Nesting Habitat of White-winged Doves in Urban Environments of Southern Texas

Jeff B. Breeden, *Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

Fidel Hernandez, *Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX 78363*

Nova J. Silvy, *Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, TX 77843*

Fred E. Smeins, *Department of Rangeland Ecology and Management, Texas A&M University, College Station, TX 77843*

Jay A. Roberson, *Texas Parks and Wildlife Department, Austin, TX 78744*

Abstract: Changes in white-winged dove (*Zenaida asiatica*) distribution and habitat use have occurred in Texas since the 1940s. Breeding populations are now common in urban areas throughout Texas. These changes have resulted in unique challenges for monitoring populations in urban environments because of factors such as traffic, construction, and residential development. Delineating potential breeding habitat within urban areas may make surveys more efficient. Our objectives were to examine nest tree selection and identify habitat attributes associated with urban populations of white-winged doves. We conducted nest searches at 15 auditory-count survey points in Kingsville, Texas, in 2003 and documented trees used for nesting. We tested the relationship of white-winged dove density (n = 49 survey points) with associated fine-resolution (mesquite [*Prosopis glandulosa*] density, favorable tree density, and total tree density) and course-resolution (% mesquite canopy cover, % shade tree canopy cover, % woody plant canopy cover, and % open lawn) habitat variables throughout Kingsville in 2005. We documented that white-winged doves selected for live oak (*Quercus virginiana*) and against mesquite for nesting. The strongest relationships we found with fine-resolution and course-resolution habitat variables were between white-winged density and favorable tree density (R^2 = 0.40; P < 0.001) and % shade tree canopy cover (R^2 = 0.57; P < 0.001), respectively. Densely-canopied trees such as live oak may be the best indicator of suitable nesting habitat in urban areas. These data can be useful in predicting potential white-winged dove habitat in urban areas and for refining survey protocol regarding allocation and distribution of survey effort.

Key words: doves, nesting habitat, urban wildlife, white-winged dove, *Zenaida asiatica*

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 62:58–63

The primary breeding range of eastern white-winged doves (*Zenaida asiatica asiatica*) in Texas historically occurred in rural areas of the Lower Rio Grande Valley (LRGV) which encompasses Cameron, Willacy, Hidalgo, and Starr counties (Cottam and Trefethen 1968, George et al. 1994). However, changes in habitat use, geographic distribution, and productivity of white-winged doves began during the 1940s (Marsh and Saunders 1942, Kiel and Harris 1956, Hayslette et al. 1996, Small and Waggerman 1999). Habitat use of white-winged doves changed from predominant use of rural areas to increased use of urban environments in the LRGV during 1976–1997 (Small and Waggerman 1999). The breeding distribution of white-winged doves also expanded northward into urban areas during the 1970s, reaching as far north as Oklahoma (West et al. 1993, Schwertner et al. 2002). By 1993, the largest known nesting colony in the United States was within the city limits of San Antonio, Texas, and was estimated at over 1 million individuals (George et al. 1994, Waggerman 2001).

The shift in habitat use pattern and expansion northward of white-winged doves has resulted in unique challenges for population monitoring. Original surveys conducted in rural areas involved 2-min auditory counts that were systematically conducted within or near brush tracts where breeding populations of white-winged doves existed. The precise delineation of brush tracts and remoteness of rural areas resulted in a survey protocol that was relatively straightforward and time efficient. However, implementing the original survey protocol in urban environments is challenging because factors such as traffic, construction, and residential development interfere with auditory counts. In addition, the number of survey points, and therefore survey time, has increased because of the necessity to obtain representative samples throughout large cities. Breeden et al. (2004) estimated that in order to detect a 20% change in white-winged dove density with 95% probability in Austin and San Antonio, Texas, >200 survey points/city would be needed. This large survey effort resulted from high variability in white-winged dove density across survey points (i.e., many points with no or low numbers of doves [located in non-suitable habitat]

1. Present address: Department of Animal Sciences, Tarleton State University, Stephenville, TX 76402

and points with many doves [located in suitable habitat]). Given limited resources and time constraints, a more efficient method of survey implementation is warranted.

Delineating potential nesting habitat of white-winged doves in urban environments can be one method to improve survey efficiency. If urban environments could be delineated into white-winged dove habitat and non-habitat, allocation of survey effort could be stratified by category type, thereby reducing variability and required survey points. This approach requires knowledge of habitat attributes associated with urban populations of breeding white-winged doves. Unfortunately, this information is lacking, and researchers merely have been able to speculate on the important components of white-winged dove habitat in urban areas (Small et al. 1989, George 1991, West 1993, West et al. 1993). Our objectives were to: 1) examine nest tree selection of white-winged doves in an urban environment of south Texas, and 2) identify habitat characteristics associated with white-winged dove breeding density.

Methods

Nest-site Selection

We conducted nest searches during 15 June–15 August 2003 within the city limits of Kingsville, Texas. We created a 1 × 1-km grid of points and randomly placed the grid over a map of Kingsville (*n* = 20 points; Breeden et al. 2004) to select points for nest searches. We categorized points into three density categories (high [≥25 pairs/ha], medium [12–24 pairs/ha], and low [≤12 pairs/ha]) based on dove density estimates obtained in May 2003 using 2-min auditory counts (Rappole and Waggerman 1986, Breeden et al. 2004). We then selected a sub-sample of points from each density category to conduct nest searches (*n* = 15). We used all the points available in the high- (*n* = 6) and medium- (*n* = 5) density categories, and we randomly selected four points from the low-density category. We stratified points by density class so that nest searches occurred over a wide range of white-winged dove densities.

We buffered each point to a 400-m radius and overlaid a uniform grid of points within this buffered area consisting of 24 nest points. We chose a 400-m radius as the maximum distance because prior research indicated this was the distance over which a calling white-winged dove could be heard (Armbruster et al. 1978, Armbruster and Basket 1985, Sepulveda 2004). We then conducted nest searches of the entire area within a 20-m radius of each nest point. If a nest point was inaccessible (i.e., on top a house), we moved the nest point to the closest accessible location. We searched each nest point for active nests twice during the nesting season (15 June–14 July and 15 July–15 August 2003). A nest was considered active if an adult was on or appeared to flush from the nest. We identified the nesting substrate to species for each nest found.

We established a separate uniform 0.5-km grid of points within the city limits of Kingsville (*n* = 49 points) to document nesting-habitat availability. At each point, we determined tree density during June 2005 using distance sampling (Buckland et al. 2001) and the program DISTANCE 5.1 Beta 3 (Thomas et al. 2005). Although nesting habitat availability was documented at a later date than the nest searches, this period of time is short relative to the time-scale over which changes in woody vegetation occur. Therefore, relating nest density to habitat attributes was valid. We measured horizontal distance from each point to the center of all detected trees >3-m tall using a laser range finder. We only measured trees >3 m because trees less than this height are rarely used for nesting (Small et al. 2005). We calculated tree density by species and estimated availability. We defined availability as a species' proportion of total tree density at each point.

Habitat Attributes Associated with White-winged Dove

We separated nesting habitat attributes into two categories: tree density and land-cover classes. For tree density, we classified trees as either those previously documented as favorable for nesting (live oak [*Quercus virginiana*], Mexican ash [*Fraxinus berlandieriana*], sugarberry [*Celtis* spp.], and Texas ebony [*Pithecellobium flexicaule*]) or unfavorable for nesting which predominantly consisted of mesquite (*Prosopis glandulosa*) (Cottam and Trefethen 1968, West 1993). Thus, we obtained estimates of favorable tree density, mesquite density, and total tree density.

We used the same points that were established to obtain tree density (see above; *n* = 49) to quantify land cover. We delineated land-cover classes using ArcGIS 9.0 and 1-m resolution infrared imagery within a 65-m radius polygon around each point. We chose a 65-m radius because preliminary analysis of distance data indicated that we were estimating white-winged dove density within 65-m radius of each point (see below). Our intent was to relate habitat characteristics to white-winged dove density; thus, it was essential that estimates of both variables were obtained from a common area.

We identified habitat characteristics that we hypothesized to be biologically important predictors of white-winged dove density and could be obtained using the available imagery. These characteristics were % canopy cover of all woody plants, % canopy cover of shade trees (i.e., trees characterized by single-stem trunk and dense canopy), % mesquite canopy cover, and % lawn cover (characterized as grass that appeared to be actively maintained and watered by a residence or business). We manually delineated these land-cover classes within the 65-m radius at each point. We then calculated their respective percent coverage within this area.

We estimated white-winged dove density at each point ($n = 49$) using distance sampling (Buckland et al. 2001). At each point, we measured the horizontal distance to all white-winged dove seen and heard during a 2-min counting period using a laser rangefinder (Breeden 2005). If a bird was heard and not seen, we measured distance to foliage near the estimated location. We surveyed each point four times during 15 May–10 June 2005 from 0645–0945 hrs to obtain a more reliable estimate of density. This time period coincides with the annual white-winged dove survey conducted by Texas Parks and Wildlife Department personnel.

Distance sampling uses the mean detections per visit to estimate density at each survey point (Buckland et al. 2001).

Statistical Analyses

We evaluated nest-site selection using Chi square analyses with proportion of tree availability and 90% Bonferonni confidence intervals (Neu et al. 1974). If the available proportion of a tree species fell within the 90% Bonferonni confidence limit of the proportion of nest occurrence, the tree species was neither selected nor avoided. Selection was indicated when the available proportion of a tree species was less than the 90% CI lower limit of the proportion of nest occurrence, whereas avoidance was indicated when the available proportion of tree species was greater than the upper limit.

We evaluated the relationship between habitat characteristics and white-winged dove density using linear regression (SAS 2001). We tested for a linear and quadratic relationship of each individual habitat variable with dove density. We also conducted multiple linear regression on all landcover variables. Model fit was assessed using adjusted R-square values and AIC values. Models with both higher adjusted R-square value and lower AIC value were chosen as the best fit model.

Results

Nest-site Selection

We located white-winged dove nests ($n = 98$) in five tree species (Table 1). The majority of nests were situated in live oak (57%) and Mexican ash (19%). Only 9% of the nests were located in mesquite. Chi-square analysis (Neu et al. 1974) indicated that live oak was the only tree species selected as a nesting substrate, whereas mesquite was avoided (Table 1). The remaining three tree species in which nests occurred were neither preferentially selected nor avoided.

Table 1. Nest-site selection (% tree availability, observed number of white-winged dove nests, expected number of nests, and 90% Bonferonni confidence intervals) by white-winged doves for tree species classes in Kingsville, Texas, June–August 2003 and 2005.

Tree species	Tree availability	*n* nests	Expected *n* nests	LCLM[a]	UCLM[a]	Selection
Live oak	0.21	56	20.48	0.46	0.69	Selected
Mexican ash	0.25	19	24.21	0.10	0.29	Neither
Texas sugarberry	0.10	7	9.51	0.01	0.13	Neither
Texas ebony	0.01	4	0.59	–0.01	0.09	Neither
Honey mesquite	0.38	9	37.04	0.02	0.16	Avoided
Other	0.06	3	6.17	–0.01	0.07	Neither

a. Lower and upper 90% Bonferonni confidence intervals (Neu et al. 1974).

Table 2. Relationships between white-winged dove density ($n = 49$ survey points) and tree density habitat variables, Kingsville, Texas, June 2005.

Model	*P*-Value	R-Square	Adjusted R-Square	AIC	ΔAIC	MSE
Favorable tree density	<0.001	0.40	0.39	109.31	1.47	8.94
Total tree density	0.001	0.28	0.25	120.56	12.72	11.04
Mesquite tree density	0.395	0.02	–0.01	133.74	22.90	14.72

Table 3. Relationships between white-winged dove density ($n = 49$ survey points) and land cover habitat variables [% total woody canopy cover, % shade tree canopy cover, % mesquite tree canopy cover, and % lawn cover], Kingsville, Texas, June 2005.

Model	*P*-Value	R-Square	Adjusted R-Square	AIC	ΔAIC	MSE
% Shade tree cover % Mesquite tree cover % Lawn cover	<0.001	0.62	0.59	92.81	0.00	6.04
% Shade tree cover	<0.001	0.57	0.56	92.93	0.12	6.40
% Shade tree cover % lawn cover	<0.001	0.59	0.57	93.34	0.53	6.33
% Lawn cover	0.002	0.24	0.21	122.99	30.18	11.60
% Mesquite tree cover	0.004	0.21	0.18	124.77	31.96	12.03
Total % woody canopy cover	0.008	0.14	0.12	127.12	34.31	12.86

Habitat Attributes Associated with White-winged Doves

Regarding fine-resolution habitat variables, we documented a positive, quadratic relationship between total tree density and white-winged dove density ($R^2 = 0.28$; $P = 0.002$; Figure 1a). This relationship appeared to be driven by two data points which skewed the data. However, removing these data points still resulted in a positive, linear relationship between total tree density and white-winged dove density ($R^2 = 0.36$; $P < 0.001$). The strongest relationship existed between favorable tree density and white-winged dove density ($R^2 = 0.40$; $P < 0.001$; Figure 1b; Table 2). We did not find any relationship between white-winged dove density and mesquite tree density ($R^2 = 0.02$; $P < 0.395$; Figure 1c; Table 2).

Regarding land cover habitat variables, we found weak relationships between dove density and % woody canopy cover ($R^2 = 0.14$; $P = 0.008$), % mesquite tree canopy cover ($R^2 = 0.21$; $P = 0.026$), and % lawn cover ($R^2 = 0.24$; $P = 0.021$; Figure 2a, c, d).

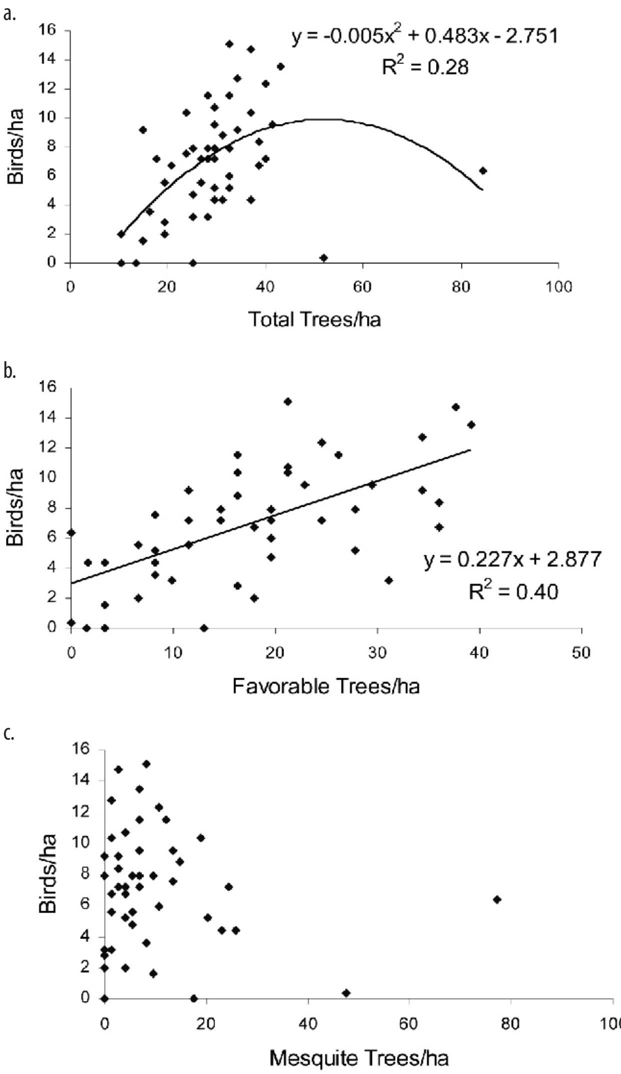

Figure. 1. Scatter plot showing relationships between (a) total tree density and white-winged dove density, (b) favorable tree density and white-winged dove density, and (c) mesquite tree density and white-winged dove density in Kingsville, Texas, June 2005.

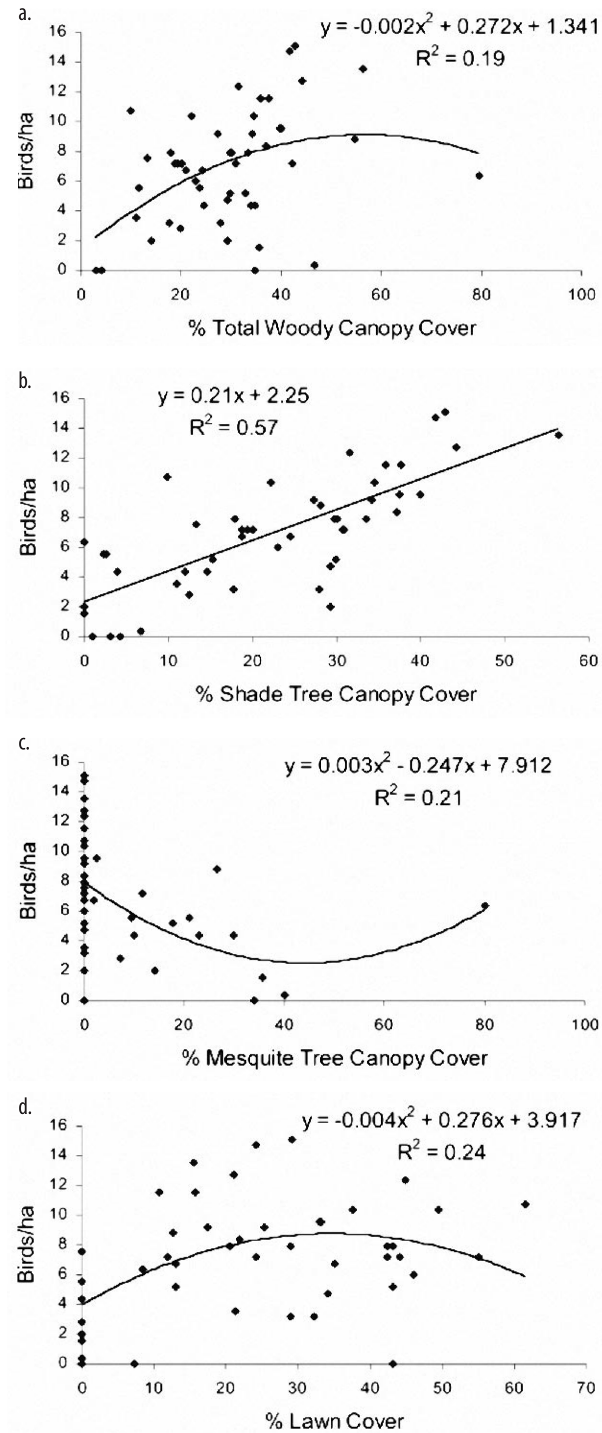

Figure. 2. Scatter plot showing relationships between (a) Total % woody canopy cover and white-winged dove density, (b) % shade tree canopy cover and white-winged dove density, (c) % mesquite tree canopy cover and white-winged dove density, and d) % lawn cover and white-winged dove density in Kingsville, Texas, in June 2005.

Our strongest single variable relationship involved % shade-tree cover and white-winged dove density ($R^2 = 0.57$; $P < 0.001$; Figure 2b; Table 3). Adding % lawn cover to the model with % shade tree cover resulted in an increase in adjusted R-square value of 0.01 but an increase in AIC by 0.41. Adding % mesquite tree cover with % lawn cover and % shade tree cover increased the adjusted R-square value by 0.05 and decreased the AIC value by 0.12.

Discussion

Our results indicate that live oak was an important component of white-winged dove nesting habitat in our urban landscape. Similar to our study, Hayslette and Hayslette (1999) documented that 94% of white-winged dove nests were situated in live oak trees on a university campus encompassed within our study area.

However, their methods only included a university campus which may not represent habitat throughout the entire urban area. Also, they did not include mesquite trees in their analyses. We speculate that our finding is applicable to other urban environments in Texas where live oak occurs. West (1993) also found that live oak was preferred nesting habitat in San Antonio, Texas. We hypothesize that live oak was an important nesting substrate in our study because its dense canopy and dark green foliage resembles the foliage of Texas ebony, a preferred tree in native south Texas habitat (Cottam and Trefethen 1968:50) and likely provides similar nest cover benefits. However, we documented that other tree species with similar canopy characteristics as live oak were not selected (i.e., Mexican ash and sugarberry). We cannot adequately explain why these trees were not selected for by breeding white-winged doves in our study. Research suggests that Arizona ash (*Fraxinus velutina*) (similar in appearance to Mexican ash) and sugarberry are preferred nesting substrates of white-winged doves in other urban areas of Texas (West 1993, Small et al. 2005). Perhaps all these species represent suitable nesting substrate for white-winged doves, but dove selection occurs on a continuum of canopy coverage from most dense to least dense. If this speculation is true, then live oak trees would represent a first-choice habitat, with doves nesting in the other suitable tree species as live oak availability declined. This tree-canopy hypothesis requires further testing, however.

Honey mesquite occurred in the highest density in Kingsville, but was selected against by white-winged dove for nesting. In native habitat, mesquite also was not a preferred nesting tree (Cottam and Trefethen 1968:52, George et al. 1994). Our finding is consistent with our tree-canopy hypothesis above because mesquite has a relatively open canopy and does not resemble preferred trees in native habitat. Thus, tree foliage cover may be an important indicator of tree suitability and selection for white-winged dove nesting.

Our results indicated that favorable-tree density was the best predictor of white-winged dove density for the tree density variables. We observed no relationship in either mesquite density or total tree density. Similarly for land cover variables, we detected weak relationships between both % mesquite cover and % total woody cover and white-winged dove density. However, % canopy cover of shade trees (i.e., favorable trees) was positively correlated with density of white-winged doves. Adding % mesquite tree cover and % lawn cover to the model resulted in a small improvement. Thus, the pattern emerging from our data collectively is that white-winged dove density in urban environments is associated with the presence and canopy cover of trees suitable for nesting. The inclusion of % mesquite cover and % lawn cover may indicate that white-winged dove prefer habitat with a dense canopy but open understory. Therefore, the amount of canopy cover of favorable nesting trees within suburban residential areas may be a predictor of white-winged dove density in that area.

Management Implications

Because white-winged doves continue to expand northward, there is a continual need to survey additional cities. Knowledge of habitat characteristics influencing dove nesting and presence provides valuable information necessary for designing efficient and effective surveys. The results from this and prior research indicate that shade trees characterized by dense foliage are an important component of white-winged dove breeding habitat in urban areas. These data can be used to develop crude habitat-suitability models to predict potential white-winged dove habitat in urban areas and thereby used to refine survey protocol regarding allocation and distribution of survey points. Therefore, surveys can be made more efficient and reliable by concentrating survey effort in areas where white-winged doves occur. Researchers also may be able to simply examine an aerial photo of an urban area and identify possible preferred habitat in which to place survey points based on presence and canopy cover of favorable nesting trees.

Acknowledgments

We acknowledge M. J. Peterson and G. L. Waggerman for providing advice and support for this study. We thank S. E. Henke, A. Ortega-Santos, and two anonymous reviewers for constructive comments on an earlier draft of this manuscript. We thank the Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, and Texas A&M University for providing logistical support and equipment. Funding for this study was provided by Texas Parks and Wildlife Department. This manuscript is Caesar Kleberg Wildlife Research Institute manuscript number 07–118.

Literature Cited

Armbruster, M. J. and T. S. Baskett. 1985. A seven-year study of mourning dove call-counts and nesting activity in central Missouri. Transactions of the Missouri Academy of Science 19:23–30.

———, ———, and K. C. Sadler. 1978. Evaluating call-count procedures for measuring local mourning dove populations. Transactions of the Missouri Academy of Science 12:75–90.

Breeden, J. B. 2005. An assessment of survey methods for white-winged dove populations in urban areas. Dissertation. Texas A&M University-Kingsville.

———, F. Hernandez, N. J. Silvy, R. L. Bingham, and G. L. Waggerman. 2004. An evaluation of sampling methods for white-winged dove surveys in urban areas. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 58:274–281.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, New York.

Cottam, C. and J. B. Trefethen. 1968. Whitewings: the life history, status, and management of the white-winged dove. D. Van Nostrand Co. Princeton, New Jersey.

George, R. R. 1991. The adaptable whitewing. Texas Parks and Wildlife Department, 49:10–15. Austin.

———, R. E. Tomlinson, R. W. Engel-Wilson, G. L. Waggerman, and A. G. Spratt. 1994. White-winged dove. Pages 28–50 *in* T. C. Tacha and C. E. Braun, editors. Migratory shore and upland game bird management in North America. Second edition. International Association of Fish and Wildlife Agencies, Washington, D.C.

Hayslette, S. E. and B. A. Hayslette. 1999. Late and early season reproduction of urban white-winged doves in southern Texas. Texas Journal of Science 51:173–180.

———, T. C. Tacha, and G. L. Waggerman. 1996. Changes in white-winged dove reproduction in southern Texas, 1954–1993. Journal of Wildlife Management 60:298–301.

Kiel, W. H. and J. T. Harris. 1956. Status of the white-winged dove in Texas. Transactions of the North American Wildlife and Natural Resources Conference 21:376–389.

Marsh, E. G., Jr. and G. B. Saunders. 1942. The status of the white-winged dove in Texas. Wilson Bulletin 54:145–146.

Neu, C. W., C. R. Byers, and J. M. Peek. 1974. A technique for analysis of utilization-availability data. Journal of Wildlife Management. 38:541–545.

Rappole, J. H. and G. L. Waggerman. 1986. Calling males as an index of density for breeding white-winged doves. Wildlife Society Bulletin 14:151–155.

SAS Institute 2001. SAS software release 8.2. SAS Institute Inc. Cary, North Carolina.

Schwertner, T. W., H. A. Mathewson, J. A. Roberson, M. Small, and G. L. Waggerman. 2002. White-winged dove (*Zenaida asiatica*). Pages 1–28 *in* A. Poole and F. Gill, editors. The Birds of North America, No. 710. The Birds of North America, Inc., Philadelphia, Pennsylvania.

Sepulveda, M. 2004. An evaluation of auditory coo-counts to estimate breeding populations of white-winged doves in a rural setting. Thesis. Texas A&M University-Kingsville.

Small, M. F., R. A. Hilsenbeck, and J. F. Scuddy. 1989. Resource utilization and nesting ecology of the white-winged dove (*Zenaida asicatica*) in central Trans-Pecos, Texas. Texas Journal of Agriculture and Natural Resources 3:37–38.

———, C. L. Schaefer, J. T. Baccus, and J. A. Roberson. 2005. Breeding ecology of white-winged doves in a recently colonized urban environment. Wilson Bulletin 117:172–176.

———, and G. L. Waggerman. 1999. Geographic redistribution of breeding white-winged doves in the lower Rio Grande Valley of Texas: 1976–1997. Texas Journal of Science 51:15–19.

Thomas, L., J. L. Laake, S. Strindberg, F. F. C. Marques, S. T. Buckland, D. L. Borchers, D. R. Anderson, K. P. Burnham, S. L. Hedley, J. H. Pollard, J. R. B. Bishop, T. A. Marques. 2005. Distance 5.0. Release "beta 3". Research Unit for Wildlife Population Assessment, University of St. Andrews, Scotland, UK. http://www.ruwpa.st-and.ac.uk/distance/

Waggerman, G. L. 2001. White-winged dove density, distribution, movement, and harvest. Performance Report, Federal Aid Project W-128-R, Job 9. Texas Parks and Wildlife Department. Austin, Texas.

West, L. M. 1993. Ecology of breeding white-winged doves in the San Anotonio metropolitan area. Thesis. Texas Tech University, Lubbock, Texas.

West, L. M., L. M. Smith, R. S. Lutz, and R. R. George. 1993. Ecology of urban white-winged doves. Transactions of the North American Wildlife and Natural Resources Conference 58:70–77.