# THE 2005 REPORT OF THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM ON FORT BRAGG

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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 that is critically needed for efforts to identify demographic causes of the severe and sometimes accelerating population declines documented for many species of North American landbirds (Robbins et al. 1989, Terborgh 1989, DeSante 1992, DeSante et al. 1995, 1999, 2001a, Peterjohn et al.1995). 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, including Neotropical-wintering migrants, temperate-wintering migrants, and permanent residents: (a) annual indices of adult population size and post-fledging productivity from data on the numbers and proportions of young and adult 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 and estimates at a variety of spatial scales ranging from the 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) identify thresholds and trigger points to notify appropriate agencies and organizations of 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 actually implemented through an adaptive management framework.

All of these monitoring, research, and management goals are in agreement with the Department of Defense (DoD) Partners-in-Flight (PIF) strategy. Moreover, because birds are excellent indicators of the health of ecological systems, they can serve as a sensitive barometer of the overall effectiveness of efforts to maintain the biodiversity and ecological integrity of military installations. Accordingly, the MAPS program was initiated on select military installations beginning in 1992 and soon became one of the focus projects of the DoD PIF program. It was expected 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.

In 1995, six MAPS stations were established and operated on Fort Bragg. The operation of these stations during the summers of 1995 and 1996 and the subsequent analyses of data from those years were accomplished through funding from U.S. Army Fort Bragg. Operation of these six MAPS station and associated data analyses during the three years 1997-1999 was accomplished by means of funding from the DoD Legacy Resource Management Program. The operation of the six stations was continued during the summers of 2000 through 2005 by means of funding from Fort Bragg, while the comprehensive analyses of data from 1995-2002 was funded by the DoD Legacy Resource Management Program.

The initial objective of the MAPS Program on DoD installations such as Fort Bragg has been to identify generalized management guidelines and formulate specific management actions that could 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 was 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. The goal was to identify relationships between adult population size, numbers of young produced, productivity (ratio of young to adults), and trends in those parameters and these habitat and weather variables. The resultant management strategies were designed to involve efforts to modify the habitat from characteristics associated with low population size, population trend, or productivity to characteristics associated with high population size, population trend, or productivity (especially for species for which low productivity was found to be driving the population decline).

The Legacy Resource Management Program allowed us to undertake these analyses and formulate management strategies. These analyses were completed in 2003 and management guidelines were formulated for ten bird species of conservation concern that breed in the southeastern United States (Nott et al. 2003). With additional funding from the Legacy Resource Management Program, we are currently implementing these guidelines through management actions on eight military installations (including Fort Bragg) 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 the effectiveness of such proposed or on-going management, 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 will remain the same.

At Fort Bragg Prairie Warbler and Field Sparrow were identified as management species of concern. Following the recommendations of Nott et al. (2003), the I102 station was discontinued in 2003 to reduce the probability of capturing endangered Red-cockaded Woodpeckers that breed within the boundaries of that station. The I102 station was replaced by the Sandstone Hill station in a mosaic of upland patchy forest, shrubland, and grasslands that are frequently managed to reduce fire risks.

A complete summary of the results of the MAPS Program on Fort Bragg from 1993-1999, as well as on 12 other installations or groups of nearby installations in the eastern United States, was presented by DeSante et al. (2001b), a summary of 2000-2004 results was presented by DeSante et al. (2002, 2004, and 2005a), and a summary of 2003 results was presented by DeSante et al. (2004). This report briefly updates these earlier reports and documents the operation of the six MAPS stations on Fort Bragg during the 2005 breeding season.

## Methods

Six MAPS stations were operated in 2005, in the same locations where they were first established in 1995 (five stations) or 2003 (Sandstone Hill station). 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. 2005b). 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 nine consecutive 10-day periods between May 12 and July 31 (Table 1). The operation of stations occurred on schedule in each of the ten-day periods and was carried out by IBP field biologist intern Doug Bruce, who was trained by IBP field biologist Nicole Michel and Jennifer McNicoll, and assisted by volunteers David and Michael McCloy.

All MAPS stations were 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. 2005b). 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-net 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) for one day in each of nine consecutive 10-day periods between May 11 and August 4 (Tables 1 and 6). The operation of all stations occurred on schedule in each ten-day period. The operation of stations at Fort Bragg was carried out by field biologist intern Doug Bruce, who was trained and supervised by IBP field biologists Nicole Michel and Jennifer McNicoll.

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. 2005):

(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, body mass, 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 proportion of young in the catch.

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 of target species was estimated using Modified Cormack-Jolly-Seber (CJS) mark-recapture analyses (Pollock et al.1990, Lebreton et al.1992) on 11 years (1995-2005) of capture histories of adult birds from the six stations at each location. 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 the six stations pooled per location, 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 (*SE*s) 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 Bragg during the summer of 2005. A total of 3085.8 net-hours were accumulated at all six stations pooled. The details of the operation of these six stations during 2005 are presented in Table 1.

For each individual species and for all species pooled, the numbers of individual birds newly banded, captured and released unbanded, and recaptured are presented for each station in Table 2 and, for all stations combined, in Table 4. A total of 490 captures of 44 species occurred at Fort Bragg during the summer of 2005 (Table 4). Newly banded birds comprised 58.8% of the total captures. The greatest number of total captures (121) was recorded at the S110 station and the smallest number of total captures (64) was recorded at the S114 station. The highest species richness occurred at Station S110 (23 species) and the lowest species richness occurred at Sandstone Hill (13 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 Station I113 (59.2 adults/600 net hours; Table 3), followed by Station S110 (53.5), Station S104 (44.8), Station S112 (41.6), Sandstone Hill (40.5), and Station S114 (25.0). Reproductive index (number of young birds per adult) showed a different pattern, being highest at S114 (0.54), followed by Station S112 (0.41), Station I110 (0.40), Station I104 (0.38), Sandstone Hill (0.35), and Station S113 (0.25). The mean reproductive index for the six stations combined was 0.37, compared with 1.16 for the same six stations in 2004, indicating a substantial drop in productivity between the two years. An unusual concentration of young Pine Warblers captured at the Sandstone Hill station in 2004 (DeSante et al. 2005a), which boosted the productivity index substantially, did not recur in 2005.

Among individual species, Carolina Wren was the most frequently captured species at the six stations in 2005 (see above), followed by Common Yellowthroat, Prairie Warbler, Northern Cardinal, Tufted Titmouse, Great Crested Flycatcher, Pine Warbler, and Carolina Chickadee (Table 4). The most abundant breeding species, having a capture rate of at least 2.0 adults per 600 net-hours, in decreasing order, were Common Yellowthroat, Prairie Warbler, Northern Cardinal, Carolina Wren, Great Crested Flycatcher, Pine Warbler, Carolina Chickadee, and Indigo Bunting. The most abundant breeding species at each station, having a capture rate of at least 2.0 birds per 600 net-hours (Table 3), were as follows:

**Sandstone Hill**
Bachman's Sparrow
Chipping Sparrow
Blue Grosbeak
Indigo Bunting

**S110**
Common Yellowthroat
Chipping Sparrow
Summer Tanager
Indigo Bunting

**I 104**
Common Yellowthroat
Eastern Towhee
Northern Cardinal

**S112**
Northern Cardinal
Common Yellowthroat
Blue Grosbeak
Summer Tanager
Indigo Bunting

**I113**
Common Yellowthroat
Northern Cardinal
Eastern Towhee
American Redstart

**S114**
Northern Cardinal
Indigo Bunting
Hooded Warbler

Using 11 years of data (1995-2005) from the six long-running stations combined, estimates of adult survival and recapture probabilities were obtained for 20 target species breeding at Fort Bragg. 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 for these 20 species. Survival-rate estimates for all six species showed variable precision (CVs 13-75%) with a mean CV of 31.3%. For 14 species for which survival was calculated using 10 years of data (DeSante et al. 2005), CV was lower or equal for 12 species and the mean CV improved from 26.7% to 25.7%, indicating an improvement in precision with the addition of an 11$^{th}$ year at Fort Bragg. Annual adult survival rates for these 20 species ranged from a low of 0.274 for Carolina Wren to a high of 0.575 for Ovenbird, with a mean of 0.440 for the six species.

Survival estimates are low at Fort Bragg compared to other locations, especially for resident species. In comparing survival values from Fort Bragg (1995-2005) with those of the Southeast Region of the United States (1992-2001; see http://www.birdpop.org/nbii/surv/default.asp), for example, survival at Fort Bragg was lower than that of the Southeast Region for 9 of the 14 target species, with the mean at Fort Bragg (0.440) being 9% lower than that of the Southeast Region (0.485). Importantly, survival for all five of the resident target species (Carolina Chickadee, Tufted Titmouse, Carolina Wren, Eastern Towhee, and Northern Cardinal) were substantially lower at Fort Bragg (mean 0.405) than in the Southeast Region (mean 0.478), indicating problems with survival of landbirds on the Fort Bragg installation itself.

These results provide a strong suggestion that overwintering survival of individuals wintering on Fort Bragg may be poor (DeSante et al. 2004, 2005a). The Institute for Bird Populations has initiated the MAWS (Monitoring Avian Wintering Survival) Program to assess habitat-specific overwintering survival rates in the southern parts of the United States. Six of the initial 24 MAWS stations have been established on Fort Bragg through funding from the Legacy Resources Management Program. Four or five years of data from these MAWS stations should be able to provide information as to the extent of any overwintering survival problem and relationships between survival and various habitat variables. Eventually, the MAWS Program, in conjunction with MAPS, should lead to the formulation of management strategies and guidelines to enhance overwintering survival, especially for declining species of conservation concern.

As mentioned earlier, analyses aimed at identifying and describing relationships between four demographic parameters (adult population size, population trends, numbers of young, and productivity) and landscape-level habitat characteristics have been completed for 13 military installations including Fort Bragg (Nott et al. 2003, Nott et al. 2005). These analyses were funded by Legacy Resource Management Program Project #103. At Fort Bragg, two species (Wood Thrush and Prairie Warbler) emerged as candidates for particular management concern. In 2003 the I102 station was replaced by the Sandstone Hill station in a mosaic of upland patchy forest, shrubland, and grasslands that are frequently managed to reduce risk of wildfire. Prior to the 2004 season the area around Sandstone Hill was burned, and in 2004 a single Prairie Warbler was captured. But in 2005 the capture rates of adult and young Prairie Warblers had increased to 15.5 and 4.8 individuals per 600 net-hours, respectively. Bachman's Sparrow, a USFWS Bird of Conservation Concern with IUCN Red List near threatened status, also showed increased capture rates at Sandstone Hill, from only 2.3 adults in 2004, to 4.8 adults and 2.4 young in 2005.

In summary, our data suggest that few Prairie Warbler or Bachman's Sparrow will occupy potential habitat immediately following a springtime burn but that breeding individuals will recruit into the habitat the second year after fire. As this fire-managed "disclimax" community succeeds towards forest, we predict that continued effectiveness monitoring of these populations will detect the onset of a decline in reproductive success or population size. Based on this timing we can adjust the prescribed fire frequency to maximize gross productivity of Prairie Warbler populations while meeting the management goals associated with Readiness and Range Sustainment. Through such adaptive management cycles, we are confident that we can achieve the long-term goal of reversing declining populations and maintaining stable or increasing source populations of target landbird species at Fort Bragg and other military installations.

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Table 1. Summary of the 2005 MAPS program on U.S. Army Fort Bragg.

| Station | | | | | | 2005 operation | | |
|---|---|---|---|---|---|---|---|---|
| Name | Code | No. | Major Habitat Type | Latitude-longitude | Avg Elev. (m) | Total number of net-hours | No. of periods | Inclusive dates |
| Sandstone Hill | SAHI | 16706 | Controlled burn pine savanna, mixed scrub oak woodland | 35°03'04"N,79°19'37"W | 152 | 504.2 (482.2) | 9 | 5/16 – 7/31 |
| I 104 | I104 | 16657 | Controlled burn pine savanna, riparian fields and scrub | 35°07'00"N,79°19'13"W | 84 | 495.8 (488.3) | 9 | 5/13 – 7/27 |
| I 113 | I113 | 16658 | Controlled burn riparian, savanna and pine-oak woodland | 35°05'37"N,79°19'28"W | 110 | 486.7 (473.3) | 9 | 5/15 – 7/30 |
| S 110 | S110 | 16659 | Riparian woodland, pine savanna and pine-oak woodland | 35°07'07"N,79°20'04"W | 94 | 538.3 (511.7) | 9 | 5/12 – 7/26 |
| S 114 | S114 | 16661 | Pine-oak and riparian woodland bordering grain fields | 35°02'58"N,79°16'11"W | 70 | 527.5 (501.2) | 9 | 5/17 – 7/29 |
| S 112 | S112 | 16660 | Pine-oak mixed with riparian woodland | 35°06'46"N,79°21'45"W | 114 | 533.3 (533.3) | 9 | 5/14 – 7/28 |
| ALL STATIONS COMBINED | | | | | | 3085.8(2990.0) | 9 | 5/12 – 7/31 |

Table 2. Capture summary for the six individual MAPS stations operated U.S. Army Fort Bragg in 2005.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

| | Sandstone Hill | | | I 104 | | | I 113 | | | S 110 | | | S 114 | | | S 112 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | N | U | R | N | U | R | N | U | R | N | U | R | N | U | R | N | U | R |
| Yellow-billed Cuckoo | | | | | | | | | | | | | | | | 1 | | |
| Ruby-throated Hummingbird | | | | | 1 | | | 2 | | | 7 | | | 2 | | | 1 | |
| Red-headed Woodpecker | | | | 2 | | 1 | | | | | | | | | | | | |
| Downy Woodpecker | | | | | | | | | | | | | 1 | | | | | |
| Hairy Woodpecker | | | | | | | | | | 2 | | | | | | | | |
| Red-cockaded Woodpecker | | | 1 | | | | | | | | | | | | | | | |
| Northern Flicker | | | | | | | 1 | | | 2 | | | | | | | | |
| Acadian Flycatcher | | | | | | | 1 | | | | | | | | | 1 | | |
| Great Crested Flycatcher | 3 | | | 6 | 1 | | 1 | | | 3 | | 1 | 5 | | | 1 | | 1 |
| White-eyed Vireo | | | | 1 | | | 1 | | | 1 | | | | | | | | |
| Yellow-throated Vireo | | | | 1 | | | | | | | | | | | | | | |
| Red-eyed Vireo | | | | | | | 2 | | | | | | | | | 4 | | |
| Blue Jay | | | | | | | | | | | 1 | | | | | | | 1 |
| Carolina Chickadee | 1 | | | 5 | | 1 | 6 | | | 4 | 1 | 3 | | | | | | |
| Tufted Titmouse | 2 | | | 2 | | 5 | 2 | | 4 | 2 | | 1 | 3 | 4 | 2 | 1 | | 1 |
| Brown-headed Nuthatch | | | | | | | | | | | | | 1 | | | | | |
| Carolina Wren | 1 | | | 4 | | 4 | 9 | | 11 | 7 | | 11 | 4 | 5 | 14 | 16 | | 7 |
| Blue-gray Gnatcatcher | | | | 3 | 1 | 1 | | | | | | | 1 | | | 1 | | |
| Eastern Bluebird | | | | | | | | | | | | | | | | 1 | | |
| Swainson's Thrush | | | | | | | | | | 1 | | | | | | | | |
| Wood Thrush | | | | | | | | | | | | | | | | 2 | | 1 |
| American Robin | | | | | | | | | | 1 | | | 1 | | | | | |
| Gray Catbird | | | | 2 | | 1 | 1 | | | | | | | | | 2 | | 2 |
| Brown Thrasher | 1 | | | 1 | | | | | | | | | | | | | | |
| Black-throated Blue Warbler | | | | | | | | | | | | | | | | 1 | 1 | |
| Pine Warbler | 5 | | | | | | 9 | | 1 | 6 | | 2 | | | | | | |

Table 2. (cont.) Capture summary for the six individual MAPS stations operated U.S. Army Fort Bragg in 2005.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

| | Sandstone Hill | | | I 104 | | | I 113 | | | S 110 | | | S 114 | | | S 112 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | N | U | R | N | U | R | N | U | R | N | U | R | N | U | R | N | U | R |
| Prairie Warbler | 15 | | 8 | 2 | 1 | 2 | 1 | 1 | | 6 | | 8 | | | | | | |
| Blackpoll Warbler | | | | | | | | | | | | | | | | 1 | | |
| Black-and-white Warbler | | | | | 1 | | | | | | | | | | | 2 | | |
| American Redstart | | | | | | | 2 | | | | | | | | | 1 | | |
| Prothonotary Warbler | | | | | | | | | | | | | 3 | | 1 | | | |
| Ovenbird | | | | | | | | | | | | | 2 | | | | 1 | |
| Louisiana Waterthrush | | | | | | | | | | 1 | | | | | | | | |
| Common Yellowthroat | | | | 14 | 1 | 7 | 10 | | 8 | 10 | 1 | 25 | 1 | | | 4 | | |
| Hooded Warbler | | | | | | | | | | 2 | | | 2 | | | 1 | | |
| Summer Tanager | 1 | | | | | | 1 | | | 3 | | | | | | 2 | | |
| Eastern Towhee | | | | 2 | | | 3 | | 1 | | | 1 | 1 | | | | | |
| Bachman's Sparrow | 6 | | 4 | | | | | 1 | | 1 | | | | | | | | |
| Chipping Sparrow | 2 | | 3 | | | | | | | 2 | | 1 | | | | | | |
| White-throated Sparrow | | | | 1 | | | | | | | | | | | | | | |
| Northern Cardinal | | | | 2 | | 1 | 4 | | 10 | | | 1 | 3 | | 4 | 4 | | 5 |
| Blue Grosbeak | 3 | | | | | | 1 | | | 1 | | | | | | 3 | | |
| Indigo Bunting | 3 | | | 1 | | | 1 | | | 2 | | | 3 | | 1 | 2 | | |
| Common Grackle | | | | 1 | | | | | | | | | | | | | | |
| ALL SPECIES POOLED | 43 | 0 | 16 | 50 | 6 | 23 | 56 | 4 | 35 | 57 | 10 | 54 | 31 | 11 | 22 | 51 | 3 | 18 |
| Total Number of Captures | | 59 | | | 79 | | | 95 | | | 121 | | | 64 | | | 72 | |
| Number of Species | 12 | 0 | 4 | 17 | 6 | 9 | 18 | 3 | 6 | 19 | 4 | 10 | 14 | 3 | 5 | 20 | 3 | 7 |
| Total Number of Species | | 13 | | | 19 | | | 20 | | | 23 | | | 15 | | | 23 | |

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 U.S. Army Fort Bragg in 2005.

| | Sandstone Hill | | | I 104 | | | I 113 | | | S 110 | | | S 114 | | | S 112 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index |
| Yellow-billed Cuckoo | | | | | | | | | | | | | | | | 1.1 | 0.0 | 0.00 |
| Red-headed Woodpecker | | | | 2.4 | 0.0 | 0.00 | | | | | | | | | | | | |
| Downy Woodpecker | | | | | | | | | | | | | 0.0 | 1.1 | und.[1] | | | |
| Hairy Woodpecker | | | | | | | | | | 0.0 | 0.0 | 0.00 | | | | | | |
| Red-cockaded Woodpecker | 0.0 | 0.0 | 0.00 | | | | | | | | | | | | | | | |
| Northern Flicker | | | | | | | 1.2 | 0.0 | 0.00 | 1.1 | 1.1 | 1.00 | | | | | | |
| Acadian Flycatcher | | | | | | | 1.2 | 0.0 | 0.00 | | | | | | | 1.1 | 0.0 | 0.00 |
| Great Crested Flycatcher | 3.6 | 0.0 | 0.00 | 4.8 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | 2.2 | 1.1 | 0.50 | 5.7 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 |
| White-eyed Vireo | | | | 1.2 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 | | | | | | |
| Yellow-throated Vireo | | | | 1.2 | 0.0 | 0.00 | | | | | | | | | | | | |
| Red-eyed Vireo | | | | | | | 2.5 | 0.0 | 0.00 | | | | | | | 4.5 | 0.0 | 0.00 |
| Blue Jay | | | | | | | | | | | | | | | | 1.1 | 0.0 | 0.00 |
| Carolina Chickadee | 1.2 | 0.0 | 0.00 | 2.4 | 3.6 | 1.50 | 4.9 | 1.2 | 0.25 | 5.6 | 0.0 | 0.00 | | | | | | |
| Tufted Titmouse | 1.2 | 1.2 | 1.00 | 2.4 | 1.2 | 0.50 | 2.5 | 1.2 | 0.50 | 3.3 | 0.0 | 0.00 | 0.0 | 3.4 | und. | 1.1 | 0.0 | 0.00 |
| Brown-headed Nuthatch | | | | | | | | | | | | | 0.0 | 1.1 | und. | | | |
| Carolina Wren | 0.0 | 1.2 | und.[1] | 3.6 | 2.4 | 0.67 | 4.9 | 8.6 | 1.75 | 3.3 | 6.7 | 2.00 | 3.4 | 3.4 | 1.00 | 4.5 | 14.6 | 3.25 |
| Blue-gray Gnatcatcher | | | | 2.4 | 2.4 | 1.00 | | | | | | | 1.1 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 |
| Eastern Bluebird | | | | | | | | | | | | | | | | 0.0 | 1.1 | und.[1] |
| Wood Thrush | | | | | | | | | | | | | | | | 3.4 | 0.0 | 0.00 |
| American Robin | | | | | | | | | | 1.1 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 | | | |
| Gray Catbird | | | | 2.4 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | | | | | | | 2.3 | 0.0 | 0.00 |
| Brown Thrasher | 1.2 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | | | | | | | | | | | | |
| Pine Warbler | 1.2 | 4.8 | 4.00 | | | | 11.1 | 0.0 | 0.00 | 5.6 | 2.2 | 0.40 | | | | | | |
| Prairie Warbler | 15.5 | 4.8 | 0.31 | 3.6 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | 8.9 | 3.3 | 0.38 | | | | | | |

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 U.S. Army Fort Bragg in 2005.

| | Sandstone Hill | | | I 104 | | | I 113 | | | S 110 | | | S 114 | | | S 112 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Species | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index | Ad. | Yg. | Repr. index |
| Black-and-white Warbler | | | | | | | | | | | | | | | | 0.0 | 0.0 | 0.00 |
| American Redstart | | | | | | | 2.5 | 0.0 | 0.00 | | | | | | | 1.1 | 0.0 | 0.00 |
| Prothonotary Warbler | | | | | | | | | | | | | 0.0 | 3.4 | und. | | | |
| Ovenbird | | | | | | | | | | | | | 1.1 | 1.1 | 1.00 | | | |
| Louisiana Waterthrush | | | | | | | | | | 1.1 | 0.0 | 0.00 | | | | | | |
| Common Yellowthroat | | | | 9.7 | 7.3 | 0.75 | 9.9 | 2.5 | 0.25 | 7.8 | 3.3 | 0.43 | 1.1 | 0.0 | 0.00 | 3.4 | 1.1 | 0.33 |
| Hooded Warbler | | | | | | | | | | 1.1 | 1.1 | 1.00 | 2.3 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 |
| Summer Tanager | 1.2 | 0.0 | 0.00 | | | | 1.2 | 0.0 | 0.00 | 2.2 | 1.1 | 0.50 | | | | 2.3 | 0.0 | 0.00 |
| Eastern Towhee | | | | 2.4 | 0.0 | 0.00 | 3.7 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 | | | |
| Bachman's Sparrow | 4.8 | 2.4 | 0.50 | | | | | | | 0.0 | 1.1 | und.[1] | | | | | | |
| Chipping Sparrow | 3.6 | 0.0 | 0.00 | | | | | | | 3.3 | 0.0 | 0.00 | | | | | | |
| Northern Cardinal | | | | 2.4 | 0.0 | 0.00 | 6.2 | 1.2 | 0.20 | 1.1 | 0.0 | 0.00 | 4.6 | 0.0 | 0.00 | 6.8 | 0.0 | 0.00 |
| Blue Grosbeak | 3.6 | 0.0 | 0.00 | | | | 1.2 | 0.0 | 0.00 | 1.1 | 0.0 | 0.00 | | | | 3.4 | 0.0 | 0.00 |
| Indigo Bunting | 3.6 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | 1.2 | 0.0 | 0.00 | 2.2 | 0.0 | 0.00 | 3.4 | 0.0 | 0.00 | 2.3 | 0.0 | 0.00 |
| Common Grackle | | | | 1.2 | 0.0 | 0.00 | | | | | | | | | | | | |
| ALL SPECIES POOLED | 40.5 | 14.3 | 0.35 | 44.8 | 16.9 | 0.38 | 59.2 | 14.8 | 0.25 | 53.5 | 21.2 | 0.40 | 25.0 | 13.6 | 0.54 | 41.6 | 16.9 | 0.41 |
| Number of Species | 11 | 5 | | 16 | 5 | | 18 | 5 | | 18 | 9 | | 10 | 6 | | 17 | 3 | |
| Total Number of Species | | 12 | | | 16 | | | 18 | | | 19 | | | 14 | | | 18 | |

[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 U.S. Army Fort Bragg MAPS stations combined in 2005.

| Species | Birds captured | | | Birds/600 nethours | | Reprod. Index |
|---|---|---|---|---|---|---|
| | Newly banded | Un-banded | Recap-tured | Adults | Young | |
| Yellow-billed Cuckoo | 1 | | | 0.2 | 0.0 | 0.00 |
| Ruby-throated Hummingbird | | 13 | | | | |
| Red-headed Woodpecker | 2 | | 1 | 0.4 | 0.0 | 0.00 |
| Downy Woodpecker | 1 | | | 0.0 | 0.2 | und.[1] |
| Hairy Woodpecker | 2 | | | 0.0 | 0.0 | und. |
| Red-cockaded Woodpecker | | | 1 | 0.0 | 0.0 | und. |
| Northern Flicker | 3 | | | 0.4 | 0.2 | 0.50 |
| Acadian Flycatcher | 2 | | | 0.4 | 0.0 | 0.00 |
| Great Crested Flycatcher | 19 | 1 | 2 | 3.1 | 0.2 | 0.06 |
| White-eyed Vireo | 3 | | | 0.6 | 0.0 | 0.00 |
| Yellow-throated Vireo | 1 | | | 0.2 | 0.0 | 0.00 |
| Red-eyed Vireo | 6 | | | 1.2 | 0.0 | 0.00 |
| Blue Jay | | 1 | 1 | 0.2 | 0.0 | 0.00 |
| Carolina Chickadee | 16 | 1 | 4 | 2.3 | 0.8 | 0.33 |
| Tufted Titmouse | 12 | 4 | 13 | 1.8 | 1.2 | 0.67 |
| Brown-headed Nuthatch | 1 | | | 0.0 | 0.2 | und. |
| Carolina Wren | 41 | 5 | 47 | 3.3 | 6.2 | 1.88 |
| Blue-gray Gnatcatcher | 5 | 1 | 1 | 0.8 | 0.4 | 0.50 |
| Eastern Bluebird | 1 | | | 0.0 | 0.2 | und. |
| Swainson's Thrush | 1 | | | | | |
| Wood Thrush | 2 | | 1 | 0.6 | 0.0 | 0.00 |
| American Robin | 2 | | | 0.4 | 0.0 | 0.00 |
| Gray Catbird | 5 | | 3 | 1.0 | 0.0 | 0.00 |
| Brown Thrasher | 2 | | | 0.4 | 0.0 | 0.00 |
| Black-throated Blue Warbler | 1 | 1 | | | | |
| Pine Warbler | 20 | | 3 | 2.9 | 1.2 | 0.40 |
| Prairie Warbler | 24 | 2 | 18 | 4.9 | 1.4 | 0.28 |
| Blackpoll Warbler | 1 | | | | | |
| Black-and-white Warbler | 2 | 1 | | 0.0 | 0.0 | und. |
| American Redstart | 3 | | | 0.6 | 0.0 | 0.00 |
| Prothonotary Warbler | 3 | | 1 | 0.0 | 0.6 | und. |
| Ovenbird | 2 | 1 | | 0.2 | 0.2 | 1.00 |
| Louisiana Waterthrush | 1 | | | 0.2 | 0.0 | 0.00 |
| Common Yellowthroat | 39 | 2 | 40 | 5.3 | 2.3 | 0.44 |

Table 4. Summary of results for all six U.S. Army Fort Bragg MAPS stations combined in 2005.

| Species | Birds captured: Newly banded | Birds captured: Un-banded | Birds captured: Recap-tured | Birds/600 nethours: Adults | Birds/600 nethours: Young | Reprod. Index |
|---|---|---|---|---|---|---|
| Hooded Warbler | 5 | | | 0.8 | 0.2 | 0.25 |
| Summer Tanager | 7 | | | 1.2 | 0.2 | 0.17 |
| Eastern Towhee | 6 | | 2 | 1.4 | 0.0 | 0.00 |
| Bachman's Sparrow | 7 | 1 | 4 | 0.8 | 0.6 | 0.75 |
| Chipping Sparrow | 4 | | 4 | 1.2 | 0.0 | 0.00 |
| White-throated Sparrow | 1 | | | | | |
| Northern Cardinal | 13 | | 21 | 3.5 | 0.2 | 0.06 |
| Blue Grosbeak | 8 | | | 1.6 | 0.0 | 0.00 |
| Indigo Bunting | 12 | | 1 | 2.3 | 0.0 | 0.00 |
| Common Grackle | 1 | | | 0.2 | 0.0 | 0.00 |
| ALL SPECIES POOLED | 288 | 34 | 168 | 43.9 | 16.3 | 0.37 |
| Total Number of Captures | | 490 | | | | |
| Number of Species | 41 | 13 | 19 | 32 | 18 | |
| Total Number of Species | | 44 | | | 36 | |

[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 time-constant models for 20 species breeding at MAPS stations on U.S. Army Fort Bragg obtained from 11 years (1995-2005) of mark-recapture data.

| Species | Num. sta2.[1] | Num. ind.[2] | Num. caps.[3] | Num. ret.[4] | Survival probability[5] | Surv. C.V.[6] | Recapture probability[7] | Proportion of residents[8] |
|---|---|---|---|---|---|---|---|---|
| Red-bellied Woodpecker ‡† | 6 | 38 | 43 | 2 | 0.406 (0.306) | 75.2 | 0.085 (0.219) | 1.000 (2.670) |
| Great Crested Flycatcher | 6 | 107 | 122 | 8 | 0.304 (0.149) | 49.0 | 0.242 (0.225) | 0.798 (0.813) |
| White-eyed Vireo | 3 | 44 | 90 | 6 | 0.318 (0.141) | 44.4 | 0.539 (0.299) | 0.483 (0.364) |
| Red-eyed Vireo ‡ | 4 | 54 | 61 | 4 | 0.553 (0.196) | 35.5 | 0.165 (0.168) | 0.411 (0.439) |
| Carolina Chickadee | 6 | 87 | 122 | 13 | 0.567 (0.104) | 18.3 | 0.331 (0.127) | 0.340 (0.170) |
| Tufted Titmouse | 6 | 118 | 201 | 25 | 0.337 (0.073) | 21.6 | 0.761 (0.140) | 0.553 (0.196) |
| Carolina Wren | 6 | 151 | 336 | 30 | 0.274 (0.058) | 21.3 | 0.759 (0.140) | 0.788 (0.258) |
| Blue-gray Gnatcatcher ‡ | 6 | 62 | 73 | 3 | 0.467 (0.244) | 52.3 | 0.358 (0.305) | 0.086 (0.101) |
| Wood Thrush | 1 | 57 | 84 | 6 | 0.516 (0.165) | 32.0 | 0.145 (0.116) | 0.722 (0.593) |
| Gray Catbird | 4 | 128 | 201 | 11 | 0.480 (0.118) | 24.5 | 0.144 (0.084) | 0.624 (0.371) |
| Brown Thrasher | 3 | 48 | 64 | 5 | 0.519 (0.161) | 31.1 | 0.392 (0.224) | 0.091 (0.098) |
| Pine Warbler ‡ | 6 | 87 | 95 | 4 | 0.497 (0.215) | 43.3 | 0.266 (0.246) | 0.210 (0.222) |
| Prairie Warbler | 4 | 172 | 262 | 27 | 0.420 (0.077) | 18.4 | 0.409 (0.116) | 0.510 (0.181) |
| Ovenbird † | 2 | 39 | 54 | 8 | 0.575 (0.140) | 24.3 | 0.177 (0.121) | 1.000 (0.716) |
| Common Yellowthroat | 6 | 341 | 766 | 44 | 0.368 (0.051) | 13.9 | 0.604 (0.104) | 0.218 (0.070) |
| Summer Tanager | 6 | 72 | 86 | 5 | 0.390 (0.190) | 48.8 | 0.185 (0.191) | 0.643 (0.683) |
| Eastern Towhee | 6 | 101 | 183 | 30 | 0.379 (0.069) | 18.3 | 0.826 (0.109) | 0.590 (0.187) |
| Northern Cardinal | 6 | 157 | 364 | 46 | 0.468 (0.054) | 11.5 | 0.695 (0.090) | 0.316 (0.103) |
| Indigo Bunting | 5 | 53 | 62 | 6 | 0.551 (0.170) | 30.9 | 0.336 (0.210) | 0.335 (0.255) |
| American Goldfinch ‡† | 5 | 34 | 37 | 2 | 0.411 (0.307) | 74.7 | 0.091 (0.255) | 1.000 (2.916) |

[1] 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.
[2] Number of adult individuals captured at stations where the species was a regular or usual breeder (i.e., number of capture histories).
[3] Total number of captures of adult birds of the species at stations where the species was a regular or usual breeder.
[4] 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.
[5] Survival probability (φ) presented as the maximum likelihood estimate (standard error of the estimate).

Table 5. (cont.) Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using time-constant models for 20 species breeding at MAPS stations on U.S. Army Fort Bragg obtained from 11 years (1995-2005) of mark-recapture data.

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[6] The coefficient of variation for survival probability, CV(φ).
[7] Recapture probability (p) presented as the maximum likelihood estimate (standard error of the estimate).
[8] 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(φ)>0.200 or CV(φ)>50.0%).
† 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 11 years, 1995-2005, of the MAPS Program on the seven stations ever operated on U.S. Army Fort Bragg.

| NUMB | SPEC | SPECIES NAME |
|---|---|---|
| 00860 | DCCO | Double-crested Cormorant |
| 00950 | AMBI | American Bittern |
| 01010 | GBHE | Great Blue Heron |
| 01040 | GREG | Great Egret |
| 01130 | GRHE | Green Heron |
| 01290 | BLVU | Black Vulture |
| 01300 | TUVU | Turkey Vulture |
| 01460 | CANG | Canada Goose |
| 01570 | WODU | Wood Duck |
| 01630 | MALL | Mallard |
| 02200 | SSHA | Sharp-shinned Hawk |
| 02210 | COHA | Cooper's Hawk |
| 02380 | RSHA | Red-shouldered Hawk |
| 02400 | BWHA | Broad-winged Hawk |
| 02460 | RTHA | Red-tailed Hawk |
| 02630 | AMKE | American Kestrel |
| 03040 | WITU | Wild Turkey |
| 03160 | NOBO | Northern Bobwhite |
| 04490 | AMWO | American Woodcock |
| 05570 | MODO | Mourning Dove |
| 06410 | YBCU | Yellow-billed Cuckoo |
| 06680 | EASO | Eastern Screech-Owl |
| 06800 | GHOW | Great Horned Owl |
| 07080 | CONI | Common Nighthawk |
| 07170 | CWWI | Chuck-will's-widow |
| 07230 | WPWI | Whip-poor-will |
| 07400 | CHSW | Chimney Swift |
| 08630 | RTHU | Ruby-throated Hummingbird |
| 09110 | BEKI | Belted Kingfisher |
| 09420 | RHWO | Red-headed Woodpecker |
| 09550 | RBWO | Red-bellied Woodpecker |
| 09650 | DOWO | Downy Woodpecker |
| 09660 | HAWO | Hairy Woodpecker |
| 09680 | RCWO | Red-cockaded Woodpecker |
| 09800 | YSFL | Yellow-shafted Flicker |
| 09860 | PIWO | Pileated Woodpecker |
| 11390 | EAWP | Eastern Wood-Pewee |
| 11460 | ACFL | Acadian Flycatcher |
| 11595 | UEFL | Unidentified Empidonax Flycatcher |
| 11610 | EAPH | Eastern Phoebe |

Appendix I. cont.

| NUMB | SPEC | SPECIES NAME |
|---|---|---|
| 11760 | GCFL | Great Crested Flycatcher |
| 12030 | EAKI | Eastern Kingbird |
| 12550 | WEVI | White-eyed Vireo |
| 12690 | YTVI | Yellow-throated Vireo |
| 12720 | BHVI | Blue-headed Vireo |
| 12790 | REVI | Red-eyed Vireo |
| 12930 | BLJA | Blue Jay |
| 13190 | AMCR | American Crow |
| 13270 | FICR | Fish Crow |
| 13340 | PUMA | Purple Martin |
| 13410 | TRES | Tree Swallow |
| 13540 | BARS | Barn Swallow |
| 13560 | CACH | Carolina Chickadee |
| 13660 | TUTI | Tufted Titmouse |
| 13700 | WBNU | White-breasted Nuthatch |
| 13720 | BHNU | Brown-headed Nuthatch |
| 14000 | CARW | Carolina Wren |
| 14350 | BGGN | Blue-gray Gnatcatcher |
| 14560 | EABL | Eastern Bluebird |
| 14780 | VEER | Veery |
| 14790 | GCTH | Gray-cheeked Thrush |
| 14810 | SWTH | Swainson's Thrush |
| 14830 | WOTH | Wood Thrush |
| 15000 | AMRO | American Robin |
| 15130 | GRCA | Gray Catbird |
| 15150 | NOMO | Northern Mockingbird |
| 15200 | BRTH | Brown Thrasher |
| 15550 | CEDW | Cedar Waxwing |
| 15630 | BWWA | Blue-winged Warbler |
| 15730 | NOPA | Northern Parula |
| 15750 | YWAR | Yellow Warbler |
| 15770 | MAWA | Magnolia Warbler |
| 15790 | BTBW | Black-throated Blue Warbler |
| 15830 | BTNW | Black-throated Green Warbler |
| 15870 | YTWA | Yellow-throated Warbler |
| 15910 | PIWA | Pine Warbler |
| 15930 | PRAW | Prairie Warbler |
| 15970 | BLPW | Blackpoll Warbler |
| 16030 | BAWW | Black-and-white Warbler |
| 16040 | AMRE | American Redstart |
| 16050 | PROW | Prothonotary Warbler |
| 16060 | WEWA | Worm-eating Warbler |

Appendix I. cont.

| NUMB | SPEC | SPECIES NAME |
|---|---|---|
| 16080 | OVEN | Ovenbird |
| 16090 | NOWA | Northern Waterthrush |
| 16100 | LOWA | Louisiana Waterthrush |
| 16110 | KEWA | Kentucky Warbler |
| 16150 | COYE | Common Yellowthroat |
| 16280 | HOWA | Hooded Warbler |
| 16290 | WIWA | Wilson's Warbler |
| 16300 | CAWA | Canada Warbler |
| 16460 | YBCH | Yellow-breasted Chat |
| 16820 | SUTA | Summer Tanager |
| 17820 | EATO | Eastern Towhee |
| 17930 | BACS | Bachman's Sparrow |
| 18020 | CHSP | Chipping Sparrow |
| 18050 | FISP | Field Sparrow |
| 18080 | VESP | Vesper Sparrow |
| 18270 | WTSP | White-throated Sparrow |
| 18560 | NOCA | Northern Cardinal |
| 18640 | BLGR | Blue Grosbeak |
| 18670 | INBU | Indigo Bunting |
| 18730 | RWBL | Red-winged Blackbird |
| 18800 | EAME | Eastern Meadowlark |
| 18870 | COGR | Common Grackle |
| 18960 | BHCO | Brown-headed Cowbird |
| 19040 | OROR | Orchard Oriole |
| 19160 | BAOR | Baltimore Oriole |
| 19370 | HOFI | House Finch |
| 19510 | AMGO | American Goldfinch |
| 19920 | HOSP | House Sparrow |