J. Field Ornithol., 58(3):306–310

FAT DEPOSITS AND MOLT OF BIRDS MIST-NETTED IN SOUTHEASTERN PERU

ANDRZEJ DYRCZ
Department of Avian Ecology
Wroclaw University
Sienkiewicza 21
50-335 Wroclaw, Poland

Abstract.—Six hundred individuals of 111 species were caught during the middle of the rainy season, November–February. Fat deposits occurred in 251 birds of 67 species. These deposits never reached the maximum found in migrating birds of the temperate zone. Manakins had the highest percentage of individuals with fat pads. Nearly half the inspected birds were molting, and the proportion of molting birds increased toward February. Fat deposition was negatively correlated with molt.

DEPÓSITOS DE GRASA Y MUDA EN AVES ATRAPADAS EN SE DE PERU

Sinopsis.—A mediados de la época de lluvia (noviembre a febrero) se capturaron 600 aves pertenecientes a 111 especies. Encontré depósitos de grasa en 251 individuos pertenecientes a 67 species. Estos depósitos de grasa no alcanzaron las cantidades máximas informadas en estudios previos sobre aves migratorias en la zona templada. El porcentaje mayor de individuos con depósitos de grasa recayó en la familia Pipridae. Cerca del 50% de las aves examinadas estaban mudando. Hubo un aumento en la proporción de aves mudando hacia el mes de febrero. Encontré una correlacion negativa entre la deposición de grasa y la muda de las aves.

Subcutaneous and visceral fat deposits were first reported in migrant birds of the temperate zone, especially just before their migration. These fat pads provide fuel for extended migratory flights (e.g., Berthold 1975, Helms and Drury 1960). Lipids have almost twice as much energy as the same dry weight of carbohydrate, but, unlike carbohydrate, do not require large amounts of additional water (Sturkie 1976). Although tropical and subtropical birds migrate less than temperate-zone birds, we know nothing about their tendency to develop fat deposits.

STUDY AREA AND METHODS

Between 7 November 1985 and 12 February 1986 I mist-netted birds in Tambopata Reserve (12°50′S, 69°17′W), ca. 30 km SW from the Puerto Maldonado (SE Peru) in a primary lowland rain forest. The reserve lies on rather flat land at an average elevation of ca. 250 m. I used 7–14 mist nets of various lengths and about 3.5 m high. I determined fat condition of the birds visually, according to the six degree scale used by Operation Baltic in Poland (Busse 1970). The scale is modified from Helms and Drury (1960). The study occurred during the middle of the rainy season, which in Tambopata starts in the second part of October and lasts to the beginning of April.

RESULTS

Six hundred individuals of 111 species were caught and inspected for fat. Fat deposits occurred in 251 birds of 67 species and 20 families. In

TABLE 1. Fat deposits, molt, and family of birds captured in mist nets.

Family Subfamily	n	Fat scale F_0	F_1–F_2	F_3	% of individuals with fat deposits	No. of individuals molting	No. of individuals not molting
Cuculidae	2	2					2
Trochilidae	49	39	10		20.4	26	23
Momotidae	5	5				3	2
Alcedinidae	4	3	1				4
Bucconnidae	5	3	2			3	2
Galbulidae	1		1			1	
Ramphastidae	14	13	1		7.1	4	10
Picidae	2	2				2	
Furnariidae	40	32	8		20.0	28	12
Dendrocolaptidae	50	28	22		44.0	22	28
Formicariidae	177	104	69	4	41.2	120	57
Tyrannidae	64	43	21		32.8	24	40
Pipridae	118	35	82	1	70.3	26	92
Hirundinidae	1		1				1
Troglodytidae	9	7	2			7	2
Muscicapidae	24	13	11		45.8	1	23
Mimidae	1		1			1	
Vireonidae	1		1				1
Emberizidae							
Icterinae	5	3	2			1	4
Thraupinae	13	7	6		46.1	3	10
Fringillidae	15	10	5		33.3	8	7
Totals	600	349	246	5	41.8	280	320

ten families the number of inspected individuals was sufficient to permit analysis. Manakins had the highest percentage of individuals with fat pads (Table 1). The percentage was also high in woodcreepers, antbirds, thrushes, and tanagers, and rather low in toucans, aracaris, hummingbirds, and furnarids. Nearly half the inspected birds (including 39 retraps) were molting (Tables 1 and 2). In some species only a few individuals were molting (e.g., Ruddy Quail-Dove [*Geotrygon montana*], Band-tailed Manakin [*Pipra fasciicauda*], Fiery-capped Manakin [*Machaeropterus pyrocephalus*], Table 2), and in others a large number were molting (e.g., White-throated Antbird [*Gymnopithys salvini*], Table 2). Possibly the species that showed little molt were breeding when captured. On 19 Nov. and 18 Dec. I caught a female Band-tailed Manakin with a brood-patch and on 14 Jan. I found a Ruddy Quail-Dove nest with an incubating bird. The proportion of molting birds increased in the latter part of the study period ($\chi^2 = 19.3$, df $= 3$, $P < 0.001$, Table 2), perhaps signifying the end of the breeding season as molting and breeding rarely overlap in land birds (Payne 1972). This was confirmed also for some tropical regions (Fogden 1972, Stiles 1980). There is little information

TABLE 2. Number of molting individuals of selected species, Nov. 1985–Feb. 1986.

Species	Nov.		Dec.		Jan.		Feb.		Total	
	Molt	No molt	Molt	No molt	Molt	No molt	Molt	No molt	Molt	No molt
Ruddy Quail-Dove[a] (*Geotrygon montana*)	2	6	1	5	0	6	0	2	3	19
White-throated Antbird (*Gymnopithys salvini*)	1	0	6	1	14	4	8	0	29	5
Band-tailed Manakin (*Pipra fasciicauda*)	10	30	5	26	6	3	0	0	21	59
Fiery-capped Manakin (*Machaeropterus pyrocephalus*)	0	7	1	12	1	6	2	2	4	27
Other species	27	49	81	72	87	80	31	28	226	229
Total	40	92	94	116	108	99	41	32	283	339

[a] In Table 1, 22 Doves were omitted as it is difficult to see fat.

about the timing of breeding among birds of Tambopata, but in lowland rainforests in Central America, Trinidad, Natal, and Sarawak (Borneo) many species show the highest intensity of breeding at the beginning of the rainy season, when insects are most abundant (Fogden 1972, Moreau 1950, Skutch 1950, Snow and Snow 1964), however hummingbirds often breed at other times (Stiles 1980). I found that fat deposition is negatively correlated with molt. Fat deposits were found in only 33.2% of molting individuals, but in 44.8% of non-molting individuals ($n = 600$, $\chi^2 = 8.8$, $P < 0.01$). Apparently some species deposit fat before molt, as an adaptation to the energetic demands of molting. In some species fat reserves are used up during breeding and accumulated again during or after molt, if there is a lean season. There is nothing known, however, about a lean season in Tambopata region.

CONCLUSIONS

The data confirm that tropical birds have fat deposits similar to those found in temperate-zone birds. Fat deposits in tropical birds were reported earlier from Honduras (Udvardy 1975), but the deposits found in the birds of Honduras and Tambopata never reach the maximum found by various authors in migrating birds of the temperate zone. Among Tambopata birds, low fat scores of 1 and 2 dominated with no score exceeding 3, whereas among migrating temperate-zone birds scores of 4 and 5 are not rare (e.g., Dyrcz 1981). This might be connected with lower energy demands in tropical birds in comparison to their temperate counterparts (Bryant and Hails 1983, Hails 1983), and less migration among tropical birds, as well.

Fat storage suggests that in the tropics there are periods of favorable and unfavorable feeding conditions. During a good period the bird accumulates fat to survive periods of unfavorable conditions, or periods with high energy demands like molting or breeding. The seasonality of many aspects of tropical, lowland rain forest life, including insect abundance, was recently stressed by Wolda (1978, 1983) and Leigh et al. (1983). Furthermore, the energetic cost of molting is high in temperate-zone birds (e.g., Dolnik and Gavrilov 1979) and relies on fat consumption (see Spitzer's 1972 data on Bearded Tit [*Panurus biarmicus*]). The same may be true of tropical avifauna.

ACKNOWLEDGMENTS

I am grateful to Dr. F. G. Stiles for his helpful comments, and to Barry Walker, Tansy J. Bliss and Keith Hambler for their help in the field.

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Received 26 Aug. 1986; accepted 25 Jan. 1987.