THE 2003 REPORT OF THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM ON TEXAS ARMY NATIONAL GUARD INSTALLATIONS CAMP BOWIE AND CAMP SWIFT

David F. DeSante, Peter Pyle, and Danielle Kaschube

THE INSTITUTE FOR BIRD POPULATIONS
P.O. Box 1346
Point Reyes Station, CA 94956-1346

(415) 663-1436

ddesante@birdpop.org

January 30, 2004

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 critically needed information on the vital rates (productivity or birth rate, and survivorship or death rate) of landbirds that is crucial for efforts to identify demographic causes of the severe and sometimes accelerating population declines documented (Robbins et al. 1989, Terborgh 1989, Peterjohn et al.1999) 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, 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; ©) 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's (DoD) Partners-in-Flight 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 Partners-in-Flight 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.

Accordingly, in 1994, six MAPS stations each were established and operated on Texas National Guard Installations Camp Bowie and Camp Swift. The operation of these stations was continued during the summers of 1994-2002 by means of funding from the DoD Legacy Resource Management Program. The operation of the 12 stations was continued during the summer of 2003 by means of modest funding from the Texas Army National Guard.

The ultimate objective of the MAPS Program on DoD installations such as Camp Bowie and Camp Swift 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 will involve efforts to modify the habitat from characteristics associated with low productivity to characteristics associated with high productivity (for species for which low productivity is driving the population decline).

The funding necessary to undertake these analyses and formulate management strategies was obtained from the Legacy Resource Management Program during 2000-2002. These analyses have been completed (Nott et al. 2003) and we are currently implementing these guidelines and actions on DoD installations in conjunction with efforts to increase military Readiness and Range Sustainment. The implementation strategy for these guidelines includes the establishment of new MAPS stations to monitor their effectiveness, the discontinuing 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. No changes in stations were made at Camp Bowie or Camp Swift between 2002 and 2003, although changes between the 2003 and 2004 seasons are currently being considered.

A complete summary of the results of the MAPS Program on Camp Bowie and Camp Swift from 1994-1999, as well as on 11 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 documents the operation of the 12 MAPS stations on Camp Bowie and Camp Swift during the 2003 breeding season.

Methods

Twelve MAPS stations were operated in 2003, six on Camp Bowie and six on Camp Swift, at the same locations where they were first established in 1994. 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. 2003). 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 8-9 (Camp Bowie) or 7-9 (Camp Swift) consecutive 10-day periods between May 11 and August 8. For the most part, the operation of stations occurred on schedule in each ten-day period that they were operated, although the operation of all stations was delayed somewhat during the first period while funding was being secured. In addition, because of logistic problems, two of the Camp Swift stations were not operated during the final 10-day period. The operation of stations was carried out by field biologist interns Graeme Stevens and Lia McKinnon (Camp Bowie) and James Ray (Camp Swift), who were trained by IBP field biologist Jeanie Woltz. Sue Morris helped re-establish the six stations on Camp Swift, supervised their operation, and operated most of them for the final two periods.

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 comprised. The following data were taken on all birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms:

(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) wing chord;
(12) fat class and weight;
(13) date and time of capture (net-run time); and
(14) station and net site where captured.

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), and extent of body and flight-feather molt, primary-feather wear, and juvenal plumage;
(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 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, and the proportion of young in the catch was used as an index of post-fledging productivity.

Survival of target species was estimated using Modified Cormack-Jolly-Seber (CJS) mark-recapture analyses (Pollock et al.1990, Lebreton et al.1992) on ten years (1994-2003) of capture histories of adult birds from the six stations at each location. Target species were those for which, on average, at least six individual adults per year were recorded from the 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 SURVIV (White 1983), 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). 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

CAMP BOWIE

We operated six MAPS stations at Camp Bowie during the summer of 2003 for a total of 2663.7 net-hours. The details of the operation of these six stations during 2003 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 (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 637 captures of 38 species occurred at Camp Bowie during the summer of 2003 (Table 4). Newly banded birds comprised 70.6% of the total captures. The greatest number of total captures (158) was recorded at the Stonehouse station and the smallest number of total captures (53) was recorded at the Bedrock station. The highest species richness also occurred at Stonehouse (22 species) and the lowest species richness occurred at Bedrock (12 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 Stonehouse (98.7 adults/600 net hours; Table 3), followed by Nighthawk (86.2), Devil's Hill (83.9), Mesquite Flat (80.3), Mockingbird Lane (51.8), and Bedrock (27.3).

Among individual species, Bewick's Wren was the most frequently captured species at the six stations in 2003, followed by Painted Bunting, Northern Cardinal, Black-crested Titmouse, Field Sparrow, Rufous-crowned Sparrow, and Summer Tanager (Table 4). The most abundant breeding species, having a capture rate of at least 4.0 adults per 600 net-hours, in decreasing order, were Painted Bunting, Northern Cardinal, Bewick's Wren, Black-crested Titmouse, Field Sparrow, Yellow-billed Cuckoo, and Simmer Tanager (Table 4). The most abundant breeding species at each installation, having a capture rate of at least 5.0 adults per 600 net-hours (Table 3) were as follows:

Mesquite Flat
Painted Bunting
Bewick's Wren
Ladder-backed Woodpecker
Black-crested Titmouse
Northern Cardinal
Golden-fronted Woodpecker
Carolina Chickadee

Bedrock
Painted Bunting
Summer Tanager

Devil's Hill
Painted Bunting
Field Sparrow
Northern Cardinal
Black-crested Titmouse
Bewick's Wren
Yellow-billed Cuckoo
Rufous-crowned Sparrow

Mockingbird Lane
Northern Cardinal
Painted Bunting
Field Sparrow
Black-crested Titmouse
Bushtit

Stonehouse
Painted Bunting
Northern Cardinal
Bewick's Wren
Field Sparrow
Yellow-billed Cuckoo
Brown-headed Cowbird

Nighthawk
Bewick's Wren
Northern Cardinal
Lark Sparrow
Black-crested Titmouse
Rufous-crowned Sparrow
Painted Bunting
Summer Tanager

Productivity (proportion of young in the catch) showed a different pattern over the six stations than adult population size, being highest at Devil's Hill (0.44), followed by Stonehouse (0.37), Nighthawk (0.37), Mockingbird Lane (0.33), Bedrock (0.27), and Mesquite Flat (0.23). The overall productivity index (proportion of young in the catch) for the six stations in 2003 was 0.35. Mean productivity for all species pooled at Camp Bowie during the six years 1994-1999 was 0.302 (DeSante et al. 2001b), indicating that overall productivity in 2003 tended to be above average.

Using ten years of data from all six stations, estimates of adult survival and recapture probabilities were obtained for 12 target species breeding at Camp Bowie. 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 12 species. Survival-rate estimates for two species, Carolina Chickadee and Northern Mockingbird, had poor precision (CVs > 30%). CVs for the remaining ten species averaged 16.0% indicating relatively good precision. Annual adult survival-rate estimates for these ten species ranged from a low of 0.391 for Bewick's Wren to a high of 0.691 for Painted Bunting, with a mean of 0.553 for the ten species. These estimates are comparable to or higher than estimates from many other locations. For example, survival-rate estimates with adequate precision (CV < 30%) are available for nine of these ten species (all but Ladder-backed Woodpecker) from the entire South-central Region over the seven-year period 1992-1998 (DeSante and O'Grady 2000) and can be compared to those from Camp Bowie. We found that the mean survival estimate for these nine species at Camp Bowie (0.542) was 4% higher than that of the South-central Region as a whole (0.522). Furthermore, six species (Black-crested Titmouse, Bewick's Wren, Summer Tanager, Field Sparrow, Painted Bunting, and Brown-headed Cowbird) had higher values at Camp Bowie, whereas only three species (Yellow-billed Cuckoo, Rufous-crowned Sparrow, and Northern Cardinal) had lower values at Camp Bowie than in the South-central Region. Thus, overall, survivorship for species breeding at Camp Bowie seems slightly better at Camp Bowie than over the South-central Region as a whole.

CAMP SWIFT

We operated six MAPS stations at Camp Swift during the summer of 2003 for a total of 3049.5 net-hours. The details of the operation of these six stations during 2003 are presented in Table 6.

For each individual species and for all species pooled, the numbers of individual birds newly banded, captured and released unbanded (including hummingbirds, which we are not licensed to band), and recaptured, are presented for each station in Table 7, and for all stations combined in Table 9. A total of 509 captures of 31 species occurred at Camp Swift during the summer of 2003 (Table 9). Newly banded birds comprised 70.7% of the total captures. The greatest number of total captures (113) was recorded at the McLaughlin Creek station and the smallest number of total captures (33) was recorded at the Sandy Junction station. The highest species richness occurred at East Loop East (14 species) and the lowest species richness occurred at Wine Cellar Loop (10 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 8, and for all stations combined in Table 9. 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 6). Adult population size (for all species pooled) was highest at McLaughlin Creek (95.6 adults/600 net hours; Table 8), followed by Wine Cellar Loop (65.5), East Loop East (62.3), East Loop West (61.3), Pipeline (61.2), and Sandy Junction (19.0).

Among individual species, White-eyed Vireo was the most frequently captured at the six stations in 2003, followed by Northern Cardinal, Painted Bunting, Carolina Wren, Tufted Titmouse, and Carolina Chickadee (Table 9). The most abundant breeding species, having a capture rate of at least 4.0 adults per 600 net-hours, in decreasing order, were White-eyed Vireo, Northern Cardinal, Painted Bunting, and Carolina Wren (Table 9). The most abundant breeding species at each installation, having a capture rate of at least 4.0 adults per 600 net-hours were as follows (Table 8):

Wine Cellar Loop
White-eyed Vireo
Painted Bunting
Northern Cardinal
Carolina Wren
Carolina Chickadee

McLaughlin Creek
White-eyed Vireo
Northern Cardinal
Carolina Wren
Painted Bunting

East Loop East
Painted Bunting
Northern Cardinal
White-eyed Vireo
Carolina Chickadee
Carolina Wren

Sandy Junction
Northern Cardinal
Painted Bunting

Pipeline
White-eyed Vireo
Northern Cardinal
Painted Bunting
Carolina Wren

East Loop West
White-eyed Vireo
Northern Cardinal
Carolina Wren

Productivity (proportion of young in the catch) showed a different pattern over the six stations than adult population size, being highest at Sandy Junction (0.41), followed by Wine Cellar Loop (0.35), Pipeline and East Loop East (0.25), McLaughlin Creek (0.23), and East Loop West (0.18). The overall productivity index (proportion of young in the catch) for the six stations in 2003 was 0.27. Mean productivity for all species pooled at Camp Swift during the six years 1994-1999 was 0.227 (DeSante et al. 2001b), indicating that productivity in 2003 was slightly above average.

Using ten years of data from all six stations, estimates of adult survival and recapture probabilities were obtained for six target species breeding at Camp Swift. 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 10 for these six species. Survival-rate estimates for all six species had relatively good precision (CVs < 30%) with a mean CV of 14.7%. Annual adult survival rates for these six species ranged from a low of 0.355 for Carolina Wren to a high of 0.595 for Northern Cardinal, with a mean of 0.515 for the six species. These estimates are comparable to estimates from many other locations. For example, survival rates with adequate precision (CV < 30%) are available for all six of these species from the entire South-central Region over the seven-year period 1992-1998 (DeSante and O'Grady 2000) and can be compared to those from Camp Swift. We found that the mean survival estimate for these six species at Camp Swift (0.515) was only 1% lower than the mean for the South-central Region as a whole (0.520); three species (White-eyed Vireo, Summer Tanager, and Northern Cardinal) had higher values at Camp Swift than in the South-central Region and three species (Tufted Titmouse, Carolina Wren, and Painted Bunting) had lower values at Camp Swift. Thus, survivorship at Camp Swift appears to be comparable to that of the South-central Region as a whole.

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 for a number of target species of Conservation Concern (BCC) have been completed for 13 military installations in south-central and southeastern United States, including both Camps Bowie and Swift (Nott et al. 2003). These analyses were also funded by the Legacy Resource Management Program.

At Camp Bowie, three species emerged as candidates for particular management concern: Bewick's Wren, Field Sparrow, and Painted Bunting. In addition, the data suggested an installation-wide decline in all breeding landbirds at Camp Bowie. Post-breeding fire management practices in oldfield and scrub/woodland habitats could reset succession and effect local recoveries of the three species of concern, while exclusion of cattle grazing from key areas could also be an effective management strategy for these and other species at Camp Bowie. The restoration of wet-season riparian corridors could be another effective management strategy and will require the removal of stock ponds and re-establishment of natural watercourses at the Camp. At Camp Swift only one species emerged as candidates for particular management concern: Painted Bunting. Post-breeding fire management practices as opposed to the current spring or fall practices would result in a more natural and diverse cool-season grassland and richer springtime/early summer forb community given adequate winter precipitations. An

objective of the MAPS program at both Fort Bowie and at Fort Swift is to evaluate the effectiveness of such proposed and on-going management practices, and to modify them according to the adaptive management process in order to achieve the long-term goal of reversing declining populations and maintaining stable or increasing populations of target landbird species.

Acknowledgments

We thank field biologist interns Graeme Stevens and Lia McKinnon (Camp Bowie) and James Ray (Camp Swift) for collecting the 2003 data. We thank Jeanie Woltz for training the interns and Sue Morris for aiding with the re-establishment and operation of stations at Camp Swift. We thank Dawn Johnson for her enthusiastic support of and kind assistance with all of the logistical and administrative aspects of this work. Financial support for this work was provided by the Texas Army National Guard through the U.S. Army Corps of Engineers, Huntsville Center. Suzanne Murdoch and Deborah Hendry of the Huntsville Center helped facilitate this funding. This is Contribution Number 220 of The Institute for Bird Populations.

Literature Cited

DeSante, D.F. (1992) Monitoring Avian Productivity and Survivorship (MAPS): a sharp, rather than blunt, tool for monitoring and assessing landbird populations. *In*: D. R. McCullough and R. H. Barrett (Eds.), Wildlife 2001: Populations, pp. 511-521. (London, U.K.: Elsevier Applied Science).

DeSante, D.F. (1995) Suggestions for future directions for studies of marked migratory landbirds from the perspective of a practitioner in population management and conservation. Journal Applied Statistics 22, pp. 949-965.

DeSante, D.F., Burton, K.M., Saracco, J.F., & Walker, B.L. (1995) Productivity indices and survival rate estimates from MAPS, a continent-wide programme of constant-effort mist netting in North America. Journal Applied Statistics, 22, pp. 935-947.

DeSante, D.F., Burton, K.M., Velez, P., & Froehlich, D. (2003) MAPS Manual, Point Reyes Station, CA: The Institute for Bird Populations; 49 pp.

DeSante, D.F., Nott, M.P., & O'Grady, D.R. (2001a) Identifying the proximate demographic cause(s) of population change by modeling spatial variation in productivity, survivorship, and population trends. Ardea 89 (special issue):185-207.

DeSante, D.F, and D.R. O'Grady. (2000). The Monitoring Avian Productivity and Survivorship (MAPS) program 1997 and 1998 report. Bird Populations 5:49-101.

DeSante, D.F., O'Grady, D.R. & Pyle, P. (1999) Measures of productivity and survival derived from standardized mist netting are consistent with observed population changes. Bird Study 46 (suppl.):S178-188.

DeSante, D.F., Pyle, P., and O'Grady, D.R. (2001b) The 1992-1999 report of the Monitoring Avian Productivity and Survivorship (MAPS Program on military installations in eastern United States. The Institute for Bird Populations, Point Reyes Station, CA 113 pp. plus figs. and tables.

DeSante, D.F., & Rosenberg, D.K. (1998) What do we need to monitor in order to manage landbirds? *In*: J. Marzluff & R. Sallabanks (Eds.), Avian Conservation: Research Needs and Effective Implementation, pp. 93-106. Island Press, Washington, DC.

Lebreton, J.-D., Burnham, K.P., Clobert, J., & Anderson, D.R. (1992) Modeling survival and testing biological hypotheses using marked animals: a unified approach with case studies, Ecological Monographs, 62, pp. 67-118.

Nott, M.P., & DeSante, D.F. (2002) Demographic monitoring and the identification of transients in mark-recapture models. Pp. 727-736 *in:* J.M. Scott & P. Heglund (eds.), Predicting Species Occurrences: Issues of Scale and Accuracy. Island Press, NY.

Nott, M.P., D.F. DeSante, and N. Michel. (2003) Management strategies for reversing declines in landbirds of conservation concern on military installations: A landscape-scale analysis of MAPS data. The Institute for Bird Populations, Pt. Reyes Station, CA.

Peach, W.J., Buckland, S.T., & Baillie, S.R. (1996) The use of constant effort mist-netting to measure between-year changes in the abundance and productivity of common passerines. Bird Study, 43, pp. 142-156.

Peterjohn, B.G., Sauer, J.R., & Robbins, C.S. (1995) Population trends from the North American Breeding Bird Survey. *In*: T.E. Martin and D.M. Finch, Ecology and Management of Neotropical Migratory Birds, New York: Oxford University Press; pp. 3-39.

Pollock, K.H., Nichols, J.D., Brownie, C., & Hines, J.E. (1990) Statistical inference for capture-recapture experiments, Wildlife Monographs, No. 107.

Pradel, R., Hines, J., Lebreton, J.-D., & Nichols, J.D. (1997) Estimating survival probabilities and proportions of 'transients' using capture-recapture data. Biometrics, 53, pp. 60-72.

Robbins, C.S., Sauer, J.R., Greenberg, R.S., & Droege, S. (1989) Population declines in North American birds that migrate to the Neotropics, Proceedings of the National Academy of Sciences (USA), 86, pp. 7658-7662.

Terborgh, J. (1989) Where Have All the Birds Gone?, Essays on the Biology and Conservation of Birds that Migrate to the American Tropics, Princeton, NJ: Princeton Univ. Press; 207 pp.

White, G.C. (1983) Numerical estimation of survival rates from band-recovery and biotelemetry data. J. Wildlife Management, 47, pp. 716-728.

Table 1. Summary of the 2003 MAPS program on Camp Bowie.

Station						2003 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude	Avg Elev. (m)	Total number of net-hours[1]	No. of periods	Inclusive dates
Mesquite Flat	MESQ	14446	Disturbed open mesquite savannah, open cedar/elm woodland	31˚39'00"N,98˚54'30"W	396	448.5 (395.8)	9	5/25 – 8/06
Devil's Hill	DEVI	14447	Live oak/post oak savannah, open mesquite savannah	31˚37'00"N,98˚53'40"W	424	464.7 (347.5)	9	5/22 – 8/01
Stonehouse	STON	14442	Live oak savannah, riparian areas	31˚35'40"N,98˚54'20"W	442	474.3 (307.7)	9	5/21 – 7/29
Bedrock	BEDR	14445	Mixed oak woodland, mesquite savannah	31˚38'40"N,98˚56'10"W	442	527.2 (343.7)	9	5/24 – 7/30
Mockingbird Lane	MOCK	14444	Arid oak/juniper highland	31˚36'20"N,98˚55'20"W	479	359.0 (272.2)	8	5/27 – 7/28
Nighthawk	NIGH	14443	Open oak woodland	31˚37'10"N,98˚57'00"W	485	390.0 (299.5)	9	5/23 – 7/31
ALL STATIONS COMBINED						2663.7 (1966.3)	9	5/21 – 8/06

[1] Total net-hours in 2003. Net-hours in 2003 that could be compared in a constant-effort manner to 2002 are shown in parentheses.

Table 2. Capture summary for the six individual MAPS stations operated on Camp Bowie in 2003.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Northern Bobwhite														1				
Common Ground-Dove							2									1		
Yellow-billed Cuckoo	2			4		2	5		1	2								
Ruby-throated Hummingbird					2													
Black-chinned Hummingbird		1			3			1			5						5	
Golden-fronted Woodpecker	5																	
Ladder-backed Woodpecker	6		2	2		1	2									1		2
Eastern Wood-Pewee	2		1															
Acadian Flycatcher							1											
"Traill's" Flycatcher																1		
Least Flycatcher																1		
Ash-throated Flycatcher	3			2		1												
Great Crested Flycatcher			2								1		1					
Western Scrub-Jay													1					
Carolina Chickadee	5		1	1			5		1	1	1	1	1			1		
Black-crested Titmouse	8	1	2	15		3	10	2	2	1			3		1	12		2
Bushtit													4					
Carolina Wren							2											
Bewick's Wren	20	1	7	22	4	6	21	4	2	4	1	2	7	1	1	27	2	4
Blue-gray Gnatcatcher							1						1			1		
Eastern Bluebird										7						1		
Swainson's Thrush										1								
Northern Mockingbird	4		1	3			1	1					1			2		
Black-and-white Warbler				1														
Common Yellowthroat				1														
Wilson's Warbler							1											
Canada Warbler							1											

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on Camp Bowie in 2003.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Summer Tanager				3			2			5	1	4				3		2
Canyon Towhee							1											
Rufous-crowned Sparrow				7	1	3	2	1								7	1	2
Chipping Sparrow																1		1
Field Sparrow				9	2	3	7	2	2				6	1	1	3		5
Lark Sparrow	3						2	1								5		1
Black-throated Sparrow	1																	
Northern Cardinal	5	1	1	14	5	3	18	1	8	2		1	6		3	9		4
Painted Bunting	10		4	16		8	29	2	7	6		6	7		5	5	1	
Brown-headed Cowbird	2		4	1		3	4		1	1			2			1		
Lesser Goldfinch				2			2											
ALL SPECIES POOLED	76	4	25	103	17	33	119	15	24	30	9	14	40	3	11	82	9	23
Total Number of Captures		105			153			158			53			54			114	
Number of Species	14	4	10	16	6	10	21	9	8	10	5	5	12	3	5	18	4	9
Total Number of Species		16			18			22			12			13			19	

Table 3. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated on Camp Bowie in 2003.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Common Ground-Dove							2.5	0.0	0.00							1.5	0.0	0.00
Yellow-billed Cuckoo	2.7	0.0	0.00	6.5	0.0	0.00	7.6	0.0	0.00	2.3	0.0	0.00						
Golden-fronted Woodpecker	5.4	0.0	0.00															
Ladder-backed Woodpecker	8.0	0.0	0.00	2.6	1.3	0.33	1.3	0.0	0.00							3.1	0.0	0.00
Eastern Wood-Pewee	2.7	0.0	0.00															
Acadian Flycatcher							1.3	0.0	0.00									
Ash-throated Flycatcher	2.7	1.3	0.33	3.9	0.0	0.00												
Great Crested Flycatcher	2.7	0.0	0.00										1.7	0.0	0.00			
Western Scrub-Jay													1.7	0.0	0.00			
Carolina Chickadee	5.4	0.0	0.00	1.3	0.0	0.00	2.5	5.1	0.67	2.3	0.0	0.00	0.0	1.7	1.00	1.5	0.0	0.00
Black-crested Titmouse	6.7	2.7	0.29	7.7	12.9	0.63	3.8	7.6	0.67	1.1	0.0	0.00	5.0	1.7	0.25	7.7	12.3	0.62
Bushtit													5.0	0.0	0.00			
Carolina Wren							1.3	1.3	0.50									
Bewick's Wren	12.0	16.1	0.57	7.7	23.2	0.75	8.9	19.0	0.68	2.3	2.3	0.50	0.0	11.7	1.00	13.8	30.8	0.69
Blue-gray Gnatcatcher							0.0	1.3	1.00				1.7	0.0	0.00	1.5	0.0	0.00
Eastern Bluebird										1.1	6.8	0.86				1.5	0.0	0.00
Northern Mockingbird	4.0	0.0	0.00	3.9	0.0	0.00	0.0	1.3	1.00				0.0	1.7	1.00	3.1	0.0	0.00
Common Yellowthroat				1.3	0.0	0.00												
Summer Tanager				3.9	0.0	0.00	2.5	0.0	0.00	5.7	1.1	0.17				6.2	0.0	0.00
Canyon Towhee							1.3	0.0	0.00									
Rufous-crowned Sparrow				5.2	3.9	0.43	1.3	1.3	0.50							7.7	3.1	0.29
Chipping Sparrow																1.5	1.5	0.50
Field Sparrow				9.0	5.2	0.36	8.9	0.0	0.00				10.0	1.7	0.14	4.6	0.0	0.00
Lark Sparrow	4.0	0.0	0.00				1.3	1.3	0.50							9.2	0.0	0.00
Black-throated Sparrow	0.0	1.3	1.00															
Northern Cardinal	6.7	1.3	0.17	9.0	11.6	0.56	20.2	6.3	0.24	3.4	0.0	0.00	11.7	0.0	0.00	13.8	3.1	0.18
Painted Bunting	14.7	1.3	0.08	16.8	6.5	0.28	29.1	12.6	0.30	8.0	0.0	0.00	11.7	6.7	0.36	7.7	0.0	0.00

Table 3. (cont.) Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated on Camp Bowie in 2003.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Brown-headed Cowbird	2.7	0.0	0.00	2.6	0.0	0.00	5.1	0.0	0.00	1.1	0.0	0.00	3.3	0.0	0.00	1.5	0.0	0.00
Lesser Goldfinch				2.6	0.0	0.00	0.0	0.0	0.00									
ALL SPECIES POOLED	80.3	24.1	0.23	83.9	64.6	0.44	98.7	56.9	0.37	27.3	10.2	0.27	51.8	25.1	0.33	86.2	50.8	0.37
Number of Species	14	6		15	7		16	10		9	3		9	6		16	5	
Total Number of Species		15			15			18			9			12			16	

Table 4. Summary of results for all six Camp Bowie MAPS stations combined in 2003.

Species	Birds captured			Birds/600 nethours		Prop. Young
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Northern Bobwhite		1				
Common Ground-Dove	3			0.7	0.0	0.00
Yellow-billed Cuckoo	13		3	3.4	0.0	0.00
Ruby-throated Hummingbird		2				
Black-chinned Hummingbird		15				
Golden-fronted Woodpecker	5			0.9	0.0	0.00
Ladder-backed Woodpecker	11		5	2.5	0.2	0.08
Eastern Wood-Pewee	2		1	0.5	0.0	0.00
Acadian Flycatcher	1			0.2	0.0	0.00
"Traill's" Flycatcher	1					
Least Flycatcher	1					
Ash-throated Flycatcher	5		1	1.1	0.2	0.17
Great Crested Flycatcher	1	1	2	0.7	0.0	0.00
Western Scrub-Jay	1			0.2	0.0	0.00
Carolina Chickadee	14	1	3	2.3	1.1	0.33
Black-crested Titmouse	49	3	10	5.2	6.1	0.54
Bushtit	4			0.7	0.0	0.00
Carolina Wren	2			0.2	0.2	0.50
Bewick's Wren	101	13	22	7.4	16.7	0.69
Blue-gray Gnatcatcher	3			0.5	0.2	0.33
Eastern Bluebird	8			0.5	1.4	0.75
Swainson's Thrush	1					
Northern Mockingbird	11	1	1	1.8	0.5	0.20
Black-and-white Warbler	1					
Common Yellowthroat	1			0.2	0.0	0.00
Wilson's Warbler	1					
Canada Warbler	1					
Summer Tanager	13	1	6	3.2	0.2	0.07
Canyon Towhee	1			0.2	0.0	0.00
Rufous-crowned Sparrow	16	3	5	2.3	1.4	0.38
Chipping Sparrow	1		1	0.2	0.2	0.50
Field Sparrow	25	5	11	5.2	1.1	0.18
Lark Sparrow	10	1	1	2.3	0.2	0.09
Black-throated Sparrow	1			0.0	0.2	1.00
Northern Cardinal	54	7	20	10.6	3.8	0.27
Painted Bunting	73	3	30	14.9	4.5	0.23
Brown-headed Cowbird	11		8	2.7	0.0	0.00
Lesser Goldfinch	4			0.5	0.0	0.00
ALL SPECIES POOLED	450	57	130	70.7	38.3	0.35
Total Number of Captures		637				
Number of Species	35	14	17	28	17	
Total Number of Species		38			29	

Table 5. Estimates of adult survival and recapture probabilities and proportion of residents using time-constant models for 12 species breeding at MAPS stations on Camp Bowie obtained from ten years (1994-2003) of mark-recapture data.

Species	Num. sta.[1]	Num. ind.[2]	Num. caps.[3]	Num. ret.[4]	Survival probability[5]	Surv. C.V.[6]	Recapture probability[7]	Proportion of residents[8]
Yellow-billed Cuckoo	6	163	189	12	0.442 (0.124)	28.0	0.365 (0.168)	0.260 (0.146)
Ladder-backed Woodpecker	5	46	70	17	0.652 (0.110)	16.9	0.458 (0.129)	0.645 (0.254)
Carolina Chickadee	6	88	102	4	0.270 (0.184)	68.3	0.226 (0.260)	0.569 (0.635)
Black-crested Titmouse	6	183	250	31	0.531 (0.075)	14.2	0.203 (0.069)	0.919 (0.330)
Bewick's Wren	6	236	337	36	0.391 (0.062)	15.9	0.601 (0.114)	0.337 (0.104)
Northern Mockingbird	6	215	267	12	0.218 (0.097)	44.4	0.327 (0.208)	0.590 (0.379)
Summer Tanager	3	63	98	19	0.619 (0.094)	15.3	0.361 (0.113)	0.663 (0.256)
Rufous-crowned Sparrow	3	69	108	12	0.505 (0.111)	22.0	0.452 (0.163)	0.348 (0.183)
Field Sparrow	5	126	171	16	0.635 (0.101)	15.8	0.147 (0.070)	0.686 (0.336)
Northern Cardinal	6	282	457	69	0.526 (0.049)	9.4	0.341 (0.061)	0.803 (0.171)
Painted Bunting	5	320	469	71	0.691 (0.047)	6.8	0.421 (0.058)	0.298 (0.060)
Brown-headed Cowbird	6	105	160	21	0.539 (0.086)	16.0	0.265 (0.094)	0.726 (0.290)

[1] Number of stations where the species was a regular or usual breeder at which adults of the species were captured.
[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.

Table 5. (cont.) Estimates of adult survival and recapture probabilities and proportion of residents using time-constant models for 12 species breeding at MAPS stations on Camp Bowie obtained from ten years (1994-2003) of mark-recapture data.

---

[5] Survival probability presented as the maximum likelihood estimate (standard error of the estimate).
[6] The coefficient of variation for survival probability.
[7] Recapture probability presented as the maximum likelihood estimate (standard error of the estimate).
[8] The proportion of residents among newly captured adults presented as the maximum likelihood estimate (standard error of the estimate).

Table 6. Summary of the 2003 MAPS program on in Camp Swift.

Station						2003 operation		
Name	Code	No.	Major Habitat Type	Latitude-longitude	Avg Elev. (m)	Total number of net-hours[1]	No. of periods	Inclusive dates
Wine Cellar Loop	WCLO	14439	Post oak/cedar woodland, open field	30°16'30"N,97°19'10"W	137	521.8 (462.3)	8	5/18 - 8/07
McLaughlin Creek	MCCR	14441	American elm bottomland, successional oak/cedar oldfield, dense oak/cedar woodland	30°16'10"N,97°16'50"W	137	452.0 (327.7)	8	5/16 - 8/02
Pipeline	PIPE	14436	Post oak/cedar woodland, successional oak/cedar oldfield	30°17'00"N,97°19'40"W	143	569.0 (485.5)	9	5/17 - 8/06
East Loop East	EALE	14438	Successional oldfield, oak/cedar woodland	30°15'50"N,97°15'40"W	152	510.7 (315.7)	7	5/22 - 7/17
East Loop West	EALW	14437	Open oak/cedar woodland, dense oak/cedar woodland, early-successional oldfield	30°15'50"N,97°16'20"W	152	460.0 (326.8)	7	5/19 - 7/15
Sandy Junction	SAJU	14440	Post oak/cedar woodland	30°17'10"N,97°17'20"W	155	536.0 (436.5)	8	5/21 - 8/01
ALL STATIONS COMBINED						3049.5 (2354.5)	9	5/16 - 8/07

[1] Total net-hours in 2003. Net-hours in 2003 that could be compared in a constant-effort manner to 2002 are shown in parentheses.

Table 7. Capture summary for the six individual MAPS stations operated on Camp Swift in 2003.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Wine Cellar Loop			McLaughlin Creek			Pipeline			East Loop East			East Loop West			Sandy Junction		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Mourning Dove																	1	
Common Ground-Dove								1										
Yellow-billed Cuckoo				1			1						2	1		1		
Black-chinned Hummingbird								1									1	
Unidentified Hummingbird											2							
Downy Woodpecker																1		
Yellow-bellied Flycatcher										1			2					
Acadian Flycatcher							1			1						1		
Traill's Flycatcher													1					
White-eyed Vireo	31	1	8	43	1	18	18	1	11	20	1	4	18		5	2		
Red-eyed Vireo				1		2							2					
Carolina Chickadee	4						2			2		3	2					
Tufted Titmouse	2		2	2			2		1	2						4		1
Carolina Wren	5	2	3	9	1	6	10	1	1	3		1	13	1	5	2		
Blue-gray Gnatcatcher	1						1											
Swainson's Thrush				2														
Yellow Warbler										2								
Chestnut-sided Warbler										1								
Magnolia Warbler													1					
Black-throated Green Warb.																1		
Black-and-white Warbler				2			1											
American Redstart	1																	
Swainson's Warbler				1														
Ovenbird	1									1								
Mourning Warbler													1					
Hooded Warbler													1					
Canada Warbler										3								

Table 7. (cont.) Capture summary for the six individual MAPS stations operated on Camp Swift in 2003.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Wine Cellar Loop			McLaughlin Creek			Pipeline			East Loop East			East Loop West			Sandy Junction		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Summer Tanager				1		1												1
Northern Cardinal	17		5	10	3	4	12		8	14	1	5	10		5	9		2
Indigo Bunting				1	1					3	1							
Painted Bunting	11		13	3			14		5	12		4	1		1	5		1
Brown-headed Cowbird	1		1				1			1			1					
ALL SPECIES POOLED	74	3	32	76	6	31	63	4	26	66	5	17	55	2	16	26	2	5
Total Number of Captures		109			113			93			88			73			33	
Number of Species	10	2	6	12	4	5	11	4	5	14	3	5	13	2	4	9	2	4
Total Number of Species		10			12			13			14			13			12	

Table 8. Numbers of aged individual birds captured per 600 net-hours and proportion of young in the catch at the six individual MAPS stations operated on Camp Swift in 2003.

	Wine Cellar Loop			McLauglin Creek			Pipeline			East Loop East			East Loop West			Sandy Junction		
Species	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.	Ad.	Yg.	Prop. Yg.
Yellow-billed Cuckoo				1.3	0.0	0.00	1.1	0.0	0.00				2.6	0.0	0.00	1.1	0.0	0.00
Downy Woodpecker																0.0	1.1	1.00
Acadian Flycatcher							1.1	0.0	0.00	1.2	0.0	0.00				0.0	0.0	0.00
White-eyed Vireo	21.8	16.1	0.42	49.1	25.2	0.34	20.0	4.2	0.17	12.9	14.1	0.52	23.5	3.9	0.14	1.1	1.1	0.50
Red-eyed Vireo				2.7	0.0	0.00							2.6	0.0	0.00			
Carolina Chickadee	4.6	0.0	0.00				1.1	1.1	0.50	4.7	0.0	0.00	1.3	1.3	0.50			
Tufted Titmouse	2.3	1.2	0.33	2.7	0.0	0.00	1.1	2.1	0.67	1.2	1.2	0.50				2.2	3.4	0.60
Carolina Wren	6.9	1.2	0.14	14.6	1.3	0.08	5.3	5.3	0.50	4.7	0.0	0.00	11.7	6.5	0.36	1.1	1.1	0.50
Blue-gray Gnatcatcher	1.2	0.0	0.00				0.0	1.1	1.00									
Black-and-white Warbler				2.7	0.0	0.00	1.1	0.0	0.00									
Summer Tanager				1.3	1.3	0.50										1.1	0.0	0.00
Northern Cardinal	10.3	12.6	0.55	15.9	1.3	0.08	14.8	3.2	0.18	16.4	3.5	0.18	15.7	1.3	0.08	6.7	5.6	0.46
Indigo Bunting				1.3	0.0	0.00				1.2	2.4	0.67						
Painted Bunting	17.2	3.4	0.17	4.0	0.0	0.00	14.8	3.2	0.18	18.8	0.0	0.00	2.6	0.0	0.00	5.6	1.1	0.17
Brown-headed Cowbird	1.2	0.0	0.00				1.1	0.0	0.00	1.2	0.0	0.00	1.3	0.0	0.00			
ALL SPECIES POOLED	65.5	34.5	0.35	95.6	29.2	0.23	61.2	20.0	0.25	62.3	21.1	0.25	61.3	13.0	0.18	19.0	13.4	0.41
Number of Species	8	5		10	4		10	7		9	4		8	4		7	6	
Total Number of Species		8			10			11			9			8			8	

Table 9. Summary of results for all six Camp Swift MAPS stations combined in 2003.

Species	Birds captured			Birds/600 nethours		
	Newly banded	Un-banded	Recap-tured	Adults	Young	Prop. Young
Mourning Dove		1				
Common Ground-Dove		1				
Yellow-billed Cuckoo	5	1		1.0	0.0	0.00
Black-chinned Hummingbird		2				
Unidentified Hummingbird		2				
Downy Woodpecker	1			0.0	0.2	1.00
Yellow-bellied Flycatcher	3					
Acadian Flycatcher	3			0.4	0.0	0.00
Traill's Flycatcher	1					
White-eyed Vireo	132	4	46	20.5	10.4	0.34
Red-eyed Vireo	3		2	0.8	0.0	0.00
Carolina Chickadee	10		3	2.0	0.4	0.17
Tufted Titmouse	12		4	1.6	1.4	0.47
Carolina Wren	42	5	16	7.1	2.6	0.27
Blue-gray Gnatcatcher	2			0.2	0.2	0.50
Swainson's Thrush	2					
Yellow Warbler	2					
Chestnut-sided Warbler	1					
Magnolia Warbler	1					
Black-throated Green Warbler	1					
Black-and-white Warbler	3			0.6	0.0	0.00
American Redstart	1					
Swainson's Warbler	1					
Ovenbird	2					
Mourning Warbler	1					
Hooded Warbler	1					
Canada Warbler	3					
Summer Tanager	1		2	0.4	0.2	0.33
Northern Cardinal	72	4	29	13.2	4.7	0.26
Indigo Bunting	4	2		0.4	0.4	0.50
Painted Bunting	46		24	10.8	1.4	0.11
Brown-headed Cowbird	4		1	0.8	0.0	0.00
ALL SPECIES POOLED	360	22	127	59.6	21.8	0.27
Total Number of Captures		509				
Number of Species	28	8	9	14	10	
Total Number of Species		31			15	

Table 10. Estimates of adult survival and recapture probabilities and proportion of residents using time-constant models for six species breeding at MAPS stations on Camp Swift obtained from ten years (1994-2003) of mark-recapture data.

Species	Num. sta.[1]	Num. ind.[2]	Num. caps.[3]	Num. ret.[4]	Survival probability[5]	Surv. C.V.[6]	Recapture probability[7]	Proportion of residents[8]
White-eyed Vireo	3	457	767	113	0.562 (0.040)	7.1	0.460 (0.053)	0.531 (0.086)
Tufted Titmouse	3	67	95	13	0.502 (0.123)	24.4	0.245 (0.127)	1.000 (0.556)
Carolina Wren	3	233	351	31	0.355 (0.070)	19.6	0.413 (0.118)	0.649 (0.217)
Summer Tanager	3	61	76	10	0.552 (0.128)	23.2	0.257 (0.140)	0.571 (0.355)
Northern Cardinal	3	623	983	180	0.595 (0.030)	5.1	0.354 (0.036)	0.661 (0.084)
Painted Bunting	3	371	564	89	0.526 (0.045)	8.6	0.452 (0.062)	0.559 (0.103)

[1] Number of super-stations where the species was a regular or usual breeder at which adults of the species were captured.
[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 presented as the maximum likelihood estimate (standard error of the estimate).
[6] The coefficient of variation for survival probability.
[7] Recapture probability presented as the maximum likelihood estimate (standard error of the estimate).
[8] The proportion of residents among newly captured adults presented as the maximum likelihood estimate (standard error of the estimate).

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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Bowie.

NUMB	SPEC	SPECIES NAME
01010	GBHE	Great Blue Heron
01040	GREG	Great Egret
01120	CAEG	Cattle Egret
01130	GRHE	Green Heron
01290	BLVU	Black Vulture
01300	TUVU	Turkey Vulture
01360	BBWD	Black-bellied Whistling-Duck
01380	FUWD	Fulvous Whistling-Duck
01570	WODU	Wood Duck
02110	MIKI	Mississippi Kite
02210	COHA	Cooper's Hawk
02380	RSHA	Red-shouldered Hawk
02420	SWHA	Swainson's Hawk
02460	RTHA	Red-tailed Hawk
02545	UNHA	Unidentified Hawk
02590	CRCA	Crested Caracara
03040	WITU	Wild Turkey
03160	NOBO	Northern Bobwhite
03780	KILL	Killdeer
05370	RODO	Rock Dove
05540	WWDO	White-winged Dove
05570	MODO	Mourning Dove
05600	INDO	Inca Dove
05610	COGD	Common Ground-Dove
06410	YBCU	Yellow-billed Cuckoo
06580	GRRO	Greater Roadrunner
06680	EASO	Eastern Screech-Owl
06800	GHOW	Great Horned Owl
06950	BADO	Barred Owl
07080	CONI	Common Nighthawk
07110	COPO	Common Poorwill
07170	CWWI	Chuck-will's-widow
07400	CHSW	Chimney Swift
08630	RTHU	Ruby-throated Hummingbird
08640	BCHU	Black-chinned Hummingbird
08775	UNHU	Unidentified Hummingbird
09110	BEKI	Belted Kingfisher
09540	GFWO	Golden-fronted Woodpecker
09550	RBWO	Red-bellied Woodpecker
09630	LBWO	Ladder-backed Woodpecker
09650	DOWO	Downy Woodpecker
09800	YSFL	Yellow-shafted Flicker

Appendix I. (cont.) 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Bowie.

NUMB	SPEC	SPECIES NAME
09915	UNWO	Unidentified Woodpecker
11340	OSFL	Olive-sided Flycatcher
11390	EAWP	Eastern Wood-Pewee
11450	YBFL	Yellow-bellied Flycatcher
11460	ACFL	Acadian Flycatcher
11475	TRFL	"Traill's" Flycatcher
11500	LEFL	Least Flycatcher
11520	GRFL	Gray Flycatcher
11595	UEFL	Unidentified Empidonax Flycatcher
11610	EAPH	Eastern Phoebe
11630	VEFL	Vermilion Flycatcher
11740	ATFL	Ash-throated Flycatcher
11760	GCFL	Great Crested Flycatcher
12020	WEKI	Western Kingbird
12070	STFL	Scissor-tailed Flycatcher
12085	UNFL	Unidentified Flycatcher
12520	LOSH	Loggerhead Shrike
12550	WEVI	White-eyed Vireo
12640	BEVI	Bell's Vireo
12650	BCVI	Black-capped Vireo
12760	WAVI	Warbling Vireo
12790	REVI	Red-eyed Vireo
12930	BLJA	Blue Jay
13110	WESJ	Western Scrub-Jay
13190	AMCR	American Crow
13300	CORA	Common Raven
13340	PUMA	Purple Martin
13490	NRWS	Northern Rough-winged Swallow
13520	CLSW	Cliff Swallow
13540	BARS	Barn Swallow
13560	CACH	Carolina Chickadee
13661	BCTI	Black-crested Titmouse
13670	VERD	Verdin
13680	BUSH	Bushtit
13830	CACW	Cactus Wren
14000	CARW	Carolina Wren
14040	BEWR	Bewick's Wren
14070	HOWR	House Wren
14350	BGGN	Blue-gray Gnatcatcher
14560	EABL	Eastern Bluebird
14810	SWTH	Swainson's Thrush

Appendix I. (cont.) 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Bowie.

NUMB	SPEC	SPECIES NAME
14820	HETH	Hermit Thrush
15000	AMRO	American Robin
15150	NOMO	Northern Mockingbird
15260	CBTH	Curve-billed Thrasher
15370	EUST	European Starling
15550	CEDW	Cedar Waxwing
15660	OCWA	Orange-crowned Warbler
15670	NAWA	Nashville Warbler
15750	YWAR	Yellow Warbler
15770	MAWA	Magnolia Warbler
15860	BLBW	Blackburnian Warbler
16030	BAWW	Black-and-white Warbler
16080	OVEN	Ovenbird
16100	LOWA	Louisiana Waterthrush
16130	MOWA	Mourning Warbler
16140	MGWA	MacGillivray's Warbler
16150	COYE	Common Yellowthroat
16290	WIWA	Wilson's Warbler
16300	CAWA	Canada Warbler
16460	YBCH	Yellow-breasted Chat
16820	SUTA	Summer Tanager
16830	SCTA	Scarlet Tanager
17820	EATO	Eastern Towhee
17840	CANT	Canyon Towhee
17920	CASP	Cassin's Sparrow
17950	RCSP	Rufous-crowned Sparrow
18020	CHSP	Chipping Sparrow
18030	CCSP	Clay-colored Sparrow
18050	FISP	Field Sparrow
18090	LASP	Lark Sparrow
18100	BTSP	Black-throated Sparrow
18130	SAVS	Savannah Sparrow
18140	GRSP	Grasshopper Sparrow
18240	LISP	Lincoln's Sparrow
18290	WCSP	White-crowned Sparrow
18335	UNSP	Unidentified Sparrow
18560	NOCA	Northern Cardinal
18640	BLGR	Blue Grosbeak
18670	INBU	Indigo Bunting
18700	PABU	Painted Bunting

Appendix I. (cont.) 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Bowie.

NUMB	SPEC	SPECIES NAME
18710	DICK	Dickcissel
18730	RWBL	Red-winged Blackbird
18800	EAME	Eastern Meadowlark
18870	COGR	Common Grackle
18890	GTGR	Great-tailed Grackle
18960	BHCO	Brown-headed Cowbird
19105	BUOR	Bullock's Oriole
19160	BAOR	Baltimore Oriole
19190	SCOR	Scott's Oriole
19370	HOFI	House Finch
19490	LEGO	Lesser Goldfinch
19510	AMGO	American Goldfinch
19920	HOSP	House Sparrow
20085	UNBI	Unidentified Bird

Appendix II. 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Swift.

NUMB	SPEC	SPECIES NAME
01010	GBHE	Great Blue Heron
01040	GREG	Great Egret
01080	SNEG	Snowy Egret
01090	LBHE	Little Blue Heron
01120	CAEG	Cattle Egret
01130	GRHE	Green Heron
01280	WOST	Wood Stork
01290	BLVU	Black Vulture
01300	TUVU	Turkey Vulture
01360	BBWD	Black-bellied Whistling-Duck
01570	WODU	Wood Duck
02070	WTKI	White-tailed Kite
02380	RSHA	Red-shouldered Hawk
02400	BWHA	Broad-winged Hawk
02420	SWHA	Swainson's Hawk
02430	WTHA	White-tailed Hawk
02460	RTHA	Red-tailed Hawk
02590	CRCA	Crested Caracara
02630	AMKE	American Kestrel
03040	WITU	Wild Turkey
03160	NOBO	Northern Bobwhite
03780	KILL	Killdeer
05570	MODO	Mourning Dove
05600	INDO	Inca Dove
05610	COGD	Common Ground-Dove
06400	BBCU	Black-billed Cuckoo
06410	YBCU	Yellow-billed Cuckoo
06580	GRRO	Greater Roadrunner
06680	EASO	Eastern Screech-Owl
06800	GHOW	Great Horned Owl
06950	BADO	Barred Owl
07080	CONI	Common Nighthawk
07170	CWWI	Chuck-will's-widow
07400	CHSW	Chimney Swift
08630	RTHU	Ruby-throated Hummingbird
08640	BCHU	Black-chinned Hummingbird
08775	UNHU	Unidentified Hummingbird
09540	GFWO	Golden-fronted Woodpecker
09550	RBWO	Red-bellied Woodpecker
09630	LBWO	Ladder-backed Woodpecker
09650	DOWO	Downy Woodpecker
09660	HAWO	Hairy Woodpecker
09800	RSFL	Red-shafted Flicker

Appendix II. (cont.) 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Swift.

NUMB	SPEC	SPECIES NAME
09800	YSFL	Yellow-shafted Flicker
09860	PIWO	Pileated Woodpecker
11340	OSFL	Olive-sided Flycatcher
11390	EAWP	Eastern Wood-Pewee
11450	YBFL	Yellow-bellied Flycatcher
11460	ACFL	Acadian Flycatcher
11475	TRFL	Traill's Flycatcher
11500	LEFL	Least Flycatcher
11555	COFL	Cordilleran Flycatcher
11555	WEFL	Western Flycatcher
11595	UEFL	Unidentified Empidonax Flycatcher
11610	EAPH	Eastern Phoebe
11760	GCFL	Great Crested Flycatcher
12020	WEKI	Western Kingbird
12030	EAKI	Eastern Kingbird
12070	STFL	Scissor-tailed Flycatcher
12085	UNFL	Unidentified Flycatcher
12550	WEVI	White-eyed Vireo
12690	YTVI	Yellow-throated Vireo
12790	REVI	Red-eyed Vireo
12930	BLJA	Blue Jay
13190	AMCR	American Crow
13300	CORA	Common Raven
13340	PUMA	Purple Martin
13410	TRES	Tree Swallow
13490	NRWS	Northern Rough-winged Swallow
13520	CLSW	Cliff Swallow
13540	BARS	Barn Swallow
13560	CACH	Carolina Chickadee
13660	TUTI	Tufted Titmouse
14000	CARW	Carolina Wren
14350	BGGN	Blue-gray Gnatcatcher
14795	GCBT	Gray-cheeked/Bicknell's Thrush
14810	SWTH	Swainson's Thrush
14830	WOTH	Wood Thrush
15130	GRCA	Gray Catbird
15150	NOMO	Northern Mockingbird
15550	CEDW	Cedar Waxwing
15670	NAWA	Nashville Warbler
15730	NOPA	Northern Parula
15750	YWAR	Yellow Warbler
15760	CSWA	Chestnut-sided Warbler
15770	MAWA	Magnolia Warbler

Appendix II. (cont.) 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 ten years, 1994-2003, of the MAPS Program on the six stations on Camp Swift.

NUMB	SPEC	SPECIES NAME
15790	BTBW	Black-throated Blue Warbler
15820	GCWA	Golden-cheeked Warbler
15830	BTNW	Black-throated Green Warbler
15860	BLBW	Blackburnian Warbler
15910	PIWA	Pine Warbler
16030	BAWW	Black-and-white Warbler
16040	AMRE	American Redstart
16070	SWWA	Swainson's Warbler
16080	OVEN	Ovenbird
16110	KEWA	Kentucky Warbler
16130	MOWA	Mourning Warbler
16150	COYE	Common Yellowthroat
16280	HOWA	Hooded Warbler
16290	WIWA	Wilson's Warbler
16300	CAWA	Canada Warbler
16460	YBCH	Yellow-breasted Chat
16495	UNWA	Unidentified Warbler
16820	SUTA	Summer Tanager
16830	SCTA	Scarlet Tanager
18020	CHSP	Chipping Sparrow
18560	NOCA	Northern Cardinal
18600	RBGR	Rose-breasted Grosbeak
18640	BLGR	Blue Grosbeak
18670	INBU	Indigo Bunting
18700	PABU	Painted Bunting
18710	DICK	Dickcissel
18730	RWBL	Red-winged Blackbird
18800	EAME	Eastern Meadowlark
18870	COGR	Common Grackle
18960	BHCO	Brown-headed Cowbird
19160	BAOR	Baltimore Oriole
19380	RECR	Red Crossbill
19490	LEGO	Lesser Goldfinch