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Status of Neotropical migrants in three forest fragments in Illinois.—Species that breed in temperate North America but migrate to the tropics in the nonbreeding season (hereafter "Neotropical migrants") have become a focal point of ornithological research and management (e.g., Hagan and Johnston 1992, Martin and Finch 1995). This concern and interest results from the finding that some Neotropical migrants have shown clear and unambiguous declines throughout their ranges (e.g., Cerulean Warbler [*Dendroica cerulea*], Robbins et al. 1992), and most species have shown pronounced declines in isolated woodlots (Askins et al. 1990) and/or some geographic regions (James et al. 1996). Regardless of how widespread declines are, high levels of nest parasitism by cowbirds and increased levels of nest predation on these species are phenomena worthy of research and management concern.

Reproductive success of many Neotropical migrants varies dramatically across their ranges in response to the degree of forest fragmentation (Robinson et al. 1995). Generally, the greater the fragmentation and the lower the proportion of forest in the landscape, the lower the reproductive success (Robinson et al. 1995). This pattern suggests that source-sink models of population structure may be very applicable to forest-nesting neotropical migrants (Brawn and Robinson 1996). The contiguous "cornbelt" region of Illinois, Indiana, Ohio, Missouri, and adjacent states may represent one of the largest reproductive sinks for these species (Brawn and Robinson 1996). We tested the generality of this idea by using mist nets to monitor reproductive success in three woodlots in east-central Illinois, including two of the largest forest fragments in this region.

Study area and methods.—We selected three forest fragments that appeared to be the best available habitat in east-central Illinois for area-sensitive, forest-nesting neotropical migrants. Two sites, Fox Ridge State Park (454 ha) in Coles County and Walnut Point State Park (223 ha) in Douglas County, were the largest contiguous blocks of forest in their respective counties. The third site, Baber Woods, is a Nature Conservancy preserve that, although much smaller (20 ha), is one of the largest stands of virgin timber in east-central Illinois. Vegetation was sampled at each site, using 12 0.04 ha circular plots (James and Shugart 1970), located randomly along the mist-net line.

We mist netted birds in each woodlot following the methods of Robinson (1992; see also Bollinger and Linder 1994). Twenty nets (black, 36 mm mesh, 12 m) were strung end-to-end along the net line and opened for three consecutive days from 06:00–12:00 CDT. Two, 20-net lines were sampled at Fox Ridge and Walnut Point but only one line at Baber Woods because of its smaller size. Each line was sampled twice, once between 20 June and 6 July 1993 and once between 7 July and 23 July 1993. Lines were located in the centers of each

TABLE 1
CHARACTERISTICS OF THREE FOREST FRAGMENTS IN CENTRAL ILLINOIS

	Baber Woods	Fox Ridge State Park	Walnut Point State Park
	General		
Total size (ha)	20	454	223
Forest interior (ha)[a]	0	31	9
Slope (°)[b]	2	24	6
	Vegetative[b]		
Tree density (stems/ha)[c]	586	529	598
Total basal area (m^2/ha)	45	30	42
White oak dominance (% of basal area)	29	29	45
Hickory dominance (% of basal area)	14	33	13
Sugar Maple dominance (% of basal area)	21	16	9
Shrub density (stems/ha)[d]	1802	3489	2917
Most common shrub	Sugar maple	Sugar maple	Sugar maple
Canopy coverage (%)	91	84	89
	Landscape		
Percent of land ≤10 km from center of site in forest	17	33	13
Percent of land ≤10 km from site in forest interior	<1	3	<1

[a] Forest interior is forest ≥250 m from edge of forest fragment.
[b] Mean of 12 random locations.
[c] Trees are woody stems ≥7.6 cm diameter at breast height (DBH).
[d] Shrubs are woody stems <7.6 cm DBH but at least 1.4 m high.

forest fragment (≥200 m from any edge at Fox Ridge and Walnut Point and ≥50 m from any edge at Baber Woods).

All birds that were captured were banded with U.S. Fish & Wildlife Service bands, aged by plumage characteristics and skull pneumatization (Pyle et al. 1987, USFWS 1991), measured, and released. Birds were aged as either adult, "after-hatching-year" (AHY), or recently fledged, "hatching-year" (HY) birds.

We analyzed our mist-netting data primarily through chi-square tests of the numbers of birds captured. Tests have one degree of freedom unless noted otherwise. We have followed the categorizations of Whitcomb et al. (1981) and Freemark and Collins (1992) to distinguish Neotropical migrants from permanent residents and short-distance migrants. These references were also used to categorize species as "forest interior," "interior/edge," or "edge" species. Permanent residents and short-distance migrants are referred to collectively as "local" species (Bollinger and Linder 1994). Finally, we determined the amount of forest and amount of forest interior (forest ≥250 m from an edge) within a 10-km radius of the center of each study site (as in Robinson et al. 1995) using 150 random locations on topographic maps.

TABLE 2

NUMBERS OF BIRDS MOST COMMONLY CAPTURED IN MIST NETS FROM LATE JUNE THROUGH MID-JULY IN THREE FOREST FRAGMENTS IN CENTRAL ILLINOIS ALONG WITH RATIOS OF HATCHING YEAR (HY) BIRDS TO ADULTS (AHY)

Species	Baber Woods	Fox Ridge	Walnut Point	Overall HY/AHY
	Neotropical migrants[a]			
Wood Thrush (*Hylocichla mustelina*)	29	3	5	0.09
Acadian Flycatcher (*Empidonax virescens*)	3	10	2	0.15
Scarlet Tanager (*Piranga olivacea*)	2	3	4	0.00
Red-eyed Vireo (*Vireo olivaceus*)	2	6	0	0.00
Eastern Wood-Pewee (*Contopus virens*)	0	5	2	0.00
Louisiana Waterthrush (*Seiurus motacilla*)	0	5	0	0.25
All Neotropical Species	41	40	17	0.09
	Local[b]			
Downy Woodpecker (*Picoides pubescens*)	2	8	15	2.57
Northern Cardinal (*Cardinalis cardinalis*)	2	6	4	0.33
Blue Jay (*Cyanocitta cristata*)	0	2	6	0.00
Brown-headed Cowbird (*Molothrus ater*)	5	1	1	0.75
Tufted Titmouse (*Parus bicolor*)	6	0	0	1.00
Hairy Woodpecker (*Picoides villosus*)	1	1	3	0.67
All Local Species	23	24	31	0.63

[a] Other neotropical migrants captured included (in decreasing order of abundance)—Ovenbird (*Seiurus aurocapillus*), Indigo Bunting (*Passerina cyanea*), Worm-eating Warbler (*Helmintheros vermivorus*), Kentucky Warbler (*Oporornis formosus*), Ruby-throated Hummingbird (*Archilochus colubris*), Great Crested Flycatcher (*Myiarchus crinitus*), Common Yellowthroat (*Geothlypis trichas*), Yellow-breasted Chat (*Icteria virens*), and White-eyed Vireo (*Vireo griseus*).

[b] Local species included both permanent residents and short-distance migrants. Other species captured included (in decreasing order of abundance)—Carolina Wren (*Thryothorus ludovicianus*), American Robin (*Turdus migratorius*), White-breasted Nuthatch (*Sitta carolinensis*), Red-bellied Woodpecker (*Melanerpes carolinus*), Rufous-sided Towhee (*Pipilo erythrophthalmus*), and Sharp-shinned Hawk (*Accipiter striatus*).

Results.—All three sites were fairly similar vegetatively. White oak (*Quercus alba*) had the highest basal area in each site, and sugar maple (*Acer saccharum*) and hickories (*Carya* spp.) were also abundant. However, Baber Woods and Walnut Point were flatter than Fox Ridge, and Baber Woods had larger trees, on average, than the other two sites. All three sites were found in landscapes with little forest cover and almost no "forest interior" (Table 1).

A total of 176 birds were captured at all three sites combined (Table 2). Of the 138 adults (AHY birds), 65% were Neotropical migrants (62% were "interior" or "interior/edge" species). Only 8% of all Neotropical migrants (all species combined) were HY birds, compared with 38% for local species ($\chi^2 = 23.6$, $P < 0.001$). The percentage of Neotropical migrants that were HY birds did not vary among the three sites ($\chi^2 = 0.36$, df = 2, $P > 0.75$). However, with all species combined (neotropical + local), the percentage of birds that were HY did vary markedly by nest type with cavity-nesting species having 51% HY birds, 15% for ground nesting species, and 8% for all others ($\chi^2 = 34.8$, df = 2, $P < 0.001$). Among the adult Neotropical migrants that we captured, 59% were males compared with 44% for local species ($\chi^2 = 2.9$, $P < 0.10$). Finally, based on 10 nests of neotropical migrants that we found on an ad hoc basis, daily predation rate averaged 6.2% (and 5% for four Wood Thrush nests), so that nest success over a 30 d nesting cycle would be 15% (Mayfield 1975). Three of these nests were parasitized by cowbirds.

Discussion.—Our data appear to support the conclusion of Robinson (1992) and Brawn and Robinson (1996) that much of the midwestern United States represents a population sink for forest-nesting neotropical migrants. However, using constant effort mistnetting (CEM) to estimate reproductive success is not without problems (Robinson 1992, Nur and Guepel 1993). The few attempts to validate CEM (e.g., Feu and McMeeking 1991, Nur and Geupel 1993) as a means of estimating reproductive success have shown that there is significant variation both within and among species in CEM's ability to track temporal changes in local productivity. Certainly more work is needed in validating CEM methodology, given its widespread use in large scale monitoring programs in North America (DeSante et al. 1993) and Britain (Baillie 1990).

Nevertheless, the extremely low percentage of HY Neotropical migrants that we captured (relative to local species) suggests that these species, as a group, are probably not able to offset adult mortality with local recruitment, even in the largest forest fragments in east-central Illinois. One explanation for low recruitment of Neotropical migrants in forest fragments is that populations are largely unmated males (e.g., Gibbs and Faaborg 1990). This was supported to some extent by our data (e.g., we captured only three male Ovenbirds); however, 44% of neotropical adults were females. More significant, in our opinion, are extremely high predation levels suggested by this study and others in Illinois (Robinson 1992, Bollinger and Peak 1995, Linder and Bollinger 1995, Brawn and Robinson 1996). Given that little can likely be done to reduce forest fragmentation in the agricultural Midwest, these results underscore the need to maintain heavily forested landscapes in nearby areas (e.g., Ozark mountains; Robinson et al. 1995, Brawn and Robinson 1996).

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Diet and hunting behavior of the Plumbeous Kite.—The Plumbeous Kite (*Ictinia plumbea*) forms a superspecies or is conspecific with the Mississippi Kite (*I. mississippiensis*), (AOU 1983, Parker 1988). It inhabits humid lowlands from eastern Mexico south to Bolivia, Argentina, and Paraguay, while the Mississippi Kite breeds widely across the southern United States and winters in South America (Brown and Amadon 1968). The Plumbeous Kite is migratory at the southern and northern limits of its range. Although the diet and hunting behavior of the Mississippi Kite have been relatively well studied (Skinner 1962, Parker 1974, 1988, Evans 1981, Glinski and Ohmart 1983), information about the Plumbeous Kite has been based on observations at one nest in Ecuador by Skutch (1947) and a handful of casual observations (Haverschmidt 1962, Ferrari 1990). Here we present data collected over a four-year period on the diet and hunting behavior of Plumbeous Kites at a Central American lowland site.

Study site and methods.—We studied Plumbeous Kites in Tikal National Park, Petén, Guatemala, from 1991–1994 as part of The Peregrine Fund's "Maya Project." Tikal National Park covers 576 km^2 in NE Guatemala (17°13′N, 89°38′W). Elevation is 200–250 m amsl, topography gently rolling, and the climate tropical, with an annual rainfall of about 1350 mm. The rainy season begins from mid-May to late June, with highest rainfall in September, and a pronounced dry season occurs from February until May or June. The semideciduous tropical forest varies along a subtle topographic continuum. In well-drained sites it is 25–30 m tall with closed canopy, open understory, and diverse tree species, while in low-lying areas, it is lower (10–15 m) with more open canopy, dense understory, and partly different tree species composition. Forest vegetation, climate, and land-use patterns of the Tikal area were described by Schulze (1992) and Whitacre et al. (1993, 1995). Tikal National Park is covered mostly by unbroken primary forest, with some areas of light selective logging prior to 1969. Study nests were located near clearings around Maya ruins and park facilities.

Plumbeous Kites arrived at Tikal in late February, began nesting in March, fledged young in June and July, and departed in August (Vásquez et al. 1992; D. Whitacre, unpubl. data). Observations of prey deliveries were conducted at six nests—two each in 1991, 1992, and 1994. In 1991 and 1992, most nest observations were full day, while in 1994 most were from two to six hours. Prey deliveries were observed using a 30-power spotting scope and binoculars at a distance of 20–30 m. Prey items were delivered to nestlings in the manner described by Skutch (1947): they were carried to the tree either in the bill or feet but always transferred to the bill before landing in the nest tree, and retained there as the bird walked to the nest, allowing sufficient time for identification. In 1994, we studied hunting behavior concurrently with nest observations, focusing on adults at two nests. We watched whichever pair member was hunting at the time, and when it joined flocks of foraging kites, we still observed one individual throughout, though not necessarily the same individual observed previously. We described all hunts, identity and position of quarry, and outcome. For success calculations, a hunt was defined as a completed attempt to seize an individual quarry. Rarely did kites make multiple attempts to seize the same quarry, but when they did, these were regarded as separate hunts. For statistical analyses, we used multiple random permutation procedure (MRPP) Chi-square tests (Berry and Mielke 1986).

Results.—We observed delivery of 702 prey items, 655 of which we identified to some