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SHORT COMMUNICATION

Migrant abundance in a Costa Rican lowland forest canopy

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Birds that breed in temperate North America (hereafter 'migrants') comprise 20-40% of the winter population in Costa Rica and Panama (Hutto 1980, Terborgh 1980). Migrants often occupy tropical habitats for 6-8 months and are an integral part of tropical avifaunas (Stiles 1983a). Many species of migrants are more abundant in second growth woodlands than in primary forest (Hutto 1980, Karr 1976, Martin 1985; but see Waide *et al.* 1980) but habitat selection patterns of migrants in the tropics are still poorly known. For example, Greenberg (1981) found many migrants in the canopy at Barro Colorado Island, Panama and suggested that previous conclusions on the rarity of migrants in lowland forest be re-evaluated. However, Martin (1985) noted that the forest section censused by Greenberg (1981) contained some aspects of the vegetation that are characteristic of younger forest (Foster & Brokaw 1982) and suggested that migrants might be more abundant in the canopy of Greenberg's site (70-100 years old; Greenberg 1981) than in the canopies of older forests.

I examined seasonal use of lowland forest canopy by migrants. Canopy habitats are a neglected area in tropical bird studies (Wilson 1984). Previous studies on habitat use by migrants have concentrated on understory and low-level birds (but see Greenberg 1981) because canopy birds are extremely difficult to count in lowland rain forest (Stiles 1983a).

I conducted canopy censuses in lowland wet forest at La Selva Biological Station (10° 25′ N, 84° 01′ W), Costa Rica (described in Hartshorn 1983). I used climbing ropes (Perry 1978) to gain access to the canopies of two emergent trees (*Dipteryx panamensis* (Pittier) Record and *Hymenolobium pulcherrium* (Ducke) located >500 m from forest edge. I conducted 49 censuses from 1 April 1985 to 28 April 1986. Censuses were concentrated during the period of migrant presence at La Selva in 1985-1986 (Figure 1). They began at sunrise and lasted 2-3 hours. The *Dipteryx* had a platform 32 m above the ground

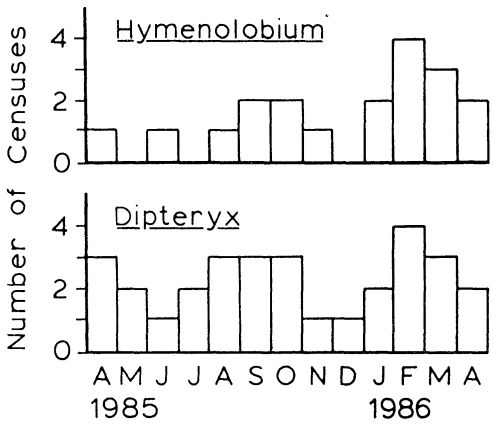

Figure 1. Distribution of canopy censuses from two emergent canopy trees at La Selva Biological Station, Costa Rica during 1985 and 1986.

and I was able to conduct 30 3-hour censuses from this tree. I restricted my census to 2 hours while in the *Hymenolobium* (19 censuses) because no platform was available and I had to conduct the census while hanging from a rope at 30 m. Some censuses were shortened by rain.

All birds seen or heard within 100–125 m (distances measured with range-finder) were recorded in 15-minute intervals and the maximum number of individuals per species within a 15-minute period was used for analysis of census results. For example, if 2, 1, and 4 individuals of migrant species A were observed in time periods 1, 2, and 3 and 0, 5, and 3 individuals of migrant species B were observed in time periods 1, 2, and 3, then for that census day I would record a maximum of 4 and 5 individuals of species A and B or a total of 9 migrants. The direction in which a recorded bird flew was noted within each 15-minute period to avoid double counting, and the number of individuals recorded was conservative. Birds flying over the canopy were not recorded. Activity declined markedly after 08.00 h and few individuals or species were added in the third hour. However, to compare migrant abundance in the two trees, I did not include new individuals or species that were recorded in the third hour from the *Dipteryx* on 17 occasions when censuses in the two trees were conducted within a three-day period.

Migrants were present in 35 of the 49 census dates and 12 species were recorded (Table 1). I limit discussion hereafter to 38 censuses that encompass the periods (April 1985 and September 1985 to April 1986) when migrants were present at La Selva. Migrants were not recorded in the canopy on three of these censuses, but were known to be present at La Selva and were recorded from the other tree within a three-day period. Mean number of migrants (± 1 SE) seen during this period was 2.5 (± 0.40) per census ($N = 38$ censuses). (Mean number of migrants is calculated from the totals of the maximum number of migrant individuals of each species recorded during any 15-minute time period in each census.)

Table 1. Number of migrant individuals observed in canopy censuses from *Dipteryx panamensis* and *Hymenolobium pulcherrimum*.

Species	*Dipteryx*	*Hymenolobium*
Olive-sided Flycatcher *Contopus borealis*	1	0
Eastern Wood-Pewee *C. virens*	2	2
Empidonax sp.	1	4
Great Crested Flycatcher *Myiarchus crinitus*	2	0
Red-eyed Vireo *Vireo olivaceus*	6	6
Tenessee Warbler *Vermivora peregrina*	11	4
Chestnut-sided Warbler *Dendroica pensylvanica*	23	12
Blackburnian Warbler *D. fusca*	2	1
Bay-breasted Warbler *D. castanea*	2	5
Dendroica sp.	0	1
Canada Warbler *Wilsonia canadensis*	1	0
Summer Tanager *Piranga rubra*	1	2
Northern Oriole *Icterus galbula*	2	4

I found no significant difference in the mean number of migrants seen per census in *Dipteryx* (2.2 ± 0.53) and *Hymenolobium* (2.4 ± 0.69) when censuses in the two trees were conducted within the same three-day period (paired $t = -0.29$, $P > 0.75$, $df = 16$). Furthermore, even when all census dates were included and censuses were not corrected for day length, mean number of migrants observed did not differ significantly between *Dipteryx* (2.5 ± 0.55, $N = 21$ censuses) and *Hymenolobium* (2.4 ± 0.69, $N = 17$ censuses) ($t = 0.19$, $P > 0.80$). Similarly, there was no significant difference in the mean number of migrant species observed using comparable dates and census length (*Dipteryx*: 1.65 ± 0.41; *Hymenolobium*: 1.88 ± 0.45) (paired $t = -0.40$, $P > 0.60$) or when all dates were used (*Dipteryx*: 1.90 ± 0.37, $N = 21$) ($t = 0.04$, $P > 0.95$). Because migrants were equally abundant in the canopies surrounding these two forest trees, I combined data from the two trees for the following analysis.

Canopy use by migrants varied seasonally with more migrants observed during fall migration than during periods of winter residence ($t = 1.83$, $P < 0.10$) or spring migration ($t = 2.01$, $P < 0.07$) (Table 2). Similarly, I observed more migrant species during fall migration than either winter ($t = 1.77$, $P < 0.10$) or spring migration ($t = 1.72$, $P = 0.10$) (Table 2). I observed no difference between winter and spring periods either in number of migrant species observed ($t = 0.0$, $P > 0.99$) or number of migrant individuals ($t = 0.42$, $P > 0.60$).

Eight migrant species occurred in forest canopy in fall and spring migration only. Five species (Olive-striped Flycatcher, Eastern Wood-Pewee, Great Crested Flycatcher, Canada Warbler, and Summer Tanager) were observed only in fall; no species were seen only in spring. I observed Tennessee, Bay-breasted, and Chestnut-sided Warblers during all three periods in the canopy. Northern Orioles were observed in fall and winter only.

Some migrant species - Eastern Kingbird (*Tyrannus tyrannus*), Scarlet Tanager (*Piranga olivacea*), Orchard Oriole (*Icterus spurius*), and Black-and-white Warbler (*Mniotilta varia*) - were observed in second-growth or forest edge

canopy, but not interior forest canopy. In particular, Eastern Kingbirds, a common spring migrant at La Selva, were observed daily in large flocks during late March and April consuming fruits in secondary habitats. Kentucky Warbler (*Oporornis formosus*), Ovenbird (*Seiurus aurocapillus*), Swainson's Thrush (*Catharus ustulatus*), Gray-cheeked Thrush (*C. minimus*), and Wood Thrush (*Hylocichla mustelina*) were observed in forest understory, but not in the canopy. However, the latter three species did forage in subcanopy trees, especially during fall migration (unpublished diet data).

In a similar study, Greenberg (1981) recorded 11 species of migrants in the canopy during censuses from a fixed tower on Barro Colorado Island, Panama. Greenberg (1981) divided his census year into five seasons based on rainfall, and three of his seasons (late wet, early and late dry) correspond to fall migration, winter residence, and spring migration, respectively. In each season, Greenberg (1981) observed more migrants per census than I did (fall: $t = 4.90$, $df = 11$, $P < 0.001$; winter: $t = 9.73$, $df = 12$, $P < 0.001$; spring: $t = 5.88$, $df = 12$, $P < 0.001$) (Table 2, 2-tailed t-test, Zar 1974). Migrants were most abundant during fall migration in both forests and declined during spring. Stiles (1983a) also has observed that migrants were more abundant in Costa Rica during fall migration, largely because migrants funnel along the coasts as they move northward in spring.

Contrary to patterns observed in the canopy in Panama and Costa Rica, Martin (1985) observed that migrants increased in abundance in second-growth woodland during spring migration relative to winter abundance. We have observed a similar shift in understory birds at our second-growth woodland sites at La Selva (Blake and Loiselle, unpublished data). Martin (1985) postulated that migrants concentrate in second-growth woodland, especially during spring migration, because of the increased relative abundance of fruits in these habitats. Most migrants are highly frugivorous during spring migration and fruits provide high energy for migration demands (Martin 1985). Perhaps the decline in abundance of canopy migrants observed by Greenberg (1981) and in this study during spring migration was a result of migrants switching to habitats with relatively high fruit abundance, such as second-growth woodland. Relatively few canopy trees produce fruits in March and April at La Selva (Frankie

Table 2. Mean ± 1 SE number of North American migrants seen per census from La Selva, Costa Rica and Barro Colorado Island, Panama (means only; from Figure 2, Greenberg 1981) during fall migration (September–November), winter residence (December–late February), and spring migration (March–April). N = number of censuses.

	La Selva			Barro Colorado Island
Season	N	Individuals	Species	Individuals
Fall	12	3.9 ± 1.02	2.8 ± 0.73	8.9
Winter	13	1.9 ± 0.37	1.5 ± 0.27	5.5
Spring	13	1.7 ± 0.41	1.5 ± 0.33	4.1

et al. 1974). In contrast, many species are fruiting during fall migration (Frankie *et al.* 1974), a period of high migrant abundance in the canopy.

As suggested by Martin (1985), migrants were more abundant overall in the canopy of Barro Colorado Island than older forest (this study, Table 2). However, these differences are probably due to a combination of factors that include canopy vegetation structure, as a function of age of forest and rainfall, and non-breeding distribution patterns of North American migrants. Bay-breasted Warblers accounted for much of the difference between the two forest canopies (Greenberg recorded a total of 134 individuals in 35 censuses). This warbler is more common as a transient than as a winter resident in La Selva and only a few overwinter in Costa Rica; more over-winter in Panama (Stiles 1983b, Wetmore *et al.* 1984). Canopy studies conducted simultaneously in old and younger forest at the same latitude are needed to clarify canopy use by migrants.

In summary, canopy use by migrants is seasonal in lowland wet forest with abundance highest during fall and lowest during spring migration. Low abundance of canopy migrants during spring may be attributable to the primarily frugivorous habits of spring migrants and the relatively low availability of canopy fruits at this time.

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LITERATURE CITED

FOSTER, R. B. & BROKAW, N. V. L. 1982. Structure and history of the vegetation of Barro Colorado Island. Pp. 67-81 in Leigh, E. G., Jr, Rand, A. S. & Windsor, D. M. (eds). *The ecology of a tropical forest: seasonal rhythms and long-term changes.* Smithsonian Institution Press, Washington, DC.

FRANKIE, G. W., BAKER, H. G. & OPLER, P. A. 1974. Comparative phenological studies of trees in tropical wet and dry forests in the lowlands of Costa Rica. *Journal of Ecology* 62:881-919.

GREENBERG, R. 1981. The abundance and seasonality of forest canopy birds on Barro Colorado Island, Panama. *Biotropica* 12:241-251.

HARTSHORN, G. 1983. Plants: introduction. Pp. 118-157 in Janzen, D. H. (ed.). *Costa Rican natural history.* University Chicago Press, Chicago.

HUTTO, R. L. 1980. Winter habitat distribution of migratory land birds in western Mexico with special reference to small, foliage-gleaning insectivores. Pp. 181-203 in Keast, A. & Morton, S. (eds). *Migrant birds in the neotropics: ecology, behavior, distribution, and conservation.* Smithsonian Institution Press, Washington, DC.

KARR, J. R. 1976. On the relative abundance of migrants from the north temperate zone in tropical habitats. *Wilson Bulletin* 88:433-458.

MARTIN, T. E. 1985. Selection of second-growth woodlands by frugivorous migrating birds in Panama: an effect of fruit size and plant density? *Journal of Tropical Ecology* 1:157-170.

PERRY, D. R. 1978. A method of access into the crowns of emergent and canopy trees. *Biotropica* 10:155-157.

STILES, F. G. 1983a. Birds: introduction. Pp. 502-530 in Janzen, D. H. (ed.). *Costa Rican natural history*. University Chicago Press, Chicago.
STILES, F. G. 1983b. Checklist of birds. Pp. 530-544 in Janzen, D. H. (ed.). *Costa Rican natural history*. University Chicago Press, Chicago.
TERBORGH, J. W. 1980. The conservation status of neotropical migrants: present and future. Pp. 21-30 in Keast, A. & Morton, E. S. (eds). *Migrant birds in the neotropics: ecology, behavior, distribution, and conservation*. Smithsonian Institution Press, Washington, DC.
WAIDE, R. B., EMLEN, J. T. & TRAMER, E. J. 1980. Distribution of migrant birds in the Yucatan Peninsula: a survey. Pp. 165-171 in Keast, A. & Morton, E. S. (eds). *Migrant birds in the neotropics: ecology, behavior, distribution, and conservation*. Smithsonian Institution Press, Washington, DC.
WETMORE, A., PASQUIER, R. F. & OLSON, S. L. 1984. *The birds of the Republic of Panama, Part 4. Passeriformes: Hirundinidae (Swallows) to Fringillidae (Finches)*. Smithsonian Miscellaneous Collections, Volume 150, Part 4. Smithsonian Institution Press, Washington, DC. 670 pages.
WILSON, E. O. 1984. *Biophilia*. Harvard University Press, Cambridge, Mass. 157 pages.
ZAR, J. H. 1974. *Biostatistical analysis*. Prentice-Hall, Englewood Cliffs, New Jersey. 620 pages.

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