



Texas Parks and Wildlife Department

Dove Population Status and Harvest, 2021



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Mourning, White-winged, and Eurasian Collared-dove Population Status and Harvest, 2021

EXECUTIVE SUMMARY

On average, Texas accounts for 30% of the total mourning dove harvest and 84% of the total white-winged dove harvest in the United States each year. Approximately 300,000 hunters take the field in Texas annually, resulting in a yearly economic impact of \$316 million (\$427 million when adjusted for inflation) (Southwick and Allen 2007). Regular monitoring of dove populations is essential to effectively managing and conserving such an important recreational and biological resource. Since 2008, Texas Parks and Wildlife Department (TPWD) has conducted rural and urban dove surveys using distance sampling to estimate annual spring breeding abundance, except for 2020 when surveys were cancelled due to restrictions from the COVID-19 pandemic. This report provides updated results from these surveys for 2021 and provides information on hunter and harvest trends for mourning, white-winged, and Eurasian collared-doves in Texas.

The 2021 combined (rural and urban) breeding mourning dove population is an estimated 23.46 million, which is 8.9% above the 2019 estimate and -17.7% below the long-term average (LTA; 2008-19). Of this total, 89.6% occurred in rural areas and 10.4% in urban areas. From 2008-21, combined statewide mourning dove abundance ranged from 21.55 million in 2019 to 37.46 million in 2016. Mourning dove densities in urban areas were, on average, 2.2 times greater (0.9-4.3) than densities in rural areas.

The 2021 combined (rural and urban) breeding white-winged dove population is estimated at 10.23 million birds, which is a 5.6% decrease from the 2019 estimate and 4.5% above the LTA (2008-19). Of this combined total, 83.9% of the white-winged doves occupied urban areas as compared to rural areas (16.1%). From 2008-21, statewide white-winged dove abundance ranged from 6.73 million in 2008 to 11.7 million in 2015. White-winged dove densities in urban areas were, on average, 259 times greater (23.5-731.8) than in rural areas.

The 2021 combined (rural and urban) Eurasian collared-dove breeding population is an estimated 3.62 million, which is a 5.1% increase from 2019 and -9.3% below the LTA (2008-19). Of this total, 51.9%

occurred in urban areas and the remainder in rural areas (49.1%). Eurasian collared-dove densities in urban areas were, on average, 31 times greater (5.0-135.9) than in rural areas.

Based on USFWS estimates, 3.73 million mourning doves were harvested during the 2020-21 hunting season, a 10% increase from the previous hunting season and -19% below the LTA (2003-19). White-winged dove harvest decreased 40.3% from 2019-20 to 2020-21 to a total of 939,600 statewide, -31.2% below the LTA (2008-19).

Background

The Texas Parks and Wildlife Department (TPWD) has monitored dove populations in Texas since the late 1930s. In 1951, TPWD began Call-count surveys (CCS) to inventory mourning doves in Texas. The CCS involved counting individual doves heard cooing along preselected survey routes and were conducted across the United States from 1966-2013 for regulatory management (Dolton 1993, Seamans 2021). The US Fish and Wildlife Service (USFWS) discontinued the CCS in 2013 and now obtains annual estimates of absolute mourning dove abundance using harvest rates from band-recovery and harvest data in a modified form of a Lincoln estimator (Lincoln 1930) for each of the three dove management units: Eastern, Central, and Western. Age-specific harvest and survival rates are calculated using band-recovery data, and annual recruitment is estimated using data from the Parts Collection Survey. These data are then used in a logistical model to predict future abundance and help determine appropriate annual hunting regulations for each upcoming season (U.S. Fish and Wildlife Service 2017). The USFWS monitors harvest but has no harvest management strategy or population monitoring plan in place for white-winged doves.

The CCS provided an index to abundance but could not produce an estimate of absolute abundance, so it was ultimately replaced with the Lincoln estimator approach. Although indices can be useful in wildlife management (Johnson 2008), estimates of absolute abundance are preferred in wildlife field studies (Anderson 2001). Due to technological advances in both methods and analysis, distance sampling has become a widely accepted tool for estimating wildlife abundance for management and monitoring at both regional and national levels (Buckland et al. 1993).

In 2004, TPWD initiated the Modified Call-Count Survey (MCCS), a monitoring program that incorporated a distance sampling component into CCS to estimate breeding season abundance of mourning doves in Texas. Observers were trained on distance sampling methods for field data collection using rangefinders to determine exact distances for both ocular and auditory observations of doves. In

2008, the MCCA was expanded in scope to include both white-winged and Eurasian collared-dove observations.

In 1949, TPWD began using an auditory-count index to monitor breeding white-winged doves in historic nesting areas in the Lower Rio Grande Valley (Cottam and Trefethen 1968). However, these field methods eventually proved to yield inaccurate and unreliable indices (Sepulveda et al. 2006). As white-winged doves expanded in range outside of the Lower Rio Grande Valley (Butcher et al. 2014) and began to occupy urban and suburban habitats, exploratory urban surveys were conducted in the San Antonio and Austin areas from the 1990s to early 2000s (Breedon et al. 2004). In 2008, a monitoring program utilizing distance sampling methods was initiated to sample urban and suburban areas each spring and provide breeding season abundance estimates for white-winged doves. Similar to the MCCA, these Urban Dove Surveys (UDS) are designed to also include both mourning and Eurasian collared-dove observations.

Eurasian collared-doves are not regulated by USFWS under the Migratory Bird Treaty Act, nor are they considered a game species by TPWD. First observed in Texas in 1995, Eurasian collared-doves are now distributed widely across the state and throughout much of North and South America. Monitoring abundance and distribution of this species in Texas may be important for understanding disease risk and potential impacts to native species.

Doves are an important recreational and biological resource for the state of Texas, and TPWD is responsible for the management and conservation of these species for the use and enjoyment of present and future generations. The MCCA and UDS are not directly utilized for regulatory purposes, but they do provide TPWD with important monitoring on population trends and annual status of doves in Texas that can inform regulatory decisions and direct priority research and management needs.

METHODS

Population Status: Modified Call-Count Surveys (MCCA)

From 1966-2013, over 1,000 CCS routes were randomly selected and surveyed in all conterminous US states from May 20 – June 10. Routes were located on secondary roads and had 20 survey points spaced at 1-mile intervals. At each point, the number of individual doves heard calling, the number of doves seen, and the level of disturbance (noise) that impairs the observer's ability to hear doves were recorded during a 3-minute period. Doves observed between stops were also recorded. Surveys began ½-hour

before sunrise, took approximately 2 hours to complete, and were not conducted when wind velocities exceeded 12 miles per hour or at times of precipitation (Dolton 1993).

In 2004, TPWD began incorporating distance sampling techniques into the CCS to estimate mourning dove abundance in Texas, resulting in the MCCA. The modifications to the survey required the use of rangefinders to obtain exact distances of mourning dove observations from each stop point location during the 3-minute period. In 2008, the MCCA was expanded to include both white-winged and Eurasian collared-dove observations. Though national CCS routes were discontinued in 2013, TPWD continues to conduct the MCCA in Texas each year. In 2015, the annual survey period was extended to May 15 –June 15 for consistency with a nationwide MCCA study with this extended time frame. That same year, observers also began to record groups of birds as clusters instead of individuals. Although methodologies differed slightly pre and post 2015, minimal differences occur in abundance estimates due to the relatively small average cluster size across years ($\bar{x} = 1.2$, 2004-21).

Population Status: Urban Dove Surveys (UDS)

Prior to 2008, urban dove survey efforts were limited to the Lower Rio Grande Valley and a select few areas of interest in the rest of the state (e.g. San Antonio, El Paso). As white-winged doves expanded in range, a statewide monitoring effort that targeted urban and suburban habitats was developed. Urban areas were delineated using National Land Cover Database (NLCD) urban classifications and buffered 500 meters, since white-winged doves are typically found within 500 meters of urban habitat (Schwertner and Johnson 2005). Since most TPWD staff workstations are not near urban centers, a point selection system was developed to optimize each observer's time commitment and reduce logistical costs. Workstation locations were plotted in a GIS and buffered 45 miles to create a non-overlapping polygon for each observer, resulting in a division of each observer's space relative to adjacent observers that prevented them from having to drive more than 1 hour to any survey point. A statewide Universal Transverse Mercator (UTM) grid of points 500 meters apart was created and then clipped within each NLCD urban polygon. The Texas Department of Transportation (TXDOT) roadnet coverage was also clipped to lie within the urban polygons. The grid points were then further reduced in number to any point lying within 100 meters of a TXDOT road feature. Those remaining points were then snapped to the nearest road and given a unique ID number, resulting in a set of 8,500 unique points available for selection. Points were then grouped by city/town and assigned to observers. Surveys are conducted

between May 15 – June 15, from sunrise to 2.5 hours past sunrise. Species, flock sizes, and exact distances from survey points are obtained during a 2-minute survey period at each point.

Population Status: Analytical

We used the ‘Distance’ package in R 4.0.2 (Miller 2021, R Core Team 2021) to model detection and calculate density estimates for each species in each Bird Conservation Region (BCR) (Bird Studies Canada 2014, US NABCI Committee 2000) in Texas (Figure 1). All data were right-truncated by the largest 10% of the observations for all species and years (Buckland et. al 1993). For the MCCA, we considered the 20 points along each route as repeated samples to reduce the magnitude of any effects of roadside sampling bias. Detections were pooled across species in each BCR by year to estimate detection functions due to the low number of observations in some species in some years, and species was included as a factor covariate as described in Buckland et al. 2015. We used model selection procedures based on Akaike Information Criteria (AIC) to select the most parsimonious model and considered models competitive if they were within ΔAIC of 2 (Burnham and Anderson 2002). We used quantile-quantile plots and Cramér-von Mises tests to inspect goodness-of-fit for all top models and, where appropriate, to choose between competing models (Miller et al. 2019).

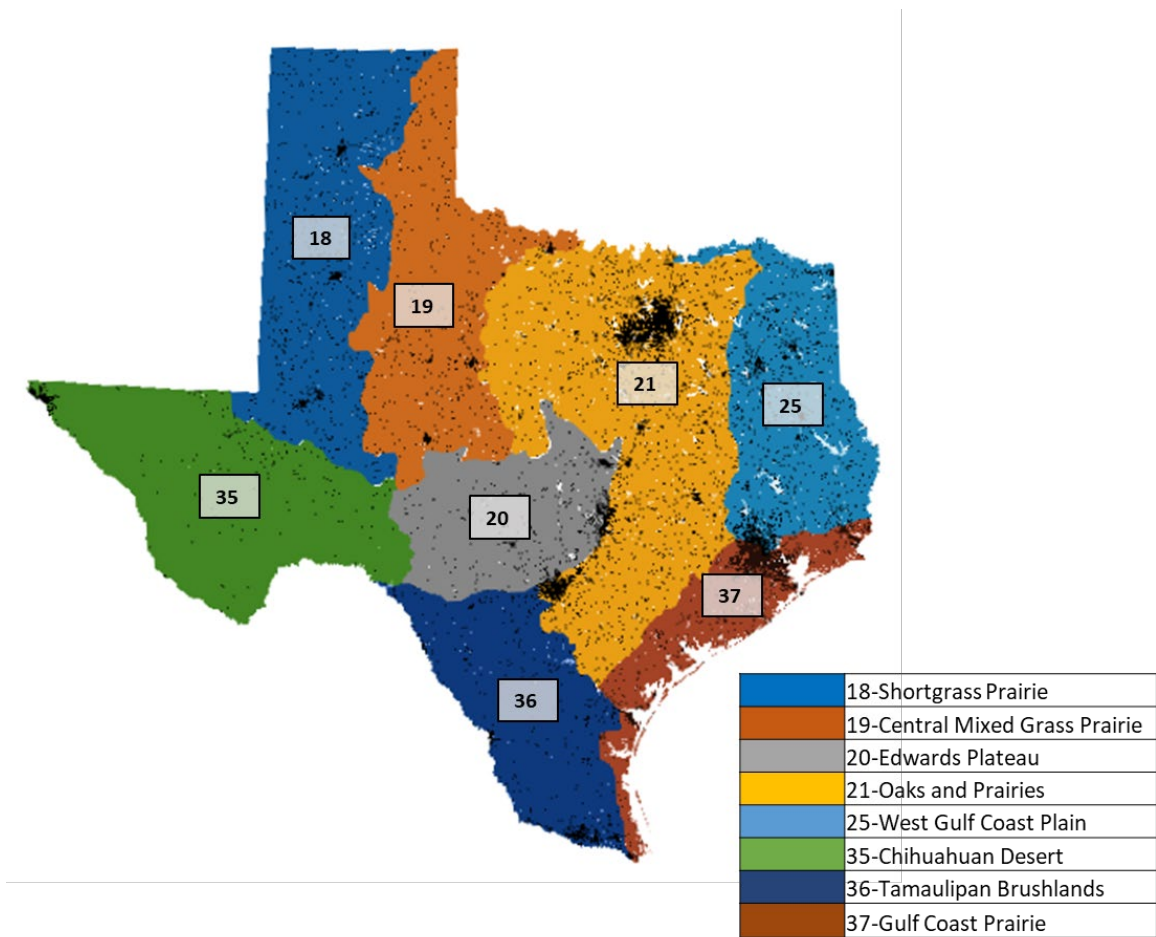


Figure 1. Bird Conservation Regions (BCRs) of Texas. ¹

We used the National Land Cover Database (2019) suite of conterminous U.S. land cover to calculate total urban and rural area in each Texas BCR, then extrapolated density estimates for each species from MCCS (rural) and UDS (urban) using the respective calculated areas to determine abundance. The NLCD 2019 suite includes eight epochs of land cover (2001, 2004, 2008, 2011, 2013, 2016, and 2019). For years without NLCD data, we calculated the percent change in urban and rural area between successive NLCD datasets and averaged across the missing years to obtain annual estimates of area. Because there are no NLCD data beyond 2019 at the time of analyses, we used 2019 urban and rural area estimates for 2021.

¹ Developed by the North American Bird Conservation Initiative (NABCI) Committee, these are ecologically distinct regions with similar bird communities, habitats, and resource management issues (Bird Studies Canada 2014, US NABCI Committee 2000).

Harvest Surveys

We report USFWS harvest and hunter estimates (Dubovsky 2020, Raftovich et al. 2021, Seamans 2021) for both mourning and white-winged doves in Texas since 2003. Information prior to 2003 is not comparable since sampling methods changed the first few years after the introduction of the Hunter Information Program (HIP) in 1999. We used TPWD Small Game Harvest Survey estimates to report trends in mourning and white-winged dove harvest in different Gould ecoregions (Figure 2) and for statewide Eurasian collared-dove harvest estimates (Purvis 2021).

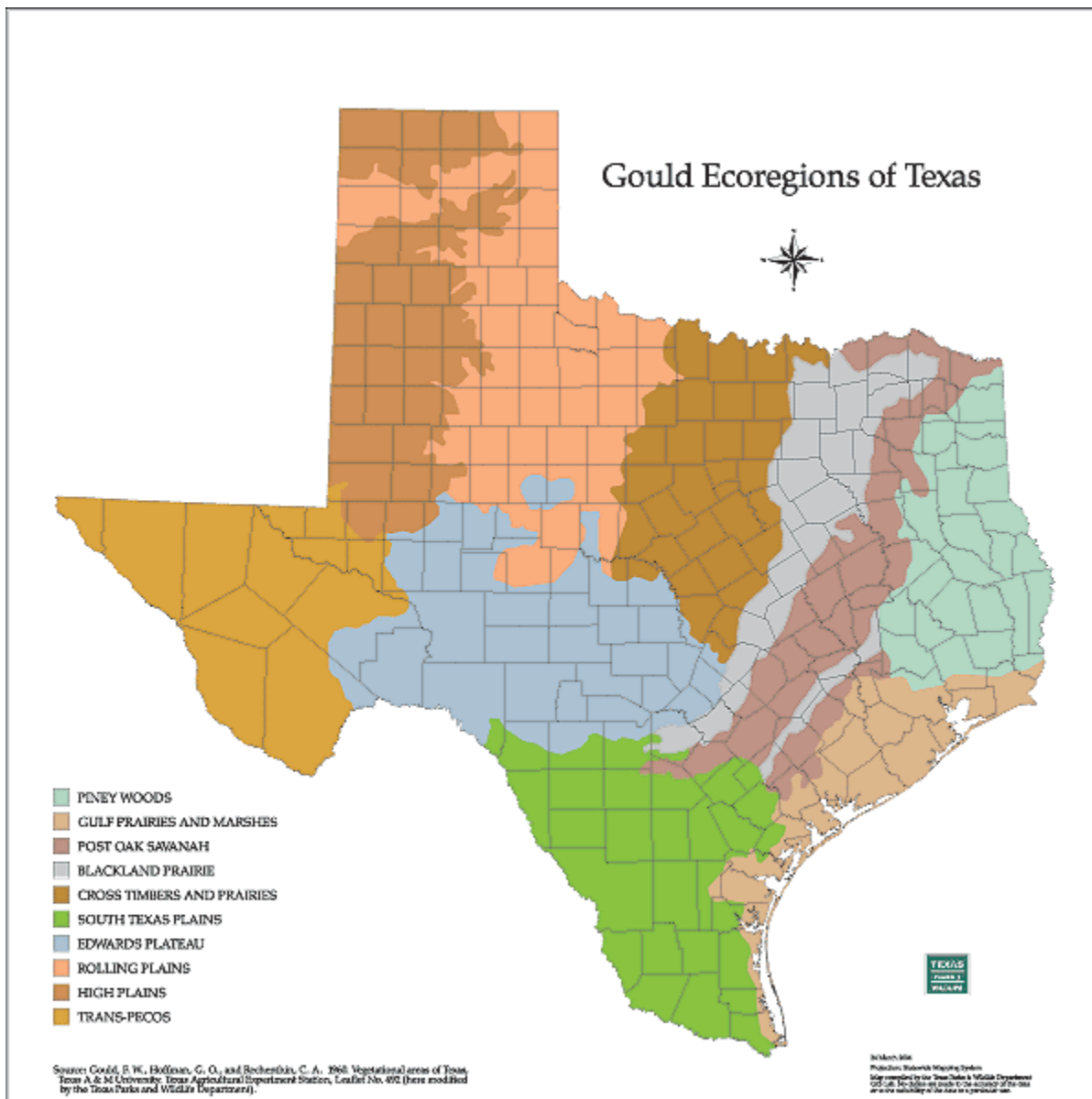


Figure 2. Gould's Ecoregions of Texas

RESULTS: Population Status

Mourning Dove

The combined rural and urban breeding abundance estimate for mourning doves in 2021 is 23.46 million, which is 8.9% above the 2019 estimate and -17.7% below the LTA (2008-19). Of this total, 89.6% occurred in rural areas compared to urban areas (10.4%). From 2008-21, combined statewide mourning dove breeding abundance ranged from 21.55 million in 2019 to 37.46 million in 2016 (Figure 3). Mourning dove densities in urban areas were, on average, 2.2 times greater (0.9-4.3) than densities in rural areas.

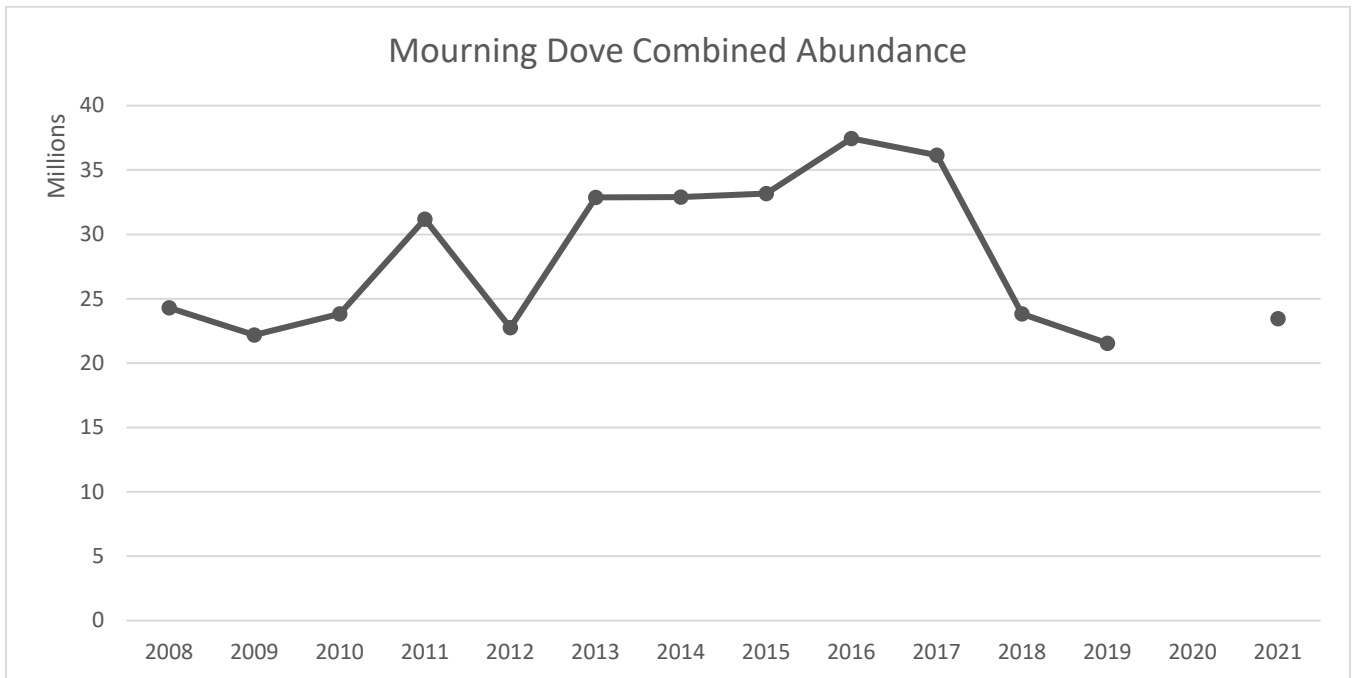


Figure 3. Combined (rural and urban) breeding abundance of Mourning Doves in Texas (2008-21), from the MCCA and UDS.

Rural (MCCA)

Based on MCCA results, the 2021 statewide rural breeding population of mourning doves in Texas is an estimated 21.03 million, which is a 13.0% increase over the 2019 estimate and -16.9% below the LTA (2008-21). From 2008-21, the rural mourning dove population ranged from 18.61 million in 2019 to 34.24 million in 2016 (Figure 4).

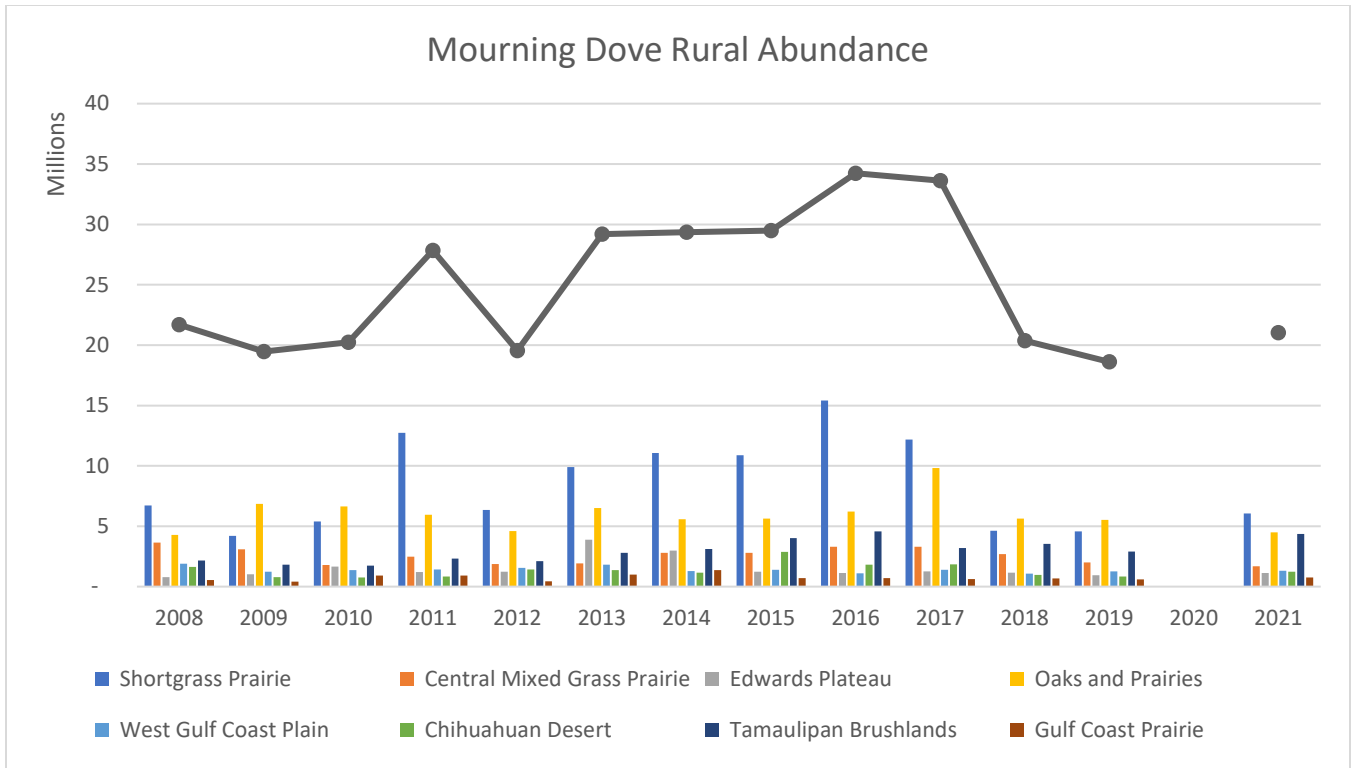


Figure 4. Breeding abundance of rural mourning doves in Texas (2008-21). from the MCCA.

In 2021, the largest rural breeding abundances of mourning doves occurred in the Shortgrass Prairie (6.05 million), Oaks and Prairies (4.49 million), Tamaulipan Brushlands (4.35 million), and Central Mixed Grass Prairie (1.70 million) BCRs (Table 1). On average, 80% of the state’s rural breeding population of mourning doves are found in these four BCRs, which encompass an estimated 61% of the state’s rural landscape (Figure 5).

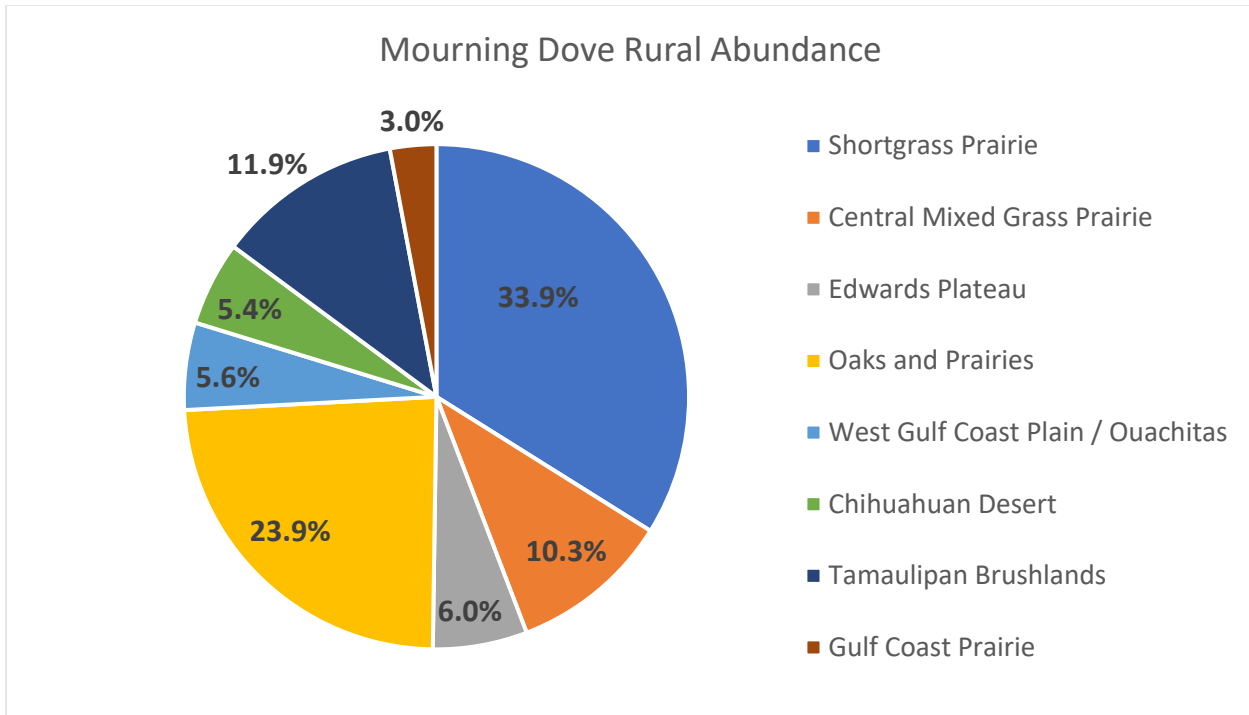


Figure 5. Average percentage of statewide mourning dove rural breeding abundance in Texas BCRs (2008-21), based on MCCS.

Increases in rural mourning dove abundance from 2019 to 2021 were observed in the Tamaulipan Brushlands (50.4%), Chihuahuan Desert (46.6%), Shortgrass Prairie (32.2%), Gulf Coast Prairie (25.4%), Edwards Plateau (22.4%), and West Gulf Coast Plain (5.44%) BCRs. Declines were observed in the Oaks and Prairies (-18.8%) and Central Mixed Grass Prairie (-15.0%) BCRs (Table 1).

Rural mourning dove densities in 2021 ranged from 0.13-0.67 doves/ha, with the highest densities supported in the Tamaulipan Brushland (0.67 doves/ha), Shortgrass Prairie (0.61 doves/ha), Oaks and Prairies (0.33 doves/ha), and Gulf Coast Prairie (0.23 doves/ha) BCRs. On average from 2008-19, rural mourning dove densities were highest in the Shortgrass Prairie (0.86 doves/ha), Oaks and Prairies (0.45/ha), and Tamaulipan Brushlands (0.44 doves/ha), and lowest in the Gulf Coast Prairie (0.22 doves/ha), West Gulf Coast Plain (0.22 doves/ha), and Chihuahuan Desert (0.14 doves/ha) BCRs (Figure 6, Table 2).

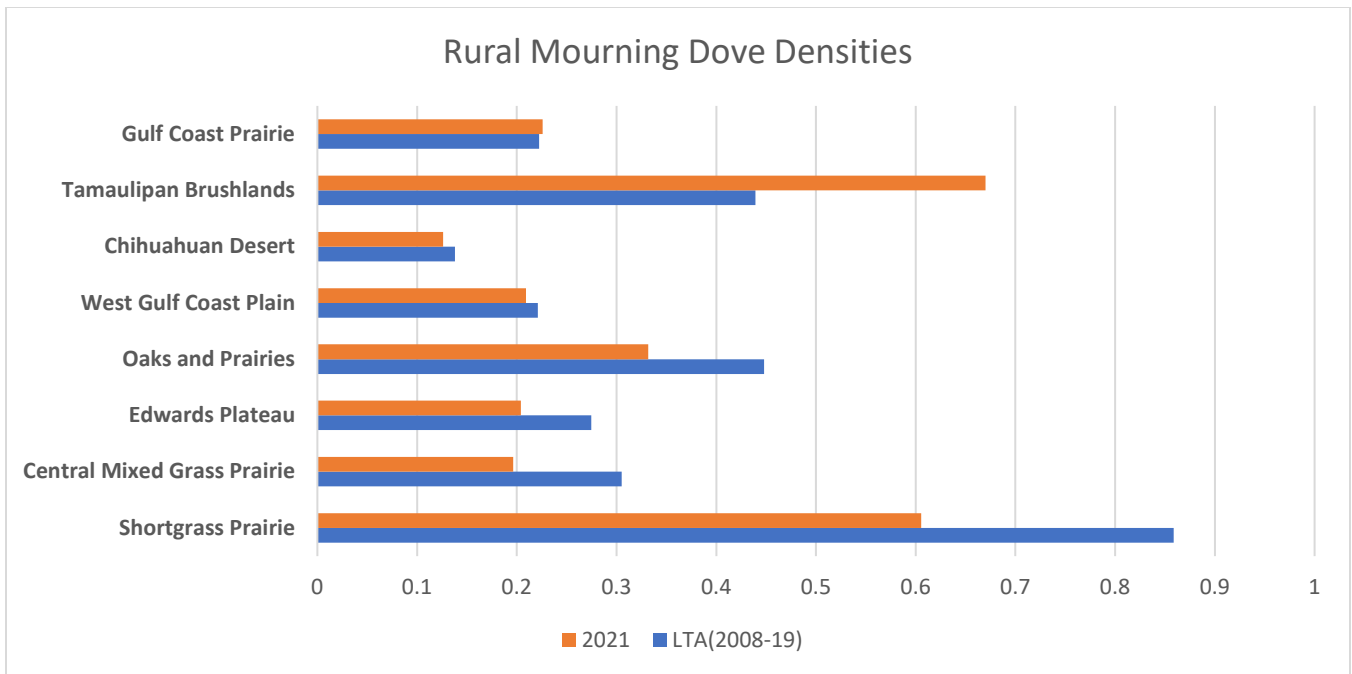


Figure 6. Rural mourning dove densities (doves/hectare) in 2021 compared to long-term average (2008-19) in Texas BCRs, based on MCCA.

Urban (UDS)

Based on UDS results, the 2021 statewide urban breeding population of mourning doves is 2.43 million, which is a -17.1% decrease from 2019 and -24.0% below the LTA (Figure 7). The largest urban populations occurred in the Oaks and Prairies (~944,000), Gulf Coast Prairie (~409,000), and Shortgrass Prairie (~350,000) BCRs, which comprise nearly 70% of the total urban mourning dove population in the state (Table 3). Percentage increases from 2019 to 2021 occurred in the Edwards Plateau (37.6%), West Gulf Coast Plain (13.6%), and Tamaulipan Brushlands (3.8%) BCRs. Decreases occurred in the Chihuahuan Desert (-48.9%), Gulf Coast Plain (-34.5%), Central Mixed Grass Prairie (-21.2%), Oaks and Prairies (-17.2%), and Shortgrass Prairie (-13.5%) BCRs.

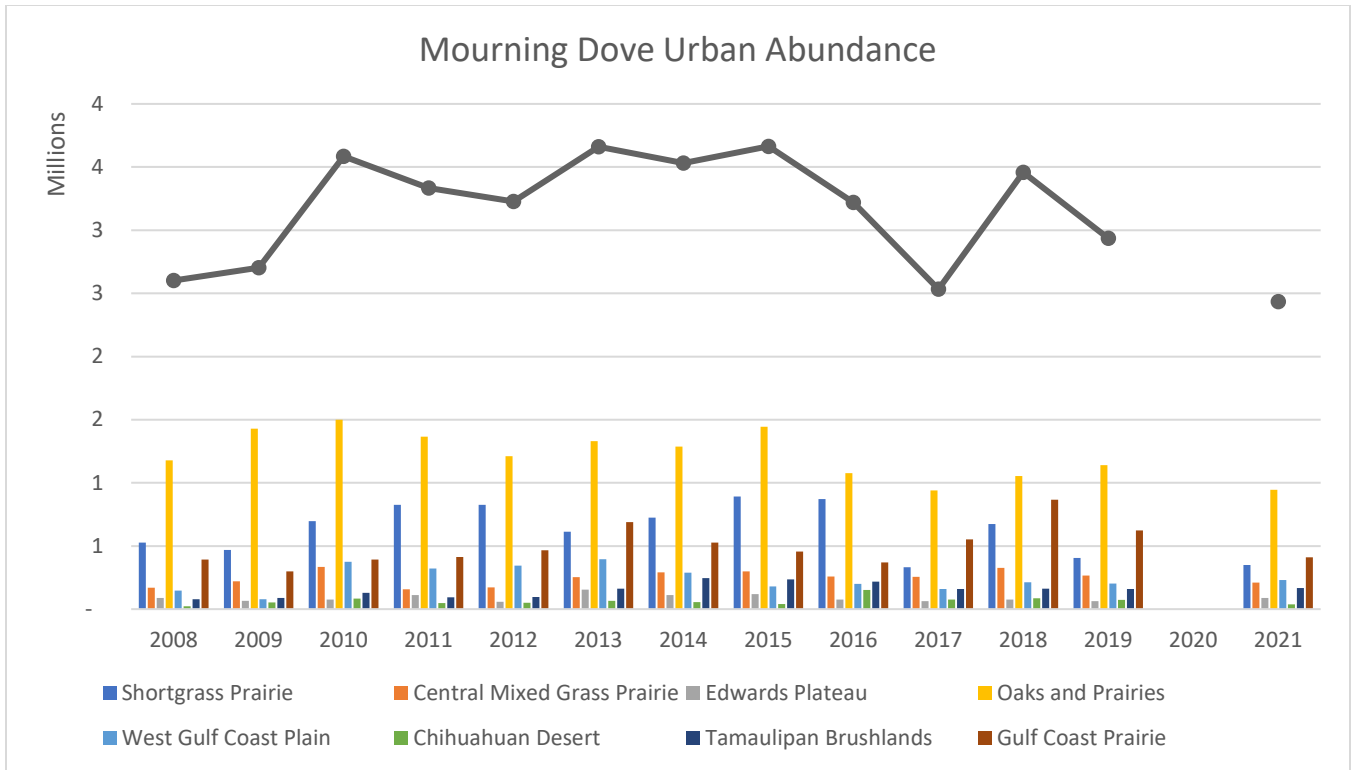


Figure 7. Breeding abundance of urban mourning doves in Texas (2008-21), from the UDS.

From 2008-21, urban mourning dove densities were typically greatest in the Shortgrass Prairie (1.66 doves/ha), Central Mixed Grass Prairie (1.02 doves/ha), Oaks and Prairies (0.93 doves/ha), and Gulf Coast Prairie (0.90 doves/ha), and lowest in the Tamaulipan Brushlands (0.59 doves/ha), Chihuahuan Desert (0.54 doves/ha), West Gulf Coast Plain (0.43 doves/ha), and Edwards Plateau (0.38 doves/ha) BCRs (Table 4).

White-winged Dove

The combined 2021 rural and urban breeding abundance estimate for white-winged doves is 10.23 million, which is a 5.6% decrease from 2019 and 4.5% above the LTA (2008-19). Of this total, 83.9% occurred in urban areas and the remainder in rural areas (16.1%). From 2008-21, statewide white-winged dove abundance ranged from 6.73 million in 2008 to 11.7 million in 2015 (Figure 8). White-winged dove densities in urban areas were, on average, 259 times greater (23.5-731.8) than in rural areas.

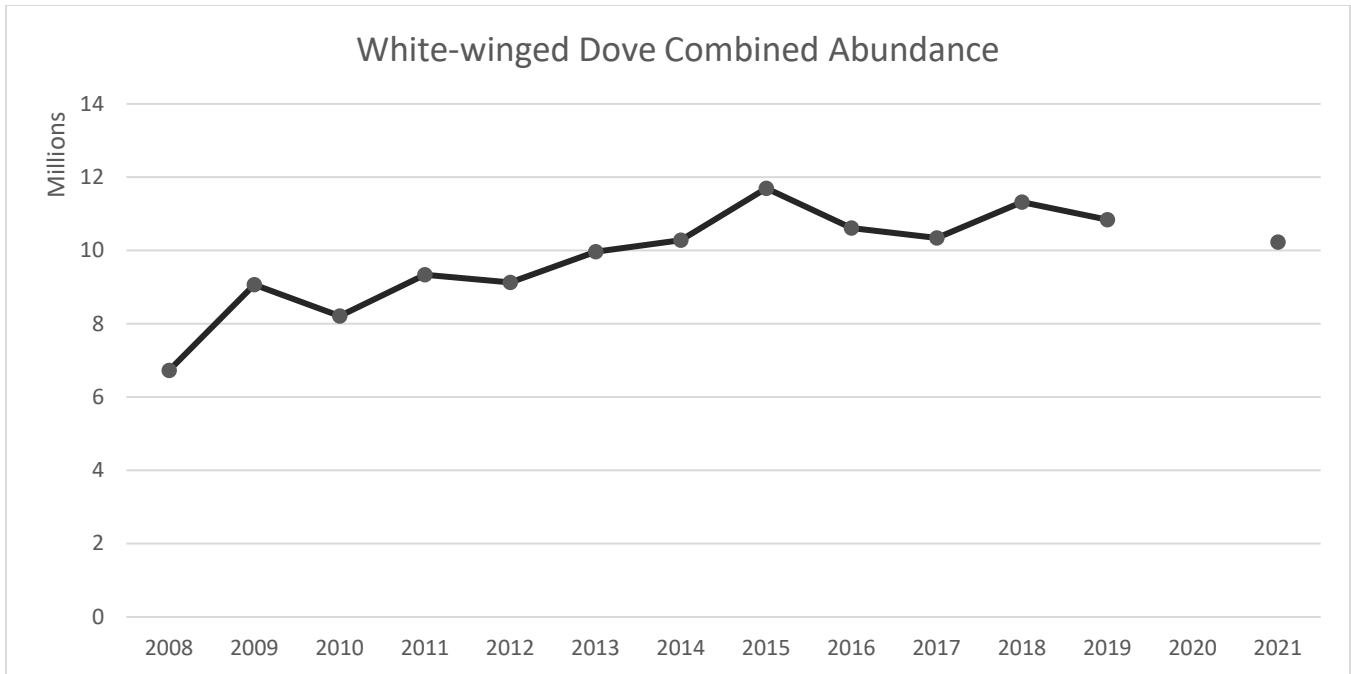


Figure 8. Combined (rural and urban) breeding abundance of White-winged Doves in Texas (2008-21), from the MCCA and UDS.

Rural (MCCA)

Based on 2021 MCCA results, statewide rural breeding abundance of white-winged doves is an estimated 1.64 million, which is a 24.5% increase over the 2019 estimate and 45.9% above the LTA (2008-19) (Figure 9). The largest rural abundances of white-winged doves occurred in the Tamaulipan Brushlands (~783,000), Chihuahuan Desert (~388,000), Edwards Plateau (~177,000), and Oaks and Prairies (~150,000) BCRs. All other BCRs supported less than 9% of the state’s rural breeding population (Table 5). Due to a low number of observations, annual estimates can be highly variable in some BCRs.

On average from 2008-21, rural white-winged dove densities were greatest in the Tamaulipan Brushlands (0.08 doves/ha) and Edwards Plateau (0.03 doves/ha) BCRs. All other BCRs averaged less than 0.02 doves/ha (Table 6).

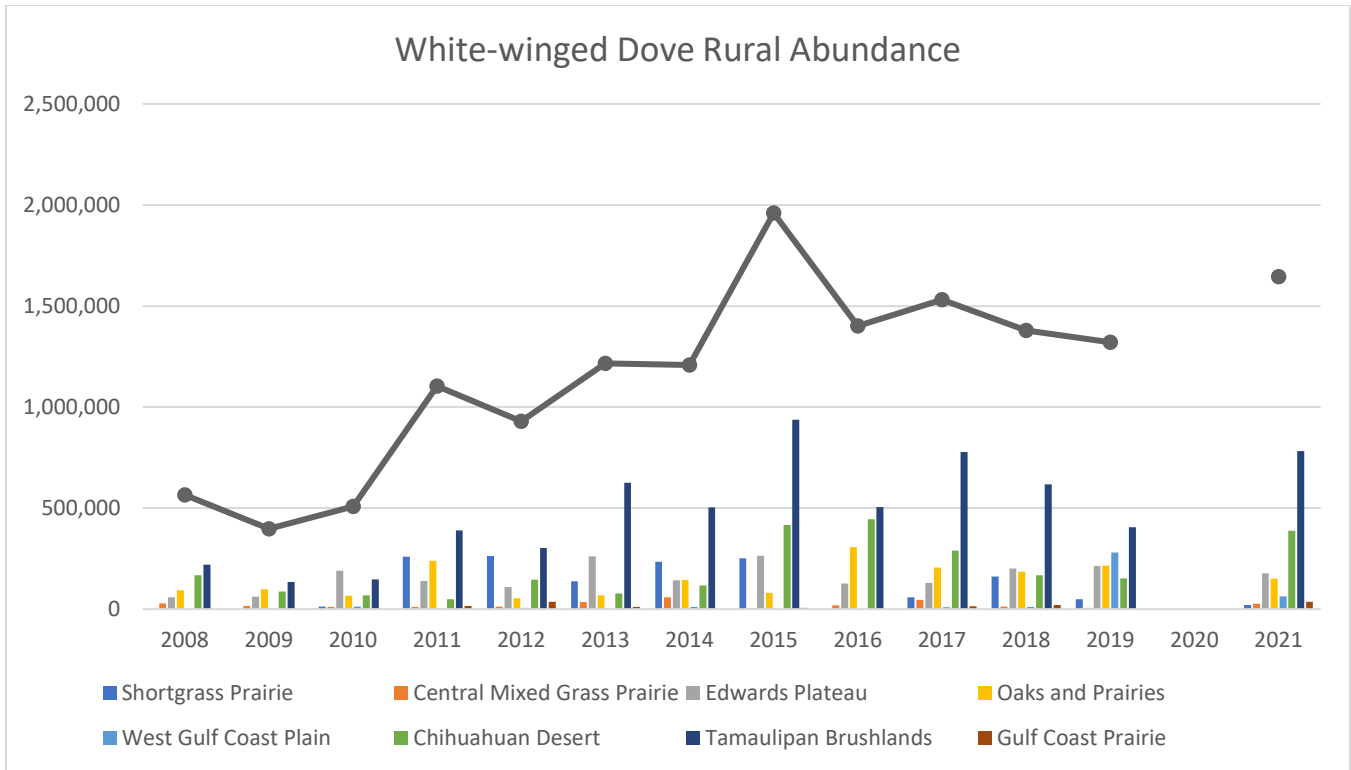


Figure 9. Breeding abundance of rural White-winged Doves in Texas (2008-21), from the MCCA.

Urban (UDS)

Based on 2021 UDS results, statewide breeding abundance of urban white-winged doves is 8.59 million, which is a 9.8% decrease from 2019 and -1.0% below the LTA (2008-19) (Figure 10).

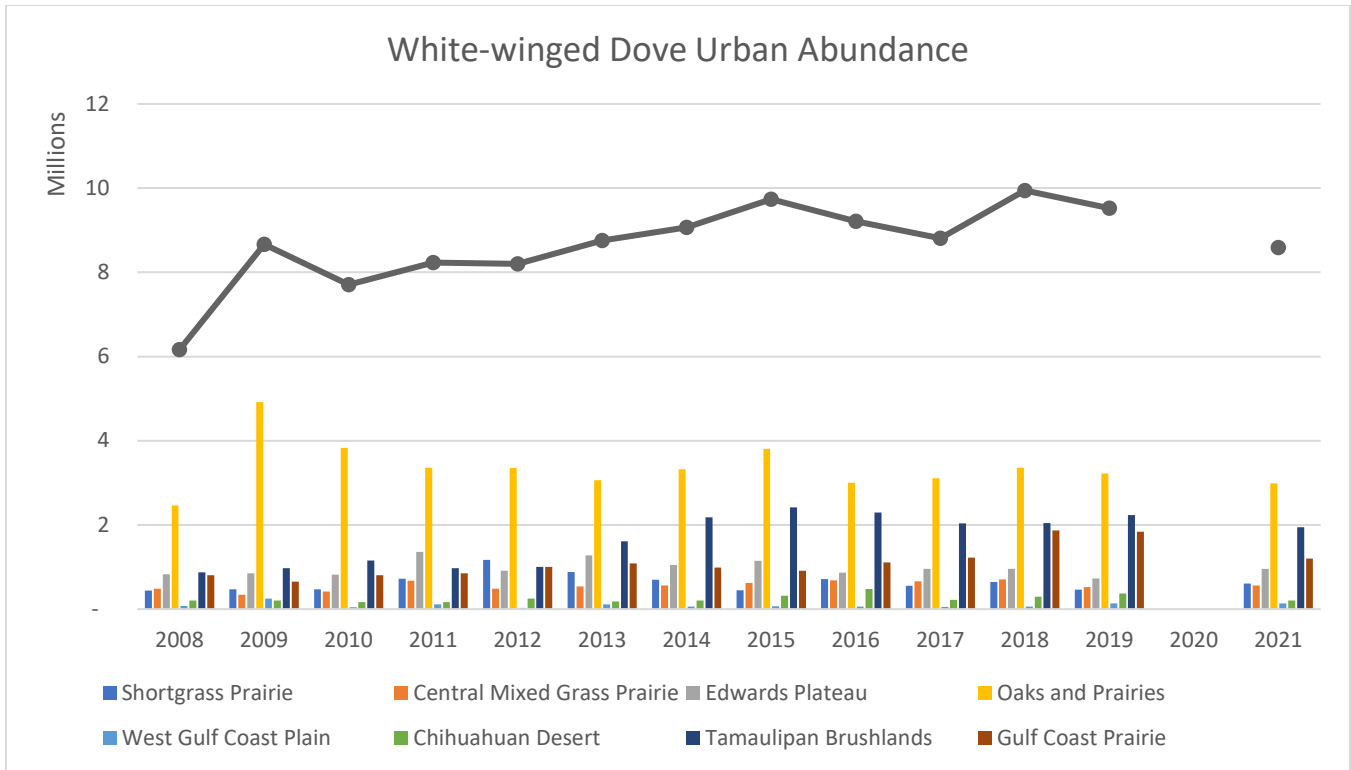


Figure 10. Breeding abundance of urban white-winged doves in Texas (2008-21), from the UDS.

The largest urban abundances of white-winged doves in 2021 occurred in the Oaks and Prairies (2.98 million), Tamaulipan Brushlands (1.94 million), Gulf Coast Prairie (1.20 million), and Edwards Plateau (0.96 million) BCRs. On average, 82.2% of the state’s urban breeding population of white-winged doves are found in these 4 BCRs (Figure 11), which encompass an estimated 64.3% of the urban area of Texas.

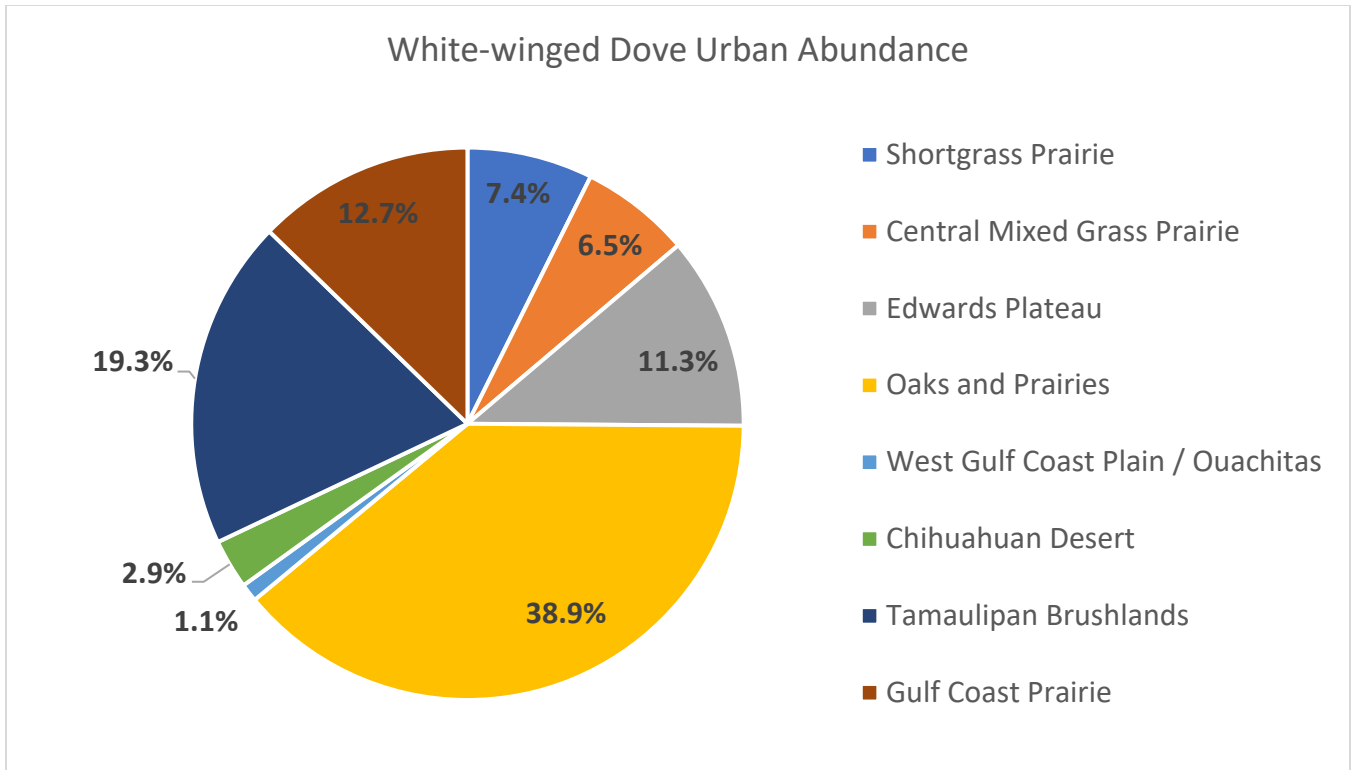


Figure 11. Average percentage of statewide white-winged dove urban breeding abundance in Texas BCRs (2008-21), based on UDS.

Increases in urban white-winged dove abundance from 2019 to 2021 occurred in the Shortgrass Prairie (30.5%), Central Mixed Grass Prairie (6.5%), Edwards Plateau (31.1%), and Western Gulf Coast Plain (4.0%) BCRs. Decreases occurred in the Oaks and Prairies (-7.39%), Chihuahuan Desert (-45.0%), Tamaulipan Brushlands (-13.0%), and Gulf Coast Prairie (-35.0%) BCRs (Table 7).

Urban white-winged dove densities in 2021 ranged from 0.23-7.03 doves/ha, with the highest densities supported in the Tamaulipan Brushlands (7.03 doves/ha), Edwards Plateau (3.87 doves/ha), Central Mixed Grass Prairie (2.23 doves/ha), and Oaks and Prairies (2.16) BCRs. On average from 2008-19, urban densities were typically highest in the Tamaulipan Brushlands (6.32 doves/ha), Edwards Plateau (4.22 doves/ha), Oaks and Prairies (2.60 doves/ha), and Central Mixed Grass Prairie (2.32 doves/ha) BCRs (Figure 12; Table 8).

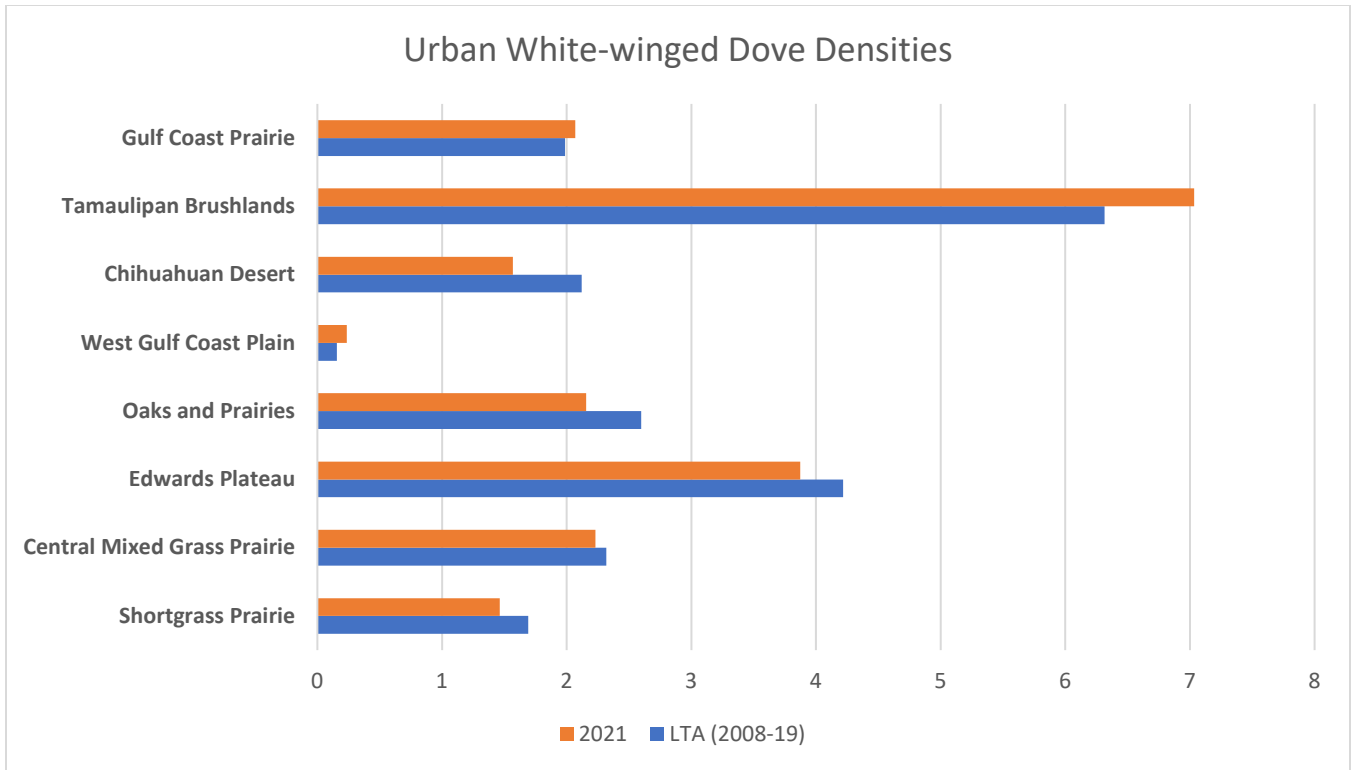


Figure 12. Urban white-winged dove densities (doves/hectare) in 2021 compared to long-term average (2008-19) in Texas BCRs, based on UDS.

Eurasian Collared dove

The combined 2021 rural and urban breeding abundance estimate of 3.62 million Eurasian collared-doves is a 5.1% increase from 2019 and -9.3% below the LTA (2008-19) (Figure 13). Of this total, 51.9% occurred in urban areas and the remainder in rural habitats (49.1%). Eurasian collared-dove densities in urban areas were, on average, 31 times greater (5.0-135.9) than in rural areas.

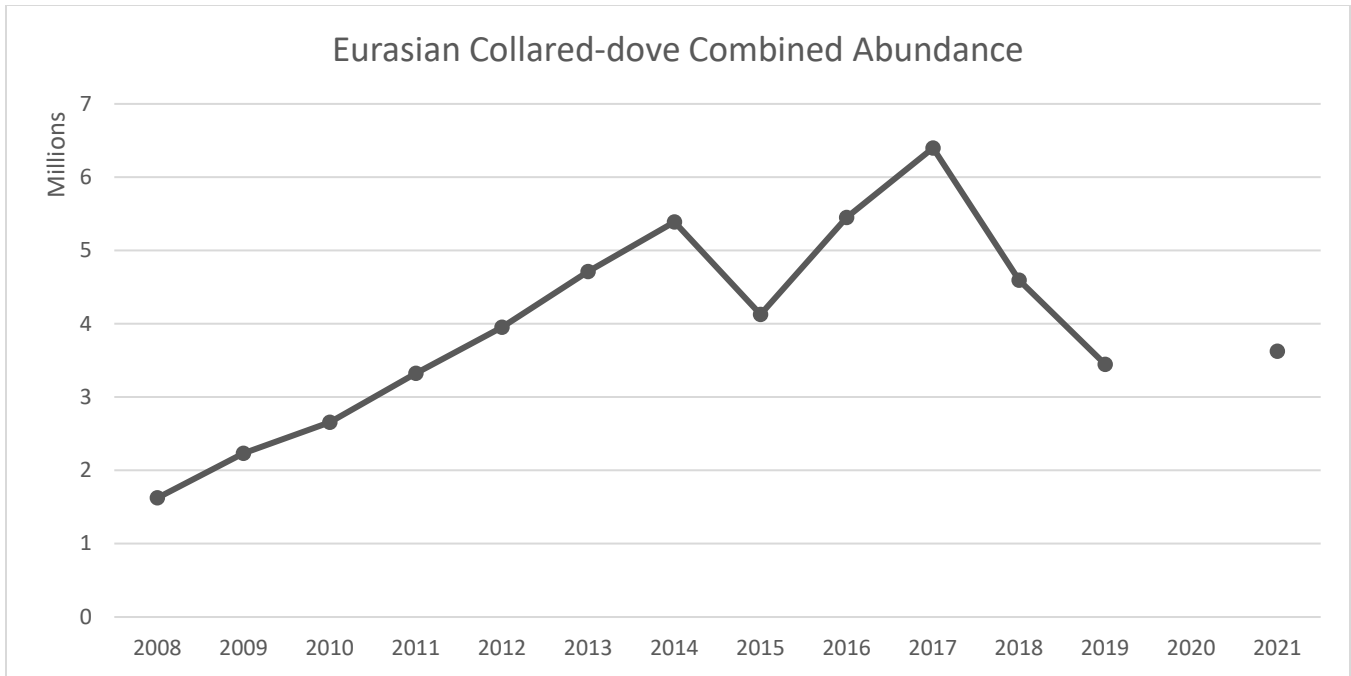


Figure 13. Combined (rural and urban) breeding abundance of Eurasian collared-doves in Texas (2008-21), from MCCA and UDS.

Rural (MCCA)

Based on 2021 MCCA results, the breeding abundance of Eurasian collared-doves in rural Texas is an estimated 1.8 million, which is a 20.4% increase from the 2019 estimate and -11.6% below the LTA (2008-19). Estimates are highly variable in some BCRs due to a relatively low number of observations in the MCCA and the resulting imprecision of estimates. The largest 2021 rural breeding abundance estimates occurred in the Shortgrass Prairie (~859,000), Oaks and Prairies (~367,000), Chihuahuan Desert (~152,000), and Tamaulipan Brushlands (~142,000) BCRs. All other BCRs combined supported less than 15% of the statewide rural breeding Eurasian collared-doves (Table 9; Figure 14). Rural breeding densities are relatively low statewide in 2021 but were highest in the Shortgrass Prairie (0.086 doves/ha), Oaks and Prairies (0.027 doves/ha), Tamaulipan Brushlands (0.022 doves/ha), and Chihuahuan Desert (0.016 doves/ha) BCRs (Table 10).

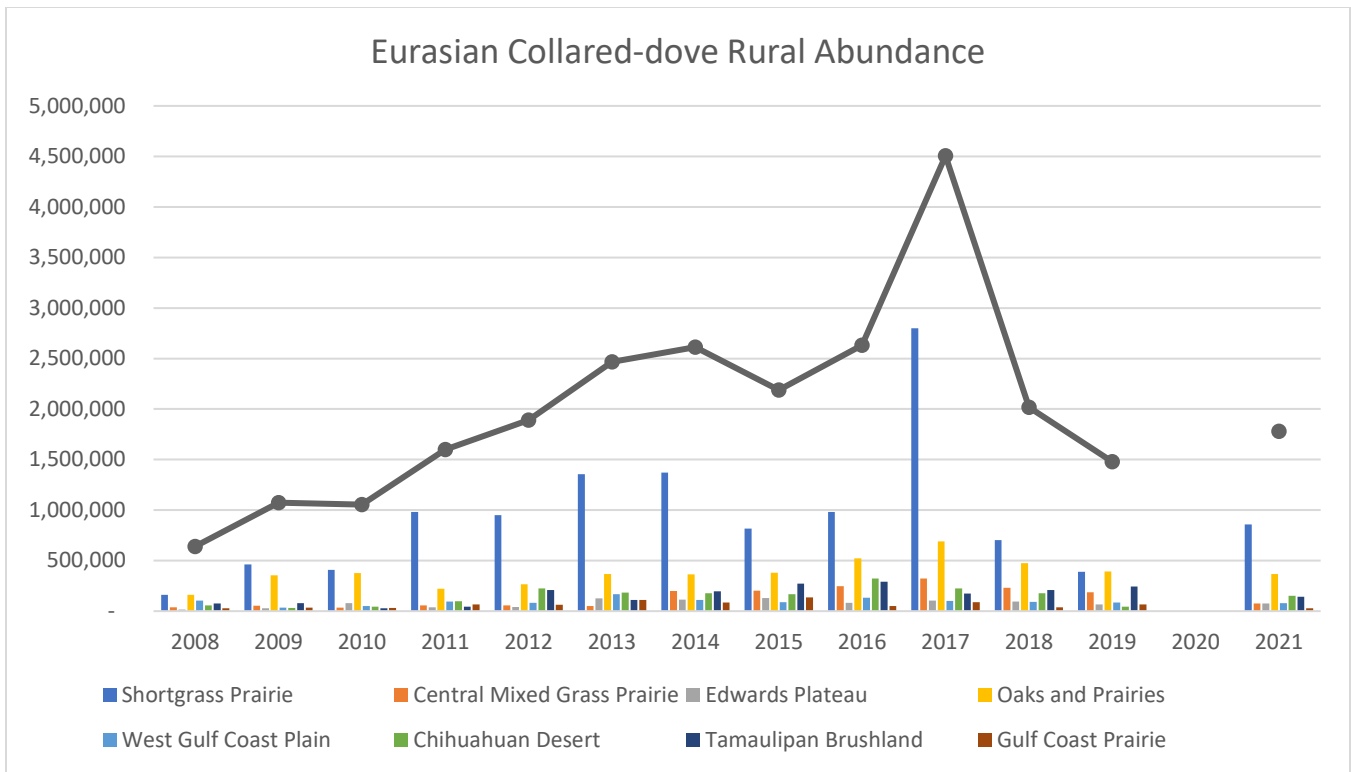


Figure 14. Breeding abundance of rural Eurasian collared-doves in Texas (2008-21), from MCCS.

Urban (UDS)

Based on 2021 UDS results, the urban breeding abundance estimate of Eurasian collared-doves is 1.84 million, which is a 6.5% decrease from the 2019 estimate and -1.0% below the LTA (2008-19). The largest urban breeding abundance estimates in 2021 occurred in the Shortgrass Prairie (~750,000), Central Mixed Grass Prairie (~296,000), Tamaulipan Brushlands (~258,000), and Chihuahuan Desert (~193,000) BCRs. All other BCRs combined supported less than 20% of the statewide urban breeding Eurasian collared-doves (Table 11; Figure 15).

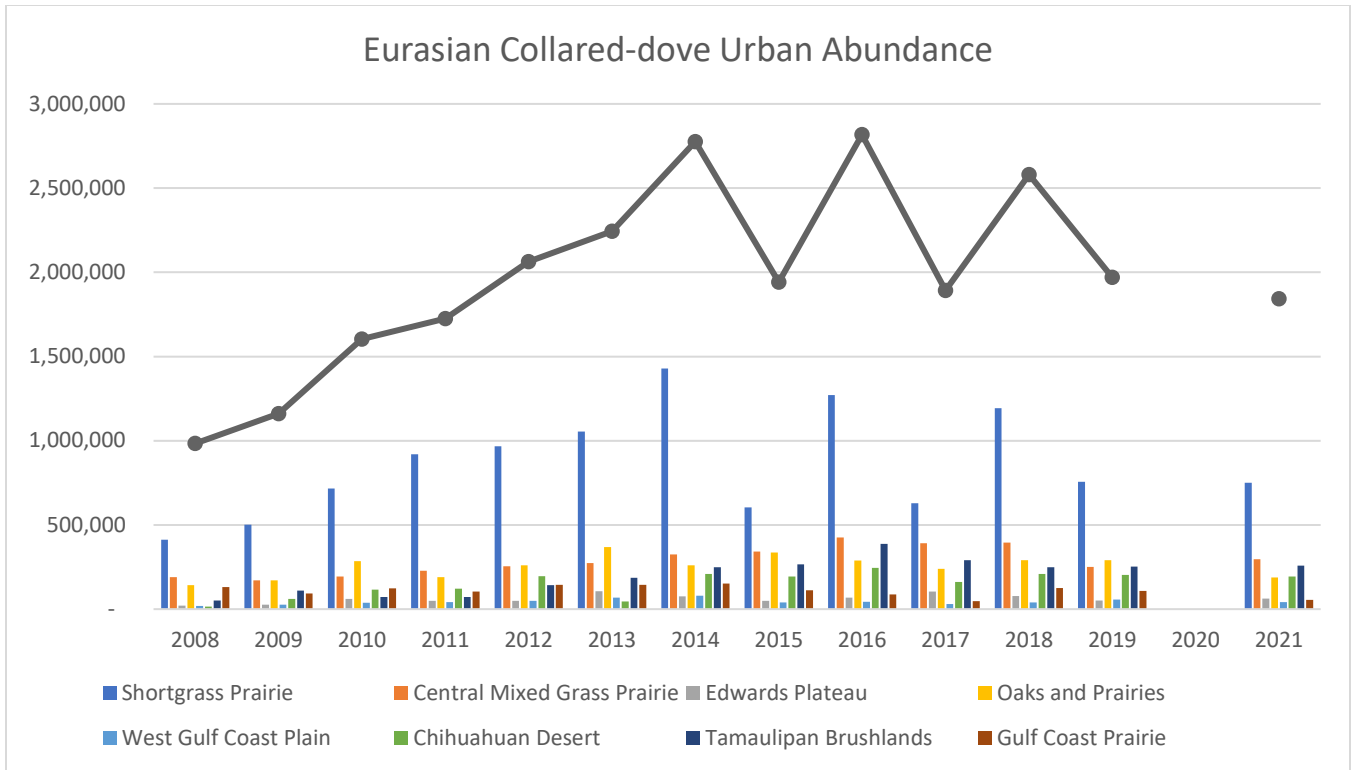


Figure 15. Breeding abundance of urban Eurasian collared-doves in Texas (2008-21), from UDS.

Urban breeding densities in 2021 ranged from 0.07-1.81 doves/ha, with the highest densities supported in the Shortgrass Prairie (1.81 doves/ha), Chihuahuan Desert (1.47 doves/ha), Central Mixed Grass Prairie (1.18 doves/ha), and Tamaulipan Brushland (0.93 doves/ha) BCRs (Table 12).

RESULTS: Harvest

More mourning and white-winged doves are harvested in Texas each year than any other state in the United States. Based on USFWS harvest surveys from the 2003-04 to 2020-21 hunting seasons, Texas accounted for an average of 29.6% and 84.2% of the United States' total mourning dove and white-winged dove harvest, respectively. During that same period, the number of annual mourning dove hunters averaged 238,140, and the annual mourning dove harvest averaged 4.55 million in Texas. Annual white-winged dove harvest averaged 1.34 million doves with 117,956 hunters during the same period (Dubovsky 2020, Raftovich et al. 2021).

Mourning Dove

Based on USFWS harvest surveys for Texas, estimated harvest of mourning doves was 3.73 million birds during the 2020-21 season, which is 10.2% more than in 2019-20 and -18.9% below the LTA

(2003-04 – 2019-20). The estimated number of mourning dove hunters in the 2020-21 season in Texas was 216,100, which is <1% different than in 2019-20 and -9.8% below the LTA (Figure 16). In 2020-21, Texas hunters spent 754,800 days afield and bagged 4.9 mourning doves/day for an average of 17.3 doves/hunter. From 2003-04 to 2019-20, Texas hunters spent an average of 868,334 days afield each year, and bagged 5.3 doves/day, or 19.2 doves/hunter annually per hunting season (Dubovsky 2020, Raftovich et al. 2021, Seamans 2021) (Table 13).

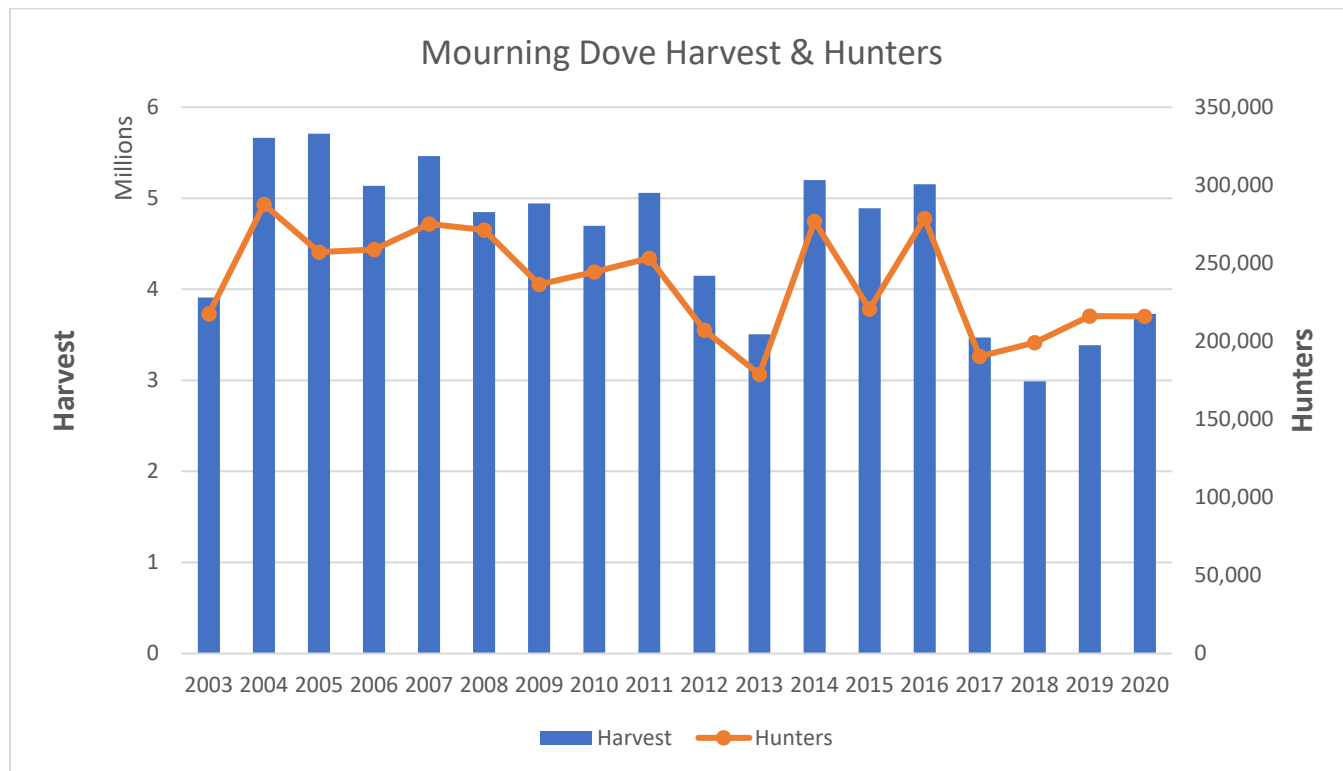


Figure 16. Estimated mourning dove harvest and hunters in Texas (2003-04 to 2020-21), from USFWS Harvest Surveys.

Based on 2020-21 TPWD Small Game Harvest Surveys, the South Texas Plains (39.1%), Rolling Plains (14.6%), and Edwards Plateau (11.4%) ecoregions comprised the highest proportions (65.1% combined) of total mourning dove harvest in Texas, with all other ecoregions combined consisting of less than 35% of the total harvest. (Purvis 2021) (Table 14; Figure 17).

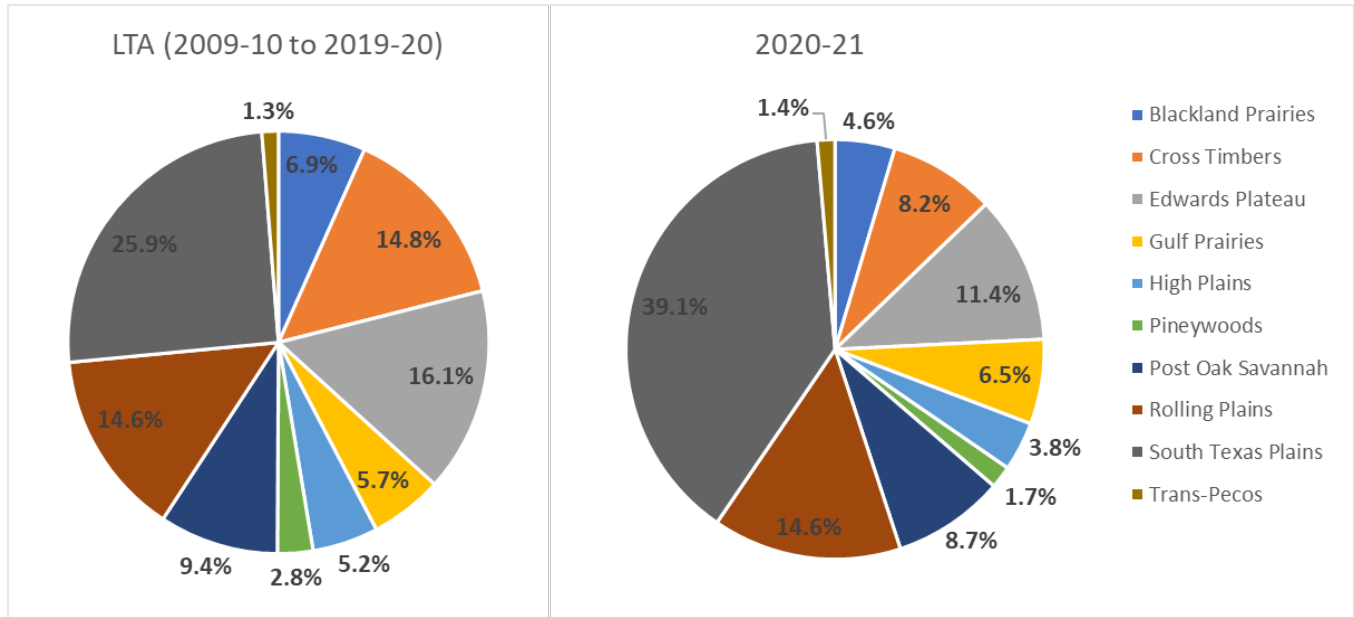


Figure 17. Distribution by Gould’s ecoregion of total mourning dove harvest in Texas, LTA (2009-10 to 2019-20 seasons), and 2020-21 season, based on TPWD Small Game Harvest Surveys.

White-winged Dove

Based on USFWS harvest surveys for Texas, the estimated white-winged dove harvest for the 2020-21 season was 939,600, which is -40.3% less than in 2019-20 and -31.1% below the LTA. The estimated number of white-winged dove hunters in the 2020-21 season in Texas was 121,100, which is -3.8% less than in 2019-20 and 2.8% above the LTA (Figure 18). In 2020-21, Texas white-winged dove hunters spent 469,800 days afield and bagged 2.0 doves/day for an average of 7.8 doves/hunter. From 2003-04 to 2019-20, Texas hunters spent an average of 439,581 days afield each year, and bagged 3.1 doves/day, or 11.6 doves/hunter, annually (Dubovsky 2020, Raftovich *et al.* 2021) (Table 15).

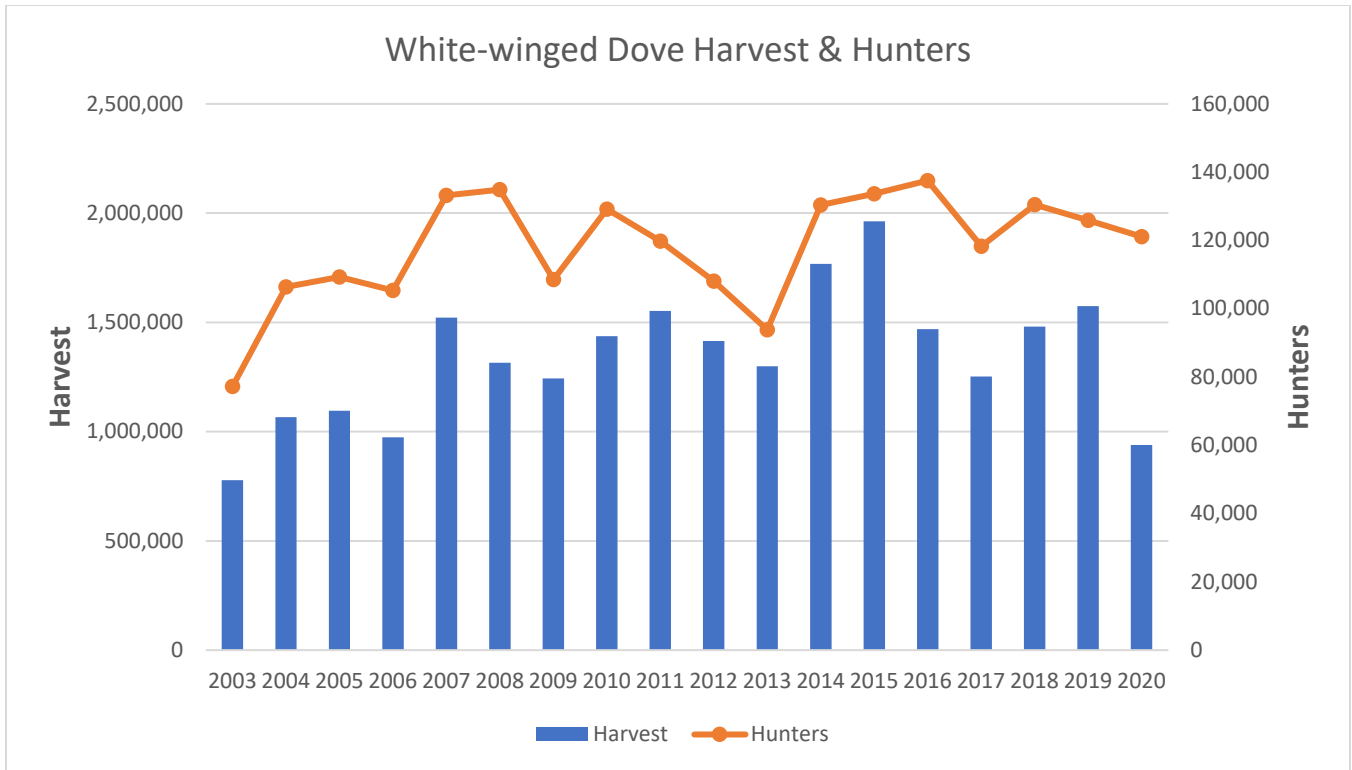


Figure 18. Estimated white-winged dove harvest and hunters in Texas (2003-20), from USFWS Harvest Surveys.

Based on 2020-21 TPWD Small Game Harvest Surveys, the South Texas Plains (46.6%) and Edwards Plateau (15.7%) ecoregions comprised the highest proportions (62.3% combined) of total white-winged dove harvest in Texas, with all other ecoregions combined consisting of less than 38% of the total harvest. (Purvis 2021) (Table 16; Figure 19).

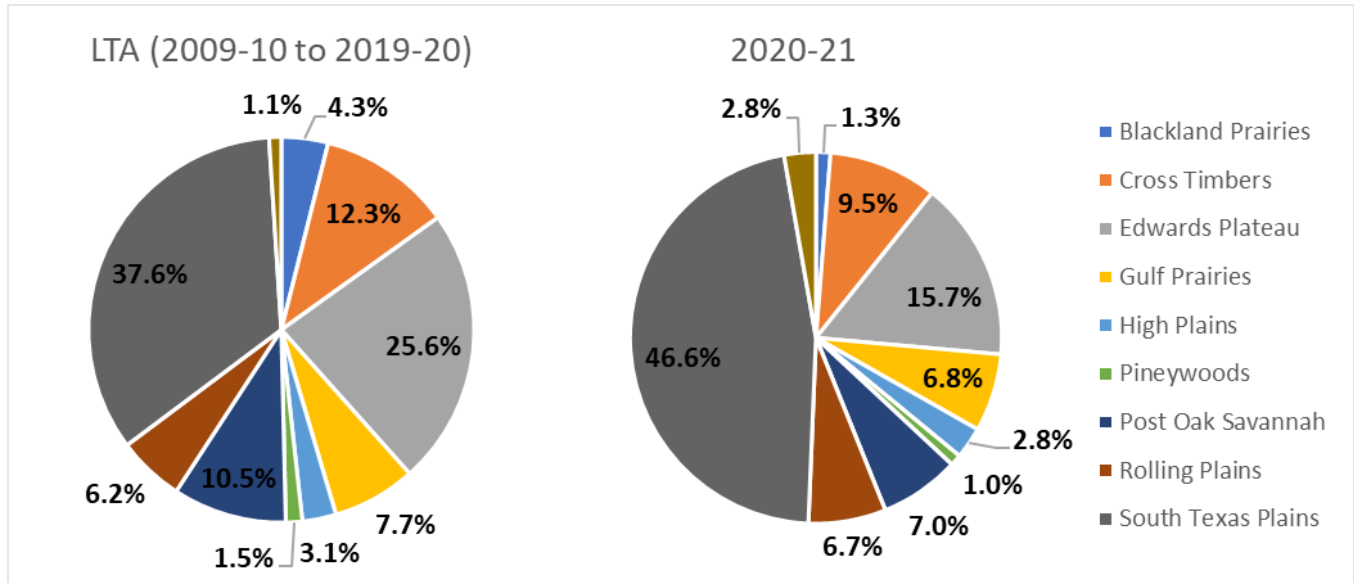


Figure 19. Distribution by Gould's ecoregion of total white-winged dove harvest in Texas, LTA (2009-10 to 2019-20 seasons), and 2020-21 season, based on TPWD Small Game Harvest Surveys.

Eurasian Collared-dove

The USFWS does not survey hunters to estimate annual Eurasian collared-dove harvest, but the TPWD Small Game Harvest Survey does provide annual harvest estimates. The total estimated Eurasian collared-dove harvest for the 2020-21 season was 200,771, which is -33.2% below the 2019-20 estimate and -64.2% below the LTA (2015-16 to 2019-20) (Table 17).

DISCUSSION

Doves are widely distributed and nest in a variety of habitats, thus it is necessary to try and representatively sample across habitats when assessing population status during the breeding season. Road-based surveys like the MCCS and UDS may violate an assumption in distance sampling (animal locations are assumed to be independent of survey points), leading to potential bias when extrapolating results to larger, non-roadside habitats. However, sampling along public roadways is the only logistically feasible method in which to survey across a state that is 95-97% privately owned. Actual densities are unknown, so the level of bias is undetectable, but bias may be less of a concern with the UDS since roadways are typically a prominent feature in urban areas and are heavily dispersed throughout these habitats. It is more likely in rural areas that doves may be attracted to features commonly found adjacent to roads like fence lines or powerlines, which may result in elevated density estimates and an overestimation of abundance. However, when compared to other existing large-scale

survey methods for doves, the UDS and MCCA provide reasonable and comparable abundance estimates and may provide more reliable indices than previous survey methods.

A severe winter storm hit Texas in mid-February 2021, resulting in record-low temperatures and winter precipitation. TPWD received numerous reports of dove mortalities directly related to the storm but had no way to accurately quantify any losses given the sudden onset and wide geographic scope of the storm. Spring dove migration is thought to typically begin in March but could possibly be underway in mid-February, and nesting activity can begin as early as mid to late February in some portions of the state. TPWD does not regularly collect data on spring migration or nesting timing so it is unclear how the winter storm may have impacted resident, migrating, and breeding doves. Results from the 2021 MCCA and UDS did indicate declines from 2019 in spring breeding abundance of mourning doves in the Central Mixed Grass Prairie (-15.7%) and of both mourning (-18.5%) and white-winged (-8.8%) doves in the Oaks and Prairies BCR. However, estimates for both species increased from 2019 in the Shortgrass Prairie BCR (and in almost every other BCR), in which temperatures and winter precipitation during the winter storm were similar. Given the wide annual variability in dove abundance at the regional (BCR) scale, and without prior-year estimates to compare to (the 2020 MCCA and UDS were not conducted due to restrictions from the COVID-19 pandemic), it is difficult to determine whether, or to what extent, any declines in breeding abundance can be attributed to the winter storm.

Many factors can affect dove recruitment at the BCR-scale including the timing and amount of precipitation, severity of storms, and resulting habitat conditions. Native forage provides critical nutrients for breeding doves, but small-grain agriculture also provides abundant supplemental food sources during the breeding season and can be associated with improved reproductive output (Muñoz and Miller 2020). Intense rain and hailstorms affected several areas of the state this spring, potentially resulting in nest mortalities during peak breeding season. Consistent and abundant spring and summer precipitation resulted in excellent range conditions across much of the state this year, but in some areas the excess moisture resulted in vegetation too thick for doves to forage and delayed or ruined agricultural production. TPWD does not currently monitor nest success, but staff reports generally indicated strong hatch-year production across the state. However, spring storms and reduced small grain production may have affected recruitment in some areas.

The factors affecting dove populations at large spatial scales are not well known and could vary greatly by region, but they likely include a combination of changes in land-use, increasing urbanization, and

fragmentation or loss of habitat. The USFWS Breeding Bird Survey data indicate a <1% annual decline in mourning dove abundance since 1966 in the Central Management Unit (-0.6%) and in Texas (-0.8%) (Seamans 2019). Mourning doves primarily occupy rural habitats, and this long-term decline may reflect a decline in rural acreage due to changing land-use or urbanization. White-winged doves now primarily occupy urban areas and have increased in abundance by nearly 70% in Texas since 2008, with an expanded breeding range that spans as far north as Nebraska and Colorado in the Central Management Unit. Spring monitoring of doves in Texas is critical to assessing changing status and trends of breeding dove populations, and TPWD plans to continue to conduct the MCCA and UDS annually. Future work may include using land-cover and crop-type datasets in conjunction with MCCA and UDS data to determine what spatial parameters may be driving dove distribution and abundance in Texas.

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Table 1. Rural mourning dove breeding abundance estimates in Texas BCRs (2008-21), from MCCS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie	Statewide Total
2008	6,715,087	3,649,219	793,823	4,284,118	1,897,756	1,627,292	2,172,075	553,554	21,692,922
2009	4,210,276	3,097,475	1,033,794	6,858,279	1,245,861	795,287	1,813,687	418,514	19,473,172
2010	5,382,855	1,796,322	1,647,416	6,649,692	1,357,908	751,840	1,744,091	914,286	20,244,410
2011	12,733,973	2,476,716	1,200,836	5,946,635	1,431,120	825,494	2,318,413	908,261	27,841,448
2012	6,354,713	1,860,866	1,228,957	4,590,097	1,548,200	1,415,941	2,101,890	435,882	19,536,546
2013	9,896,754	1,927,657	3,886,849	6,521,065	1,820,554	1,358,971	2,805,603	984,097	29,201,549
2014	11,078,484	2,802,967	2,976,247	5,570,027	1,298,821	1,150,868	3,124,644	1,363,201	29,365,258
2015	10,884,281	2,785,083	1,238,092	5,623,491	1,388,995	2,875,015	4,005,029	695,992	29,495,978
2016	15,425,102	3,296,126	1,116,112	6,216,882	1,103,823	1,821,215	4,560,870	695,590	34,235,720
2017	12,174,701	3,304,891	1,265,985	9,815,159	1,394,949	1,841,480	3,195,795	632,689	33,625,648
2018	4,627,938	2,678,736	1,167,442	5,621,893	1,085,002	962,797	3,547,205	680,660	20,371,675
2019	4,574,770	1,996,726	932,098	5,524,921	1,251,989	844,732	2,891,638	593,876	18,610,751
2020	-	-	-	-	-	-	-	-	-
2021	6,047,764	1,697,044	1,141,094	4,488,660	1,320,142	1,238,613	4,349,466	744,984	21,027,767
Average	8,469,746	2,566,910	1,509,904	5,977,763	1,395,778	1,346,888	2,971,570	740,122	24,978,680

Table 2. Rural mourning dove breeding density estimates (doves/hectare) in Texas BCRs (2008-21), from MCCS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	0.66	0.42	0.14	0.31	0.30	0.17	0.33	0.17
2009	0.41	0.36	0.18	0.50	0.20	0.08	0.28	0.13
2010	0.53	0.21	0.29	0.49	0.21	0.08	0.27	0.27
2011	1.26	0.29	0.21	0.44	0.22	0.08	0.36	0.27
2012	0.63	0.21	0.22	0.34	0.24	0.14	0.32	0.13
2013	0.97	0.22	0.69	0.48	0.29	0.14	0.43	0.30
2014	1.09	0.32	0.53	0.41	0.20	0.12	0.48	0.41
2015	1.08	0.32	0.22	0.41	0.22	0.29	0.62	0.21
2016	1.54	0.38	0.20	0.46	0.17	0.19	0.70	0.21
2017	1.21	0.38	0.23	0.72	0.22	0.19	0.49	0.19
2018	0.46	0.31	0.21	0.42	0.17	0.10	0.55	0.21
2019	0.46	0.23	0.17	0.41	0.20	0.09	0.45	0.18
2020	-	-	-	-	-	-	-	-
2021	0.61	0.20	0.20	0.33	0.21	0.13	0.67	0.23
Average	<i>0.84</i>	<i>0.30</i>	<i>0.27</i>	<i>0.44</i>	<i>0.22</i>	<i>0.14</i>	<i>0.46</i>	<i>0.22</i>

Table 3. Urban mourning dove breeding abundance estimates in Texas BCRs (2008-21), from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie	Statewide Total
2008	526,277	168,312	88,535	1,177,526	145,878	23,099	77,515	393,412	2,600,553
2009	468,191	220,223	66,001	1,429,020	79,614	54,013	87,701	298,147	2,702,909
2010	695,615	333,708	75,776	1,498,769	375,991	83,981	129,799	391,616	3,585,255
2011	824,756	156,184	111,574	1,364,513	320,666	49,079	94,180	413,352	3,334,302
2012	825,975	171,738	58,212	1,210,986	345,584	50,816	97,116	466,771	3,227,197
2013	612,163	252,494	153,716	1,330,050	395,979	64,840	161,783	689,117	3,660,142
2014	724,425	292,367	110,917	1,286,251	288,154	55,239	246,629	527,764	3,531,747
2015	892,534	298,493	119,779	1,443,700	179,616	39,749	234,443	455,824	3,664,140
2016	870,807	258,540	75,463	1,077,635	198,822	151,162	217,440	369,143	3,219,012
2017	331,782	255,696	62,846	939,739	158,861	74,697	158,516	551,029	2,533,165
2018	674,550	327,500	75,991	1,052,703	212,968	85,609	162,109	866,828	3,458,258
2019	404,449	267,059	63,431	1,140,030	202,206	74,388	159,832	624,236	2,935,629
2020	-	-	-	-	-	-	-	-	-
2021	349,935	210,512	87,264	943,912	229,736	38,030	165,853	409,042	2,434,285
Average	630,881	247,140	88,423	1,222,680	241,083	64,977	153,301	496,637	3,145,123

Table 4. Urban mourning dove breeding density estimates (doves/hectare) in Texas BCRs (2008-21), from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	1.51	0.73	0.41	0.95	0.27	0.21	0.32	0.77
2009	1.32	0.95	0.30	1.14	0.15	0.49	0.36	0.57
2010	1.92	1.42	0.34	1.18	0.68	0.75	0.52	0.74
2011	2.23	0.65	0.49	1.05	0.57	0.43	0.37	0.77
2012	2.23	0.72	0.25	0.93	0.62	0.44	0.38	0.87
2013	1.66	1.06	0.67	1.03	0.71	0.56	0.64	1.28
2014	1.92	1.21	0.48	0.98	0.51	0.47	0.96	0.97
2015	2.31	1.23	0.51	1.09	0.32	0.33	0.89	0.82
2016	2.20	1.06	0.32	0.80	0.35	1.21	0.82	0.66
2017	0.83	1.04	0.26	0.69	0.28	0.59	0.59	0.97
2018	1.66	1.32	0.31	0.77	0.37	0.66	0.59	1.51
2019	0.98	1.07	0.26	0.82	0.35	0.56	0.58	1.08
2020	-	-	-	-	-	-	-	-
2021	0.85	0.84	0.35	0.68	0.39	0.29	0.60	0.71
Average	<i>1.66</i>	<i>1.02</i>	<i>0.38</i>	<i>0.93</i>	<i>0.43</i>	<i>0.54</i>	<i>0.59</i>	<i>0.90</i>

Table 5. Rural white-winged dove breeding abundance estimates in Texas BCRs (2008-21), from MCCS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie	Statewide Total
2008	0	27,705	57,906	93,133	0	167,356	219,619	0	565,719
2009	0	15,587	61,803	98,542	0	87,600	134,154	0	397,686
2010	12,183	11,259	190,346	67,017	12,732	67,902	147,076	0	508,515
2011	259,525	10,395	139,723	239,177	0	49,195	389,545	16,320	1,103,882
2012	263,003	12,129	109,428	53,310	6,994	145,628	302,037	36,962	929,489
2013	138,331	34,655	260,395	68,355	0	76,756	625,494	11,652	1,215,638
2014	233,945	57,998	141,860	143,206	11,415	117,054	503,198	0	1,208,677
2015	252,091	4,325	264,985	80,277	0	415,914	936,545	5,642	1,959,779
2016	0	19,013	126,500	306,772	0	445,230	504,236	0	1,401,751
2017	59,130	45,793	129,787	206,093	9,481	288,898	777,513	14,560	1,531,255
2018	161,067	12,957	201,283	185,545	10,736	167,998	618,147	20,816	1,378,552
2019	48,933	6,045	213,466	215,099	280,183	151,266	405,673	0	1,320,666
2020	-	-	-	-	-	-	-	-	-
2021	19,973	26,773	176,585	150,163	63,104	387,987	782,787	36,952	1,644,324
Average	111,399	21,895	159,544	146,668	30,357	197,599	488,156	10,993	1,166,610

Table 6. Rural white-winged dove breeding density estimates (doves/hectare) in Texas BCRs (2008-21), from MCCA.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	0.00	0.00	0.01	0.01	0.00	0.02	0.03	0.00
2009	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.00
2010	0.00	0.00	0.03	0.00	0.00	0.01	0.02	0.00
2011	0.03	0.00	0.02	0.02	0.00	0.01	0.06	0.00
2012	0.03	0.00	0.02	0.00	0.00	0.01	0.05	0.01
2013	0.01	0.00	0.05	0.01	0.00	0.01	0.10	0.00
2014	0.02	0.01	0.03	0.01	0.00	0.01	0.08	0.00
2015	0.03	0.00	0.05	0.01	0.00	0.04	0.14	0.00
2016	0.00	0.00	0.02	0.02	0.00	0.05	0.08	0.00
2017	0.01	0.01	0.02	0.02	0.00	0.03	0.12	0.00
2018	0.02	0.00	0.04	0.01	0.00	0.02	0.10	0.01
2019	0.00	0.00	0.04	0.02	0.04	0.02	0.06	0.00
2020	-	-	-	-	-	-	-	-
2021	0.00	0.00	0.03	0.01	0.01	0.04	0.12	0.01
Average	0.01	0.00	0.03	0.01	0.00	0.02	0.08	0.00

Table 7. Urban white-winged dove breeding abundance estimates in Texas BCRs (2008-21), from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie	Statewide Total
2008	441,076	487,859	826,239	2,459,697	71,721	201,152	870,881	805,355	6,163,979
2009	472,347	344,677	850,291	4,917,703	253,306	203,447	971,114	654,465	8,667,350
2010	468,056	414,549	823,828	3,833,788	44,143	163,042	1,155,081	804,788	7,707,274
2011	725,001	676,797	1,362,955	3,361,661	113,979	167,174	975,990	847,166	8,230,723
2012	1,170,107	485,396	912,178	3,355,053	28,004	248,202	1,001,629	1,000,961	8,201,529
2013	877,386	542,068	1,279,246	3,062,769	111,341	183,845	1,610,088	1,086,260	8,753,003
2014	699,954	564,722	1,051,709	3,320,356	56,704	207,554	2,177,200	990,636	9,068,833
2015	450,387	619,246	1,145,034	3,804,732	64,238	321,605	2,419,472	912,976	9,737,691
2016	713,162	683,315	867,920	2,998,865	60,002	480,793	2,298,233	1,109,839	9,212,130
2017	555,900	659,631	957,047	3,105,276	55,284	216,350	2,039,659	1,220,260	8,809,408
2018	646,238	708,254	960,652	3,357,933	58,812	296,258	2,043,033	1,872,813	9,943,993
2019	463,673	524,952	729,003	3,222,864	132,500	375,613	2,232,036	1,840,025	9,520,666
2020	-	-	-	-	-	-	-	-	-
2021	604,896	558,810	955,441	2,984,810	137,830	206,512	1,942,505	1,197,046	8,587,850
Average	637,553	559,252	978,580	3,368,116	91,374	251,658	1,672,071	1,103,276	8,661,879

Table 8. Urban white-winged dove breeding density estimates (doves/hectare) in Texas BCRs (2008-21), from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	1.27	2.13	3.80	1.99	0.13	1.87	3.60	1.57
2009	1.33	1.48	3.84	3.92	0.46	1.85	3.96	1.26
2010	1.29	1.76	3.65	3.01	0.08	1.45	4.63	1.52
2011	1.96	2.83	5.93	2.59	0.20	1.45	3.86	1.57
2012	3.17	2.03	3.97	2.59	0.05	2.16	3.96	1.86
2013	2.37	2.27	5.56	2.36	0.20	1.60	6.36	2.02
2014	1.85	2.34	4.52	2.53	0.10	1.75	8.45	1.82
2015	1.16	2.55	4.86	2.87	0.11	2.64	9.23	1.65
2016	1.80	2.79	3.64	2.23	0.10	3.84	8.62	1.98
2017	1.38	2.68	3.97	2.29	0.10	1.70	7.56	2.15
2018	1.59	2.85	3.94	2.45	0.10	2.29	7.48	3.27
2019	1.12	2.10	2.95	2.33	0.23	2.85	8.08	3.18
2020	-	-	-	-	-	-	-	-
2021	1.46	2.23	3.87	2.16	0.24	1.57	7.03	2.07
Average	<i>1.67</i>	<i>2.31</i>	<i>4.19</i>	<i>2.56</i>	<i>0.16</i>	<i>2.08</i>	<i>6.37</i>	<i>1.99</i>

Table 9. Rural Eurasian collared-dove breeding abundance estimates in Texas BCRs (2008-21), from MCCA.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushland	Gulf Coast Prairie	Statewide Total
2008	161,895	38,960	14,617	161,613	105,042	56,114	74,944	27,829	641,013
2009	460,578	54,554	27,530	353,110	35,014	30,512	77,497	34,123	1,072,920
2010	407,115	34,645	79,170	377,481	50,293	44,284	27,984	32,045	1,053,017
2011	981,330	55,442	37,035	220,043	96,130	98,390	45,523	64,947	1,598,840
2012	949,450	57,177	40,965	265,181	80,748	225,330	208,952	62,935	1,890,739
2013	1,354,828	49,383	125,708	366,383	167,641	183,033	110,113	109,196	2,466,284
2014	1,372,278	199,965	113,263	362,788	109,081	177,057	195,290	84,099	2,613,820
2015	816,775	201,529	128,291	378,256	89,306	166,169	270,557	135,747	2,186,630
2016	981,889	247,166	83,401	522,598	131,573	322,374	292,405	51,034	2,632,441
2017	2,799,139	323,145	105,732	690,139	101,761	223,061	174,729	87,690	4,505,396
2018	702,294	229,779	95,609	474,021	90,312	177,823	209,729	37,337	2,016,904
2019	390,468	186,545	67,616	393,671	84,560	44,201	244,702	65,986	1,477,750
2020	-	-	-	-	-	-	-	-	-
2021	858,830	75,136	77,116	366,614	78,880	152,248	142,148	28,704	1,779,678
Average	<i>941,298</i>	<i>134,879</i>	<i>76,620</i>	<i>379,377</i>	<i>93,872</i>	<i>146,200</i>	<i>159,583</i>	<i>63,206</i>	<i>1,995,033</i>

Table 10. Rural Eurasian collared-dove breeding density estimates (doves/hectare) in Texas BCRs (2008-21), from MCCS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	0.02	0.00	0.00	0.01	0.02	0.01	0.01	0.01
2009	0.05	0.01	0.00	0.03	0.01	0.00	0.01	0.01
2010	0.04	0.00	0.01	0.03	0.01	0.00	0.00	0.01
2011	0.10	0.01	0.01	0.02	0.02	0.01	0.01	0.02
2012	0.09	0.01	0.01	0.02	0.01	0.02	0.03	0.02
2013	0.13	0.01	0.02	0.03	0.03	0.02	0.02	0.03
2014	0.14	0.02	0.02	0.03	0.02	0.02	0.03	0.03
2015	0.08	0.02	0.02	0.03	0.01	0.02	0.04	0.04
2016	0.10	0.03	0.01	0.04	0.02	0.03	0.05	0.02
2017	0.28	0.04	0.02	0.05	0.02	0.02	0.03	0.03
2018	0.07	0.03	0.02	0.04	0.01	0.02	0.03	0.01
2019	0.04	0.02	0.01	0.03	0.01	0.00	0.04	0.02
2020	-	-	-	-	-	-	-	-
2021	0.09	0.01	0.01	0.03	0.01	0.02	0.02	0.01
Average	<i>0.09</i>	<i>0.02</i>	<i>0.01</i>	<i>0.03</i>	<i>0.01</i>	<i>0.01</i>	<i>0.02</i>	<i>0.02</i>

Table 11. Urban Eurasian collared-dove breeding abundance estimates in Texas BCRs (2008-21), from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie	Statewide Total
2008	412,223	189,904	20,934	141,955	19,757	14,922	51,950	131,922	983,568
2009	502,435	171,781	26,237	170,247	26,191	60,826	109,423	93,688	1,160,828
2010	715,656	193,451	60,611	285,213	37,599	115,846	71,418	122,982	1,602,778
2011	919,188	227,072	48,349	190,710	42,426	121,926	71,274	105,061	1,726,007
2012	967,235	254,023	49,246	259,636	49,385	196,408	142,598	144,372	2,062,902
2013	1,054,164	272,539	105,780	367,688	69,027	45,110	185,221	145,072	2,244,600
2014	1,428,123	324,422	75,295	261,132	79,713	208,394	247,943	151,507	2,776,530
2015	604,011	340,972	50,213	336,797	39,238	193,579	265,489	111,274	1,941,572
2016	1,270,537	425,705	68,065	289,394	44,457	244,595	387,529	86,739	2,817,020
2017	628,398	392,001	104,743	238,836	29,577	162,269	290,609	46,783	1,893,216
2018	1,193,324	394,570	77,797	290,141	40,488	209,807	249,321	124,675	2,580,123
2019	755,458	251,006	51,391	290,509	57,171	204,009	253,350	108,233	1,971,128
2020	-	-	-	-	-	-	-	-	-
2021	749,879	296,084	62,124	188,782	41,355	193,049	257,741	54,898	1,843,912
Average	861,587	287,195	61,599	254,695	44,337	151,596	198,759	109,785	1,969,553

Table 12. Urban Eurasian collared-dove breeding density estimates (doves/hectare) in Texas BCRs, from UDS.

	Shortgrass Prairie	Central Mixed Grass Prairie	Edwards Plateau	Oaks and Prairies	West Gulf Coast Plain	Chihuahuan Desert	Tamaulipan Brushlands	Gulf Coast Prairie
2008	1.18	0.83	0.10	0.11	0.04	0.14	0.22	0.26
2009	1.41	0.74	0.12	0.14	0.05	0.55	0.45	0.18
2010	1.97	0.82	0.27	0.22	0.07	1.03	0.29	0.23
2011	2.49	0.95	0.21	0.15	0.08	1.06	0.28	0.20
2012	2.62	1.06	0.21	0.20	0.09	1.71	0.56	0.27
2013	2.85	1.14	0.46	0.28	0.12	0.39	0.73	0.27
2014	3.78	1.35	0.32	0.20	0.14	1.76	0.96	0.28
2015	1.56	1.40	0.21	0.25	0.07	1.59	1.01	0.20
2016	3.21	1.74	0.29	0.22	0.08	1.95	1.45	0.15
2017	1.57	1.59	0.43	0.18	0.05	1.27	1.08	0.08
2018	2.93	1.59	0.32	0.21	0.07	1.62	0.91	0.22
2019	1.83	1.00	0.21	0.21	0.10	1.55	0.92	0.19
2020	-	-	-	-	-	-	-	-
2021	1.81	1.18	0.25	0.14	0.07	1.47	0.93	0.09
Average	2.25	1.18	0.26	0.19	0.08	1.24	0.75	0.20

Table 13. Mourning dove hunters, harvest, days afield, average daily bag (doves/day), and average annual bag (doves/hunter) in Texas (2003-04 to 2020-21), from USFWS harvest estimates.

Mourning Dove Harvest

	<i>Hunters</i>	<i>Harvest</i>	<i>Days Afield</i>	<i>Doves/Day</i>	<i>Doves/Hunter</i>
2003	217,700	3,909,000	802,800	4.87	17.96
2004	287,700	5,664,600	1,089,200	5.20	19.69
2005	257,180	5,710,707	1,029,986	5.54	22.21
2006	258,900	5,138,700	986,200	5.21	19.85
2007	275,200	5,463,300	1,149,600	4.75	19.85
2008	271,268	4,849,583	974,121	4.98	17.88
2009	236,576	4,945,108	846,164	5.84	20.90
2010	244,595	4,699,316	876,512	5.36	19.21
2011	253,241	5,061,083	958,563	5.28	19.99
2012	207,185	4,150,771	720,168	5.76	20.03
2013	178,855	3,506,735	677,911	5.17	19.61
2014	276,800	5,199,449	934,258	5.57	18.78
2015	220,662	4,892,144	833,971	5.87	22.17
2016	278,678	5,155,315	956,788	5.39	18.50
2017	190,469	3,469,459	703,284	4.93	18.22
2018	199,108	2,990,357	553,168	5.41	15.02
2019	216,300	3,385,000	668,988	5.06	15.65
2020	216,100	3,729,300	754,800	4.94	17.26
Average	<i>238,140</i>	<i>4,551,107</i>	<i>862,027</i>	<i>5.29</i>	<i>19.04</i>

Table 14. Mourning dove harvest by Gould’s ecoregion in Texas, LTA (2009-10 to 2019-2020 seasons) and 2020-21 season, from TPWD Small Game Harvest Surveys.

Mourning Dove Harvest

<i>Ecoregion</i>	<i>LTA (2009-19)</i>	<i>2020-21</i>
Blackland Prairies	407,164	179,833
Cross Timbers	874,299	319,260
Edwards Plateau	951,703	443,472
Gulf Prairies	339,965	254,161
High Plains	307,388	147,408
Pineywoods	165,904	67,344
Post Oak Savannah	556,572	336,470
Rolling Plains	866,131	568,682
South Texas Plains	1,534,577	1,519,229
Trans-Pecos	77,560	53,626

Table 15. White-winged dove hunters, harvest, days afield, average daily bag (doves/day), and average annual bag (doves/hunter) in Texas (2003-04 to 2020-21), from USFWS harvest estimates.

White-winged Dove Harvest					
	Hunters	Harvest	Days Afield	Doves/Day	Doves/Hunter
2003	77,211	778,155	357,028	2.18	10.08
2004	106,369	1,066,300	383,283	2.78	10.02
2005	109,257	1,095,132	432,998	2.53	10.02
2006	105,319	974,501	459,378	2.12	9.25
2007	133,209	1,522,099	519,507	2.93	11.43
2008	134,888	1,314,921	468,181	2.81	9.75
2009	108,579	1,243,489	425,005	2.93	11.45
2010	129,213	1,436,829	470,352	3.05	11.12
2011	119,769	1,551,987	458,529	3.38	12.96
2012	108,125	1,414,818	423,317	3.34	13.09
2013	93,848	1,299,710	359,966	3.61	13.85
2014	130,377	1,767,860	472,834	3.74	13.56
2015	133,697	1,963,071	511,578	3.84	14.68
2016	137,537	1,469,670	522,096	2.81	10.69
2017	118,295	1,252,803	407,384	3.08	10.59
2018	130,514	1,481,229	374,924	3.95	11.35
2019	125,900	1,574,600	426,523	3.69	12.51
2020	121,100	939,600	469,800	2.00	7.76
Average	<i>117,956</i>	<i>1,341,487</i>	<i>441,260</i>	<i>3.04</i>	<i>11.34</i>

Table 16. White-winged dove harvest by Gould’s ecoregion in Texas, LTA (2009-10 to 2019-2020 seasons) and 2020-21 season, from TPWD Small Game Harvest Surveys.

White-winged Dove Harvest

<i>Ecoregion</i>	<i>LTA (2009-19)</i>	<i>2020-21</i>
Blackland Prairies	104,258	21,972
Cross Timbers	296,823	166,359
Edwards Plateau	619,388	275,172
Gulf Prairies	186,264	119,014
High Plains	75,361	48,390
Pineywoods	36,485	17,264
Post Oak Savannah	253,785	122,153
Rolling Plains	148,797	118,230
South Texas Plains	908,598	817,407
Trans-Pecos	27,143	48,390

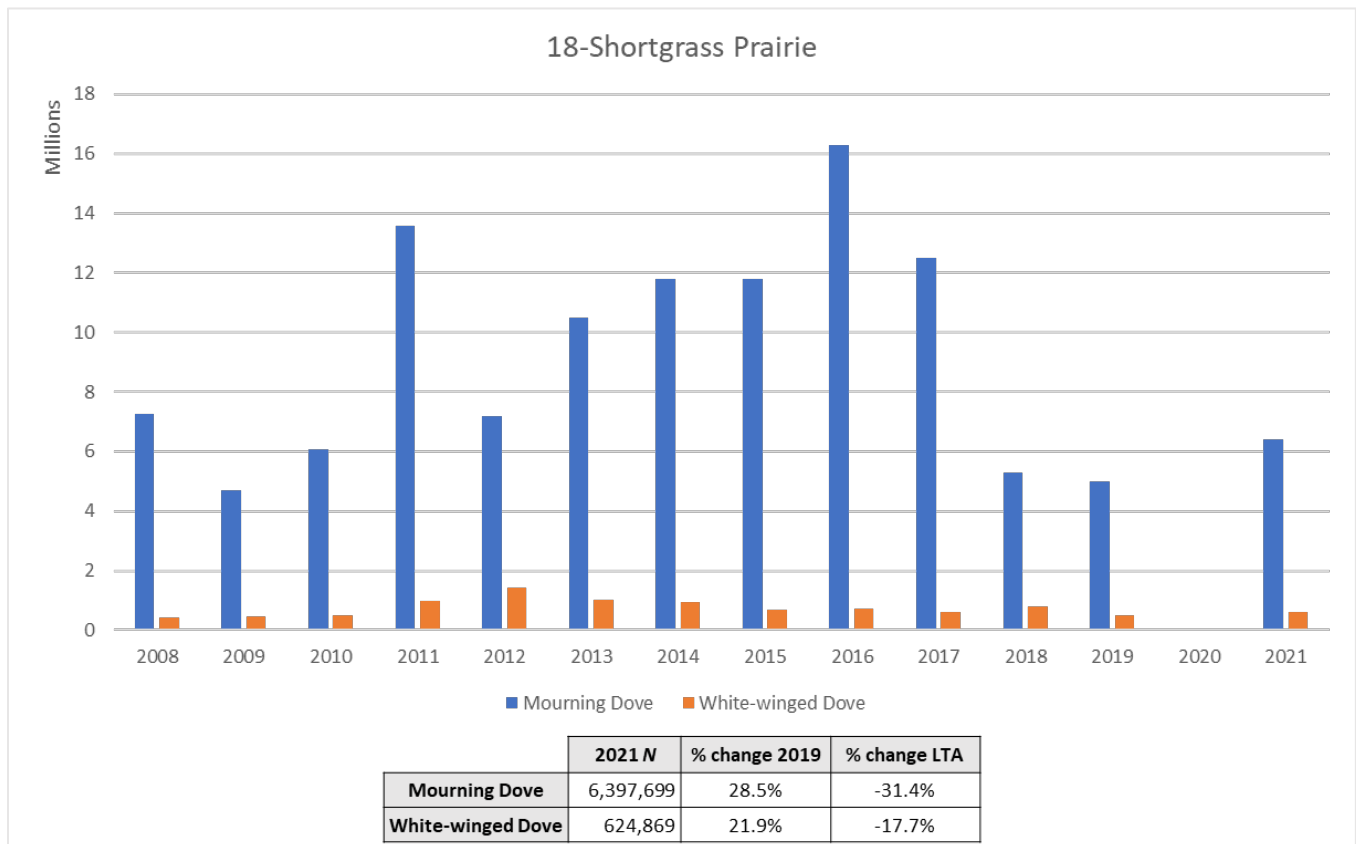
Table 17. Annual harvest of Eurasian collared-doves in Texas, from TPWD Small Game Harvest Surveys.

Eurasian collared-dove Harvest

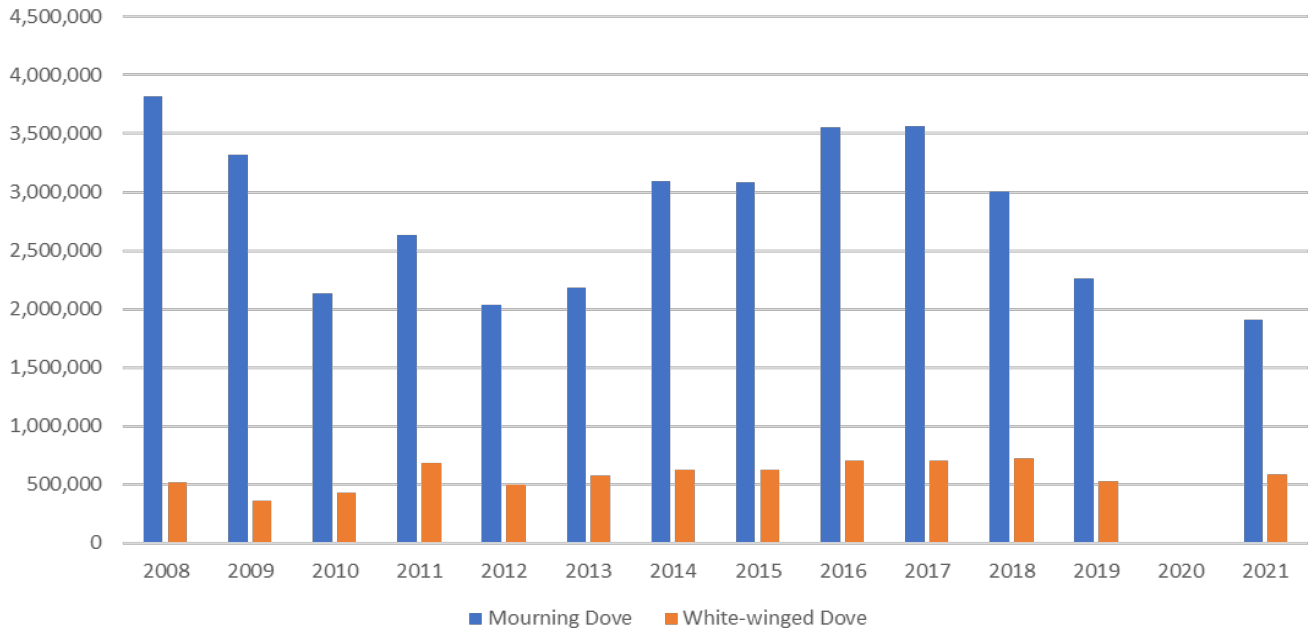
2015-16	781,253
2016-17	887,529
2017-18	474,493
2018-19	361,600
2019-20	300,340
2020-21	200,771
Average	500,998

APPENDIX: BCR Abundance Estimates

Combined (rural and urban) breeding abundance estimates from the MCCA and UDS in each Texas BCR including the 2021 estimate (2021 *N*), percent change from 2019 to 2021 (% change 2019), and percent difference in 2021 from the Long-Term Average (% change LTA; 2008-19).

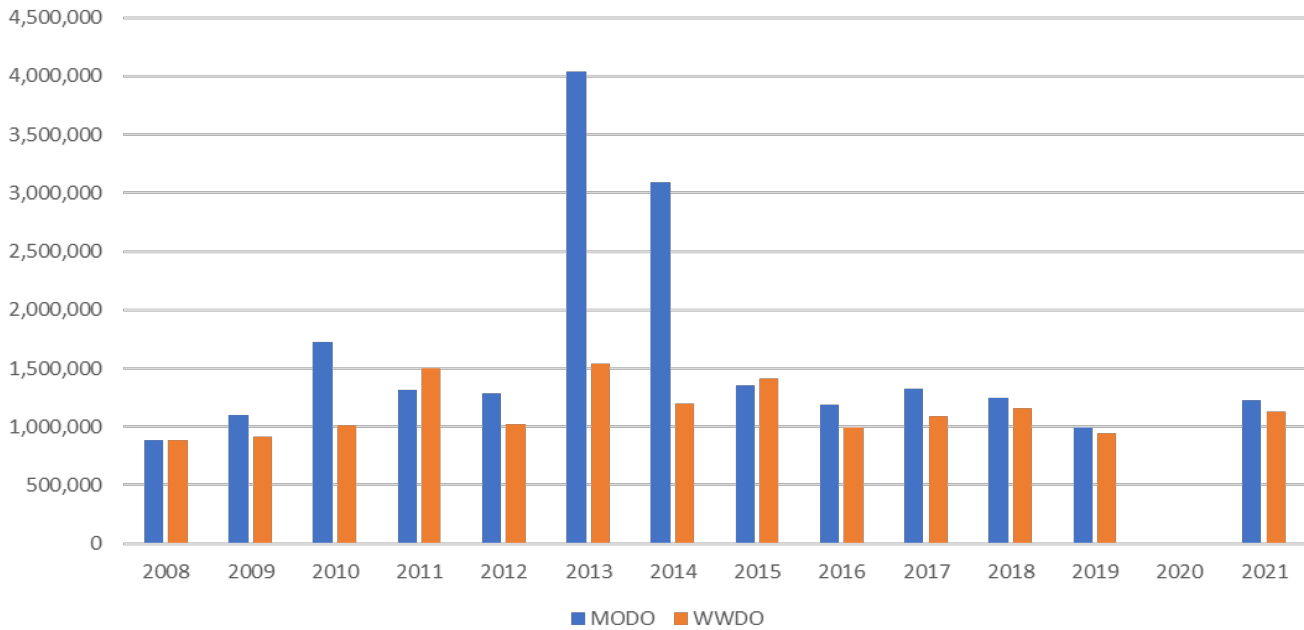


19-Central Mixed Grass Prairie



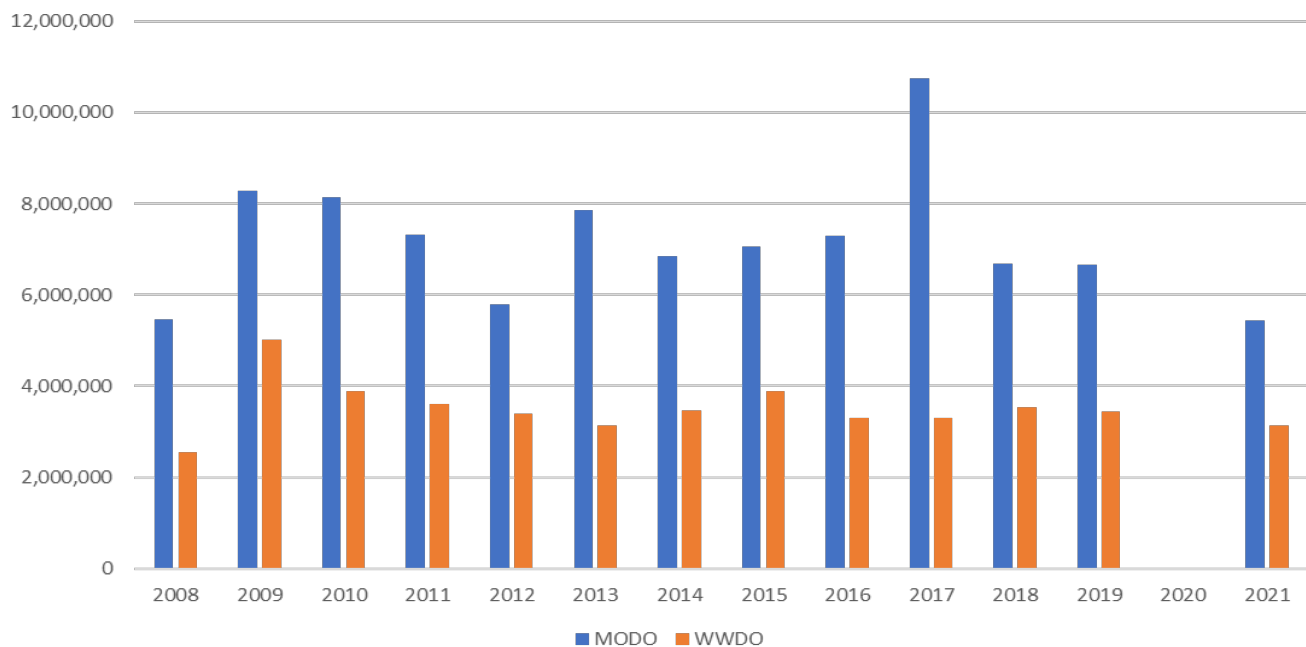
	2021 N	% change 2019	% change LTA
Mourning Dove	1,907,556	-15.7%	-34.0%
White-winged Dove	585,582	10.3%	0.8%

20-Edwards Plateau



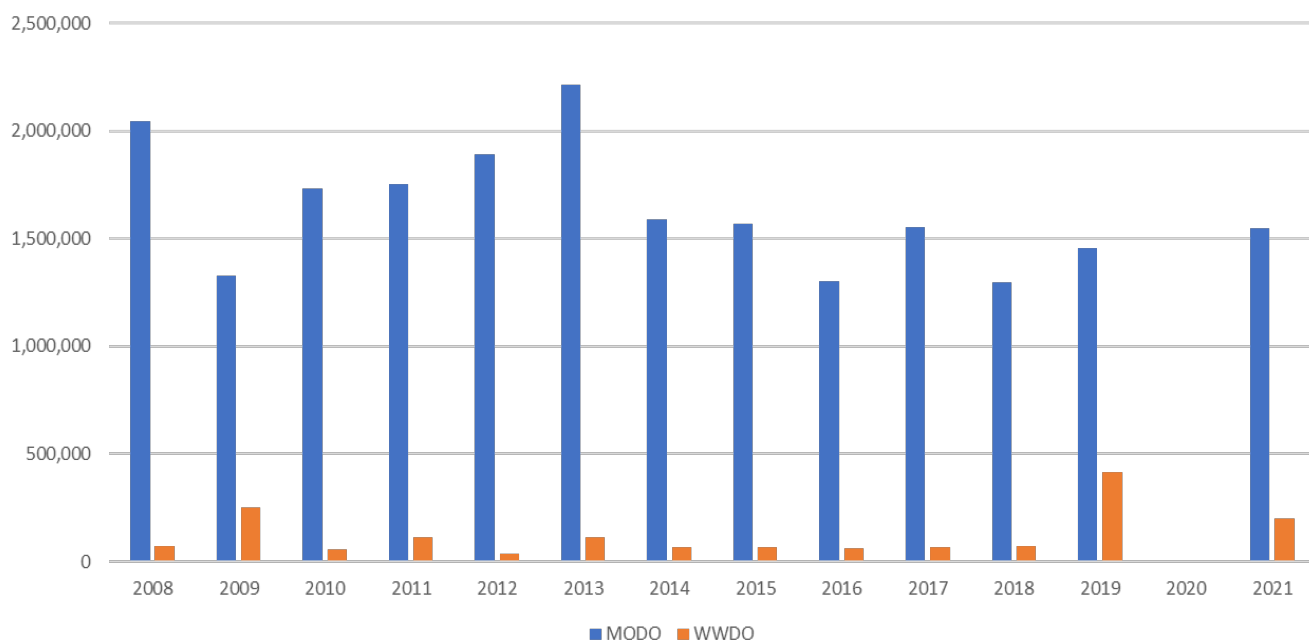
	2021 N	% change 2019	% change LTA
Mourning Dove	1,228,358	23.4%	-24.6%
White-winged Dove	1,132,026	20.1%	-0.6%

21-Oaks and Prairies



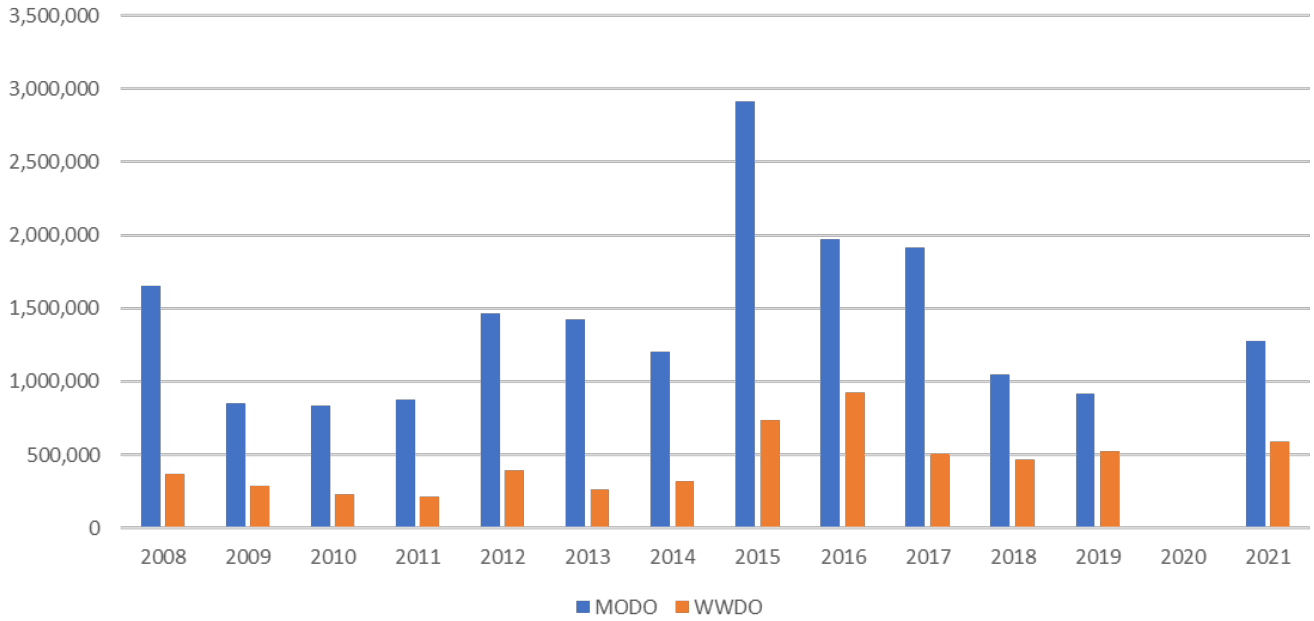
	2021 N	% change 2019	% change LTA
Mourning Dove	5,432,572	-18.5%	-26.1%
White-winged Dove	3,134,973	-8.8%	-11.6%

25-West Gulf Coast Plain



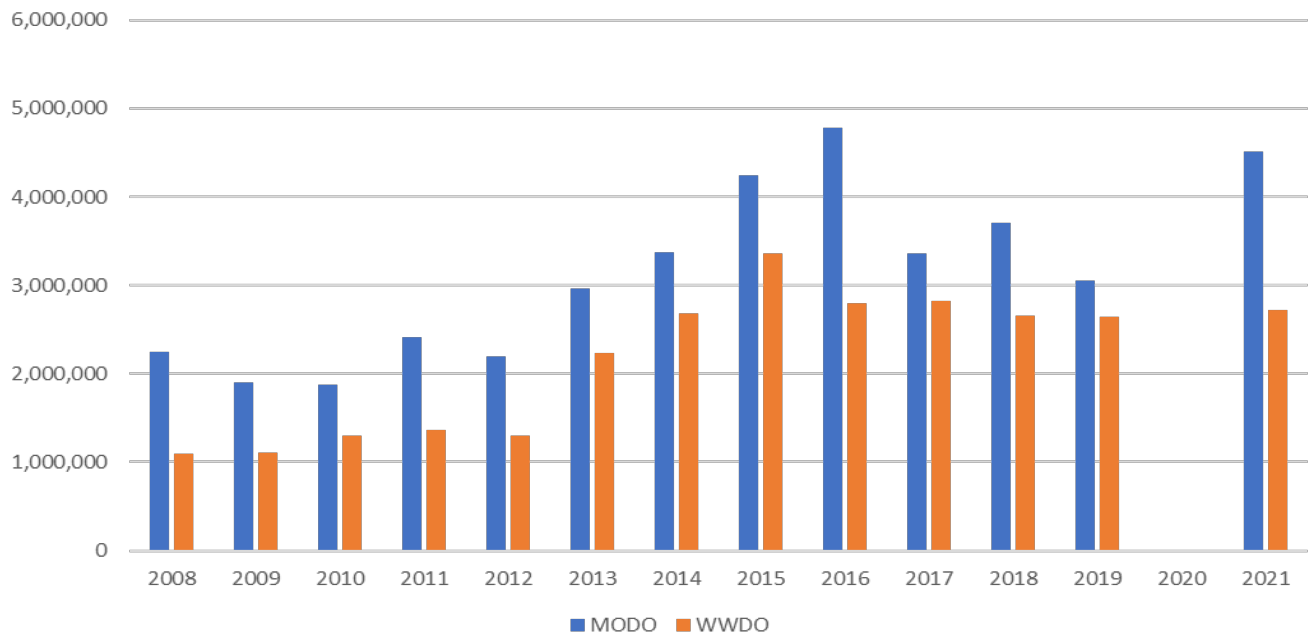
	2021 N	% change 2019	% change LTA
Mourning Dove	1,549,878	6.6%	-5.7%
White-winged Dove	200,934	-51.3%	74.5%

35-Chihuahuan Desert



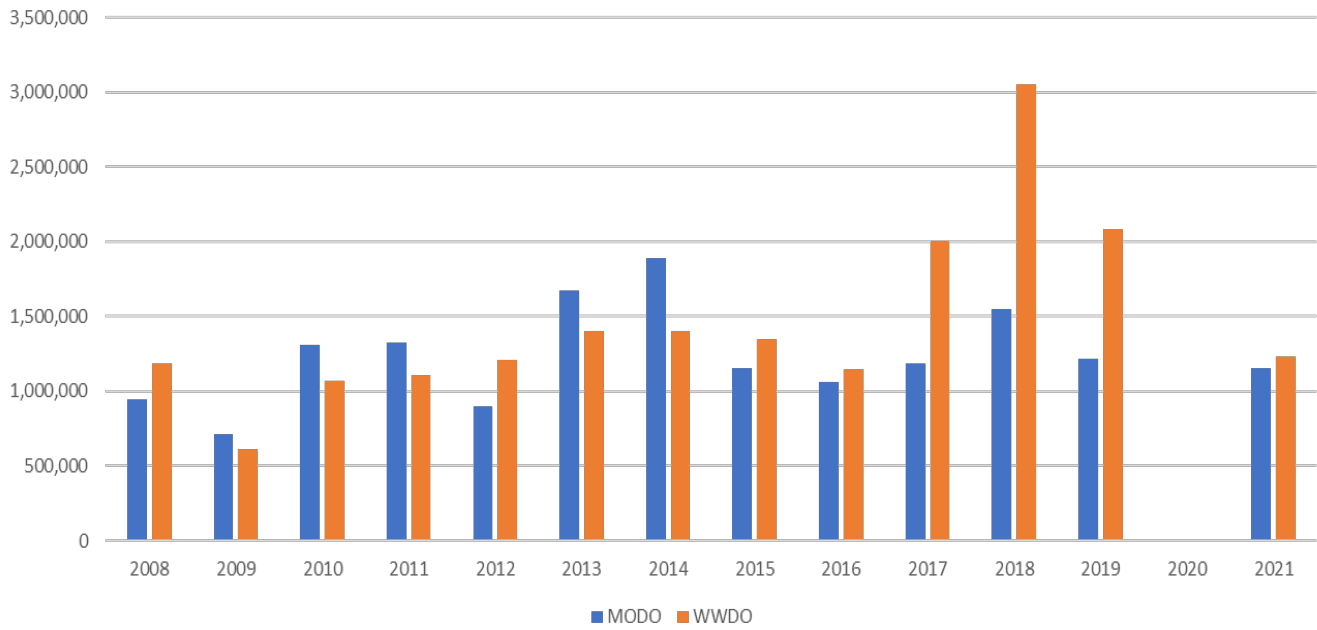
	2021 N	% change 2019	% change LTA
Mourning Dove	1,276,643	38.9%	-10.3%
White-winged Dove	594,499	12.8%	36.0%

36-Tamaulipan Brushland



	2021 N	% change 2019	% change LTA
Mourning Dove	4,515,318	48.0%	50.1%
White-winged Dove	2,725,292	3.3%	29.0%

37-Gulf Coast Prairie



	2021 N	% change 2019	% change LTA
Mourning Dove	1,154,027	-7.2%	-5.3%
White-winged Dove	1,233,998	-16.0%	-40.8%