Modeling Overwintering Survival of Declining Landbirds

A Technical Analysis of the Monitoring Avian Winter Survival (MAWS) Program on four DoD Installations in Southeastern United States

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INTRODUCTION

Tremendous concern has been generated in recent decades over declines in populations of Neotropical migratory birds, particularly for species that breed or over-winter in forested habitats (Robbins et al. 1989, Terborgh 1989, Hagan and Johnston 1992, Faaborg 2002). Yet population changes in temperate-wintering bird species that occupy grassland, scrub, and successional habitats are at least as alarming. For example, 15 (65%) of 23 temperate-wintering grassland species sampled by the North American Breeding Bird Survey (BBS) have declined significantly between 1966-2005, while only two such species significantly increased (Sauer et al. 2005). A similar number of species that winter in scrub and successional habitats of temperate North America are also significantly declining (16 of [31%] 51 species significantly declining; just three species are significantly increasing). Conservation of these species is hindered by a lack of information on causes of declines (Donovan et al. 2002). Replicated standardized monitoring of a suite of demographic parameters across broad geographic regions and ecological gradients is needed to identify underlying causes of population declines (DeSante and Rosenberg 1998). Such monitoring during the breeding season is well-established (DeSante et al. 1995, 2004). Yet many bird populations may be limited by non-breeding season factors (Marra et al. 1998, Sillett et al. 2000, DeSante et al. 2001, Nott et al. 2002). Complimentary monitoring efforts during the non-breeding season can lend further insight into causes of avian population changes (DeSante et al. 2005b).

In 2003, through funding from the DoD Legacy Resources Management Program, The Institute for Bird Populations initiated the Monitoring Avian Winter Survival (MAWS) program on four military installations in the southeastern United States. The principal goal of this program is to monitor the winter demography of landbirds to develop effective management and conservation strategies. Many of the bird species monitored by MAWS are declining species that inhabit edge, shrub, and grassland habitats; these habitats are also favored for military training activities. Thus, MAWS offers a unique opportunity to develop management prescriptions capable of enhancing both bird populations and the military's mission of Readiness and Range Sustainment (R&RS). We have now completed three MAWS field seasons (November-March 2003-04, 2004-05, and 2005-2006) and have conducted a variety of analyses of capture rates, body condition, and winter monthly apparent survival rates for 25 target species. Following the 2006-07 season, we expect to build on these analyses to construct models that incorporate age, a variety of local (station-level) and landscape-scale habitat variables, and behavioral variables (e.g., flocking propensity). Here we assess the current status of the program and propose future directions.

FIELD METHODS EMPLOYED BY MAWS

MAWS utilizes a methodology that was developed during an earlier project funded by the DoD Legacy Resources Management Program on Naval Station Guantanamo Bay, Cuba (Siegel et al. 2004) and now employed as part of the MoSI (Monitoreo de Sobrevivencia Invernal) program, which is coordinated by The Institute for Bird Populations in Mexico, Central America, and the Caribbean. Essentially, the protocol consists of the distributing approximately 16 mist nets across the central 12 ha of a 20 ha study area (the MAWS "station"). Twenty-four such stations have been established and operated on Fort Chafee, AR, Camp Joseph T. Robinson, AR, Fort Bragg, NC, and Fort Benning, GA. Mist nets are operated at these stations during five 2-3 day "pulses" of

mist netting spaced at monthly intervals between November and March. All unbanded birds captured during these mist-netting pulses are aged, sexed, and banded, and all recaptured birds are recorded. A few target species are also color-banded each year in an effort to increase "recapture" probabilities through re-sightings (currently we are only color-banding Song Sparrow, White-throated Sparrow, and Dark-eyed Junco). Mist-netting effort and the recording of the residency status of birds at MAWS stations are also carefully recorded during station visits. Habitat maps and semi-quantitative habitat descriptions are completed at all MAWS stations.

ANALYTICAL METHODS EMPLOYED BY MAWS

We employ state-of-the-art analytical methods to draw inference from MAWS mist-netting and capture-recapture data. In particular, we construct modified Cormack-Jolly-Seber (CJS) models to analyze station-specific monthly apparent winter survival rates as functions of habitat variables. Model selection methods are based on the information-theoretic approach advanced by Burnham and Anderson (1998). We have conducted correlation analyses between body condition indices and habitat variables and will be constructing multivariate body condition-habitat models following the 2006-07 season. We have also produced summaries of capture rates (birds*100 net-hours^{-1}) for each station and year for 25 target species. Collectively, our analyses are providing a composite picture of winter habitat requirements for a broad suite of overwintering landbird species in the southeastern United States.

SUMMARY OF RESULTS OF THE FIRST THREE YEARS OF THE MAWS PROGRAM

Banding effort goals have been met during each of the three Monitoring Avian Winter Survival (MAWS) field seasons and more than 15,000 birds have been banded as part of MAWS program to date. These efforts are yielding a large body of new information regarding the winter population dynamics of many landbird species and the characteristics that determine the quality of their habitats (see DeSante and Kaschube 2004, DeSante et al. 2005a, and Saracco et al. 2006).

From initial analyses of our mist-netting data, populations of many bird species appear to be declining across all installations sampled by the MAWS program (based on capture rates). With just three years of data, it is difficult to ascertain whether trends are real; however, the consistency in pattern among locations and species is troubling. We recommend additional years of monitoring to better enable us to evaluate the trends and dynamics of winter bird populations.

All of the metrics monitored by MAWS – capture rates, body condition, and survival rates – are highly variable among installations and stations. Spatial patterns in this variation tend to be similar for each of the three metrics. That is, sites with high capture rates tend to be sites that also have high survival rates and birds in relatively good body condition. Variation in capture rates, body condition, and survival is often strongly correlated with quantitative habitat variables measured at stations for many species. For example, we have found strong correlations between capture rates or body condition and at least one of 16 quantitative habitat variables for 20 of 25 target species. In addition, survival analyses that incorporate habitat variables are often strongly supported when compared to models that do not include habitat variables. Collectively, our results suggest that the bird population metrics and habitat variables being monitored by MAWS yield useful information for assessing habitat quality for overwintering birds. Upon completion of our final analyses, these

data will provide a sound basis for the formulation of habitat management and conservation strategies that are capable of reversing population declines and maintaining healthy bird populations.

FUTURE DIRECTIONS

Funding for an additional two seasons of data collection and analysis would enable us to expand upon and refine habitat models. In addition, we have proposed to develop a larger DoD MAWS program that would integrate more directly into proposed or ongoing management actions on DoD installations. During the next couple of years we plan to initiate discussions with natural resource personnel at a variety of southeastern U. S. military installations to identify management efforts with which we can integrate. We envision establishing 3 pairs of MAWS stations on each of 5-6 installations; each pair of stations will consist of a control (unmanaged) and nearby treatment site. We aim to select paired sites that are as similar as possible in every other respect (e.g., habitat type, configuration, elevation, etc.). Likely management programs with which we could integrate include controlled burns, brush-hogging operations, or silvicultural treatments. Specific goals of this work will be (1) to test survival- and physical condition-habitat relationships identified during the first five years of the MAWS project and (2) to compare overwintering survival and physical condition of declining bird species in managed and unmanaged land units.

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