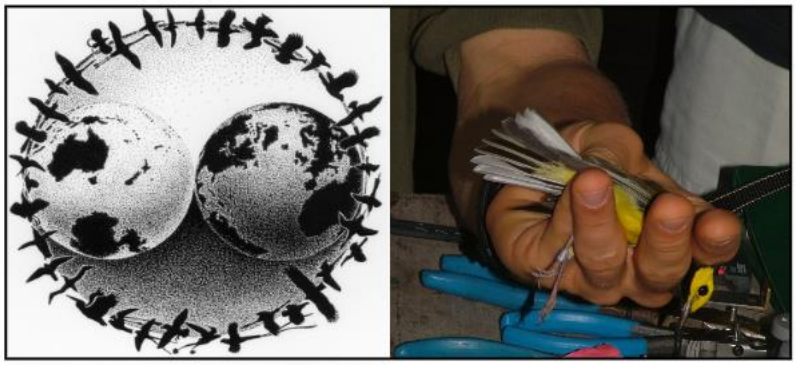
2006 ANNUAL PERFORMANCE REPORT FOR NMBCA PROJECT:

HABITAT-MANAGEMENT STRATEGIES THAT ENHANCE OVERWINTERING SURVIVAL OF MIGRATORY LANDBIRDS

Agreement No. CA-N191



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Introduction

In an unprecedented international effort to provide broad-scale data on winter habitat quality for Neotropical migratory birds and to link wintering and breeding population parameters, The Institute for Bird Populations (IBP) and partners across the northern Neotropics established the Monitoreo de Sobrevivencia Invernal (MoSI) program in 2002 (DeSante et al. 2005a). MoSI consists of a network of mist-netting and bird-banding stations in Mexico, Central America, and the Caribbean that utilizes a standardized field protocol and state-of-the-art analytical models to make inferences about wintering Neotropical migratory bird populations and their habitats at multiple spatial and temporal scales. With FY2003 support from the Neotropical Migratory Bird Conservation Act (NMBCA), MoSI grew from 29 stations in its initial season to 63 stations in 2003-04. Although we envision that MoSI will continue as a long-term monitoring program, the work funded under this current NMBCA grant agreement encompasses just the last 3 years of a 5-year pilot project (2002-2007). As of the 2005-06 MoSI field season, we have registered 50 partners (organizations or independent researchers) that have established and operated as many as 138 MoSI stations in 14 countries during at least one winter season (Fig. 1).

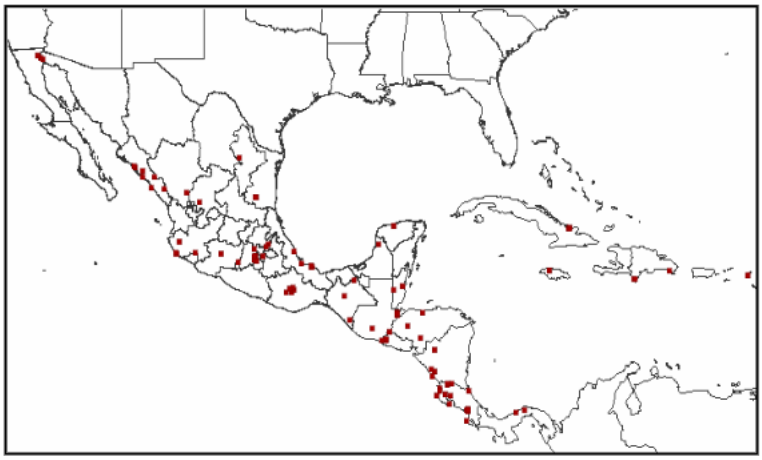

Fig. 1. Distribution of MoSI stations that have operated during at least one winter season as part of the MoSI program.

The ultimate objective of the 5-year pilot project is the formulation of habitat-management strategies that will help reverse population declines of ten declining migratory landbird species that winter largely in Middle America or the Caribbean and to maintain stable or increasing populations for eight non-declining migratory landbird species. To accomplish this goal, we proposed five major tasks: (1) the expansion of the MoSI program to 80 stations during the 2005-06 and 2006-07 winter field seasons (prior to 2005-06, the largest number of stations operated in any year was 63); (2) the mapping of habitats at each MoSI station and the collection of station-specific data on vegetation structure and species composition; (3) the obtaining of remote-sensed landscape-scale habitat data from 2- to 5-km radius areas surrounding each station; (4) the modeling of overwintering site persistence and physical condition as functions of station-specific and landscape-scale habitat characteristics; and (5) the incorporation of modeling results into the formulation of habitat-management strategies for Neotropical migratory landbirds on their wintering grounds. With the last field season of the 5-year MoSI pilot project just beginning, many of these tasks remain only partially completed. Here we provide a brief summary of activities completed between October 2005 and October 2006.

Progress of the project to date

Our first task, expansion of the MoSI program, has largely been met. As many as 91 stations were operated during winter 2005-06; however, complete data from that season have been received from just 70 stations as of October 2006. From a preliminary survey of station

operators regarding the 2006-07 field season, we expect that about 85 stations will be operated during this final year of the pilot project. Thus, overall we expect that about 80 stations, on average, will have contributed data during the last two years of the pilot project. Of the 70 stations from which we have received 2005-06 data, 20 operated during 5 pulses of mist netting and banding, 12 operated during 4 pulses, and 28 operated during 3 pulses. The remaining 10 stations operated during 1-2 pulses. Stations that operated during fewer than 3 pulses typically represent situations where logistical difficulties or vagaries in the weather prevented additional sampling. In some cases, station operators encountered (unexpected) funding difficulties and so were unable to complete at least three pulses.

All banding and mist-netting effort data that have been received to date have been run through a series of specialized data verification programs. Verification programs included: (1) clean-up programs to check the validity of all codes entered and the ranges of numerical information in all banding, effort, winter residency, and habitat data; (2) cross-check programs to compare station, date, and net information in the banding and effort data; (3) within-record verification programs to compare species, age, and sex determinations in the banding data against molt limits and plumage characteristics, degree of skull pneumaticization, and extent of body and flight-feather molt and primary-feather wear; (4) between-record verification programs to screen banding and recapture data from all days of operation for inconsistent species, age, or sex determinations for each band number; and (5) screening programs to identify unusual or duplicate band numbers or unusual band sizes for each species. Discrepancies or suspicious data identified by any of these programs have been examined manually and corrected if necessary. Wing chord, body mass, station of capture, date, and any pertinent notes were used as supplementary information for the correct determination of species, age, and sex in all of these verification processes.

We developed a habitat mapping and vegetation description protocol during the 2004-05 MoSI field season. All station operators are required to complete these maps and habitat descriptions by the end of the 5-yr MoSI pilot project. To date, we have received habitat data from about one third of all MoSI stations. We expect to receive habitat data from the remaining stations by the end of the 2006-07 field season. We have successfully incorporated station-scale habitat variables derived from data collected according to the MoSI habitat description protocol into models of monthly winter apparent survival rates of birds wintering in the southeastern United States (DeSante et al. 2005b, Saracco et al. 2006). We expect to develop similar station-scale survival-habitat models with MoSI data. In addition, we have acquired satellite-derived data on land cover, vegetation structure, and plant productivity. Specifically, we have obtained 1 km $\times$ 1 km land cover data from the Global Land Cover 2000 (GLC2000) data base (European Commission, Joint Research Centre 2003) and finer-scale (250 m $\times$ 250 m) monthly indices of Leaf Area Index (LAI; http://cliveg.bu.edu/modismisr/index.html) that encompass the sampling period of the MoSI pilot project. Thus, in addition to including station-scale habitat variables into survival- or body condition-habitat models, we will also derive and include landscape-scale habitat variables into these models (Pettorelli et al. 2005).

Although we have not yet incorporated quantitative habitat variables into monthly winter apparent survival rate models, we have developed preliminary models that include a geographic (southeast to northwest) gradient in survival for several target species. In general, time-constant (i.e., averaged across winter months and years) models of monthly apparent winter survival rates

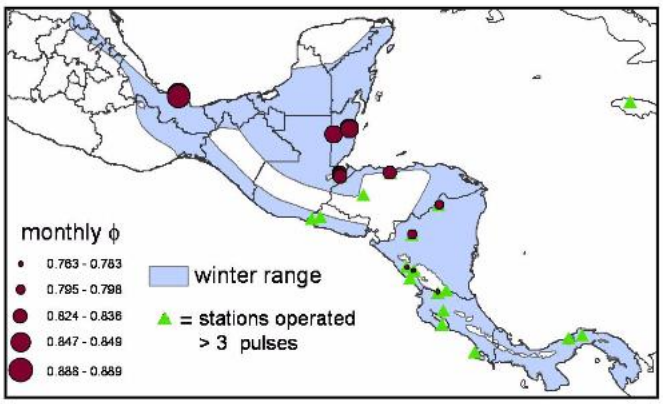

Fig. 2. Spatial pattern in Wood Thrush monthly winter apparent survival rates (ϕ) during the winters of 2002-03, 2003-04, 2004-05, and 2005-06. Estimates of survival rates are time-constant and averaged across 9 models that allowed survival to vary by station, to vary as a linear function of a geographic SE-NW axis, and models that constrained survival to be constant among stations. Not all stations were operated in all years; we considered all stations that captured Wood Thrushes that operated for at least 3 pulses. Monthly winter apparent survival rate estimates were highest at Los Tuxtlas in Veracruz and lowest at the Nicaragua stations. Captures were too few at most southerly stations to estimate survival rates (green triangles *without* overlaid red circles).

that incorporate a geographic gradient are strongly supported by the data compared to models that estimate station-scale survival without constraining by a geographic gradient and to models that estimate survival as constant across stations. For example, models of Wood Thrush (*Hylocichla mustelina*) winter monthly apparent survival rates that included a geographic gradient as a covariate received about 50 times more statistical support than models that did not include the geographic gradient (based on QAICc model weights of a set of nine models; Burnham and Anderson 1998). This analysis suggested that Wood Thrush site persistence is much higher in the more northerly reaches of its wintering range (Fig. 2). Although Wood Thrushes were captured at stations farther south, too few captures or recaptures were recorded to estimate survival rates at those stations. Our preliminary findings suggest the importance of habitats of the Caribbean slope of southern Mexico and northern Central America for wintering Wood Thrushes. Once habitat variables are included in survival-rate analyses, we will be able to identify habitat characteristics affect site-persistence rates throughout the Wood Thrush wintering range. We have conducted similar analyses of late-winter body condition (weight adjusted for body size), and in many cases spatial patterns in body condition corroborate patterns in survival.

Although (as already indicated) we have not yet included quantitative habitat variables into winter survival-rate or body-condition models, overlays of satellite-derived habitat data onto initial station-level survival-rate estimates are suggesting working hypotheses for such analyses. For example, Prothonotary Warbler (*Protonotaria citrea*) monthly winter survival rates appear to be lowest at the most northwesterly Costa Rica sites where forest fragmentation is great, and higher at stations farther south in western Costa Rica and Panama where forest coverage is higher (Fig. 3). We will continue exploring spatial patterns in MoSI data and the links between these patterns and habitat variables during the coming months. These exploratory analyses will better guide the development of formal sets of models to be run once the complete MoSI 5-yr data set has been collected and prepared for analyses.

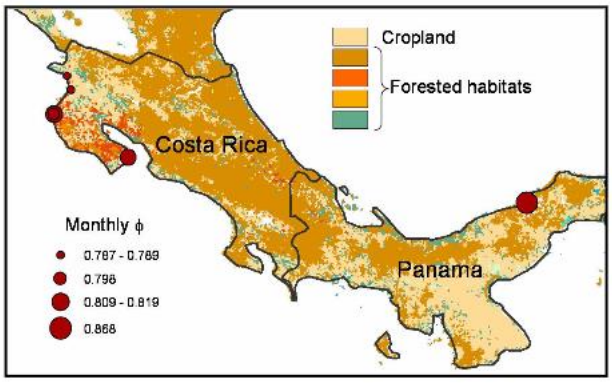

Fig. 3. Model-averaged Prothonotary Warbler monthly apparent winter survival rates (ϕ) at six MoSI stations. Survival rate estimates were lowest at the most northwesterly stations in highly fragmented landscape.

Conclusions

The MoSI pilot project has been remarkably successful to date. Although we have not yet received all data that were likely collected prior to the current 2006-07 field season, we expect to reach our goal of having 80+ stations contribute data during each of the last two years of the pilot project. We have received station-scale habitat data from many station operators, and we have also been acquiring satellite-derived habitat data for inclusion in survival- and body condition-habitat models. We have gained considerable experience with similar analyses using data collected at winter monitoring stations in the southeastern U.S. Our experience with these analyses suggests that our approach will be highly effective at identifying habitat characteristics that are important in affecting winter site persistence rates of many migratory birds. Results of these efforts will form a sound basis for the formulation of habitat-management strategies that are capable of reversing population declines and maintaining healthy bird populations.

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