

**THE 2007 REPORT OF THE
MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP
(MAPS) PROGRAM ON FORT LEONARD WOOD**

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Introduction

Since 1989, The Institute for Bird Populations has been coordinating the Monitoring Avian Productivity and Survivorship (MAPS) Program, a cooperative effort among public and private agencies and individual bird banders in North America, to operate a continent-wide network of over 500 constant-effort mist-netting and banding stations. MAPS was designed to provide information on the vital rates (productivity or birth rate, and survivorship or death rate) of landbirds critically needed for efforts to identify demographic causes of the severe and sometimes accelerating population declines documented (Robbins et al. 1989, Terborgh 1989, Peterjohn et al. 1995) for many species of North American landbirds (DeSante 1992, DeSante et al. 1995, 1999, 2001a). Such data on vital rates are also critically needed in efforts to identify management strategies to reverse such population declines (DeSante 1995, DeSante and Rosenberg 1998).

MAPS is organized to fulfill three sets of goals and objectives: monitoring, research, and management. The specific **monitoring** goals of MAPS are to provide, for over 100 target species: (a) annual indices of adult population size and post-fledging productivity from analysis of adult and young birds captured; and (b) annual estimates of adult population size, adult survival rates, proportions of residents, and recruitment into the adult population from modified Cormack- Jolly-Seber analyses of mark-recapture data on adult birds.

The specific **research** goals of MAPS are to identify and describe: (a) temporal and spatial patterns in these demographic indices at a variety of spatial scales ranging from local landscape to the entire continent; and (b) relationships between these patterns and ecological characteristics of the target species, population trends of the target species, station-specific and landscape-level habitat characteristics, and spatially-explicit weather variables.

The specific **management** goals of MAPS are to use these patterns and relationships, at the appropriate spatial scales, to: (a) notify appropriate agencies and organizations of thresholds and trigger-points indicating the need for further research and/or management actions; (b) determine the proximate demographic cause(s) of population change; (c) suggest management actions and conservation strategies to reverse population declines and maintain stable or increasing populations; and (d) evaluate the effectiveness of the management actions and conservation strategies implemented through an adaptive management framework.

All of these monitoring, research, and management goals are in accordance with the Department of Defense (DoD) Partners-in-Flight avian conservation strategy. Moreover, because birds are excellent indicators of the health of ecological systems, they can serve as sensitive barometers of the overall effectiveness of efforts to maintain the biodiversity and ecological integrity of military installations. Accordingly, the MAPS program (<http://www.birdpop.org/maps.htm>) was initiated on select military installations beginning in 1992 and soon became one of the focal projects of the DoD Partners-in-Flight program. We proposed that information from the MAPS program would be capable of aiding research and management efforts on these military installations to protect and enhance the installations' avifauna and ecological integrity, while allowing them to fulfill their military mission.

Accordingly, in 1993, six MAPS stations were established and operated on Fort Leonard Wood. The operation of these stations was continued during the summers of 1994-2002 by means of funding from the DoD Legacy Resource Management Program, and during the summers of 2003-2007 by means of funding from Fort Leonard Wood, which also supports studies of Cerulean Warblers on the installation.

The ultimate objective of the MAPS Program on DoD installations such as Fort Leonard Wood is to identify generalized management guidelines and formulate specific management actions that can be implemented on military installations and elsewhere, to reverse the population declines of target landbird species, and to maintain the populations of stable or increasing species. The identification and formulation of these management guidelines and actions is to be achieved by modeling the vital rates (productivity and survivorship) of the various landbird species as a function of landscape-level habitat characteristics and spatially explicit weather variables. Our goal is to identify relationships between productivity (and survivorship for permanent resident species) and these habitat and weather variables. These management strategies involve efforts to modify habitat characteristics from those associated with low productivity to those associated with high productivity, for species for which low productivity is driving a population decline.

The Legacy Resource Management Program allowed us to undertake these analyses and formulate management strategies. These analyses have now been completed ([Nott et al. 2003](#)) and management guidelines have been formulated for ten bird species of conservation concern that breed in the southeastern United States. With additional funding from the Legacy Resource Management Program, we are currently implementing these guidelines and actions on eight military installations (including Fort Leonard Wood) in conjunction with efforts to increase military Readiness and Range Sustainment ([Nott and Michel 2005](#)). The strategy for implementing these guidelines includes the establishment of new MAPS stations to monitor their effectiveness, the discontinuance of an equal number of old stations, and the continued operation of others of the old stations to serve as controls for the new management stations. In this way, the total number of stations operated has remained the same.

At Fort Leonard Wood, following the recommendations of Nott et al. ([2003](#)), the Smith Ridge and Miller Ridge stations were discontinued in 2003 due to low capture rates and because they were located in mature forest where management results are less achievable. They were replaced by the Tilley Bottoms station (to act as a replicate for the Big Piney station) and the Bradford Cemetery station, a grassland area that is presently undergoing secondary succession and should be monitored. The Big Piney and Laughlin Bottoms stations were maintained as controls. Fire management of open scrubby habitat around the Miller Pond and Macedonia stations occurred during the spring of 2004. Thus, 2007 is the fourth year of operation for the Tilley Bottoms and Bradford Cemetery stations.

A complete summary of the results of the MAPS Program on Fort Leonard Wood from 1993-1999, as well as on 12 other installations or groups of nearby installations in eastern United States, was presented by DeSante et al. (2001b). This report briefly updates that earlier report and previous reports (DeSante et al. 2004, 2005; Pyle et al. 2006; Nott et al. 2006), and

documents the operation of the six MAPS stations on Fort Leonard Wood during the 2007 breeding season.

Methods

Six MAPS stations were operated in 2007, at the same locations where they were operated in 2003-2006. Each of these six MAPS stations was operated in accordance with the highly standardized banding protocols established by The Institute for Bird Populations for use by the MAPS Program throughout North America and spelled out in detail in the MAPS Manual ([DeSante et al. 2007](#)). On each day of operation each year, one 12-m long, 30-mm mesh, 4-tier nylon mist net was erected at each of ten fixed mist-netting sites within the interior eight ha of each 20-ha station. These ten nets at each station were operated for six morning hours per day (beginning at local sunrise), and for one day in each of eight consecutive 10-day periods between May 21 and August 5 (Table 1). The operation of stations occurred on schedule in each of the ten-day periods and was carried out by IBP field biologist interns Andrea Lory and Wendy Schalk, who were trained by IBP field biologists Bernie Emmons, Raphael Hernandez, and Angelina Sanchez, and were supervised by Bernie Emmons throughout the season.

With few exceptions, all birds captured during the course of the study were identified to species, age, and sex and, if unbanded, were banded with USGS/BRD numbered aluminum bands. Birds were released immediately upon capture and before being banded or processed if situations arose where bird safety would be compromised. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms ([DeSante et al. 2007](#)):

- (1) capture code (newly banded, recaptured, band changed, unbanded);
- (2) band number;
- (3) species;
- (4) age and how aged;
- (5) sex (if possible) and how sexed (if applicable);
- (6) extent of skull pneumaticization;
- (7) breeding condition of adults (i.e., extent of cloacal protuberance or brood patch);
- (8) extent of juvenal plumage in young birds;
- (9) extent of body and flight-feather molt;
- (10) extent of primary-feather wear;
- (11) presence of molt limits and plumage characteristics;
- (12) wing chord;
- (13) fat class and body mass;
- (14) date and time of capture (net-run time);
- (15) station and net site where captured; and
- (16) any pertinent notes.

Effort data (i.e., the number and timing of net-hours on each day of operation) were also collected in a standardized manner. In order to allow constant-effort comparisons of data to be made, the times of opening and closing the array of mist nets and of beginning each net check were recorded to the nearest ten minutes. The breeding (summer residency) status (confirmed

breeder, likely breeder, non-breeder) of each species seen, heard, or captured at each MAPS station on each day of operation was recorded using techniques similar to those employed for breeding bird atlas projects.

The computer entry, proofing, and verification of all banding, effort, and breeding status data were completed by IBP biologists using specially designed data entry, verification, and editing programs. The critical data for each banding record (capture code, band number, species, age, sex, date, capture time, station, and net number) were proofed by hand against the raw data and any computer-entry errors were corrected. All banding data were then run through a series of verification programs as follows:

- (1) Clean-up programs to check the validity of all codes entered and the ranges of all numerical data;
- (2) Cross-check programs to compare station, date, and net fields from the banding data with those from the effort and breeding status data;
- (3) Cross-check programs to compare species, age, and sex determinations against degree of skull pneumaticization, breeding condition (extent of cloacal protuberance and brood patch), extent of juvenal plumage, extent of body and flight-feather molt, extent of primary-feather wear, and presence of molt limits and plumage characteristics;
- (4) Screening programs which allow identification of unusual or duplicate band numbers or unusual band sizes for each species; and
- (5) Verification programs to screen banding and recapture data from all years of operation for inconsistent species, age, or sex determinations for each band number.

Any discrepancies or suspicious data identified by any of these programs were examined manually and corrected if necessary. Wing chord, weight, fat content, date and station of capture, and any pertinent notes were used as supplementary information for the correct determination of species, age, and sex in all of these verification processes. The proofed, verified, and corrected banding data from each year were then run through a series of analysis programs that calculated for each species and for all species pooled at each station and for all stations pooled on each forest:

- (1) the numbers of newly banded birds, recaptured birds, and birds released unbanded;
- (2) the numbers and capture rates (per 600 net-hours) of first captures (in each year) for individual adult and young birds; and
- (3) the reproductive index.

Following the procedures pioneered by the British Trust for Ornithology (BTO) in their CES Scheme (Peach et al. 1996), the number of adult birds captured was used as an index of adult population size. For our estimate of post-fledging productivity, we are now using “reproductive index” (number of young divided by number of adults) as opposed to “proportion of young in the catch” previously used. Reproductive index is a more intuitive value for productivity, and it is also more comparable to other calculated MAPS parameters such as

recruitment indices.

Survival was estimated for 24 target species using Modified Cormack-Jolly-Seber (CJS) mark-recapture analyses (Pollock et al.1990, Lebreton et al.1992) on 14 years (1993-2007) of capture histories of adult birds from the six long-running (including the discontinued Smith Ridge and Miller Ridge) stations. Target species were those for which, on average, at least 2.5 individual adults per year and at least two between-year returns were recorded from up to all six stations pooled at which the species was a breeder during more than half of the years the station was operated. Using the computer program TMSURVIV (White 1983, Hines et al. 2003), we calculated, for each target species, maximum-likelihood estimates and standard errors (*SEs*) for adult survival probability, adult recapture probability, and the proportion of residents among newly captured adults using a time-constant, between- and within-year transient model (Pradel et al. 1997, Nott and DeSante 2002, Hines et al. 2003). The use of the transient model accounts for the existence of transient adults (dispersing and floater individuals which are only captured once) in the sample of newly captured birds, and provides survival estimates that are unbiased with respect to these transient individuals (Pradel et al. 1997). Recapture probability is defined as the conditional probability of recapturing a bird in a subsequent year that was banded in a previous year, given that it survived and returned to the place it was originally banded.

Results and Discussion

We operated six MAPS stations on Fort Leonard Wood during the summer of 2007 for a total of 2326.7 net-hours. This represents 71.8% of the maximum expected effort. Details of the operation of these six stations are presented in Table 1.

For each individual species and for all species pooled, the numbers of individual birds newly banded, released unbanded (including hummingbirds, which we are not licensed to band), and recaptured, are presented for each station in Table 2 and for all stations combined in Table 4. A total of 979 captures of 55 species occurred at Fort Leonard Wood during the summer of 2007 (Table 4). Newly banded birds comprised 62.0% of the total captures. The greatest number of total captures (215) was recorded at the Bradford Cemetery station and the smallest number of total captures (43) was recorded at the Macedonia station. The highest species richness occurred at Big Piney (31 species) and the lowest species richness occurred at Macedonia (17 species).

The capture rates (per 600 net-hours) of individual adult and young birds and the proportion of young in the catch are presented for each species and for all species pooled at each station in Table 3, and for all stations combined in Table 4. We present capture rates (captures per 600 net-hours) of adults and young in these tables so that the data can be compared among stations which, because of the vagaries of weather and accidental net damage, can differ from one another in effort expended (Table 1). Adult population size (for all species pooled) was highest at Bradford Cemetery (184.6 adults/600 net hours; Table 3), followed by Miller Pond (181.2), Tilley Bottoms (161.4), Laughlin Bottoms (149.0), Big Piney (146.3), and Macedonia (49.4). These adult capture rates generally increased by small amounts from those of 2006 at all stations except Miller Pond (where it decreased slightly) indicating generally smaller breeding populations at Leonard Wood in 2007. Adults captured at all stations pooled (147.5; Table 4) increased by 4.6% over the value of 141.0 recorded in 2006.

Among individual species, Yellow-breasted Chat was the most frequently captured species at the six stations in 2007, followed by Indigo Bunting, White-eyed Vireo, Kentucky Warbler, Blue-winged Warbler, Field Sparrow, American Redstart, Northern Cardinal, and Common Yellowthroat (Table 4). The most abundant breeding species, having a capture rate of at least 6.0 adults per 600 net-hours, in decreasing order, were Indigo Bunting, Yellow-breasted Chat, White-eyed Vireo, Blue-winged Warbler, Kentucky Warbler, and Northern Cardinal (Table 4). The most abundant breeding species at each installation, having a capture rate of at least 6.0 adults per 600 net-hours were as follows (Table 3; species of concern, as noted below, in *italics*):

Big Piney

American Redstart
Kentucky Warbler
Louisiana Waterthrush
Acadian Flycatcher
 Blue-winged Warbler
 Indigo Bunting
 Red-eyed Vireo
 Wood Thrush*
Worm-eating Warbler
 Northern Cardinal*
 White-eyed Vireo[†]
 Carolina Wren[†]

Bradford Cemetery

Yellow-breasted Chat
 White-eyed Vireo
 Indigo Bunting
Field Sparrow
 Blue-winged Warbler
 Prairie Warbler
 Red-eyed Vireo*
 Black-and White Warbler
Kentucky Warbler
 Northern Cardinal
 American Goldfinch*
 Blue-gray Gnatcatcher

Laughlin Bottoms

Indigo Bunting
 Blue-winged Warbler
Kentucky Warbler
 White-eyed Vireo
 Yellow-breasted Chat
 Ovenbird*
 Carolina Wren[†]
Field Sparrow[†]
 Blue-gray Gnatcatcher[†]
 Common Yellowthroat[†]

Miller Pond

American Goldfinch
 Yellow-breasted Chat
 Indigo Bunting
 White-eyed Vireo
 Cedar Waxwing*
Field Sparrow
 Carolina Chickadee
 Blue-winged Warbler
 Common Yellowthroat
 Northern Cardinal
 Prairie Warbler[†]
 Red-eyed Vireo[†]
 Northern Parula[†]

Tilley Bottoms

White-eyed Vireo
 Yellow-breasted Chat
 Indigo Bunting
 Common Yellowthroat
 Blue-winged Warbler
 American Redstart*
 Blue-gray Gnatcatcher[†]
 Prairie Warbler[†]
 Black-and-white Warbler[†]
Kentucky Warbler[†]
 Northern Cardinal[†]
 American Goldfinch[†]

Macedonia

Ovenbird
 Summer Tanager*
 Indigo Bunting*
 Black-and-white Warbler[†]

* At least 6.0 adults per 600 net hours in 2007 but not in 2006.

† At least 6.0 adults per 600 net hours in 2006 but not in 2007.

Reproductive index (the number of young per adult captured) showed a different pattern over the six stations than adult population size (Table 3), being highest at Miller Pond (0.35),

followed by Macedonia (0.32), Big Piney (0.30), Tilley Bottoms (0.28), Laughlin Bottoms (0.26), and Bradford Cemetery (0.15). The overall reproductive index for the six stations in 2007 was 0.27 (Table 4), same as in 2006 (and compared to 0.26 in 2005), suggesting similar productivity between the three years. Mean reproductive index for all species pooled at Fort Leonard Wood during the seven years 1993-1999 was 0.209 (see DeSante et al. 2001b), less than the 2005-2007 values (albeit with two different stations).

Using 14 years of data from the six long-running stations combined, estimates of adult survival and recapture probabilities were obtained for 24 target species breeding at Fort Leonard Wood. Maximum-likelihood estimates of annual adult survival probability, recapture probability, and proportion of residents among newly captured adults from the time-constant transient model are presented in Table 5. Annual adult survival-rate estimates ranged from a low of 0.331 for Carolina Wren to a high of 0.650 for Ovenbird, with a mean of 0.531 for the 24 species. Furthermore, the C.V.s for the 24 species at Fort Leonard Wood were low (18 of the 24 species < 30%, 14 species < 20%, and 9 species < 10%) indicating quite precise estimates. Moreover, we found that the mean C.V. for the same 24 species from 14 years (1993-2006) of data declined from 19.8% to 18.6% with the addition of the 15th year of data, indicating that survival estimates may continue to become more precise, even after 15 years of data have been collected.

In summary, survival of landbirds at Fort Leonard Wood appears to be quite good, better than that at other MAPS stations in the South-central MAPS Region (DeSante et al. 2004). We suggest that the populations of landbirds breeding at Fort Leonard Wood consist of high-quality individuals that are attracted to and able to hold territories in the pristine habitats at the Fort and that, on average, display better survival than birds that breed over the South-central Region as a whole. This suggests that Fort Leonard Wood is very important to landbird populations.

As mentioned earlier, analyses aimed at identifying and describing relationships between four demographic parameters (adult population size, population trend, number of young, and productivity) and landscape-level habitat characteristics for ten bird species of conservation concern have been completed for 13 military installations in south-central and southeastern United States, including Fort Leonard Wood (Nott et al. 2003, Nott and Michel 2005). At Fort Leonard Wood, five species with declining or stable populations emerged as candidates for particular management concern: Acadian Flycatcher, Worm-eating Warbler, Louisiana Waterthrush, Kentucky Warbler, and Field Sparrow.

Nott et al. (2003) predicted that fire management practices, implemented in the vicinity of certain stations, should result in increased populations and productivity among Field Sparrows at those stations. Fire management has occurred at Fort Leonard Wood at various times: during spring 2000 at Laughlin Bottoms, spring 2002 at Miller Pond and Bradford Cemetery, and spring 2003 at Macedonia; no fire management has occurred at the remaining two stations, Big Piney and Tilley Bottoms. Examination of Field Sparrow data indicate that adult populations at each of the four stations having fire management showed increases which peaked during the year or two following that of the managed burns: 2002 at Laughlin Bottoms (10.2 adults/600 net hours), 2003 at Miller Pond (29.3), 2003 at Bradford Cemetery (36.0), and 2004 at Macedonia (4.3). In

each case, these totals were the highest recorded during the 7-year period 2001-2007. Interestingly, breeding populations declined in each case during the following three-year period, including 2007 (Table 3), suggesting that the positive effects of burn management on Field Sparrow populations last only 2-3 years. Field Sparrow productivity have appeared fairly stable at the burn-management stations since the burns took place. Interestingly, however, productivity has show slight increases over the past four years, from 0.26-0.28 in 2004-2006, to 0.33 in 2007. This suggests a pattern whereby recruitment is strong in the 2-3 year following a burn, after which populations decrease but productivity increases. Perhaps some of the adults captured during years of recruitment were non-breeding or poor-breeding individuals.

For successional species, such as Field Sparrow, the conservation goal is to consistently provide enough primary breeding habitat to annually support a target number of territories (dependent on installation or management zone) and level of productivity consistent with that of a source population in which breeding individuals are able to replace their own numbers. This requires maintaining a mosaic of habitat patches in various stages of post-fire succession such that every year there are adequate areas of habitat for recruitment, breeding, and strong reproductive success. The ability to maintain an abundant "source" population might be considered an adequate performance measure by which to evaluate landbird conservation efforts and habitat management techniques.

Nott et al. (2003) also predicted that the establishment of the two new stations, Tilley Bottoms and Bradford Cemetery, should shed further light on landbird population dynamics at Fort Leonard Wood, including those of the other four target species, Acadian Flycatcher, Worm-eating Warbler, Louisiana Waterthrush, and Kentucky Warbler. In 2005 all of these species except the waterthrush were captured at these two stations, including excellent capture rates of Kentucky Warbler. During 2006-2007, captures of all species except Kentucky Warbler were low at these stations, which might relate to decreased capture rates overall during 2006-2007 as compared with 2005. Excellent capture rates of two other target species (with increasing populations), Blue-winged and Prairie warblers, were also obtained at one or both of the two new stations in 2005-2007, and Yellow-breasted Chats were also commonly captured. We might expect the numbers and reproductive success of both these species to decline in coming years as Bradford Cemetery is managed for succession of the pine forest community currently surrounding it. Although this will eventually represent a loss of productive field sparrow habitat, "disclimax" management on other parts of the installation could replace such habitat. Thus, it appears that the addition of these two stations will help us resolve the population dynamics of target species of management concern at Fort Leonard Wood.

The overall goal of this work is to evaluate the efficiency of on-going management practices (or cessation thereof) aimed at reversing declining populations and maintaining stable or increasing populations of target landbird species; and to modify those management practices in an adaptive management framework. The results of the first two years of this effort indicates that we are well on our way to achieving success in this endeavor.

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Table 1. Summary of the 2007 MAPS program on Fort Leonard Wood.

Station					Avg Elev. (m)	2007 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude		Total number of net-hours ¹	No. of periods	Inclusive dates
Big Piney	BIPI	14422	Bottomland riparian forest, open fields, scrublands	37°44'33"N,92°02'34"W	235	393.7 (382.3)	8	5/24-8/01
Laughlin Bottoms	LABO	14423	Oldfield complex, walnut plantation, deciduous forest, mature riparian forest	37°46'44"N,92°10'47"W	300	442.8 (430.3)	8	5/23-7/30
Tilley Bottoms	TIBO	14495	Black walnut plantation, mesic lowland	37°46'26"N,92°12'03"W	250	353.2 (340.0)	8	5/25-8/02
Bradford Cemetery	BRCE	14494	Oldfield complex burned every three years, oak forest, pond	37°42'18"N,92°07'00"W	317	403.0 (318.8)	8	5/20-8/04
Miller Pond	MIPO	14424	Old field complex, deciduous forest of varying ages, ponds, mowed firebreaks	37°41'40"N,92°06'40"W	326	394.0 (309.5)	8	5/21-8/03
Macedonia	MACE	14425	Oldfield complex, cedar brakes, secondary woodland	37°36'40"N,92°14'10"W	360	340.0 (315.8)	8	5/22-7/31
ALL STATIONS COMBINED						2326.7(2096.8)	8	5/20 - 8/04

¹ Total net-hours in 2007. Net-hours in 2007 that could be compared in a constant-effort manner to 2006 are shown in parentheses.

Table 2. Capture summary for the six individual MAPS stations operated on Fort Leonard Wood in 2007.
 N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Cooper's Hawk										1								
Mourning Dove								2										
Ruby-throated Hummingbird		1			5			8		7			6					1
Unidentified Hummingbird		1			5			1					1					
Red-bellied Woodpecker	1																	
Downy Woodpecker	1																	
Hairy Woodpecker	1								1							1		
Pileated Woodpecker		1																
Eastern Wood-Pewee				2			2			2			2					2
Yellow-bellied Flycatcher	1																	
Acadian Flycatcher	5		3	2		1				1								
Traill's Flycatcher							1	1		2								
Unident. Empidonax Flycat.		4			1				6		2			1				1
Eastern Phoebe				1			2						8			2		
Eastern Kingbird													1					
Unidentified Flycatcher														2				
White-eyed Vireo	1		4	12		5	11		8	15		16	5		6			
Red-eyed Vireo	5		3	6			3			10		3	3					1
Blue Jay													2					
Carolina Chickadee	1			1						3			4					1
Carol. X Black-c. Chick. Hybrid														1				
Tufted Titmouse				3			1			2			2			2		1
Carolina Wren	5		2	7		2	1						4		2			
Bewick's Wren														1				
Unidentified Wren														1				

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on Fort Leonard Wood in 2007.
 N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Blue-gray Gnatcatcher	1			4	2		3	1		4	3	1	5					
Eastern Bluebird													5					
Swainson's Thrush	1			2			1		1							1	1	
Wood Thrush	5		3				3		1							1		
Gray Catbird				1														
Brown Thrasher							2	1										
Cedar Waxwing										1			7		1			
Blue-winged Warbler	7		2	7		10	11		1	4	1	9	2		3			
Northern Parula	2			1			2			4			2					
Yellow Warbler				1														
Magnolia Warbler							2	1		1								
Yellow-throated Warbler	1																	
Prairie Warbler					1					6	1	8	6	1	2			
Black-and-white Warbler	3		1	2		1	3			5		4				5		
American Redstart	12	4	12	1	1		4	1										
Prothonotary Warbler	1																	
Worm-eating Warbler	7			3			1			2								
Ovenbird	3			7		2	7	1		3			1			4		1
Louisiana Waterthrush	13		3										1					
Kentucky Warbler	15		7	14	1	6	4	1		4		4	2		1			
Mourning Warbler													2					
Common Yellowthroat	1			4			7		13	1			3		4			
Wilson's Warbler							1											
Yellow-breasted Chat				8		6	10	3	13	17		20	14		14			
Summer Tanager	1		1	1						2						4		

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on Fort Leonard Wood in 2007.
 N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Scarlet Tanager																		1
Eastern Towhee		1		1	1	1				2								
Chipping Sparrow																		1
Field Sparrow				2		1		1	2	7		9	8		4			2
Northern Cardinal	5		2	2		2	6	1	2	4		1	4	1	2			3
Blue Grosbeak													1					
Indigo Bunting	4		4	11		10	11		2	8	1	5	15		8	4	1	1
Brown-headed Cowbird	1			1			1		1	1			1					
American Goldfinch	1			3			2	1	1	5	1	1	30		4			
ALL SPECIES POOLED	105	12	47	110	17	47	102	30	45	117	17	81	140	15	51	33	5	5
Total Number of Captures		164			174			177			215			206			43	
Number of Species	28	4	13	28	6	12	26	13	11	27	7	12	27	5	12	14	4	5
Total Number of Species		31			30			29			29			30			17	

Table 3. Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Fort Leonard Wood in 2007.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
Red-bellied Woodpecker	1.5	0.0	0.00															
Downy Woodpecker	0.0	1.5	und. ¹															
Hairy Woodpecker	0.0	0.0	0.00							1.5	0.0	0.00				1.8	0.0	0.00
Eastern Wood-Pewee				1.4	1.4	1.00	3.4	0.0	0.00	3.0	0.0	0.00	3.0	0.0	0.00	3.5	0.0	0.00
Acadian Flycatcher	9.1	0.0	0.00	4.1	0.0	0.00				0.0	1.5	und. ¹						
Traill's Flycatcher							1.7	0.0	0.00	3.0	0.0	0.00						
Eastern Phoebe				0.0	1.4	und. ¹	3.4	0.0	0.00				4.6	7.6	1.67	3.5	0.0	0.00
Eastern Kingbird													1.5	0.0	0.00			
White-eyed Vireo	4.6	0.0	0.00	14.9	6.8	0.46	23.8	1.7	0.07	23.8	1.5	0.06	10.7	1.5	0.14			
Red-eyed Vireo	7.6	1.5	0.20	5.4	1.4	0.25	5.1	0.0	0.00	10.4	4.5	0.43	3.0	1.5	0.50	1.8	0.0	0.00
Blue Jay													3.0	0.0	0.00			
Carolina Chickadee	1.5	0.0	0.00	1.4	0.0	0.00				3.0	1.5	0.50	6.1	0.0	0.00	1.8	0.0	0.00
Tufted Titmouse				0.0	4.1	und.	0.0	1.7	und. ¹	1.5	1.5	1.00	0.0	3.0	und. ¹	1.8	3.5	2.00
Carolina Wren	4.6	6.1	1.33	2.7	8.1	3.00	1.7	0.0	0.00				0.0	6.1	und.			
Blue-gray Gnatcatcher	1.5	0.0	0.00	5.4	0.0	0.00	5.1	0.0	0.00	6.0	0.0	0.00	3.0	4.6	1.50			
Eastern Bluebird													0.0	7.6	und.			
Wood Thrush	7.6	1.5	0.20				5.1	0.0	0.00							0.0	1.8	und. ¹
Gray Catbird				1.4	0.0	0.00												
Brown Thrasher							0.0	1.7	und.									
Cedar Waxwing										1.5	0.0	0.00	10.7	0.0	0.00			
Blue-winged Warbler	9.1	3.0	0.33	19.0	0.0	0.00	15.3	5.1	0.33	11.9	0.0	0.00	6.1	0.0	0.00			

Table 3. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Fort Leonard Wood in 2007.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
Northern Parula	3.0	0.0	0.00	1.4	0.0	0.00	1.7	1.7	1.00	4.5	1.5	0.33	3.0	0.0	0.00			
Yellow Warbler				1.4	0.0	0.00												
Yellow-throated Warbler	1.5	0.0	0.00															
Prairie Warbler										11.9	3.0	0.25	3.0	9.1	3.00			
Black-and-white Warbler	3.0	3.0	1.00	1.4	1.4	1.00	1.7	3.4	2.00	10.4	1.5	0.14				3.5	5.3	1.50
American Redstart	24.4	1.5	0.06	0.0	1.4	und.	6.8	0.0	0.00									
Prothonotary Warbler	1.5	0.0	0.00															
Worm-eating Warbler	6.1	4.6	0.75	1.4	2.7	2.00	1.7	0.0	0.00	3.0	0.0	0.00						
Ovenbird	4.6	0.0	0.00	10.8	1.4	0.13	5.1	6.8	1.33	4.5	0.0	0.00	1.5	0.0	0.00	7.1	1.8	0.25
Louisiana Waterthrush	12.2	10.7	0.88										0.0	1.5	und.			
Kentucky Warbler	22.9	6.1	0.27	17.6	4.1	0.23	3.4	3.4	1.00	7.4	1.5	0.20	1.5	1.5	1.00			
Common Yellowthroat	0.0	1.5	und.	4.1	1.4	0.33	17.0	5.1	0.30	0.0	1.5	und.	6.1	1.5	0.25			
Yellow-breasted Chat				14.9	2.7	0.18	23.8	6.8	0.29	26.8	7.4	0.28	28.9	4.6	0.16			
Summer Tanager	1.5	0.0	0.00	1.4	0.0	0.00				3.0	0.0	0.00				7.1	0.0	0.00
Scarlet Tanager																1.8	0.0	0.00
Eastern Towhee				2.7	0.0	0.00				3.0	0.0	0.00						
Chipping Sparrow																1.8	0.0	0.00
Field Sparrow				4.1	0.0	0.00	3.4	0.0	0.00	13.4	1.5	0.11	9.1	7.6	0.83	1.8	1.8	1.00
Northern Cardinal	6.1	3.0	0.50	5.4	0.0	0.00	5.1	6.8	1.33	7.4	0.0	0.00	6.1	1.5	0.25	5.3	0.0	0.00
Blue Grosbeak													1.5	0.0	0.00			
Indigo Bunting	9.1	0.0	0.00	21.7	0.0	0.00	20.4	0.0	0.00	14.9	0.0	0.00	22.8	3.0	0.13	7.1	1.8	0.25

Table 3. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Fort Leonard Wood in 2007.

Species	Big Piney			Laughlin Bottoms			Tilley Bottoms			Bradford Cemetery			Miller Pond			Macedonia		
	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index	Ad.	Yg.	Repr. index
Brown-headed Cowbird	1.5	0.0	0.00	1.4	0.0	0.00	1.7	1.7	1.00	1.5	0.0	0.00	0.0	1.5	und.			
American Goldfinch	1.5	0.0	0.00	4.1	0.0	0.00	5.1	0.0	0.00	7.4	0.0	0.00	45.7	0.0	0.00			
ALL SPECIES POOLED	146.3	44.2	0.30	149.0	37.9	0.26	161.4	45.9	0.28	184.6	28.3	0.15	181.2	64.0	0.35	49.4	15.9	0.32
Number of Species	23	12		24	13		22	12		24	12		21	16		14	6	
Total Number of Species		25			27			24			26			26			15	

¹ Reproductive index (young/adult) is undefined because no adults of this species were captured at this station in this year.

Table 4. Summary of results for all six Fort Leonard Wood MAPS stations combined in 2007.

Species	Birds captured			Birds/600 nethours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Cooper's Hawk		1				
Mourning Dove		2				
Ruby-throated Hummingbird		28				
Unidentified Hummingbird		8				
Red-bellied Woodpecker	1			0.3	0.0	0.00
Downy Woodpecker	1			0.0	0.3	und. ¹
Hairy Woodpecker	3			0.5	0.0	0.00
Pileated Woodpecker		1				
Eastern Wood-Pewee	10			2.3	0.3	0.11
Yellow-bellied Flycatcher	1					
Acadian Flycatcher	8		4	2.3	0.3	0.11
Traill's Flycatcher	3	1		0.8	0.0	0.00
Unidentified Empidonax Flycatcher		15				
Eastern Phoebe	13			1.8	1.5	0.86
Eastern Kingbird	1			0.3	0.0	0.00
Unidentified Flycatcher		2				
White-eyed Vireo	44		39	13.2	2.1	0.16
Red-eyed Vireo	27	1	7	5.7	1.5	0.27
Blue Jay	2			0.5	0.0	0.00
Carolina Chickadee	9		1	2.3	0.3	0.11
Carolina X Black-c. Chickadee Hybrid		1				
Tufted Titmouse	10		1	0.5	2.3	4.50
Carolina Wren	17		6	1.5	3.6	2.33
Bewick's Wren		1				
Unidentified Wren		1				
Blue-gray Gnatcatcher	17	6	1	3.6	0.8	0.21
Eastern Bluebird	5			0.0	1.3	und.
Swainson's Thrush	5	1	1			
Wood Thrush	9		4	2.1	0.5	0.25
Gray Catbird	1			0.3	0.0	0.00
Brown Thrasher	2	1		0.0	0.3	und.
Cedar Waxwing	8		1	2.1	0.0	0.00
Blue-winged Warbler	31	1	25	10.6	1.3	0.12

Table 4. (cont.) Summary of results for all six Fort Leonard Wood MAPS stations combined in 2007.

Species	Birds captured			Birds/600 nethours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Northern Parula	11			2.3	0.5	0.22
Yellow Warbler	1			0.3	0.0	0.00
Magnolia Warbler	3	1				
Yellow-throated Warbler	1			0.3	0.0	0.00
Prairie Warbler	12	3	10	2.6	2.1	0.80
Black-and-white Warbler	18		6	3.4	2.3	0.69
American Redstart	17	6	12	5.2	0.5	0.10
Prothonotary Warbler	1			0.3	0.0	0.00
Worm-eating Warbler	13			2.1	1.3	0.63
Ovenbird	25	1	3	5.7	1.5	0.27
Louisiana Waterthrush	14		3	2.1	2.1	1.00
Kentucky Warbler	39	2	18	9.3	2.8	0.31
Mourning Warbler	2					
Common Yellowthroat	16		17	4.4	1.8	0.41
Wilson's Warbler	1					
Yellow-breasted Chat	49	3	53	16.0	3.6	0.23
Summer Tanager	8		1	2.1	0.0	0.00
Scarlet Tanager	1			0.3	0.0	0.00
Eastern Towhee	3	2	1	1.0	0.0	0.00
Chipping Sparrow	1			0.3	0.0	0.00
Field Sparrow	19	1	16	5.4	1.8	0.33
Northern Cardinal	24	2	9	5.9	1.8	0.30
Blue Grosbeak	1			0.3	0.0	0.00
Indigo Bunting	53	2	30	16.2	0.8	0.05
Brown-headed Cowbird	5		1	1.0	0.5	0.50
American Goldfinch	41	2	6	10.8	0.0	0.00
ALL SPECIES POOLED	607	96	276	1 47.5	39.7	0.27
Total Number of Captures		979				
Number of Species	49	23	26	41	28	
Total Number of Species		55			44	

¹ Reproductive index (young/adult) is undefined because no adults of this species were captured at this location in this year.

Table 5. Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using a time-constant model for 24 species breeding at MAPS stations on Fort Leonard Wood obtained from 15 years¹ (1993-2007) of mark-recapture data. Data is included from all eight MAPS stations that have ever operated on Fort Leonard Wood.

Species	Num. sta ²	Num. ind. ³	Num. caps. ⁴	Num. ret. ⁵	Survival probability ⁶	Surv. C.V. ⁷	Recapture probability ⁸	Proportion of residents ⁹
Downy Woodpecker	7	109	126	12	0.622 (0.109)	17.6	0.250 (0.114)	0.278 (0.150)
Acadian Flycatcher	6	185	308	52	0.620 (0.049)	7.9	0.385 (0.064)	0.415 (0.101)
White-eyed Vireo	6	309	592	97	0.572 (0.042)	7.4	0.523 (0.058)	0.491 (0.086)
Red-eyed Vireo	7	292	368	47	0.514 (0.061)	11.9	0.303 (0.073)	0.572 (0.163)
Carolina Chickadee †	7	164	196	19	0.484 (0.099)	20.4	0.143 (0.081)	1.000 (0.583)
Carolina Wren	5	113	152	14	0.331 (0.103)	31.1	0.566 (0.206)	0.402 (0.199)
Blue-gray Gnatcatcher ‡†	7	154	171	4	0.514 (0.215)	41.8	0.031 (0.059)	1.000 (1.868)
Blue-winged Warbler	5	468	716	109	0.582 (0.039)	6.7	0.416 (0.050)	0.416 (0.069)
Northern Parula †	7	94	105	7	0.644 (0.143)	22.3	0.056 (0.064)	1.000 (1.168)
Prairie Warbler	4	263	376	52	0.574 (0.059)	10.2	0.226 (0.055)	0.734 (0.198)
Black-and-white Warbler	6	133	152	8	0.493 (0.164)	33.3	0.342 (0.202)	0.217 (0.159)
American Redstart	1	120	163	24	0.643 (0.083)	12.9	0.257 (0.082)	0.574 (0.216)
Worm-eating Warbler	2	92	118	11	0.536 (0.116)	21.6	0.572 (0.173)	0.132 (0.075)
Ovenbird	7	166	220	24	0.650 (0.074)	11.4	0.264 (0.078)	0.348 (0.126)
Louisiana Waterthrush	1	68	112	13	0.339 (0.105)	30.9	0.780 (0.188)	0.474 (0.234)
Kentucky Warbler	6	381	642	113	0.636 (0.035)	5.6	0.452 (0.047)	0.374 (0.061)
Common Yellowthroat	4	282	533	81	0.470 (0.045)	9.5	0.604 (0.071)	0.485 (0.095)
Yellow-breasted Chat	4	557	1022	205	0.632 (0.028)	4.4	0.400 (0.034)	0.597 (0.070)
Summer Tanager	3	47	55	5	0.479 (0.176)	36.9	0.187 (0.180)	0.689 (0.716)
Eastern Towhee ‡†	6	53	63	3	0.509 (0.250)	49.1	0.071 (0.103)	1.000 (1.420)
Field Sparrow	4	429	639	86	0.456 (0.044)	9.6	0.311 (0.055)	0.812 (0.165)
Northern Cardinal	7	228	319	50	0.601 (0.057)	9.5	0.239 (0.056)	0.743 (0.195)
Indigo Bunting	7	806	1262	197	0.488 (0.029)	6.0	0.404 (0.040)	0.680 (0.086)
American Goldfinch †	4	221	264	14	0.366 (0.108)	29.4	0.137 (0.098)	1.000 (0.726)

Table 5. (cont.) Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using a time-constant model for 24 species breeding at MAPS stations on Fort Leonard Wood obtained from 15 years¹ (1993-2007) of mark-recapture data. Data is included from all eight MAPS stations that have ever operated on Fort Leonard Wood.

- ¹ Analysis of all stations pooled include data from 1993-2007 from the Big Piney, Laughlin Bottoms, Miller Pond and Macedonia stations as well as data from 1993-2002 from the Smith Ridge and Miller stations and 2003-2007 from the Tilley Bottoms and Bradford Cemetery stations.
- ² Number of stations where the species was a regular or usual breeder and at which adults of the species were captured. Stations within one km of each other were combined into a single super-station to prevent individuals whose home ranges included portions of two or more stations from being counted as multiple individuals.
- ³ Number of adult individuals captured at stations where the species was a regular or usual breeder (i.e., number of capture histories).
- ⁴ Total number of captures of adult birds of the species at stations where the species was a regular or usual breeder.
- ⁵ Total number of returns. A return is the first recapture in a given year of a bird originally banded at the same station in a previous year.
- ⁶ Survival probability (ϕ) presented as the maximum likelihood estimate (standard error of the estimate).
- ⁷ The coefficient of variation for survival probability, $CV(\phi)$.
- ⁸ Recapture probability (p) presented as the maximum likelihood estimate (standard error of the estimate).
- ⁹ The proportion of residents among newly captured adults (τ) presented as the maximum likelihood estimate (standard error of the estimate).
- ‡ The estimate for survival probability should be viewed with caution because it is based on fewer than five between-year recaptures, or the estimate is very imprecise ($SE(\phi) > 0.200$ or $CV(\phi) > 50.0\%$), or the proportion of residents is equal to zero.
- † The estimate for recapture probability (and possibly survival probability as well) may be biased low because the estimate for τ was 1.000.

Appendix I. Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha codes, and species names for all species banded or encountered during the 15 years, 1993-2007, of the MAPS Program on the eight stations ever operated on Fort Leonard Wood.

Cumulative breeding status for all years in which each station was operated are also included (B = Regular Breeder (all years); U = Usual Breeder (>½, not all, years); O = Occasional Breeder (≤½ years); T = Transient; M = Migrant; A= Altitudinal Disperser; ? = Uncertain Species ID

NUMB	SPEC	SPECIES NAME	Big Piney (BIP)	Laughlin Bottoms (LABO)	Tilley Bottoms (TIBO)	Bradford Cemetery (BRCE)	Miller Pond (MIPPO)	Macedonia (MACE)	Miller Ridge (MIRI)	Smith Ridge (SMRI)
00130	PBGR	Pied-billed Grebe	T							
00950	AMBI	American Bittern		T						
01010	GBHE	Great Blue Heron	T	T		T	T	O	O	
01040	GREG	Great Egret	T							
01130	GRHE	Green Heron	T	T			T	O		
01300	TUVU	Turkey Vulture	O	O	T	T	O	O	O	O
01460	CANG	Canada Goose	T		T		T	T		
01570	WODU	Wood Duck	T				O	O		
01580	GADW	Gadwall					T	O		
02015	UNDU	Unidentified Duck		?	?		?			
02130	BAEA	Bald Eagle	T							
02200	SSHA	Sharp-shinned Hawk	M		M			M		
02210	COHA	Cooper's Hawk		T		T			T	
02380	RSHA	Red-shouldered Hawk	O	O	U	T	O	U	U	O
02400	BWHA	Broad-winged Hawk		T	T	T	O	T	T	T
02460	RTHA	Red-tailed Hawk	T	O	T	T	T	T	T	
02545	UNHA	Unidentified Hawk					?	?		
03040	WITU	Wild Turkey	O	O	T	T	U	O	O	O
03160	NOBO	Northern Bobwhite	U	U	T	T	U	O	O	T
03550	AMCO	American Coot	T	T						
03780	KILL	Killdeer					O	T		
04490	AMWO	American Woodcock	O	T			T			
05570	MODO	Mourning Dove	U	U	B	U	U	B	O	O
06400	BBCU	Black-billed Cuckoo	T	T	O		O			T
06410	YBCU	Yellow-billed Cuckoo	U	B	B	B	B	U	U	U
06680	EASO	Eastern Screech-Owl	T			T				
06800	GHOW	Great Horned Owl				T				

Appendix I. Continued.

NUMB	SPEC	SPECIES NAME	BIP1	LABO	TIBO	BRCE	MIPO	MACE	MIRI	SMRI
13490	NRWS	Northern Rough-winged Swallow	T	T	T		T	O		
13540	BARS	Barn Swallow	T		T	T	T	T		
13560	CACH	Carolina Chickadee	U	B	B	B	B	B	U	U
13565	CBCC	Carolina X Black-c. Chickadee Hybrid				T	T			
13570	BCCH	Black-capped Chickadee	T	O	T		O	O	O	
13575	UPCH	Unidentified Poecile Chickadee	?	?	?	?	?	?		
13660	TUTI	Tufted Titmouse	B	B	B	B	B	B	B	U
13700	WBNU	White-breasted Nuthatch	B	O	T	T	O	O	U	U
14000	CARW	Carolina Wren	B	U	B	U	U	O	U	O
14040	BEWR	Bewick's Wren		T		T	O			T
14070	HOWR	House Wren			T		T	O		
14205	UNWR	Unidentified Wren					?			
14350	BGGN	Blue-gray Gnatcatcher	U	B	B	B	B	B	U	U
14560	EABL	Eastern Bluebird	T	T		T	O	O		
14780	VEER	Veery						M	M	M
14790	GCTH	Gray-cheeked Thrush	M	M	M					M
14810	SWTH	Swainson's Thrush	M	M	M			M		M
14830	WOTH	Wood Thrush	B	O	O	T		U	U	O
15000	AMRO	American Robin	T	T	T	T	O	O		
15130	GRCA	Gray Catbird	T	O	T	T	O	T		T
15150	NOMO	Northern Mockingbird					O			
15200	BRTH	Brown Thrasher	O	O	B	T	O	T		
15550	CEDW	Cedar Waxwing	T	O	T	T	T	T		T
15630	BWWA	Blue-winged Warbler	B	B	B	B	B	U	O	
15640	GWWA	Golden-winged Warbler		T						
15650	TEWA	Tennessee Warbler	M							
15670	NAWA	Nashville Warbler							M	
15730	NOPA	Northern Parula	B	B	B	B	U	U	B	U
15750	YWAR	Yellow Warbler	T	T						
15760	CSWA	Chestnut-sided Warbler				M				
15770	MAWA	Magnolia Warbler		M	M	M	M			
15870	YTWA	Yellow-throated Warbler	U	O	O		O			
15910	PIWA	Pine Warbler		M		M	M		T	O
15930	PRAW	Prairie Warbler		U	B	B	B	U		

Appendix I. Continued.

NUMB	SPEC	SPECIES NAME	BIP1	LABO	TIBO	BRCE	MPO	MACE	MIRI	SMRI
15980	CERW	Cerulean Warbler	U	O	T				O	
16030	BAWW	Black-and-white Warbler	U	U	B	B	U	U	U	O
16040	AMRE	American Redstart	B	O	T			O	O	
16050	PROW	Prothonotary Warbler	U	T						
16060	WEWA	Worm-eating Warbler	B	O	T	T	T	O	U	O
16080	OVEN	Ovenbird	U	U	B	O	O	B	B	B
16090	NOWA	Northern Waterthrush	M	M			M			
16100	LOWA	Louisiana Waterthrush	B	O			T	O	O	
16110	KEWA	Kentucky Warbler	B	B	B	B	U	U	U	T
16130	MOWA	Mourning Warbler	M	M	M		M			
16150	COYE	Common Yellowthroat	U	B	B	U	B	O	O	T
16280	HOWA	Hooded Warbler					T			
16290	WIWA	Wilson's Warbler		M	M	M				
16300	CAWA	Canada Warbler	M	M				M		
16460	YBCH	Yellow-breasted Chat	U	B	B	B	B	O	O	T
16495	UNWA	Unidentified Warbler		?			?		?	?
16820	SUTA	Summer Tanager	O	O	T	B	U	O	U	B
16830	SCTA	Scarlet Tanager	T	T	T	T	O	O	O	O
17820	EATO	Eastern Towhee	B	B	B	B	B	B	U	T
18020	CHSP	Chipping Sparrow	T	O		T	O	O		O
18050	FISP	Field Sparrow	T	B	B	B	B	B		
18090	LASP	Lark Sparrow					T			
18140	GRSP	Grasshopper Sparrow						T		
18160	HESP	Henslow's Sparrow				M				
18240	LISP	Lincoln's Sparrow		M						
18560	NOCA	Northern Cardinal	B	B	B	B	B	B	B	U
18600	RBGR	Rose-breasted Grosbeak		T				T		
18640	BLGR	Blue Grosbeak	T				O	T		
18670	INBU	Indigo Bunting	B	B	B	B	B	B	B	U
18730	RWBL	Red-winged Blackbird	O			T	O	U		
18800	EAME	Eastern Meadowlark	T	T			T	T		
18870	COGR	Common Grackle		T		T	T	T		
18960	BHCO	Brown-headed Cowbird	O	O	U	U	B	U	O	O
19040	OROR	Orchard Oriole	T	O			O			

Appendix I. Continued.

NUMB	SPEC	SPECIES NAME	BIP1	LABO	TIBO	BRCE	MIPO	MACE	MIRI	SMRI
19160	BAOR	Baltimore Oriole		T			T			
19370	HOFI	House Finch						T		
19510	AMGO	American Goldfinch	O	U	B	B	B	U	O	O
20085	UNBI	Unidentified Bird		?		?	?			?