

Adaptation of two Falcon species *Falco femoralis* & *Falco subbuteo* to an Urban Environment

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ABSTRACT

Falco subbuteo in Europe and the New World *Falco femoralis* have been shown to be birds of open country with prey such as larks (Alaudidae) and swallows (Hirundinidae) in *Falco subbuteo* and a variety of passerine birds and small pigeons (Columbidae) in *Falco femoralis*. In contrast, pairs of both species can be found near or even in the cities of Berlin in Germany, and Rio de Janeiro in Brazil. *Falco subbuteo* exploit urban birds like sparrows (*Passer*), greenfinches (*Carduelis*), swifts (*Apus*) and escaped budgerigars (*Melopsittacus*), while *Falco femoralis* predate on passerine birds especially ground doves (*Columbina*). This phenomenon could be widespread, and the authors suggest further studies, especially in the Aplomado Falcon *Falco femoralis*.

INTRODUCTION

Like other vertebrates, birds of prey may exploit abundant food resources, shelter and protection that human settlements can offer (Klausnitzer 1988; Wandeler & Lüps 1993; Sukopp 1990). We studied two falcon species in Brazil and Germany and demonstrate here that even more stenotic species can adapt themselves to breed and hunt in big cities such as Rio de Janeiro and Berlin.

MATERIALS AND METHODS

Falco femoralis was studied in the city of Rio de Janeiro, Brazil, 22° 55' S / 43° 10' W, on excursions along the coast of the Atlantic ocean in the state ("estado") of Rio de Janeiro and Espírito Santo, 20° S / 40° W by KDF when he was living in Rio since 1991 and was joined by the co-author (PS) in Nov 1995, 1996 and Oct 1997, who trapped a resident male Aplomado and also the small birds in the home range of that Falcon. In Dec-Jan 1994-95 special attention was given to a pair of falcons with their offspring during the post-fledging period in a rural habitat in the Lake Region east of Rio de Janeiro; a pair of Aplomado Falcons were observed from July to September 1996 breeding (unsuccessfully) in an urban environment.

Falco subbuteo has been studied intensively in Berlin, Germany, 52° 30' N / 13° 20' E, since 1956 (Fiuczynski 1987), when falcons were abundant in city forests and even bred in gardens in city

districts like Steglitz, Frohnau and the cemetery of Pankow. Additional observations in the area (Wendland 1953) north of Berlin and an extension of the study area by P. Soemmer led to studies on all aspects of population ecology including colour banding of young and trapping of adults. Today an area of approx. 1,000 km² is covered every year by regular observations between April and Aug/ Sep; 1009 nestlings and 9 adults have been banded from 1956-1997 (Fiuczynski & Sömmmer 1995).

Rural habitat of *F. femoralis*

We found this hunter of birds, bats and insects in its typical habitat of "open country, rural areas" (Sick 1988) at 60 - 1 m a.s.l. with clumps of trees or small woods between pastures, cattle or horse raising areas and scattered farm houses between the fringe of the Atlantic rain forest (Mata Atlântica) and dune vegetation (Restinga) or the coast of the Atlantic ocean in the south-eastern region of Brazil, state of Rio de Janeiro up to Espírito Santo. The composition of the avicoenosis of one well studied pair in the Restingas de Maricá is given in Table 1. Trees were mainly *Eucalyptus*, *Mangifera indica*, Coconut palm trees, Casuarina (all planted), various Bignoniaceae like the yellow flowering Ipê amarelo, *Tabebuia chrysotricha*, and others, *Chorisia speciosa*, *Gouania polymorpha*. Of the 20 km² home range (including hunting territory), about 30 % were covered with trees (between 0.5 and 75 % at the mountain slope). Typical shrubs were *Tibouchina*, *Eugenia*, *Clusia*, among ground vegetation (cover 90 - 100 %), we found Bromeliads like *Aechmea nudicaulis*, *Neoregelia cruenta*, *Vriesea* and *Dyckia* in the Restinga dune zone (Rizzini *et al.* 1991).

Urban habitat of *F. femoralis*

After sporadic observations in the city a breeding pair was found in 1996 in an old *Milvago chimachima* nest in a coconut palm tree, 80 m a.s.l. on the SE slope of Corcovado mountain about 100 m from the densely populated district of Botafogo, 1302.9 ha with a human population of 251 668 (1991), i.e. 193.2 inhabitants / ha (Anuário Estatístico Da Cidade Do Rio De Janeiro) with apartment blocks, tall office and administration buildings, schools, hospitals. Also 50 m off the favela Dona Marta, there are approximately 1,000 inhabitants. The vegetation was the very fringe of Tijuca forest, a National Park of 33 km², formerly Atlantic rain forest, now secondary forest with characteristic trees like *Cecropia pachystachya*, *C. hololeuca*, *Artocarpus integrifolia* and *A. incisa*, *Caesalpinia echinata*, *Cariniana legalis*, *Chorisia speciosa*, *Ficus*, *Cassia* and members of the Bignoniaceae (Cezar *et al.* 1992). Parks and streets in Rio de Janeiro contain numerous trees such as *Cassia*, *Ficus*, *Triplaris*, *Mangifera*, *Pinus elliotti*, *Schizolobium parahyba*, *Pachira aquatica*, *Caesalpinia leucostachya* and others (Soares *et al.* 1994).

Forest-type and rural habitat of *F. subbuteo*

In the Berlin area, the falcons nest in old open Scots pinewoods of the *Pino - Quercetum* type, *Pinus sylvestris* with *Pteridium aquilinum* and *Avellana flexuosa*, near forest clearings and new growth not far from the city where they hunt small birds. North of Berlin and outside the Scots pine forest, smaller woods and clumps of pine trees are also inhabited by *F. subbuteo*. As in the Berlin region, the falcons breed in nests of *Corvus corone cornix*, *Corvus corax* and artificial baskets hung up by the authors (about 60 in Berlin and 30 outside) (Sömmmer 1991).

Urban habitat of *F. subbuteo*

Some of the falcons of the Berlin Scots pine forests already nested near the city, and in some cases individual pairs moved into the city and bred for some years in the urban districts of Berlin-Steglitz, Berlin-Frohnau and Berlin-Pankow (cemetery), breeding amidst houses and gardens in tall Scots pines.

Hunting in and around the city and abroad: *F. subbuteo*

The majority of the "Berlin forest falcons" and the urban pairs of *Falco subbuteo* used to hunt exclusively in the city with males delivering sparrows, *Passer domesticus* & *P. montanus* (53 %), Swallows/Martins *Delichon urbica* & *Hirundo rustica* (10 %), escaped Budgerigars *Melopsittacus undulatus* (9 %), Swifts *Apus apus* (9 %), Greenfinches *Carduelis chloris* (6 %), Larks *Alauda*

Table. 1. Avicoenosis in a rural habitat (Maricá, rj, Brazil)

<i>Crypturellus tataupa</i>	<i>Ardea cocoi</i>	<i>Casmerodius albus</i>
<i>Nycticorax nycticorax</i>	<i>Cochlearius cochlearius</i>	<i>Egretta caerulea</i>
<i>Egretta thula</i>	<i>Bubulcus ibis</i>	<i>Butorides striatus</i>
<i>Ixobrychus involucris</i>	<i>Anas bahamensis</i>	<i>Dendrocygna vituata</i>
<i>Amazonetta brasiliensis</i>	<i>Cathartes burrovianus</i>	<i>Cathartes aura</i>
<i>Coragyps atratus</i>	<i>Pandion haliaetus</i>	<i>Eleanus leucurus</i>
<i>Heterospizias meridionalis</i>	<i>Parabuteo unicinctus</i>	<i>Chondrohierax uncinatus</i>
<i>Buteo magnirostris</i>	<i>Buteo albicaudatus</i>	<i>Polyborus plancus</i>
<i>Milvago chimachima</i>	<i>Herpetotheres cachinnans</i>	<i>Falco sparverius</i>
<i>Falco femoralis</i>	<i>Gallinula chloropus</i>	<i>Porphyryla martinica</i>
<i>Rallus sanguinolentus</i>	<i>Porzana albicollis</i>	<i>Jacana jacana</i>
<i>Vanellus chilensis</i>	<i>Charadrius collaris</i>	<i>Himantopus palliatus</i>
<i>Nycticryphes semicollaris</i>	<i>Columba picazuro</i>	<i>Claravis pretiosa</i>
<i>Columbina talpacoti & minuta</i>	<i>Brotoyeris tirica</i>	<i>Amazona amazonica</i>
<i>Crotophaga ani</i>	<i>Guira guira</i>	<i>Tapera naevia</i>
<i>Coccyzus americanus</i>	<i>Coccyzus melacoryphus</i>	<i>Speotyto cunicularia</i>
<i>Hydropsalis brasiliana</i>	<i>Macropsalis creagra</i>	<i>Nyctidromus albicollis</i>
<i>Podager nacunda</i>	<i>Eleothreptus anomalus</i>	<i>Streptoprogne zonaris</i>
<i>Chaetura anrei</i>	<i>Thalurania clauopsis</i>	<i>Anthracothonax nigricollis</i>
<i>Amazilia fimbriata</i>	<i>Eupetomena macroura</i>	<i>Ceryle torquata</i>
<i>Chloroceryle americana</i>	<i>Nystalus chacuro</i>	<i>Colaptes campestris</i>
<i>Leuconerpes candidus</i>	<i>Veniliornis passerinus</i>	<i>Picumnus cirrhatas</i>
<i>Progne chalybea</i>	<i>Phaeoprogne tapera</i>	<i>Riparia riparia</i>
<i>Notiochelidon cyanoaleuca</i>	<i>Stelgiopteryx ruficollis</i>	<i>Tachycineta leucorrhoa</i>
<i>Furnarius figulus</i>	<i>Furnarius rufus</i>	<i>Thamnophilus punctatus</i>
<i>Myrmotherula axillaris</i>	<i>Pachyrhamphus polychropteri</i>	<i>Manacus manacus</i>
<i>Machetornis rixosus</i>	<i>Tyrannus melancholicus</i>	<i>Pitangus sulphuratus</i>
<i>Myiozetetes cayanensis</i>	<i>Myiozetetes similis</i>	<i>Myiodynastes maculatus</i>
<i>Muscivora tyrannus</i>	<i>Elaenia flavogaster</i>	<i>Gubernates yetapa</i>
<i>Tolomias flaviventris</i>	<i>Fluvicola nengeta</i>	<i>Myiophobus fasciatus</i>
<i>Serpophaga subcristata</i>	<i>Culicivora caudacuta</i>	<i>Arundinicola leucocephala</i>
<i>Turdus rufiventris</i>	<i>Turdus leucomelas</i>	<i>Mimus saturninus</i>
<i>Donacobius atricapillus</i>	<i>Troglodytes aedon</i>	<i>Thryothorus genibarbis</i>
<i>Hylophilus thoracicus</i>	<i>Conirostrum speciosum</i>	<i>Dacnis cayana</i>
<i>Coreba flaveola</i>	<i>Cacicus cela</i>	<i>Agelaius ruficapillus</i>
<i>Leistes militaris</i>	<i>Parula pitiauyumi</i>	<i>Ramphocelus bresilius</i>
<i>Ramphocelus carbo</i>	<i>Thraupis sayaca</i>	<i>Thraupis palmarum</i>
<i>Nemosia pileata</i>	<i>Saltator maximus</i>	<i>Emberizoides herbicola</i>
<i>Zonotrichia capensis</i>	<i>Sicalis flaveola</i>	<i>Passer domesticus</i>
<i>Estrilda astrild</i>	<i>Sporophila frontalis</i>	<i>Sporophila caeruleascens</i>
<i>Sporophila bouvreuil</i>	<i>Volatinia jacarina</i>	

arvensis & *Lullula arborea* (0.3 %) (Fiuczynski 1987; Gawlik & Otto 1982) of 758 avian prey items. In contrast to this ranking, falcons in rural areas usually feed on Swallows (40%), Larks (21 %), Sparrows (6 %) and Swifts (2 %) out of 916 prey items all over Germany (Uttendörfer 1952). In Holland Bijlsma (1980) found 18 % Swallows, 11 % Larks, 28 % Sparrows and 6 % Swifts of 5728 prey items. Similar results were obtained in the falcons north of Berlin hunting in agricultural areas: 37% Swallows/Martins, 21% Sparrows, 18 % Sky Larks and 5 % Swifts 254 prey items 1987-1997, (Soemmer unpubl.).

Falco femoralis

In open *rural habitat*, we found an adult pair hunting using the known pair-hunting strategy which was synchronized from the beginning, i.e. leaving the lookout in an eucalyptus tree to attack a bird. The male flew above waiting for a chance to stoop while the female flushed out a hiding passerine from a shrub for the waiting male. Other methods included a communal "stoop and chase" pursuit of higher flying small pigeons like *Columbina minuta*. After having left the nest, young falcons preyed heavily and successfully on large tree-sitting cicadas (*Quesada gigas*), which they located acoustically and optically, this attracted other fledged young of the region to join until 7 young perched in trees on the hill, competing for those singing cicadas. The male of the *urban pair* in Rio de Janeiro brought avian prey to the female during the courtship and brooding period. Concluding from time and direction of the male's arrival around sunrise and sunset - minimum 6 minutes before sunrise in the short tropical dawn - the male hunted 1.5, maximum 10, km from the nest in the city districts of Botafogo and Lagoa, where "rolinhas" *Columbina talpacoti* bred and also gathered in flocks being fed by humans, thus constituting a numerous and easily available prey among other members of the urban avicosenosis such as Tyrannidae (*Pitangus sulphuratus*, *Tyrannus melancholicus*), Turdidae *Turdus rufigiventris* and - less numerous - House Sparrow *Passer domesticus*. The columbid food resource is also exploited by Peregrine Falcons *Falco peregrinus* coming from the northern hemisphere and spending the southern summer from November to March regularly in Rio de Janeiro (Sick 1988; pers. obs.). Their hunting methods are similar to the Aplomado Falcons hunting the numerous bats (*Chiroptera*) at dusk above the favela Dona Marta and at the fringe of Tijuca National Park forest.

CONCLUSION

Apparently the abundance of food and also lack of human persecution towards *F. femoralis* and *F. subbuteo* offer them an opportunity to breed and hunt inside cities if at least a few trees are available. We presume that this phenomenon is more widespread for *F. femoralis* and suggest further study in its distribution area in Latin America.

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