

NEOTROPICAL MIGRATORY LANDBIRD USE OF THE ST. FRANCIS NATIONAL FOREST DURING SPRING AND AUTUMN OF 1997

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ABSTRACT

Neotropical migratory landbird (NML) species are declining continentally. However, the relative importance of various habitats for providing the migratory stopover needs of NMLs remains undetermined. Therefore, an investigation of possible relationships between NML relative abundance and stopover habitat should be useful in developing management recommendations to help reverse declining NML populations. The objectives of this project are to determine if species composition and migrational volume differ between early-successional habitats in the bottomland and upland of the Mississippi Alluvial Valley (MAV). Birds in both habitat types were sampled by mist-netting in the spring and autumn of 1997. For analysis, birds were classified as either NML or other (non-NML). Fifty-six bird species, including 771 individuals, were captured during 58 sampling days in 1997. A significantly ($t = 6.14$, $P < 0.05$) greater mean number of NMLs ($\bar{X} = 10.31$ NMLs per sample day; $n = 58$) was recorded than birds of other migratory status ($\bar{X} = 2.98$; $n = 58$). Also, mean NML species diversity ($\bar{X} = 5.53$ NML species per sample day; $n = 58$) was significantly ($t = 7.27$, $P < 0.05$) greater than birds of other migratory status ($\bar{X} = 1.88$; $n = 58$). NMLs used both early-successional bottomland and early-successional upland habitats heavily in the MAV during the spring and autumn migration periods. Other data of interest include records for the Yellow-bellied Flycatcher (*Empidonax flaviventris*) and the Swainson's Thrush (*Catharus ustulatus*).

INTRODUCTION

Analyses of breeding bird censuses suggest population declines for various Neotropical migratory landbird (NML) species (James et al. 1992). Most current research investigating these declines focuses on the reproductive period in North America and on the over-wintering ecology during the non-breeding season in the tropics (Hagan et al. 1992, Witham and Hunter 1992). However, the habitat preferences and

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needs of NMLs along their annual migration routes are poorly known, and the relative importance of different stopover habitats to migrating populations is undetermined (Morris et al. 1994). We suggest that NMLs may have specific habitat preferences when using stopover habitat during migration. If this hypothesis is correct, and these habitat needs cannot be met, then managing for breeding and over-wintering habitats could become of little consequence in altering declining trends in NML populations (Moore and Woodrey 1993).

Whether migrating in spring or autumn, finding adequate food and the most clement en route weather requires departure at a time favorable for successful completion of migration (Safriel and Lavee 1988). Many NML species use similar time-windows for initial departure, which seems to result in increased competition for quality stopover habitat, where sufficient food and protection from inclement weather can be found (Loria and Moore 1990).

Although forests in the MAV have long been considered to be critical NML stopover habitat, research data supporting this suggestion are very limited (Smith et al. 1993). The key questions we address here are: Do species composition and migrational volume differ between early-successional bottomland and upland habitats that are used as stopover sites in the Mississippi Alluvial Valley? Answers to these and related questions could be useful in developing management recommendations that may reverse declining NML populations.

This project was begun in the St. Francis National Forest during the 1995 autumn migratory period (Bednarz 1996) and continued during the spring and autumn migratory periods of 1996 (Thomas and Bednarz 1996) and 1997. This paper describes: (1) project methods; (2) an assessment of species composition and migrational volume in early-successional habitats in the bottomland and upland of the St. Francis National Forest during 1997; and (3) records of interest regarding the phenology of migration.

METHODS

Study Areas and Sampling Dates

We sampled in two habitats. They included: (1) mostly early-successional sites within a bottomland forest (n = 5; Figure 1; T1S, R4E, S7 and S8) and (2) early-successional sites within an upland forest (n = 4; Figure 1; T1N, R4E, S19, S20, and S28).

Each bottomland site was a disturbed area with shrubby characteristics with these areas being maintained as wildlife food-plots by the U. S. Forest Service. Sites B-1 and B-2 (Figure 1) were adjacent to a mature bottomland hardwood forest. Site B-2 was additionally disturbed by the presence of a riverside road and a largely non-harvested pecan (*Carya illinoensis*) grove. Sites B-3 through B-5 were situated within a 25-year-old cottonwood (*Populus deltoides*) plantation, which had been invaded by bottomland

hardwood plant species at food-plot edges. Sites in the mostly early-successional bottomland habitat were sampled on fourteen dates during the spring and fifteen dates during the autumn migratory periods: 26 April; 3, 4, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, and 22 May; 30 and 31 August; 1, 6, 7, 13, 14, 20, 21, 27, and 28 September; and 5, 11, and 12 October. Common plant species in all bottomland sites included: oak (*Quercus* spp.), pecan, sweet gum (*Liquidambar styraciflua*), cottonwood, willow (*Salix nigra*), sycamore (*Plantanus occidentalis*), ash (*Fraxinus pennsylvanica*), deciduous holly (*Ilex decidua*), paw paw (*Asimina triloba*), cane (*Arundinaria gigantea*), partridge pea (*Chaemacrista fasciculata*), rose mallow (*Hibiscus moscheutos*), balloon vine (*Cardiospermum halicababum*), and poison ivy (*Toxicodendron* spp.) (Thomas 1996).

Each upland site was adjacent to a clear-cut less than fifteen years of age. Site U-1 was on a logging road adjacent to and between a mature upland forest and a clear-cut. Sites U-2 through U-4 (Figure 1) were also adjacent to clear-cuts and consisted of disturbed areas with shrubby characteristics and were maintained as wildlife food-plots by the U. S. Forest Service. The early-successional upland habitat sites were sampled during fourteen dates in spring and fifteen dates during the autumn migratory period: 19, 20, 26, and 27 April; 3, 4, 10, 11, 13, 16, 17, 18 and 19 May; 1, 2, 7, 8, 14, 15, 21, 22, 28, and 29 September; and 4, 5, 11, and 12 October. Common plant species in all upland sites included: oak (*Quercus* spp.), elm (*Ulmus* spp.), red mulberry (*Morus rubra*), southern sugar maple (*Acer barbatum*), tulip poplar (*Liriodendron tulipifera*), sassafras (*Sassafras albidum*), cane (*Arundinaria gigantea*), rose mallow (*Hibiscus laevis*), thoroughwort (*Eupatorium coelistinum*), trumpet creeper (*Campsis radicans*), and poison ivy (*Toxicodendron* spp.) (Thomas 1996).

An equivalent of ten 12.8-m nylon (50 denier/2 ply) mist nets (3.85-cm mesh size) per site was usually used to sample birds. Nets were located in edge situations in both upland and bottomland early-successional habitats to maximize probability of bird captures. Nets were erected in the respective study habitat locations on the evening prior to the first day of sampling and were collapsed and rolled after initial placement. Nets were unrolled and opened by 15 minutes before sunrise on sample days. All nets were inspected at approximately 30-minute intervals, with captured birds being removed to a central processing station. Birds were then banded, and measurements were taken. Data recorded included wing chord, mass, and age assessment following Pyle et al. (1987). Nets were operated until approximately mid-day when either bird-capture frequency slowed substantially and/or the rising heat of the day could stress birds.

For each sampling day at each site, the number of net-hours was calculated after subtracting the median time between the opening of the first net and the last net from the median of the closing of the first net and the last net. This time interval measured in hours was multiplied by the number of nets used, which provided an estimate of the total net-hours sampled per site per day. Data are reported in terms of birds captured per 10 net-hours.

In an effort to optimize comparisons between bottomland and upland habitats, sites from both habitats were simultaneously sampled (*e.g.*, one pair per sample day) and in rotation (*e.g.*, usually sampling different pairs of sites every 2-3 days; Tables 1-4). Exceptions occurred during the spring when we occasionally sampled only one site per day. Days when only a bottomland site was sampled included: 15, 20, 21, and 22 May (Table 3). Days when only an upland site was sampled included: 19, 20, and 27 April (Table 3). All other spring sampling days, and all autumn sampling days, included a pair of bottomland and upland sites sampled simultaneously (Tables 3-4).

For analysis regarding migratory status, each species captured was classified as (1) NML or (2) other (non-NML). Other classifications not used in analysis, but shown in Appendix 1, included: (1) migrant/breeder (M/B) — NML species that breed within the St. Francis National Forest area; (2) migrant (M) — (*a*) NML species not known to breed in the study area and (*b*) Nearctic migratory species (*e.g.*, White-throated Sparrow [*Zonotrichia albicollis*]) that winter in the study area, but breed in northern North America); and (3) resident (R) — present year round. Classifications according to migratory status were based on nesting distribution and other information provided by James and Neal (1986) and Sauer et al. (1997).

Comparisons of mean numbers of NML species or NML individuals between combinations of habitat types, sampling dates, seasons, and years were performed using *t*-tests or paired *t*-tests (Tukey 1977). Results of these tests were considered statistically significant for *P* values ≤ 0.05 .

RESULTS AND DISCUSSION

Species Composition and Relative Abundance

A total of 56 bird species (771 individuals excluding recaptures) was captured in 1997 during 58 sampling days (bottomland site = 29 sample days; upland site = 29 sample days) in 1997 (Figures 2-3; Tables 1-4). We captured 50 species in the bottomland sites and 43 species in the upland sites (Appendix 1). In all, the two habitats shared 37 species. We captured a significantly ($t = 6.14$; $P < 0.05$) greater mean number of NMLs ($\bar{X} = 10.31$ NMLs per sample day; $n = 58$) than birds of other migratory status ($\bar{X} = 2.98$; $n = 58$; Figure 2; Tables 1-4). Also, a significantly ($t = 5.53$; $P < 0.05$) greater number of bird species captured were NMLs ($\bar{X} = 5.53$ NML species per sample day; $n = 58$) than bird species of other migratory status ($\bar{X} = 1.88$; $n = 58$; Figures 3-7; Tables 1-4).

During the spring, we captured 48 bird species (475 individuals excluding recaptures; Tables 1 and 3) during 28 sampling days. In the bottomland sites, we captured 40 species, and 37 species were netted in the upland sites (Appendix 1). In all, the two habitat-types shared 29 species (Appendix 1). A significantly ($t = 5.39$; $P < 0.05$)

greater number of individual birds were NMLs ($\bar{X} = 13.82$; $n = 28$) than birds of other migratory status ($\bar{X} = 3.14$; $n = 28$; Table 3). There was also a significant ($t = 4.30$; $P < 0.05$) difference between the mean numbers of NMLs caught per day in the bottomland ($\bar{X} = 11.90$; $n = 10$; Figure 8; Table 3) and upland habitats ($\bar{X} = 22.60$; $n = 10$; Figure 9; Table 3). Also during spring, a significantly ($t = 5.98$; $P < 0.05$) greater number of bird species caught were NMLs ($\bar{X} = 6.96$; $n = 28$) compared to bird species of other migratory status ($\bar{X} = 2.12$; $n = 28$; Tables 1 and 3). However, there was no significant ($t = 1.09$; $P > 0.05$) difference between the daily mean numbers of NML species sampled in bottomland ($\bar{X} = 7.00$; $n = 10$; Table 3) versus numbers captured in the upland sites ($\bar{X} = 9.10$; $n = 10$; Table 3). The most commonly captured NML species in the bottomland (35 captures; 7.36% of total spring captures) and the upland (67 captures; 14.11% of total spring captures; Appendices 2-3) was the Indigo Bunting (*Passerina cyanea*). The Swainson's Thrush (*Catharus ustulatus*) was the second most commonly-captured bird (51 captures; 10.73% of total spring captures) in the upland sites.

During the autumn, we captured 37 bird species (296 individuals excluding recaptures; Appendix 1) during 30 sampling days (Tables 2 and 4). We captured 33 species in the bottomland site and 28 species in the upland. In all, the two habitats shared 24 species (Appendix 1). A significantly ($t = 3.78$; $P < 0.05$) greater number of individual birds was comprised of NMLs ($\bar{X} = 7.03$; $n = 30$) rather than birds of other migratory status ($\bar{X} = 2.83$; $n = 30$; Tables 2 and 4). However, there was no significant ($t = -0.47$; $P > 0.05$) difference between the mean daily numbers of NML captures in the bottomland ($\bar{X} = 7.53$; $n = 15$; Figure 10; Table 4) and upland sites ($\bar{X} = 6.53$; $n = 15$; Figure 11; Table 4). A significantly ($t = 5.01$; $P < 0.05$) greater number of bird species were NMLs ($\bar{X} = 4.20$; $n = 30$) per sample day rather than bird species of other migratory status ($\bar{X} = 1.57$; $n = 30$; Tables 2 and 4). However, there was no significant ($t = 1.28$; $P > 0.05$) difference between the daily mean numbers of NML species counted for bottomland ($\bar{X} = 3.93$; $n = 10$; Table 4) and upland sites ($\bar{X} = 4.47$; $n = 10$; Table 3). The most commonly captured NML species in the bottomland (47 captures; 15.88% of total autumn captures; Appendix 2) and the upland (20 captures; 6.75% of total autumn captures; Appendix 3) was the Indigo Bunting. The White-eyed Vireo (*Vireo griseus*) was the second most commonly-captured bird (11 captures; 3.72% of total autumn captures; Appendix 3) in the upland sites.

Phenology of Migration

During the spring, we mist-netted at a single upland site on our first day of sampling, 19 April (Table 3). On that date, we recorded a mean capture rate of 1.6 birds per 10 net-hours (Figure 9). The capture rate in the upland sites first peaked on 4 May at 6.8 birds per 10 net-hours, then declined to 3.0 birds on 14 May (Figure 9). A second peak occurred on 16 May with 8.4 birds caught per 10 net-hours (Figure 9). Capture rates then declined until 19 May, when the mean capture rate was 1.9 birds per 10 net-hours

(Figure 9). Early upland NML arrivals during the spring included the Northern Waterthrush (*Seiurus aurocapillus*), Hooded Warbler (*Wilsonia citrina*) and the Yellow-breasted Chat (*Icteria virens*; Appendix 3). Late upland arrivals included the American Redstart (*Setophaga ruticilla*) and the Canada Warbler (*Wilsonia canadensis*; Appendix 3).

During the spring, we mist-netted the first bottomland site on 26 April (Table 3). On that date, we recorded a mean capture rate of 0.9 birds per 10 net-hours (Figure 8). The capture rate in the upland sites peaked on 3 May at 7.0 birds per 10 net-hours (Figure 8). By 15 May, we were still capturing birds at a relatively high capture rate of 3.1 birds per 10 net-hours (Figure 8). Capture rates then rapidly declined in the bottomland. The final spring-bottomland sampling day was 22 May, when the mean capture rate was 0.8 birds per 10 net-hours (Figure 8). Early bottomland NML-arrivals during the spring included the Ruby-throated Hummingbird (*Archilochis colubris*) and the Indigo Bunting (Appendix 2). Late bottomland arrivals included the American Redstart, Swainson's Warbler (*Limnothlypis swainsonii*), and the Canada Warbler (*Wilsonia canadensis*; Appendix 2).

During autumn, all daily samples included both bottomland and upland sites (Table 4). On 30 August, the capture rate for the first bottomland site was 2.9 birds per 10 net-hours (Figure 10) and 1.1 birds per 10 net-hours for the upland (Figure 11). The bottomland capture rate peaked both on 20 September and 4 October at 5.1 birds per 10 net-hours, declining by 12 October (final autumn sample day) to 1.0 birds per 10-net-hours (Figure 10). The upland capture rate first peaked on 20 September at 3.1 birds per 10 net-hours (Figure 11). The upland sites peaked twice more at 3.1 birds per 10 net-hours on 4 and 12 October (Figure 11). Early bottomland captures during the autumn included the Yellow-bellied Flycatcher (*Empidonax flaviventris*), Prothonotary Warbler (*Protonotaria citrea*), and Swainson's Warbler (Appendix 2). Late bottomland captures included the White-eyed Vireo and the Indigo Bunting (Appendix 2). Early upland captures during the autumn included the Yellow-billed Cuckoo (*Coccyzus americanus*), Acadian Flycatcher (*Empidonax vireescens*), Swainson's Warbler, and Kentucky Warbler (*Oporornis formosus*; Appendix 3). Late upland captures included the Ovenbird (*Seiurus aurocapillus*) and the Indigo Bunting (Appendix 3).

Records of interest for Arkansas collected during 1997 included data for the Yellow-bellied Flycatcher (*Empidonax flaviventris*) and the Swainson's Thrush (*Catharus ustulatus*).

James and Neal (1986) state that very few autumn reports exist for the Yellow-bellied Flycatcher in Arkansas between the second week of August and the middle of October. All of these reports involved single birds, except for two found at Winslow on 13 October (James and Neal 1986). In the autumn, we captured six Yellow-bellied Flycatchers between 7 September and 4 October (Appendix 2-3). In the upland, two individuals were captured on 4 October. All others in the autumn were single-bird captures. Combined with data collected during 1996, we captured 22 Yellow-bellied

Flycatchers (18 in the upland; 3 in the bottomland) between 1 September and 4 October (Thomas and Bednarz 1997). One Yellow-bellied Flycatcher was captured in the spring on 3 May 1997 at a bottomland site.

We recorded 21 Swainson's Thrushes between 15 and 19 May. Three were bottomland captures (Appendix 2). Eighteen were captured in the upland with seven birds representing the largest single-day sample on 17 May (Appendix 3). James and Neal (1986) state that 24 May represents a late peak.

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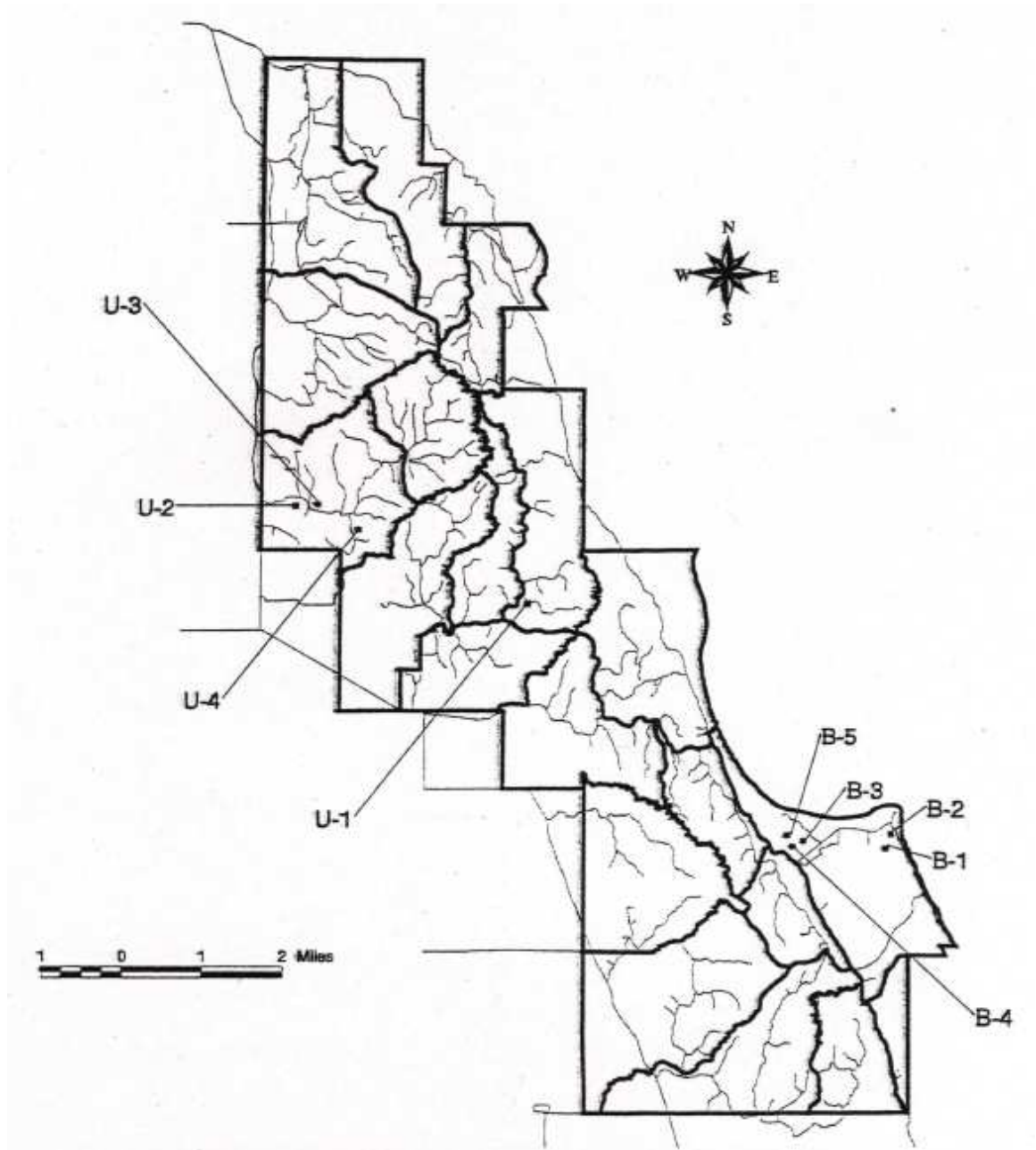


Figure 1. Mist-netting bird-sampling locations in early-successional bottomland (sites B-1 through B-5) and upland (U-1 through U-4) habitats in the St. Francis National Forest during migratory periods in 1997. Bold-faced lines represent national forest compartment boundaries. Other lines represent roads and waterways.

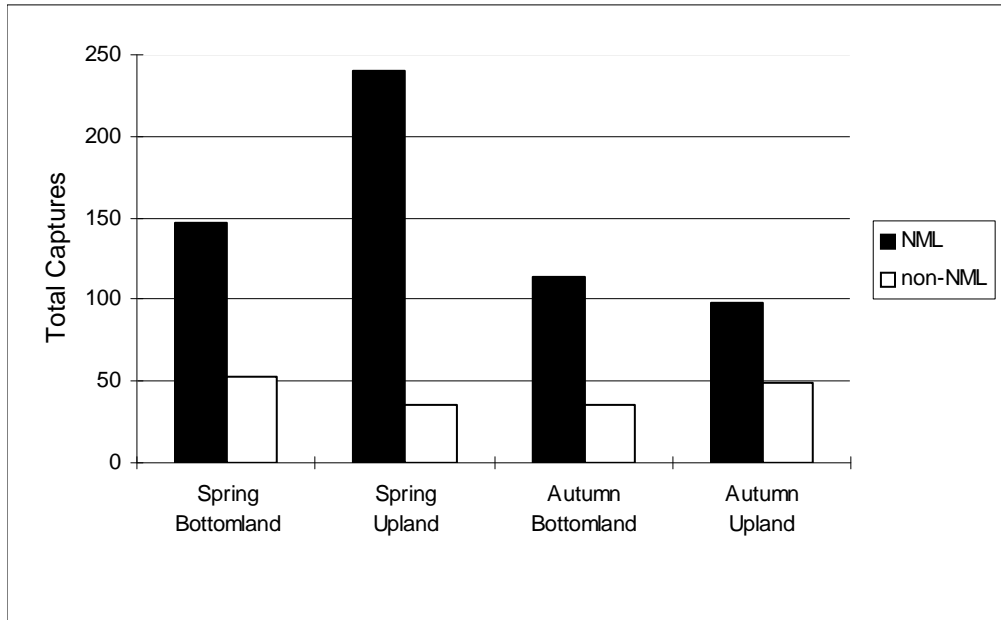


Figure 2. Numbers of Nearctic-Neotropical migratory landbird (NML) captures versus captures of non-NML bird species during mist-netting surveys in edge situations in an early-successional bottomland habitat and an early-successional upland habitat in the St. Francis National Forest during spring and autumn migration periods. Recaptures are not shown.

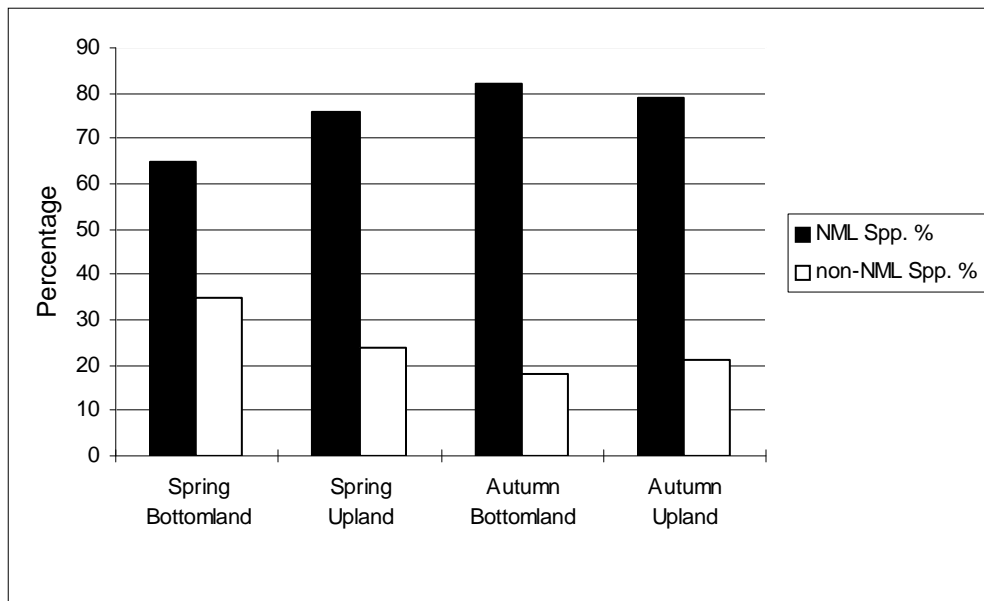


Figure 3. Percentages of Neotropical migratory landbird (NML) species captured versus percentages of non-NML bird species captured during mist-netting surveys in edge situations in an early-successional bottomland habitat and an early-successional upland habitat in the St. Francis National Forest during the 1997 spring and autumn migration periods. Recaptures are not shown.

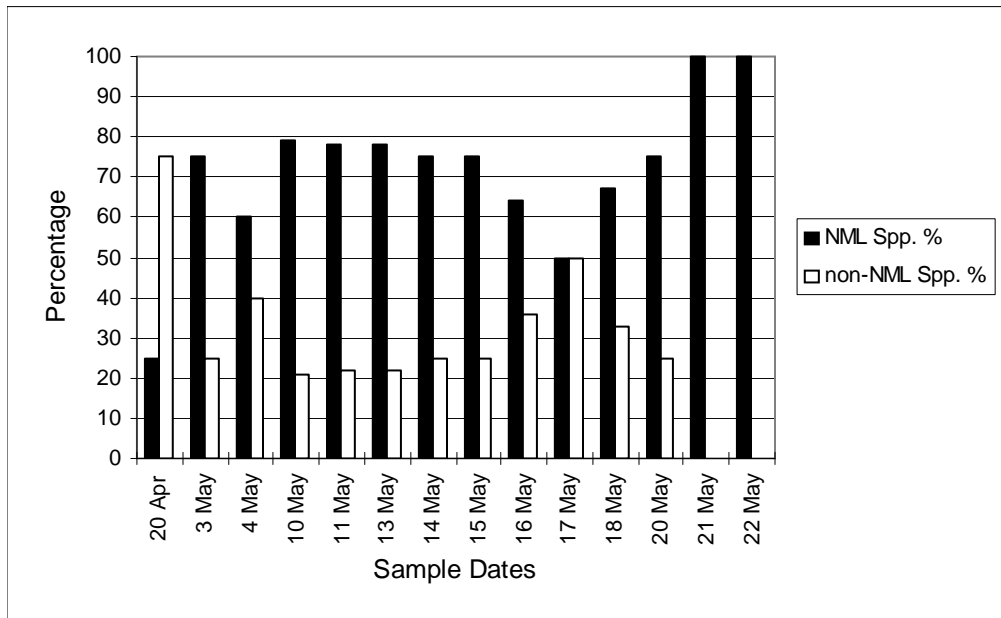


Figure 4. Percentages of Neotropical migratory landbird (NML) species captured versus percentages of non-NML bird species captured during mist-netting surveys in edge situations in an early-successional bottomland habitat during the 1997 spring migration period (recaptures excluded).

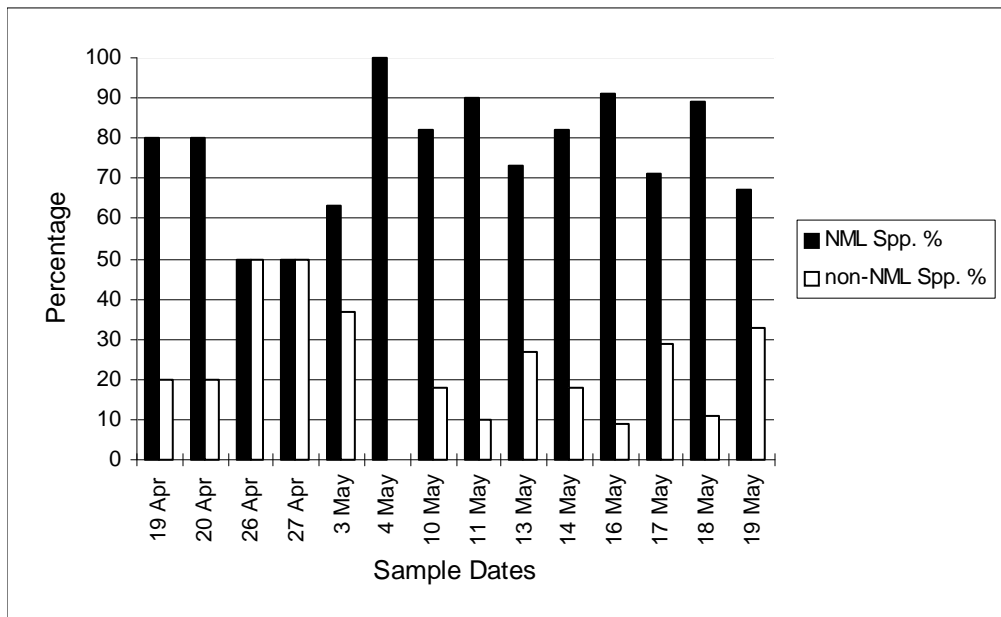


Figure 5. Percentages of Neotropical migratory landbird (NML) species captured versus percentages of non-NML bird species captured during mist-netting surveys in edge situations in an early-successional upland habitat during the 1997 spring migration period (recaptures excluded).

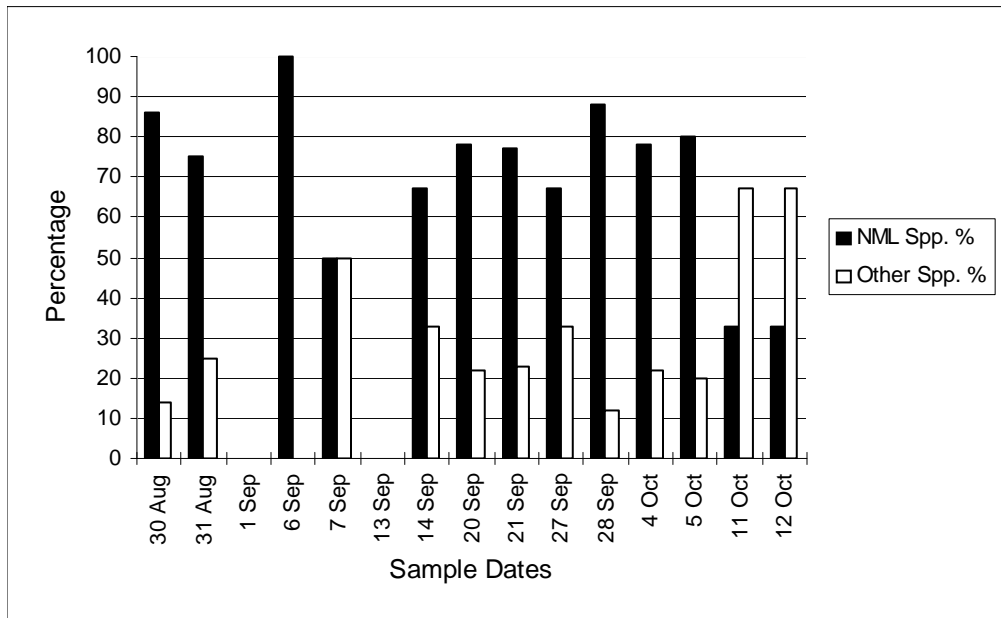


Figure 6. Percentages of Neotropical migratory landbird (NML) species captured versus percentages of non-NML bird species captured during mist-netting surveys in edge situations in an early-successional bottomland habitat during the 1997 autumn migration period (recaptures excluded).

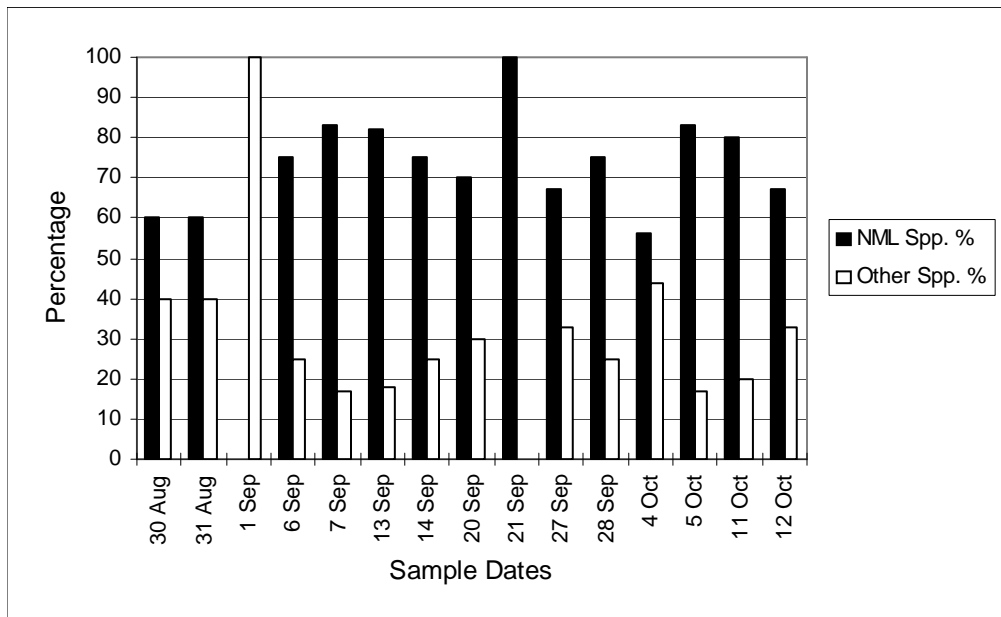


Figure 7. Percentages of Neotropical migratory landbird (NML) species captured versus percentages of non-NML bird species captured during mist-netting surveys in edge situations in an early-successional upland habitat during the 1997 autumn migration period (recaptures excluded).

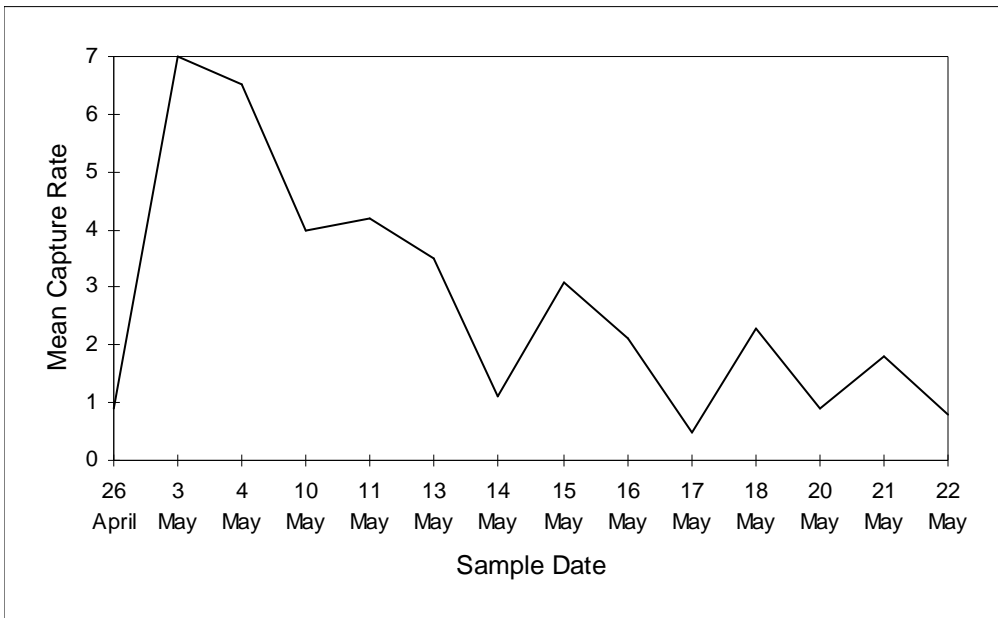


Figure 8. Mean capture rates for Nearctic-Neotropical migratory landbirds (NML) during mist-netting surveys in edge situations in an early-successional bottomland habitat in the St. Francis National Forest during the spring migration period. Recaptures are not shown.

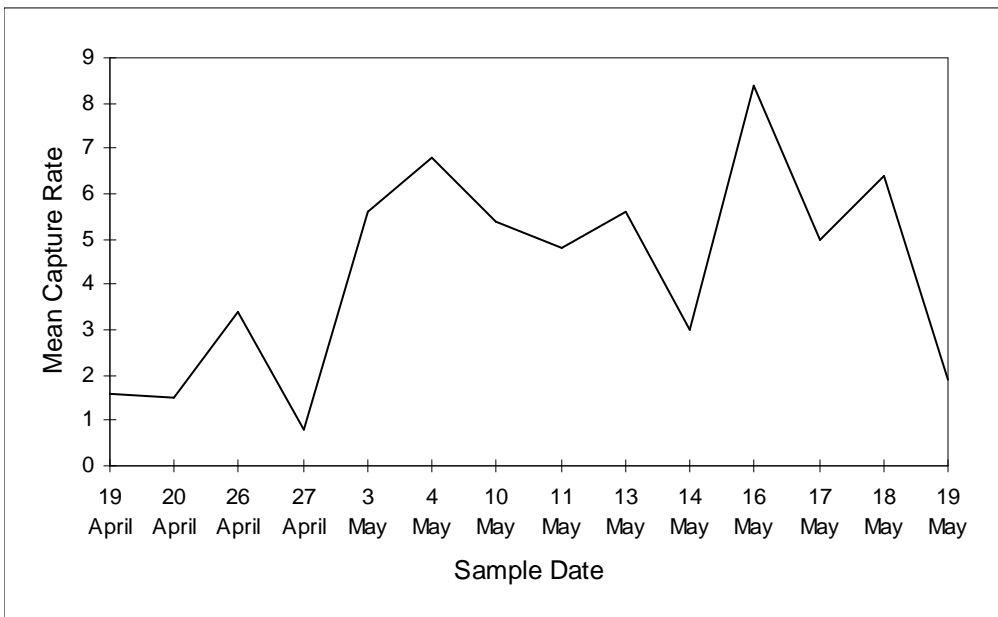


Figure 9. Mean capture rates for Nearctic-Neotropical migratory landbirds (NML) during mist-netting surveys in edge situations in an early-successional upland habitat in the St. Francis National Forest during the spring migration period. Recaptures are not shown.

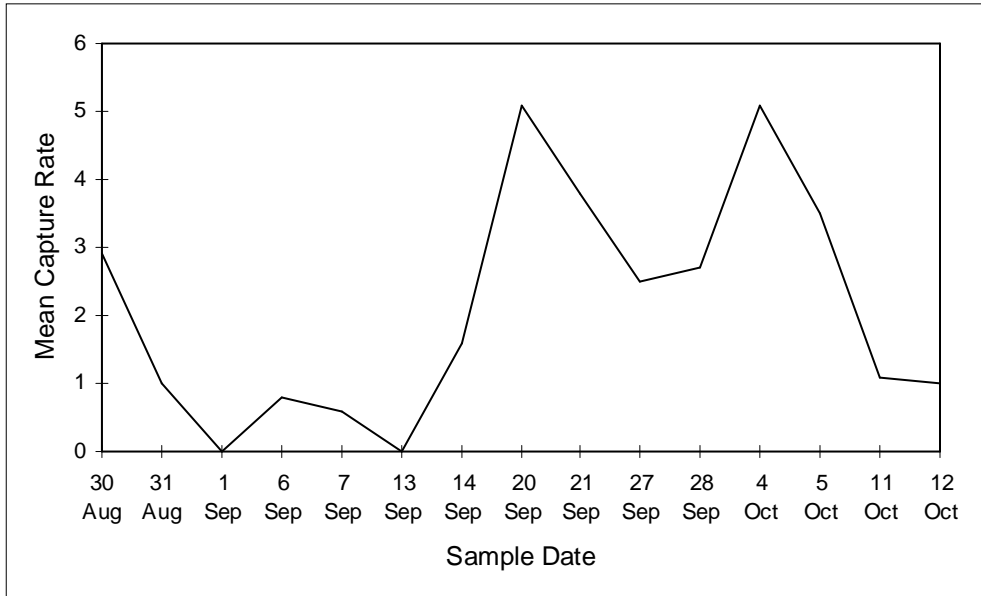


Figure 10. Mean capture rates for Nearctic-Neotropical migratory landbirds (NML) during mist-netting surveys in edge situations in an early-successional bottomland habitat in the St. Francis National Forest during the autumn migration period. Recaptures are not shown.

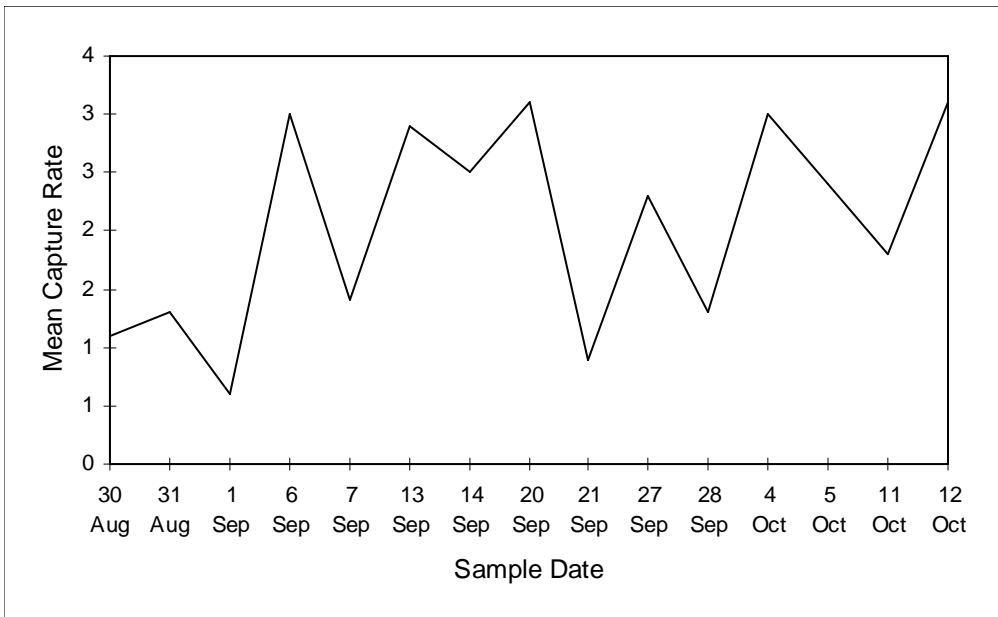


Figure 11. Mean capture rates for Nearctic-Neotropical migratory landbirds (NML) during mist-netting surveys in edge situations in an early-successional upland habitat in the St. Francis National Forest during the autumn migration period. Recaptures are not shown.

Table 1. Spring comparison mist-net sampling in early-successional stage bottomland (14 sample days: 26 April — 22 May 1997) and upland forests (14 sample days; 19 April — 19 May 1997) in the St. Francis National Forest. NML = Neotropical migratory landbird.

	Bottomland Forest	Upland Forest
Total captures	200.0	275.0
Total net-hours	6700.0	6475.0
Mean total capture rate per 10 net-hours	3.0	4.2
Mean NML capture rate per 10 net-hours	2.2	3.7
NML capture percentage (%) in sample	73.5	87.2
Total number of species in sample	40.0	37.0
Percentage of NML species in sample	65.0	75.7

Table 2. Autumn comparison mist-net sampling in early-successional stage bottomland (15 sample days: 30 August — 12 October 1997) and upland forests (15 sample days; 30 August — 12 October 1997) in the St. Francis National Forest. NML = Neotropical migratory landbird.

	Bottomland Forest	Upland Forest
Total captures	149.0	147.0
Total net-hours	6950.0	7100.0
Mean total capture rate per 10 net-hours	2.2	2.1
NML capture percentage (%) in sample	76.0	66.7
Total number of species in sample	33.0	28.0
Percentage of NML species in sample	81.8	78.6

Table 3. Summary of spring mist-net sampling of birds in early-successional stage bottomland (14 sample days: 26 April — 22 May 1997) and upland forests (14 sample days; 19 April — 19 May 1997) in the St. Francis National Forest. NML = Neotropical migratory landbird.

Date	Habitat Site:	Total Net-Hrs	Mean Capture Rate	NML Captures	Non-NML Captures	Total Captures	NML Capture %	NML Species	Non-NML Species	Total Species	NML Species %
<u>Bottomland</u>											
26 April	B-1	450	0.9	1	3	4	25.0	1	3	4	25.0
03 May	B-2	575	7.0	30	10	40	75.0	12	4	16	75.0
04 May	B-2	550	6.5	25	11	36	69.4	9	6	15	60.0
10 May	B-2	500	4.0	17	3	20	85.0	11	3	14	78.6
11 May	B-2	475	4.2	14	6	20	70.0	11	3	14	78.6
13 May	B-2	575	3.5	14	6	20	70.0	11	3	14	78.6
14 May	B-3	350	1.1	3	1	4	75.0	3	1	4	75.0
15 May	B-3	575	3.1	15	3	18	83.3	9	3	12	75.0
16 May	B-3	525	2.1	7	4	11	63.6	7	4	11	63.6
17 May	B-5	400	0.5	1	1	2	50.0	1	1	2	50.0
18 May	B-5	475	2.3	7	4	11	63.6	4	2	6	66.7
20 May	B-5	450	0.9	3	1	4	75.0	3	1	4	75.0
21 May	B-4	400	1.8	7	0	7	100.0	5	0	5	100.0
22 May	B-4	400	0.8	3	0	3	100.0	3	0	3	100.0
<u>Upland</u>											
19 April	U-1	450	1.6	5	2	7	71.4	5	1	5	100.0
20 April	U-1	400	1.5	4	2	6	66.7	4	1	5	80.0
26 April	U-1	525	3.4	12	6	18	66.7	5	5	10	50.0
27 April	U-1	400	0.8	1	2	3	33.3	1	1	2	50.0
03 May	U-4	500	5.6	24	3	28	85.7	5	3	8	62.5
04 May	U-4	500	6.8	34	0	34	100.0	9	0	9	100.0
10 May	U-3	500	5.4	25	2	27	92.6	9	2	11	81.8
11 May	U-3	500	4.8	23	1	24	95.8	9	1	10	90.0
13 May	U-2	450	5.6	21	4	25	84.0	8	3	11	72.7
14 May	U-2	625	3.0	17	2	19	89.5	9	2	11	81.8
16 May	U-2	250	8.4	19	2	21	90.5	10	1	11	90.9
17 May	U-2	500	5.0	21	4	25	84.0	10	4	14	71.4
18 May	U-1	500	6.4	30	2	32	93.8	17	2	19	89.5
19 May	U-1	375	1.9	4	3	7	57.1	4	2	6	66.7

Table 4. Summary of autumn mist-net sampling of birds in early-successional stage bottomland (15 sample days: 30 August — 12 October 1997) and upland forests (15 sample days; 30 August — 12 October 1997) in the St. Francis National Forest. NML = Neotropical migratory landbird.

Date	Habitat Site:	Total Net-Hr	Mean Capture Rate	NML Captures	Non-NML Captures	Total Captures	NML Capture %	NML Species	Non-NML Species	Total Species	NML Species %
Bottomland											
30 Aug	B-1	475	2.9	12	2	14	85.7	6	1	7	85.7
31 Aug	B-2	500	1.0	4	1	5	80.0	3	1	4	75.0
01 Sep	B-2	425	0.0	0	0	0	0.0	0	0	0	0.0
06 Sep	B-3	475	0.8	4	0	4	100.0	2	0	2	100.0
07 Sep	B-3	475	0.6	2	1	3	66.7	1	1	2	50.0
13 Sep	B-4	475	0.0	0	0	0	0.0	0	0	0	0.0
14 Sep	B-4	450	1.6	5	1	7	71.4	2	1	3	66.7
20 Sep	B-1	475	5.1	22	2	24	91.7	7	2	9	77.8
21 Sep	B-1	500	3.8	16	3	19	84.2	10	3	13	76.9
27 Sep	B-2	325	2.5	4	4	8	50.0	4	2	6	66.7
28 Sep	B-2	475	2.7	12	1	13	92.3	7	1	8	87.5
04 Oct	B-1	550	5.1	19	9	28	67.9	7	2	9	77.9
05 Oct	B-1	425	3.5	11	4	15	73.3	8	2	10	80.0
11 Oct	B-2	525	1.1	1	5	6	16.7	1	2	3	33.3
12 Oct	B-2	400	1.0	1	3	4	25.0	1	2	3	33.3
Upland											
30 Aug	U-2	450	1.1	3	2	5	60.0	3	2	5	60.0
31 Aug	U-3	475	1.3	3	3	6	50.0	3	2	5	60.0
01 Sep	U-3	475	0.6	0	3	3	0.0	0	2	2	0.0
06 Sep	U-4	500	3.0	11	4	15	73.3	6	2	8	75.0
07 Sep	U-4	500	1.4	6	1	7	85.7	5	1	6	83.3
13 Sep	U-1	550	2.9	13	3	16	81.3	9	2	11	81.8
14 Sep	U-1	525	2.5	10	3	13	76.9	6	2	8	75.0
20 Sep	U-2	550	3.1	9	8	17	52.9	7	3	10	70.0
21 Sep	U-2	425	0.9	4	0	4	100.0	3	0	3	100.0
27 Sep	U-3	475	2.3	7	4	11	63.6	4	2	6	66.7
28 Sep	U-3	450	1.3	5	1	6	83.3	3	1	4	75.0
04 Oct	U-1	500	3.0	6	9	15	40.0	5	4	9	55.6
05 Oct	U-1	425	2.4	8	2	10	80.0	5	1	6	83.3
11 Oct	U-4	450	1.8	6	2	8	75.0	4	1	5	80.0
12 Oct	U-4	350	3.1	7	4	11	63.6	4	2	6	66.7

Appendix 1. Species captured during mist-netting surveys in edge situations in an early-successional bottomland habitat and an early-successional upland habitat in the St. Francis National Forest during the 1997 spring and autumn migration periods. M = migrant (includes Nearctic and Neotropical); B = breeder (St. Francis Natl. Forest); R = resident (year-round in St. Francis Natl. Forest); *b* = bottomland capture; and *u* = upland capture.

Species	Migratory Status	Season Captured	
		Spring	Autumn
Yellow-billed Cuckoo (<i>Coccyzus americanus</i>)	M/B		<i>b/u</i>
Eastern Screech-Owl (<i>Otus asio</i>)	R	<i>b</i>	
Ruby-throated Hummingbird (<i>Archilochus colubris</i>)	M/B	<i>b/u</i>	<i>u</i>
Red-bellied Woodpecker	R	<i>b</i>	
Hairy Woodpecker (<i>Picoides villosus</i>)	R	<i>b</i>	
Downy Woodpecker (<i>Picoides pubescens</i>)	R	<i>b/u</i>	
Eastern Wood-Pee-wee (<i>Contopus virens</i>)	M/B	<i>b/u</i>	<i>b</i>
Great-crested Flycatcher (<i>Myiarchus crinitus</i>)	M/B	<i>u</i>	
Yellow-bellied Flycatcher (<i>Empidonax flaviventris</i>)	M	<i>b</i>	<i>b/u</i>
Acadian Flycatcher (<i>Empidonax virescens</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Alder Flycatcher (<i>Empidonax alnorum</i>)	M		<i>u</i>
Least Flycatcher (<i>Empidonax minimus</i>)	M		<i>b</i>
Blue Jay (<i>Cyanocitta cristata</i>)	R	<i>b/u</i>	
Eastern Tufted Titmouse (<i>Parus bicolor</i>)	R	<i>b/u</i>	<i>b/u</i>
Carolina Chickadee (<i>Parus carolinensis</i>)	R	<i>b/u</i>	<i>b/u</i>
Carolina Wren (<i>Thryothorus ludovicianus</i>)	R	<i>b/u</i>	<i>b/u</i>
Ruby-crowned Kinglet (<i>Regulus calendula</i>)	M		<i>b</i>
Blue-gray Gnatcatcher (<i>Polioptila caerulea</i>)	M/B		<i>b</i>
Veery (<i>Catharus fuscescens</i>)	M	<i>b/u</i>	
Gray-cheeked Thrush (<i>Catharus minimus</i>)	M	<i>b/u</i>	<i>u</i>
Swainson's Thrush (<i>Catharus ustulatus</i>)	M	<i>b/u</i>	<i>b/u</i>
Hermit Thrush (<i>Catharus guttatus</i>)	M	<i>u</i>	

Appendix 1 continued.

Species	Migratory Status	Season Captured	
		Spring	Autumn
Wood Thrush (<i>Hylocichla mustelina</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Gray Catbird (<i>Dumetella carolinensis</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Brown Thrasher (<i>Toxostoma rufum</i>)	R		<i>b/u</i>
White-eyed Vireo (<i>Vireo griseus</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Yellow-throated Vireo (<i>Vireo flavifrons</i>)	M		<i>b</i>
Philadelphia Vireo (<i>Vireo philadelphicus</i>)	M	<i>b</i>	
Red-eyed Vireo (<i>Vireo olivaceus</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Tennessee Warbler (<i>Vermivora peregrina</i>)	M	<i>b/u</i>	
Nashville Warbler (<i>Vermivora ruficapilla</i>)	M		<i>b/u</i>
Chestnut-sided Warbler (<i>Dendroica pensylvanica</i>)	M	<i>u</i>	<i>b</i>
Blackpoll Warbler (<i>Dendroica striata</i>)	M	<i>b</i>	
Magnolia Warbler (<i>Dendroica magnolia</i>)	M	<i>b/u</i>	<i>b/u</i>
Black-and-White Warbler (<i>Mniotilta varia</i>)	M/B	<i>u</i>	<i>b/u</i>
American Redstart (<i>Setophaga ruticilla</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Prothonotary Warbler (<i>Protonotaria citrea</i>)	M/B	<i>b</i>	
Worm-eating Warbler (<i>Helminthos vermivorus</i>)	M	<i>u</i>	
Swainson's Warbler (<i>Limnithlypis swainsonii</i>)	M/B	<i>b</i>	<i>b/u</i>
Ovenbird (<i>Seiurus aurocapillus</i>)	M	<i>b/u</i>	<i>b/u</i>
Northern Waterthrush (<i>Seiurus noveboracensis</i>)	M	<i>b/u</i>	<i>b</i>
Kentucky Warbler (<i>Oporornis formosus</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Mourning Warbler (<i>Oporornis philadelphia</i>)	M	<i>b</i>	
Common Yellowthroat (<i>Geothlypis trichas</i>)	M/B	<i>b/u</i>	<i>b</i>
Hooded Warbler (<i>Wilsonia citrina</i>)	M/B	<i>u</i>	<i>b/u</i>
Wilson's Warbler (<i>Wilsonia pusilla</i>)	M	<i>b</i>	
Canada Warbler (<i>Wilsonia canadensis</i>)	M	<i>b/u</i>	<i>b</i>

Appendix 1 continued.

Species	Migratory Status	<u>Season Captured</u>	
		Spring	Autumn
Yellow-breasted Chat (<i>Icteria virens</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Brown-headed Cowbird (<i>Molothrus ater</i>)	R	<i>b/u</i>	
Orchard Oriole (<i>Icterus spurius</i>)	M/B	<i>b</i>	
Summer Tanager (<i>Piranga rubra</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Northern Cardinal (<i>Cardinalis cardinalis</i>)	R	<i>b/u</i>	<i>b/u</i>
Indigo Bunting (<i>Passerina cyanea</i>)	M/B	<i>b/u</i>	<i>b/u</i>
Rufous-sided Towhee (<i>Pipilo erythrophthalmus</i>)	R	<i>u</i>	<i>u</i>
Lincoln's Sparrow (<i>Melospiza lincolni</i>)	M	<i>u</i>	
White-throated Sparrow (<i>Zonotrichia albicollis</i>)	M	<i>b/u</i>	

Appendix 2. Total NML captures with inclusive capture dates for mist-net sampling in early-successional bottomland habitat (T1S, R4E, S7 and S8) during 1997. Recaptures are not shown.

Species	<u>Total Captures</u>		<u>Inclusive Dates</u>	
	Spring	Autumn	Spring	Autumn
Yellow-billed Cuckoo		1		27 Sep
Ruby-throated Hummingbird	1		3 May	
Eastern Wood-Pee-wee	1	1	3 May	21 Sep
Yellow-bellied Flycatcher	1	2	3 May	31 Aug - 21 Sep
Acadian Flycatcher	6	6	3 May - 22 May	20 Sep - 20 Oct
Least Flycatcher		1		21 Sep
Blue-gray Gnatcatcher		1		31 Aug
Veery	6		4 May - 16 May	
Gray-cheeked Thrush	2		4 May - 13 May	
Swainson's Thrush	16	2	3 May - 18 May	27 Sep - 28 Sep
Wood Thrush	3	3	3 May - 11 May	14 Sep - 5 Oct
Gray Catbird	18	3	3 May - 11 May	4 Oct
White-eyed Vireo	2	12	10 May - 11 May	30 Aug - 10 Oct
Yellow-throated Vireo		1		4 Oct
Philadelphia Vireo		1		28 Sep
Red-eyed Vireo	4	1	10 May - 20 May	28 Sep
Magnolia Warbler	6	1	3 May - 21 May	21 Sep
Blackpoll Warbler	1		10 May	
Tennessee Warbler	2		10 May	
Nashville Warbler		1		4 Oct
Chestnut-sided Warbler		2		21 Sep - 5 Oct
Black-and-White Warbler		1		20 Sep
American Redstart	3		11 May - 13 May	
Prothonotary Warbler	4	2	3 May - 21 May	30 Aug

Appendix 2 continued.

Species	<u>Total Captures</u>		<u>Inclusive Dates</u>	
	Spring	Autumn	Spring	Autumn
Worm-eating Warbler		2		31 Aug
Swainson's Warbler	1	1	13 May	30 Aug
Ovenbird	5	5	4 May - 15 May	4 Oct - 5 Oct
Northern Waterthrush	4	2	10 May - 15 May	20 Sep - 27 Sep
Kentucky Warbler	3	7	3 May - 20 May	30 Aug - 28 Sep
Mourning Warbler	1		10 May	
Common Yellowthroat	5	1	14 May - 22 May	5 Oct
Hooded Warbler		1		5 Oct
Wilson's Warbler	1		13 May	
Canada Warbler	1	1	16 May	4 Oct
Yellow-breasted Chat	1	2	3 May	30 Aug - 9 Sep
Summer Tanager	4	2	4 May - 14 May	7 Sep
Indigo Bunting	35	47	26 Apr - 21 May	30 Aug - 12 Oct
Orchard Oriole	9		4 May - 22 May	

Appendix 3. Total NML captures with inclusive capture dates for mist-net sampling in early-successional upland habitat (T1N, R4E, S19, S20, and S28) during 1997. Recaptures are not shown.

Species	<u>Total Captures</u>		<u>Inclusive Dates</u>	
	Spring	Autumn	Spring	Autumn
Yellow-billed Cuckoo		1		30 Aug
Ruby-throated Hummingbird	1	1	26 Apr	6 Sep
Eastern Wood-Pee-wee	2		18 May	
Great-crested Flycatcher	3		13 May - 18 May	
Yellow-bellied Flycatcher		6		7 Sep - 4 Oct
Acadian Flycatcher	8	2	10 May - 18 May	30 Aug - 6 Sep
Alder Flycatcher		1		7 Sep
Veery	1		17 May	
Gray-cheeked Thrush	20	1	26 Apr - 18 May	5 Oct
Swainson's Thrush	51	5	26 Apr - 19 May	13 Sep - 5 Oct
Hermit Thrush	2		19 April - 20 April	
Wood Thrush	3	6	4 May - 18 May	13 Sep - 11 Oct
Gray Catbird	2	10	3 May - 4 May	13 Sep - 12 Oct
White-eyed Vireo	14	11	20 Apr - 19 May	31 Aug - 4 Oct
Red-eyed Vireo	4	2	13 May - 19 May	6 Sep - 21 Sep
Tennessee Warbler	2		4 May - 11 May	
Nashville Warbler		1		12 Oct
Chestnut-sided Warbler	1		18 May	
Magnolia Warbler	5	1	14 May - 18 May	12 Oct
Black-and-White Warbler	3	1	13 May - 17 May	20 Sep
American Redstart	1	4	18 May	13 Sep - 20 Sep
Worm-eating Warbler	2	1	26 Apr	14 Sep
Swainson's Warbler		2		31 Aug
Ovenbird	9	9	10 May - 17 May	13 Sep - 11 Oct

Appendix 3 continued.

Species	<u>Total Captures</u>		<u>Inclusive Dates</u>	
	Spring	Autumn	Spring	Autumn
Northern Waterthrush	2		19 Apr - 18 May	
Kentucky Warbler	9	2	20 Apr - 18 May	31 Aug - 7 Sep
Common Yellowthroat	1		4 May	
Hooded Warbler	14	9	19 Apr - 18 May	30 Aug - 28 Sep
Canada Warbler	2		16 May - 18 May	
Yellow-breasted Chat	8	1	5 Apr - 18 May	6 Sep
Summer Tanager	1	1	14 May	14 Sep
Indigo Bunting	67	20	27 Apr - 19 May	6 Sep - 12 Oct
Rufous-sided Towhee	1	1	19 Apr	20 Sep
Lincoln's Sparrow	1		3 May	
