticks/bird). The two most infested birds were one Furnariidae (*A. amaurotis*) with 57 ticks, and one Dendrocolaptidae (Lesser Woodcreeper, *Lepidocolaptes*

TABLE 1. Prevalence [number of birds examined (% infested)] of ticks, feather-mites and chewing lice on Passeriformes of the Atlantic Forest, at lowland and montane sites, during winters (1991 and 1995) and summers (1992 and 1993).

		Season/Year					
		Winter			Summer		
Ectoparasite	Altitude	1991	1995	Total	1992	1993	Total
Ticks	Lowland	29 (27.6)	34 (50.0)	63 (39.7)	-	-	-
	Montane	133 (50.4)	115 (41.7)	248 (46.4)	108 (8.3)	76 (19.7)	184 (13.0)
	Total	162 (46.3)	149 (43.3)	311 (45.7)	108 (8.3)	76 (19.7)	184 (13.0)
Feather-mites	Lowland	-	34 (91.2)	34 (91.2)	-	-	-
	Montane	-	116 (87.9)	116 (87.9)	108 (28.7)	76 (61.8)	184 (42.4)
	Total	-	150 (88.7)	150 (88.7)	108 (28.7)	76 (61.8)	184 (42.4)
Chewing lice	Lowland	-	34 (91.2)	34 (91.2)	-	-	-
	Montane	-	116 (59.5)	116 (59.5)	-	-	-
	Total	-	150 (66.7)	150 (66.7)	-	-	-

fuscus) with 49 ticks.

None of the bird families had low prevalence of feather mites, with all values ranging from 70.0 % on Formicariidae to 95.5 % on Turdidae (see Appendix). Chewing lice prevalence varied considerably among bird families, with Fringillidae being the least infested (25.0 %) and Turdidae being the most (95.5 %).

Foraging guild. Tick prevalence was much higher on bark insectivores than in any other guild of passerines during the winters (table 2). The six species of bark insectivores had, on the average, high tick prevalence (84.2 %), and high mean infestation intensity (6.8 ticks per host). Insectivores in general and omnivores had higher prevalence (50.0 and 42.2 % respectively) than frugivores and granivores. Tick prevalence, however, varied considerably among insectivore families and species (Appendix).

Flock participation and nest type. The correlates of tick prevalence with type of participation in mixed-species flocks and nest type was analyzed jointly for insectivores and omnivores, since these two groups showed similar prevalence rates ($\chi_Y^2 = 0.699$; df = 1; P = 0.403).

Birds that participated regularly in mixed-species flocks had significantly higher ($\chi_{M-H}^2 = 11.314$, d.f. = 1, P = 0.001) prevalence than birds with irregular participation. Birds that build closed nests had similar ($\chi_{M-H}^2 = 0.405$, d.f. = 1, P = 0.525) prevalence to birds that build open nests. These two characteristics are confounded, however, by the significant ($\chi_{M-H}^2 = 30.306$, d.f. = 1, P < 0.000) association between nest type and flock participation, since most species that build closed nests also participate in mixed species flocks (table 3).

Body mass vs. infestation intensity. Body mass of birds during the winter was not affected by infestation intensity (tick load). We tested the effect of infestation intensity on the body mass with the four species that had more than 10 records and a high range of ticks. Parasitism by ticks did not affect significantly any of the four species tested [*L. fuscus*, (r_s = - 0.005, N = 15, NS), Olivaceous Woodcreeper, *Sittasomus griseicapillus* (r_s = 0.158, N = 11, NS), *A. amaurotis* (r_s ≈ - 0.059, N = 28, NS), and *S. rufosuperciliata* ($r_{s=}$ - 0.306, N = 13, NS)].

Hummingbird ectoparasitism

We never recorded ticks and haematophagous Diptera on hummingbirds, but the three other ectoparasites (flower mites, chewing lice and feather mites) occurred in all five species of hummingbirds sampled during the winter of 1995. Hummingbird flower mites varied considerably in prevalence among the three most common host species (table 4), being almost always (92.3 %) present on the Scale-throated Hermit, *Phaethornis eurynome*, common (60.0 %) on the Violet-capped Woodnymph, *Thalurania glaucopis*, but rare (8.3 %) on the Brazilian Ruby, *Clytolaema rubricauda*. Chewing lice varied less (33.3-60.0 %) among the three most common hosts. Feather-mites were almost always (93.2 %) present on hummingbirds, with the lowest prevalence reported for *P. eurynome* (76.9 %). Of the 44 hummingbirds sampled for the three ectoparasites, 14 (31.8 %) had triple infestation, 19 (43.2 %) had double infestation, 11 (25.0 %) had single infestation, and no hummingbird was ever free of ectoparasites.

DISCUSSION

The most evident pattern detected is that ectoparasite prevalence is higher during winters than during summers (table 1). This pattern is probably related to the annual cycles and natural history of the parasites. Ectoparasite prevalence was not homogeneous between years, seasons and forests at different altitudes (table 1). These findings suggest complex spatial and temporal population dynamics of ectoparasites on their hosts.

Tick prevalence on Passeriformes varied considerably among families and was related to foraging guild and type of participation in mixed-species flocks (tables 2 and 3). Bark insectivores were the most infested, with prevalence even higher than terrestrial foragers (table 2), which are expected to be more infested by ticks which wait on the litter. Insectivores and omnivores were infested much more than frugivores and granivores, but the variation among the insectivore families was as great as the variation between insectivores and frugivores (Appendix). Thus, diet alone is a poor correlate of tick prevalence.

The association between nest type and flock participation (table 3) may be explained by the characteristics of two families (Dendrocolaptidae and Furnariidae which participate in mixed-species flocks, and build closed nests) most represented in the samples. Even though birds of the Paraná region do not reproduce during the winter, nesting behavior may be related with roosting behavior.

TABLE 2. Number of species and of individuals (% infested) examined, and infestation intensity of ticks on Passeriformes captured during the winters by guild (foraging substrate and diet).

Guild	Number of species	Number of birds examined (% infested)	Mean (range) infestation intensity
Terrestrial (Insectivore)	5	13 (38.5)	1.5 (0-8)
Bark (Insectivore)	6	38 (84.2)	6.8 (0-49)
Arboreal	42	260 (40.4)	1.6 (0-57)
Insectivore	26	175 (43.4)	1.9 (0-57)
Omnivore	9	45 (42.2)	1.1 (0-10)
Frugivore	5	26 (26.9)	0.9 (0-8)
Granivore	2	14 (21.4)	1.1 (0-8)
All insectivores	37	226 (50.0)	2.7 (0-57)

TABLE 3. Prevalence [number of birds examined (% infested)] of ticks on Passeriformes during the winters, in relation to their participation in mixed species flocks (regular vs. irregular), diet [insectivore, omnivore and plant eater (frugivore + granivore)] and nest type (closed vs. open).

Participation in mixed species flocks	Diet	Nest type		Total
		Closed	Open	
Regular	Insectivore	111 (63.1)	10 (40.0)	121 (61.2)
	Omnivore	6 (16.7)	6 (50.0)	12 (33.3)
	Plant	1 (0)	1 (0)	2 (0)
	Total	118 (60.2)	17 (41.2)	135 (57.8)
Irregular	Insectivore	78 (32.1)	27 (51.9)	105 (37.1)
	Omnivore	0 (0)	33 (39.4)	33 (39.4)
	Plant	0 (0)	38 (26.3)	38 (26.3)
	Total	78 (32.1)	98 (37.4)	176 (35.0)
Total		196 (49.0)	115 (37.9)	311 (45.7)

Dendrocolaptidae, for example, nest and roost in trunk cavities (Oniki 1970, Skutch 1989), and Furnariidae may roost in their closed nests (Sick 1985).

Species that participate regularly in mixed-species flocks had higher prevalence than irregular participants (table 3). The positive benefits of participating in mixed-species flocks may be counterbalanced by potential negative direct or indirect effects of ectoparasitism (review in Lehmann 1993). Ectoparasitism may still be considered an important factor in the evolution of mixed-species flock participation behavior even though no negative fitness (loss of body mass) effect was detected here. Alternatively, if flock species are transmitting ectoparasites to other flock species (cross-species infection) they can benefit by indirectly excluding the flock competitors (see Holt 1993).

Lice prevalence on birds may vary considerably among Neotropical forests. Our lice estimate for Passeriformes during the winter was of 66.7 %, a value 40 % higher than that reported by Clayton *et al.* (1992) in Amazonian Peru. This difference may be related, however, to the fact that their samples were taken during summer and winter and that they included both Passeriformes and Non-Passeriformes.

The community of ectoparasites on hummingbirds differed from Passeriformes, by the lack of ticks and haematophagous flies and the presence of flower mites on hummingbirds. Oniki and Willis (1991) also did not encounter ticks on eight hummingbird species from Colombia. Among the ectoparasites found on hummingbirds, flower mites showed the most interesting pattern, varying in prevalence among hummingbird species. The ecology and coevolution of flower mites and hummingbirds was studied in detail by Colwell (1973, 1995 and references). *Phaethornis* spp. and the Saw-billed Hermit (*Ramphodon naevius*), seem to have a very close association with flower mites, deserving further studies.

The fact that few ticks were found on body parts besides the birds' heads and necks suggests that either the birds clean ectoparasites or the ectoparasites select attachment sites [see Choe and Kim (1989) for feather mites]. The first hypothesis is supported by Boyd's (1951) finding of fleas and lice in bird stomachs. Preening is considered the primary defence of hosts against lice (Waage 1979, Clayton 1991). Besides the self-grooming behavior, some birds exhibit allopreening (reviews in Cullen and Ashmole 1963, Harrison 1965). Brooke (1985), for example, demonstrated that penguin pairs have less ectoparasites than unmated individuals, possibly because of allopreening by the pair. It is not known how much allopreening occurs in the Passeriformes studied here.

Implications for Conservation Biology

Several endemic birds of the Brazilian Atlantic Forest region showed high ectoparasite prevalence with a strong potential for infestation by diseases. Prevalence of the ectoparasites sampled was high for some groups of parasites (e.g. 88.7 % for feather mites during the winters) or for specific host taxons (e.g. 85.3 % for ticks on Dendrocolaptidae, or 95.5 % for chewing lice on Turdidae). Lack of similar studies prevents us from evaluating whether these proportions are within natural levels or higher than levels whithin which birds of the region evolved. The montane and lowland sites sampled are not pristine habitat, since forests are variably disturbed and domestic animals such as fowl, dogs, cats and others live nearby. This contact between domestic animals and wildlife may have altered the original prevalence of parasites. Case studies showing domestic-wildlife transmission raise concerns about whether endangered or endemic bird species that live in the Paraná region (e.g. *A. amaurotis*, Spadebill *Platyrinchus leucoryphus*, Azure-shouldered Tanager *Thraupis cyanoptera*, Blackish-blue Seedeater *Amaurospiza moesta*, and Uniform Finch *Haplospiza unicolor*) are under threat of dangerous parasitic infection. Mixed-species flock participants, specially Dendrocolaptidae and Furnariidae, should be more endangered of being infested by an ectoparasite transmitted

TABLE 4. Prevalence [number of birds examined (% infested)] of flower mites (Gamasida), chewing lice (Phthiraptera) and feather mites (Analgoidea) in hummingbirds of the Paraná Atlantic Forest, Brazil, during the winter of 1995.

Species	Number examined	Number (%) infested		
		Flower mites	Chewing lice	Feather mites
Phaethornis eurynome	13	12 (92.3)	7 (53.9)	10 (76.9)
Phaethornis squalidus	1	1 (100)	1 (100)	1 (100)
Thalurania glaucopis	15	9 (60.0)	9 (60.0)	15 (100)
Clytolaema rubricauda	12	1 (8.3)	4 (33.3)	12 (100)
Ramphodon naevius	3	3 (100)	3 (100)	3 (100)
Total	44	26 (59.1)	24 (54.6)	41 (93.2)

disease than irregular flock participants. Several endemic Atlantic Forest species (Appendix) already show high prevalence of one or more ectoparasites (e.g. *A. amaurotis* had prevalence rates of 92 % for feather-mites, 83 % for ticks and 75 % for chewing lice), and we do not know the potential danger of these infestation levels to wildlife. This possible danger (see also Kirkwood 1993, Aguirre and Starkey 1994) should be evaluated further as a background for conservation and management programs of endangered species.

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APPENDIX

Prevalence [number of birds examined (% infested)], relative infestation intensity and range of ticks (Acari), and prevalence number of birds examined (% infested)] of feather mites (Analgoidea) and chewing lice (Phthiraptera) on birds of the Paraná Atlantic Forest, Brazil, during the winters of 1991 and 1995.

	Ticks			Feather mites	Chewing lice
Family-Subfamily (No.)/Bird species	Number examined (% infested)	Infestation intensity	Range ectop.	Number examined (% infested)	Number examined (% infested)
Dendrocolaptidae (5)	34 (85.3)	7.4	0-49	14 (92.9)	14 (35.7)
Lepidocolaptes fuscus	15 (80.0)	9.1	0-49	5 (100)	5 (40.0)
Sittasomus griseicapillus	11 (100)	6.0	1-16	4 (100)	4 (25.0)
Dendrocolaptes platyrostris	3 (100)	12.7	5-23	1 (100)	1 (100)
Dendrocincla fuliginosa	3 (33.3)	1.0	0-3	3 (66.7)	3 (33.3)
Campylorhamphus falcularius	2 (100)	4.0	3-5	1 (100)	1 (100)
Furnariidae (9)	70 (61.4)	3.9	0-57	27 (92.6)	27 (81.5)
Anabacerthia amaurotis	29 (82.8)	6.4	0-57	12 (91.7)	12 (75.0)
Syndactyla rufosuperciliata	13 (61.5)	4.8	0-17	5 (100)	*5 (100)*
Synallaxis ruficapilla	13 (30.8)	0.5	0-4	5 (100)	5 (80.0)
Heliobletus contaminatus	4 (75.0)	1.8	0-5	-	-
Xenops minutus	3 (33.3)	1.3	0-4	-	-
Philydor rufus	3 (33.3)	0.3	0-1	1 (0)	1 (0)
Automolus leucophthalmus	3 (66.6)	0.7	0-1	2 (100)	2 (100)
Lochmias nematura	1 (0)	0.0	0	1 (100)	1 (100)
Sclerurus scansor	1 (0)	0.0	0	1 (100)	1 (100)
Formicariidae (7)	24 (50.0)	1.5	0-11	10 (70.0)	10 (30.0)
Conopophaga lineata	9 (44.4)	1.2	0-4	3 (100)	3 (0)
Dysithamnus mentalis	6 (50.0)	1.5	0-4	4 (75.0)	4 (50.0)
Drymophila malura	5 (60.0)	2.8	1-11	1 (0)	1 (0)
Drymophila squamata	1 (100)	2.0	2	-	-
Chamaeza ruficauda	1 (0)	0.0	0	-	-
Grallaria varia	1 (100)	8.0	8	1 (0)	1 (100)
Myrmotherula gularis	1 (0)	0.0	0	1 (100)	1 (0)
Cotingidae (1)	4 (0)	0.0	0	2 (100)	2 (0)
Carpornis cucullatus	4 (0)	0.0	0	2 (100)	2 (0)
Pipridae (2)	26 (34.6)	1.2	0-8	14 (92.9)	14 (85.7)
Chiroxiphia caudata	19 (31.6)	1.2	0-8	10 (90.0)	10 (90.0)
Schiffornis virescens	7 (42.9)	1.4	0-6	4 (100)	4 (75.0)
Tyrannidae (13)	57 (40.4)	0.7	0-9	28 (85.7)	28 (57.1)
Hemitriccus obsoletus	19 (52.6)	2.5	0-9	8 (100)	8 (62.5)
Hemitriccus nidipendulus	1 (100)	3.0	3	-	-
Hemitriccus diops	1 (0)	0.0	0	-	-
Platyrinchus mystaceus	8 (62.5)	0.9	0-2	6 (66.7)	6 (16.7)
Platyrinchus leucorhyphus	1 (0)	0.0	0	-	-
Todirostrum plumbeiceps	5 (20.0)	0.2	0-1	2 (0)	2 (0)
Mionectes rufiventris	5 (0)	0.0	0	4 (100)	4 (100)
Myiobius barbatus	4 (25.0)	0.3	0-1	1 (100)	1 (100)
Tolmomyias sulphurescens	4 (25.0)	0.3	0-1	2 (100)	2 (100)
Phylloscartes ventralis	3 (0)	0.0	0	1 (100)	1 (0)
Phylloscartes difficilis	1 (0)	0.0	0	-	-
Leptopogon amaurocephalus	3 (66.6)	1.3	0-3	2 (100)	2 (100)
Attila rufus	2 (100)	3.0	2-4	2 (100)	2 (50.0)

APPENDIX

(continued)

	Ticks			Feather mites	Chewing lice
Family-Subfamily (No.)/Bird species	Number examined (% infested)	Infestation intensity	Range ectop.	Number examined (% infested)	Number examined (% infested)
Turdidae (3)	28 (50.0)	0.8	0-7	22 (95.5)	22 (95.5)
Turdus albicollis	22 (54.6)	1.2	0-7	16 (100)	16 (93.8)
Turdus rufiventris	4 (0)	0.0	0	3 (100)	3 (100)
Platycichla flavipes	3 (0)	0.0	0	3 (66.7)	3 (100)
Vireonidae (2)	7 (42.9)	1.9	0-10	4 (100)	4 (75.0)
Cyclarhis gujanensis	4 (50.0)	2.7	0-10	3 (100)	3 (66.7)
Hylophilus poecilotis	3 (33.3)	0.7	0-2	1 (100)	1 (100)
Parulidae (2)	37 (5.4)	0.08	0-2	14 (85.7)	14 (71.4)
Basileuterus leucoblepharus	23 (4.4)	0.09	0-2	12 (83.3)	12 (75.0)
Basileuterus culicivorus	13 (7.7)	0.08	0-1	2 (100)	2 (100)
Thraupinae (6)	9 (44.4)	1.4	0-8	7 (71.4)	7 (71.4)
Tangara desmaresti	3 (33.3)	0.3	0-1	3 (100)	3 (33.3)
Trichothraupis melanops	2 (50.0)	1.5	0-3	2 (0)	2 (100)
Tachyphonus coronatus	1 (100)	8.0	8	-	-
Euphonia pectoralis	1 (0)	0.0	0	-	-
Thraupis cyanoptera	1 (100)	1.0	1	1 (100)	1 (100)
Habia rubica	1 (0)	0.0	0	1 (100)	1 (100)
Fringillinae (3)	15 (20.0)	0.9	0-7	8 (87.5)	8 (25.0)
Haplospiza unicolor	11 (9.1)	0.6	0-7	7 (85.7)	7 (28.6)
Amaurospiza moesta	3 (66.6)	2.0	0-4	1 (100)	1 (0)
Saltator similis	1 (0)	0.0	0	-	-
TOTAL (53)	311 (45.7)	2.3	0-57	150 (88.7)	150 (66.7)

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Descrição do macho adulto de *Stymphalornis acutirostris* (Aves: Formicariidae)

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ABSTRACT. **Description of the adult male of *Stymphalornis acutirostris* (Aves: Formicariidae).** *Stymphalornis acutirostris* was recently described based on a pair collected at Balneário Ipacaray (25°45'S, 48°31'W), on the coast of the state of Paraná. These specimens show similar plumage pattern. We discovered now that the male (paratype) is a juvenile. Adult males are distinct from youngs and females, beeing blackish gray on face and underparts, with the white remaining only on tips of chin and moustachial streak feathers and in the center of auricular feathers. Intermediate plumages are represented by specimens having grayish underparts. Collected specimens show two or four pairs of tail feathers with the tips coloured as follow: white in the fifth pair, white or grayish in the thirth and fourth pairs, and grayish in the second pair. The presence of a strong sexual dimorphism in the plumage of *S. acutirostris*, as found in the majority of the typical antbirds (= Thamnophilidae), do not put under dowght the genus *Stymphalornis* since it was not erected by plumage aspects.

KEY WORDS: Adult male, Formicariidae, immature male, plumage variation, *Stymphalornis acutirostris*.

PALAVRAS-CHAVE: Formicariidae, macho adulto, macho jovem, *Stymphalornis acutirostris*, variação plumária.

Stymphalornis acutirostris Bornschein, Reinert e Teixeira, 1995 foi descrito com base em um casal coletado no Balneário Ipacaray (25°45'S, 48°31'W), litoral do Estado do Paraná, Brasil (Bornschein *et al.* 1995). Com a continuidade das pesquisas na região costeira do sul do Brasil, observamos exemplares de *S. acutirostris* com a superfície ventral escura ou mesclada de escuro com áreas alvi-negras semelhante ao padrão do material-tipo. Coletamos alguns espécimes, verificando após a análise das gônadas que tratavam-se de machos. A evidência da sucessão plumária foi corroborada através da recuperação de um espécime, um mês após o seu anilhamento, que havia escurecido parcialmente. Concluímos, então, estar diante de machos de *S. acutirostris* mais velhos, que passamos a descrever.

Designamos as cores conforme Smithe (1975). Comparações com o material-tipo de *S. acutirostris* basearam-se na descrição original da espécie e em material fotográfico. O holótipo e o parátipo, posteriormente citados no texto, são uma fêmea e um macho respectivamente. Os espécimes coletados foram depositados no Museu Nacional (MN), Rio de Janeiro (RJ) e no Louisiana State University Museum of Natural Science (LSUMZ), de Baton Rouge, Louisiana, nos Estados Unidos da América.

- Macho adulto (MN 42.978; coletado em IV/1996): Mento, garganta, ventre e coberteiras inferiores da cauda anegrados (cor 82), crescentemente lavados de cinzento-escuro (aproximadamente entre a cor 82 e 83) do mento ao abdômen (frontispício). A extremidade de algumas penas do mento quase imperceptivelmente riscadas de brancacento. Estria mistacal anegrada e maculada de branco, prolongando-se com penas cinzentas (aproximadamente cor 86). Face anegrada com a porção mediana das penas da região auricular branca. Lados do pescoço e do peito cinzento-escuro; flancos marrom-oliváceo escuro (cor 28, similar ao material-tipo da espécie). Coxas anegradas variavelmente manchadas de cinzento-escuro, branco e marrom-oliváceo escuro. Fronte cinzento-escura com os ramos das penas cinzentos. Pequenas coberteiras superiores das asas brancas, com algumas penas da divisa com as médias coberteiras apresentando uma mancha preta. Álulas e médias coberteiras superiores das asas pretas com uma mancha branca no ápice; grandes coberteiras superiores das asas pretas com uma mancha apical branca, sendo que as mais internas são anegradas, orladas de castanho-oliváceo (similar ao material tipo da espécie) e uniformes no ápice. Coberteiras inferiores das asas mescladas de branco e cinzento-escuro. Margem das asas pretas com algumas manchas brancas. Escapulares castanho-oliváceas, sendo que as mais externas apresentam-se variavelmente orladas em ambos os vexilos de anegrado internamente e branco externamente. A coloração das demais regiões deste exemplar é similar ao descrito para o material-tipo da espécie.

Outros dois machos (LSUMZ 161.021, MN 42.979; coletados respectivamente em IV e VII de 1996) diferem do espécime descrito acima por terem apenas o mento e a garganta anegrados. O mento é mais nitidamente marcado de branco, especialmente no espécime LSUMZ 161.021. O marrom-oliváceo escuro da superfície ventral prolonga-se dos flancos até os lados do peito; as penas da zona auricular apresentam o ápice castanho-oliváceo e as coberteiras inferiores das asas são menos tingidas de cinzento-escuro. A área da fronte com cinzento-escuro é reduzida e lavada de castanho-oliváceo, principalmente no espécime LSUMZ 161.021. A margem das asas apresenta maior quantidade de branco no exemplar LSUMZ 161.021 e as escapulares são mais expressivamente marcadas de anegrado e branco no macho MN 42.978.

Ainda não foi possível determinar se as diferenças observadas entre os machos descritos acima refletem uma mera variação individual, ou se os dois últimos são subadultos, uma vez que apresentam a região gular mais intensamente marcada de branco, a superfície inferior com menos anegrado, etc.

Um macho (MN 42.980; coletado em VII/1996) encontra-se em estágio intermediário entre a plumagem "alvi-negra" do parátipo (MN 39.457) e anegrada dos demais espécimes (MN 42.978, MN 42.979, LSUMZ 161.021). A superfície ventral apresenta penas anegradas margeadas de branco apenas na região gular e no centro do abdômen, sendo que no peito elas são cinzentas (cor 83). Do parátipo difere ainda, sobretudo, por apresentar parte do vexilo externo de algumas escapulares sutilmente escurecido e margeado de branco; pequenas coberteiras superiores das asas com uma mancha preta em algumas penas; coberteiras inferiores das asas coloridas de branco e cinzento; coberteiras inferiores da cauda anegradas e coxas anegradas lavadas de marrom-oliváceo escuro e pintalgadas de brancacento.

As etapas e o tempo gasto na sucessão plumária de *S. acutirostris* ainda não são conhecidas. Entretanto, já foi possível confirmar que a ossificação craniana se completa antes dos machos escurecerem completamente, uma vez que todos os espécimes masculinos coletados (subadultos e adultos) possuíam o crânio plenamente pneumatizado.

Uma fêmea (LSUMZ 161.020; coletada em IV/1996) difere do holótipo (MN 39.458), basicamente, por apresentar algumas escapulares parcialmente orladas de branco e tenuemente tingidas de anegrado em parte do vexilo externo.

Enquanto algumas diferenças na plumagem de *S. acutirostris* relacionam-se com o desenvolvimento etário (colorido da face, superfície inferior e talvez da fronte, escápula e das médias e grandes coberteiras superiores das asas), certas características variam individualmente (número, forma e cor das máculas apicais das retrizes e talvez a cor da margem, das coberteiras inferiores e das pequenas coberteiras superiores das asas). Na série coletada, o número de retrizes maculadas inclui apenas o quarto e o quinto par (n = 4) (figura 1), ou do segundo ao quinto par (n = 2). As manchas do quinto par de retrizes ocupam o ápice da pena e uma estreita borda do vexilo externo variável no comprimento (em penas muito desgastadas a forma da mancha foi desconsiderada). Rumo ao par central as máculas são gradualmente menores, representando uma fímbria quase imperceptível no segundo par. A coloração das manchas é branca no quinto par, branca ou cinzento-amarronzada (aproximadamente entre as cores 80 e 81) no terceiro e quarto pares e cinzento-amarronzada no segundo par.

Figura 1. Face ventral da cauda de *Stymphalornis acutirostris*, evidenciando o escalonamento das 10 retrizes e o tamanho das máculas apicais - no caso presentes apenas no quarto e quinto pares. Desenho de Rafael A. Dias.

A presença de acentuado dimorfismo sexual na plumagem de *S. acutirostris*, como ocorre na maioria dos Formicariidae típicos (= Thamnophilidae) (*e.g.* Ridgely e Tudor 1994), não fragiliza o gênero *Stymphalornis* pelo fato de que este não foi criado com base em aspectos plumários (Bornschein *et al.* 1995).

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Novos registros de *Tiaris fuliginosa* (Emberizidae) no Paraguai e no sul do Brasil

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ABSTRACT. **New records on the Sooty Grassquit (*Tiaris fuliginosa*) (Emberizidae) in Paraguay and Southern Brazil**. We present a fourth and a fifth record of the Sooty Grassquit in Paraguay (Itabó, 25°15'S, 54°40'W, 30 November 1978, and Viveiro Florestal Itaipu, 25°27'S, 54°37'W, 30 April 1979, both in Alto Paraná Department). For Southern Brazil, we present additional records for the species in Paraná State (Refúgio Biológico de Bela Vista, 25°28'S, 54°30'W, 1991; Usina Parigot de Souza - Bairro Alto, 25°15'S, 48°45'W, 27 September 1992, and Limeira - Serra da Prata, 25°45'S, 48°45'W, 01 November 1992), and the first one for Santa Catarina State (Praia Vermelha, 26°47'S, 48°36'W, 14 November 1993), which is now the southernmost distribution limit for the species.

KEY WORDS: Geographic distribution, Paraguay, Southern Brazil, *Tiaris fuliginosa*.

PALAVRAS-CHAVE: Distribuição geográfica, Paraguai, sul do Brasil, *Tiaris fuliginosa*.

Tiaris fuliginosa é uma espécie disjuntamente distribuída na América do Sul em pequenas porções da Colômbia, Venezuela, Guiana e Brasil (Ridgely e Tudor 1989). No museu do Viveiro Florestal Itaipu (VFI), próximo a Hernandarias, Departamento de Alto Paraná, Paraguai, existem dois machos desta espécie. Foram coletados perto do rio Paraná em Itabó (25°15'S, 54°40'W), Alto Paraná, em 30 de novembro de 1978 (VFI 150) e no próprio Viveiro Florestal Itaipu (25°27'S, 54°37'W), em 30 de abril de 1979 (VFI 235). Apenas recentemente esta espécie foi assinalada para o país, com ocorrência em Lagunita - Reserva Natural del Bosque Mbaracayú

(24°07'S, 55°26'W), Departamento de Canindeyú, em 12 de setembro de 1992 e em 1995 e na Estancia Nuñez (não localizado) em 1995 (Brooks 1993 *in* Hayes 1995, Lowen *et al.* no prelo *in* Barnett e Herrera 1996).

No sul do Brasil, *T. fuliginosa* conta com registros publicados para o Estado do Paraná, embora ainda não incluídos na literatura corrente sobre distribuição de aves (*e.g.* Sick 1985, 1993, Ridgely e Tudor 1989, Sibley e Monroe-Jr. 1990). Rodrigues *et al.* (1981) observaram esta espécie na Fazenda Monte Alegre (24°12'S, 50°33'W), município de Telêmaco Borba (sem data de registro) e Anjos e Graf (1993) na Fazenda Santa Rita (25°18'S, 49°48'W; *c.* 1000 m a.n.m.), município de Palmeira, em fevereiro, março, abril e julho de 1990. Estas duas localidades situam-se na região leste do Paraná. Barnett e Herrera (1996) citaram um registro efetuado por D. Finch em 22 de outubro de 1994 na Trilha das Bananeiras (*c.* 25°39'S, 54°27'W), no Parque Nacional do Iguaçu, município de Foz do Iguaçu, porção oeste do estado. Estes autores também mencionaram as primeiras ocorrências da espécie para a Argentina, onde foi coletada em 29 de setembro e 18 de outubro de 1994 próximo das cataratas do rio Iguaçu (*c.* 25°43'S, 54°27'W), no Parque Nacional Iguazú, Província de Misiones, que é vizinho do parque brasileiro mencionado acima.

No oeste do Paraná capturamos um macho em uma rede ornitológica no Refúgio Biológico de Bela Vista (25°28'S, 54°30'W), município de Foz do Iguaçu, próximo ao lago de Itaipu (rio Paraná), em 1991. No extremo leste do estado, P. Scherer-Neto capturou em rede ornitológica um casal de *T. fuliginosa* na Usina Parigot de Souza - Bairro Alto (25°15'S, 48°45'W; 100 m a.n.m.), município de Antonina, em 27 de setembro de 1992. Estes espécimes foram coletados e depositados no Museu de História Natural "Capão da Imbuia" (MHNCI), em Curitiba, Paraná (MHNCI 4203, 4204). Ainda na região oriental paranaense, observamos uma fêmea da espécie em Limeira - Serra da Prata (25°45'S, 48°45'W; 450 m a.n.m.), município de Guaratuba, em primeiro de novembro de 1992. O indivíduo deslocava-se entre as frutificações de taquaras (Poaceae) da beira de uma estrada que cortava uma floresta primária.

Em Santa Catarina observamos *T. fuliginosa* no litoral norte do estado na Praia Vermelha (26°47'S, 48°36'W; 50 m a.n.m.), município de Penha, em 14 de novembro de 1993. Na ocasião vimos alguns indivíduos alimentando-se nas frutificações de Poaceae, juntamente com *Volatinia jacarina* e *Haplospiza unicolor*.

Aparentemente os registros para o sul do Brasil citados acima são os únicos conhecidos na região, sendo que o de Santa Catarina representa o limite austral da distribuição geográfica da espécie.

Devido a escassez de informações sobre *T. fuliginosa* nos seus limites meridionais de ocorrência, não é possível assegurar se este pássaro é residente, sazonal ou de aparição ocasional na região envolvida. Neste sentido, Barnett e Herrera (1996) cogitaram a possibilidade da espécie estar expandindo a sua distribuição para sul, em função dos recentes registros no Paraná (Brasil), Paraguai e Argentina. Cumpre notar ainda, que a identificação de *T. fuliginosa* em campo e mesmo com espécimes em museu é problemática e requer atenção especial, dada a semelhança plumária com outros Emberizidae (veja Sick 1985).

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Nesting records of the genus *Daptrius* (Falconidae) from the Brazilian Amazon, with the first documented nest of the Black Caracara

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RESUMO. **Registros de nidificação do gênero *Daptrius* na bacia Amazônica, Brasil, com a primeira documentação do ninho do Gavião-de-anta.** O gênero *Daptrius* tem duas espécies *D. ater* e *D. americanus*. A biologia reprodutiva destas espécies é pouco conhecida. Eu apresento aqui a primeira descrição confirmada do ninho de *D. ater* e informo sobre as observações no ninho de *D. americanus*, incluindo dados sobre o comportamento reprodutivo coletivo e o uso de sentinelas para vigiar o ninho.

PALAVRAS-CHAVE: Bacia Amazônica, biologia reprodutiva, *Daptrius*, espécie indicadora, *Falconidae*, reprodução coletiva, sentinela.

KEY WORDS: Amazon basin, breeding biology, communal breeding, *Daptrius*, Falconidae, indicator species, sentinel.

The Black Caracara, *Daptrius ater* is found throughout the Amazon Basin and the Guianas, inhabiting edges of *terra firme* forest, tropical forest fragments, and forested river banks (Hilty and Brown 1986, Thiollay 1991, Robinson 1994). *Daptrius ater* is usually found to be a fairly common and widespread raptor, being most often observed in pairs or small family groups of three to five birds. However very little has been documented regarding the species breeding biology. Brown and Amadon (1968) report *D. ater* nests from March-June in Guyana, making a stick nest in a tree and laying two or three eggs, but provide no further information on the nest. Robinson (1994) reports nesting from a 200-ha pantanal habitat in Manu National Park, south eastern Peru in an area with isolated trees, but gives no further information. Also a female in breeding condition was reported by Carriker (1955) from Columbia in early August.

The Red-throated Caracara, *Daptrius americanus* is found from extreme southeastern Mexico, south through Central America to western Ecuador, eastern Peru and Amazonian Brazil (Hilty and Brown 1986) and was recently reported in parts of southern Brazil (Straube and Bornschein 1989). *D. americanus* is more of a forest interior bird than *D. ater* and is found to be uncommon however widespread in large areas of intact lowland rainforest, both *varzea* and *terra firme* (Hilty and Brown 1986, Thiollay 1991). Declines in populations in Central America during the 1950s and 1960s have been noted and in recent years it has disappeared from most of its Middle American range, even where forest remains intact (Stiles and Skutch 1989). *Daptrius americanus* therefore may be an important "indicator species" for monitoring conditions of tropical rainforests. Thiollay (1991) during his studies of home ranges of three groups in virgin forest in French Guiana concluded *D. americanus* required large home ranges, areas estimated from 396 ha up to 510 ha. The social behavior of *D. americanus* habitually traveling around in small, often very noisy groups of five to seven birds (Thiollay 1991) inside the forest, makes it one of the most conspicuous and easily encountered Neotropical forest raptors. Despite this, *D. americanus* is a rather secretive breeder with very few records of the species unique communal breeding behavior (Thiollay 1991). Thiollay (1991) provides the only nesting record for *D. americanus* which is from French Guiana where a nest containing nestling(s) in February-March 1990. The nest being well hidden, 22 m high in a vine-covered tree.

Daptrius ater nest. While traveling up the Rio Tejo, a tributary of the Rio Juruá, Acre, western Amazonian Brazil, on 22 November 1994, I encountered a single *D. ater* building a nest. The bird was carrying large, bare twigs of about 60-70 cm in length to a nest being built in a 25m high tree. The tree was on a tall river cliff where the *terra firme* forest came right down to the river bank. The area surrounding the nest was mature *terra firme* and transitional *varzea* forest. The nest was well-concealed in the top of a large clump of flowering bromeliads situated at a height of about 18-20 m in the crown of the tree. The bromeliad clump was situated on the only major junction of the main trunk where a single, large almost-horizontal bough branched out. The bromeliad clump covered an area of about 2 x 0.75 m in height, where the tree crown was rather open, with no other large branches, and sparsely covered with small leaves offering very little protection to the nest. The nest, however, was only partially visible because of the large size of the bromeliad. From what could be seen from the ground, the nest consisted of large bare branches. I returned to the nest site again on 4 December and observed a bird flying to the nest, calling in flight but not carrying any nesting material. I judged the nest to be basically the same size as in the previous visit and it was still well hidden, certainly not an obvious bulky nest as in some other Neotropical raptors. From these brief observations it was not possible to determine the stage of construction of the nest.

I also have recorded an immature bird with dull yellow gray facial skin and brown eyes giving food begging calls to a near by adult on 5 July 1996 along the Rio Apuau, Amazonas, Brazil.

***Daptrius americanus* nest.** During a short stay (24-30 January 1995) at Fazenda Rancho Grande near Ariquemes, Rondonia, southwestern Brazil (10°17'S, 62°52'W), I discovered a nesting site of *D. americanus*. The nesting tree was a dead isolated hollow tree trunk in cattle pasture situated about 250 m from a small corridor of tropical forest leading to virgin *terra firme* 1 km away. Within the pasture, adjacent to the nest, there were several scattered trees including a small clump within 75 m of the nest. The surrounding area was dominated by rolling *terra firme* forest with some hills (200-300 m) with large exposed boulders. Several farms were found along both sides of a dirt road dissecting the forest and forming a rough patchwork of pasture, cacao plantations, secondary growth and small isolated tracts of forest.

At 17:30 on 25 January I saw a single adult *D. americanus* perched in an isolated tree in the middle of cattle pasture. The caracara was well away from the nearest forest and did not vocalize as I approached and stopped along a well-used dirt road in a small bus to within 250 m distance. Normally, *D. americanus* are found in small groups within the forest, or perched at a forest border and are usually very vocal when approached. This atypical behavior made me suspect that the bird may have been a sentinel overlooking a possible nesting site nearby. Returning to the area on 27 January at 17:45 as I walked along the road, a caracara flew across the pasture calling loudly and landing in a line of trees about 100 m from where I had first seen a caracara two days before. A few minutes later a caracara started calling loudly from the same general area and a second bird appeared, flying out from behind a large isolated dead tree stump. This second caracara flew across the pasture and perched in the same tree that I had observed the bird the first afternoon. The bird remained perched there at the top of tree silently, and was presumably taking up sentry duty. The first perched caracara then flew silently to the large dead isolated tree stump, flying behind it and out of sight near the top.

The nesting stump was about 18-20 m tall and about 3 m in diameter, with a large single broken fork about 2 m from the top. At the base of the fork grew a strangler fig (*Ficus* sp.) about 1 m tall. One side of the stump had a large hollow at a height of about 16-17 m and was about 1.0 m in diameter, and 0.5 m high. Across the entrance of the hollow there were a couple of thick 3-5 cm diameter bare fig roots forming a loop. I was unable to see the nest, which was most certainly within the hollow of the stump. After about 5 minutes the sentinel flew back to the nearby forest, from which another bird appeared calling. This third bird flew out of the forest corridor, across the pasture towards the nest and was carrying food, a large round fruit in its beak. It flew past the stump and landed on a large palm tree in a small clump of trees. The fruit was about 2 cm in diameter and perfectly round, probably a palm fruit. A minute latter the bird flew directly to the top of the nesting stump and went behind and out of site. Almost immediately another bird appeared from behind the stump, flying silently to the forest. The following afternoon a *D. americanus* was seen perched on the fig roots at the entrance to the nest. The bird remained perched for half a minute before flying off to the nearby forest. On a return visit to the site on 3 November 1995 I still found activity around the nesting stump. One adult caracara was perched on the stump calling while another flew out from the nest hollow and followed the calling bird as it now flew to the nearby forest edge. I was unable to confirm if the second caracara was an immature bird or not.

Thiollay (1991) records three identified prey items brought to feed nestlings, all different types of wasp nests with larva. The main diet of *D. americanus* is wasps nests and their larva (Skutch 1959). Thiollay (1991) recorded that 74% of all food items were either wasp nests or other insect nests and that 9% was hard fruits. Fruits, especially palms, have also been noted for *D. americanus* (Stiles and Skutch 1989). Thiollay (1991) stated that palm fruit was probably a regular component of their diet. Palm fruits are also known to be taken by *D. ater* (Sick 1984).

Thiollay (1991) also observed, as I did, one or two individuals on sentry duty, within 10-40 m of the nest site, in the forest canopy. As other members of the social group arrived bringing in prey items to the nest, a sentinel would leave the nest area to feed, leaving the recent new arrival to take up duty after feeding the young. As many as four individuals were seen sequentially delivering prey to the nest. Although the location of this Rondonian nest site in pasture was decidedly different from the French Guiana site of Thiollay (1991) which was in dense forest, the brief behavior I recorded was very similar. I believe that the markedly different nesting location of the Rondonia birds most certainly would result in the caracara's resorting to some different or at least modified behavioral strategy at the nest.

Thiollay (1991) concluded that his study group of caracaras apparently successfully bred only twice in 5 years. However he did observe an adult carrying twigs one December, which was presumably another possible nesting attempt, which most certainly failed. He also recorded from another group a single immature bird being fed by adults in October. I observed a single immature *D. americanus* giving continuous food-begging calls and being fed by at least two adults in January 1995 on the Anavilhanas archipelago in Amazonas, Brazil.

The only other nesting data to my knowledge for *D. americanus* was reportedly a twig nest in a tree containing 2-3 white or buff colored eggs spotted brown (Brown and Amadon 1968). Also an isolated tree was used for nesting in south eastern Peru (Robinson 1994), but with no further details. Breeding-condition birds have been recorded in Colombia on 11 July (Carriker 1955), and from Panama in late May (Wetmore 1965).

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Táticas de forrageamento de *Conopophaga melanops* (Passeriformes: Formicariidae) na área de Mata Atlântica da Ilha Grande, Estado do Rio de Janeiro

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ABSTRACT. **Foraging tactics of *Conopophaga melanops* (Passeriformes: Formicariidae) at the Atlantic Rain Forest of Ilha Grande, Rio de Janeiro.** We studied the foraging tactics of *Conopophaga melanops* in two areas of Atlantic Forest at Ilha Grande. The areas (primary and secondary forest) were subjected to different levels of anthropic disturbance. The results indicated that *C. melanops* fed solitarily or in pairs capturing insects from the leaf litter or at low heights above ground in the forest. Its foraging tactics consisted mainly of ground feeding. *Conopophaga melanops* was found in secondary and primary areas of Atlantic Forest being mostly recorded in the secondary area continous with the primary.

KEY WORDS: Atlantic Forest, *Conopophaga melanops*, foraging, Formicariidae.

PALAVRAS-CHAVE: *Conopophaga melanops*, Formicariidae, forrageamento, Mata Atlântica.

Conopophaga melanops, espécie de formicarídeo endêmica da Mata Atlântica, possui evidente dimorfismo sexual, sendo comum em florestas de baixada litorânea e da encosta da Serra do Mar, onde ocupa preferencialmente o sub-bosque das matas a uma pequena altura do solo (Sick 1985). O conhecimento sobre a biologia e a ecologia desta espécie é restrito a registros isolados de nidificação (Straube 1989, E. O. Willis com. pess., 1996).

Entre dezembro de 1995 e junho de 1996 estudamos as táticas de forrageamento e os microhábitats de uma população de *C. melanops* em uma área de Mata Atlântica secundária (em regeneração há aproximadamente 20 anos) e, em uma área de mata primária na Ilha Grande.

A Ilha Grande localiza-se no litoral sul do Estado do Rio de Janeiro, a aproximadamente 150 km da cidade do Rio de Janeiro, possuindo uma área de cerca de 19.000 ha. A ilha é coberta por Floresta Atlântica em diferentes estágios sucessionais, resultado da utilização de várias de suas áreas para agricultura. O clima da área é quente e úmido, sem uma estação seca definida e, com uma pluviosidade média anual de aproximadamente 1500 mm (Oliveira e Netto 1996). Nós realizamos este estudo na área da Vila Dois Rios, localizada na porção leste da ilha, voltada para o mar aberto. Durante um a quatro dias em cada mês, realizamos transecções (n = 13) de 500 m em cada uma das áreas, entre 6:30-12:00 e de 14:00-18:00, alternando as áreas em que se iniciavam os mesmos. Ao longo de cada transecção, que percorremos a uma velocidade regular, registramos as táticas de forrageamento que *C. melanops* utilizava na captura de presas, através de observações com binóculos 8 x 40. Nos baseamos nas táticas descritas por Fitzpatrick (1980) ou descrevendo-as quando não se encaixavam nas categorias anteriormente descritas. Durante cada percurso, anotamos o número de indivíduos de *C. melanops* detectados. Registramos as táticas de forrageamento mantendo um intervalo mínimo de cinco minutos entre as observações, para que as amostras fossem consideradas independentes. Adicionalmente, registramos a altura sobre o solo em que os indivíduos de *C. melanops* estavam inicialmente quando anotadas as táticas de forrageamento.

Conopophaga melanops forrageou isoladamente, ou em pares (com uma média de 1,14 ± 0,36 indivíduos, n = 28). Durante o forrageamento os indivíduos permaneceram a pouca distância acima do solo, pousados em poleiros, em troncos de árvores ou sobre pedras, olhando alternadamente para os lados e para o chão. As táticas de forrageamento executadas foram as seguintes: a) 'poleiro-poleiro-chão': o indivíduo pula de um poleiro para outro(s) antes de descer ao chão; b) 'poleiro-chão': o indivíduo encontra-se num poleiro e dirige-se ao chão para a captura da presa; c) 'chão-poleiro-chão': o indivíduo sobe do chão

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para um poleiro, retornando em seguida para o chão; d) 'saltando-chão': no chão, o indivíduo salta e bica; e) 'golpe-folhagem': o indivíduo, pousado em um poleiro, voa subitamente para cima e bica a folhagem; f) 'bicando-tronco': o indivíduo, pousado em tronco ou galho, bica; e g) 'golpe-tronco': o indivíduo, pousado em um poleiro, voa subitamente para cima e bica um tronco ou um galho (figura 1).

As táticas mais freqüentemente utilizadas por *C. melanops* foram as de coleta de chão, incluindo em ordem decrescente de freqüência as táticas de 'poleiro-poleiro-chão', 'poleiro-chão', 'chão-poleiro-chão' e 'saltando-chão'; enquanto as táticas de coleta no tronco e na folhagem ocorreram com uma freqüência comparativamente menor (figura 2). A distância média acima do solo em que os indivíduos foram encontrados ao iniciarmos os registros de suas táticas de forrageamento foi de 1,31 ± 0,90 m (n = 37) (figura 3).

A análise dos conteúdos estomacais de um macho e de uma fêmea mortos acidentalmente em armadilhas de adesão, colocadas em troncos para amostrar artrópodos, mostrou que a fêmea havia ingerido uma larva de díptero

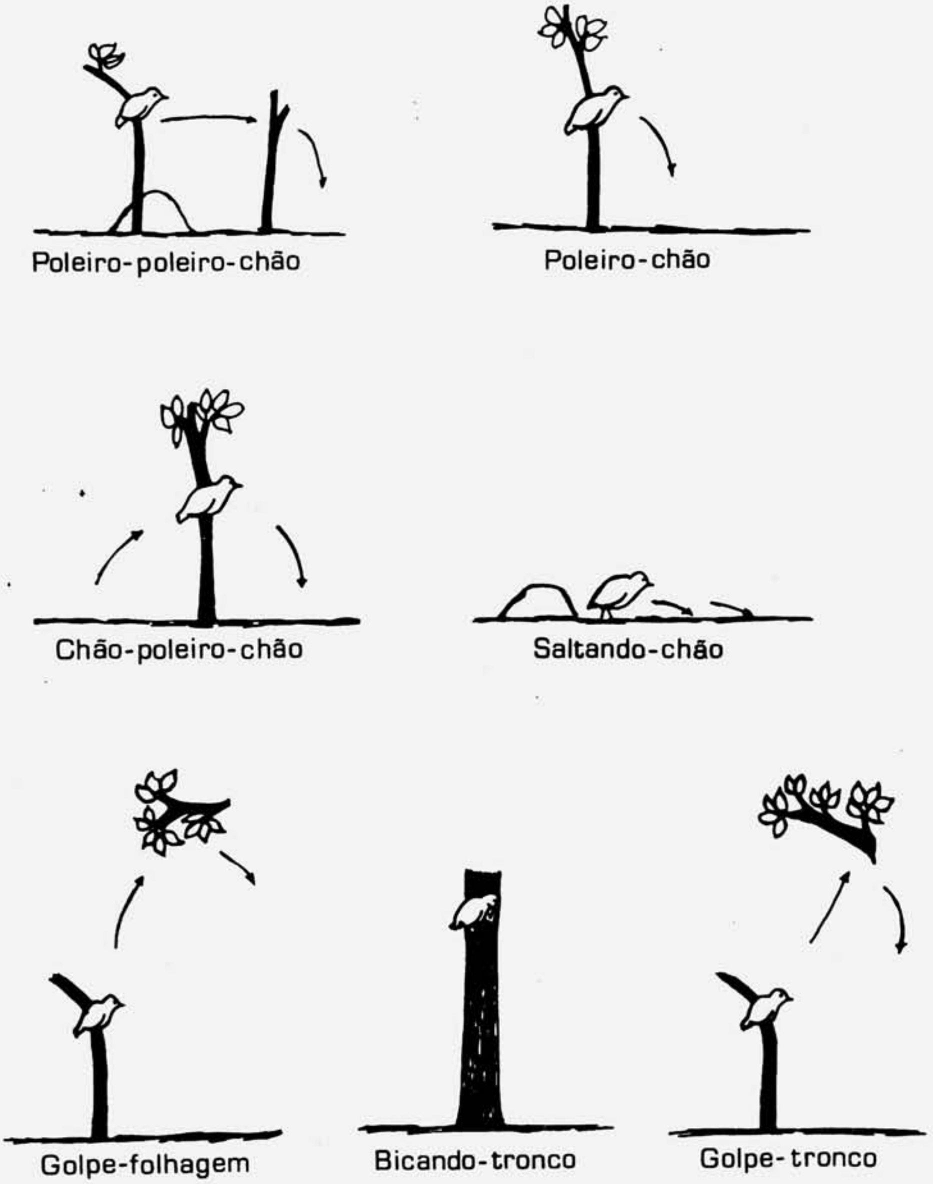

Figura 1. Táticas de forrageamento de *Conopophaga melanops* na área de Mata Atlântica da Vila Dois Rios, Ilha Grande, Rio de Janeiro.

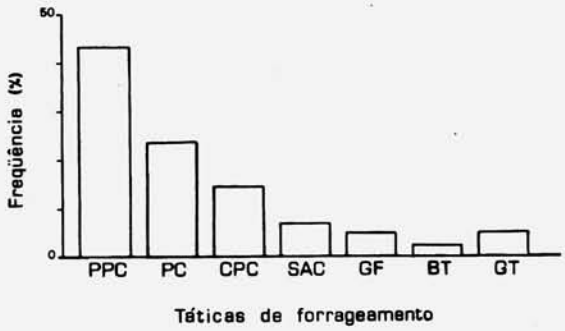

Figura 2. Freqüência das táticas de forrageamento de *Conopophaga melanops* na área de Mata Atlântica da Vila Dois Rios, Ilha Grande, Rio de Janeiro (n = 42). PPC = poleiro-poleiro-chão; PC = poleiro-chão; CPC = chão-poleiro-chão; SAC = saltando-chão; GF = golpe-folhagem; BT = bicando-tronco e GT = golpe-tronco.

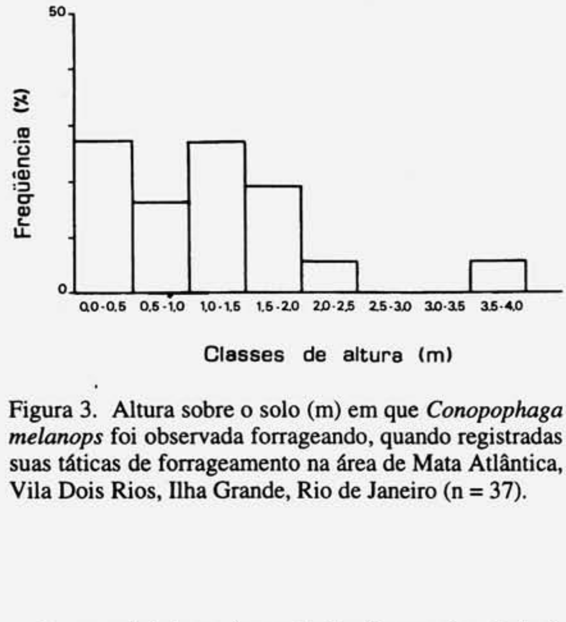

Figura 3. Altura sobre o solo (m) em que *Conopophaga melanops* foi observada forrageando, quando registradas suas táticas de forrageamento na área de Mata Atlântica, Vila Dois Rios, Ilha Grande, Rio de Janeiro (n = 37).

e alguns coleópteros (encontrados fragmentos destes), além de um ácaro, enquanto o estômago do macho nada continha. Os indivíduos de *C. melanops* foram geralmente vistos voando baixo no sub-bosque, capturando insetos principalmente no folhiço e, algumas vezes foram observados subindo do chão com insetos de 1-2 cm no bico. Tal comportamento é semelhante ao registrado para uma espécie congênere, *C. lineata* (Willis *et al.* 1983).

Encontramos *C. melanops* tanto em área de mata secundária como em área de mata primária, na Ilha Grande. Entretanto, o número total de observações nas transecções na mata secundária foi superior (n = 36, sendo 9 vezes observações de fêmeas e 27 vezes observações de machos) ao encontrado para a mata primária (n = 8, sendo duas vezes observações de fêmeas e 6 vezes observações de machos), o que pode ser indicativo de que na área secundária a espécie seja mais abundante. Alternativamente, os indivíduos desta espécie são mais fáceis de serem vistos na área de mata secundária, por se tratar de uma área mais aberta que a área de mata primária. Em um estudo com espécies de aves em fragmentos florestais isolados de 6 e 10 ha e em uma área demarcada de 10 ha no interior de uma mata contínua (de aproximadamente 2.000 ha) na Reserva Biológica de Poço das Antas, Rio de Janeiro, esta espécie ocorreu apenas na mata contínua (M. A. S. A. obs. pess.), apesar do baixo grau de perturbação antrópica em ambos os fragmentos. Na Ilha Grande as áreas estudadas são contínuas, o que sugere que esta espécie seja sensível à fragmentação de hábitats.

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Predation of *Chironius flavolineatus* (Squamata: Colubridae) by *Nystalus maculatus* (Piciformes: Bucconidae)

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RESUMO. **Predação de *Chironius flavolineatus* (Squamata: Colubridae) por *Nystalus maculatus* (Piciformes: Bucconidae).** Em 24 de junho de 1994, na região de Três Lagoas - MS (20°59'S, 51°46'W), os autores capturaram com rede de nylon um indivíduo de *Nystalus maculatus*, tendo em seu bico uma serpente *Chironius flavolineatus*. O registro adiciona este ítem alimentar na dieta deste Bucconidae.

PALAVRAS-CHAVE: Bucconidae, *Chironius*, *Nystalus*, predação.

KEYWORDS: Bucconidae, *Chironius*, *Nystalus*, predation.

The diet of *Nystalus maculatus* (Aves, Bucconidae) consists of lizards and insects (Sick 1985), caught on the ground from perching position in trees (Dubs 1992). During the course of a banding project in an area of *cerrado* (Brazilian savanna) in Três Lagoas, Mato Grosso do Sul State, Brazil (20°59'S, 51°46'W), an individual of *Nystalus maculatus* was captured on June 24, 1995 at 11:30 with a mist net (12 x 2m, 36 mm mesh). The bird was 183 mm long and was marked with a metal band from CEMAVE/IBAMA (H28161) and released.

At the moment of the capture, the bird was ingesting a femae *Chironius flavolineatus* (Squamata: Colubridae) 442 mm long and weighting 5 g. The bird had already ingested about one-fourth of the snake, head first. The head of the snake was severely damaged, suggesting that the bird directed its attack to that region.

The snake was collected and deposited at the Natural History Museum at Campinas State University (UNICAMP), in Campinas, São Paulo state, Brazil (ZUEC 01835). This is the first record of predation of this snake by *Nystalus maculatus*.

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Primeira descrição do ninho e do ovo de *Polystictus superciliaris* (Passeriformes: Tyrannidae) ocorrente na Serra do Curral, Minas Gerais

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ABSTRACT. **First description of the nest and the egg of *Polystictus superciliaris* (Passeriformes: Tyrannidae) occurrent at Serra do Curral, Minas Gerais.** Two nests of *Polystictus superciliaris* were found at Serra do Curral, Minas Gerais in July and September 1996. The nests were cup-shaped with interior composed of feathers and external constitution of vegetal matter. The measurements of the two nests were: 34,8 and 36,6 mm internal diameter, 52,9 and 48,5 mm external diameter, 38,5 and 35,0 mm internal depth and 54,6 and 51,0 mm external height. The single egg found in the first nest measured 15,5 x 12,2 mm and had a clear cream-color. This appears to be the first description of the nest and the egg of *P. superciliaris*.

KEY WORDS: egg, nest, *Polystictus superciliaris*, Tyrannidae, Serra do Curral.

PALAVRAS-CHAVE: ninho, ovo, *Polystictus superciliaris*, Serra do Curral,Tyrannidae.

O papa-moscas-de-costas-cinzentas, *Polystictus superciliaris*, é uma espécie endêmica do Brasil (Sick 1985), ocorrendo nas Serras do Leste do país (Ridgely e Tudor 1994). Seus hábitats são os campos de altitude, carrascos e campos cerrados abertos (Sick 1985), sendo geralmente observado forrageando em pares (Ridgely e Tudor 1994). Até o momento pouco se sabe sobre a biologia reprodutiva desta espécie, não se encontrando nenhuma referência a respeito de seu ninho e ovo. T. A. Melo-Júnior com pess. 1996 foi o primeiro a registrar *P. superciliaris* no município de Belo Horizonte.

A Serra do Curral se localiza nos limites Sul da cidade de Belo Horizonte, fazendo parte do Complexo do Espinhaço (Eiten 1992), possuindo vegetação com influência de cerrado na face Norte e vegetação de domínio florestal atlântico na face Sul, nas partes mais altas e rochosas há vegetação de campos rupestres. Além de *P. superciliaris* mais cinco espécies de aves consideradas endêmicas da região do cerrado por da Silva (1995) ocorrem na região, sendo elas: *Melanopareia torquata*, *Cyanocorax cristatellus*, *Poospiza cinerea*, *Embernagra longicauda* e *Porphyrospiza caerulescens*. A área vem sofrendo recentemente impactos das mais variadas formas como mineração e incêndios anuais.

Neste trabalho, foram dispendidas duas horas de observação em um ninho, distribuídas nos dias 20 e 28 de julho e 04, 11, 12, 13, 14 e 15 de agosto de 1996. No dia 15 de setembro de 1996, um segundo ninho foi encontrado já desocupado a aproximadamente 50 m do primeiro ninho. As medidas dos ninhos e do ovo foram tomadas com o auxílio de um paquímetro.

No dia 20 de julho de 1996 foram observados dois indivíduos de *P. superciliaris* bastante agitados, saltitando entre galhos de arbustos na parte alta da Serra do Curral. Um dos indivíduos possuía uma pluma no bico e a aproximadamente 5 m deste, localizou-se em um arbusto um ninho forrado de plumas. Em novas visitas nos dias 28 de julho e 04 de agosto, não foram observados indivíduos desta espécie no local e o ninho permanecia vazio. Entretanto, observou-se que a sua entrada já se encontrava mais arrumada e que haviam mais plumas em seu interior.

No dia 11 de agosto foi encontrado um indivíduo adulto de *P. superciliaris* pousado no ninho. A ave não abandonou o ninho com a aproximação do observador, apenas permaneceu inquieta, movendo seu corpo dentro do ninho de um lado para outro. Após 30 min. o observador aproximou-se novamente do ninho e a ave que se encontrava neste voou, registrando-se a presença de apenas um ovo.

O ninho foi acompanhado nos dois dias subsequentes, sempre se visualizando um indivíduo em fuga do local com a aproximação do observador. No dia 14 de agosto o ninho foi aparentemente abandonado. O ninho e o ovo foram coletados no dia 15 de agosto por se encontrarem na mesma situação do dia anterior.

O ninho (figura 1A) estava a 53 cm do solo, construído em bifurcações de um arbusto de *Eremanthus erythropappus* (DC.) MacLeish. (Asteraceae) de 79 cm de altura. Este arbusto se encontrava em um local parcialmente aberto no final de uma estrada de terra abandonada. O ninho possuía a forma de taça com um prolongamento lateral que o ligava a uma das bifurcações do arbusto. As medidas do ninho foram: 34,8 mm de diâmetro interno, 52,9 mm de diâmetro externo, 38,5 mm de profundidade e 54,6 mm de altura.

Externamente o ninho era formado por fragmentos de folhas de gramíneas, fragmentos de matéria plástica (saco de lixo), aquênios e pappus de Asteraceae e principalmente de folhas e ráquis de *Mimosa* sp. (Fabaceae: Mimosoideae). Sua forragem interna era constituída unicamente de penas de cor predominantemente clara. O único ovo de cor creme-clara media 15,5 x 12,2 mm (figura 1B).

O segundo ninho se encontrava em bifurcações de um arbusto de Lamiaceae a 81 cm do solo em área de campo rupestre, possuindo suas constituições interna e externa e forma semelhantes ao do primeiro ninho. Suas medidas eram de 36,6 mm de diâmetro interno, 48,5 mm de diâmetro externo, 35,0 mm de profundidade e 51,0 mm de altura. O ninho possuía sua forragem interna bastante amassada e suja, indicando que este já se encontrava desocupado, sendo coletado. Os dois ninhos e o ovo foram depositados na Coleção de Ornitologia do Departamento de Zoologia da UFMG.

Os ninhos de *P. superciliaris* se enquadram na descrição de "Tipo 1" para a família Tyrannidae conforme Sick (1985), se mostrando bastante semelhante com o de seu congênere, *Polystictus pectoralis* (Collar e Wege 1995).

Esta parece ser a primeira descrição de um ninho e de um ovo desta espécie, segundo Sick (1985) e Ridgely e Tudor (1994); referências mais recentes não foram localizadas em levantamento bibliográfico. Na descrição original da espécie Wied (1831: 953) não cita qualquer informação a respeito de seu ninho e ovo. A única observação reprodutiva para esta espécie foi feita por Willis e Oniki (1991) em Conceição do Mato Dentro, MG, com o registro de um indivíduo carregando material para um ninho não localizado. A época do ano citada por estes autores, isto é, em julho, coincide com a observada na Serra do Curral em 1996.

Por se tratar de um local que apresenta endemismos de avifauna (da Silva 1995), sendo registrado inclusive a reprodução de uma destas espécies, recomenda-se uma maior atenção para a conservação da Serra do Curral, assim como do conjunto das Serras da região, que vêm sendo rapidamente degradadas pelas atividades de mineração e por incêndios periódicos.

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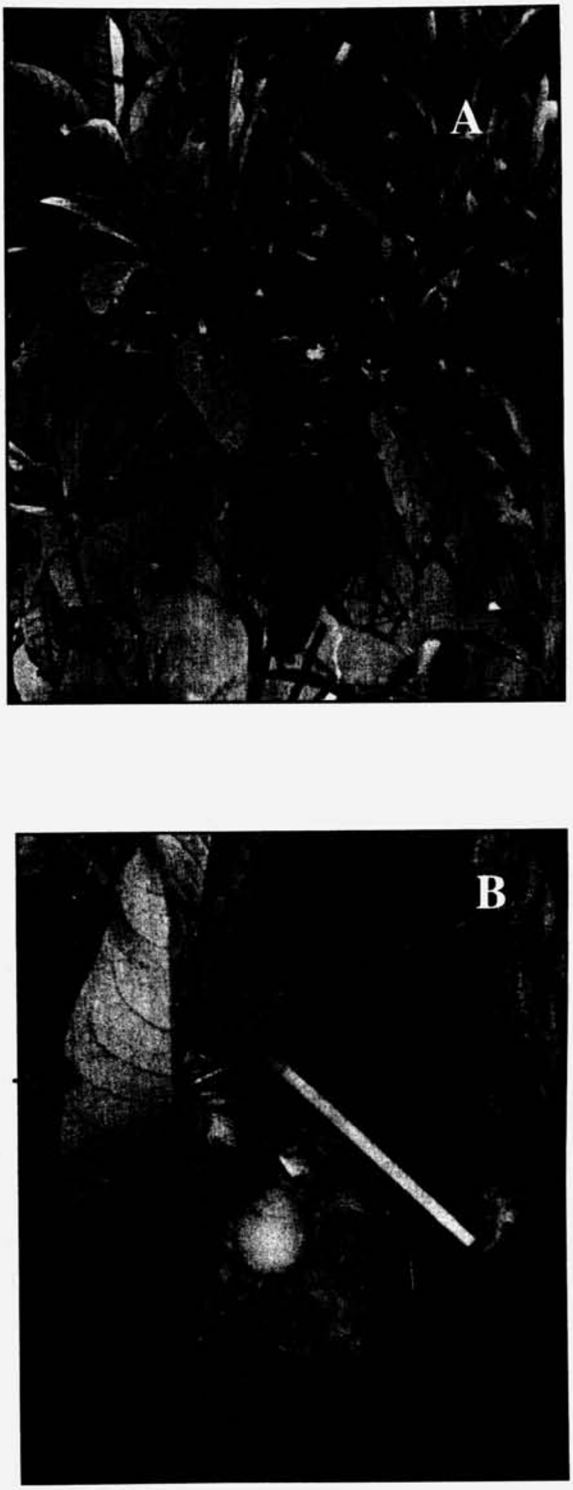

Figura 1. Ninho e ovo de *Polystictus superciliaris*. A: Visão lateral do ninho. B: Visão superior do ninho e do ovo.

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New Records of the House Sparrow (*Passer domesticus*) in the Brazilian Amazon

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RESUMO. **Novos registros de pardais (*Passer domesticus*) na Amazônia brasileira.** Foram registradas em anos recentes novas localidades na Amazônia onde o pardal (*Passer domesticus*) pode ser encontrado. Em Manaus o pardal foi observado pela primeira vez em 1987 na região do bairro Parque 10. A população de pardais neste bairro está em expansão e estima-se atualmente a presença de pelo menos 18 casais no local. No Amapá pardais foram registrados em pelo menos quatro localidades entre 1994 e 1996: Macapá, Santana, Serra do Navio e Porto Grande.

PALAVRAS-CHAVE: Amazônia, pardal, *Passer domesticus*.

KEY WORDS: Amazon, House Sparrows, *Passer domesticus*.

The House Sparrow (*Passer domesticus*) was introduced in Brazil early this century in the city of Rio de Janeiro, and spread throughout in the South, Southeast, Central west, and Northeast of Brazil (Sick 1959, 1985). The House Sparrows were detected in the Brazilian Amazon in the mid-1970's (Smith 1973). The species expansion in the Western Amazon was facilitated by the Belém-Brasília highway opened in 1964 and by 1980 the presence of House Sparrons had already been documented for at least 10 localities in the state of Pará (Smith 1980). Recently, we found new localities for the species in the Brazilian Amazon.

1) Manaus: A pair of House Sparrows was first observed in Manaus by A.W. on 17 May 1987 in the neighborhood "Parque 10" (3°4,91'S, 60°0,50'W - coordinates from a Global Positioning System). The female was building a nest under a roof. A.W. also observed a female building a nest on June 3, 1987. In October of the same year, A.W. saw a female near the Manaus airport. S.H.B. observed a pair of these birds in December 1993 in the same neighborhood where A.W. had seen them previ-

ously. Subsequent observations in January 1994 revealed at least 10 individuals in the area, including young birds and females carrying nest material in their bills. Two years later, S.H.B. estimated the number of pairs in the same locality at 18. The House Sparrows were observed in small groups of up to three pairs perched in mango trees and in a *Terminalia* sp. (Combretaceae), a common tree at the spot. Other bird species observed at the site included *Ammodramus aurifrons*, *Tyrannus melancholicus*, and *Estrilda astrild*. No interactions were observed between the House Sparrows and these other species. The origin of the House Sparrows that colonized Manaus is unknown. However a resident living in the neighborhood for over twenty-five years said that the House Sparrows had escaped from cages in the mid-1980's. Another possibility is the transport of individuals by boat from Belém, where these birds are common in the vicinity of the port (Silva and Oren 1990). House Sparrows were observed as hidden passengers on boats on the Rio São Francisco and may have reached the state of Pernambuco (Northeastern of Brazil) this way (Sick 1985). Our observations indicate that the population of *Passer domesticus* is increasing in Parque 10 and expanding to other neighborhoods. Sick (1985) also mentioned without details, the presence of House Sparrows in the area of Balbina, north of Manaus.

2) Amapá State: J.F.P. found House Sparrows in the city of Macapá (00° 01'N, 51°04'W) on 10 and 24 January 1994, where the population appeared to be fairly small. In the state of Amapá, House Sparrows were observed in three other localities (Santana, Serra do Navio, and Porto Grande). In Santana, a municipality situated at the outskirts of Macapá a pair was observed on 11 January 1994 on the main street. On the 4 August 1994, House Sparrows were observed for the first time by JFP in the town of Serra do Navio (00°54'N, 51°58'W). A total of six individuals were counted near the employee housing of a local manganese mining company. Also, in February 1996, A.W. observed at least 10 pairs of *Passer domesticus* in the vicinity of Serra do Navio. In the municipality of Porto Grande, located midway between Macapá and Serra do Navio, House Sparrows were more easily found than in other localities in Amapá State (6 August 1994, J.F.P. pers. obs.). Like in Manaus, the way the House Sparrows arrived in Amapá is unknown. However, the dispersing of this bird in the Amapá is clearly facilitated by the road BR 210.

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REVISÃO

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Bibliografia recente da ornitologia brasileira - 1994/1995

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É apresentado uma lista de títulos bibliográficos da ornitologia brasileira para o biênio 1994/1995 que pretende suplementar a lista apresentada em *Ararajuba* 4(1):56-62, conforme previamente estabelecido.

Estão considerados nesta relação de títulos ordenada por autor os artigos e notas científicas ou de divulgação científica publicados em periódicos nacionais ou estrangeiros, sob forma de livros ou publicações avulsas e como capítulos de livros. Para ser considerado como integrante da bibliografia ornitológica brasileira o trabalho deve ter sido executado no Brasil ou mencionar explicitamente material oriundo do Brasil. Não são considerados trabalhos monográficos puramente compilatórios, salvo se produzido por autor brasileiro ou radicado no Brasil e trabalhos - a qualquer título que tratem de espécies (também) brasileiras - produzidos a partir de observações realizadas em outros países ou fundamentadas em material oriundo de fora do Brasil.

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A Petrobras e o Meio Ambiente: Projeto Tamar

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A atuação da Petrobras com relação ao meio ambiente evolui permanentemente e, nos últimos anos, tem se manifestado em duas direções. De um lado, estabelecendo convênios, incentivando pesquisas e conscientizando seus empregados quanto à necessidade de melhorar o seu próprio desempenho na área ambiental e, de outro lado, patrocinando e incentivando projetos que sejam de interesse da sociedade como um todo.

Neste contexto se enquadra o apoio da Companhia ao Projeto Tamar - Tartarugas Marinhas - que já completou 15 anos, pois esta parceria vem desde 1982, dois anos após o IBDF ter criado o projeto, com o objetivo de salvar e proteger as espécies de tartarugas marinhas que habitam a costa brasileira.

Para a Petrobras o mar é mais do que o cenário de novas conquistas, fonte de divisas e motivo de orgulho para o País. É um patrimônio a ser preservado, por meio de iniciativas que contribuam efetivamente para a conservação das espécies e a manutenção dos ecossistemas marinhos.

Do subsolo marinho a Petrobras produz cerca de 70% do petróleo nacional, extraído por dezenas de plataformas, frutos de anos de pesquisas e investimentos expressivos em tecnologia e recursos humanos.

Os recursos financeiros repassados pela Petrobras, que é a patrocinadora oficial do projeto, contribuem significativamente para a manutenção da atual estrutura operacional das equipes de técnicos, que atuam em mil quilometros de praias brasileiras, por intermédio de 22 bases que cobrem nove estados. Este trabalho já vem sendo divulgado também no exterior, com exposições montadas em importantes cidades européias.

Os resultados positivos que a Petrobras vem registrando em sua atuação - já reconhecida internacionalmente - em exploração de petróleo em águas profundas estreitam ainda mais as relações de estudos e pesquisas sobre a ambiente marinho e sua importância para o desenvolvimento sócio-econômico e cultural do País.

Nos mares brasileiros vivem espécies de tartarugas marinhas que estão sendo preservadas pelo Projeto Tamar e em 1996 a parceria Petrobras x Tamar foi decisiva para o importante marco comemorativo da soltura do filhote número dois milhões.

Nesta união de tecnologia, ciência, educação e preservação ambiental, quem ganha é a vida.

Figura 1.