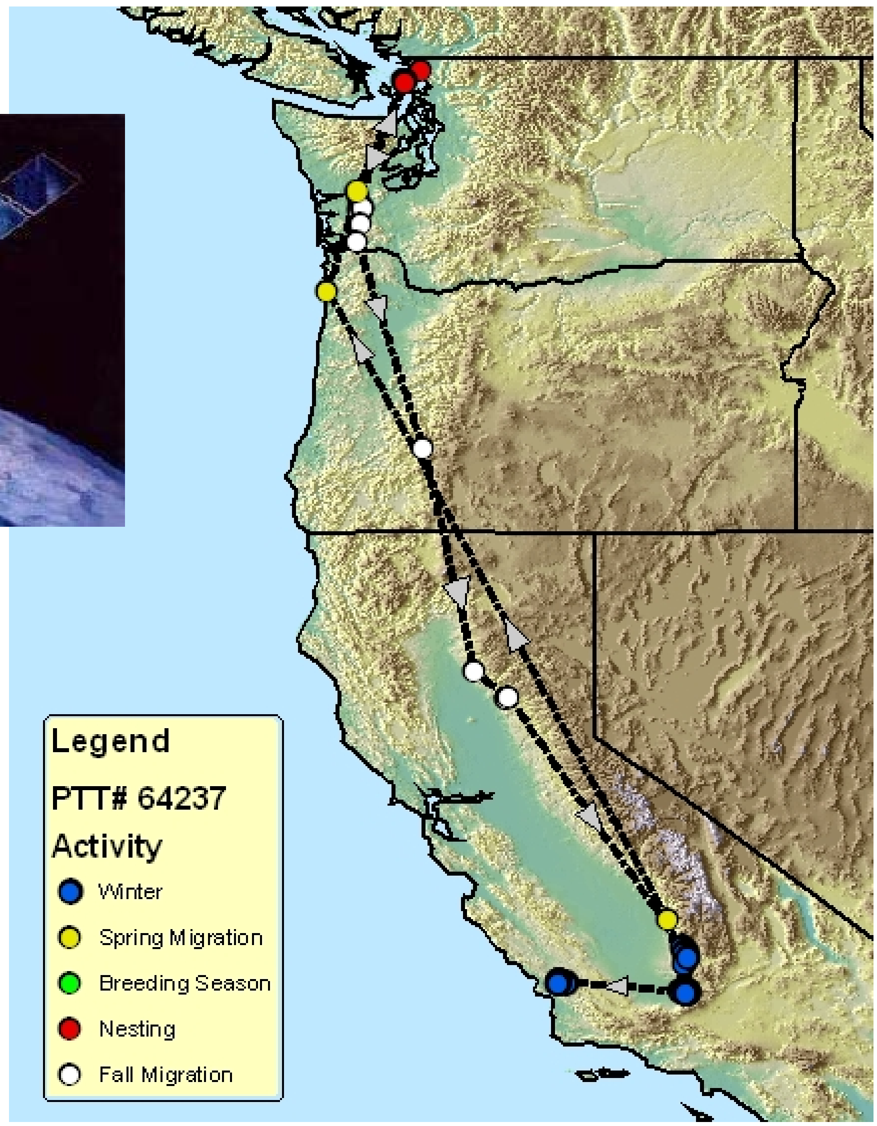
U.S. Fish & Wildlife Service

# Webless Migratory Game Bird Research Program

## *Project Abstracts – 2006*




Satellite Track of a Band-tailed Pigeon by an Argos Satellite (inset)
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# Webless Migratory Game Bird Research Program

## Project Abstracts – 2006

compiled by David D. Dolton
Project Officer

U.S. Fish and Wildlife Service
Division of Migratory Bird Management
PO Box 25486 DFC
Denver, CO 80225-0486

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**Mourning Doves and White-winged Doves**

# History and Administration of the Webless Migratory Game Bird Research Program, 1995-2006

**DAVID D. DOLTON, U.S. Fish and Wildlife Service, Office of Migratory Bird Management, PO Box 25486 DFC, Denver, CO 80225-0486 (David_Dolton@fws.gov)**

## HISTORY

### Introduction

The Webless Migratory Game Bird Research (WMGBR) Program was established in December 1994 with the first projects being funded in 1995. It was designed to provide cooperative funding from the U.S. Fish and Wildlife Service (USFWS), state wildlife agencies, and other sources for research on migratory game birds other than waterfowl (e.g., doves, pigeons, cranes, woodcock, snipe, and rails). Information from these studies will be used to more effectively manage these "webless" species.

Formation of the program was not easy and what follows is an attempt to document the events and the individuals associated with it's evolution. This historical overview was derived primarily through use of unpublished minutes from meetings between 1984 and 1995 of the Migratory Shore and Upland Game Bird (MSUGB) Subcommittee (named Committee between 1991-1996) of the International Association of Fish and Wildlife Agencies (IAFWA). The WMGBR Program is similar to the preceding Accelerated Research Program which was discontinued in 1982. After its formation in 1984, the MSUGB Subcommittee worked for 9 years to reinstate a research program for migratory shore and upland game birds. These efforts were realized finally when H. Ronald Pulliam, Director of the National Biological Survey (NBS; now U.S. Geological Survey-Biological Resources Division), contributed $300,000 for the program for FY1995/96. Subsequently, John G. Rogers, Deputy Director of the USFWS, authorized the Division of Federal Aid to allocate $150,000 per year as an annual funding item for the program beginning in FY1996. In FY1998, the USFWS contributed $300,000 for the WMGBR Program, thanks to the efforts of Paul R. Schmidt and Robert Blohm (USFWS) who worked to get an additional $150,000 for the Program in the budget for the Office [now Division] of Migratory Bird Management (DMBM)]. Beginning in FY1999, however, only $150,000 from the DMBM budget was available. In 2003 and 2004, funding was suspended due to budget limitations. Funding was reinstated in 2005 at a level of $250,000, $30,000 of which will go towards cooperative funding of an early succession habitat biologist in the Northeast for the next 3 years.

### The Accelerated Research Program, 1967-82

The history of the Accelerated Research Program (ARP) was documented by MacDonald and Evans (1970). In July 1967, Congress appropriated $250,000 for the program. Support for this appropriation came from the Southeastern Association of Game and Fish Commissioners and the International Association of Game, Fish, and Conservation Commissioners (predecessor to the IAFWA). Also, Leonard E. Foote (Wildlife Management Institute) was instrumental in development of and gaining support for the program (R.E. Tomlinson, USFWS, personal communication). Internal support within the USFWS (then Bureau of Sport Fisheries and Wildlife) came principally from Walter F. Crissey, Director of the Migratory Bird Population Station (MBPS); significant input for justifying the program was provided by Aelred D. Geis, William H. Goudy, Howard M. Wight, and Roy E. Tomlinson (H.M. Reeves, USFWS, personal communication). Subsequent to the appropriation, the International Association created a National Program Planning Committee for Shore and Upland Game Birds (later known as the National Program Planning Group [NPPG]). The ARP was designed to provide funding for migratory shore and upland game bird research. The NPPG was formed to solicit, screen, and select projects for funding under the program (Sanderson 1977).

Congressional funding of the ARP was $250,000 annually. Of this total, $175,000 was contracted to states; $50,000 was used directly by the USFWS to support 2 field stations—one in Maine to study American woodcock and one in South Carolina to study mourning doves; and, $25,000 was retained by the USFWS to administer the program. William Russell was the first biologist at the Maine woodcock station followed by William Krohn. Spencer Amend initiated the dove study in South Carolina, followed by George Haas. The dove study site was later moved to Georgia. Henry M. Reeves administered the program until March 1968 when Duncan MacDonald was hired for this purpose. In 1971, Fant Martin took over, followed in 1975 by Richard Coon and in 1980 by Thomas Dwyer.

In the 16 years the program was in operation (1967-82), 122 research projects were completed in 41 states. Over the years, funding for state projects amounted to about $2.5 million. The ARP ended in October 1982 when funding for the program was eliminated, primarily because of fiscal constraints upon the USFWS.

## Formation of the Migratory Shore and Upland Game Bird Subcommittee

When the ARP was terminated, the NPPG, which served as an advisory group for the ARP, became inactive in 1982. Consequently, a new group was deemed necessary for focusing attention on MSUGB issues. Accordingly, and largely due to the efforts of Roy Tomlinson (USFWS), and Ronnie George and Ted Clark (Texas Parks and Wildlife Department), the MSUGB Subcommittee was established in 1984 by Mr. Clark, who was Chairman of the IAFWA's Migratory Wildlife Committee. The Subcommittee quickly became a force in migratory bird management.

## Development of the Webless Migratory Game Bird Research Program

After its formation, the MSUGB Subcommittee sought to obtain information about the contributions made through the ARP and to determine whether or not the state wildlife agencies wanted to support Subcommittee efforts to have it reinstated. Clait Braun (Colorado Division of Wildlife) outlined 20 specific benefits of ARP to state wildlife agencies (letter attached to MSUGB Subcommittee minutes, March 1985). In summary, he showed that ARP facilitated substantial interchange of ideas among individuals working within regions and different agencies, which greatly expanded our knowledge about this important group of birds.

In 1985, Ronnie George, Chairman of the MSUGB Subcommittee, conducted a survey of all state wildlife agency directors about current MSUGB research needs and the ARP; all 50 states responded to the questionnaire. Results were summarized in a March 1986 report by Mr. George, entitled *Results of the Accelerated Research Program Questionnaire*. All but 3 states indicated MSUGB needs that had not been addressed to date. Thirty-two states felt that [future] MSUGB research needs could best be undertaken through combined USFWS and state wildlife agency funding. Forty-seven states believed ARP served a useful purpose considering the cost, and 49 states favored reestablishment of ARP (or a similar program) as a Congressionally-funded *addition* to the USFWS budget. Only 17 states, however, gave unqualified approval to redirecting current USFWS funds to an ARP-type program.

In a second March 1986 report, entitled *Summary of Accelerated Research Program Publications by Region and State*, Mr. George listed references for 340 publications known to have directly resulted from ARP. One of the most significant contributions was the book, *Management of Migratory Shore and Upland Game Bird Species in North America* (Sanderson 1977). These publications detail the wealth of information that was learned through the research program.

After confirming that state agencies had been pleased with the program and desired a similar program to be organized, the MSUGB Subcommittee passed a resolution in March 1986 asking the IAFWA to support reestablishment of ARP (or a similar program) as a Congressionally-funded $350,000 annual addition to the USFWS budget. The IAFWA also passed the resolution, but did not take further action because they did not feel the timing was right. At the March 1988 MSUGB Subcommittee meeting, a USFWS representative stated that the need exists for such a program, but that the USFWS was faced with rather severe budget limitations and there was a reluctance by the current administration to initiate new funding activities. He also stated that to effect such a resumption, enthusiasm and pressure from the Subcommittee was necessary. Consequently, another motion was made for the current Chairman, Kenneth Babcock, to reiterate the need for immediate study on several declining populations and ask the IAFWA Budget Committee to address those concerns when they testified before Congress on budget considerations. Once again, the IAFWA voiced support of their efforts but decided it was not the appropriate time to make a request before Congress.

In March 1990, a different strategy was undertaken by the Subcommittee, whereby Chairman Babcock was asked to write directly to Director John Turner of the USFWS, pointing out the success of the past program, the current needs, and requesting the addition of a $350,000 line item by the USFWS. Two letters eventually were written. In the telephone reply to the second letter, Deputy Director Richard Smith indicated that the USFWS would consider the request in its 1992 budget deliberations.

At the March 1991 MSUGB Committee (new name) meeting, Mr. Babcock reported that Max Peterson, Executive Vice President of the IAFWA, acted on their past recommendations and provided testimony before the House Appropriations Committee for the FY1992 budget. In this testimony, the IAFWA strongly recommended addition of $350,000 to the USFWS budget for the development of a research program to address existing data deficiencies on webless migratory game birds. Subsequent to the meeting, Chairman Babcock contacted directors of all state wildlife agencies to urge their congressional delegations to support the add-on to the budget. Many state agencies did contact their delegations. Mr. Peterson then testified before the USFWS Appropriations Subcommittee and asked that they add an item to the budget specifically for this work. Unfortunately, these efforts failed.

In 1992, the MSUGB Committee decided to change direction and develop a proposal for an entirely new program that would be submitted to the USFWS. Chairman Babcock (personal communication) then asked John H. Schulz (Missouri Department of Conservation) to take the lead in formulating a proposal for a fresh type of research effort. Although his name did not appear on the document, Mr. Schulz prepared the first draft of a proposal, entitled *Proposal for a Webless Game Bird Research Program,* with input from others. According to Schulz (personal communication), Roy Tomlinson (USFWS) provided the most detailed and lengthy comments, while substantive comments were also provided by Clait Braun, Richard Jachowski (NBS), Thomas Tacha (Texas A&M University-Kingsville), and Ronnie George. The proposal was distributed to MSUGB Committee members for review in August 1992. In the package, the USFWS was asked to establish an annual, line-item-funded research program for migratory shore and upland game bird species. One significant difference from earlier efforts was a request of $750,000 that would fund cooperative state-federal studies. These monies were envisioned to be matched at some level with state or other funding. It was suggested that 12.5% of the funds allocated for such a program be retained by the USFWS for administrative costs. The proposal package included a detailed screening process utilizing committees to review and prioritize submitted proposals. The MSUGB Committee would then review the lists and recommend studies to the USFWS for funding. A suggestion was made to give greater weight to studies supported by population management plans. After input from MSUGB Committee members, a revised proposal was sent to all state wildlife agency directors and USFWS Director Turner on 10 December 1992. The USFWS replied favorably to the plan on 18 March 1993, but several concerns were expressed in an attached review of the proposal by the Office of Migratory Bird Management. Chairman Babcock expressed his appreciation to the USFWS in a letter dated 28 May 1993, and offered suggestions for resolving the concerns raised.

The MSUGB Committee decided in September 1993 to recommend that an ad hoc Task Force, consisting of 2-3 committee members and an equal number from the USFWS, be formed to work out the details of a final joint proposal. The USFWS concurred. Subsequently, Ronnie George was named Chairman of the Task Force with the following members: Duane Shroufe (Arizona Game and Fish Commission), Cal DuBrock (Pennsylvania Game Commission), Roy Tomlinson [David Dolton replaced Roy after his retirement in June 1994] and Robert Blohm (USFWS), and Russell Hall (NBS). This group met to finalize the proposal for a webless research program, and developed details for a review process and evaluation criteria for research proposals under the program.

In August of 1994, Kenneth Babcock met with USFWS Director Mollie Beattie to urge her support for the webless research program. Also, he met with Ronald Pulliam and F. Eugene Hester (NBS) to enlist their support (K. M. Babcock, personal communication). The effort was successful. Mr. Babcock stated that Noreen Clough (who worked in the Director's Office at the time) helped arrange the meeting and that Paul Schmidt (Chief, MBM) helped set the stage by briefing the Director beforehand.

On 13 September 1994, Ronnie George transmitted the final version of *Recommendations for a Webless Migratory Game Bird Research Program,* prepared by the Webless Migratory Game Bird Research Task Force, to MSUGB Committee Chairman Kenneth Babcock. Key recommendations included the designation of 4 Technical Committees to evaluate proposals, a WMGBR Review Committee appointed by the MSUGB Committee to make the final project selection, the designation of a Project Officer within MBM to coordinate this activity, a USFWS budget line item of $750,000 annually, and that the United States Congress be urged to pass a budget, including a Webless Migratory Game Bird Research Program.

The efforts and persistence of the MSUGB Committee finally came to fruition in the fall of 1994 when funding became available, as stated in the Introduction. One stipulation was that 1/3 of the project cost must come from non-federal dollars. Also, funds were to be given for the life of the project rather than for just one year, as was done under the ARP.

Even though the amount of funding was not at the level recommended in the original proposal, the WMGBR Program has been successful thus far. MBM absorbed the administrative cost of the program without taking any of the research funds and designated David Dolton as Project Officer and program coordinator.

Another key contribution made by the MSUGB Committee was the publication of the book entitled *Migratory Shore and Upland Game Bird Management in North America* (Tacha and Braun 1994). This was a revised and updated version of the book edited by Sanderson (1977). As stated in the Preface to the book, key individuals responsible for planning, authorship selection, and other aspects of the publishing process included the editors and ad hoc committee members T. C. Tacha, C. E. Braun, J. M. Anderson, R. R. George, and R. E. Tomlinson. Authors of individual chapters were recognized authorities in their field. Immediately after publication, the book began to serve as a guide for research on species described therein.

There remains support to increase funding to the level originally recommended. On 26 July 1996, and again on 28 July 2000, the 4 Flyway Councils passed a Joint Recommendation requesting that the USFWS and the National Biological Service [USGS in 2000 version] seek additional revenue to fully fund the WMGBR Program at the recommended level of $750,000 per year. In December 1998, an IAFWA Ad Hoc Committee on Migratory Bird Funding met with USFWS personnel in Washington, D.C. to discuss funding needs for migratory birds. One of the recommendations was to fund the WMGBR Program at the full recommended level.

## WMGBR PROGRAM ADMINISTRATION

At least 1/3 of the total project cost must be paid with non-federal dollars. In-kind services, such as salaries of state employees and vehicle expenses, are acceptable as matching funds. Study proposals may be on any webless migratory game bird topic identified as a research need in a national, regional, or state management plan or other document, or in the 1994 book entitled *Migratory Shore and Upland Game Bird Management in North America.* Additionally, a letter of support is required for each proposal from the state in which it originates.

A call for proposals is distributed by the USFWS Project Officer in July each year to USFWS Flyway Representatives and Migratory Bird Coordinators, and USGS-Biological Research Division (BRD) Regional Offices and the Cooperative Research Units office. Flyway Representatives are responsible for distributing the letter to biologists in their respective states. State biologists, in turn, are asked to send the information to other state personnel, universities, and any others who may be interested. Migratory Bird Coordinators forward the letter to National Wildlife Refuges and other federal offices. USGS-BRD Regional Offices are asked to forward the letter to all their respective Science and Technology Centers, while the Cooperative Research Units office distributes the call to all Cooperative Fish and Wildlife Research Units.

The review process is as follows. Proposals are sent by 15 November to the Project Officer for the program (David Dolton, USFWS/DMBM). He checks the proposals for budget and support letter compliance and sends these materials to 4 Regional Technical Committees (Appendix 1). These committees review all the proposals submitted within their respective region and provide David with an evaluation of each project. The evaluations are based upon criteria that have been developed for this program and also upon regional needs (Appendix 2). Additionally, the projects are ranked in priority order. A compilation of all evaluations and rankings, along with the proposals, are then sent to members of a WMGBR Review Committee for review. Ronnie George (Texas Parks and Wildlife Department) served as the first Chairman of the Review Committee from 1994-96. Current committee members include

Robert Boyd, Chairman, (Pennsylvania Game Commission) and David Dolton (USFWS), along with the 2006 Chairmen of the 4 Technical Committees: Western–Tom Hemker (Idaho Department of Fish and Game); Central–John H. Schulz (Missouri Department of Conservation); Northeastern–Ed Robinson (New Hampshire Fish and Game Department); and Southeastern–Billy Dukes (South Carolina Department of Natural Resources).

In February, the WMGBR Review Committee discusses the evaluations and rankings, and selects projects for funding. Funds become available as soon as contracts can be completed and signed.

To date, $1,891,219 in WMGBR Program funds has been expended to support 49 research projects and 1 workshop with a total value of $7,456,063 (Table 1). Proceedings of the Marshbird Monitoring Workshop are available from David Dolton. The uneven Grand Total for WMGBR funds is due to NBS contributing an additional $5,578 to the program in 1996 and an unused $395 in 1999. Although not reflected in the Grand Total, USGS-BRD (formerly NBS) provided additional support in 1997, 1998, and 1999 by contributing a total of $30,000 directly to 3 of the projects selected. In 2003, 2 projects were selected for funding prior to the suspension of funds. Later, however, the U.S. Fish and Wildlife Service committed to fund one of the projects for $119,000 (pilot reward banding study of mourning doves) using other funds. Additionally, in order for 2 USGS studies to be completed, the USGS-BRD funded the second project on sandhill cranes ($30,900) along with another one on band-tailed pigeons ($19,215). For 2006, 12 proposals with a total value of $1,839,165 were received, requesting $1,065,375 in WMGBR funds.

The WMGBR Program is invaluable in providing much-needed funding for webless species who receive considerably less attention than waterfowl. The current level of funding will not begin to meet the needs identified in the 1994 management book mentioned previously, but it is a start. This is a very cost-effective program and it is hoped that funding can be increased in the future.

Table 1. Projects funded through the Webless Migratory Game Bird Research (WMGBR) Program, 1995-06.

| Species | Number of projects | WMGBR Program funds | Total project cost |
|---|---|---|---|
| Mourning dove | 12 | $544,060 | $2,299,280 |
| American woodcock | 9 | $370,086[a] | $1,574,418 |
| Marsh game birds | 10 | $246,274 | $1,232,262 |
| Band-tailed pigeon | 7 | $385,670[b] | $909,345 |
| Sandhill crane | 10 | $324,824[c] | $1,415,306 |
| White-winged dove | 1 | $13,452 | $25,452 |
| Marshbird Monitoring Workshop | – | $6,853[d] | — |
| GRAND TOTAL | 49 | $1,891,219[e] | $7,456,063 |

[a] An additional $13,000 was given to 1 project by the U.S. Geological Survey (Biological Resources Division) in 1997.

[b] An additional $11,000 was given to 1 project by the U.S. Geological Survey (Biological Resources Division) in 1998; $6,000 was given to 1 project in 1999; and, $19,215 was given to 1 project in 2003.

[c] An additional $30,900 was given to 1 project by the U.S. Geological Survey (Biological Resources Division) in 2003.

[d] An additional $6,046 was provided for the workshop by the the U.S. Geological Survey (Biological Resources Division) in 1998. Other funding support came from a variety of state and federal agencies, the Canadian Wildlife Service, and private organizations.

[e] The National Biological Service contributed $5,578 to the WMGBR Program in 1996.

## ACKNOWLEDGMENTS

I am grateful for the comprehensive minutes prepared by R. E. Tomlinson for each meeting of the MSUGB Subcommittee between 1984 and 1994. Without them, a detailed historical account of events and programs would not have been possible. Additionally, I want to thank R. E. Tomlinson, J. H. Schulz, R. R. George, H.M. Reeves, R. J. Blohm, D. MacDonald, and K. M. Babcock for reviewing the first versions of this paper for the 1997 and 1998 reports, and providing information and suggestions for improvement.

## LITERATURE CITED

Much of the information contained herein is from minutes and reports on file in the author's USFWS office. Additionally, all remaining copies of Tacha and Braun (1994) are being stored there. Copies of either the minutes or the book can be obtained upon request.

MacDonald, D. and T.R. Evans. 1970. Accelerated research on migratory webless game birds. Transactions of the Thirty-fifth North American Wildlife and Natural Resources Conference. Wildlife Management Institute, Washington, D.C. 35:149-156.

Sanderson, G.C., editor. 1977. Management of migratory shore and upland game birds in North America. International Association of Fish and Wildlife Agencies, Washington, D.C. 358 pp.

Tacha, T.C., and C.E. Braun, editors. 1994. Migratory shore and upland game bird management in North America. International Association of Fish and Wildlife Agencies. Washington, D.C. 223 pp.

Appendix 1. Technical Committees for evaluating and prioritizing Webless Migratory Game Bird Research Program proposals.

| Western | Central | Northeastern | Southeastern |
|---|---|---|---|
| Alaska | Arkansas | Connecticut | Alabama |
| Arizona | Colorado | Delaware | Florida |
| California | Iowa | Illinois | Georgia |
| Hawaii | Kansas | Indiana | Kentucky |
| Idaho | Minnesota | Maine | Louisiana |
| Oregon | Missouri | Massachusetts | Maryland |
| Utah | Montana | Michigan | Mississippi |
| Washington | Nebraska | New hampshire | North Carolina |
| | New Mexico | New Jersey | South Carolina |
| | North Dakota | New York | Tennessee |
| | Oklahoma | Ohio | Virginia |
| | South Dakota | Pennsylvania | West Virginia |
| | Texas | Rhode Island | |
| | Wyoming | Vermont | |
| | | Wisconsin | |

Appendix 2. Evaluation criteria for Webless Migratory Game Bird Research Program proposals (Revised July 20, 1998).

| Possible points | Criteria |
|---|---|
| **10** | **I. Existing information data base related to the problem in question for this species/population**<br>10 pts. Little known<br>5 pts. Moderately known<br>2 pts. Extensive |
| **20** | **II. Information needs**<br>20 pts. Addresses an immediate need identified in a management plan (national, regional, or state), the 1994 book *Migratory Shore and Upland Game Bird Management in North America*, or a regional technical committee priority list.<br>10 pts. Addresses a future need identified in a management plan (national, regional, or state), the 1994 book *Migratory Shore and Upland Game Bird Management in North America*, or a regional technical committee priority list.<br>2 pts. Addresses a need identified only in the proposal. |
| **30** | **III. Status of the species/population**<br>**A. Population**<br>15 pts. Decreasing<br>13 pts. Unknown<br>7 pts. Stable<br>2 pts. Increasing<br>**B. Habitat**<br>15 pts. Decreasing<br>13 pts. Unknown<br>7 pts. Stable<br>2 pts. Increasing |
| **20** | **IV. Management applicability**<br>**A. Range**<br>15 pts. Results applicable throughout<br>10 pts. Results applicable to > 50% of range<br>5 pts. Results applicable to < 50% of range<br>**B. Applicability**<br>5 pts. Multi-species (Biodiversity approach)<br>3 pts. Single species |
| **30** | **V. Scientific merit**<br>30 pts. Objectives are clearly stated, procedures are well designed, results are attainable, quantifiable estimates will be statistically reliable and comparable to other studies, manpower and budget are adequate.<br>15 pts. Objectives are clearly stated, most procedures are well designed, important results are attainable, quantifiable estimates will be statistically reliable and comparable to other studies, manpower and budget are generally adequate.<br>0 pts. Objectives fuzzy, poor design or results not attainable, results will not be statistically reliable or will be difficult to compare, budget and manpower are inadequate (zero value automatically kills the proposal). |
| **10** | **VI. Funding**<br>10 pts. > 75% of funding from other sources<br>7 pts. 50-75% of funding from other sources<br>5 pts. 33-49% of funding from other sources<br>0 pts. <33% of funding from other sources (zero value automatically kills the proposal). |
| **120** | **TOTAL** |

# Webless Migratory Game Bird Research Program Projects
# *Progress to Date*

## Mourning Doves

### Development and Evaluation of Mourning Dove Population Models for Optimizing Harvest Management Strategies in the Eastern, Central, and Western Management Units

**DAVID L. OTIS, U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA 50011 (dotis@iastate.edu)**

**Final report**

A primary accomplishment of this 5-year project was the development of first generation demographic models for each of the 3 mourning dove management units. These models required analysis and synthesis of historical data produced from banding and recruitment studies, and from harvest and population monitoring programs. This modeling framework was integral to the Mourning Dove National Strategic Harvest Management Plan, and helped to guide development of new long term monitoring programs. The second major accomplishment was development of an interim harvest strategy that used a population growth rate estimator derived from harvest estimates in the USFWS Harvest Information Program and harvest rate estimates derived from an ongoing national banding program.

This work was funded by the USFWS Webless Migratory Game Bird Research program and by a consortium of more than 25 state wildlife agencies. Project accomplishments were the result of multiple collaborations with many state and federal cooperators, as well as university faculty and students. Four manuscripts have been published from this project and more than 20 technical presentations have been given to dove management technical committees and at professional meetings.

A second phase of development of new harvest management strategies was initiated in 2006. The objectives are to (1) develop a revised interim harvest strategy derived from a composite population growth rate estimator derived from CCS and BBS trends, and harvest-based population estimates, and (2) continue development of more informed long-term management strategies that explicitly connect population demographic and harvest dynamics.

# A National Reward Banding Study to Estimate Reporting Rates and Associated Harvest Parameters of Mourning Dove Populations

**DAVID L. OTIS, U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA 50011 (dotis@iastate.edu)**

**Final report**

## Introduction and Objectives

Efforts are underway to use the best available data to construct demographic models that can be used as the basis for long term informed harvest management strategies. A critical component in these strategies is an understanding of the relationship between population harvest and survival rates. Given the lack of current information on survival and harvest rates, a logical first step toward is to conduct a reward banding study. The primary objectives of such a study are to produce estimates of band reporting rates that can be used to convert standard band recovery rates into harvest rates using well-established analysis techniques. Secondary objectives are to 1) establish protocols, training, and cost estimates for a future coordinated nationwide operational banding program designed to monitor harvest and survival rates, 2) provide information on geographical distribution of harvest, and 3) provide initial estimates of annual survival and breeding site fidelity. Information from this study will be used to update and improve population models developed to support harvest management strategies.

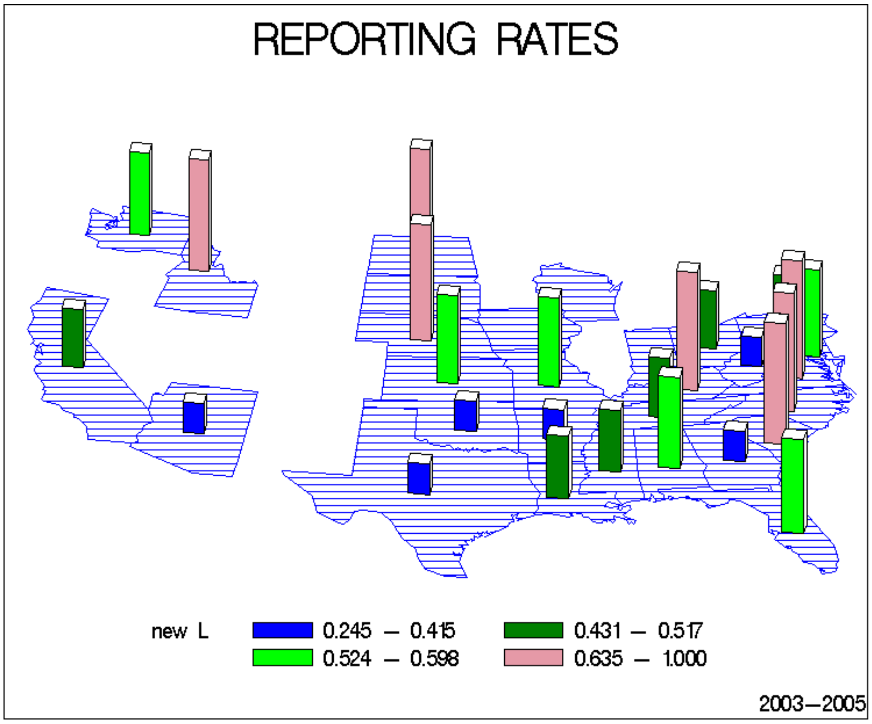
## Study Design

Thus, banding quotas were developed on a subregion scale, with allocations to individual states determined by relative Call Count Survey indices and geographic area. In 2003, 26 states volunteered to participate in the 3 year study, and participation grew to 29 states by 2005 (Fig. 1). The initial banding study protocol specified that 2000 birds would be banded in each subregion with standard bands only in 2003 and 2005. Quotas increased to 3100 in 2004; 2400 of these bands would be put on juveniles and every third juvenile received a $100 reward band in addition to its standard band. Based on results from 2004 and availability of funding, supplemental reward banding was repeated in 2005 in 8 states in the Central and Western Management Units.

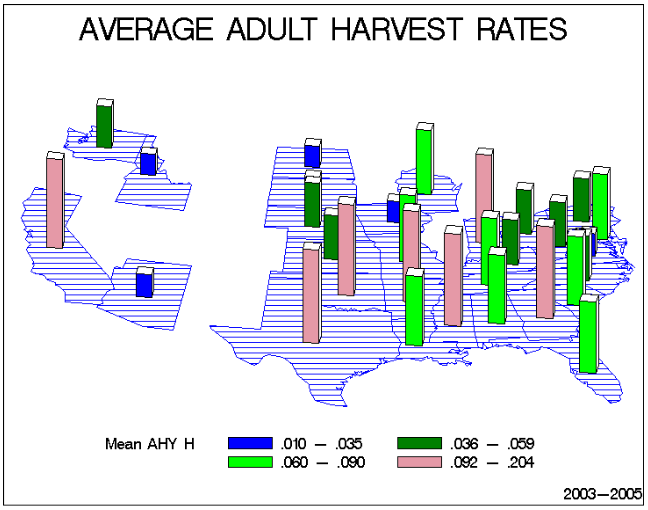
**Summary of Results**

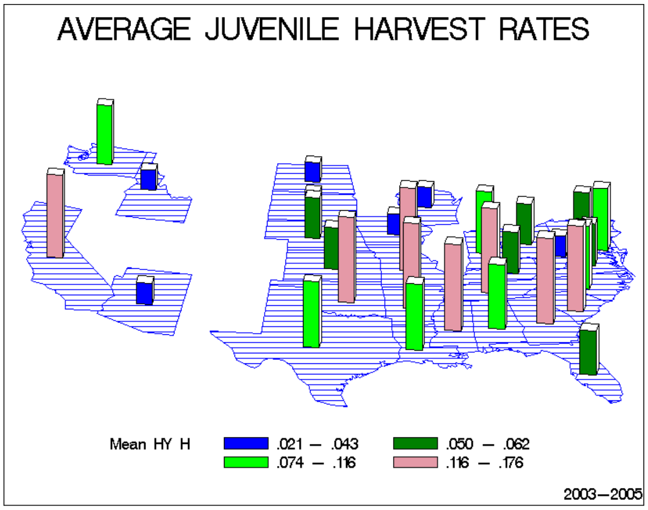
Nearly 100,000 birds were banded in the EMU (54,000), CMU (32,000), and WMU(10,000) in the summers of 2003 – 2005. Approximately 5000 recoveries have been reported from the 2003 – 2005 hunting seasons, including approximately 600 reward bands.

Reporting rates were assumed constant across years. State reporting rate estimates ranged from 0.31 – 1.00, with an unweighted average of 0.56. Average CV of state estimates was 28%; CVs for subregions averaged 19%.



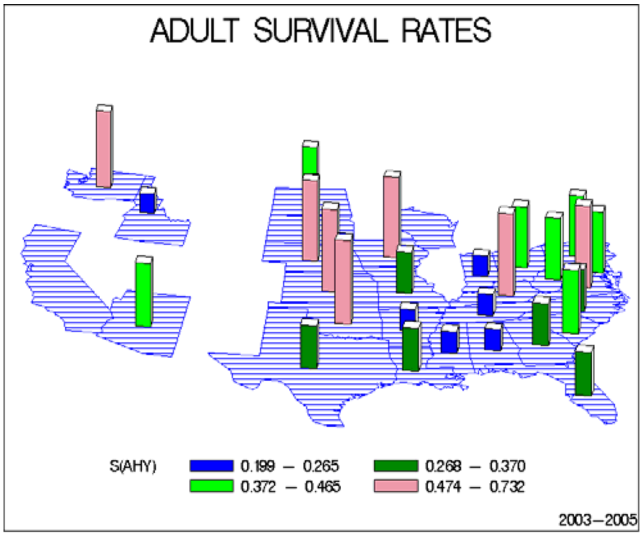

Harvest rates varied substantially both spatially and across years. Averages ranged from 0.018 – 0.204 for adults and from 0.021 – 0.176 for juveniles. Careful interpretation of these estimates is required because of concerns in some states about the representativeness of banded cohorts with respect to harvest pressure.

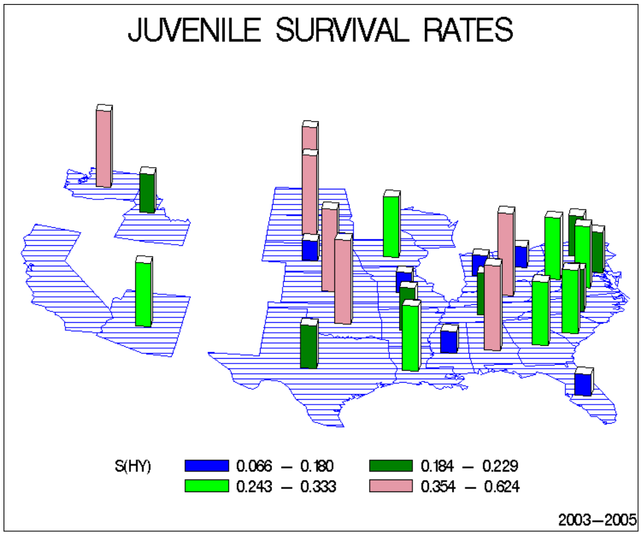


Averaged over all hunting states, at least 80% of the harvest of the banded cohorts in a state occurred in the same state. Also, an average of >90% of a state's total harvest of both age classes was derived from that same state.

For all but 4 states, annual adult survival was greater than juvenile survival, and there was considerable variation among states. Estimates were imprecise, with average CVs ~ 35%. Subregion survival rates were more precise, with CVs ~ 25%.




**Future Plans**

Cooperating states, which included Illinois and Utah, continued banding in 2006. Study results will be used to develop, in cooperation with the USFWS, a Banding Needs Assessment to guide a long term operational banding program to be initiated in 2007. Results will also be used in development and application of current interim harvest management strategies.

# Development and Evaluation of Methods for Regional Monitoring of Mourning Dove Recruitment

**DAVID L. OTIS, U.S. Geological Survey, Iowa Cooperative Fish and Wildlife Research Unit, Iowa State University, Ames, IA 50011. (dotis@iastate.edu)**
**DAVID A. MILLER, Department of Natural Resource Ecology and Management and Ecology and Evolutionary Biology Program, Iowa State University, Ames, IA 50011. (millerda@iastate.edu)**

**Graduate Student**: David Miller(Ph.D.); **expected completion**: 2008

## Introduction and Objectives

Increased recognition of the importance of sustained recreational use and conservation of the mourning dove (dove; *Zenaida macroura*) has motivated a coordinated effort by state and federal agencies to improve the data sources and analytical tools necessary for informed harvest management. The 4 Flyway Councils and IAFWA recently approved a Mourning Dove National Strategic Harvest Management Plan. The Strategic Plan recognizes 1) the need to improve the knowledge base used for managing harvest of this important game bird and 2) the role of large-scale and long-term monitoring programs in meeting these information gaps. As part of this effort, a pilot harvest wing survey was started in the fall of 2005.

Parts collections are a traditional method for estimating fall age ratios for game bird species. However, before a reliable operational wing survey can be implemented for doves, a number of issues needed to be addressed. These include the need to calibrate harvest wing age ratios to produce an estimate of true age ratios, to evaluate the efficiency of different sampling protocols to meet the information needs for doves, and to validate the accuracy of age ratio estimates using independent data. Finally, there is a continuing need to increase our understanding of the basic breeding biology of the species, which will in turn assist with interpretation of recruitment estimates.

The following objectives, all of which are important steps in the implementation of a national demographic monitoring program for doves, were included in our original proposal.

1. Calibrate juvenile to adult ratios of harvested doves in order to produce an unbiased estimate of annual recruitment of juveniles into the fall population from wing collections by:
    a. Estimation of regional primary molt rate of adult and juvenile doves and the age-specific proportion of molt completed birds obtained from a wing survey.
    b. Correct harvest age ratios for differential harvest vulnerability of juveniles and adults.
2. Evaluate potential sampling designs and logistical constraints for a national harvest wing survey for monitoring recruitment.
3. Determine the potential for employing recaptures from an intensive banding program to generate independent estimates of age ratios that can be used to validate wing survey estimates.

Improve understanding of intra-annual variation in reproductive output of breeding doves.

## Progress to Date

Thanks to the enthusiastic effort of the participating state agencies, the pilot program has been successful in meeting and exceeding goals for the wing collection portion of the study. In 2006, 4 new states (North Dakota, South Dakota, Tennessee, and Texas) and ~ 15 new blocks as defined for the late summer banding program were added to the 17 states and 46 blocks that participated in 2005. During the first two years, these 21 states have collected more than 65,000 wings from 58 unique blocks. In almost all cases, states have been successful in meeting the goals of collecting 400 wings and banding 200 birds per block.

In November of 2006, the second annual mourning dove wing bee was again held at the Reed Wildlife Area outside of Kansas City, MO. Twenty-two participants representing 12 states, the USFWS, and the USGS processed more than 36,000 wings in two and a half days of work. This data is now in the process of being entered and verified thanks to the help of the Missouri Department of Conservation. As was the case last year, a significant percentage of wings could not be aged due to advanced molt stage and it will continue to be important to account for these birds when calibrating estimates.

Preliminary efforts began this past year to begin to calibrate wing survey estimates to account for unknown age birds. Classification of unknown age wings has focused on projecting primary molt scores from hatch year and after hatch year birds captured during late summer when almost all can be aged to the time of harvest. We have developed initial statistical estimation models to predict the proportion of unknown age birds that should be present from each age class. Initial results from simulations and 2005 data are promising. To this point we have had better success in projections of after hatch year molt scores and continue to work to improve hatch year projections.

As part of an effort to improve understanding of reproductive biology of doves, a field study was initiated in central Iowa during the summer of 2005 and continued in 2006. From mid-April to early September, more than ~ 200 dove nests were found and monitored in each of the two years. More than 100 adults have been trapped on nests, measured, and marked, and a blood sample taken. Current lab work is focused on measuring hormone levels from blood samples in an effort to better understand the physiological changes that occur in nesting birds throughout the summer. In addition, blood samples were taken from more than 200 squabs in order to determine their sex using PCR techniques. This information will help to determine whether there are sex specific patterns in growth and recruitment for the population. Additional objectives involve measurement of growth rates of squabs to understand factors that affect growth and development during the nestling stage. In an attempt to better understand growth and development during the post-fledging stage, we held 21 squabs during 2006 in a captive facility, and collected baseline data on growth rates that will be used to formulate hypotheses about the effects of stress on growth and fitness of young

**Future Work**

Wing collections as part of the pilot program will continue during 2007. We are hoping, in conjunction with the USFWS, to also conduct a parts collection mail survey program in 2007 to compare results and cost efficiency of this alternative monitoring design. We also will continue to refine statistical methods for calibrating age ratio estimates in order to improve information gained from the pilot program and to produce methods that could be used in future wing collection efforts.

Field work will also continue to be expanded in the coming year. Work will continue to focus on growth and development of squabs. The goal will be to determine factors that affect development and understand how this affects later fitness of these birds. In addition, we will further examine growth in the post-fledging stage of captive squabs.

Nests in central Iowa were found and monitored as part of studies of dove reproduction. Photo by David Miller.

Left: Nesting adults were trapped using mist nets. David Miller is removing a dove from a net. Right: A blood sample was taken for measurement of hormone levels of nesting birds. Photos by Chad Holy.

During 2006, squabs were held in captivity to monitor growth and development during the post-fledging stage. Photo by David Miller.

David Miller recording data at the Mourning Dove Wingbee. Photo by David Dolton.

Participants in the 2006 Mourning Dove Wingbee: *Left to right:* David Dolton (USFWS), David Miller (ISU), Kurt Hodges (FL), Billy Dukes (SC), Dave Otis (USGS), Lyle Fendrick (OH), Becky Rau (USFWS), Jay Roberson (TX), Dennis Browning (MO), Mile Olinde (LA), Andy Friesen (KS), Julie Fleming (MO), Don McGowan (GA), Jeff Neal (OK), Andy Tappmeyer (MO), Jeff Lusk (NE), Brad Jump (MO), Helen Hands (KS), John Brunjes (KY), Corey Huxoll (SD), Tony Mong (MO), John Schulz (MO). In 2 ½ days, the group aged ~36,500 wings.

The wingbee was held in the Visitor Center at the James A. Reed Memorial Wildlife Area near Kansas City, MO. Photo by David Dolton.

# Mourning Dove Demographics and Harvest Management in an Agroforestry Complex

**JOHN H. SCHULZ, Missouri Department of Conservation, Resource Science Center, 1110 South College Avenue, Columbia, MO 65201 (John.H.Schulz@mdc.mo.gov)**
**JOSHUA J. MILLSPAUGH, School of Natural Resources, University of Missouri-Columbia, 302 Anheuser-Busch Natural Resources Building, Columbia, MO 65211**
**TONY W. MONG, School of Natural Resources, University of Missouri-Columbia, 302 Anheuser-Busch Natural Resources Building, Columbia, MO 65211**
**DAN DEY, North Central Research Station, U.S. Forest Service, University of Missouri-Columbia, 202 Anheuser-Busch Natural Resources Building, Columbia, MO 65211**
**RICK BREDESEN, James A. Reed Memorial Wildlife Area, Lee's Summit, MO 64082**

**Expected completion:** June 2011

Future improvements associated with harvest management of mourning doves will rely on information that cannot be obtained from simple trend information. The National Mourning Dove Strategic Harvest Management Plan (National Plan) shows that future harvest management decisions will be based upon mechanistic population models, requiring modern estimates of demographic characteristics (e.g., recruitment, survival). Recruitment estimates obtained from a sample of radio marked hatching-year (HY) individuals produced by after-hatching-year (AHY) females will become one of the critical elements used in the population models along with estimates of age-specific annual survival and harvest rates. These data will also be critical in understanding and interpreting age-ratio data from surveys of wings from hunter-killed doves. Our objectives are (1) to estimate mourning dove population characteristics (e.g., recruitment, survival) and local harvest characteristics (e.g., harvest rates, crippling rates) during 2005-2010, and (2) evaluate agroforestry practices while determining the efficacy of associated number of sunflower fields and field size to attract mourning doves for harvest on James A. Reed Memorial Wildlife Area (JARMWA) during 2005-2010. Knowledge generated from this project will also guide management decisions for private landowners combining agroforestry practices and managed dove hunting fields, provide information about relationships between observed recruitment from radio marked doves and fall age-ratios from hunter-killed doves, provide comparisons of actual and reported crippling rates during the hunting season, and provide information on harvest rates on a heavily harvested local population of mourning doves.

During 2005 we planted 1448 trees on 2 study sites at JARMWA. Approximately 53% suffered mortality during the winter of 2005–2006, and roughly 60% all trees received some type of main stem damage from rabbits or deer.

During 2006 we implanted subcutaneous transmitters with external antennas in 130 AHY and 101 HY doves. From the 41 nests we located by following radioed AHY doves, we implanted transmitters in 35 nestling mourning doves. On average AHY and HY surgeries were completed in 10.1 (±3.1 SD) minutes compared to 9.5 (±2.6 SD) minutes for nestlings. We obtained 2,993 locations from the 266 radioed doves, and observed 67 non-hunting related mortalities. An additional 401 doves were trapped and banded on JARMWA prior to the hunting season. A cooperative effort with USDA-APHIS resulted in an additional 566 doves being trapped and translocated to JARMWA.

The presence/absence automatic data-logger system (Figure 1) at JARMWA yielded >98,000 data points for radioed doves using the area. On the first day of the administered hunt there were 54 radioed doves detected by the towers; 12 were shot and recovered, 4 were unretrieved and recovered the next day. Number of doves harvested per hunter on the JARMWA in 2005 and 2006 was similar between agroforestry fields (average 6.2, range 6.1 to 6.3) and non-agroforestry fields (average 6.1, range 5.8 to 6.4).

During the first two years we have surgically implanted transmitters in 426 mourning doves. We analyzed the daily probability of survival based on main effects models that included age, sex, year and a constant rate of survival (using Program Mark). We also tested an additive model that included an interaction between age and sex. We found that the best fitting model for survival for the pre-hunting season was the age/sex additive model. When we ran separate analyses that included the hunting season, the additive model was replaced by the main effects age model. The daily probability of survival was higher before the hunting season (Table 1).

These are preliminary results; the project is expected to last 5-6 years. The project is a cooperative venture including the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service), University of Missouri's Center for Agroforestry, University of Missouri School of Fisheries and Wildlife Sciences, U.S. Forest Service - North Central Forest Experiment Station, and Resource Science Division of the Missouri Department of Conservation.

Table 1. Daily survival probabilities for different mourning dove age classes based on 1) survival during the summer/fall up to but not including hunting season, and 2) survival probabilities during the summer/fall including hunting season (AHY = after hatching year; HY = hatching year and NE = doves we outfitted with transmitters as nestlings).

| Age | Daily Survival Probability | SE | 95%CI |
|---|---|---|---|
| Before the September 1 mourning dove opener. | | | |
| AHY | 0.9938 | 0.0010 | 0.9914 – 0.9956 |
| HY | 0.9883 | 0.0018 | 0.9842 – 0.9914 |
| NE | 0.9723 | 0.0061 | 0.9576 – 0.9821 |
| Including the mourning dove hunting season. | | | |
| AHY | 0.9890 | 0.0013 | 0.9861 – 0.9913 |
| HY | 0.9761 | 0.0025 | 0.9706 – 0.9806 |
| NE | 0.9674 | 0.0066 | 0.9515 – 0.9783 |

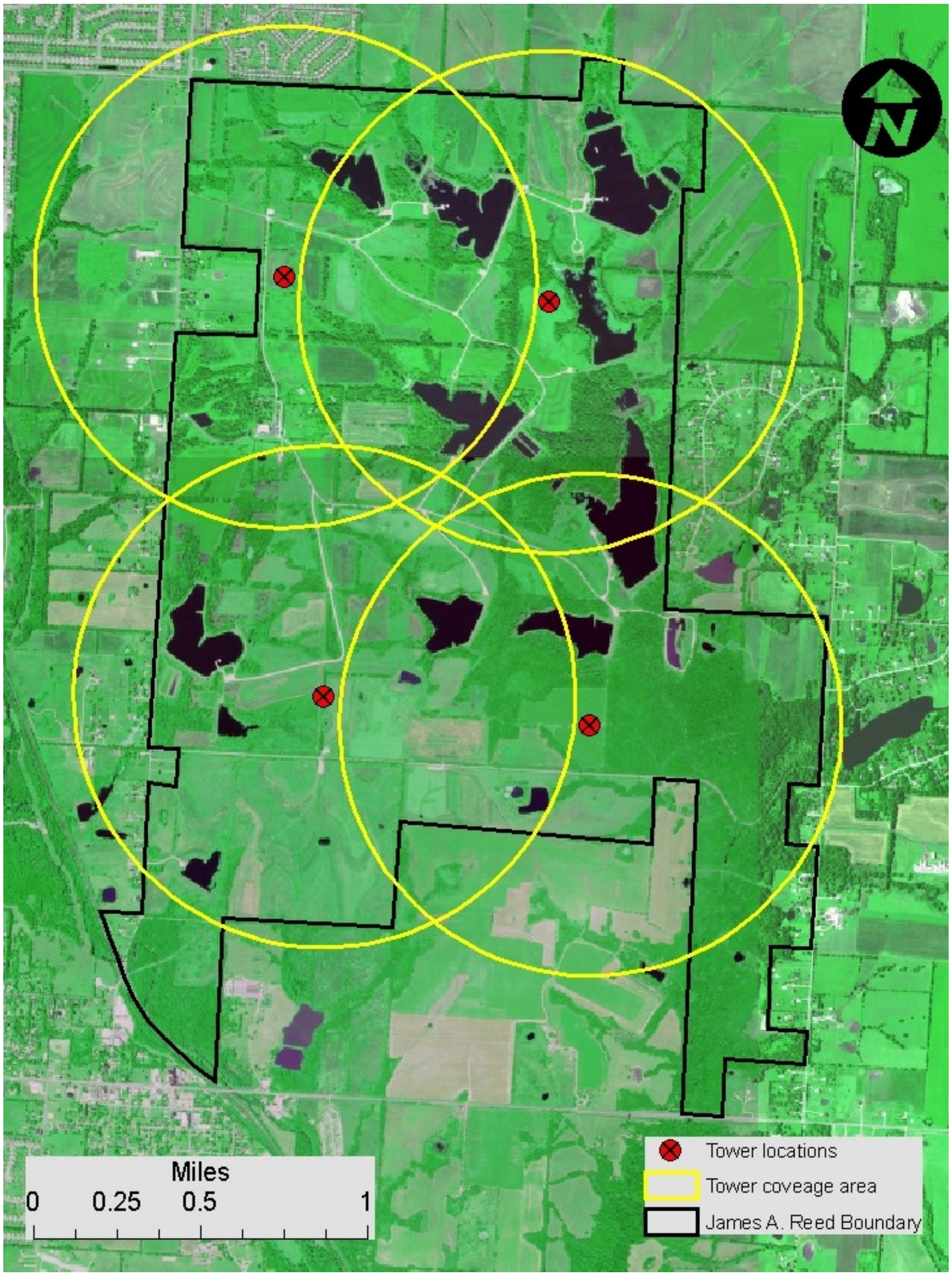



Figure 1. Location and estimated range of automatic data-logger dipole antennas on the James A. Reed Memorial Wildlife Area near Kansas City, Missouri.

Figure 2. Shown is an anesthetized mourning dove receiving a subcutaneous radio transmitter. During the surgical procedure the transmitter antenna is guided through a tunnel created by a large gauge needle. Photo by Tony Mong.

Figure 3. A close-up view of inserting the transmitter into a subcutaneous pocket located near the back of the neck or nape. The transmitter will eventually end up in the thoracic inlet. Photo by Tony Mong.

Figure 4. A young hunter in an agroforestry field. Photo by Tony Mong.

# Effects of Eurasian Collared-doves on Populations of Mourning Doves and Other Species in the Southeastern U.S.

**JESSICA N. ORR, Department of Biology, Box 5063, Tennessee Technological University, Cookeville, TN 38505**
**STEVEN E. HAYSLETTE, Department of Biology, Box 5063, Tennessee Technological University, Cookeville, TN 38505 (shayslette@tntech.edu)**

**Graduate student:** Jessica N. Orr (M.S.); **Abstract of final report**

Eurasian collared-doves (*Streptopelia decaocto*; hereafter 'collared-doves' or 'ECDOs') are recent invaders of North America. In recent years, concern has been raised about the potential effects of the collared-dove invasion of North America on indigenous species, particularly other species of doves and pigeons. Ecological similarity between collared doves and other columbids may lead to competition between the exotic invaders and their native relatives. Effective and cost-efficient management of collared-dove populations to benefit mourning doves and other native species requires an understanding of the population-level effects of collared-doves on these native species.

The primary objectives of this study were to document trends in populations of mourning doves (*Zenaida macroura*) and other potential collared-dove competitors in the newly-occupied range of Eurasian collared-doves using existing North American Breeding Bird Survey (BBS) and Christmas Bird Count (CBC) data, and to test the hypothesis that arrival and expansion of collared-dove populations in the southeastern U.S. have been associated with declines of mourning doves and other avian species. Other objectives were to identify site-specific geographic or other variables affecting the relationship between collared-doves and native species, such as mourning doves, and to assess the usefulness of existing databases for evaluating the ecological, population-level effects of the Eurasian collared dove invasion of North America.

We examined population trends in 6 species with which Eurasian collared-doves are likely to compete, mourning doves, rock doves (*Columba livia*), common ground-doves (*Columbina passerina*), white-winged doves (*Zenaida asiatica*), blue jays (*Cyanocitta cristata*), and northern cardinals (*Cardinalis cardinalis*), using BBS and CBC count data compiled from BBS and CBC websites. We documented trends in these species prior to, and after, ECDO arrival on BBS routes and CBC circles within a 4-state region (Florida, Georgia, Alabama, and Mississippi) with a history of 8+ years of ECDO presence ('experimental' routes/circles) using estimating equations and observer as a covariate (BBS only). Analyses of CBC data used birds/party hour. We estimated mourning dove trends similarly on BBS routes with no history of ECDO presence ('control' routes), using 1995 as the last 'pre-ECDO' year and 1996 as the first 'post-ECDO' year. We compared trends before and after arrival of collared-doves separately by species, survey type (BBS or CBC), and route type (experimental or control, BBS only, mourning dove only) using paired 1-tailed *t*-tests and routes (BBS) or circles (CBC) as experimental units. We also compared trends both before and after arrival of collared-doves to zero using 1-sample 2-tailed *t*-tests, and we compared mourning dove trends between experimental and control BBS routes separately by period (pre-ECDO vs. post-ECDO) using 2-sample 2-tailed *t*-tests.

Given a significant difference in population trends of mourning doves before and after the arrival of Eurasian-collared doves in Florida, we modeled spatial variability in recent (1996-2005) mourning dove population trends across all BBS routes in Florida as a function of 11 predictor variables, including ECDO-related variables (number of years since colonization by ECDOs, average ECDO abundance, maximum ECDO abundance), route location variables (peninsula vs. panhandle, coastal vs. inland), white-winged dove presence/absence, and land-use variables (proportion land cover within 0.4 km of route in development, forest, cropland, pasture, and brush/shrubland). We used multiple linear regression with routes as data points and mourning dove trend (1996-2005) as our dependent variable. We used an information-theoretic approach to model selection; models selected using a minimum-AIC$_c$ criterion were evaluated using standard parametric procedures. We also compared ECDO-related variables between peninsula and panhandle routes using a 2-sample 2-tailed *t*-test, and we examined relationships between these variables and recent mourning dove trends separately for peninsula and panhandle routes using Spearman's rank order correlation.

Among all experimental routes and those in Florida, mourning dove population trends were more negative after the arrival of collared-doves than prior to their arrival (Table 1). Trends prior to collared-dove arrival were positive for all routes and Florida routes, but trends subsequent to arrival did not differ from zero. Trends on non-Florida routes, however, were not more negative after than before collared-dove arrival, and did not differ from zero in either period. Among all control routes and non-Florida control routes, trends did were not more negative after than before collared-dove arrival and did not differ from zero in either period (Table 1). Using all experimental and control routes, trends prior to collared-dove arrival were more positive on experimental routes than on control routes, but trends following collared-dove arrival were similar between experimental and control routes. Mourning dove CBC results closely mirrored BBS results (Table 1).

Among 17-30 experimental BBS routes trends in rock doves, common ground-doves, blue jays, and northern cardinals were not more negative after than before collared-dove arrival, and did not differ from zero in either period. Lack of experimental routes precluded analysis of white-winged dove BBS trends. Likewise, among 11-51 experimental CBC circles, trends in rock doves, common ground-doves, white-winged doves, blue jays, and northern cardinals were not more negative after than before collared-dove arrival, although trends did differ from zero for some species during one or both periods.

The best model of 10-year mourning dove population trends in Florida included 2 variables, region (peninsula versus panhandle) and proportion forest cover. Trends were more positive on panhandle routes ($\beta = 0.085$) than on peninsula routes ($\beta = -0.008$), but were not significantly related to proportion forest cover. In analyses using only peninsular routes, the best model included 2 variables, proportion forest cover and average ECDO abundance. Mourning dove trend was negatively associated with forest cover, but was not significantly related to ECDO abundance. In analyses using only panhandle routes, the best model was the null (no variable) model. None of the ECDO-related variables varied between peninsula and panhandle routes, and none was rank-correlated with mourning dove population trends on peninsular or panhandle routes.

Our study offers somewhat conflicting evidence with respect to effects of collared-doves on mourning dove populations. A shift in mourning dove population trends on experimental routes/circles concomitant with the arrival and establishment of collared-doves suggests a negative effect of collared-doves. This shift was restricted to Florida, however; no such shift appears to have occurred in Georgia, Alabama, or Mississippi, although relatively few routes or circles in these 3 states had sufficient history of collared-dove presence to be used. Regrettably, nearly all control routes were in these latter 3 states, rather than Florida, making our analysis of these control routes of limited value. Differing mourning dove trends on the 2 route types prior to arrival of collared-doves highlights this limitation. Analyses of recent local mourning dove trends in Florida suggest the possibility that factors other than Eurasian collared-doves may be responsible for temporal changes we documented. We failed to find any significant relationship between recent mourning dove population trends and trends in local collared-dove distribution and abundance. Changing land uses may be a factor in recent changes in mourning dove population dynamics in Florida. A negative relationship between recent mourning dove trends and percent forest cover in the peninsular region of Florida likely reflects the association of mourning doves with open, early-successional habitats and ecotones.

Our study offered no evidence for negative effects of collared-doves on populations of rock doves, common ground doves, blue jays, or northern cardinals. Likewise, we found no evidence of negative effects on white-winged doves, although our analysis largely was limited to introduced white-winged dove populations in Florida. General agreement between results of BBS and CBC analyses corroborates results of previous studies, and indicates that both survey types may be useful in analyses of population trends in the species we studied, although they provide only circumstantial evidence for ecological processes. The CBC, although conducted with less rigorous field protocols than the BBS, provided more experimental data points in our study region, and may offer a more completely documentation of the distribution and abundance of collared-doves than the BBS, particularly in areas where they are relatively rare.

Based on our results, we hypothesize that Eurasian-collared doves may have had a less serious impact on populations of mourning doves and other species than early reports predicted, and that other ecological factors are the primary determinants of mourning dove population dynamics, even in areas where collared-doves are abundant. This hypothesis should be tested at future points with similar studies conducted over longer time periods and broader geographic areas, and with field studies of ecological interactions between collared-doves and potential competitors, including both mourning doves and white-winged doves. If future studies confirm our hypotheses, active management of collared-dove populations may not be necessary for the conservation of mourning doves and other native species.

A final report of this study will be available at the end of 2006. Funding and/or other support for this project were provided by the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service); Center for Management, Utilization, and Protection of Water Resources at Tennessee Tech University (TTU); and TTU Department of Biology.

Table 1. Mourning dove population trends before and after the arrival of Eurasian Collared-doves in Florida (FL), Georgia (GA), Alabama (AL), and Mississippi (MS) over the time period 1967-2005.

| | | | | Mourning dove population trend ($\beta$) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Pre-ECDO | | Post-ECDO | |
| Survey[a] | Type[b] | Area | $n$[c] | $\bar{x}$ | SE | $\bar{x}$ | SE |
| BBS | Experi- | FL | 21 | 0.085 | 0.024 | 0.025 | 0.015 |
| | mental | AL-GA-MS | 9 | 0.003 | 0.029 | -0.013 | 0.011 |
| | | FL-AL-GA-MS | 30 | 0.060 | 0.020 | 0.013 | 0.011 |
| | Control | AL-GA-MS | 29 | 0.002 | 0.012 | -0.004 | 0.014 |
| | | FL-AL-GA-MS | 32 | 0.005 | 0.011 | 0.000 | 0.013 |
| CBC | ECDO | FL | 37 | 0.053 | 0.013 | -0.013 | 0.011 |
| | | AL-GA-MS | 14 | 0.031 | 0.015 | 0.008 | 0.019 |
| | | FL-AL-GA-MS | 51 | 0.047 | 0.010 | -0.007 | 0.009 |

[a] BBS = North American Breeding Bird Survey, CBC = Christmas Bird Count.
[b] Experimental = routes/circles on/in which Eurasian collared-doves were present for 8+ years as of 2005; control = routes/circles on/in which Eurasian collared-doves have never been present as of 2005.
[c] $n$ = number of routes/circles.

Jessica Orr compiling BBS and CBC data for their inclusion in analyses of population-level effects of Eurasian collared-doves on mourning doves and other species.

# Mourning Dove Recruitment in Tennessee

**RUSSELL R. SKOGLUND, Tennessee Wildlife Resources Agency, Ellington Agricultural Center, P.O. Box 41489, Nashville, TN 37204**
**STEVEN E. HAYSLETTE, Department of Biology, Box 5063, Tennessee Technological University, Cookeville, TN 38505 (shayslette@tntech.edu)**

**Graduate student:** Russell R. Skoglund (Ph.D.); **expected completion date:** June 2008

Current nationwide efforts to better understand mourning dove population dynamics require estimates of annual recruitment. Previous mourning dove nesting studies have generated estimates of reproductive parameters such as nesting success and fledglings produced/minimum number of nesting pairs, but such studies do not permit direct documentation of reproductive output per female and do not address fledgling survival. Radiotelemetry offers an alternative approach to estimating recruitment that addresses both of these limitations. This study will document survival (nesting females, nests, and post-fledging juveniles) and recruitment in an EMU mourning dove population, to complement ongoing mourning dove recruitment research in other units.

Field work will take place during March-September 2007 on a 162-ha former cattle farm in western Wilson County, Tennessee. Mourning doves will be trapped using Kniffin modified funnel traps, and radiotransmitters will be subcutaneously implanted in approximately 30 adult females during March, prior to the onset of nesting. Females with transmitters will be monitored regularly throughout the nesting season to determine survival and total productivity. Nests initiated by radio-marked doves will be monitored to determine number of young fledged. Prior to fledging (at approximately 8 days of age), young will be banded, and transmitters will be implanted. Radio-marked fledglings will be monitored regularly throughout the breeding season. Mortality among radio-marked doves will be investigated to determine cause, if possible. Telemetry data will be used to estimate survival of both nesting females and post-fledging juveniles, as well as recruitment. Recruitment will be estimated as number of HY doves entering the fall (September) population per adult nesting female. Total number of fledglings produced by radio-marked females will be multiplied by rate of survival of fledglings to harvest to generate total number of HY doves recruited for these calculations.

Data analysis and preparation of the final report and manuscripts will follow the conclusion of field work in September 2007, although additional funding is being sought for a second year of study. The final report for this project will be completed by June 2008. Funding and/or other support for this project are provided by the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service); Tennessee Wildlife Resources Agency; Center for Management, Utilization, and Protection of Water Resources at Tennessee Tech University (TTU); TTU Environmental Science Ph.D. Program; and TTU Department of Biology.

Former cattle farm in Wilson County, Tennessee, to be used for radiotelemetry studies of mourning dove recruitment during March-September 2007.

# Band-tailed Pigeons

## Breeding Distribution and Migration Routes of Pacific Coast Band-tailed Pigeons

**MICHAEL L. CASAZZA and CORY T. OVERTON, US Geological Survey, Western Ecological Research Center, 6924 Tremont Road, Dixon, CA 95620 (Mike_Casazza@usgs.gov, coverton@usgs.gov)**

**Expected completion:** September 2007

Band-tailed pigeons (*Patagioenas fasciata monilis*) are currently surveyed using a breeding population index derived from pigeon counts conducted at mineral sites distributed throughout their breeding range (Casazza et al. 2005). This range-wide survey became operational in 2004 andmet a management need identified more than 30 years ago and reiterated in the 1994 Pacific Coast band-tailed pigeon management plan (Keppie et al. 1971, West. Migr. Upland Gamebird Tech. Comm. 1994). One of the critical issues in implementing this method is appropriate representation of their breeding range and mineral site use (Casazza et al. 2003).

We conducted a pilot study to determine if newly-available miniaturized satellite transmitters (PTTs) could be used to successfully track and monitor Pacific Coast band-tailed pigeons through migration to breeding areas and return to wintering grounds. The duty cycle for all transmitters was 96 hours off and 10 hours on. Argos satellites obtained multiple locations in different location quality classes during each duty cycle (Table 1). Each location was analyzed with a filtering algorithm (David Douglas, USGS Alaska Science Center). This algorithm parse the locations into those of poor quality (filtered), unfiltered, and a single highest quality (selected) location for each duty cycle. Criteria for selection and filtering include movement distance, angle of successive location, and location redundancy (i.e. overpassing of locations). The user defined attributes of this algorithm are still under development but appear to have worked well for the current dataset.

Results from the first spring migration and breeding season illustrate the potential knowledge gained through the use of satellite telemetry. Four transmitters were deployed on band-tailed pigeons in California during winter and spring of 2006. One bird was marked near the town of San Luis Obispo, on the central coast of California, a second bird was marked in the Tehachapi Mountains, a third bird marked on Mount Palomar near San Diego, and the final bird was marked in the Central Sierra Nevada foothills.

Three of the four radio-marked pigeons migrated from their capture locations. Two birds migrated north of California, one to the Central Oregon Coast (Figure 1) and one to Washington's San Juan Islands (Figure 2). The Mount Palomar bird was killed by an avian predator when crossing the Mohave region between the San Gabriel and Tehachapi Mountains early in its migration (Figure 3). The bird marked near San Luis Obispo remained in the local area through both the spring and summer, likely breeding in See Canyon, a few kilometers southwest (Figure 4).

On several occasions we obtained data during an active transmitter duty cycle (about 8 hours) indicating the marked pigeon was in the process of migrating between locations. We documented active migration during one transmission cycle for the pigeon that migrated to the San Juan Islands. The satellite data indicated that this bird moved from Northern Oregon near the Wuana Mill and Clatskanie mineral sites at 11 pm to a region west of Elma, Washington by 2 am. The bird traveled a distance of 111 km over this three-hour period. To our knowledge, this is the first recorded observation of night-time migration by band-tailed pigeons.

Two likely nest sites were identified for the radio-marked birds. One bird remaining along the California coast exhibited a period of relatively consistent location for 60 days (nesting and fledging cycle is 45 days; Keppie and Braun 2000) in a canyon within the Irish Hills west of San Luis Obispo. The other bird, remained on the eastern point of Orcas Island in the San Juan Islands for 63 days. This bird also made forays to the agricultural area near Ferndale, WA about 15 kilometers south of the Canadian border.

Post migration locations for these birds were within 25 km of known mineral sites. Transmission from the bird in Oregon ended shortly following migration. There was evidence that the transmitter failed, but we cannot rule out mortality. The pigeon that settled on Orcas Island was not recorded at a known mineral site, suggesting an alternate site may exist on Orcas Island, though we cannot rule out visitation outside the programmed duty cycle of the transmitter. Nearby Shaw Island was previously investigated for band-tailed pigeon mineral sites (Savidge 1993). The Washington bird began its post-breeding migration at the end of August. It initially returned to within 15 kilometers of its northward stopover west of Elma, WA where it remained for several weeks.

The technical advancements in lightweight solar-powered satellite transmitters have provided an opportunity to advance our understanding of the ecology of small-bodied, long-range migrant birds. We used 12-gram solar PTT transmitters to provide critical information on the movements and breeding distribution of Pacific Coast band-tailed pigeons. Ninety-five percent of all duty cycles recorded included at least one high quality location (SD = <1 km error). Locations with this accuracy illustrate the potential to evaluate stand level habitat associations across the landscape and provide an opportunity for range-wide analysis and management of important habitats. Two of the marked pigeons migrated north from California to Oregon and Washington allowing for the identification of likely breeding areas and potential mineral sites for inclusion in the range-wide population index. The satellite data provides a unique opportunity to describe migration pathways, breeding distribution and key stopover habitats for a highly mobile and nomadic species that would otherwise be impractical to relocate. Satellite technology also allows the examination of linkages between nesting and wintering habitat areas as well as timing of migration relative to current hunting seasons. Identification of areas of disease outbreaks and enhanced monitoring of these outbreaks may also now be possible using satellite technology.

Primary support for this two-year project has been provided through a grant from the Webless Migratory Game Bird Research Program administered by the US Fish and Wildlife Service. Partners include the California, Oregon, and Washington state wildlife agencies, Quail Unlimited and the Canadian Wildlife Service.

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Table 1. Location quality for each deployed PTT transmitter and proportion of duty cycles obtaining at least one high quality location (SD = <1 Km error).

| Location class | 64234 | 64235 | 64236 | 64237 | 64238 | Total |
|---|---|---|---|---|---|---|
| LZ | 4 (3%) | 14 (4%) | 1 (4%) | 28 (5%) | 5 (4%) | 52 (5%) |
| LB | 24 (19%) | 71 (16%) | 2 (8%) | 89 (17%) | 32 (24%) | 218 (19%) |
| LA | 20 (16%) | 56 (16%) | 5 (20%) | 69 (13%) | 15 (11%) | 172 (15%) |
| L0 | 15 (12%) | 125 (36%) | 5 (20%) | 53 (10%) | 18 (14%) | 216 (19%) |
| L1 | 20 (16%) | 60 (17%) | 4 (16%) | 102 (19%) | 18 (14%) | 204 (18%) |
| L2 | 20 (16%) | 16 (5%) | 6 (24%) | 101 (19%) | 20 (15%) | 163 (14%) |
| L3 | 21 (17%) | 3 (1%) | 1 (4%) | 86 (16%) | 15 (11%) | 126 (11%) |
| Proportion of duty cycles w/high quality locations (LC 1-3) | 96% | 79% | 100% | 100% | 100% | 95% |

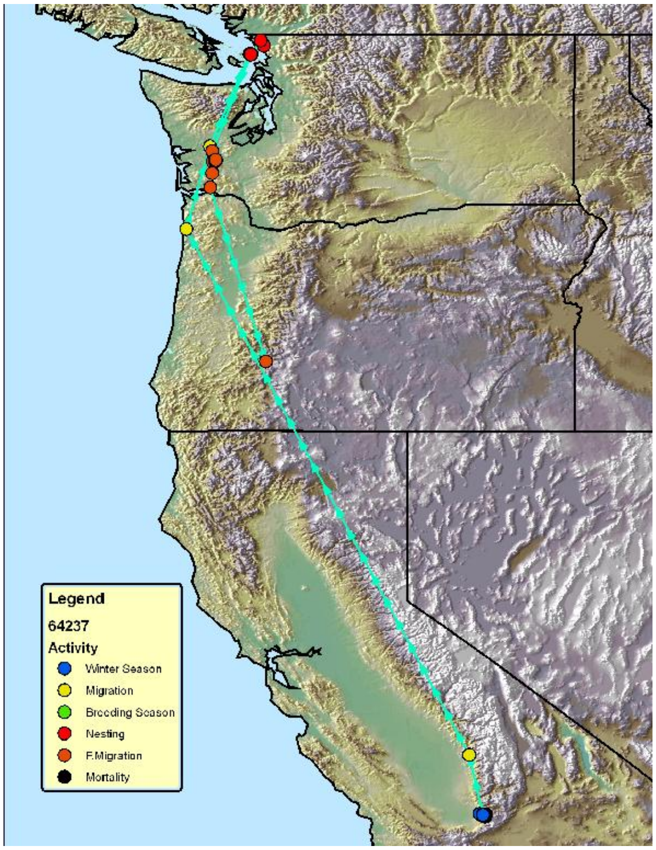


Figure 1. Movement path for PTT 64237 from February to October of 2006.

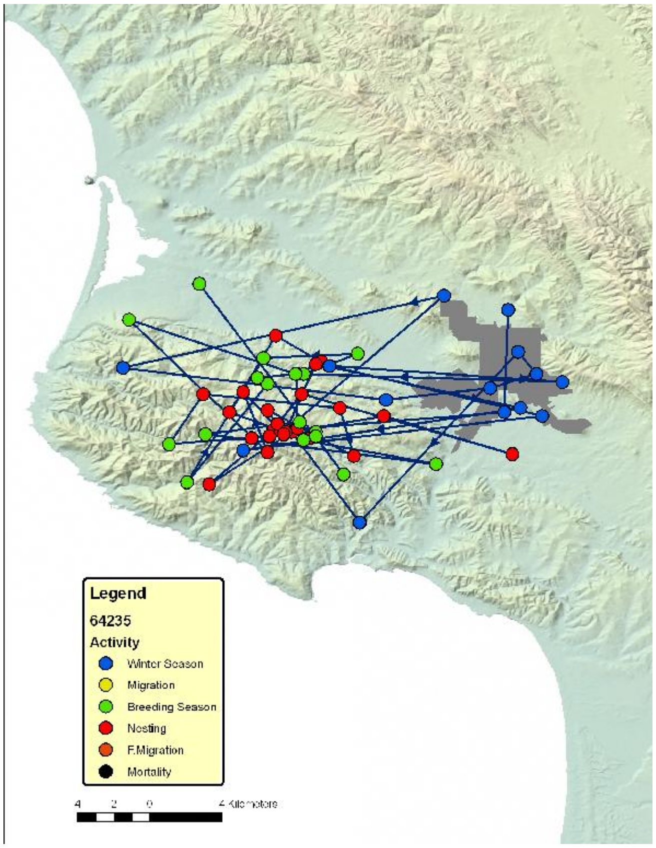


Figure 2. Movement path for PTT 64235 (non-migratory) from February to October of 2006 near San Luis Obispo, CA.

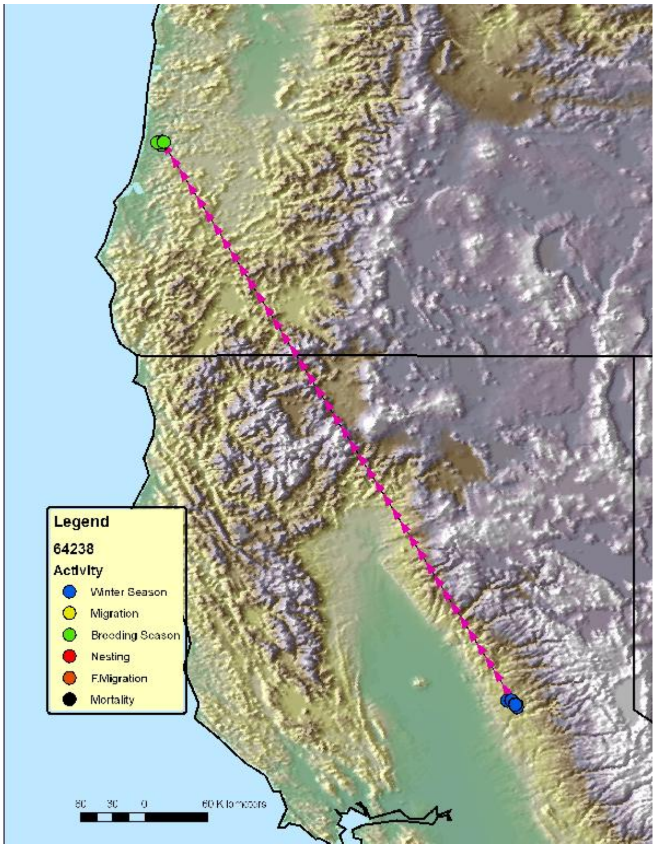


Figure 3. Movement path for PTT 64238 from May to July of 2006.

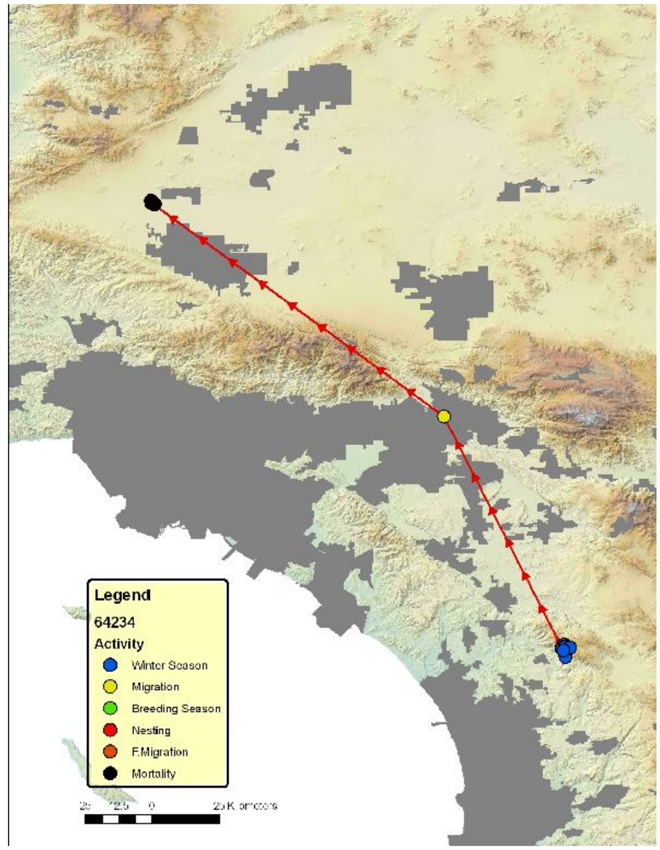


Figure 4. Movement path for PTT 64234 from February to May of 2006.

Band-tailed pigeon with solar powered backpack PTT attached with Teflon harness. Photo by Cory Overton.

Band-tailed pigeon trap set over acorns and corn within Palomar Mountain State Park, San Diego County, California, February 2006. Photo by Cory Overton.

# Sandhill Cranes

## Food Production in Habitats Utilized by the Rocky Mountain Population of Sandhill Cranes during Breeding, Migration, and Wintering

**LEIGH H. FREDRICKSON, Department of Wildlife and Fisheries Sciences, South Dakota State University, Brookings, ND 57007 (gaylord1@sheltonbbs.com)**

**Graduate students:** Diana Iriarte and Bret Beasley (M.S.)**; expected completion date:** December 2008

The Rocky Mountain Population (RMP) of Sandhill Cranes is faced with increasing habitat loss and degradation from urbanization of historic habitats, changes in agricultural practices, drought, and competing use of surface and ground water that compromise habitat conditions at historic use sites. Biologists and managers lack information about the distribution, availability, and quality of wetland foraging habitats at a local landscape scale and the characteristics of wetland systems that provide quality foods throughout the range of RMP cranes. Information generated during this study will enable resource managers to understand the importance of a wide array of wetlands and the role of wetland management in providing quality feeding habitats for migratory RMP cranes. Information that identifies the distribution, nutrient composition, and abundance of invertebrate and plant foods is critical for RMP crane management. The objectives of this study are: (1) Quantify the availability, distribution, nutritional characteristics of foods produced in temporary, seasonal, and agricultural habitats on public and private lands across breeding, fall staging, stopover, and wintering grounds of RMP cranes, (2) Compare biomass, gross energy, and crude protein levels of common animal and plant foods (temporary and seasonal wetlands) with agricultural foods (waste grain and alfalfa) on breeding, fall staging, stopover, and wintering grounds of RMP cranes, and (3) Determine the potential of each habitat type to meet nutrient requirements of RMP cranes while on breeding, fall staging, stopover, and wintering grounds, using existing RMP crane energetics models specific to each area and annual cycle event.

Two M.S. graduate students, Diana Iriarte and Bret Beasley, were selected for the project. They initiated fieldwork in August 2006 at Grays Lake National Wildlife Refuge. After a preliminary sampling design was developed, food samples (above and below ground) were taken to test the sampling protocol and to have test samples to sort as a means to determine the time required to sort and identify the food contents of samples. Each student also became proficient in the scan sampling protocol, (the technique by which the distribution of cranes is determine as well as their abundance and frequency of use,) which generates a database on crane use of polygons representing different habitats. The crane use on these habitats determines the sites selected for sampling either as use or non-use sites. In addition, samples with different plants were taken to identify the characteristics of the below-ground features that must be known so that plants can be identified during the sorting process.

Diana is taking classes at South Dakota State University and working up samples collected at Grays Lake. Her effort has resulted in an SOP for sample processing as well as providing the information on time required to sort samples and to identify foods in samples. Bret continued with fieldwork and was responsible of developing the SOP for field sampling. Additional samples were taken in the San Luis Valley to further test sampling protocol. Because of the high use of cow pies at Grays Lake, Bret also developed a classification for cow pies based on age (the abundance and composition of invertebrates is tied to age) as well as a sampling protocol to determine the amount of food available in cow pies.

Additional changes were made in the sampling design. Foremost among these is use and non-use sites will now be sampled. Furthermore, to assess the constantly changing conditions within the polygons representing the different hydrologic and agricultural conditions used by cranes, biweekly samples are scheduled to monitor the changes in abiotic and vegetation conditions during the time period that sandhill cranes are spending at each of the core areas under investigation. A sampling schedule for above- and below-ground biomass was developed and initiated in early December at Bosque del Apache

National Wildlife Refuge.

These are the results from August through December 2006 for the first year of a 2-year study funded by the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service. Other sources of funding for this and other aspects of a concurrent study on RMP cranes include Friends of Bosque del Apache National Wildlife Refuge, South Dakota State University, USGS SSP program, Wetland Management and Educational Services, Inc., Volunteers from Bosque del Apache and Monte Vista/Alamosa National Wildlife Refuges, and Volunteers from Adams State College, Alamosa Colorado.

Ashley Hitt (left) and Bret Beasley (right) sampling for above-ground foods at the Bosque del Apache National Wildlife Refuge in New Mexico. Photo by Leigh Fredrickson.

Ashley Hitt (left) and Bret Beasley (right) sampling for below-ground foods at the Bosque del Apache National Wildlife Refuge in New Mexico. Photo by Leigh Fredrickson.

# American Woodcock

## American Woodcock Singing-ground Surveys in the Western Great Lakes Region: Assessment of Trends in Woodcock Counts, Forest Cover Types along Survey Routes, and Landscape Cover Type Composition

**DAVID E. ANDERSEN, Minnesota Cooperative Fish and Wildlife Research Unit, 200 Hodson Hall, 1980 Folwell Avenue, St. Paul, MN 55108 (dea@umn.edu)**
**JAMES R. KELLEY, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, BH Whipple Federal Building, 1 Federal Drive, Fort Snelling, MN 55111-4056. (James_R_Kelley@fws.gov)**

**Estimated completion date:** 2009

### Introduction and Objectives

Declines in the number of American woodcock (*Scolopax minor*) detected on the annual Singing-ground Survey have lead to reductions in hunting bag limit and season length, delaying season framework opening dates, and development of a management plan to increase woodcock population size. However, trends in counts of woodcock along survey routes are difficult to interpret without an understanding of forest cover type composition along survey routes, and how well cover type along routes represents cover type composition in the larger landscape. Woodcock use early successional cover types in forested landscapes for courtship and breeding, and declines in counts on the Singing-ground Survey may reflect changes in extent and distribution of cover types along survey routes. Because the location of survey routes does not change, and because survey routes are generally located along secondary roads that existed at the time the survey was developed (1968), it is not known whether survey routes are currently representative of the landscapes in which they occur. The relationship between cover type characteristics along existing survey routes and cover type characteristics of the larger landscapes in which routes occur has been assessed in only a few locations. In the Central Management Region, only in Michigan has an assessment been completed comparing landscapes covered by Singing-ground Survey routes and land cover across the state, with few and small differences noted.

In the Central Management Region, changes in extent of cover types used by woodcock are thought to have influenced woodcock abundance. Since the mid-1960s, the total area of aspen (*Populus* spp.), an important component of woodcock habitat, decreased by 21% in Michigan, Minnesota, and Wisconsin. However, although the percentage of aspen-dominated cover types in the landscape has decreased throughout the western Great Lakes region, the extent of hardwood seedling-sapling cover types increased 23% in Minnesota from 1962-1990 and 3% in Wisconsin from 1968-1996. During this same period, the number of singing woodcock detected on routes declined 29% in Minnesota and 44% in Wisconsin. Thus, the cause of apparent population declines may vary across the breeding range of woodcock. Similarly, the relationship between extent and distribution of cover types used by woodcock along survey routes and their extent and distribution in the larger landscape may also vary across regions.

Determining the relationship between extent and distribution of cover types used by woodcock along survey routes and their extent and distribution in the larger landscape is a priority for management of woodcock. Furthermore, how changes in extent and distribution of cover types along survey routes are related to changes in apparent woodcock abundance can be different in different landscapes, and as indicated above, reasons for changes in apparent abundance in Minnesota and Wisconsin are not currently evident. Change across the breeding range from early successional forest types and old fields to a more mature landscape is widely regarded as the reason for apparent woodcock population declines, and woodcock abundance appears to be negatively correlated with an increase in the extent of urban-industrial land uses in the northeast U.S. It is not evident whether these same factors are operating in the

Central Management Region.

To address these issues in the Central Management Region, our overall project objective is to better understand the relationship(s) between changes in counts of woodcock on Singing-ground Surveys in Minnesota and Wisconsin and forest land cover. We propose to (1) assess patterns in annual counts of woodcock along existing survey routes, (2) assess changes in time in land cover types along these routes, (3) relate temporal changes in woodcock counts to changes in land cover composition, and (4) compare current cover type composition along routes to current landscape cover type composition. If possible, we will also compare past cover type composition along survey routes to landscape cover composition.

**Progress to Date**

To date, we have established an agreement through the Minnesota Cooperative Fish and Wildlife Research Unit to support this project at the University of Minnesota. Agency cooperators (Minnesota Department of Natural Resources and Wisconsin Department of Natural Resources) are in the process of establishing funding agreements with the University of Minnesota in support of this project. Woodcock Minnesota has contributed matching funds to the University of Minnesota for this project, as has the Minnesota Cooperative Fish and Wildlife Research Unit.

We are currently working to identify an M.S. student for this project, and are working with agency cooperators to identify existing landcover databases to conduct analyses.

**Future Work**

During the next year, we will work to accomplish the following:

(1) Complete funding agreements with cooperators in support of this project
(2) Identify a graduate student to conduct this project
(3) Compile existing landcover data bases necessary to conduct analyses
(4) Based on landcover data availability, determine feasible analytical approaches and begin data analyses

This is a summary of the first year of a 3-year study funded by the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service), the Minnesota Department of Natural Resources, the Wisconsin Department of Natural Resources, Woodcock Minnesota, and the Minnesota Cooperative Fish and Wildlife Research Unit (U.S. Geological Survey and the University of Minnesota).

# Marsh Birds

## Distribution of King Rails (*Rallus elegans*) along the Mississippi Flyway

**DAVID G. KREMENTZ, USGS Arkansas Cooperative Fish and Wildlife Research Unit, University of Arkansas, Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701 (Krementz@uark.edu)**
**ABIGAIL J. DARRAH, Arkansas Cooperative Fish and Wildlife Research Unit, University of Arkansas, Department of Biological Sciences, University of Arkansas, Fayetteville, AR 72701 (adarrah@uark.edu)**

**Graduate student:** Abigail Darrah (MS)**; expected completion:** 2009

### Introduction and Objectives

The king rail (*Rallus elegans*) is a large rail found throughout coastal and inland wetlands in southeastern and midwestern North America, with populations also found in the Greater Antilles and central Mexico. Coastal populations are mainly resident year-round, while more northern and interior populations are migratory. The migratory population has declined dramatically in the past 30 years, most likely due to the extensive loss of wetland habitat. Another potential impact on king rail populations is hunting. Although migratory populations are listed as Endangered or Species of Concern in many midwestern states, the king rail is a game bird in 14 Atlantic and Gulf coast states. It is possible that migratory populations winter in coastal areas where they are exposed to harvest.

Due to the secretive nature of the king rail, it is a difficult species to study. Even with the aid of taped calls, it is difficult to detect and thus difficult to monitor. Little is known about specific habitat associations, migration routes, and wintering areas. Refuge managers wanting to manage for king rails need more information about distribution and habitat requirements to develop effective plans, and determining the winter distribution of endangered migratory king rails may alter hunting regulations in some states. This project will be one in a series of studies meant to build upon one another to address these issues. The project objectives are: 1) to asses the distribution, abundance, and habitat occupancy of apparently migratory king rails along the Mississippi River between St. Louis and Hannibal, Missouri; 2) to gather basic information about reproductive ecology and habitat use; and 3) to assess different trapping methods for future studies.

### Methods

From 2 May to 1 July 2006, we surveyed 89 points among 15 refuges along both sides of the Mississippi River between St. Louis and Hannibal, Missouri. We used the protocol described in the North American Standardized Marsh Bird Survey, and surveyed each point 8-10 times in mornings and evenings. Temperature, cloud cover, wind speed, background noise, and water level conditions were recorded at the time of each survey. We collected habitat data ≤100 m of each survey point. Measurements recorded included rank of vegetation height and water depth and percent of crop field, bare ground, open water, woody, upland grass/forb, and emergent plants by species. We will analyze the response data and habitat covariates in the program PRESENCE to estimate the probability of a site being occupied (psi) and the probability of detection (p), as well as to assess the relative importance of habitat or landscape variables in explaining psi.

### Progress to Date

We detected king rails on 2 refuges, BK Leach Conservation Area and Clarence Cannon National Wildlife Refuge. The highest numbers of detections occurred in early May, dropping off to zero by the end of June. From 26 May to 6 July we searched for nests within these 2 refuges by walking transects through management pools. We found 3 inactive nests, 2 that had apparently been predated and one that was probably destroyed in a storm. Two nests were found in dense vegetation over ankle-deep water, and one was located in a dry area dominated by sparse *Solidago* spp. From 7 July through 7 August we observed 6 king rail broods at these 2 refuges. We recorded qualitative information about movement patterns, prey taken, foraging methods, and other behaviors. After the chicks vacated the area, we measured the following habitat parameters within a 25 m radius: rank of vegetation height, water level, percent of each plant species, distance to nearest levee, and distance to other edge (meadow, open water, etc.). Broods were generally found in areas of patchy robust emergent vegetation with pools of shallow water. The chicks would forage in these small pools or hide in the vegetation while an adult brought them food.

From 20 July to 7 August we tried several methods to trap rails. We placed walk-in traps in natural pathways through the marshes, and on some traps we added leads 10-50 m long made from chicken wire. At first we tried placing speakers playing king rail calls into the traps, but abandoned this method because the rails did not respond. We did not catch any king rails using the traps. We also tried nightlighting, by walking through the marsh during the night with a spotlight and a dip net. To narrow our search we would often watch the king rails in the evening, take note of their location at sunset, and return to that area after dark for nightlighting. However, we never encountered any king rails using this method. The low density of king rails in this area renders walk-in traps during the late summer and nightlighting by walking ineffective.

**Future Work**

Survey and habitat data will be analyzed this winter using the program PRESENCE. During the 2007 season we will extend our survey area farther from the Mississippi River and include more private Wetland Restoration Program lands. We will attempt to capture king rails using speakers and walk-in traps at the beginning of the breeding season, around the second week of May to minimize the number of migrant captures. Based on conversations with other rail researchers using similar traps, we expect king rails will respond to tape-playback calls during the height of mate pairing and territory establishment. We will place a leg band and radio transmitter using a thigh harness on all captured king rails. We will also collect a feather sample for stable isotope analysis to compare to samples taken from king rails in coastal Louisiana. Rails will be tracked several times a day to asses habitat use, daily movements, and to aid in nest searching. If necessary, depending on the battery life of the transmitters in use, marked rails will be recaptured in August and given new transmitters so they can be tracked through fall migration.

Primary support for this two-year project has been provided through a grant from the Webless Migratory Game Bird Research Program administered by the U.S. Fish and Wildlife Service. Partners include the Clarence Cannon National Wildlife Refuge, Missouri Department of Conservation, USGS Arkansas Cooperative Fish and Wildlife Research Unit, and Illinois Department of Natural Resources.

King rail foraging on crayfish at BK Leach Conservation Area, Missouri.
Photo by Noppadol Poathong, Missouri Department of Conservation.

King rail brood-rearing habitat at BK Leach Conservation Area, Missouri.
Photo by Abigail Darrah.

*Left*: Field technician Benton Gann near a king rail nest at BK Leach Conservation Area, Missouri. Photo by Abigail Darrah. *Right*: King rail feeding chick at Clarence Cannon National Wildlife Refuge, Missouri. Photo by Noppadol Paothong, Missouri Department of Conservation.

# White-winged Doves

## Gender Identification of White-winged Doves

**SARA J. OYLER-MCCANCE, U.S. Geological Survey - Fort Collins Science Center, Rocky Mt. Center for Conservation Genetics and Systematics, Department of Biological Sciences, University of Denver, Denver, CO 80208. (sara_oyler-mccance@usgs.gov)**
**CLAIT E. BRAUN, Grouse, Inc. 5572 N. Ventana Vista Rd., Tucson, AZ 85750, (sg-wtp@juno.com)**

**Expected completion:** 2007

### Introduction and Objectives

White-winged doves (*Zenaida asiatica*) are migratory game birds with an expanding distribution. Reasons for the range expansion are largely unknown as are characteristics of populations in newly occupied areas. This species is avidly sought in states having large white-wing populations and where it is hunted with specific hunting seasons designed to prevent local over-harvest. Increasing distribution and apparent population size in other states may result in legalizing or liberalization of hunting regulations in those states. Prior to any liberalization, more knowledge is needed on population characteristics including population demography in both the Central Flyway and Pacific Flyway portions of the species' range. These needs should be specific by age and gender as hunting may over exploit one gender (or age class). Harvest rates may be measured through banding programs; these rates should be gender specific to examine possible rates of hunting loss on population composition, which could affect breeding population size. Harvest by gender can also be measured through use of hunter bag checks and collections use of parts collection surveys.

Gender of white-winged doves based on examination of live birds is difficult although some indicate that it can be done using plumage coloration or body mass. However, others believe the only useful method to correctly assign gender to white-winged doves is through cloacal examination. Cloacal examination takes time and, especially in warm climates, can be stressful to birds. Further, it takes experience and leaves doubt as excreta can obscure either the 2 papillae (males) or the oviductal opening (females). Further, it is ineffective in hatching year birds and in some second-year individuals. Thus, there is a need for a rapid and effective method to ascertain gender of white-winged doves in banding programs, especially those that are likely to result in capture of large numbers of individuals. Our preliminary work suggests a method is available to accurately classify captured white-winged doves by gender.

Our objective is to test use of length of 1 of the 2 central brown tail feathers of white-winged doves to learn if this method can be used to correctly assign gender to live birds that will have their gender verified using molecular techniques. Preliminary work in Arizona (800+ bandings, 50+ recaptures) during 2000-06 indicates there is a difference in tail feather length between males and females of all age classes (AHY, SY, HY) although sample sizes for SY's and HY's are small. These differences have also been verified on small samples (~ 20 birds) of gonadally checked hunter- harvested white-winged doves in Arizona. The hypothesis is that central tail feather length (mm) is correlated with gender and can be used to reliably assign gender to live or dead white-winged doves.

### Progress to Date

A central brown tail feather was plucked from a sample of 200 white-winged doves captured in normal banding operations. Feathers were labeled by band number, measured (mm) fresh, and stored dry. These feathers were sent to the Rocky Mountain Center for Conservation Genetics and Systematics to identify gender using molecular methods. Once in the lab, feathers were again measured to ascertain whether shrinkage occurred due to drying. DNA was then extracted from all feathers and a PCR-based test was performed to identify gender. To date, the gender has been identified for all feather samples. Data analysis is ongoing. We will continue to analyze the data from this project. Upon completion of the data analysis, we anticipate writing a manuscript reporting the results of the study. These results are from the first 6 months of a 1-year study funded by the Webless Migratory Game Bird Research Program (U.S. Fish and Wildlife Service).

# Other Webless Research Projects

## Mourning Doves and White-winged Doves

### Studies of Native Columbiformes in Tucson, Arizona, 2006

**CLAIT E. BRAUN, Grouse Inc., 5572 North Ventana Vista Road, Tucson, AZ 85750 (sg-wtp@juno.com)**

Banding of mourning (*Zenaida macroura*) and white-winged doves (*Z. asiatica*) continued in 2006. Five hundred mourning doves and 107 white-winged doves were banded. No Inca doves (*Columbina inca*) were seen at the trap location (Catalina Foothills, northeast Tucson) in 2006. All bandings were between 24 March and 11 October although mourning doves were present at the trap site in substantial numbers every day. Breeding activities of mourning doves began between 10 and 15 January and calling continued until 15 September. White-winged doves arrived in the area of the trap location in late March and most departed in mid to late August with few remaining into September. Breeding activity of white-winged doves commenced in April and mostly ended by mid August.

About 30 recoveries have been received from the ~5,700 mourning dove bandings since start of banding in 2000 with only 2 shot recoveries. Only 2 shot recoveries (of 7 total recoveries) have been reported from the 926 white-winged doves banded. All recoveries of mourning doves were in Arizona but one shot recovery of a white-winged dove was reported from Michoacan, Mexico. Based on band recoveries, mourning doves banded in the Catalina Foothills area at the northeast periphery of Tucson would appear to be non-migratory with little exposure to harvest. Few white-winged doves occur in the Tucson area after early September and some are now known to migrate into Mexico. Little is known about movement patterns of mourning doves in the Tucson area although there are clearly increases and decreases in number of birds at the trap location irrespective of food availability. Further, recaptures (repeat captures) at the banding site indicate that some banded birds are not available for capture or have trap avoidance during some months and years.

Few repeat captures have occurred of white-winged doves (63 recaptures of 54 different individuals during 2000-2006) unlike mourning doves (2,796 repeat captures during 2000-2006). Of the repeat captures of white-winged doves, 25 were first banded in 2000, 9 in 2001, 6 in 2002, 9 in 2003, 7 in 2004, 6 in 2005, and 1 in 2006. Of the 8 white-winged doves that were recaptured more than once (one recaptured 3 times after initial banding), 8 were recaptured after 1 year, 6 were recaptured after 2 years, 2 were recaptured after 3 years, and 1 was recaptured 5 years after year of banding. Only 1 white-winged dove banded in this program has been recaptured elsewhere (~5 miles southwest of the banding location in Tucson). No white-winged or mourning doves banded by others have been recaptured during the program.

Trichomoniasis (caused by *Trichomonas gallinae*) in mourning doves was nonexistent in 2006. Trichomoniasis has not observed in white-winged doves.

Data analysis was started in 2006 with calculation of hatching dates for all HY birds newly banded. The earliest calculated hatching date was 16 February and the latest was 29 September. This analysis will continue in 2007 and a manuscript will be prepared for publication.

# Interspecific Interactions between Mourning Doves and Eurasian Collared-doves

**DONALD W. SPARLING, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901 (dsparl@siu.edu)**
**TIFFANY OSBORNE, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901**

**Graduate student:** Tiffany Osborne**; expected completion:** 2011

The Eurasian collared-dove (ECDO) is an exotic species that initially became established in the southeastern portion of the United States in the 1980's and has since spread throughout much of the East and South. Little is known about the ecology of the ECDO in the United States and wildlife managers are concerned about possible adverse interactions between it and the smaller mourning dove (MODO). This study, which will begin its first field season in Spring 2007, will investigate the territorial, nesting and feeding ecology of ECDOs in urban and semi-urban areas of southern Illinois. In addition to developing a further understanding of the ecology of this invasive species, the study will also examine interactions between ECDO and MODO. Through the use of radio telemetry, observations of individually banded birds and experiments on feeding behavior we will examine niche overlap between the two species and evaluate the potential for ECDO to compete with MODO. A disease or parasite component to the study is being contemplated.

# Nesting Success of Mourning Doves Relative to Urbanization in Southern Illinois

**ERIC SCHAUBER, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901 (Schauber@siu.edu)**
**DAN STOELB, Cooperative Wildlife Research Laboratory, Southern Illinois University, Carbondale, IL 62901**

**Graduate student:** Dan Stoelb**; expected completion:** 2008

Mourning doves (MODO) tend to be habitat generalists in that they nest in a wide variety of habitats including woodlots, orchards, vineyards, and urban and suburban landscapes. Whereas nesting behavior and success in farmlands have been studied in this species, less is known about the contributions that urban and suburban areas provide to regional MODO populations and to harvest statistics. This study will begin its first field season in Spring 2007. We will use radio telemetry and observations of banded birds to examine nesting success and movement patterns of MODO in areas ranging from rural (unincorporated areas with human densities ca. 3-9/mile2); exurban (small towns with human populations < 2000 and densities ca. 1000/mile2); semi-urban(5,000-10,000 people, ca. 1200/mile2); and urban (> 10,000 people and > 1250 /mile2).

# A Genetic and Isotopic Characterization of Eastern and Western White-winged Dove Breeding Populations to Determine Wintering Ground Distribution and Population Genetic Structure

**SCOTT A. CARLETON, Department of Zoology and Physiology, University of Wyoming, Laramie, WY 82072 (scarlet@uwyo.edu)**
**CARLOS MARTINEZ DEL RIO, Department of Zoology and Physiology, University of Wyoming, Laramie, WY 82072 (cmdelrio@uwyo.edu)**

**Graduate Student:** Scott Carleton (Ph.D.)**; expected completion: 2007**

### Introduction

Across their range, white-winged dove populations have exhibited large increases and declines over a relatively short period of time. These fluctuations have been caused, to a large extent, by anthropogenic changes on the landscape. The sources of anthropogenic change on the breeding grounds and their effects on white-winged dove populations have been well documented and addressed. However, our understanding of factors effecting white-winged doves on the wintering grounds are less understood. To investigate white-winged doves on the wintering grounds we identified two objectives that must first be met: (1) Gain a better understanding of the distribution of eastern and western populations on the wintering grounds, and (2) Determine if the eastern and western populations of white-winged doves can be differentiated from one another.

Two new analytical methods, stable isotope and genetic marker analysis, have emerged as powerful tools to answer these types of questions. During molt the carbon ($\delta^{13}C$) and hydrogen ($\delta^{2}H$ henceforth referred to as $\delta D$) isotopic signatures of the food and water birds consume are incorporated into their tissues. This signature, once incorporated into feather tissue, becomes inert and remains as a record of the breeding ground until the feather is again molted. This is important because hydrogen isotopic composition ($\delta D$) of precipitation forms a gradient across North America due roughly to differences in temperature, humidity, evaporation, topography and patterns of rainfall (Figure 1). Because of this gradient, feathers grown in one geographic location are discernible from feathers grown in another geographic location. In addition, genetic markers, such as microsatellite DNA and amplified fragment length polymorphisms (AFLP), are a powerful tool to differentiate populations of closely related species. We wanted to combine these two methods to differentiate the two populations of white-winged doves that breed in North America and then determine their distribution on the wintering grounds in Southern Mexico.

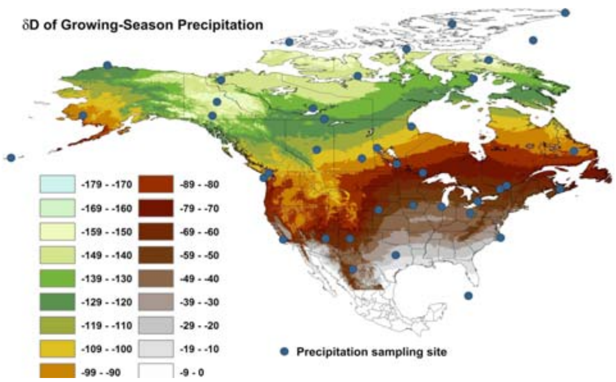


Figure 1. Hydrogen isotope precipitation values across North America show a clear north to south gradient useful for tracking migratory animals (from Meehan et al. 2003).

### Progess to date

Stable isotope and genetic marker analysis

With the help of Texas Parks and Wildlife and Arizona Game and Fish biologists we began collecting wings from hunters in the fall of 2004, 2005, and 2006. We pulled the earliest molted flight feather as this would have been grown on or near the breeding grounds. Deuterium, $\delta D$, isotope analysis of feathers revealed clear differentiation between the two populations (Figure 2). Discriminant analysis correctly placed 1080 of the 1200 feathers collected in the correct population. Determining the distribution of white-winged doves on the wintering grounds relied on our ability to differentiate the two populations from one another. Now that we can differentiate the two populations using stable isotopes, we

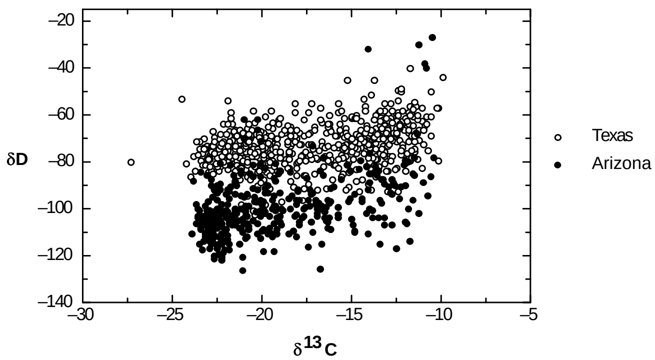


Figure 2. Feather isotope values from birds collected in Texas (○) and Arizona (●) following the breeding season show a clear differentiation between the two populations.

are currently collecting doves in the southern states of Mexico. The results of this data will help determine the location and distribution of eastern and western populations in Southern Mexico during the winter.

We are continuing to analyze the microsatellite and AFLP markers from collected tissues and do not have data to report at this time.

Funding for this project has been provided by Texas Parks and Wildlife Department, Arizona Game and Fish Department, and the University of Wyoming.

**Future Directions**

It has long been believed that desert dwelling white-winged doves move into agricultural areas prior to migration. Preliminary results from our migration study reveal that breeding season habitat use can be differentiated between doves in the Sonoran desert and doves in agricultural areas as well as post-breeding dispersal patterns using stable isotopes (Figure 3B).

In Arizona the western population of white-winged doves can be divided into two subgroups. These two subgroups are comprised of doves that breed and forage within the Sonoran desert and doves that breed and forage within or near agricultural areas. The heterogeneity of isotope values displayed between these two habitats is the result of photosynthetic pathway differences in food plants and sources of drinking water.

The photosynthetic pathway (C3, C4, CAM) that a plant uses to convert the sun's energy into sugars creates very different carbon isotopic ratios ($\delta^{13}C/\delta^{12}C$) in the tissues of the plant. When an animal consumes the tissues of a plant it incorporates this signal into tissues such as a growing feather during molt. In Arizona, a large proportion of foraging activity of white-winged doves breeding in the desert is on saguaro cacti. Cacti derive their sugars via CAM (crusalacean acid metabolism) photosynthesis ($\delta^{13}C \approx$ -11‰; Figure 3B). In agricultural areas, doves forage on crops that derive their sugars from C3 and C4 photosynthesis ($\delta^{13}C \approx$ -24 and -11‰ respectively; Figure 3B). Interestingly, this difference in foraging alone does not account for the heterogeneity we observe in isotope values between habitats. There is another difference between these two habitats that contributes to the creation of a unique isotopic signature in the tissues of white-winged doves. That difference is derived from the source of drinking water (δD).

Doves feeding in agricultural areas utilize surface waters for drinking. Doves in the Sonoran desert derive a large proportion of their drinking water from the tissues of saguaro cacti. During peak flower and fruit production the δD isotopic composition of white-winged dove body water was equilibrated with water derived from saguaro cacti. In the Sonoran desert ecosystem saguaro cacti are a very predictable resource, annually producing large crops of flowers and fruits. The predictability of this resource makes it an important source of food and water for desert white-winged doves. Remember, hydrogen forms a gradient across North America due in part to temperature, humidity, topography, and patterns of rainfall. Cacti store large amounts of water and over time, the pool of water inside the cactus becomes isotopically "heavier" as water molecules containing the lighter hydrogen isotope ($\delta^{1}H$) preferentially evaporate leaving a greater proportion of water molecules containing the heavier hydrogen isotope (δD). This causes the hydrogen isotope ratio ($\delta^{1}H/D$) of water from cacti to be more enriched (positive) than surface water (Figure 3B). The result is that doves feeding in the desert incorporate a carbon isotopic signature of the photosynthetic process (CAM) and hydrogen signature of the water they derive from cacti into growing feathers. Agricultural doves incorporate a carbon isotopic signature of crops they feed on (C3, C4) and the hydrogen signature of the surface waters they consume. These combined differences create the heterogeneity we see between habitats (Figure 3B).

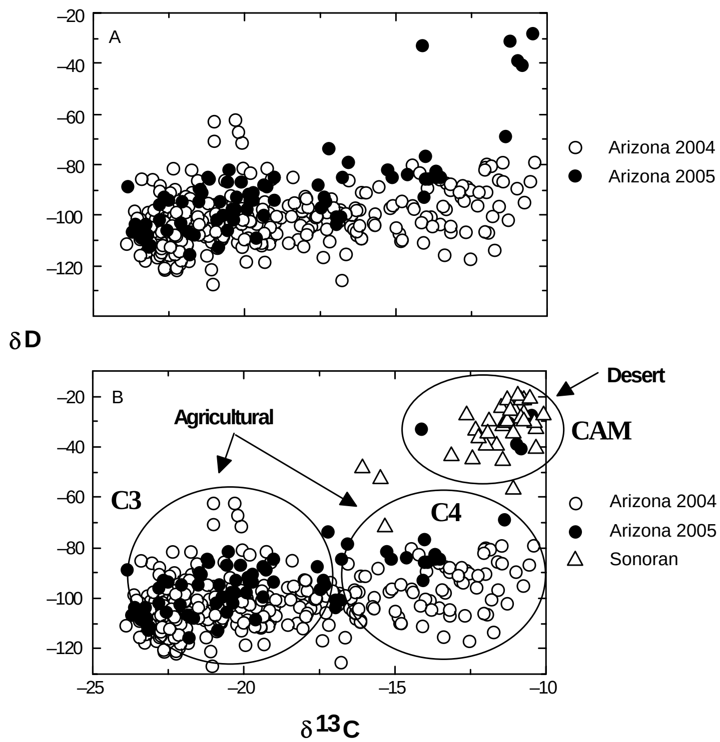


Figure 3. Feather isotope values show little annual variation between 2004 (○) and 2005 (●) collection seasons from hunters in agricultural areas (A). In 2005, five samples fall well outside the range of previously recorded values (A). When you overlay this data with doves collected in the Sonora desert (Δ) in the summer of 2005, the data reveals 1) a clear difference between agricultural and desert habitats and 2) shows that desert birds have moved into agricultural areas prior to migration where they were collected by hunters (B).

Hunters exiting areas outside Tucson, Arizona are greeted by Arizona Game and Fish biologists and volunteers at a hunter check station. Stations like these facilitated the collection of wings for this study. Photo by Scott Carleton.

A wing collected from a hunter is prepared for pulling of molted flight feathers for isotope analysis and muscle tissue for genetic analysis. Note that primaries 1-3 have been molted while 4-10 have not. Primaries 8-9 are actually missing and will most likely be molted ahead of 4-7. Photo by Gary Waggerman.

A young hunter prepares to shoot a dove in the Sonoran Desert in Arizona. Photo by Scott Carleton.

*Top*: White-winged doves in the Sonoran desert rely heavily on saguaro cacti as a food resource. *Bottom*: Saguaro cacti fruit are full of carbohydrate, water-rich pulp. Photos by Scott Carleton.

# Assessing Habitat Adjacent to Mourning Dove Call-Count Transects in Texas

**BRIAN L. PIERCE, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258 (blpierce1@sbcglobal.net)**
**NOVA SILVY, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258**
**MARKUS PETERSON, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843-2258**
**JAY ROBERSON, Texas Parks and Wildlife Department, 4200 Smith School Rd., Austin, TX 78744**
**FRED SMEINS, Department of Rangeland Ecology and Management, Texas A&M University, College Station, TX 7843-2126**
**BEN X. WU, Department of Rangeland Ecology and Management, Texas A&M University, College Station, TX 77843-2126**

**Graduate student:** Brian Pierce, Ph.D**; Final report**

In order to investigate the relationship between mourning dove population density, habitat, and harvest regulations in Texas, we repeated an earlier (1976) study of mourning dove habitat in Texas. We used a novel method of canonical discriminant analysis (CDA) to evaluate 4 contemporary classification schemes, and to determine the extent of temporal change in land use adjacent to the 133 call-count survey (CCS) routes within Texas. We used distance-based redundancy analysis (db-RDA) to examine the correlation between habitat variables and CCS results, and to identify important habitat variables for use in future mourning dove research. In contrast with the earlier study, which used univariate analysis of CCS results to identify sampling units, the present study partitioned Texas into homogenous habitat areas based solely upon environmental variables. By delineating experimental units based upon habitat variables directly, rather than using a proxy variable (CCS dove heard or route regression parameter) influenced by detectability, we tried to identify and alleviate the potential confounding between habitat and density in future dove research efforts. CDA results derived from the 2002 data set indicated the Gould (Cohen's Kappa = 0.76) and Omerick (Cohen's Kappa = 0.70) classifications are currently the most suitable for use as experimental units in Texas. The classification error matrix derived from this analysis indicates that as the human population grows, it will become harder to differentiate the natural underlying (background) habitat from the perturbations caused by anthropomorphic influences. Additional CDA results indicate that significant ($P < 0.0001$) changes in habitat occurred along the 84 CCS routes that remained spatially congruent between 1976 and 2002. The number of linear features, such as roads and buildings, and the index of interspersion increased substantially between the 2 periods. Increased amounts of physiognomic categories such as parkland, woodland, and shrub parkland, and decreased amounts of pasture, forest, savannah, shrub savannah, and shrubland are indicative of habitat fragmentation as a result of anthropomorphic land use. A db-RDA showed that grain density, diffuse canopy cover, and interspersion were positively correlated with dove seen and dove seen driving between CCS points, while dense canopy cover was negatively correlated with dove seen and dove seen driving between CCS count points. The number of doves heard was positively correlated with deciduous canopy cover, abundance of linear perching features, low traffic roadways, and more rural settings, while negatively correlated with human population density, high traffic roadways, building density, and coniferous canopy cover. Finally, these db-RDA results illustrate how differences in detectability between vegetation types may produce similar numbers of dove heard and/or dove seen in areas with disparate mourning dove densities.

Figure 1. Desert scrubland habitat in the Trans-Pecos ecoregion of Texas.

Figure 2. Decideous savannah habitat in the Edwards Plateau ecoregion of Texas.

Figure 3. Shrubland habitat in the South Texas Plains ecoregion of Texas.

Figure 4. Mesquite Parkland habitat in the Cross Timbers ecoregion of Texas.

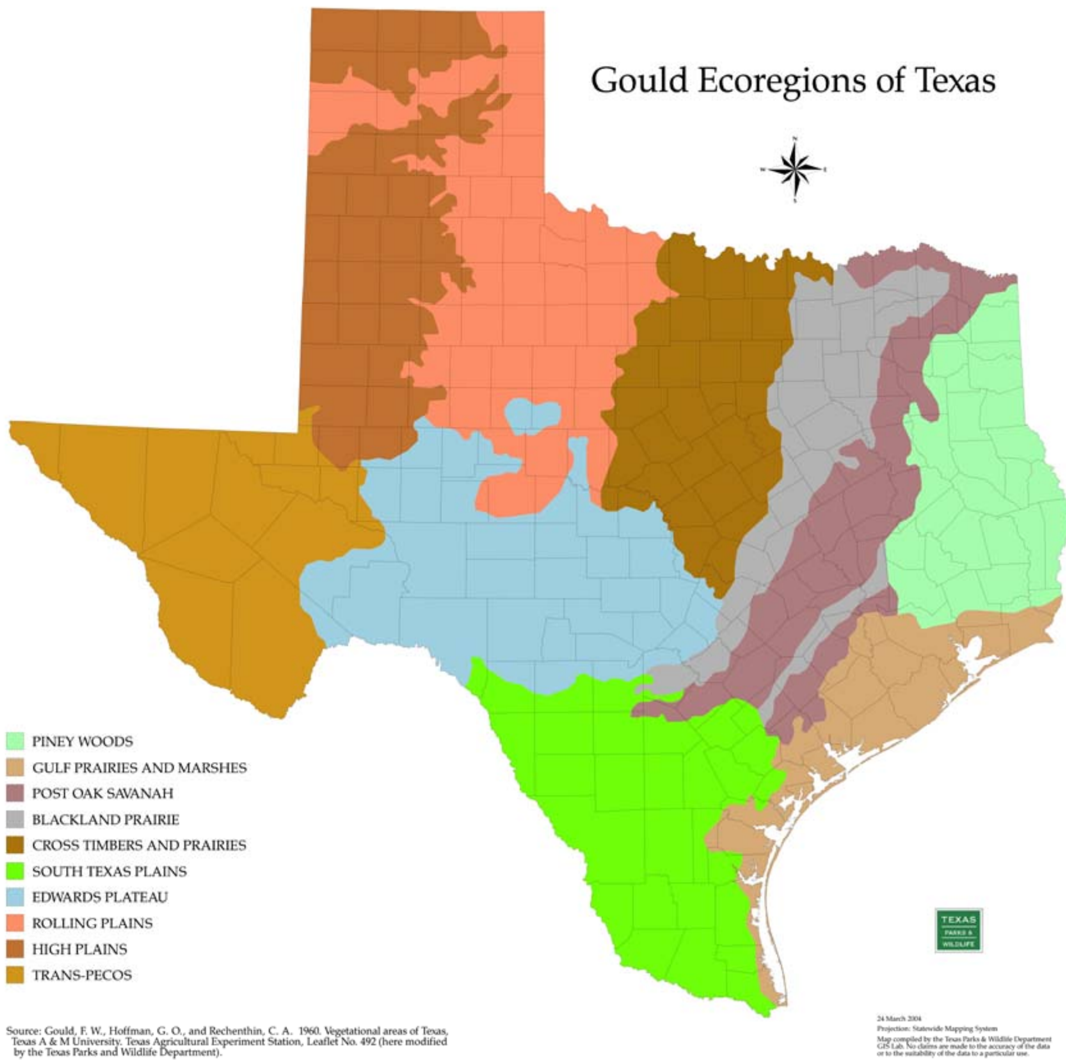


Figure 5. Gould (1975) ecoregions of Texas.

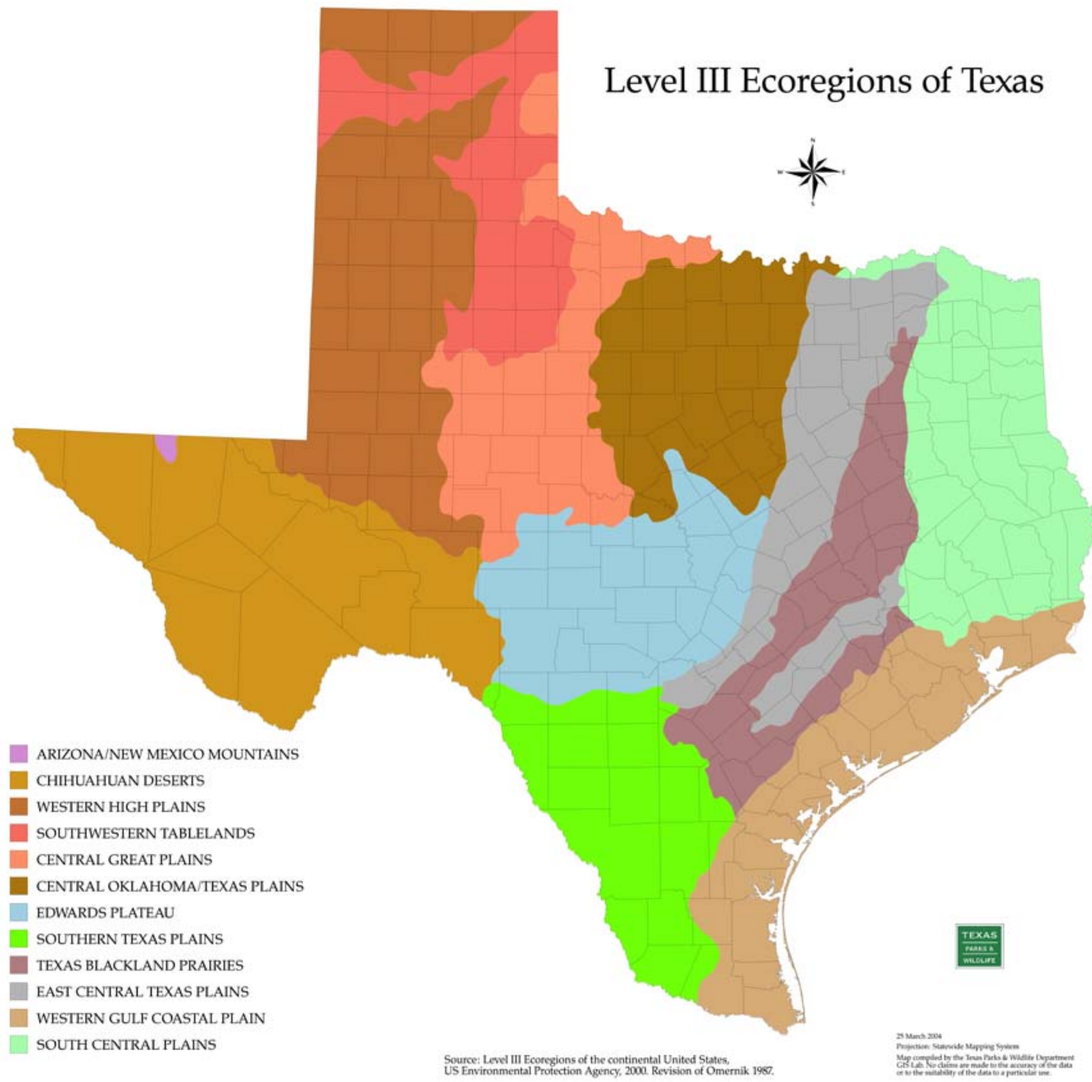


Figure 6. Omerick (1987) ecoregions of Texas.

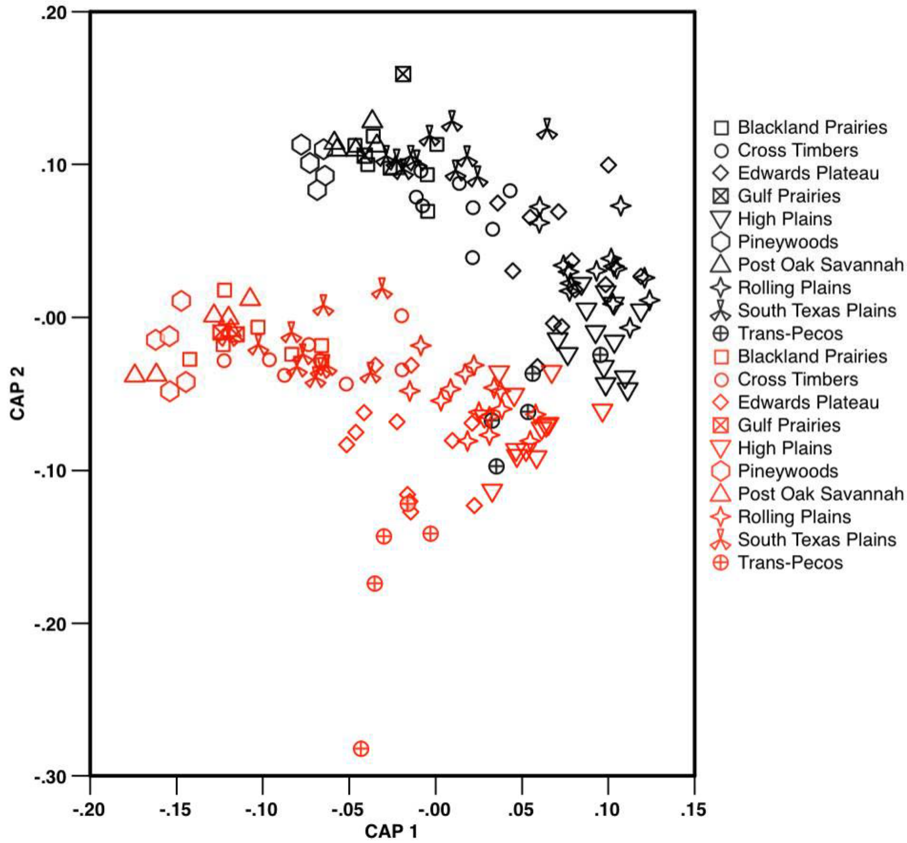


Figure 7. Canonical discriminant analysis showing multivariate change in habitat adjacent to 84 congruent CCS routes between 1976 and 2002. Plot shows the distribution of CCS for each year and ecoregion along the first 2 canonical discriminant axes.

Division of Migratory Bird Management
PO Box 25486
Denver, CO 80225-0486
303-275-2388

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