Attwater's Greater Prairie-Chicken
(Tympanuchus cupido attwateri)

5-Year Review:
Summary and Evaluation

Photo: John Magera

U.S. Fish and Wildlife Service

Attwater Prairie Chicken National Wildlife Refuge
Eagle Lake, Texas

Texas Coastal Ecological Services
Houston, Texas

May 26, 2021

5-YEAR REVIEW
Attwater's Greater Prairie-Chicken (*Tympanuchus cupido attwateri*)

1 GENERAL INFORMATION

1.1 Listing History

Species: Attwater's greater prairie-chicken (*Tympanuchus cupido attwateri*)

Date listed: March 11, 1967

FR citation(s): 32 FR 4001

Classification: Endangered

Critical habitat/4(d) rule/Experimental population designation/Similarity of appearance listing: N/A

1.2 Methodology used to complete the review:

In accordance with section 4(c) (2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a 5-year review is to assess each threatened and endangered species to determine whether its status has changed and it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) most recently evaluated the biology and status of the Attwater's greater prairie-chicken (hereafter Attwater's prairie-chicken) as part of a status review and recovery planning process that was finalized on March 17, 2010. This review incorporates updated information made available since then in the form of published research, project reports, unpublished field observations, and personal communications. We relied on the best available information to reach our conclusions during this process. No part of this review was contracted to an outside party. The Service's lead recovery biologists completed this review.

1.3 FR Notice citation announcing the species is under active review:

May 5, 2021 (86 FR 23976)

2 REVIEW ANALYSIS

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of "endangered species" or "threatened species." The Act defines an "endangered species" as a species that is "in danger of extinction throughout all or a significant portion of its range," and a "threatened species" as a species that is "likely to become an endangered species

within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether a species meets the definition of "endangered species" or "threatened species".

The identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an "endangered species" or a "threatened species." In assessing whether a species meets either definition, we must evaluate all identified threats by considering the expected response of the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species—such as any existing regulatory mechanisms or conservation efforts. The Service recommends whether the species meets the definition of an "endangered species" or a "threatened species" only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

2.1 Distinct Population Segment (DPS) policy (1996): N/A

2.2 Updated Information and Current Species Status

2.2.1 Biology and Habitat

2.2.1.1 Abundance, population trends, demographic features, or demographic trends

A recovery plan for the Attwater's greater prairie-chicken was first completed in 1983, with revisions in 1993 and 2010. The citation for the last revision is:

U.S. Fish and Wildlife Service. 2010. Attwater's Prairie-Chicken Recovery Plan, Second Revision. Albuquerque, New Mexico.

This plan specifies criteria for downlisting the Attwater's prairie-chicken to threatened status (minimum of 3,000 breeding adults over 5-year period, 150,000 acres of grassland habitat distributed along a linear distance of 50 miles) and for removing this species from the endangered species list (minimum of 6,000 breeding adults over 10-year period, 300,000 acres of grassland habitat distributed along a linear distance of 100 miles). While considerable progress has been made in identifying factors limiting progress toward recovery, Attwater's prairie-chicken numbers remain well below recovery criteria for downlisting or delisting (Figure 1). Considerable grassland restoration and maintenance has been accomplished, particularly in Goliad County, Texas. However, habitat availability also remains well below recovery thresholds.

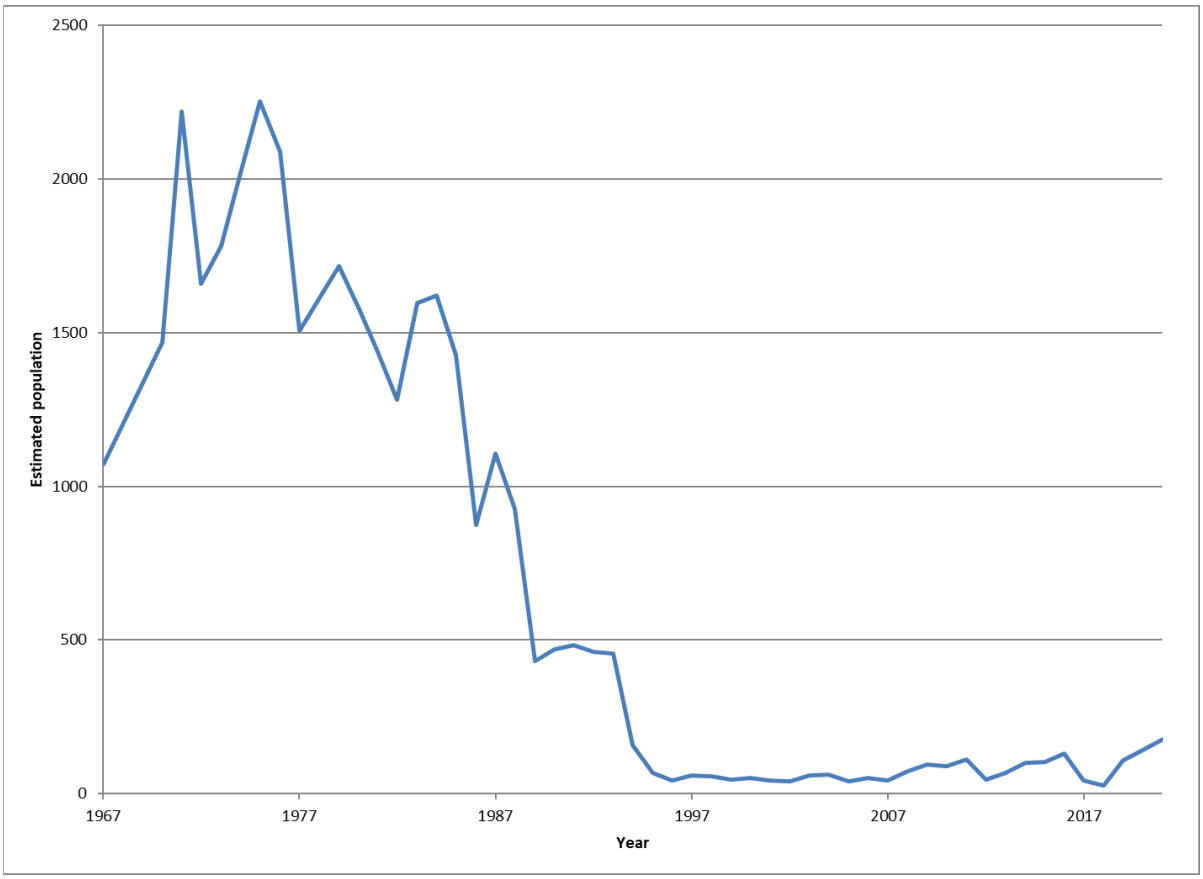

Figure 1. Estimated number of wild Attwater's prairie-chickens in Texas, 1967–2021. Data are based on spring booming grounds counts of males and an assumed 1:1 sex ratio.

Free-ranging Attwater's prairie-chicken populations have remained on the precipice of extinction since 1996 following years of population declines (Figure 1). An Attwater's prairie-chicken captive breeding program was established in 1992 at Fossil Rim Wildlife Center (Glen Rose, Texas). In following years, the Houston Zoo (Houston, Texas), San Antonio Zoo (San Antonio, Texas), Sea World of Texas (San Antonio, Texas), Abilene Zoo (Abilene, Texas), Caldwell Zoo (Tyler, Texas), and Sutton Avian Research Center (Bartlesville, Oklahoma) have reared Attwater's prairie-chickens with two overarching goals (1) preserve as much genetic representation as possible from founder populations, and (2) provide source stock for re-establishing viable populations in the wild. Currently, Fossil Rim Wildlife Center, Houston Zoo, Caldwell Zoo, and the Sutton Avian Research Center hold a total of approximately 130 breeding individuals. Over the last five years, these breeding facilities together produced an average of >300 captive-reared Attwater's prairie-chickens for release into wild habitats at the Attwater Prairie Chicken National Wildlife Refuge and on private ranchlands in Goliad County, Texas.

Since the first release in 1995, a total of 4,846 captive-reared Attwater's prairie-chickens have been released into the wild. The first release was a pilot release

consisting of 13 males. Numbers released each year have ranged from 13–494, and averaged 186 over the 26-year period. Captive-reared birds have been released at the Attwater Prairie Chicken National Wildlife Refuge (Colorado County, Texas), the Texas City Prairie Preserve (Galveston County, Texas), and on private ranchlands in Goliad County. Survival to one year post-release has averaged 16% (range 0–43%) over the history of the release program, although considerable variability has been observed among years (Figure 2). While substantially lower than the approximately 50% annual survival typically experienced by wild prairie-chickens, the observed average post-release survival for the Attwater's prairie-chicken release program is several times higher than reported in the literature for other captive-reared galliform release programs (Pratt 2010, USFWS 2010).

Movements, monthly ranges, and habitats used by Attwater's prairie-chickens released from captivity have been comparable to previous observations on wild birds (Lockwood 1998, Lockwood et al. 2005). Released birds have displayed typical breeding behavior, and have established nests in typical habitat. A total of 444 nests have been located for released Attwater's prairie-chickens (or their progeny) at the Attwater Prairie Chicken National Wildlife Refuge (n = 335), the Texas City Prairie Preserve (n = 45), and on private ranchlands in Goliad County, Texas (n = 64) during 1997–2020. Morrow and Toepfer (2020) developed a technique for enhancing nest

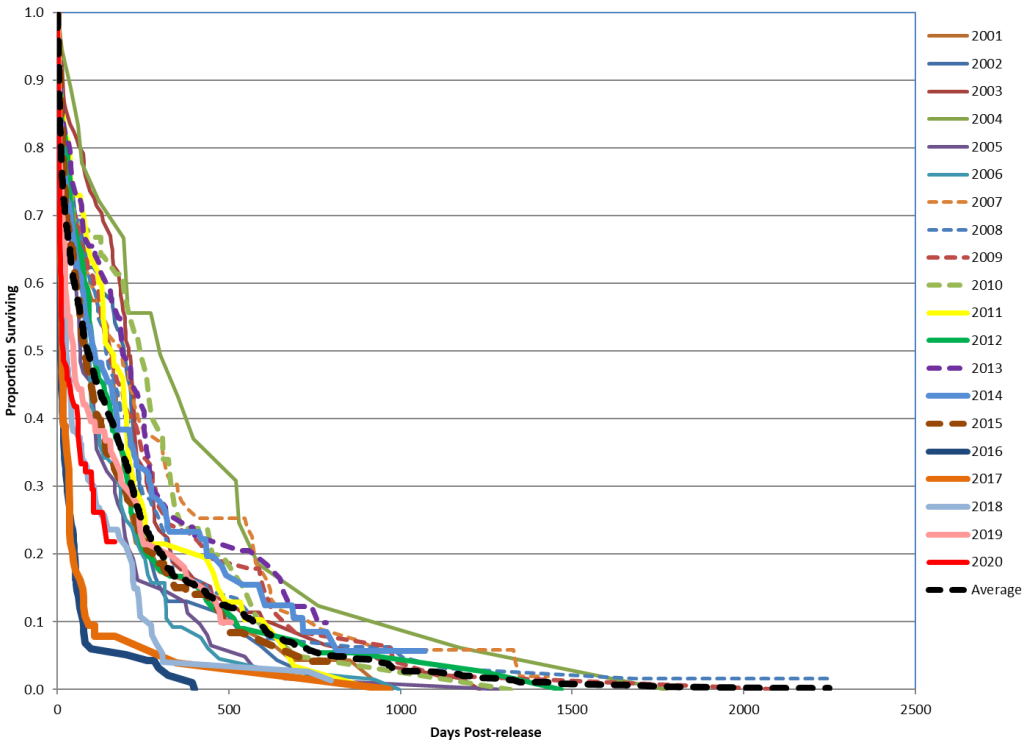

Figure 2. Kaplan-Meier estimates of post-release survival for Attwater's prairie-chickens released on the Attwater Prairie Chicken National Wildlife Refuge, Colorado County, Texas from 2001–2020. Birds were released in July–October after spending approximately two weeks in acclimation pens at the release site. Food and water was provided outside acclimation pens for a minimum of 30 days post-release.

survival by protecting individual nests with predator-deterrent fences. These authors reported 82% success for fenced nests compared to 12% for unfenced nests in their study, and compared to 32% average success reported for historic Attwater's prairie-chicken nesting data by Peterson and Silvy (1996). This technique has been used on most nests located since 2000.

Despite good nest success made possible by the predator-deterrent fences, survival of chicks was consistently poor across release sites, prompting the following conclusion in the 2010 revision of the Attwater's Prairie-Chicken Recovery Plan: "Poor survival of chicks produced by released captive-reared APCs is currently the single-most factor limiting significant progress toward recovery" (USFWS 2010, p. 40). Pratt (2010) used simulation models to evaluate number of birds released from captivity, post-release survival, and survival of broods produced in the wild on population trajectories with respect to recovery goals specified in the 2010 recovery plan. Pratt (2010, p. 50) concluded "Successful recovery of the APC is not possible by increasing post-release survival alone, even if survival is 100%...The only variable that can be increased independently and have a truly successful recovery is brood survival…"

Therefore, research was focused on identifying factors potentially affecting brood survival in the wild. Meier (2010) and Meier et al. (2013) studied whether unintentional selection in the captive environment may have led to structural or physiological changes in young chicks that adversely affected their ability to survive in wild habitats. Specifically, these authors evaluated three indicators of innate immunity, gastrointestinal tract length, and organ mass in Attwater's prairie-chicken chicks compared with wild greater prairie-chicken (*T. c. pinnatus*) chicks. All indicators for Attwater's prairie-chicken innate immune function were comparable to or greater than values observed in greater prairie-chickens. These authors also found that structural size as a function of age was similar regardless of whether chicks were raised in captivity or the wild, but body mass and mass of many organs were significantly higher in captive-reared chicks compared to those in the wild. Based on their evaluations, the authors expressed doubt that impaired ontogeny of structural size or organ growth were causative factors in the poor chick survival observed for wild-hatched Attwater's prairie-chicken chicks during the first two weeks post-hatch.

Morrow et al. (2015) concluded that invertebrate abundance at Attwater's prairie-chicken brood sites was directly related to brood survival during the critical first two weeks post-hatch. These authors also demonstrated that invasive red imported fire ants (*Solenopsis invicta*) reduced invertebrate abundance by 26–27%. Based on findings of this research, fire ant suppression efforts were expanded at the Attwater Prairie Chicken National Wildlife Refuge and at Goliad County release sites. Fire ants first invaded Attwater's prairie-chicken habitats in Texas circa 1970 (https://ant-pests.extension.org/texas-quarantine-map/). It is likely that invasion by this species contributed, at least in part, to the precipitous declines of Attwater's prairie-chicken populations which resulted in their near extinction (Figure 1).

Biological control agents including several phorid flies (*Pseudacteon spp.*) from the fire ant's native range have been evaluated by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS) and the Agricultural Research Service (USDA-ARS). Several phorid fly species have been approved for release by the University of Texas, in the state of Texas, and by USDA-ARS in the state of Florida and other southeastern states. In addition, several naturally occurring fire ant disease vectors have recently been identified in fire ant populations within the ant's acquired North American range. Gilbert and Plowes (2016) assessed the prevalence of introduced and naturally occurring biological control agents for red imported fire ants at and surrounding the Attwater Prairie Chicken National Wildife Refuge. These investigators found two phorid fly species (*Pseudacteon curvatus and obtusus*), three viruses (SINV-1, SINV-2, SINV-3), and one microsporidian (*Kneallhazia solenopsae*). Over 20 species of parasitoid flies in the genus *Pseudacteon* affect fire ants in their native South American range (Calcaterra et al. 2008). Direct fire ant mortality is generally low (<3%) from phorid fly parasitism, but these flies disrupt ant foraging behavior resulting in reduced protein intake and colony growth rates (Calcaterra et al. 2008, Mehdiabadi and Gilbert 2002). Gilbert and Plowes (2016) suggested that the low prevalence of the most virulent red imported fire ant pathogens (SINV-3 and *Kneallhazia*) and the absence of several introduced phorid flies at the Attwater Prairie Chicken National Wildlife Refuge could be rectified by release of these vectors.

Despite these intensive research and recovery efforts, Attwater's prairie-chicken populations remain at extremely vulnerable levels (Figures 1 and 3). Only continued supplementation of wild populations with releases of captive-reared stock have kept the Attwater's prairie-chicken from extinction in the wild. Since 2010 populations have exhibited significant growth on two occasions, only to be set back by a string of catastrophic weather conditions (Figure 3). Sustained population growth from 2007–2011 was ended by a near-historic drought which persisted during most of 2011. Populations immediately began to build again from 2012–2016. These years of successive population increases were ended by catastrophic flooding at the Attwater Prairie Chicken National Wildlife Refuge during the nesting season of 2016, followed by the devastating impacts of hurricane Harvey throughout the Attwater's prairie-chicken historic range in 2017. Populations have shown continued growth since 2017, and in 2021 reached numbers not seen since 1993 (Figure 3). Analyses continue to point to invertebrate abundance and fire ant treatment, along with favorable rainfall conditions (Keetch-Byram Drought Index 200–400 indicating not too wet or not too dry during the critical two weeks after hatch) as important factors for predicting Attwater's prairie-chicken chick survival in the wild (Morrow et al. in prep). Consistent with these findings, Lehmann (1941, p. 33) highlighted the importance of May rainfall to Attwater's prairie-chicken annual chick production (because most chicks hatch in May), and concluded that production of chicks was highest when May rainfall in the vicinity of what is now the Attwater Prairie Chicken National Wildlife Refuge was approximately 1.5 inches below average. Lehmann (1941, p. 34) reported an average annual rainfall of 39 inches at Columbus, Texas, 15 miles west of the refuge.

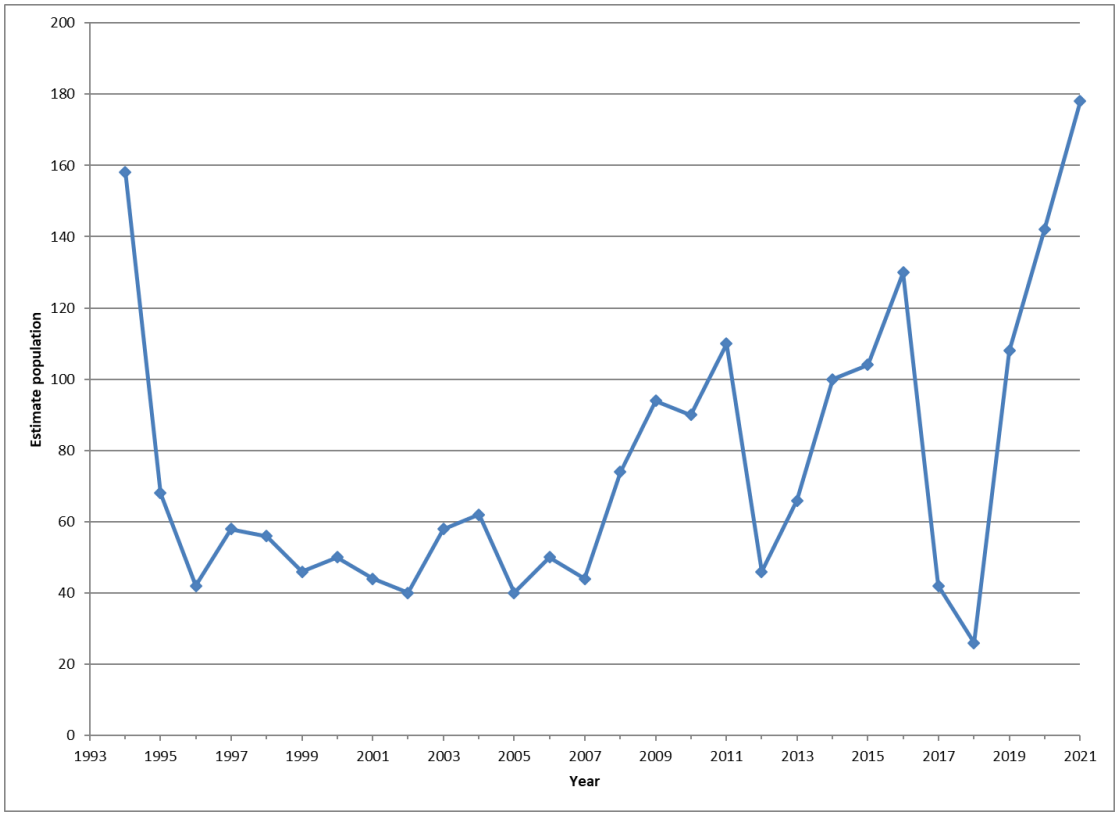

Figure 3. Population trends for wild Attwater's prairie-chickens in Texas, 1994–2021. Data are based on spring booming grounds counts of males and an assumed 1:1 sex ratio.

Based on review of the literature, biological planning documents for the Attwater Prairie Chicken National Wildlife Refuge have established the following targets for average Attwater's prairie-chicken chick survival in the wild: (1) 69% survival of broods to two weeks post-hatch (Pratt 2010), (2) 36% survival of broods to fledging (8–9 weeks of age) (Pratt 2010, Morrow 1986), and (3) an average 2.1 juveniles/adult at fledging (roughly August 1) (Peterson and Silvy1996). In 2020 at the Attwater Prairie Chicken National Wildlife Refuge, 100% of broods survived to two weeks post-hatch, 73% of known-fate broods survived to six weeks post-hatch, and an average 3.6–3.8 chicks/brood were observed at ≥6 weeks.

It is expected that populations will remain extremely vulnerable to extirpation from catastrophic weather events typical of the Attwater's prairie-chicken's coastal prairie habitat, including the extremes of drought and excessive rainfall brought by tropical systems, until populations transition from the lag phase of population growth characteristic of small populations. Population levels required to withstand the range of environmental stochasticity expected for Attwater's prairie-chicken populations is unknown. However, the recovery plan (Objective 3) recommends establishment of multiple core populations of more than 500 individuals to mitigate extirpation risks associated with these potentially catastrophic events.

2.2.1.2 Genetics, genetic variation, or trends in genetic variation

A number of studies regarding genetics of Attwater's prairie-chicken populations in captivity and the wild were published since the last status review. Bollmer et al. (2011) found consistent with the effects of genetic drift on smaller populations, wild Attwater's prairie-chicken populations had the lowest number of haplotypes/locus, haplotype diversity, fewest segregating sites at immune genes, and the lowest number of alleles/locus at microsatellite sites compared with five other populations of *T. cupido*. Hammerly et al. (2013) found the captive Attwater's prairie-chicken population contained low levels of genetic diversity in 2006, and both allelic richness and haplotype diversity were significantly lower than historic or pre-captive levels. These authors documented a negative correlation between the level of inbreeding and chick survival in captivity, and inbreeding and the incidence of wryneck (torticollis) in captivity. Hammerly et al. (2015) concluded that inadvertent errors introduced in pedigree records for the Attwater's prairie-chicken captive flock contributed to reduced chick survival, and recommended periodic evaluation by DNA methods to correct accumulated errors. Bateson et al. (2016) found that post-release survival of captive-reared Attwater's prairie-chickens was related to alleles of the innate and adaptive immune systems, but not to genome-wide heterozygosity. These authors concluded that the lack of relationship between post-release survival and genome-wide standardized heterozygosity indicated no apparent effects of inbreeding on post-release survival. However, relationships with specific immune system alleles suggest that pathogens in the environment may impact post-release survival.

2.2.1.3 Spatial distribution, trends in spatial distribution or historic range

Attwater's prairie-chickens were last observed in 2012 at the Texas City Prairie Preserve (Galveston County). Prairie-chickens have not been released at that location since 2010. Small populations remain at the Attwater Prairie Chicken National Wildlife Refuge (Colorado County) and on private ranchlands in Goliad County (Figure 4). Both of these populations continue to be supplemented with captive-reared birds.

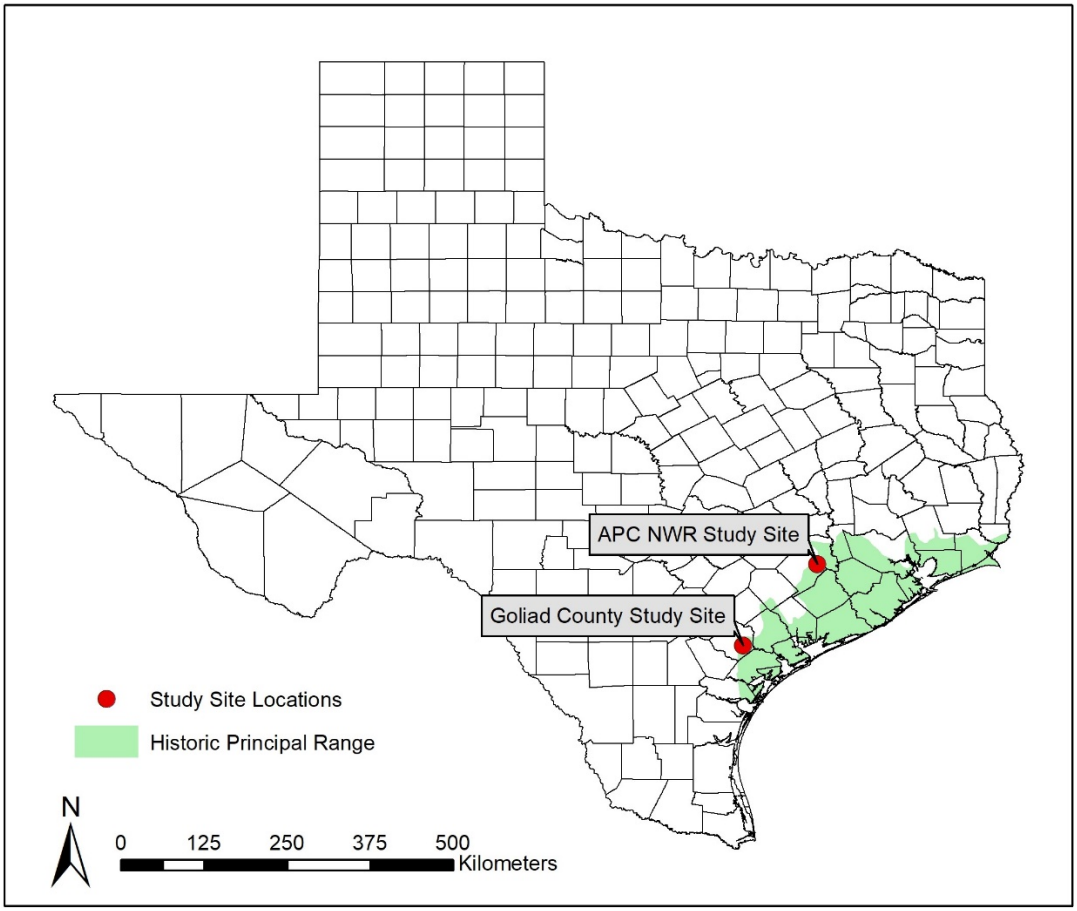

Figure 4. Current and historic (from Lehmann 1941) range of Attwater's prairie-chickens in Texas.

2.2.1.4 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of habitat or ecosystem)

In December 2020, the Service assessed woody vegetation encroachment throughout the historic range of Attwater's prairie-chicken using remotely-sensed data. This assessment used the 2016 National Land Cover Database derived from Landsat imagery (Homer et al. 2020) and the 2019 Global Forest Canopy Height layer derived from satellite-based lidar (Potapov et al. 2020). Multiple studies have found that tree canopy cover is negatively associated with use by greater prairie-chickens for booming grounds and nest sites (Merrill et al. 1999, Niemuth 2005, Gregory et al. 2011, Matthews et al. 2013, Hovick et al. 2015), and 2% tree cover is a level beyond which use for mating and nesting declines abruptly or ceases. Based on this, the Service mapped areas delineated as shrub/scrub, herbaceous, or hay/pasture and having <2% canopy cover taller than 3 m within 1 km. The largest patch of this potential high-quality habitat consisted of 41,877 acres within the Goliad County Study Site. At the Austin-Colorado County Study Site which includes the Attwater Prairie Chicken National Wildlife Refuge, 8,700 of the 58,188 acres (15%) met these criteria; much of the refuge did not

meet the criteria due to tall woody vegetation along the San Bernard River and Coushatta Creek. Additional large patches meeting the criteria were located north of Anahuac National Wildlife Refuge (30,030 acres) and west of the Whitmire Unit of Aransas National Wildlife Refuge (16,632 acres). This assessment reaffirmed that the Goliad County Study Site retains the greatest extent of potential high quality habitat and provided a map of areas to evaluate as potential future introduction sites.

Using isotope values from feathers, Torres-Poché et al. (2020) compared diet sources from historic wild Attwater's prairie-chickens with those of extant wild birds. They observed that the predominant food source during the period of feather growth was insects (62%) followed by C3 plants (17–18%), spiders (12–18%), and C4 plants (2–3%). Feathers from contemporary birds had slightly lower δ15N values than those from museum specimens, suggesting potential shifts in diets. Starns et al. (2020) examined the effects of pyric herbivory on prairie-chickens (*Tympanuchus* spp.), including Attwater's prairie-chickens. These authors concluded that pyric herbivory (i.e., combination of patch burning and grazing) (1) improves vegetation characteristics reported as critical to prairie-chicken reproduction, and (2) is a viable management technique to promote prairie-chicken habitat in the southern Great Plains while still accommodating livestock production. Pyric herbivory has been used as a management tool on the Attwater Prairie Chicken National Wildlife Refuge since 2003.

2.2.1.5 Captive-rearing program

Institutional participation in the Attwater's prairie-chicken captive-rearing program has changed since the last status review. The San Antonio Zoo dropped out of the program in 2013 followed by the Abilene Zoo in 2018. The Sutton Avian Research Center in Bartlesville, Oklahoma has been added as a new captive-rearing facility. They first reared Attwater's prairie-chickens in 2019, and provided the first birds for release in 2020. Once this facility is fully operational, it intends to produce 500 8-week old chicks per year. Prior to addition of the Sutton Center, Fossil Rim Wildlife Center, Houston Zoo, Caldwell Zoo, and the Abilene Zoo cumulatively produced an average of 453 8-week chicks per year from 2014–2018.

In addition to research previously discussed, several projects were conducted that have specific relevance to the Attwater's prairie-chicken captive rearing program. Sun et al. (2011) reported on a duplex real-time polymerase chain reaction (PCR) assay which increased the sensitivity for detection of reticuloendotheliosis virus (REV) 10-fold compared to traditional gel-based PCR assays. Reticuloendotheliosis virus is a recurring problem in captive flocks that has complicated and frustrated management of the captive program and Attwater's prairie-chicken recovery efforts. Ferro et al. (2017) evaluated wild birds as a potential source for REV infection. Because REV outbreaks in captive Attwater's prairie-chickens have often been associated with outbreaks of avian pox, Hofmeister et al. (in prep.) identified specific poxvirus clades involved in pox and REV outbreaks in the captive flock, and whether those poxviruses carried the REV genome capable of infection. They found two poxvirus clades (fowlpox and

canarypox) affecting captive Attwater's prairie-chicken. The fowlpox clade isolate (which typically affects raptors, doves, waterfowl, and gallinaceous birds) carried the fully competent REV genome. Mulreany et al. (2018) conducted a retrospective study of chick mortality and evaluated various neonatal treatments used by veterinarians on 975 Attwater's prairie-chicken chicks <8 weeks old at the Houston Zoo from 2009–2015.

Zhang et al. (2016) quantified spatial variation of microbes in the gastrointestinal tract of captive Attwater's prairie-chickens, and Morrow et al. (2019) compared nutrient profiles of eggs produced by wild and captive Attwater's prairie-chicken hens and wild greater prairie-chicken hens. This study addressed two management-oriented questions: (1) do eggs produced by Attwater's prairie-chicken hens in the wild, but released from captivity several months prior, contain comparable nutrient profiles to eggs produced by wild greater prairie-chicken hens? and (2) do eggs produced by captive hens contain nutrient profiles comparable to those produced by wild hens? Main conclusions of this research were (1) eggs produced by wild Attwater's prairie-chickens generally displayed nutrient compositions within the range of variation observed for wild greater prairie-chicken populations with no history of captivity, (2) omega 6:omega 3 fatty acids were significantly higher (6.7×) in captive-produced eggs, and (3) carotenoid levels were higher in wild eggs.

2.2.2 Threats Analysis (threats, conservation measures, and regulatory mechanisms):

Factor A: The present or threatened destruction, modification, or curtailment of habitat or range.

This factor remains a real threat to the ultimate recovery of Attwater's prairie-chickens. Loss of grassland habitat from woody species encroachment and expansion of urban centers remain very serious threats. Cultural removal of grassland fire as an accepted management tool leaves woody encroachment unchecked throughout most of the Attwater's prairie-chicken's historic range. Currently, considerable habitat thought to be suitable for occupancy by prairie-chickens still exists, but not enough to sustain full recovery as outlined in the Attwater's prairie-chicken recovery plan.

Factor B: Overutilization for commercial, recreational, scientific, or educational purposes.

There is no evidence that this factor is currently a significant threat to Attwater's prairie-chicken populations.

Factor C: Disease or predation

Disease, especially in the captive environment where birds are more crowded than they would typically occur in the wild setting, continues to frustrate recovery efforts and represents a threat to not only the captive flock, but to the existence of the subspecies until viable populations are established in the wild. Reticuloendotheliosis virus, avian

pox, and cryptosporidiosis have been particularly problematic for captive populations at some breeding facilities in recent years. Breeding birds are currently maintained at four separate facilities (Fossil Rim Wildlife Center, Houston Zoo, Caldwell Zoo, and Sutton Avian Research Center) to mitigate risks of a disease outbreak affecting the entire captive program. Risk of disease and parasites to wild birds exists, but the magnitude of such risk is unknown.

Predation threatens individual survival, and is especially acute for captive-reared birds immediately post-release. However, within reason some predation pressure serves to refine the gene pool of released birds. Predation also affects nesting success. Predator management may be necessary if predation becomes excessive, especially for small, vulnerable populations.

Factor D. Inadequacy of existing regulatory mechanisms

Threats from this factor remain unchanged from the analysis presented in the recovery plan (USFWS 2010, p. 42).

Factor E. Other natural or manmade factors affecting its continued existence

Genetics. Given that no source stock exists for infusing additional genetic variability into captive or wild Attwater's prairie-chicken populations, potential deleterious effects of inbreeding and associated loss of evolutionary potential are very real threats to this subspecies. While Hammerly et al. (2013) documented inbreeding depression in the captive Attwater's prairie-chicken population, they concluded that the range of inbreeding values observed and their significant correlation with chick mortality indicate that deleterious alleles associated with inbreeding had not gone to fixation. Continued diligence, including periodic genetic evaluation of the captive flock, is required to counteract and minimize pedigree errors (Hammerly et al. 2015), inadvertent selection in captivity, and genetic drift.

Population fragmentation/small populations. The analysis presented in the recovery plan (USFWS 2010, pp. 42–43) regarding small population size remains unchanged.

Husbandry issues. Considerable progress has been made regarding refinement of husbandry techniques, and the captive flock provides a secure safety net against extinction of this subspecies. Comparisons of production statistics with those from Kruse (1984), used as an evaluation standard for the Attwater's prairie-chicken captive breeding program since its inception, demonstrate that except for eggs/hen, current Attwater's program metrics are comparable to or exceeded those reported by Kruse (1984). Failure to thrive during the first 10 days post-hatch continues to represent the largest source of chick mortality. In 2020, 69% of chick deaths occurred during this time-frame. Continued refinement of breeder and chick diet formulations may help with this issue. Continued research is also needed to help guide disease management in the captive setting. Because the captive program is currently the only available source of Attwater's prairie-chickens for re-establishing wild populations, and because of the

tremendous value this program provides as a safety net against extinction of the subspecies until secure wild populations are established, a reliable source of funding for this program is essential for the foreseeable future.

Poor brood survival. Morrow et al. (2015) and Morrow et al. (in prep.) provided considerable information on this issue since the last status review. Specifically, these studies highlighted the critical importance of invertebrate abundance to survival of Attwater's prairie-chicken broods. These studies also documented the importance of suppressing red imported fire ants to Attwater's prairie-chicken brood survival because of the adverse impacts of these invasive ants on invertebrate communities. Morrow et al. (in prep.) found no evidence that hen characteristics (including captive vs. wild-reared, age, previous experience raising chicks) were important in predicting Attwater's prairie-chicken brood survival. While fire ant suppression with products specifically designed for that purpose are successful in increasing invertebrate abundance in the short term, the ubiquitous distribution and rapid colonization potential of fire ants means that annual treatments are necessary to maintain suppression. Therefore, availability of funding to maintain suppression at the landscape scale necessary to achieve recovery is a major limitation for the foreseeable future.

2.3 Synthesis:

Although tremendous gains in information needed to guide Attwater's prairie-chicken recovery have occurred since the last status review, populations remain extremely vulnerable to extirpation in large part due to their small size. Known impediments to population growth, and in turn to species persistence, include (1) impacts of red imported fire ants on invertebrates required as food for chicks, (2) stochastic weather events, (3) and continued loss and fragmentation of habitat from woody species encroachment and urban expansion. The long-term consequences associated with the extreme population bottleneck experienced by this species, especially with regard to population genetics, are unknown. Availability of suitable grassland habitat will ultimately limit recovery progress, but the ubiquitous presence of fire ants within existing grasslands is a much more immediate threat. Research suggests that progress toward recovery will only occur if significant resources are available to manage fire ants at the landscape scale required to support Attwater's prairie-chicken populations. Until then, this subspecies will remain in imminent danger of extinction. Therefore, no change in status is warranted or recommended.

3 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *The species is extinct*
____ *The species does not meet the definition of an endangered species or a threatened species (i.e., is recovered, or new information on status and threats indicate species does not meet definitions)*
____ *The listed entity does not meet the statutory definition of a species.*
_X___ **No change is needed**

3.2 New Recovery Priority Number: No change recommended.

Brief Rationale:

Based on recovery priority number guidance promulgated in 48 FR 51985, the current recovery priority number of 6 reflects a high degree of threat, low recovery potential, and its subspecies status. Recovery potential depends on (1) how well biological and ecological limiting factors are understood, (2) how well threats to species existence are understood and potentially alleviated, and (3) whether management techniques to alleviate limiting factors and threats are well documented and can be implemented with a high probability of success. While biological and ecological limiting factors are now understood for the species and management needed is known, identified threats to the species' (e.g., red imported fire ants, displacement of grasslands by woody species and urbanization) are pervasive and difficult to alleviate.

3.3 Listing and Reclassification Priority Number: N/A

Reclassification (from Threatened to Endangered) Priority Number: ____
Reclassification (from Endangered to Threatened) Priority Number: ____
Delisting (Removal from list regardless of current classification) Priority Number: ___

Brief Rationale: N/A

4 RECOMMENDATIONS FOR FUTURE ACTIONS

Future actions should include continued focus on captive propagation, release efforts to supplement existing populations, and the establishment of new populations where quality habitat exists (recovery plan objectives 2 and 3). This requires continued work to restore and maintain a network of large, high quality prairie habitats within the historic range of the Attwater's prairie-chicken (recovery plan objective 1). Fire ant management must be an integral part of the

restoration and maintenance of habitat quality. Research is needed to optimize fire ant management with regard to retreatment intervals and selection of areas for treatment (recovery plan task 3.7). Support for existing captive rearing facilities is essential to provide source stock for the continued expansion of wild populations, and to serve as a hedge against extinction until viable populations are established in the wild (recovery plan objective 2).

5 REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Attwater's Prairie-Chicken

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
_X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: N/A

FIELD OFFICE APPROVAL:

Lead Field Office Refuge Manager, Fish and Wildlife Service, Attwater Prairie Chicken National Wildlife Refuge

Approve JOHN MAGERA Digitally signed by JOHN MAGERA Date: 2021.05.27 09:43:24 -05'00'

Cooperating Field Supervisor, Fish and Wildlife Service, Texas Coastal Ecological Services

Approve CHARLES ARDIZZONE Digitally signed by CHARLES ARDIZZONE Date: 2021.06.01 07:07:29 -05'00'