THE 2008 REPORT OF THE

MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM ON

TEXAS NATIONAL GUARD INSTALLATIONS

CAMP SWIFT AND CAMP BOWIE

Camp Bowie's Mesquite Flat MAPS Station before (left) and after (right) the June 2008 wildfire.

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SUMMARY

The Institute for Bird Populations operated 12 Monitoring Avian Productivity and Survivorship (MAPS), demographic monitoring stations on Texas National Guard Installations Camp Bowie (6 stations) and Camp Swift (6 stations). These stations have operated annually since 1994 and were visited nine times (during 10-day periods) each breeding season (May to August) as weather, military maneuvers, and stochastic events permitted. In 2008, the percentages of total banding effort achieved at each location were high enough to include the annual dataset into the longer-term continent-wide MAPS dataset (1989-2008), such that the data can be included in analyses to estimate apparent survival rates and index productivity, as defined by the MAPS protocol.

At Camp Swift 93.5% of expected effort was achieved compared to 99.0% in 2007. Pooling data from all stations, the most abundant breeding species, having a capture rate of at least 3.0 adults per 600 net-hours, in decreasing order, were White-eyed Vireo, Northern Cardinal, Painted Bunting, and Carolina Wren. Compared to 2007, four species (Carolina Wren, Carolina Chickadee, Summer Tanager, and Blue-gray Gnatcatcher) were new to station-specific species lists because more than three birds were captured per 600 net hours. Numbers of individual adult captures increased by 78.5% over those of 2007 and by 18.1% over those of 2006. The overall reproductive index for the six stations in 2008 was 0.52, a 10.3% decrease from last year's index of 0.58, but an increase of 40.5% over the 0.37 value recorded in 2006 at Camp Swift. Although overall productivity indices decreased by 10.3% since 2007, effort decreased by 5.6%, but the absolute number of young birds increased by more than 50%.

At Camp Bowie, a June wildfire burned most of the area of one station and military scheduling conflicted with the final period of the MAPS season such that of only 70.8% of expected effort was achieved. Pooling data from all stations, the most abundant breeding species, having a capture rate of at least 3.0 adults per 600 net-hours, in decreasing order, were Painted Bunting, Northern Cardinal, Black-crested Titmouse, and Bewick's Wren. Compared to 2007, 13 species (Ladder-backed Woodpecker, Bewick's Wren, Northern Cardinal, Bushtit, Black-crested Titmouse, Eastern Bluebird, Northern Mockingbird, Summer Tanager, Rufous-

crowned Sparrow, Field Sparrow, Lark Sparrow, Painted Bunting, and Brown-headed Cowbird) were new to one or more station-specific species lists because more than three birds were captured per 600 net hours. Overall, numbers of individual adult captures increased by 52% over those of 2007 but decreased by 8.5% over those of 2006. The overall reproductive index for the six stations in 2008 was 0.49, representing a 25.6% increase over last year's index of 0.39 at Camp Bowie, and an 88.2% increase over the 0.17 recorded in 2006. However, the absolute number of young birds increased by more than 50%. Although the low percentage of effort should have biased annual productivity indices low, the overall productivity in 2008 exceeded that of 2007, a year in which 83.7% of expected effort was achieved. Thus, with full effort this year's productivity would have been even higher than observed.

The June 16th wildfire that passed through the Mesquite Flat MAPS station (see front cover) presents an opportunity to monitor the effects of warm-season burning on avian community dynamics. The fire burned forbs and grasses to the ground, consumed most dead vegetation, and removed the leaves from the trees, but the fire was not hot enough to destroy their ability to produce new leaves. Rain a few days following the burn resulted in grass and other vegetation sprouting up by mid-July. By comparing 2008 captures with those from other years at this station we concluded that the post-fire landscape was attractive to several species previously recorded in low numbers, such as Bewick's Wren, Eastern Bluebird, Lark Sparrow, and Ladder-backed Woodpecker, and may also have resulted in increased captures of other more commonly captured species such as Northern Cardinal and Painted Bunting. We suggest that the altered structure of the post-fire landscape provided optimal post-breeding foraging conditions for these species. Compared with 2007, adult capture rate at Mesquite Flat more than doubled, from 22.1 to 51.2 birds per 600 net-hours, and reproductive index increased by over four-fold, from 0.24 to 1.11. We are confident that these increases do not reflect the natural dynamics that would have likely occurred had the station not burned. Continued monitoring will reveal how warm-season burns (proposed for most of Camp Bowie and the Dropzone station on Camp Swift) affect local bird population dynamics in 2009 and subsequent years.

Camp Swift, Camp Bowie, and Fort Hood MAPS data are invaluable to landbird conservation efforts. Painted Bunting data from these locations are the focus of intense analysis to resolve migration connectivity and identify the nature of, and timing of, environmental stressors acting upon the breeding habitats, the wintering habitats, and migration stopover habitats. Here we provide the abstract from a manuscript in preparation that emphasizes the importance of these data and the analytical techniques under development.

"Special [conservation] consideration must be given to the subset of Neotropical migrants that "molt migrate", including the western race of Painted Bunting (*Passerina ciris*). Like other Neotropical migrants, Painted Buntings face long-term challenges as the geographic ranges of plants and animals currently associated with their winter and summer habitats shift in response to climate change. After breeding, these molt migrants fly to riparian habitats of the North American Monsoon (NAM) region of northwestern Mexico, molt, and then fly to their wintering habitats of central Mexico and as far south as western Panama. Studies of Painted Bunting data from all three Texas military MAPS locations (Camp Swift, Camp Bowie, and Fort Hood) have been useful in resolving Painted Bunting migration connectivity (i.e., where local breeding populations overwinter). We analyzed MAPS data collected during 14 breeding seasons (1994-2007) at the three locations and data collected at 22 sites in Mexico and Central America (2002-2007) during winter as part of the Monitoreo de Sobrevivencia Invernal (MoSI) program. From these data we constructed latitudinal and longitudinal gradient models of wing chord length from MoSI program data to map male and female populations of the three Texas breeding locations onto approximate wintering locations. We compared seasonal precipitation patterns throughout the molt migration and winter ranges with annual breeding season demographics (including body condition). For two short-winged Painted Bunting populations the annual breeding season body condition correlated most strongly with conditions in the NAM region during the previous July-October monsoon season. Mean annual body condition of a long-winged population correlated with winter precipitation in the western Panama region.

Effective conservation must monitor the effects of land use, land conversion, and climate change on critical breeding, migration, and overwintering habitats and the sensitive phases of Neotropical migrant life cycles."

The Texas MAPS locations provide ideal “early warning” stations for monitoring climate change-induced effects on avian community composition. Furthermore, the Painted Bunting appears to be an ideal organism for conceptualizing and constructing predictive models of landbird annual life cycles under alternate climate scenarios Such models will provide information relating to the consideration of climate change in natural resource management of these (and other) Texas National Guard locations.

INTRODUCTION

Since 1989, The Institute for Bird Populations has been coordinating the Monitoring Avian Productivity and Survivorship (MAPS) Program (DeSante et al. 2008), a cooperative effort among public and private agencies and individual bird banders in North America, to operate a continent-wide network of over 1000 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 that may be affecting 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). A recent study (Saracco et al. 2008) used novel analytical methods to a) show that both MAPS and the North American Breeding Bird Survey (BBS) provide similar estimates of population trends for 36 species of wood warblers, and b) show that adult survival, rather than productivity, is the primary demographic parameter driving regional population changes in Yellow Warbler. Hence, as Nott et al. (in prep.) suggested, annual survival rate of Neotropical migrants is strongly affected by stressors act on migrating and overwintering individuals.

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 strategy. Moreover, because birds are excellent indicators of the health of ecological systems, they can serve as sensitive barometers of the overall effectiveness of efforts to maintain the biodiversity and ecological integrity of military installations. Accordingly, the MAPS program was initiated on select military installations beginning in 1992 and soon became a focal project 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, 12 MAPS stations were established and operated on Texas National Guard Installations Camp Swift (6 stations) and Camp Bowie (6 stations). The operation of these stations was continued during the summers of 1994-2002 by means of funding from the DoD Legacy Resource Management Program, and during the summers of 2003-2008 through funding from the Texas Army National Guard. Data from these stations and six stations at Fort Hood comprise a) three installation-specific analytical units for comparison, and b) a regional (pooled) analytical unit.

The ultimate objective of the MAPS Program on military installations, such as Camp Swift and Camp Bowie, 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 maintain 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. The management strategies will involve efforts to modify habitat characteristics from those associated with low productivity to those associated with high productivity, for species in which low productivity is driving a population decline.

The Legacy Resource Management Program allowed us to undertake these analyses and formulate management strategies. These analyses have now been completed (Nott et al. 2003) and management guidelines have been formulated for ten bird species of conservation concern that breed in the United States east of the 100th meridian. With additional funding from the Legacy Resource Management Program, we are currently implementing these guidelines and actions on eight military installations (including Camp Swift and Camp Bowie) in conjunction with efforts to increase military Readiness and Range Sustainment (Nott and Michel 2005). The strategy for implementing these guidelines includes the establishment of new MAPS stations to monitor their effectiveness. Consequently, we have discontinued an equal number of old stations, and continued their operation of other existing stations to serve as controls for the new management stations. In this way, the total number of stations operated has remained the same.

At Camp Swift in 2004, we replaced the McLaughlin Creek station with a new station, Dropzone, aimed at better monitoring Painted Bunting, a species of conservation and management concern. We achieved this by selecting an area in which habitat patterns, according to our models, should support healthy bunting populations (e.g., oak prairie). We also hypothesized that, by implementing warm-season burn regimes upon these areas, we would be able to enhance the restoration of native grasses and forbs in the oak prairie habitat, leading to further increases in population sizes and reproductive success of Painted Bunting.

Unfortunately, implementation of the warm-season fire regime has not been possible due to unfavorable weather conditions and logistical considerations, but it is proposed again for the winter of 2008-2009. However, in the winter of 2008-2009 authorities did remove shrubs from in and around the Dropzone area to increase the efficacy of the military mission. Thus, we are now monitoring the effects of these management actions on populations at each station and will be especially interested in observing changes in the population dynamics of birds breeding there such as Painted Bunting.

At Camp Bowie all six stations have been in operation since 1994 and have provided data critical to the resolution of Painted Bunting migration connectivity. These investigations have resulted in the consideration of climate change in landbird management plans and in assessing the efficacy of management implementation. The Integrated Natural Resource Management Plan includes management actions to restore riparian corridors, fill stock ponds, prescribe fires to clear vegetation for both Black-capped Vireo habitat restoration, restore native plant communities, and cattle grazing to create more grassland habitat and reduce the success of nest-parasitizing Brown-headed Cowbirds. Cattle grazing is now prohibited within the boundaries of Camp Bowie and it will be interesting to see how this affects captures of cowbirds and reproductive success of host species.

On 16 June 2008, half way through the 2008 MAPS season, a wildfire completely burned vegetation around one of our banding stations, Mesquite Flat. We are already seeing affects of this burn (see Results and Discussion), and it will be of extreme interest to see how this stochastic event shapes bird dynamics over the next few breeding seasons. Otherwise, there are no current plans to move existing MAPS stations, merely to monitor the changes in avifauna that will occur in response to a) management actions, b) no management actions, and c) the June 2008 wildfire.

A complete summary of the results of the MAPS Program on Camp Swift and Camp Bowie 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 both

that earlier report and previous years' reports (DeSante et al. 2004, 2005a; Nott et al. 2006, 2008), and documents the operation of the 12 MAPS stations on Camp Swift and Camp Bowie during the 2008 breeding season. Reports were also submitted to the Legacy Resource Management Office which included information regarding the long-term precipitation patterns associated with the stations, and assessments of their regional importance in providing large contiguous patches of habitat. Furthermore, analyses of the Painted Bunting data from these and Fort Hood stations form the basis of a manuscript entitled "Painted Bunting (*Passerina ciris*) Demographics in Texas: Survival, Reproduction, and Migration Connectivity" (Nott et al. in prep.)

METHODS

Six MAPS stations were operated in 2008 on each of Camp Swift and Camp Bowie. At Camp Swift (Table 1), five stations were at the same locations where they were first established in 1994. The sixth station, Dropzone, was established in 2004 in an area of mixed little bluestem grassland and post oak woodland habitat bordered by cedars and loblolly pines, on the border of a Texas Reserve Air National Guard drop zone. While the location of this site was initially selected from species/landscape models of MAPS data for the target species Painted Bunting, point counts were conducted in the area to verify the abundance of Painted Buntings prior to final site selection for this new station. At Camp Bowie (Table 6) the same six stations have been operated from 1994 through 2008.

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. 2008). 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, except that period 10 could not be run for four stations at Camp Bowie due to schedule conflicts with camp operations. The operation of stations at Swift was carried out by field biologist interns Debby Peng and Keith Coutleman and the operation of stations at Bowie were carried out by Dacia Wiitala and Zac Ruzycki. All four of these interns were trained by IBP field biologists Melissa Wolfe and Mary Chambers, and were supervised by Melissa Wolfe throughout the season.

With few exceptions, all birds captured during the course of the study were identified to species, age, and sex and, if unbanded, were banded with USGS/BRD numbered aluminum bands. Birds were released immediately upon capture and before being banded or processed if situations arose where bird safety would be compromised. The following data were taken on all

birds captured, including recaptures, according to MAPS guidelines using standardized codes and forms (DeSante et al. 2008):

(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.

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 15 years (1994-2008) 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 (seven at Camp Swift), 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

Camp Swift

We operated six MAPS stations at Camp Swift during the summer of 2008 for a total of 3029.8 net-hours. This represents 93.5% of the maximum effort possible at this station. The operation details of these six stations are presented in Table 1.

For each individual species and for all species pooled, the numbers of individual birds newly banded, captured and released unbanded (we do not band hummingbirds), and recaptured are presented for each station in Table 2, and for all stations combined in Table 4. A total of 634 captures of 29 species occurred at Camp Swift during the summer of 2008 (Table 4). Newly banded birds comprised 69.2% of the total captures. The greatest number of total captures (156) was recorded at the Wine Cellar Loop station and the smallest number of total captures (39) was recorded at the Sandy Junction station (Table 2). The highest species richness occurred at Wine Cellar Loop, East Loop East, and East Loop West (15 species each) and the lowest species richness occurred at Sandy Junction (8 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 achieved (Table 1). Adult population size (for all species pooled) was highest at Wine Cellar Loop (98.9 adults/600 net hours; Table 3), followed by Dropzone (91.1), East Loop West (67.5), East Loop East (58.9), Pipeline (47.8) , and Sandy Junction (23.5). All of these values are substantially higher that those recorded last year, with the exception of Sandy Junction (which is slightly lower). Overall, 63.2 individual adults were captured per 600 net hrs in 2008 (Table 4), representing a 78.5% increase compared with the 35.4 adults per 600 net hours captured in 2007, and an 18.1% increase over the 53.5 adults captured per 600 net hours in 2006.

Among individual species, Northern Cardinal was the most frequently captured at the six stations in 2008, followed by White-eyed Vireo, Painted Bunting, Carolina Wren, Carolina Chickadee, Tufted Titmouse, and Blue-gray Gnatcatcher (Table 4). The most abundant breeding species, having a capture rate of at least 3.0 adults per 600 net-hours, in decreasing order, were White-eyed Vireo, Northern Cardinal, Painted Bunting, and Carolina Wren (Table 4). The most abundant breeding species at each installation, having capture rates of at least 3.0 adults/600 net-hours were as follows (Table 3):

Wine Cellar Loop	**Pipeline**	**East Loop East**
White-eyed Vireo	Northern Cardinal	Northern Cardinal
Painted Bunting	White-eyed Vireo	White-eyed Vireo
Northern Cardinal	Painted Bunting	Carolina Wren
Carolina Wren	Carolina Wren*	Painted Bunting*
Summer Tanager		
Carolina Chickadee*	**East Loop West**	**Dropzone**
	Northern Cardinal	White-eyed Vireo
Sandy Junction	White-eyed Vireo	Painted Bunting
Painted Bunting	Painted Bunting	Carolina Wren*
Northern Cardinal	Carolina Chickadee	Northern Cardinal
Carolina Wren*	Carolina Wren*	Carolina Chickadee*
Summer Tanager*	Blue-gray Gnatcatcher*	Blue-gray Gnatcatcher*
	Indigo Bunting	

* Did not exceed 3.0 adults per 600 net hours in 2007.

† Exceeded 3.0 adults per 600 net hours in 2007 but not in 2008.

Reproductive index (the number of young per adult captured) showed a different pattern over the six stations than adult population size, being highest at East Loop East (0.74), followed by East Loop West (0.58), Dropzone (0.55), Wine Cellar Loop (0.46), Sandy Junction (0.43), and Pipeline (0.34). These rates show different levels of change since the previous season, with

three stations declining, East Loops East and West showing increases, and Dropzone remaining similar as compared with values recorded in 2007. The overall reproductive index for the six stations in 2008 was 0.52 (Table 4), a 10.3% decrease from last year's index of 0.58 but an increase of 40.5% over the 0.37 value recorded in 2006 at Camp Swift. Mean productivity for all species pooled at Camp Swift during the six years 1994-1999 was 0.294 (see DeSante et al. 2001b), indicating that productivity in all three years, but especially 2007-2008 was well above average.

Using 15 years of data (1994-2008) from all six stations combined, 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 5 for these six species. Survival-rate estimates for all six species showed good precision (CVs < 22%) with a mean CV of 11.6%, the same as recorded in 2007 for the same six species using 14 years of data (1994-2007). Annual adult survival rates for these six species ranged from a low of 0.417 for Carolina Wren to a high of 0.574 for Northern Cardinal, with a mean of 0.510 for the six species. This compares to a mean survival of 0.518 for the same six species after 14 year's of data had been collected, indicating lower than average survival rates for these species during the winter of 2007-2008 for Camp Swift. Survivorship at Camp Swift has been shown to be comparable to that of the South-central Region as a whole (DeSante et al. 2004).

As mentioned earlier, analyses aimed at identifying and describing relationships between four demographic parameters (adult population size, population trend, number of young, and productivity) and landscape-level habitat characteristics for ten bird species of conservation concern have been completed for 13 military installations in south-central and southeastern United States, including Camp Swift (Nott et al. 2003, Nott and Michel 2005). At Camp Swift, one species, Painted Bunting, emerged as a candidate for particular management concern. Post-breeding "warm season" fire management practices, as opposed to the current spring or fall practices, would (given adequate winter precipitation) result in a more natural and diverse cool-

season grassland and richer springtime/early summer forb community, which should benefit buntings.

An objective of the MAPS program at Camp Swift is to evaluate the effectiveness of such proposed and on-going management practices, and to modify them, according to an adaptive management process, to reverse declining populations and maintain stable or increasing populations of target landbird species. During 2004 we made advancements toward these goals by replacing a woodland station (McLaughlin Creek), which experienced few captures of Painted Buntings, with the Dropzone station. We predicted from our species/landscape models that the new station would have higher capture rates and high productivity in general. Moreover, this station underwent habitat management in the form of prescribed burning during the spring of 2005, which we predicted would provide high quality Painted Bunting habitat by improving the nesting and foraging quality of the Camp Swift's oak-prairie habitats and encouraging the establishment of a more natural grassland-forb community than previously existed.

In 2004 we captured 7.6 adult Painted Buntings per 600 net-hours at Dropzone, and this value increased to 20.7 in 2005, 26.5 in 2006, 11.3 in 2007, and 21.4 in 2008 (Table 3). Reproductive Index was 0.49, 0.27, 0.33, 0.00, and 0.20, respectively, indicating reduced productivity from that of 2004. Population sizes of all breeding species were up in 2008 compared with 2007 but productivity was similar if not slightly lower and we suggest that the drop in adults captured in 2007 at Dropzone probably related to climatic variables. Evidence is thus provided that the species/landscape models developed through our analyses of MAPS data have predictive power, and that the prescribed burn appears to have resulted in increased recruitment of this species (which, predictably, may show lower productivity due to a surplus of younger breeders).

Painted Bunting requires the right mix of forest, shrub and grassland to breed successfully which must be maintained by fire or physical means. The conservation goal is to consistently provide enough primary breeding habitat to annually support a target number of territories (dependent on installation or management zone) and a level of productivity consistent

with that of a “source” population in which breeding individuals replace their own numbers. This requires maintaining a mosaic of habitat patches in various stages of post-fire succession such that every year there is an adequate area of breeding habitat in primary condition. We anticipate observing the response in productivity of Painted Buntings to proposed fire and shrub clearance at Dropzone, Camp Swift. The ability to maintain an abundant “source” population might be considered an adequate performance measure by which to evaluate landbird conservation efforts and habitat management techniques at TNG Installations such as Camp Swift.

Camp Bowie

We operated six MAPS stations at Camp Bowie (Table 1) during the summer of 2008 for a total of 2296.5 net-hours (Table 6). This represents 70.8% of the maximum effort at this station. This value is lower than usual because of scheduling conflicts that prevented the operation of the last period for four stations. The details of the operation of these six stations are presented in Table 6.

For each individual species and for all species pooled, we tabulated the numbers of individual birds newly banded, captured and released unbanded (we do not band hummingbirds), and recaptured for each station (Table 7), and for all stations combined (Table 9). We recorded a total of 445 captures (28 species) at Camp Bowie during the 2008 season (Table 9). Newly banded birds comprised 65.8% of the total captures. The greatest number of total captures (81) was recorded at the Stonehouse and Nighthawk stations and the smallest number of total captures (58) was recorded at the Bedrock station (Table 7). The highest species richness occurred at Devil's Hill (16 species) and the lowest occurred at Bedrock (8 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 Nighthawk (74.3 adults/600 net hours; Table 8), followed by Stonehouse (66.4), Mockingbird Lane (60.6), Devil's Hill (59.0), Mesquite Flat (51.2), and Bedrock (34.2). These values are all substantially higher (by 30-60%) than those from the 2007 season. Overall, 57.0 individual adults were captured per 600 net hrs (Table 9), representing a 52% increase over the 37.4 adults captured per 600 net hours in 2007, but an 8.5% decrease from the 62.3 recorded in 2006.

Among individual species, Painted Bunting was the most frequently captured at the six stations in 2008, followed by Northern Cardinal, Bewick's Wren, Black-crested Titmouse, Black-chinned Hummingbird, Rufous-crowned Sparrow, and Eastern Bluebird (Table 9). The most abundant breeding species, having a capture rate of at least 3.0 adults per 600 net-hours, in decreasing order, were Painted Bunting, Northern Cardinal, Black-crested Titmouse, and Bewick's Wren (Table 9). The most abundant breeding species at each banding station, having capture rates of at least 3.0 adults/600 net-hours were as follows (also see Table 8):

Mesquite Flat	**Devil's Hill**	**Bedrock**
Bewicks' Wren*	Painted Bunting	Painted Bunting
Northern Cardinal*	Northern Cardinal*	Northern Cardinal
Painted Bunting*	Northern Mockingbird*	Summer Tanager*
Black-crested Titmouse*	Carolina Chickadee*	
Eastern Bluebird*	Black-crested Titmouse	**Nighthawk**
Lark Sparrow*	Bewick's Wren†	Northern Cardinal
Ladder-backed Woodpecker*	Rufous-crowned Sparrow†	Painted Bunting
Yellow-billed Cuckoo†		Black-crested Titmouse*
Carolina Chickadee†	**Stonehouse**	Bushtit*
	Painted Bunting	Bewick's Wren*
Mockingbird Lane	Field Sparrow*	Summer Tanager
Painted Bunting	Northern Cardinal	Lark Sparrow*
Northern Cardinal	Bewick's Wren*	Rufous-crowned Sparrow
Black-crested Titmouse*	Black-crested Titmouse*	Field Sparrow*
Rufous-crowned Sparrow*	Rufous-crowned Sparrow*	Yellow-billed Cuckoo†
Lark Sparrow	Brown-headed Cowbird*	

* Did not exceed 3.0 adults per 600 net hours in 2007.

† Exceeded 3.0 adults per 600 net hours in 2007 but not in 2008.

The pattern of reproductive indices (the number of young per adult captured) among the six stations differed from that of adult population size, being highest at Mesquite Flat (1.11) followed by Mockingbird Lane (0.50), Devil's Hill (0.48), Stonehouse (0.40), Nighthawk (0.34), and Bedrock (0.23). Three stations (Mesquite Flat, Devil's Hill, and Stonehouse) had increased values compared with those of 2007, whereas the remaining three stations showed decreased values. The overall reproductive index for the six stations in 2008 was 0.49 (Table 9), representing a 25.6% increase over last year's index of 0.39 at Camp Bowie, and an 88.2% increase over the 0.17 recorded in 2006. Mean productivity for all species pooled at Camp Bowie during the six years 1994-1999 was 0.43 (see DeSante et al. 2001b), indicating that productivity was slightly above this six-year average in 2008. Because nearly a whole banding period was missed due to military exercises at the end of the season (when the most young birds are typically captured), we suggest that productivity was in reality even higher.

Some of these changes between 2007 and 2008 were likely related to the burning of the Mesquite Flat station on 16 June 2008, half-way through the MAPS season. The result of this burn was a near-complete incineration of vegetation, leaving burned standing trees and little understory in the area. Rain a few days following the burn resulted in grass and other vegetation sprouting up by mid-July. The opening up the vegetation and creation of dead wood and snags by the fire provided optimal foraging conditions for some species, and this was reflected by increased captures of both adults and young of Bewick's Wren, Eastern Bluebird, Lark Sparrow, and Ladder-backed Woodpecker, but may also have resulted in increased captures of other more-common species such as Northern Cardinal and Painted Bunting. Compared with 2007, adult capture rate more than doubled, from 22.1 to 51.2 birds per 600 net-hours, and reproductive index increased by over four-fold, from 0.24 to 1.11. While these increases do not reflect the natural dynamics that would have occurred had the station not burned, it does show how burns can be beneficial to local bird populations, and it will be interesting to see how dynamics at this station is affected in 2009 and later years.

Using 15 years of data (1994-2008) from all six stations combined, estimates of adult survival and recapture probabilities were obtained for 14 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 10 for these 14 species. Survival-rate estimates for all 14 species showed good to poor precision (CVs 5-75%) with a mean of 22.4%. The mean for the same 14 species in 2007 was 22.8%, indicating slight improvement with the addition of the 15th year of data. Annual adult survival rates for these 14 species ranged from a low of 0.314 for Northern Mockingbird to a high of 0.650 for Painted Bunting, with a mean of 0.498 for the 14 species. This is practically identical to the mean of 0.497 recorded in 2007.

As mentioned earlier, analyses aimed at identifying and describing relationships between four demographic parameters (adult population size, population trend, number of young, and productivity) and landscape-level habitat characteristics for ten bird species of conservation concern have been completed for 13 military installations in south-central and southeastern United States, including Camp Bowie (Nott et al. 2003, Nott and Michel 2005). At Camp Bowie, previous data has suggested an installation-wide decline in all breeding landbirds, including three species of management concern (Bewick's Wren, Field Sparrow, and Painted Bunting). Post-breeding fire management practices in oldfield and scrub/woodland habitats could reset succession and effect local recoveries of the three species of concern (plus the Endangered Black-capped Vireo), 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. We recommend that these management practices be undertaken at Bowie so that we can monitor their effects on landbird populations. Currently there are no plans to move existing MAPS stations, merely to monitor the changes in avifauna that will occur when the proposed management actions are implemented. We look forward with great interest to see how the burn that occurred at the Mesquite Flat station in 2008 affects local landbird population dynamics in future years.

The following section is the abstract of the Painted Bunting migration connectivity manuscript and emphasizes the need for considering climate change in natural resource management plans:

These and other MAPS data are invaluable to landbird conservation efforts. Special consideration must be given to the subset of Neotropical migrants that "molt migrate", including the western race of Painted Bunting (*Passerina ciris*). Like other Neotropical migrants, Painted Buntings face long-term challenges as the geographic ranges of plants and animals currently associated with their winter and summer habitats shift in response to climate change. After breeding, these molt migrants fly to riparian habitats of the North American Monsoon (NAM) region of northwestern Mexico, molt, and then fly to their wintering habitats of central Mexico and as far south as western Panama. Studies of Painted Bunting data from all three Texas military MAPS locations (Camp Swift, Camp Bowie, and Fort Hood) have been useful in resolving Painted Bunting migration connectivity (i.e., where local breeding populations overwinter). We analyzed MAPS data collected during 14 breeding seasons (1994-2007) at the three locations and other banding data collected at 22 sites in Mexico and Central America (2002-2007) during winter as part of the Monitoreo de Sobrevivencia Invernal (MoSI) program. From these data we constructed latitudinal and longitudinal gradient models of wing chord length from MoSI program data to map male and female populations of the three Texas breeding locations onto approximate wintering locations. We compared seasonal precipitation patterns throughout the molt migration and winter ranges with annual breeding season demographics (including body condition). For two short-winged Painted Bunting populations the annual breeding season body condition correlated most strongly with conditions in the NAM region during the previous July-October monsoon season. Mean annual body condition of a long-winged population correlated with winter precipitation in the western Panama region.

Effective conservation must monitor the effects of land use, land conversion, and climate change on critical breeding, migration, and overwintering habitats and the sensitive phases of Neotropical migrant life cycles. The Texas MAPS locations provide ideal "early warning" stations for monitoring climate change-induced effects on avian community composition.

Furthermore, the Painted Bunting appears to be an ideal organism for conceptualizing and constructing predictive models of landbird annual life cycles under alternate climate scenarios Such models will provide information relating to the consideration of climate change in natural resource management of these (and other) Texas National Guard locations.

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Table 1. Summary of the 2008 MAPS program on Camp Swift.

Station						2008 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°16'28"N,97°19'13"W	134	503.5 (457.2)	9	5/09 - 7/30
Pipeline	PIPE	14436	Post oak/cedar woodland, successional oak/cedar oldfield	30°17'00"N,97°19'41"W	145	552.0 (473.2)	9	5/11 - 8/01
East Loop East	EALE	14438	Successional oldfield, oak/cedar woodland	30°15'54"N,97°15'48"W	151	509.0 (358.7)	8	5/16 - 8/04
East Loop West	EALW	14437	Open oak/cedar woodland, dense oak/cedar woodland, early-successional oldfield	30°15'46"N,97°16'19"W	149	507.0 (431.5)	9	5/12 - 7/31
Dropzone	DROP	14509	mixed grassland/post oak woodland	30°15'07"N,97°16'21"W	155	421.3 (357.2)	9	5/13 - 8/02
Sandy Junction	SAJU	14440	Post oak/cedar woodland	30°17'09"N,97°17'22"W	155	537.0 (487.0)	9	5/15 - 8/03
ALL STATIONS COMBINED						3029.8(2564.7)	9	5/09 - 8/04

[1] Total net-hours in 2008. Net-hours in 2008 that could be compared in a constant-effort manner to 2007 are shown in parentheses.

Table 2. Capture summary for the six individual MAPS stations operated on Camp Swift in 2008.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Wine Cellar Loop			Pipeline			East Loop East			East Loop West			Dropzone			Sandy Junction		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Common Ground-Dove							1	1										
Yellow-billed Cuckoo								1					2					
Ruby-throated Hummingbird											1							
Unidentified Hummingbird		1			1			1			1							
Red-bellied Woodpecker	1												1					
Downy Woodpecker													1					
Acadian Flycatcher	1																	
Traill's Flycatcher										1								
Least Flycatcher							3											
Unidentified Empid. Flycat.					1			1						3				
Unidentified Flycatcher											1			1				
White-eyed Vireo	35	3	9	12	1	6	22	1	14	26	3	12	22		8	2		
Red-eyed Vireo										1			1					
Blue Jay				1														
Carolina Chickadee	3				1		2			6			4					
Tufted Titmouse	2			3			1			2		1	2			2		3
Black-crested Titmouse	1																	
Carolina Wren	15	4	10	4	1	1	10	1	4	9	4	6	12		4	3		1
Blue-gray Gnatcatcher	2						1			4	1		2		2	1		
Swainson's Thrush	1			2			1											
Gray Catbird	1									1								
Northern Mockingbird							2											
Pine Warbler				1						2								
Black-and-white Warbler	2															2		
Mourning Warbler							1											
Common Yellowthroat										1								

Table 2. (cont.) Capture summary for the six individual MAPS stations operated on Camp Swift in 2008.
N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

	Wine Cellar Loop			Pipeline			East Loop East			East Loop West			Dropzone			Sandy Junction		
Species	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Wilson's Warbler													1					
Canada Warbler	2																	
Unidentified Warbler					1													
Summer Tanager	3		1	1												4		
Northern Cardinal	24	4	8	21	3	7	26		11	18		7	27		4	7	2	1
Indigo Bunting							1			2		1						
Painted Bunting	14		9	6		4	9		1	11	2	2	14	2	4	6		5
Brown-headed Cowbird								1		1								
ALL SPECIES POOLED	107	12	37	51	9	18	80	7	30	85	13	29	89	6	22	27	2	10
Total Number of Captures		156			78			117			127			117			39	
Number of Species	15	3	5	9	4	4	13	5	4	14	5	6	12	1	5	8	1	4
Total Number of Species		15			10			15			15			12			8	

Table 3. Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Camp Swift in 2008.

	Wine Cellar Loop			Pipeline			East Loop East			East Loop West			Dropzone			Sandy Junction		
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
Common Ground-Dove							1.2	0.0	0.00									
Yellow-billed Cuckoo													2.8	0.0	0.00			
Red-bellied Woodpecker	0.0	1.2	und.[1]										1.4	0.0	0.00			
Downy Woodpecker													1.4	0.0	0.00			
Acadian Flycatcher	0.0	0.0	0.00															
White-eyed Vireo	29.8	19.1	0.64	15.2	2.2	0.14	25.9	9.4	0.36	14.2	16.6	1.17	24.2	12.8	0.53	2.2	0.0	0.00
Red-eyed Vireo										1.2	0.0	0.00	1.4	0.0	0.00			
Blue Jay				1.1	0.0	0.00												
Carolina Chickadee	3.6	0.0	0.00				1.2	1.2	1.00	5.9	1.2	0.20	4.3	1.4	0.33			
Tufted Titmouse	1.2	1.2	1.00	1.1	2.2	2.00	1.2	0.0	0.00	0.0	2.4	und.[1]	1.4	1.4	1.00	1.1	2.2	2.00
Black-crested Titmouse	0.0	1.2	und.															
Carolina Wren	14.3	4.8	0.33	3.3	1.1	0.33	8.3	3.5	0.43	4.7	5.9	1.25	15.7	2.8	0.18	3.4	0.0	0.00
Blue-gray Gnatcatcher	2.4	0.0	0.00				1.2	0.0	0.00	3.6	1.2	0.33	4.3	0.0	0.00	0.0	0.0	0.00
Northern Mockingbird							1.2	1.2	1.00									
Pine Warbler				1.1	0.0	0.00				2.4	0.0	0.00						
Black-and-white Warbler	2.4	0.0	0.00													0.0	2.2	und.[1]
Common Yellowthroat										1.2	0.0	0.00						
Summer Tanager	4.8	0.0	0.00	1.1	0.0	0.00										3.4	1.1	0.33
Northern Cardinal	16.7	16.7	1.00	17.4	9.8	0.56	11.8	24.8	2.10	16.6	10.7	0.64	12.8	27.1	2.11	4.5	3.4	0.75
Indigo Bunting							1.2	0.0	0.00	3.6	0.0	0.00						
Painted Bunting	23.8	1.2	0.05	7.6	1.1	0.14	5.9	3.5	0.60	13.0	1.2	0.09	21.4	4.3	0.20	8.9	1.1	0.13

Table 3. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Camp Swift in 2008.

	Wine Cellar Loop			Pipeline			East Loop East			East Loop West			Dropzone			Sandy Junction		
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
Brown-headed Cowbird										1.2	0.0	0.00						
ALL SPECIES POOLED	98.9	45.3	0.46	47.8	16.3	0.34	58.9	43.6	0.74	67.5	39.1	0.58	91.1	49.8	0.55	23.5	10.1	0.43
Number of Species	9	7		8	5		10	6		11	7		11	6		6	5	
Total Number of Species		11			8			10			12			11			7	

[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 Camp Swift MAPS stations combined in 2008.

Species	Birds captured			Birds/600 net-hours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Common Ground-Dove	1	1		0.2	0.0	0.00
Yellow-billed Cuckoo	2	1		0.4	0.0	0.00
Ruby-throated Hummingbird		1				
Unidentified Hummingbird		4				
Red-bellied Woodpecker	2			0.2	0.2	1.00
Downy Woodpecker	1			0.2	0.0	0.00
Acadian Flycatcher	1			0.0	0.0	und.[1]
Traill's Flycatcher	1					
Least Flycatcher	3					
Unidentified Empidonax Flycat.		5				
Unidentified Flycatcher		2				
White-eyed Vireo	119	8	49	18.2	9.5	0.52
Red-eyed Vireo	2			0.4	0.0	0.00
Blue Jay	1			0.2	0.0	0.00
Carolina Chickadee	15	1		2.4	0.6	0.25
Tufted Titmouse	12		4	1.0	1.6	1.60
Black-crested Titmouse	1			0.0	0.2	und.
Carolina Wren	53	10	26	7.9	2.8	0.35
Blue-gray Gnatcatcher	10	1	2	1.8	0.2	0.11
Swainson's Thrush	4					
Gray Catbird	2					
Northern Mockingbird	2			0.2	0.2	1.00
Pine Warbler	3			0.6	0.0	0.00
Black-and-white Warbler	4			0.4	0.4	1.00
Mourning Warbler	1					
Common Yellowthroat	1			0.2	0.0	0.00
Wilson's Warbler	1					
Canada Warbler	2					
Unidentified Warbler		1				
Summer Tanager	8		1	1.6	0.2	0.13
Northern Cardinal	123	9	38	13.3	14.9	1.12
Indigo Bunting	3		1	0.8	0.0	0.00
Painted Bunting	60	4	25	13.1	2.0	0.15

Table 4. (cont.) Summary of results for all six Camp Swift MAPS stations combined in 2008.

Species	Birds captured			Birds/600 nethours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Brown-headed Cowbird	1	1		0.2	0.0	0.00
ALL SPECIES POOLED	439	49	146	63.2	32.7	0.52
Total Number of Captures		634				
Number of Species	29	10	8	20	12	
Total Number of Species		30			21	

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

Table 5. Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using a time-constant model for six species breeding at the seven MAPS stations ever operated on Camp Swift obtained from 15 years (1994-2008) 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]
White-eyed Vireo	3	771	1326	202	0.544 (0.028)	5.1	0.444 (0.039)	0.499 (0.061)
Tufted Titmouse †	3	90	123	15	0.467 (0.102)	21.7	0.209 (0.107)	1.000 (0.549)
Carolina Wren	3	339	523	48	0.417 (0.055)	13.2	0.306 (0.073)	0.690 (0.186)
Summer Tanager	3	94	117	15	0.543 (0.104)	19.2	0.244 (0.112)	0.639 (0.334)
Northern Cardinal	3	870	1405	273	0.574 (0.024)	4.1	0.371 (0.030)	0.670 (0.069)
Painted Bunting	3	637	990	169	0.517 (0.032)	6.2	0.527 (0.046)	0.484 (0.064)

[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).
[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 recapture probability (and possibly survival probability as well) may be biased low because the estimate for τ was 1.000.

Table 6. Summary of the 2008 MAPS program on Camp Bowie.

Station						2008 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˚38'52"N,98˚54'29"W	393	328.0 (307.8)	8	5/21 - 7/22
Devil's Hill	DEVI	14447	Live oak/post oak savannah, open mesquite savannah	31˚37'06"N,98˚53'38"W	437	427.0 (371.0)	9	5/17 - 7/27
Stonehouse	STON	14442	Live oak savannah, riparian areas	31˚35'40"N,98˚54'27"W	439	388.7 (340.3)	9	5/22 - 7/30
Bedrock	BEDR	14445	Mixed oak woodland, mesquite savannah	31˚38'30"N,98˚56'11"W	435	456.5 (374.2)	8	5/19 - 7/20
Mockingbird Lane	MOCK	14444	Arid oak/juniper highland	31˚36'17"N,98˚55'25"W	465	316.8 (268.7)	8	5/18 - 7/26
Nighthawk	NIGH	14443	Open oak woodland	31˚37'16"N,98˚57'07"W	473	379.5 (334.7)	8	5/20 - 7/21
ALL STATIONS COMBINED						2296.5(1996.7)	9	5/17 - 7/30

[1] Total net-hours in 2008. Net-hours in 2008 that could be compared in a constant-effort manner to 2007 are shown in parentheses.

Table 7. Capture summary for the six individual MAPS stations operated on Camp Bowie in 2008.
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
Mourning Dove							0	1	0									
Common Ground-Dove													1					
Yellow-billed Cuckoo	1					2							1					
Black-chinned Hummingbird		4			3			2			18			3			3	
Unidentified Hummingbird		3			2			3										
Golden-fronted Woodpecker	2																	
Ladder-backed Woodpecker	1		1				1									2		
Downy Woodpecker											1							
Yellow-bellied Flycatcher							1											
Ash-throated Flycatcher	1			1														
Unidentified Flycatcher																	1	
White-eyed Vireo													1					
Carolina Chickadee	1	1		6		2	1						1			1		
Tufted Titmouse	1												1					
Black-crested Titmouse	5	1	3	3		1	6	1	1	5		2	2		1	8	2	1
Verdin				1														
Bushtit													1			6		
Carolina Wren					1		1									3		1
Bewick's Wren	7	3	5	6		1	12		1	3	1	1	6	1	3	6	2	4
Blue-gray Gnatcatcher				1									1					
Eastern Bluebird	20	1																
Swainson's Thrush				1												1		
Northern Mockingbird				10	1													
Summer Tanager				1			1			2	1	3				5		
Rufous-crowned Sparrow				3	1	4	5		4				6		1	2		
Field Sparrow				1			7									2	1	

Table 7. (cont.) Capture summary for the six individual MAPS stations operated on Camp Bowie in 2008.
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
Lark Sparrow	4							1		1	1		2			4	1	
Northern Cardinal	7	1	1	5	1	5	8		3	6		2	6	1	3	11		3
Painted Bunting	3		1	14	1	2	12		7	8		3	16		9	8		2
Brown-headed Cowbird							2									1		
ALL SPECIES POOLED	53	14	11	53	10	17	57	8	16	25	22	11	45	5	17	60	10	11
Total Number of Captures		78			80			81			58			67			81	
Number of Species	12	6	5	13	6	7	12	4	5	6	5	5	13	3	5	14	5	5
Total Number of Species		13			16			15			8			14			15	

Table 8. Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Camp Bowie in 2008.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
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
Mourning Dove							1.5	0.0	0.00									
Common Ground-Dove													1.9	0.0	0.00			
Yellow-billed Cuckoo	1.8	0.0	0.00	1.4	0.0	0.00							1.9	0.0	0.00			
Golden-fronted Woodpecker	1.8	1.8	1.00															
Ladder-backed Woodpecker	3.7	0.0	0.00				0.0	1.5	und.							1.6	1.6	1.00
Ash-throated Flycatcher	1.8	0.0	0.00	0.0	1.4	und.												
White-eyed Vireo													1.9	0.0	0.00			
Carolina Chickadee	1.8	0.0	0.00	4.2	4.2	1.00	0.0	1.5	und.				0.0	1.9	und.	1.6	0.0	0.00
Tufted Titmouse	0.0	1.8	und.										0.0	1.9	und.			
Black-crested Titmouse	5.5	7.3	1.33	4.2	1.4	0.33	6.2	3.1	0.50	2.6	6.6	2.50	3.8	1.9	0.50	6.3	6.3	1.00
Verdin				1.4	0.0	0.00												
Bushtit													0.0	1.9	und.	6.3	1.6	0.25
Carolina Wren							0.0	1.5	und.							0.0	4.7	und.
Bewick's Wren	9.1	7.3	0.80	1.4	7.0	5.00	7.7	10.8	1.40	2.6	1.3	0.50	1.9	9.5	5.00	6.3	6.3	1.00
Blue-gray Gnatcatcher				1.4	0.0	0.00							0.0	1.9	und.			
Eastern Bluebird	5.5	31.1	5.67															
Northern Mockingbird				8.4	5.6	0.67												
Summer Tanager				1.4	0.0	0.00	1.5	0.0	0.00	5.3	0.0	0.00				6.3	1.6	0.25
Rufous-crowned Sparrow				2.8	4.2	1.50	6.2	4.6	0.75				3.8	7.6	2.00	3.2	0.0	0.00
Field Sparrow				1.4	0.0	0.00	10.8	0.0	0.00							3.2	0.0	0.00
Lark Sparrow	5.5	1.8	0.33							1.3	0.0	0.00	3.8	0.0	0.00	4.7	0.0	0.00

Table 8. (cont.) Numbers of adult and young individual birds captured per 600 net-hours and reproductive index (young/adult) at the six individual MAPS stations operated on Camp Bowie in 2008.

	Mesquite Flat			Devil's Hill			Stonehouse			Bedrock			Mockingbird Lane			Nighthawk		
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
Northern Cardinal	7.3	5.5	0.75	11.2	1.4	0.13	9.3	1.5	0.17	10.5	0.0	0.00	11.4	1.9	0.17	17.4	3.2	0.18
Painted Bunting	7.3	0.0	0.00	19.7	2.8	0.14	20.1	1.5	0.08	11.8	0.0	0.00	30.3	1.9	0.06	15.8	0.0	0.00
Brown-headed Cowbird							3.1	0.0	0.00							1.6	0.0	0.00
ALL SPECIES POOLED	51.2	56.7	1.11	59.0	28.1	0.48	66.4	26.2	0.40	34.2	7.9	0.23	60.6	30.3	0.50	74.3	25.3	0.34
Number of Species	11	7		12	8		9	8		6	2		9	9		12	7	
Total Number of Species		12			13			12			6			13			13	

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

Table 9. Summary of results for all six Camp Bowie MAPS stations combined in 2008.

Species	Birds captured			Birds/600 nethours		Reprod. Index
	Newly banded	Un-banded	Recap-tured	Adults	Young	
Mourning Dove		1		0.3	0.0	0.00
Common Ground-Dove	1			0.3	0.0	0.00
Yellow-billed Cuckoo	2		2	0.8	0.0	0.00
Black-chinned Hummingbird		33				
Unidentified Hummingbird		8				
Golden-fronted Woodpecker	2			0.3	0.3	1.00
Ladder-backed Woodpecker	4		1	0.8	0.5	0.67
Downy Woodpecker		1				
Yellow-bellied Flycatcher	1					
Ash-throated Flycatcher	2			0.3	0.3	1.00
Unidentified Flycatcher		1				
White-eyed Vireo	1			0.3	0.0	0.00
Carolina Chickadee	10	1	2	1.3	1.3	1.00
Tufted Titmouse	2			0.0	0.5	und.[1]
Black-crested Titmouse	29	4	9	4.7	4.4	0.94
Verdin	1			0.3	0.0	0.00
Bushtit	7			1.0	0.5	0.50
Carolina Wren	4	1	1	0.0	1.0	und.
Bewick's Wren	40	7	15	4.7	6.8	1.44
Blue-gray Gnatcatcher	2			0.3	0.3	1.00
Eastern Bluebird	20	1		0.8	4.4	5.67
Swainson's Thrush	2					
Northern Mockingbird	10	1		1.6	1.0	0.67
Summer Tanager	9	1	3	2.6	0.3	0.10
Rufous-crowned Sparrow	16	1	9	2.6	2.6	1.00
Field Sparrow	10	1		2.6	0.0	0.00
Lark Sparrow	11	3		2.4	0.3	0.11
Northern Cardinal	43	3	17	11.2	2.1	0.19
Painted Bunting	61	1	24	17.2	1.0	0.06
Brown-headed Cowbird	3			0.8	0.0	0.00
ALL SPECIES POOLED	293	69	83	57.0	27.7	0.49
Total Number of Captures		445				
Number of Species	25	15	10	22	17	
Total Number of Species		28			24	

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

Table 10. Estimates of adult annual survival and recapture probabilities and proportion of residents among newly captured adults using a time-constant model for 14 species breeding at MAPS stations on Camp Bowie obtained from 15 years (1994-2008) 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]
Yellow-billed Cuckoo	6	194	225	14	0.483 (0.101)	21.0	0.283 (0.125)	0.246 (0.126)
Ladder-backed Woodpecker	5	59	91	24	0.613 (0.082)	13.4	0.455 (0.108)	0.609 (0.203)
Carolina Chickadee	6	113	128	6	0.321 (0.159)	49.6	0.177 (0.185)	0.665 (0.701)
Black-crested Titmouse †	6	239	333	45	0.489 (0.058)	11.8	0.218 (0.061)	1.000 (0.301)
Bewick's Wren	6	327	475	58	0.434 (0.050)	11.5	0.502 (0.082)	0.388 (0.092)
Eastern Bluebird ‡†	1	42	55	2	0.387 (0.291)	75.1	0.083 (0.153)	1.000 (1.741)
Northern Mockingbird	6	237	297	16	0.314 (0.092)	29.3	0.236 (0.126)	0.597 (0.329)
Summer Tanager	5	139	196	34	0.567 (0.071)	12.5	0.318 (0.083)	0.661 (0.205)
Rufous-crowned Sparrow	3	111	183	26	0.591 (0.076)	12.9	0.339 (0.090)	0.471 (0.163)
Field Sparrow	5	178	240	31	0.460 (0.073)	15.9	0.277 (0.089)	0.797 (0.286)
Lark Sparrow ‡†	4	77	85	3	0.637 (0.204)	32.1	0.027 (0.051)	1.000 (1.874)
Northern Cardinal	6	424	684	111	0.508 (0.038)	7.4	0.362 (0.050)	0.782 (0.131)
Painted Bunting	6	592	895	149	0.650 (0.033)	5.0	0.397 (0.040)	0.387 (0.054)
Brown-headed Cowbird	6	128	193	25	0.511 (0.074)	14.6	0.267 (0.086)	0.680 (0.250)

[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).
[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 15 years, 1994-2008, of the MAPS Program on the seven stations ever operated on **Camp Swift.**

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

NUMB	SPEC	SPECIES NAME	Wine Cellar Loop (WCLO)	Pipeline (PIPE)	East Loop East (EALE)	East Loop West (EALW)	Dropzone (DROP)	Sandy Junction (SAJU)	McLaughlin Creek (MCCR)
00130	PBGR	Pied-billed Grebe				T			
01010	GBHE	Great Blue Heron	T	T	T	T	T	T	T
01040	GREG	Great Egret			T	T	T	T	
01080	SNEG	Snowy Egret				T			T
01090	LBHE	Little Blue Heron	T			T	T	T	
01120	CAEG	Cattle Egret	T	O	T	T	T	T	T
01130	GRHE	Green Heron		T	T	T			
01280	WOST	Wood Stork	M						
01290	BLVU	Black Vulture	T	O	O	O	T	T	T
01300	TUVU	Turkey Vulture	O	U	U	U	B	T	O
01360	BBWD	Black-bellied Whistling-Duck			T	T	T		
01570	WODU	Wood Duck		O					
01630	MALL	Mallard					M		
02070	WTKI	White-tailed Kite			O	O	T		T
02110	MIKI	Mississippi Kite			M				
02380	RSHA	Red-shouldered Hawk	U	B	U	U	U	U	U
02400	BWHA	Broad-winged Hawk		M		M	M		
02420	SWHA	Swainson's Hawk			T	T	T		
02430	WTHA	White-tailed Hawk							T
02460	RTHA	Red-tailed Hawk	O	T	T	T		T	T
02545	UNHA	Unidentified Hawk	?	?			?	?	
02590	CRCA	Crested Caracara		T		T	T	T	
02630	AMKE	American Kestrel		T					
03040	WITU	Wild Turkey		T					T
03780	KILL	Killdeer	T						
05540	WWDO	White-winged Dove				T	T		
05570	MODO	Mourning Dove	B	B	U	B	B	B	B
05600	INDO	Inca Dove			T	T	T		
05610	COGD	Common Ground-Dove	U	U	U	U	U	U	U
06400	BBCU	Black-billed Cuckoo			M	M			
06410	YBCU	Yellow-billed Cuckoo	B	B	U	U	B	B	B

Appendix I. (cont.)

NUMB	SPEC	SPECIES NAME	WCLO	PIPE	EALE	EALW	DROP	SAJU	MCCR
06580	GRRO	Greater Roadrunner	T	T	T	T		O	T
06680	EASO	Eastern Screech-Owl	T	T		T	T		O
06800	GHOW	Great Horned Owl	O	T		T		T	T
06950	BADO	Barred Owl	O	T	T			O	O
07055	UNOW	Unidentified Owl					?		
07080	CONI	Common Nighthawk	O		T	T		O	T
07170	CWWI	Chuck-will's-widow	O	U	O	O	U	U	O
07400	CHSW	Chimney Swift	T	T	T	T	T	T	
08630	RTHU	Ruby-throated Hummingbird	T	O	T	O	T	T	O
08640	BCHU	Black-chinned Hummingbird	T	T	T	T		T	T
08775	UNHU	Unidentified Hummingbird	?	?	?	?	?	?	?
09540	GFWO	Golden-fronted Woodpecker							T
09550	RBWO	Red-bellied Woodpecker	U	U	U	U	U	O	B
09630	LBWO	Ladder-backed Woodpecker	O		O	O		T	
09650	DOWO	Downy Woodpecker	U	U	U	U	B	U	U
09660	HAWO	Hairy Woodpecker		T					
09800	NOFL	Northern Flicker	T				T		
09800	RSFL	Red-shafted Flicker				T			
09800	YSFL	Yellow-shafted Flicker			T	O			
09860	PIWO	Pileated Woodpecker	U	O	O	O	B	U	U
09915	UNWO	Unidentified Woodpecker				?		?	
11340	OSFL	Olive-sided Flycatcher			M	M			
11390	EAWP	Eastern Wood-Pewee	O	T		T			T
11450	YBFL	Yellow-bellied Flycatcher	M	M	M	M		M	M
11460	ACFL	Acadian Flycatcher	T	T	T	T		T	O
11475	TRFL	Traill's Flycatcher	M	M	M	M	M	M	M
11500	LEFL	Least Flycatcher	M	M	M	M	M	M	M
11555	COFL	Cordilleran Flycatcher	M		M	M			
11555	WEFL	Western Flycatcher	M		M	M			
11595	UEFL	Unidentified Empidonax Flycatcher	?	?	?	?	?	?	
11610	EAPH	Eastern Phoebe	T			T	T		
11760	GCFL	Great Crested Flycatcher	T	T	T	T	T	T	T
12020	WEKI	Western Kingbird			T	T	T		
12030	EAKI	Eastern Kingbird			M	M			
12070	STFL	Scissor-tailed Flycatcher	T	T	O	O			
12085	UNFL	Unidentified Flycatcher			?	?	?		?
12550	WEVI	White-eyed Vireo	B	B	B	B	B	B	B
12690	YTVI	Yellow-throated Vireo							T
12790	REVI	Red-eyed Vireo	O	O	O	T	T	O	B
12930	BLJA	Blue Jay	O	O	O	O	T	O	T

Appendix I. (cont.)

NUMB	SPEC	SPECIES NAME	WCLO	PIPE	EALE	EALW	DROP	SAJU	MCCR
13190	AMCR	American Crow	B	U	B	B	B	B	B
13300	CORA	Common Raven			T	T			
13340	PUMA	Purple Martin	O	O	O	O	T	O	T
13410	TRES	Tree Swallow	T					T	
13490	NRWS	Northern Rough-winged Swallow	T		T				
13520	CLSW	Cliff Swallow	T	T		T	T	T	
13540	BARS	Barn Swallow	T	T	T		T	T	
13560	CACH	Carolina Chickadee	B	B	U	U	B	B	B
13660	TUTI	Tufted Titmouse	B	B	U	U	B	B	B
13661	BCTI	Black-crested Titmouse	T					T	
13700	WBNU	White-breasted Nuthatch	M					M	
14000	CARW	Carolina Wren	B	B	B	B	B	B	B
14040	BEWR	Bewick's Wren			T				
14350	BGGN	Blue-gray Gnatcatcher	B	U	O	U	B	U	O
14560	EABL	Eastern Bluebird			T				
14790	GCTH	Gray-cheeked Thrush	M			M			
14795	GCBT	Gray-cheeked/Bicknell's Thrush	M			M			
14810	SWTH	Swainson's Thrush	M	M	M	M	M	M	M
14830	WOTH	Wood Thrush						M	M
15000	AMRO	American Robin					T		
15130	GRCA	Gray Catbird	M	M	M	M		M	M
15150	NOMO	Northern Mockingbird	T	T	T	T	T	T	
15550	CEDW	Cedar Waxwing	M						
15670	NAWA	Nashville Warbler							M
15730	NOPA	Northern Parula	T	T	T	O	T	T	O
15750	YWAR	Yellow Warbler			M				M
15760	CSWA	Chestnut-sided Warbler			M				
15770	MAWA	Magnolia Warbler	M			M			M
15790	BTBW	Black-throated Blue Warbler						M	
15820	GCWA	Golden-cheeked Warbler		M					
15830	BTNW	Black-throated Green Warbler	M	M			M	M	M
15860	BLBW	Blackburnian Warbler	M						
15910	PIWA	Pine Warbler	U	U	O	T	U	O	O
15930	PRAW	Prairie Warbler			M				
16030	BAWW	Black-and-white Warbler	O	U	O	O	T	O	O
16040	AMRE	American Redstart	M	M	M	M			M
16070	SWWA	Swainson's Warbler			M	M			M
16080	OVEN	Ovenbird	M	M	M	M			M
16090	NOWA	Northern Waterthrush					M		
16110	KEWA	Kentucky Warbler	T						O

Appendix I. (cont.)

NUMB	SPEC	SPECIES NAME	WCLO	PIPE	EALE	EALW	DROP	SAJU	MCCR
16130	MOWA	Mourning Warbler	M		M	M	M		M
16140	MGWA	MacGillivray's Warbler					M		
16150	COYE	Common Yellowthroat	T		T	T	T	T	T
16280	HOWA	Hooded Warbler	M	M		M			
16290	WIWA	Wilson's Warbler		M	M		M		
16300	CAWA	Canada Warbler	M	M	M	M			
16460	YBCH	Yellow-breasted Chat		T	T	T		T	
16495	UNWA	Unidentified Warbler	?	?	?	?		?	
16820	SUTA	Summer Tanager	B	U	U	U	B	B	U
16830	SCTA	Scarlet Tanager	M		M			M	
17820	EATO	Eastern Towhee				M			
18020	CHSP	Chipping Sparrow		M					T
18050	FISP	Field Sparrow			T				
18560	NOCA	Northern Cardinal	B	B	B	U	B	B	B
18600	RBGR	Rose-breasted Grosbeak			M	M			
18640	BLGR	Blue Grosbeak		T	O	T			
18670	INBU	Indigo Bunting	T	O	O	O			O
18700	PABU	Painted Bunting	B	B	B	B	B	B	B
18710	DICK	Dickcissel	T		T	T			
18730	RWBL	Red-winged Blackbird			T	T			
18800	EAME	Eastern Meadowlark			T	T			
18870	COGR	Common Grackle	T	T	T	O	T		
18890	GTGR	Great-tailed Grackle		T	T				
18960	BHCO	Brown-headed Cowbird	U	B	U	U	B	U	U
19040	OROR	Orchard Oriole		T		T			
19160	BAOR	Baltimore Oriole						M	
19380	RECR	Red Crossbill	M						
19490	LEGO	Lesser Goldfinch				T			
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 15 years, 1994-2008, of the MAPS Program on the six stations ever operated on **Camp Bowie.**

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

NUMB	SPEC	SPECIES NAME	Mesquite Flat (MESQ)	Devil's Hill (DEVI)	Stonehouse (STON)	Bedrock (BEDR)	Mockingbird Lane (MOCK)	Nighthawk (NIGH)
01010	GBHE	Great Blue Heron	O	T	T	T	T	T
01040	GREG	Great Egret				T		
01090	LBHE	Little Blue Heron						T
01120	CAEG	Cattle Egret			T			T
01130	GRHE	Green Heron	T	T	T	T	T	
01290	BLVU	Black Vulture	U	O	O	O	O	O
01300	TUVU	Turkey Vulture	U	U	B	U	B	U
01360	BBWD	Black-bellied Whistling-Duck	M	M	M		M	M
01380	FUWD	Fulvous Whistling-Duck	T					
01570	WODU	Wood Duck	T					
02110	MIKI	Mississippi Kite					T	O
02200	SSHA	Sharp-shinned Hawk			T			
02210	COHA	Cooper's Hawk	T	T	T	T		T
02380	RSHA	Red-shouldered Hawk	T		O	O	T	O
02420	SWHA	Swainson's Hawk	T	T	T			T
02460	RTHA	Red-tailed Hawk	T	O	O	T	T	O
02545	UNHA	Unidentified Hawk		?		?		
02590	CRCA	Crested Caracara	T				T	
03040	WITU	Wild Turkey	O	O	B	U	U	O
03160	NOBO	Northern Bobwhite	U	B	B	B	U	U
03780	KILL	Killdeer	B	U	O	U	T	O
05370	ROPI	Rock Pigeon		T				
05540	WWDO	White-winged Dove	T	T		T	T	T
05570	MODO	Mourning Dove	B	B	B	B	B	B
05600	INDO	Inca Dove		T				T
05610	COGD	Common Ground-Dove	O	O	U	O	O	O
06410	YBCU	Yellow-billed Cuckoo	B	B	B	B	B	B
06580	GRRO	Greater Roadrunner	O	O	O	T	O	T
06680	EASO	Eastern Screech-Owl		T	T	O	T	
06800	GHOW	Great Horned Owl	O	O	O	O	T	T
06950	BADO	Barred Owl	O	T		T		

Appendix II. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha

NUMB	SPEC	SPECIES NAME	MESQ	DEVI	STON	BEDR	MOCK	NIGH
07055	UNOW	Unidentified Owl					?	
07080	CONI	Common Nighthawk	O	U	U	B	U	B
07110	COPO	Common Poorwill		T	T	T	T	O
07170	CWWI	Chuck-will's-widow	O	O	O	T	U	O
07400	CHSW	Chimney Swift	O	T	O	O	T	T
08630	RTHU	Ruby-throated Hummingbird	T	O	O	O	T	T
08640	BCHU	Black-chinned Hummingbird	O	U	O	U	O	U
08775	UNHU	Unidentified Hummingbird	?	?	?	?	?	?
09110	BEKI	Belted Kingfisher	T	O	T	O	T	T
09540	GFWO	Golden-fronted Woodpecker	U	O	O	O		O
09550	RBWO	Red-bellied Woodpecker	O			T	T	
09630	LBWO	Ladder-backed Woodpecker	B	U	U	U	O	U
09650	DOWO	Downy Woodpecker	O	O	O	O	T	T
09660	HAWO	Hairy Woodpecker		T				
09800	YSFL	Yellow-shafted Flicker				T		
09915	UNWO	Unidentified Woodpecker	?	?	?	?	?	?
11340	OSFL	Olive-sided Flycatcher			M	M		
11390	EAWP	Eastern Wood-Pewee	O	T	T	O		T
11450	YBFL	Yellow-bellied Flycatcher			M		M	M
11460	ACFL	Acadian Flycatcher			T		T	
11475	TRFL	Traill's Flycatcher	M	M		M	M	M
11500	LEFL	Least Flycatcher	M	M	M	M	M	M
11520	GRFL	Gray Flycatcher		M				
11595	UEFL	Unidentified Empidonax Flycatcher	?	?	?	?	?	?
11610	EAPH	Eastern Phoebe	O	O	O	O	O	O
11630	VEFL	Vermilion Flycatcher	O			T		
11740	ATFL	Ash-throated Flycatcher	O	O	O	T	T	T
11760	GCFL	Great Crested Flycatcher	B	O	O	U	T	T
12020	WEKI	Western Kingbird	O		T	T		O
12070	STFL	Scissor-tailed Flycatcher	U	O	O	O	U	O
12085	UNFL	Unidentified Flycatcher	?				?	?
12520	LOSH	Loggerhead Shrike	T					
12550	WEVI	White-eyed Vireo	T	T	O	T	T	
12640	BEVI	Bell's Vireo		O		T		
12650	BCVI	Black-capped Vireo		T				
12760	WAVI	Warbling Vireo				M		
12790	REVI	Red-eyed Vireo				M		M
12930	BLJA	Blue Jay	T	O	O	O	T	U
13110	WESJ	Western Scrub-Jay			T		U	

Appendix II. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha

NUMB	SPEC	SPECIES NAME	MESQ	DEVI	STON	BEDR	MOCK	NIGH
13190	AMCR	American Crow	O	O	O	O	O	T
13300	CORA	Common Raven	T	T	O	T	T	T
13340	PUMA	Purple Martin	T	O	T		T	T
13490	NRWS	Northern Rough-winged Swallow	O	O		T		
13520	CLSW	Cliff Swallow		T	T			T
13540	BARS	Barn Swallow	T	T	T	T	T	T
13560	CACH	Carolina Chickadee	B	B	B	B	B	B
13660	TUTI	Tufted Titmouse	T		T		T	
13661	BCTI	Black-crested Titmouse	B	B	B	B	B	B
13670	VERD	Verdin		O	T			
13680	BUSH	Bushtit		O	O	T	O	O
13830	CACW	Cactus Wren		O	O			
13850	CANW	Canyon Wren		T				
14000	CARW	Carolina Wren	O	O	O	U	O	O
14040	BEWR	Bewick's Wren	B	B	B	U	U	B
14070	HOWR	House Wren		M	M			M
14350	BGGN	Blue-gray Gnatcatcher	O	O	U	O	O	U
14560	EABL	Eastern Bluebird	U	O	O	O	T	O
14810	SWTH	Swainson's Thrush		M		M	M	M
14820	HETH	Hermit Thrush				M	M	
15000	AMRO	American Robin	O		T	T		O
15150	NOMO	Northern Mockingbird	B	B	U	U	U	U
15260	CBTH	Curve-billed Thrasher		T				
15370	EUST	European Starling	T					
15550	CEDW	Cedar Waxwing		M		M		
15660	OCWA	Orange-crowned Warbler			M			
15670	NAWA	Nashville Warbler	M			M		
15750	YWAR	Yellow Warbler	M			M		
15770	MAWA	Magnolia Warbler					M	M
15830	BTNW	Black-throated Green Warbler		M				
15860	BLBW	Blackburnian Warbler				M		
16030	BAWW	Black-and-white Warbler	M	M	M	M	M	M
16080	OVEN	Ovenbird		M		M	M	M
16100	LOWA	Louisiana Waterthrush				M		
16130	MOWA	Mourning Warbler		M	M		M	
16140	MGWA	MacGillivray's Warbler		M	M	M		
16150	COYE	Common Yellowthroat	T	T			T	T
16290	WIWA	Wilson's Warbler		M	M		M	
16300	CAWA	Canada Warbler			M			

Appendix II. (cont.) Numerical listing (in AOU checklist order) of all the species sequence numbers, species alpha

NUMB	SPEC	SPECIES NAME	MESQ	DEVI	STON	BEDR	MOCK	NIGH
16460	YBCH	Yellow-breasted Chat	T	T	T			
16820	SUTA	Summer Tanager	U	U	U	B	O	B
16830	SCTA	Scarlet Tanager			M			
17820	EATO	Eastern Towhee			M			
17840	CANT	Canyon Towhee	T	O	O	T	T	T
17920	CASP	Cassin's Sparrow		T				
17950	RCSP	Rufous-crowned Sparrow	T	B	U	O	O	U
18020	CHSP	Chipping Sparrow	T	O	T	T	O	U
18030	CCSP	Clay-colored Sparrow		M				
18050	FISP	Field Sparrow	U	B	B	O	B	U
18090	LASP	Lark Sparrow	O	O	U	U	U	B
18100	BTSP	Black-throated Sparrow	T					
18130	SAVS	Savannah Sparrow		M				
18140	GRSP	Grasshopper Sparrow		T	O			
18240	LISP	Lincoln's Sparrow		M				
18290	WCSP	White-crowned Sparrow		M				
18335	UNSP	Unidentified Sparrow	?	?	?	?	?	?
18560	NOCA	Northern Cardinal	B	B	B	B	B	B
18640	BLGR	Blue Grosbeak	O	T	T	T		
18670	INBU	Indigo Bunting	T	T			T	
18700	PABU	Painted Bunting	B	B	B	U	B	U
18710	DICK	Dickcissel	O	O	O		T	
18730	RWBL	Red-winged Blackbird	O	T	T	T		
18800	EAME	Eastern Meadowlark	O	O	O	T	O	O
18870	COGR	Common Grackle	O	T	T	O	O	O
18890	GTGR	Great-tailed Grackle	T	T			T	T
18960	BHCO	Brown-headed Cowbird	B	B	B	B	B	B
19105	BUOR	Bullock's Oriole	O	T				
19160	BAOR	Baltimore Oriole	T					
19190	SCOR	Scott's Oriole			T			
19370	HOFI	House Finch	T		T	T	T	T
19490	LEGO	Lesser Goldfinch	T	T	O	O	T	T
19510	AMGO	American Goldfinch	T					
19920	HOSP	House Sparrow	T					
20085	UNBI	Unidentified Bird		?	?			