

- GONZÁLEZ, J.L. 1991. El Aguilucho lagunero *Circus aeruginosus* en España: situación, biología de la reproducción, alimentación y conservación. Ed. ICONA, Madrid, Spain.
- JOHANNESSON, H. 1975. Activities of breeding Marsh Harriers *Circus aeruginosus*. *Vår Fågelvärld* 34:197–206.
- NEWTON, I. 1976. Population limitation in diurnal raptors. *Can. Field-Nat.* 90:274–300.
- . 1979. Population ecology of raptors. T. and A.D. Poyser, Berkhamsted, U.K.
- . 1986. The Sparrowhawk. T. and A.D. Poyser, Berkhamsted, U.K.
- SASVARI, L. 1990. Feeding response of mated and widowed bird parents to fledglings: an experimental study *Ornis Scand.* 21:287–292.
- SOKAL, R.R. AND F.J. ROHLF. 1969. Biometry. Freeman and Co., San Francisco, CA.
- TRIVERS, R.L. 1972. Parental investment and sexual selection. Pages 136–179 in B. Campbell [ED.], Sexual selection and the descent of man. Aldine Press, Chicago, IL.

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### BATS AS PREY OF STYGIAN OWLS IN SOUTHEASTERN BRAZIL

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Few studies have examined quantitatively large numbers of pellets or stomachs for assessing the relative frequency of bats as prey of owls (cf., Uttendörfer 1943, Ruprecht 1979, Mikkola 1983). Pellets cast by three or four Stygian Owls (*Asio stygius*) were collected during 25 mo, mostly between June 1985 and February 1987 and sporadically in August–September 1989, December 1990 and February 1991. We collected pellets under trees in a *Pinus* sp. plantation located in São Carlos, São Paulo State, southeastern Brazil (21°58'S, 47°52'W) at an altitude of 840 m. The climate of the study area is a transition between Köppen's Cwai and Aw, or rainy tropical with dry (April to September) and wet (October to March) seasons (To-

lentino 1967). The nocturnal foraging activities of the owls took place in savannah ("campo cerrado") and grassland ("campo") habitats near the *Pinus* plantation, which was used for diurnal roosting. All data were gathered through direct observation in the study area.

A total of 422 pellets were analyzed after treatment with a 3% boiling solution of NaOH (Schueler 1972). Prey remains were identified by comparison with reference collections. The bulk of the prey items consisted of small birds (Table 1), mostly finches (e.g., *Volatinia jacarina* which alone comprised 62.5% of all birds or 56.3% of all prey), weighing 10–15 g (J.C. Motta Junior unpubl.). Bats were the second most frequent prey whereas insects

Table 1. Numbers of prey items found in pellets of Stygian Owls in two climatic seasons in southeastern Brazil.

PREY	DRY SEASON		WET SEASON		TOTAL	
	N	(%)	N	(%)	N	(%)
Bats	49	(5.7)	26	(6.8)	75	(6.1)
Birds	793	(93.1)	318	(83.7)	1111	(90.2)
Frogs	0		1	(0.3)	1	(0.1)
Insects	10	(1.2)	35	(9.2)	45	(3.6)
<b>Total Prey</b>	<b>852</b>	<b>(100.0)</b>	<b>380</b>	<b>(100.0)</b>	<b>1232</b>	<b>(100.0)</b>
<b>Total Pellets</b>	<b>265</b>		<b>157</b>		<b>422</b>	

Table 2. Bats ( $N = 75$ ) found as prey of Stygian Owls in southeastern Brazil. Body weights were obtained from museum specimens, collected in São Paulo state.

SPECIES	WEIGHT (g) (RANGE)	(N)	NO. (%) OF BATS IN PELLETS
<b>Molossidae</b>			
<i>Eumops glaucinus</i>	28.6–38.6	(12)	47 (62.7%)
<i>Nyctinomops laticaudatus</i>	8.5–13.8	(6)	10 (13.3%)
<i>Nyctinomops macrotis</i>	26.0	(1)	1 (1.3%)
<b>Vespertilionidae</b>			
<i>Eptesicus furius</i>	5.0–7.2	(8)	3 (4.0%)
<i>Histiotus velatus</i>	7.0–10.8	(9)	1 (1.3%)
<i>Lasiurus blossevillii</i>	8.7–11.4	(3)	1 (1.3%)
<i>Lasiurus cinereus</i>	14.3–23.5	(3)	3 (4.0%)
<i>Lasiurus ega</i>	14.3–15.0	(3)	6 (8.0%)
<b>Phyllostomidae</b>			
<i>Glossophaga soricina</i>	8.2–12.0	(86)	1 (1.3%)
<i>Chiroderma doriae</i>	26.9–33.0	(18)	1 (1.3%)
<i>Pygoderma bilabiatum</i>	15.4–15.9	(2)	1 (1.3%)

(Scarabaeidae and Orthoptera) and a frog seemed to be of minor importance. The absence of rodents in the diet of the Stygian Owls studied was surprising. Rodents were abundant in the study area as evident from their frequent occurrence in pellets of Barn Owls (*Tyto alba*) living in the same area (Motta Junior 1988).

G-tests (Sokal and Rohlf 1969) applied to seasonal frequencies of prey items (Table 1) demonstrated that insects were more frequently preyed upon during the wet season ( $G = 39.92$ ,  $P < 0.001$ ), whereas consumption of birds and bats did not show seasonal trends ( $G = 2.58$ ,  $P > 0.10$  and  $G = 0.35$ ,  $P > 0.50$ , respectively).

Eleven species of bats in eight different genera and three families were recorded. The largest bat (*Eumops glaucinus*) was also the most frequently preyed upon by Stygian Owls (Table 2).

Data from Colombia (Borrero 1967), Belize (Franz 1991) and from Colima, Mexico (based on three pellets) were similar to ours. Except for the Black-and-White Owl (*Ciccaba nigrolineata*) that forages heavily on bats (Ibáñez et al. 1983) and the Stygian Owl (this study), apparently no other owls include bats so frequently (6.1%) in their diet (cf., Uttendörfer 1943, Earhart and Johnson 1970, Burton 1973, Mikkola 1983).

RESUMEN.—Durante 25 meses, entre junio de 1985 y febrero de 1991, estudiamos la ocurrencia de murciélagos en la dieta del Tecolote Fusco (*Asio stygius*) en el sudeste de Brasil. El análisis de 422 egagrópilas rindió 1232 presas

entre las cuales las aves representaron 90,2%, los murciélagos 6,1%, los insectos 3,6%, y los anuros 0,1%. Identificamos 11 especies de murciélagos entre 75 individuos. *Eumops glaucinus* fue la especie más frecuente (47 individuos). La predación de murciélagos fue regular a lo largo de las estaciones. *Asio stygius* es apuntada como una de las especies de Strigiformes que más preda murciélagos en todo el mundo.

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#### LITERATURE CITED

- BORRERO, J.I. 1967. Notas sobre hábitos alimentarios de *Asio stygius robustus*. *Hornero* 10:445–447.
- BURTON, J.A. [ED.]. 1973. Owls of the world. E.P. Dutton and Co., New York.
- EARHART, C.M. AND N.K. JOHNSON. 1970. Size dimorphism and food habits of North American owls. *Condor* 72:251–264.
- FRANZ, M. 1991. Field observations on the Stygian Owl *Asio stygius* in Belize, Central America. (Abstract). *J. Raptor Res.* 25:163.
- IBÁÑEZ, C., C. RAMO AND B. BUSTO. 1983. La lechuza blanquinegra (*Ciccaba nigrolineata*) como depredador de murciélagos. Page 123 in F.G. Stiles and P.G. Aguiar [EDS.], Primer Simposio de Ornitología Neotropical, Lima, Peru.
- MIKKOLA, H. 1983. Owls of Europe. Buteo Books, Vermillion, SD.
- MOTTA JUNIOR, J.C. 1988. Alimentação diferencial da suindara (*Tyto alba*) (Aves, Strigiformes) em duas estações do ano em São Carlos, estado de São Paulo *Anais do Seminario Regional de Ecologia* 5:357–364.
- RUPRECHT, A.L. 1979. Bats (Chiroptera) as constituents of the food of Barn Owls *Tyto alba* in Poland. *Ibis* 121: 489–494.
- SCHUELER, F.W. 1972. A new method of preparing owl pellets: boiling in NaOH. *Bird-Banding* 43:142.
- SOKAL, R.R. AND F.J. ROHLF. 1969. Biometry. W.H. Freeman and Co., San Francisco, CA.
- TOLENTINO, M. 1967. Estudo crítico sobre o clima da região de São Carlos. Concurso de Monografias Municipais. São Carlos, São Paulo, Brazil.
- UTTENDÖRFER, O. 1943. Fledermäuse als Raubvogel—und Eulenbeute. *Z. Säugetierk.* 15:317–319.

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