



March 1, 2017

VIA FEDERAL EXPRESS

The Honorable Ryan Zinke
Secretary of the Interior
U.S. Department of the Interior
1849 C Street, NW
Washington, DC 20240

VIA FEDERAL EXPRESS

Dr. Benjamin N. Tuggle
Southwest Regional Director
U.S. Fish and Wildlife Service
500 Gold Avenue, SW
Albuquerque, NM 87102

VIA FEDERAL EXPRESS

The Honorable Jim Kurth
Acting Director
U.S. Fish and Wildlife Service
1849 C Street, NW
Washington, DC 20240

RE: Notice of Intent to File Suit Concerning the status of the Golden-Cheeked Warbler
under the Endangered Species Act

Dear Secretary Zinke, Director Kurth, and Regional Director Tuggle:

Pursuant to the citizen suit provision of the Endangered Species Act (“ESA”), 16 U.S.C. § 1540(g)(2), this letter serves as a 60-day notice on behalf of the General Land Office of the State of Texas (“GLO”) of intent to sue the Secretary of the Interior (“Secretary”). As detailed below, the Secretary has violated the ESA (16 U.S.C. § 1531, *et seq.*) and its implementing regulations (50 C.F.R. § 424.01, *et seq.*), as well as the Administrative Procedure Act (5 U.S.C. § 551 *et seq.*) by maintaining the Warbler in endangered status for over 26 years while simultaneously refusing to designate critical habitat, failing to adequately examine the new data contained in the 2015 Petition to Delist (“Petition”) and supporting 2015 study produced by the Texas A&M Institute of Renewable Natural Resources (“Texas A&M Study”), and failure to prepare an Environmental Impact Study (“EIS”) prior to listing the Warbler as endangered.

PARTIES

The General Land Office of the State of Texas is the oldest state agency in Texas, established by the Constitution of the Republic of Texas. Upon annexation by the United States, Texas retained

control of its public lands. Texas constitutionally dedicated half of these public lands to the Permanent School Fund, which is maintained for the benefit of the public schoolchildren of the State of Texas. T.X. Const. art. VII §2. The GLO is responsible for maximizing revenues from Texas public school lands. Tex. Nat. Res. Code Ann. §31.051. Under the Texas Constitution, proceeds from the sale and mineral leasing of public school lands flow to the Permanent School Fund via the GLO. T.X. Const. art. VII § 5(g). The Texas Legislature established the School Land Board in 1939 to manage the sale and mineral leasing of Permanent School Fund lands. The Commissioner of the Texas General Land Office chairs the School Land Board.

Additionally, the GLO owns and maintains State Veterans Cemeteries to honor those who have served, as well as State Veterans Homes that provide care and dignity for veterans, their spouses, and Gold Star parents. The ability of the GLO to maximize revenues from Texas public school lands, and to maintain State Veterans Cemeteries and State Veterans Homes to a high standard, is undermined by the restrictions imposed due to the presence of Warblers or Warbler habitat on GLO properties.

For example, in Bexar and Kendall counties, GLO owns a 2,316.45-acre parcel of land – approximately 84.5% of which contains Warbler habitat. In order to clear or develop the property under the Service’s mitigation program, GLO must replace every one acre of cleared land with three acres of Warbler habitat. This encumbrance on the property makes development of the property vastly more expensive and significantly decreases its market value if sold, resulting in less money for the Permanent School Fund, State Veterans Cemeteries, and State Veterans Homes. In fact, after conducting three studies on the presence of Warbler habitat on this property, experts concluded that the presence of Warbler habitat decreased the property’s value an average of 43%.

GLO also owns and leases 429 acres in Williamson County, approximately 5 miles east of Jonah. Warbler habitat is located throughout Williamson and surrounding counties.

If the Service does not correct the noted deficiencies within 60 days of this notice, GLO will seek to have the challenged Negative Finding declared unlawful and set aside. In addition, all other appropriate relief, including costs and fees, will be sought.

BACKGROUND

A. THE ESA 90-DAY FINDING

The ESA requires the Secretary of the Interior, acting through the U.S. Fish and Wildlife Service (“Service”), to the maximum extent practicable, within 90 days after receiving a petition to delist a threatened or endangered species under the ESA, make a finding as to whether the petition presents substantial information indicating that delisting may be warranted. 50 C.F.R. §424.14(b)(1). If the Secretary makes a positive 90-day finding by determining that a petition presents substantial information indicating the petitioned action may be warranted, the Secretary is required to commence a review of the species’ status and make a determination as to whether listing is warranted. This second determination is called a “12-month finding.” If the Secretary makes a negative 90-day finding, the petition is rejected and no further review is conducted by the

agency. A negative 90-day finding is then subject to judicial review. 16 U.S.C. §§ 1533(b)(3)(C)(ii), 1540(g).

Making a positive 90-day finding is a low bar, as it simply triggers further review of the status of a species. At the 90-day finding stage, the Secretary is required to determine only whether a petition presents substantial scientific information indicating that the petitioned action may be warranted. Service regulations define “substantial information” as “that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted.” 16 U.S.C. § 1543(b)(3)(A); 50 C.F.R. § 424.14(b)(1). The Secretary does not critically analyze petitions, conduct additional research, or make a determination as to whether listing under the ESA is warranted at the 90-day finding stage. *See, e.g., Colorado River Cutthroat Trout v. Kempthorne*, 448 F.Supp.2d 170, 176-77 (D.D.C. 2006) (recognizing the Service’s explicit acknowledgement, in the agency’s routine statement in 90-day findings on petitions, that it does not conduct additional research or subject the petition to rigorous critical review at the 90-day finding stage). In a 90-day review, the Service may utilize the information that it already has in its files regarding the species in addition to the information provided in the petition; however, the Service may not solicit or consider outside information and opinions. *E.g., Ctr. For Biological Diversity v. Morgenweck*, 351 F.Supp.2d 1137 (D.Colo. 2004); *Wildearth Guardians v. U.S. Secretary of the Interior*, 2011 WL 1225547, *4, *7 (D.Idaho Mar. 28, 2011); *McCrary v. Gutierrez*, 2010 WL 520762 (N.D.Cal. Feb. 8, 2010).

Importantly, it is well-established that a lower standard of evidence is required at the 90-day finding stage than is required to make a 12-month finding, because the question before the service at that preliminary stage is whether the petitioned action *may be warranted*, not whether it *is warranted*. *E.g., Moden v. U.S. Fish and Wildlife Serv.* 281 F.Supp.2d 1193, 1203-4 (D.Or. 2003) (concluding that “the standard for evaluating whether substantial information has been presented by an ‘interested person’ is not overly-burdensome, does not require conclusive information, and uses the ‘reasonable person’ to determine whether...action may be warranted.”); *Humane Society of the U.S. v. Pritzker*, 2014 WL 6946022, *5-8 (D.D.C. Nov. 14, 2014) (summarizing case law verifying the lower evidentiary standard for a 90-day finding and determining that the agency was arbitrary and capricious in its failure to apply the correct evidentiary standard where there was “conflicting evidence” regarding the species and the agency’s “own conclusion regarding the need for more thorough analysis suggest[ed] that a reasonable person might conclude that a review of the status of the species concerned was warranted”); *Ctr. for Biological Diversity v. Kempthorne*, 2008 WL 659822, *9 (D.Ariz. Mar. 6, 2008) (holding that “the application of an evidentiary standard requiring conclusive evidence in the context of a 90-day review is arbitrary and capricious”); *Morgenweck*, 351 F.Supp.2d at 1141; *Colorado River Cutthroat Trout*, 448 F.Supp.2d at 176 (holding that the 90-day finding stage is intended to be a “threshold determination” and a “less searching review”).

B. THE GOLDEN-CHEEKED WARBLER

On May 4, 1990, the Service listed the Warbler as endangered on an emergency basis, based upon its belief that the species was rare and that its breeding habitat was primarily limited to Travis County, Texas. 55 Fed. Reg. 18844. The Service published the final rule listing the Warbler as endangered on December 27, 1990. 55 Fed. Reg. 53153. Pursuant to the listing factors identified

in the ESA, the Service provided the following justifications for the listing of these species as endangered:

Listing Factor A (the present or threatened destruction, modification, or curtailment of its habitat or range): The Service stated “[w]idespread clearing of juniper as a range management practice and urban encroachment continue to threaten the golden-cheeked warbler and its habitat.” At that time, the Service found the greatest rate of Warbler habitat loss had occurred in the southern and eastern portions of the Edwards Plateau. The Service also cited habitat fragmentation due to highway construction, proposed residential and commercial developments, and proposed reservoirs and water delivery systems, as well as habitat loss in the Warbler’s winter territory in Mexico and Central America.

Listing Factor B (overutilization for commercial, recreational, scientific, or educational purposes): The Service determined that none of these factors were present at the time of listing.

Listing Factor C (disease or predation): The Service determined that it was difficult to assess the extent of next predation due to the difficulty in observing Warbler nests, but listed scrub jays, blue jays, crows, grackles, feral cats and dogs, rat snakes, raccoons, opossums, and squirrels as nest predators. The Service noted that fire ants “could become a threat.”

Listing Factor D (the inadequacy of existing regulatory mechanisms): The Service determined that although the Warbler is protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) and was listed as a threatened species by the Texas Parks and Wildlife Department, making it illegal to “shoot or physically harm, possess, sell or transport” Warblers without a permit, there was not provision of the protection of habitat in the regulations. The Service also noted that the City of Austin had limited power to protect Warbler habitat.

Listing Factor E (other natural or manmade factors affecting its continued existence): The Service determined that “[h]abitat destruction that causes habitat fragmentation is an immediate threat to the golden-cheeked warbler.” The Service also listed brown-headed cowbird parasitism and lack of reproduction of deciduous trees as factors affecting the continued existence of the Warbler.

55 Fed. Reg. 53153-60.

Essentially, the listing decision was based on the following key assumptions: (1) habitat loss and fragmentation due to urbanization and range clearance would continue unchecked; (2) current protections under the Migratory Bird Treaty Act and the Texas’ endangered species law were insufficient to protect Warbler habitat; and (3) predation might occur, although the difficulty in observing Warblers made this uncertain.

At the time of the listing, the Service relied on the only available studies of the Warbler, which were based upon 10-year old satellite mapping using the dated technology then available, as well as a 14 year-old study of warbler density that significantly underestimated the extent of Warbler habitat and the size of the warbler population at that time.

In making the listing decision, the Service did not simultaneously designate critical habitat as required by the ESA, 55 Fed. Reg. 18843, nor did it take any action to comply with the requirements of the National Environmental Policy Act. 42 U.S.C. § 4332(C).

C. THE PETITION TO DELIST THE GOLDEN-CHEEKED WARBLER

On June 29, 2015, a group of petitioners¹ submitted to the Service a petition to delist the Warbler. The petition provides substantial new scientific information indicating that delisting may be warranted. The petition provides the current body of information on the Warbler and documents almost five times more Warbler breeding habitat than was known at the time of the listing, as well as roughly nineteen times more Warblers in existence than was known at the time of the listing. The petition includes scientific support showing that the Warbler does not currently meet the ESA's definition of "endangered" or "threatened," and is not today "in danger of extinction throughout all or a significant portion of its range," nor is it likely to become so in the foreseeable future. In addition, the petition points to research indicating that there is consensus among the scientific community that breeding warblers inhabit a much wider range of habitat types than were identified in the early studies on which the Service relied in making its listing determination.

In rejecting the Petition to Delist, the Secretary did not undertake to designate critical habitat, did not use the best available scientific and commercial data, and did not comply with NEPA. The Secretary has thereby failed to perform mandatory substantive and procedural duties under federal law and has acted arbitrarily, as set forth below.

LEGAL CHALLENGE

A. FAILURE TO DESIGNATE CRITICAL HABITAT IS INCONSISTENT WITH CONTINUED LISTING

The ESA defines "critical habitat" as either "the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 1533 of this title, on which there are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection," and "specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 1533 of this title, upon a determination by the Secretary that such areas are essential for the conservation of the species." 16 U.S.C. § 1532(5)(A).

The crucial importance of habitat to the protection of endangered species as at the forefront of legislators' minds during the initial discussions on the ESA: "Often, protection of habitat is the only means of protecting endangered animals which occur on nonpublic lands." S.Rep. No. 307,

¹ Texans for Positive Economic Policy, Susan Combs, the Texas Public Policy Foundation, and the Reason Foundation. A copy of the Petition to Delist is attached to this 60-day notice.

93 Cong., 1st Sess. 4 (1973). In 1978, Congress amended the ESA to expressly link the timing of the critical habitat designation to the decision to list a species. 16 U.S.C. §1533(a)(3). The duty to designate critical habitat is a “non-discretionary duty” and a “Congressional mandate.” *Schoeffler v. Kempthorne*, 493 F.Supp.2d 805, 809 (W.D. Louisiana 2007).

In the years since, courts have regularly emphasized the central importance in protecting habitat in the ESA. *See, e.g., Catron County Board of Commissioners v. FWS*, 75 F.3d 1429 (10th Cir. 1996) ([T]he main purpose of the ESA is to prevent extinction of species by preserving and protecting the habitat on which species depend from the intrusive activities of humans.); *Palila v. Hawaii Department of Land & Natural Resources*, 649 F.Supp. 1070 (D. Hawaii 1986), *aff.* 852 F.2d 1106 (9th Cir. 1986) (Main purpose of ESA is conservation and preservation of ecosystems upon which endangered species depend.).

Despite this, critical habitat for the Warbler has never been designated. When the final listing was made in December 1990, the Service claimed that the Warbler’s critical habitat was undeterminable at that time, but that the Service was “presently funding a study to determine minimum patch size requirements for the species” and gave itself a deadline of May 4, 1992, to designate critical habitat. 55 FR 53153, 53160 (1990). The Service never fulfilled its obligation to designate critical habitat, despite repeatedly affirming that the Warbler is endangered and faces its greatest threat from habitat destruction. Further, the Service has never articulated a rational connection between its primary reason for listing the Warbler (habitat destruction) and its decision not to designate critical habitat. Claiming that the Warbler is endangered while at the same time refusing to designate critical habitat is both logically and legally inconsistent. The Service cannot have it both ways. Either critical habitat must be designated or the Warbler must be delisted.

The fact that the Warbler has been listed for nearly 27 years without a critical habitat designation strongly supports delisting, especially in light of the new evidence on species recovery brought to the Service’s attention in the Petition to Delist. Failure to designate critical habitat for over two decades after listing the Warbler is a violation of the mandatory duty set forth in 16 U.S.C. § 1533(a)(3)(A). Failure to delist under these circumstances is arbitrary and capricious, calling into question the validity and necessity of the Warbler’s listing as an endangered species in the first place, which constitutes a continuing violation of 16 U.S.C. §1533(c)(2). *See Schoeffler v. Kempthorne*, 493 F. Supp 2d 805, 809 (W. D. La. 2007); *See also Dickson v. Quarterman*, 2006 WL 2457073, *7 (5th Cir. 2006) (“If the entire United States government bureaucracy performed its duties as the United States Department of Interior performed, or rather failed to perform, its duties in this case, the Republic could no longer endure. The citizens of the United States, the taxpayers who pay the freight, have the right not only to expect more, but to demand more from their Government.”)

B. FAILURE TO CONSIDER BEST AVAILABLE DATA IN PETITION TO DELIST

The 90-day finding, in which the Service denied the Petition to Delist, impermissibly ignored the data contained in the Petition, which is the best available data on the Warbler. For example, in its analysis of Factor A, the Service dismissed the study conducted in 2015 by the Texas A&M Institute of Renewable Natural Resources (“Texas A&M Study”) as summarizing “information already known to the Service and discussed in the 5-year review” and praised the Service’s 2014

5-year review as representing “the best available body of science known to the Service pertaining to the status of the Warbler.”² However, in the very next line, the Service states that it “recognizes that the modeling studies described in the Texas A&M Study do represent the most recent and comprehensive efforts to estimate range-wide Warbler habitat and population size to date.” It is contradictory to claim that the 2014 5-year review is the “best available body of science” on the status of the Warbler, when the more recent 2015 Texas A&M Study is the most “recent and comprehensive” research on Warbler habitat and population size, which are key factors in determining the viability of the Warbler’s status as endangered.

The Texas A&M Study presents considerable new information on the amount of existing Warbler habitat and the most scientifically advanced methods of calculating the amount of habitat, both of which are critical to a review of the Warbler’s endangered status. Despite this, the Service concluded in its 90-day finding that the Texas A&M Study “does not present substantial information not previously addressed in the 2014 5-year review for this species and does not offer any substantial information indicating that the petitioned action to delist the species may be warranted.”³ The Service provided no credible analysis to support its summary dismissal of the Texas A&M Study.

The weaknesses in the 90-day finding are clear. First, as indicated, in its analysis of Factor A10, the Service dismissed the Texas A&M Study as summarizing “information already known to the Service and discussed in the 5-year review,” and praises its 2014 five-year review as representing “the best available body of science known to the Service pertaining to the status of the warbler.” The Service then adds that it “recognizes that the modeling studies described in the 2015 Texas A&M Study do represent the most recent and comprehensive efforts to estimate range-wide warbler habitat and population size to date.” Logically, the 2014 five-year review cannot be the “best available body of science” on the status of the warbler when the more recent 2015 Texas A&M Study is the most “recent and comprehensive” research on warbler habitat and population size, which are key factors in determining the viability of the warbler’s status as endangered.

Second, the Service mentions habitat destruction multiple times throughout its 90-day finding, in its analysis of Factor A, Factor C, Factor D, and Factor E. In its analysis of Factor D, the Service claims that “an estimated 29 per cent of existing breeding season habitat was lost between 1999-2001 and 2010-2011,” and cites “increasing urbanization” and “habitat loss” as reasons why the warbler should not be delisted. This stands in stark contrast to the Service’s refusal to designate critical habitat. It begs the question posed above from a different angle. How can destruction of the warbler’s habitat be the primary reason for denying the delisting petition when the Service has explicitly stated that it cannot determine which areas of Texas are critical habitat for the warbler?

Third, in its analysis of Factor C, the Service states that the delisting petition’s claim that predation does not constitute a significant threat to the continued existence of the warbler is refuted by the 2014 five-year review, which concluded that urbanization and habitat fragmentation “have likely resulted in increased rates of predation of warbler nests by a wide variety of animal predators, especially rat snakes.” The 2014 five-year review merely lists animals which have been known to

² A copy of the Texas A&M Study is attached to this 60-day notice.

³ A copy of the 90-day finding is attached to this 60-day notice.

prey on warbler nests, which the Service acknowledges is a “natural occurrence in [Warbler] habitat,” but goes on to extrapolate from these perfectly natural instances of predation the unsupported contention that increased urbanization leads to higher than normal levels of predation. (2014 5-year review at 11). There is no concrete support given for this analytical leap, which the Service then relied upon in its denial of the delisting petition.

Fourth, in its analysis of Factor E, the Service states that “habitat fragmentation, habitat degradation, inappropriate habitat management practices, and excessive noise all contribute to reductions in overall warbler habitat quality and present a real and significant threat to the long term viability of the species.” In discussing each of these threats, the Service states that they each have the potential to significantly affect Warbler habitat, but does not cite to any examples of instances where this has actually been the case. For instance, the Service states that “catastrophic wildfires have the potential to significantly diminish occupancy by Warblers in previously occupied habitat.” This is likely true, but in the same way that a meteor strike has the potential to significantly diminish Warbler occupancy of previously occupied habitat. Nowhere does the Service state that wildfires, or any of the other natural or man-made threats, have actually impacted Warbler habitat in any way. In fact, without being able to determine where the Warbler’s critical habitat exists, the Service’s conclusions are speculative at best and incoherent at worst.

Finally, in its concluding “Petition Finding” paragraph, the Service claims that the Texas A&M Study “does not present substantial information not previously addressed in the 2014 five-year review for this species and does not offer any substantial information indicating that the petitioned action to delist the species may be warranted.” However, the Texas A&M Study presents considerable new information on the amount of existing warbler habitat and the most scientifically advanced methods of calculating the amount of habitat, both of which are critical to a review of the warbler’s endangered status. It is clear that the Service chose to dismiss outright the new information presented in the Texas A&M Study and did so with almost no analysis to support its decision.

In short, the Service failed to examine the relevant data and articulate a satisfactory explanation for its action, including a rational connection between the facts found and the choice made, especially in light of the Service’s two-decades-plus failure to designate critical habitat. *See Motor Vehicle Manufacturers Ass’n of US, Inc. v. State Farm Mutual Auto Ins. Co.*, 463 US 29, 43 (1983).

Under 50 CFR §424.11, the Service has a mandatory duty to delist a species if any one of the three delisting criteria – extinction, recovery, or “original data for classification in error” – is present. Arguably, two of the three criteria are met in the case of the Warbler. The Texas A&M Study shows that the data relied upon in the initial listing decision was inaccurate, showing far fewer birds than actually existed. Alternatively, even if the Warblers were endangered in 1990, the Texas A&M Study results show that the species has since recovered.

C. FAILURE TO COMPLY WITH NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (“NEPA”) requires any federal agency to prepare an EIS any time the agency proposes a major federal action significantly affecting the quality of the human environment. 42 U.S.C. § 4332(2)(C). The EIS must detail the environmental impact of the action,

unavoidable adverse environmental effects, alternatives to the action, the relationship between the short-term uses and long-term productivity of the affected environment, and irretrievable and irreversible commitments of resources should the action be implemented. 42 U.S.C. § 4332(2)(C)(i)-(v).

Until September 21, 1983, the Service prepared Environmental Assessments (“EAs”) for all endangered species listing regulations. *See* Endangered and Threatened Wildlife and Plants, 48 Fed. Reg. 49244-02 (Oct. 25, 1983). After recommendations from the Council on Environmental Quality (CEQ), the Service adopted CEQ’s judgment that Section 4 listing actions are exempt from NEPA review “as a matter of law.” *Id.*

The Service listed three supporting reasons for this change:

1. That of the 130 EAs conducted in the past 10 years in connection with Section 4 actions, none resulted in a decision to prepare an EIS;
2. The Sixth Circuit’s finding in *Pacific Legal Foundation v. Andrus*, 657 F.2d 829 (6th Cir. 1981) that as a matter of law an EIS is not required for listings under the Act, and that preparing an EIS on listing actions does not further the goals of NEPA or ESA; and
3. ESA Amendments of 1982 require listing decisions under the ESA to be based solely upon biological grounds and not upon consideration of economic or socioeconomic factors.

Id. The Service claimed that foregoing EAs for all Section 4 listings would “allow better utilization of personnel and fiscal resources and will eliminate the preparation of documents that did not further the goals of either NEPA or ESA. *Id.*

Compliance with NEPA is excused when there is a statutory conflict with the agency’s authorizing legislation that prohibits or renders compliance impossible. *Flint Ridge Dev. Co. v. Scenic Rivers Ass’n*, 426 U.S. 776, 788 (1976). Courts have varied in their interpretation of what constitutes a “conflict,” and have approved foregoing NEPA on the basis of statutory conflict after finding either an unavoidable conflict between two statutes that renders compliance with both impossible, or duplicative procedural requirements between the statutes that essentially constitute functional equivalents, making compliance with both statutes superfluous. *See Catron County Bd. Of Commissioners, New Mexico v. US Fish & Wildlife Service*, 75 F.3d 1429, 1435 (10th Cir. 1996).

In *Catron County*, the court found that “given the focus of the ESA together with the rather cursory directive that the Secretary is to take into account ‘economic and other relevant impacts,’ we do not believe that the ESA procedures have displaced NEPA requirements.” *Id.* at 1436. Additionally, NEPA’s procedures allow all parties to determine what the effect of the agency’s action will be, and compliance with NEPA furthers the goals of the ESA. *Id.* Although *Catron County* did not deal with listing or delisting decisions, the court rejected the argument that the legislative history of the ESA indicates congressional endorsement of the Secretary’s decision to cease complying with NEPA. *Id.* at 1339. The court explicitly refused to extend the holding of the Sixth Circuit in *Pacific Legal Foundation v. Andrus*, 657 F. 2d 829 (6th Cir. 1981), to designations

of critical habitat, instead holding that “the available material indicates that Congress intended that the Secretary comply with NEPA when designating critical habitat under ESA when such designations constitute major federal action significantly affecting the quality of the human environment.” *Id.* The decision to list the Warbler as endangered was a major federal action that significantly affected the quality of the human environment, thus triggering the EIS requirement. For the same reason, the rejection of the petition to delist triggered the EIS requirement. At the very least, NEPA required that an EA be performed to determine whether an EIS was necessary. In any event, the Service’s utter refusal to even consider complying with NEPA was arbitrary, capricious and not in accordance with the law.

The Service was required to comply with NEPA and conduct an EIS before the Warbler’s final listing as endangered, but failed to do so. The decision to list the Warbler as endangered was a major federal action that significantly affects the quality of the human environment, and should have been subjected to the rigorous examination of an EIS. Likewise, the decision to reject the delisting petition was a major federal action affecting the quality of the human environment, and should have been subjected to the same rigorous NEPA analysis.

Respectfully submitted,



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**Petition to remove the golden-cheeked warbler
from the list of endangered species**

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From U.S. Fish & Wildlife Serv., National Digital Library, at <http://digitalmedia.fws.gov/cdm/singleitem/collection/natdiglib/id/40/rec/1>.

Executive summary

On May 4, 1990, the U.S. Fish and Wildlife Service (FWS) listed the golden-cheeked warbler (*Setophaga chrysoparia*) as endangered on an emergency basis, erroneously believing that the species was rare and that its best breeding habitat was primarily limited to Travis County, Texas.¹ At that time, FWS relied on the only available studies of the golden-cheeked warbler, which were based on ten-year-old satellite mapping using the relatively primitive technology then available, and a fourteen-year-old study of warbler density that significantly underestimated the extent of warbler habitat and the size of the warbler population.²

Today, after 25 years of additional studies, the best available science shows that the warbler's habitat and population are greater than what FWS believed in 1990. Recent studies show that the amount of warbler habitat is five times larger, and that the warbler population is roughly 19 times greater in number, than what FWS thought it to be in 1990.

Simply put, the science that prompted FWS to list the warbler in 1990 was inaccurate, and certainly current studies show that the warbler's continued listing is neither scientifically sound nor warranted by the listing criteria under the Endangered Species Act.³

¹ Endangered and Threatened Wildlife and Plants; Emergency Rule to List the Golden-cheeked Warbler as Endangered, 55 Fed. Reg. 18,844, 18,844 (May 4, 1990) (“Some of the best habitat for this species occurs in Travis County, Texas. Travis County has, by far, more warbler habitat than any other county, and it is some of the least fragmented habitat in the golden-cheeked warbler's range.”).

² *Id.*; Endangered and Threatened Wildlife and Plants; Final Rule to List the Golden-cheeked Warbler as Endangered, 55 Fed. Reg. 53,153, 53,154 (Dec. 27, 1990).

³ 16 U.S.C. § 1533(a)(1).

Introduction

On May 4, 1990, FWS listed the golden-cheeked warbler (*Setophaga chrysoparia*) as endangered on an emergency basis, based on its mistaken belief that the species was rare and that its breeding habitat was primarily limited to Travis County, Texas.⁴ FWS published a final rule listing the warbler on December 27, 1990.⁵ At that time, FWS relied on the only available studies of the golden-cheeked warbler, which were based on ten-year-old satellite mapping using the primitive technology then available, and a fourteen-year-old study of warbler density that significantly underestimated the extent of warbler habitat and the size of the warbler population.⁶ Now, after 25 years of additional studies and massive efforts to conserve the warbler, its continued listing is neither scientifically sound nor warranted by the listing criteria under the Endangered Species Act.⁷ The time has come to remove the golden-cheeked warbler from the endangered species list.

At the time of listing in 1990, the best available science was based on a small number of studies of sites in Travis County—believed to be the prime breeding habitat of the warbler. This research suggested that there were only about 328,928 hectares⁸ of potential warbler habitat in Texas supporting 13,800 warbler territories (Wahl et al. 1990; FWS 1992). But over the last twenty-five years, extensive and comprehensive biological research has been performed indicating:

- There is almost 5 times more warbler breeding habitat (1,678,312 hectares) than FWS believed at the time of the listing;
- There are roughly 19 times more warblers than FWS believed at the time of the listing (263,339 males; 95% confidence interval = 223,927–302,620) (Collier et al. 2012, Mathewson et al. 2012); and,

The science upon which listing was based in 1990, and upon which FWS based its 1992 Recovery Plan, is therefore out-of-date. Even if it had been prudent to list the species in 1990 (although the facts suggest otherwise), today’s science shows that the species does not meet the Endangered Species Act’s definition of “endangered” or “threatened”—the golden-cheeked warbler today is not “in danger of extinction throughout all or a significant portion of its range,”⁹ nor is it likely to become so in the

⁴ 55 Fed. Reg. at 18,844 (“Some of the best habitat for this species occurs in Travis County, Texas. Travis County has, by far, more warbler habitat than any other county, and it is some of the least fragmented habitat in the golden-cheeked warbler’s range.”).

⁵ 55 Fed. Reg. 53,153 (Dec. 27, 1990)

⁶ *Id.*; 55 Fed. Reg. at 53,154.

⁷ 16 U.S.C. § 1533(a)(1).

⁸ There are 2.471 acres in a hectare, and 259 hectares comprise one square mile.

⁹ 16 U.S.C. § 1532(6).

foreseeable future.¹⁰ In addition, there is consensus among the scientific community that breeding warblers inhabit a much wider range of habitat types than identified in the early studies on which FWS relied (e.g., Klassen et al. 2012).¹¹ Recent studies also suggest that there is no genetic basis for managing warblers as separate population entities.¹²

Recognizing that the science upon which listing was based in 1990 is outmoded, FWS has concluded that its 1992 Recovery Plan—which was based on that same early science—must be revised: “[a]dditional information has been collected since the recovery plan was published [in 1992] and warrants revision of the recovery plan.”¹³

In short, both the listing and recovery plan for this species were based on scientific evidence that has since been made obsolete. There is no biological or scientific basis for maintaining this species on the endangered species list. Delisting this species is now compelled by today’s best available science and the provisions of the Endangered Species Act.¹⁴

The golden-cheeked warbler

The golden-cheeked warbler (*Setophaga chrysoparia*) is a small, insectivorous, migratory songbird that breeds in mixed oak-juniper (*Quercus-Juniperus*) woodland of central Texas between March and August (Pulich 1976; Ladd and Gass 1999). The warbler nests in tall, closed canopy stands of Ashe juniper mixed with a variety of oak, maple, and other trees.¹⁵ During the breeding season, warblers require shredded bark from mature Ashe juniper (*Juniperus ashei*) for nest material and a combination of Ashe juniper, oaks, and associated hardwoods for nesting and foraging (Pulich 1976; Ladd and Gass 1999). The composition of woody vegetation found in warbler habitat varies, with

¹⁰ See *id.* at § 1532(20) (defining “threatened species”).

¹¹ See Ex. 1, Tex. A&M Inst. of Renewable Natural Resources, Conservation Status of the Federally Endangered Golden-cheeked Warbler (unpublished research summary, June 2015), available at <http://irnr.tamu.edu/publications/research-reports/> (hereinafter “Ex. 1, Texas A&M Survey”).

¹² Denise L. Lindsay et al., *Habitat fragmentation and genetic diversity of an endangered, migratory songbird, the golden-cheeked warbler* (*Dendroica chrysoparia*), 17 MOLECULAR ECOLOGY 2122 (2008).

¹³ U.S. Fish & Wildlife Serv., Golden-cheeked warbler (*Setophaga chrysoparia*) 5-Year Review: Summary and Evaluation 3 (Aug. 26, 2014) (hereinafter “Five-Year Review”).

¹⁴ 16 U.S.C. § 1533(a)(1).

¹⁵ 55 Fed. Reg. at 53,154; see also U.S. Fish & Wildlife Serv., Species Profile for golden-cheeked warbler (*Dendroica chrysoparia*), <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=B07W>.

Ashe juniper often but not always the dominant species.¹⁶ The male warbler is territorial, and can be located by its territorial song.¹⁷

Most warblers leave the breeding grounds in late July and migrate through Mexico and Central America to their wintering grounds in southern Mexico, Guatemala, Honduras, El Salvador, and Nicaragua, where they remain until spring migration begins in late February (Pulich 1976; Ladd and Gass 1999). In the past few years, warbler presence has been confirmed in northern El Salvador and north-central Nicaragua.¹⁸ Warblers have also recently been documented in other new areas since 2000, and warbler sightings from Costa Rica and Panama suggest the warbler's winter range extends further south than originally assumed.¹⁹ According to Komar (2011), "[t]he warblers were overlooked for decades in other parts of their range, now recognized as regular wintering areas, such as Nicaragua, northern El Salvador and southern Chiapas."²⁰

Petitioners

Petitioners are the Texans for Positive Economic Policy, Susan Combs, the Texas Public Policy Foundation, and the Reason Foundation.

Texans for Positive Economic Policy (TPEP) is devoted to promoting, among other objectives, the use of sound science in protecting endangered species. Over the past 20 years, Texas has created a national model for funding objective, peer-reviewed science to deal with the Endangered Species Act and thereby assure protection of both the species and the economy. TPEP works to promote the use of sound science in the study of species and habitat by helping to secure funding for research, study, and analysis. TPEP has a key organizational interest in promoting the use of objective, peer-reviewed science in listing and delisting decisions. TPEP supports local and state conservation efforts for the warbler rather than the unnecessary federal listing of the warbler under the Endangered Species Act. Texans for Positive Economic Policy is based in Austin, Texas, and can be contacted through counsel for Petitioners.

Susan Combs is a fourth-generation Texan with a ranch in Brewster County, Texas, first owned by her great grandfather over a century ago. Combs has served as a state representative, agriculture commissioner, and most recently, as state comptroller.

¹⁶ U.S. Fish & Wildlife Serv., Species Profile for golden-cheeked warbler (*Dendroica chrysoparia*),

<http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=B07W>.

¹⁷ *Id.*

¹⁸ Five-Year Review at 6.

¹⁹ *Id.*

²⁰ Oliver Komar, Winter ecology, relative abundance and population monitoring of Golden-cheeked Warblers throughout the known and potential range 29 (May 4, 2011) (submitted to Tex. Parks & Wildlife).

Combs has devoted her career to Endangered Species Act issues, heading the state task force on endangered species, and holding the state permit for the Candidate Conservation Agreement with Assurances for the dunes sagebrush lizard in her capacity as Texas Comptroller. Combs has an aesthetic interest in the golden-cheeked warbler and seeks to conserve the warbler and its habitat within Texas. Combs believes that local and state conservation efforts would be of greater benefit to the warbler and that continued unwarranted regulation under the Endangered Species Act can impede voluntary and local conservation efforts. Susan Combs is a resident of Texas and can be contacted through counsel for Petitioners.

The Texas Public Policy Foundation is a 501(c)(3) nonprofit, nonpartisan research institute, whose mission is to promote and defend liberty, personal responsibility, and free enterprise in Texas and the nation by educating and affecting policymakers and the Texas public policy debate with academically sound research and outreach. The Foundation's research fellows regularly testify before the U.S. Congress and Texas legislature on environmental and endangered species issues. This delisting petition supports the Foundation's ongoing efforts to promote the use of academically sound research in federal regulatory decisions. The Foundation supports state and local conservation efforts as being of greater benefit to the warbler and that continued regulation under the Endangered Species Act can impede voluntary and local conservation efforts. The Texas Public Policy Foundation is based in Austin, Texas, and can be contacted through counsel for Petitioners.

Reason Foundation was founded in 1978 and is a 501(c)(3) nonprofit organization. Reason Foundation's nonpartisan public policy research promotes choice, competition, and a dynamic market economy as the foundation for human dignity and progress. Reason produces rigorous, peer-reviewed research and directly engages in the policy process, seeking strategies that emphasize cooperation, flexibility, local knowledge, transparency, accountability, and results. This delisting petition is consistent with Reason's mission to encourage voluntary efforts to support conservation using peer-reviewed research and to discourage unwarranted federal regulation of species. Reason Foundation is based in Los Angeles, California, and can be contacted through counsel for Petitioners.

Procedural history

1. Emergency listing decision—May 4, 1990

Under Section 4(a)(1) of the federal Endangered Species Act, the Secretary is required to evaluate five factors in determining whether to list a species as endangered:

The Secretary shall by regulation . . . determine whether any species is an endangered species or a threatened species because of any of the following factors:

- (A) the present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) overutilization for commercial, recreational, scientific, or educational purposes;
- (C) disease or predation;
- (D) the inadequacy of existing regulatory mechanisms; or
- (E) other natural or man-made factors affecting its continued existence.²¹

On May 4, 1990, FWS published an emergency listing for the golden-cheeked warbler, stating that “an emergency posing a significant risk to the well-being of the golden-cheeked warbler exists as a result of on-going and imminent habitat destruction by both illegal and legal clearing” in and around the City of Austin in Travis County, Texas. At the time of the emergency listing, FWS believed that warbler breeding habitat was very limited—31,750 to 106,750 hectares located primarily in Travis County, Texas—according to a study conducted for FWS by Wahl et al. in 1990. Wahl et al.’s analysis was based on three key sources of information: satellite images from 1974, 1976, and 1981 used to classify warbler habitat; the decision to exclude habitat under 50 hectares; and density estimates from a 1976 study by Pulich used to estimate the total warbler population.

2. Final listing decision—December 27, 1990

On December 27, 1990, FWS published its final rule to list the golden-cheeked warbler as endangered based solely on evidence found to support the first factor, threatened habitat destruction. In response to the proposed rule several commentators suggested that FWS wait to make its listing decision, stating that “further studies and surveys should be conducted and evaluated before a final decision is made on whether or not to list the golden-cheeked warbler as endangered.”²² FWS ignored that advice, instead taking the position that the agency is required to make a decision within a year of the proposal on the best science it had available at the time.

The final rule again relied on the same habitat and population estimates of Wahl et al. (1990) along with Pulich (1976). The final rule stated FWS’s belief at the time that “[b]ased on the assumption that all suitable habitat is occupied, the carrying capacity of the available suitable habitat area would support between 4,600–16,000 pairs of golden-cheeked warblers at a density of 15 pairs/100 hectares (247 acres).”²³ The primary reason for listing the warbler was the potential for habitat destruction, as described by

²¹ 16 U.S.C. § 1533(a)(1).

²² 55 Fed. Reg. at 53,156.

²³ *Id.* at 53,154.

Wahl et al.: “At present rates, the estimated maximum carrying capacity of the habitat will be 2,266–7,527 pairs of golden-cheeked warblers by the year 2000, a reduction in population size of more than 50 percent.”²⁴ Echoing the emergency rule, the final rule emphasized that the primary threat to the warbler was habitat loss in Travis County.²⁵

But FWS admitted in the final listing rule that its information on warbler habitat was so limited that it could not designate critical habitat along with the listing:

Critical habitat for this species remains undeterminable at this time. There is currently insufficient information on warbler habitat requirements to support delineation of critical habitat boundaries throughout summer range. Although some areas of warbler habitat have been identified by satellite mapping, all the specific elements of the habitat that are critical to the survival of the golden-cheeked warbler are not known. For example, information is lacking on habitat configuration fragmentation corridors, and minimum patch size.²⁶

3. FWS Species Recovery Plan—September 30, 1992

On September 30, 1992, FWS approved a Recovery Plan for the warbler based on the same scientific information that FWS relied on when issuing the 1990 listing decision. That Recovery Plan contained the following criteria based on FWS’s flawed notion that there were few warblers in Texas and that the species’ habitat was limited:

- Sufficient breeding habitat protection to ensure continued existence of at least one viable, self-sustaining population in each of the eight regions outlined in the plan;
- The potential for gene flow exists across regions between demographically self-sustaining populations needed for long-term viability;
- Sufficient and sustainable non-breeding habitat to support the breeding populations;
- All existing warbler populations on public lands are protected and managed to ensure their continued existence;
- All criteria met for 10 consecutive years.²⁷

²⁴ *Id.* at 53,157.

²⁵ *Id.* at 53,156.

²⁶ *Id.* at 53,158.

²⁷ Recovery Plan at iv.

4. Five-Year Review—August 26, 2014

On April 21, 2006, FWS published a notice indicating its intent to perform a review of the warbler’s status.²⁸ FWS then commissioned a report by Groce et al. (2010) that summarized available scientific information on the warbler and made general recommendations.²⁹ FWS published its Five-Year Review on August 26, 2014.³⁰

The Five-Year Review correctly criticized the 1992 Recovery Plan for failing to address the statutory listing factors and for relying on out-of-date information, and stated that FWS was “in the process of revising the [1992] recovery plan.”³¹ And the Five-Year Review identified additional newly protected habitat, including 19,994,190 hectares of Department of Defense lands.³²

The Five-Year Review did not, however, take advantage of the work already completed by Groce et al. (2010) reviewing the state of scientific knowledge concerning the warbler. The Five-Year Review concluded that “the greatest threat to [the golden-cheeked warbler] is habitat loss” and therefore “permanent protection of large blocks of contiguous habitat is necessary for the long-term survival and recovery of the [warbler]. Enough habitat should be protected in the breeding, migrating, and wintering habitat to support viable [warbler] populations.”³³ Yet Groce et al. discussed studies that indicated “habitat type (semifragmented or fragmented) did not emerge as a significant predictor of territory abundances”; “[t]here was no difference in age structure of male warblers in unfragmented and fragmented study sites”; and “minimum patch size threshold for productivity of 15–24 h[ectares].”³⁴ The Five-Year Review also did not respond to the recommendation by Groce et al. that limited study sites for the warbler made population and habitat estimates unreliable: “Current estimates of demographics and habitat influences are derived from limited locations (i.e., Fort Hood and Travis County), thus, biasing estimates towards the eastern and central extent of the warbler range.”³⁵ Instead, the Five-Year Review relied—as did the 1990 Final Rule—on the limited surveys of Pulich (1976) and Wahl et al. (1990).³⁶ Furthermore, Groce et al. cited multiple studies

²⁸ Endangered and Threatened Wildlife and Plants; 5-Year Review of 25 Southwestern Species, 71 Fed. Reg. 20,714 (Apr. 21, 2006).

²⁹ Julie Groce et al., Five-year Status Review: Golden-Cheeked Warbler (Apr. 15, 2010) (prepared for Tex. Parks & Wildlife under Grant No. TX E-102-R).

³⁰ Five-Year Review.

³¹ *Id.* at 3; *see also id.* at 4 (“A revision to the recovery plan is warranted and a draft is being developed.”).

³² *Id.* at 10.

³³ *Id.* at 16.

³⁴ Groce et al., *supra* note 29, at 86–87.

³⁵ *Id.* at 170.

³⁶ Five-Year Review at 5.

that detected “an increasing trend in density of warblers,”³⁷ while the Five-Year Review did not discuss these findings.³⁸ The Five-Year Review also questioned population demographics studies because of the need to consider pairing success to accurately estimate the female population while ignoring the discussion in Groce et al. of various estimates of warbler pairing success, generally ranging from 53 to 100 percent.³⁹ Finally, the Five-Year Review did not delineate what would be a “viable” warbler population.

Reasons for delisting the species as endangered

1. Standard of review

When the Secretary of Interior receives a petition to delist a species from the endangered species list, the Secretary must “make a finding” within 90 days “as to whether the petition presents substantial scientific or commercial information indicating that the petitioned action may be warranted.”⁴⁰

To determine if delisting is warranted, the Secretary must consider whether the petition contains:

1. The administrative measures sought;
2. The common and scientific name of the species;
3. A narrative justifying the measure based upon available information including past and present numbers, distribution and current threats to the species;
4. The status of the species in all or a significant portion of its range; and
5. Supporting documentation such as a bibliography, copies of publications, reports, letters from authorities, and maps.⁴¹

If the Secretary finds that there is information “that would lead a reasonable person to believe that the measures proposed in the petition may be warranted,”⁴² the Secretary is required to “promptly commence a review of the status” of the species.⁴³

Within 12 months of receiving the petition, the Secretary must issue a finding that the petitioned action is either warranted or not warranted.⁴⁴ If the petitioned action is warranted, the Secretary must promptly publish “a general notice and complete text of proposed regulation to implement such action” or publish a finding that the action is

³⁷ Groce et al., *supra* note 29, at 39–40.

³⁸ See Five-Year Review at 5.

³⁹ Compare Five-Year Review at 5, with Groce et al., *supra* note 29, at 44–45.

⁴⁰ 16 U.S.C. § 1533(b)(3)(A).

⁴¹ 50 C.F.R. § 424.14(b)(2).

⁴² *Id.* § 424.14(b)(1).

⁴³ 16 U.S.C. § 1533(b)(3)(A).

⁴⁴ *Id.* § 1533(b)(3)(B).

warranted but precluded at that time because of other pending proposals or efforts to change the status of species on the lists.⁴⁵

To make a determination that a petition is warranted under 16 U.S.C. § 1533(b)(3)(B), the Secretary must consider the “best available scientific and commercial information” for the species.⁴⁶ The scientific and commercial information should consider whether there is a “present or threatened destruction, modification or curtailment of its habitat or range; over utilization for commercial, recreational, scientific, or education purposes; disease or predation”; inadequate existing regulations, or other factors that affect the species’ continued existence.⁴⁷ In addition, the delisting petition and the scientific or commercial information must show that the species has either recovered to the point where protection of the species is no longer required or new information shows that the original data for classification was in error.⁴⁸

Federal regulations provide three circumstances under which FWS may delist a previously listed species—extinction, recovery, and error. Petitioner seeks the delisting of the golden-cheeked warbler under the authority of 16 U.S.C. § 1533(b)(3), 5 U.S.C. § 553(e), and 50 C.F.R. § 424.11(d)(2) and (3), because the best available science today shows that the species is not endangered: the warbler was either listed in error⁴⁹ or has recovered since listing.⁵⁰

Since the 1990 listing, multiple surveys and research have established that the warbler breeding habitat is five times larger, extending far beyond Travis County, and that the warbler population is an order of magnitude greater than FWS believed at the time. The exhaustive survey of these studies prepared by the Texas A&M Institute of Renewable Natural Resources, attached as Exhibit 1, summarizes these studies. Estimates of warbler habitat have dramatically increased—ranging between 551,668 and 1,771,552 hectares—due to improved classification techniques, better satellite image quality, and on-the-ground sampling.⁵¹ Independent, peer-reviewed studies in 2012—Collier et al. and Mathewson et al.—and one independent, peer-reviewed study in 2013—Duarte et al.⁵²—put the total potential habitat between 1,578,281 and 1,678,053 hectares,

⁴⁵ *Id.* § 1533(b)(3)(B).

⁴⁶ 50 C.F.R. § 424.11(b).

⁴⁷ *Id.* § 424.11(c).

⁴⁸ *Id.* § 424.11(d).

⁴⁹ *Id.* § 424.11(d)(3).

⁵⁰ *Id.* § 424.11(d)(2).

⁵¹ *See* Ex. 1, Texas A&M Survey 3 & 4 tbl. 1.

⁵² The Five-Year Review cites Duarte et al. (2013) only to highlight the study’s determination that warbler breeding habitat decreased 29 percent between 1999–2001 and 2010–2011. Five-Year Review at 8. The Five-Year Review fails to mention that Duarte et al.’s 1999–2001 habitat estimate for the warbler was 2,219,168 hectares—higher than any other published study to date, or that their 2010–2011 habitat estimate was 1,578,281

or nearly five times more habitat than originally estimated when the warbler was listed in 1990.⁵³ And the territory density estimates derived by Mathewson et al. (2012) were well within the range of most available information for the species (Table 1). These more recent studies represent the best available science on warbler habitat, carrying capacity, and abundance. And the reliability of these studies is underlined by the fact that these three peer-reviewed population estimates came to similar conclusions with regard to the extent of warbler breeding habitat.

This best available science, developed long after the 1976 study and the 1980s satellite images on which the listing was based, shows that the warbler does not meet the five statutory factors for listing the species. As summarized by Exhibit 1, the 2015 Texas A&M Survey, the original data on warbler habitat and population were based on a small number of study sites in a limited portion of the warbler's breeding range, while the best available scientific evidence today shows a much larger warbler habitat and population size than originally estimated. Because the golden-cheeked warbler does not meet the statutory factors, it should be delisted.

2. The best available science developed since the listing of the warbler in 1990 shows that the species is not endangered

In 2015, the Institute of Renewable Natural Resources at Texas A&M conducted a survey analyzing the status of the golden-cheeked warbler, attached to this Petition as Exhibit 1. The 2015 Texas A&M Survey summarized the extensive research and analysis that has been performed since 1990 and concluded that the warbler's listing status should be re-examined. This represents the best available science concerning the warbler, and it confirms that the warbler is not and never has been endangered in Texas and its habitat is far more abundantly available than FWS erroneously concluded in 1990.⁵⁴

The information presented in this Petition demonstrates that the species has either recovered to the point where protection of the species is no longer required or presents new information demonstrating that the original data for classification was in error,⁵⁵ making the golden-cheeked warbler ineligible for continued listing as an endangered species. The golden-cheeked warbler habitat and population size were significantly

hectares—in line with Mathewson et al. (2012) and Collier et al. (2012). Adam Duarte et al., *Spatiotemporal variation in range-wide Golden-cheeked Warbler breeding habitat*, 4 ECOSPHERE 5 (2013).

⁵³ Bret A. Collier et al., *Predicting patch occupancy in fragmented landscapes at the rangewide scale for an endangered species: an example of the American warbler*, 18 DIVERSITY & DISTRIBUTION 158 (2012); Heather A. Mathewson et al., *Estimating Breeding Season Abundance of Golden-Cheeked Warblers in Texas, USA*, 76 J. WILDLIFE MGMT. 1117 (2012); Duarte et al., *supra* note 52, at 5.

⁵⁴ Ex. 1, Texas A&M Survey at 2–13.

⁵⁵ 50 C.F.R. § 424.11(d).

underestimated in the 1990 listing. The best available scientific data today shows that habitat is at least five times larger and the warbler population is an order of magnitude larger than estimated in 1990. In addition, regulations will continue to protect the warbler and its habitat even after delisting (as discussed in Section 6 of this petition), and none of the other statutory factors are a significant threat to the warbler (as discussed in Sections 4, 5, and 7).

FWS's original listing of the warbler primarily relied upon the Wahl et al. (1990) estimate of warbler habitat of 338,035 hectares.⁵⁶ The Wahl et al. estimate was further reduced in the 1992 Recovery Plan to 237,163 hectares. This research was based on a small number of study sites in a limited portion of the warbler's breeding range.⁵⁷ As Groce et al. (2010) noted, "[w]hen the golden-cheeked warbler was listed as federally endangered, no known population size was provided for the species; rather, a range of possible population sizes was provided based on habitat and density estimates by Pulich (1976) and Wahl et al. (1990)."⁵⁸ The Wahl et al. study, and several other studies prior to 2010, sampled from small survey areas primarily within Fort Hood, which was problematic: "[T]he relative lack of warbler population estimates from other areas in the breeding range reflects the fact that both the species and the habitat have not been well studied outside of Fort Hood."⁵⁹ The pre-2010 studies' reliance on such a limited sample was based on an erroneous assumption that habitat conditions and warbler population densities were the same, or very similar, outside Fort Hood as inside Fort Hood.

Since the Wahl et al. study in 1990, a number of subsequent studies, summarized in Table 2, have estimated the range of warbler habitat at two to six times the estimate by Wahl et al. and estimated warbler population at many times—up to an order of magnitude—greater than the estimate by Wahl et al.

Morrison et al. (2012) described the flawed assumptions relied upon in the 1990 listing:

For the golden-cheeked warbler, understanding of the species at the time of listing in 1990 was based on either incorrect or untested assumptions of species distribution within available habitats. Adhering to untested assumptions led to development of priorities for research and management that were well-intentioned but largely misguided. Ample information on the distribution of the warbler's habitats existed, however, which should have encouraged questions into the basis of population conditions when developing management prescriptions. Current knowledge clearly indicates

⁵⁶ R. Wahl, D.D. Diamond, & D. Shaw, *The Golden-cheeked Warbler: a status review* (unpubl., 1990); Recovery Plan.

⁵⁷ Ex. 1, Texas A&M Survey at 2.

⁵⁸ Groce et al., *supra* note 29.

⁵⁹ *Id.*

that a new paradigm for the warbler is needed, that being one of a widely distributed species that is preadapted to occur within a variety of environmental conditions.⁶⁰

Morrison et al. (2012) was published in a respected and widely-respected peer-reviewed scientific journal. And at least eight other studies described in Table 2 also estimated a much larger warbler habitat and population than was originally thought when FWS finalized the warbler listing in 1990 and published its Recovery Plan in 1992. FWS, however, ignored these studies in the 2014 Five-Year Review and instead relied on the out-of-date 1990 Wahl et al. study along with one 2007 SWCA study. More recent estimates since the early 1990s, contained in studies described in Table 2, of the warbler's total available habitat and population are based on much more scientifically valid and robust data: randomly sampled habitat patches on public and private land across the warbler's breeding range, congruent satellite imagery, and biological covariates known to influence warbler occurrence. One such recent study, Collier et al. (2012), identified 1,678,698 hectares of potential warbler breeding habitat.⁶¹ This estimate falls within the range of potential warbler breeding habitat—643,454 to 1,679,234 hectares—identified by others since the listing decision (see Table 2).⁶²

The 1990 Wahl et al. study used Landsat imagery at 60-meter resolution to classify potential warbler habitat.⁶³ More recent studies have improved on this classification dramatically, with the 2012 studies by Collier et al. and Mathewson et al. relying on 1-meter resolution aerial photography to classify habitat along with 30-meter resolution satellite imagery.⁶⁴ To put this into perspective, a 1-meter resolution image can have as much as 3,600 times greater detail than a 60-meter resolution image. This greater detail allows for more accurate classification of landscape features, such as the types of vegetation that constitute warbler habitat, than is possible with lower-resolution imagery. In addition, recent studies rely on more sophisticated remote sensing classification techniques that take advantage of the enormous progress in computing power since the 1990 Wahl et al. study.

Groce et al. (2010), commissioned by FWS to undertake the Five-Year Review, recognized how more recent studies used more sophisticated estimation techniques to improve survey estimates of the warbler breeding population:

Although most studies discussed in previous sections incorporated multiple site visits in their survey methods, the inclusion of detection probabilities as

⁶⁰ Michael L. Morrison et al., *The Prevailing Paradigm as a Hindrance to Conservation*, 36 WILDLIFE SOC'Y BULLETIN 408 (2012).

⁶¹ Collier et al., *supra* note 53.

⁶² See Table 2.

⁶³ Final Rule, 55 Fed. Reg. at 53,155.

⁶⁴ Mathewson et al., *supra* note 53, at 1118; Collier et al., *supra* note 53, at 160.

a component of golden-cheeked warbler research is relatively recent. . . . Results from these [more recent] studies indicate warblers are more likely to be detected in certain locations and at certain times of the breeding season. Low detection probabilities would necessitate increasing the number of visits to a site to limit non-detection errors (MacKenzie and Royle 2005).⁶⁵

In their 2012 study, Morrison et al. summarized how recent studies have re-examined pre-existing assumptions concerning warbler habitat and abundance:

It is evident that the golden-cheeked warbler is widely distributed throughout its breeding range (Collier et al. 2012), is breeding successfully in a variety of habitat conditions (Butcher et al. 2010, Klassen et al. 2012, see also Campomizzi et al., this section), and is more abundant than previous estimates have indicated (Mathewson et al. 2012). Within those areas with the longest record of research, the warbler has been shown to occur at a roughly stable abundance and shows a level of breeding success expected for similar species (Groce et al. 2010). Additionally, there is scant evidence that habitat or other resources are limited outside of the Texas breeding range. We are not implying that there are no potential threats that could negatively impact the warbler's distribution and abundance; however, given current estimates of habitat and abundance, their situation may not be as dire as it was originally assumed.⁶⁶

The 2015 Texas A&M Survey determined:

Regardless of the actual warbler population size, it is clear that there are substantially more warblers than assumed at the time of listing (Mathewson et al. 2012), the available warbler breeding habitat is much more widely distributed than initially thought (Collier et al. 2012), and that breeding warblers inhabit a much wider range of habitat conditions than identified during early studies (e.g., Klassen et al. 2012). In addition, there is no genetic evidence that warblers have demographically self-sustaining populations, and thus, there is no basis for managing warblers as separate population entities across the recovery regions (Lindsay et al. 2008).⁶⁷

The best available, peer-reviewed scientific evidence therefore presents a new perspective on the golden-cheeked warbler. Its breeding habitat is more widely distributed; its preferred habitat conditions are wider ranging; and its population is much larger than originally estimated.

⁶⁵ Groce et al., *supra* note 29, at 69–70.

⁶⁶ Morrison et al., *supra* note 60.

⁶⁷ Ex. 1, Texas A&M Survey at 15.

3. The scientific evidence confirms that there are more warblers and more habitat than FWS believed existed when it listed the species as endangered

A. Breeding habitat estimates

At the time of its listing, research conducted on a small number of study sites, primarily at Fort Hood, located in the eastern portion of the warbler's breeding range suggested that there were roughly 328,929 hectares of potential warbler habitat in Texas (Wahl et al. 1990).⁶⁸ Since that time, there have been numerous updates to this original warbler breeding habitat estimate. Results have been highly variable due to differences in land cover classification techniques, source imagery (year collected, image quality, resolution), post-hoc adjustments (minimum patch size requirements, estimated conversion rates, personal opinion), counties included as part of the warbler's breeding range, access to private land for surveys, and actual change in ground cover over time. But all of the recent studies confirm that FWS was wrong in its original conclusion that the warbler species is rare, on which it based its 1990 listing decision.

The most recent estimates, based on randomly sampled patches on public and private land across the warbler's breeding range, congruent satellite imagery, and biological factors known to influence warbler occurrence, identified 1,678,053 hectares (Collier et al. 2012; Mathewson et al. 2012) and 1,678,281 hectares (Duarte et al. 2013) of potential warbler breeding habitat. These estimates fall within the range of potential warbler breeding habitat identified by others since the listing decision (551,668–1,771,552 hectares; Table 2).

The Collier et al. (2012) habitat model provides the first probabilistic predictions for the likelihood of patch occupancy by warblers and was constructed using data and statistical procedures that were appropriate for the scale and scope of the project. Collier et al. thus is the most robust habitat model available. The Collier et al. study indicates that there is five times more warbler breeding habitat than identified at the time of the warbler's listing, that there are a large number of warbler habitat patches across their breeding range, and that these patches are not separated by large distances.⁶⁹

B. Winter and migratory habitat estimates

Recent studies have also provided estimates of the warbler's winter and migratory habitat estimates. Warblers winter in pine-oak forests of southern Mexico, Guatemala, Honduras, El Salvador, Nicaragua, and possibly Costa Rica at elevations between 792 and 2,591 meters (Komar et al. 2011). Warblers may also be found in pine, cloud or broadleaf forests; scrub habitat; or agricultural areas (Rappole et al. 2003; Potosem and Muñoz 2007; McCrary et al. 2009). Using U.S. Geological Survey data and Landsat

⁶⁸ See Recovery Plan.

⁶⁹ Collier et al., *supra* note 53.

imagery, Rappole et al. (2003) estimated 673,397 hectares of potential pine oak-habitat on the wintering grounds (excluding Nicaragua). Those authors acknowledged that known detections, however, fell into a USGS land cover class of “evergreen needleleaf forest” that they did not include in their initial analyses; this additional class could add 440,298 hectares to their estimate, resulting in 1,113,695 hectares of potential winter habitat.⁷⁰

In addition, the Alliance for the Conservation of Mesoamerican Pine-Oak Forests estimated 1,942,491 hectares of potential warbler wintering habitat, including parks and protected areas that exist along the migration route.⁷¹

C. Breeding population estimates

Population estimates extrapolated from research conducted on a small number of study sites located in the eastern portion of the warbler’s breeding range suggested that there were 13,800 warbler territories in Texas at the time of the warbler’s emergency listing as federally endangered (Wahl et al. 1990).⁷² Subsequent population estimates based on improved imagery (though still quantified using a small number of site-specific observations, qualitative definitions of warbler habitat based on personal opinion, and assumptions of constant density across the warbler’s breeding range) indicated that there were 13,000–230,000 warblers (Table 2). Most recently, Mathewson et al. (2012) estimated the warbler population size using models of patch-specific densities derived from randomly located range-wide abundance surveys, and then developed a predictive equation that related biological metrics to patch-scale density. They found that patch-specific occupancy probability (which is a function of patch size and landscape composition; Collier et al. 2012) was the best predictor of patch-specific densities, and estimated the population of male warblers at 263,339 (95% confidence interval = 223,927–302,620). Mathewson et al.’s territory density estimate was well within the range of most available information for the species (Table 1). Without accounting for detection probability, which would have increased the overall population estimate, this indicates that there are 19 times more warblers than assumed at the time of the emergency listing decision.

FWS’s Five-Year Review suggested that the Mathewson et al. (2012) model may have over-predicted warbler density estimates, and, therefore, resulted in inflated population estimates by FWS in 2014. FWS noted concerns that patch-specific territory density estimates with known warbler numbers are lower than predicted by the range-

⁷⁰ John H. Rappole, David I. King, & Jeffrey Diez, *Winter- vs. breeding habitat limitation for an endangered avian migrant*, 13 ECOLOGICAL APPLICATIONS 735 (2003).

⁷¹ Alianza para la Conservación de los Bosques de Pino-Encino de Mesoamérica, Plan de Conservación de los Bosques de Pino-Encino de Centroamérica y el Ave Migratoria *Dendroica chrysoparia* (2008).

⁷² See Recovery Plan.

wide estimates. But this is a misapplication of the model results, which the authors explained should only be applied at the range-wide scale. Mathewson et al. used data and statistical procedures that were appropriate for the scale and scope of the project (i.e., patches were randomly sampled on public and private land across the warbler's breeding range, imagery was current to the study). In addition, their overall estimates align with other habitat and population estimates when assumptions regarding habitat quality are removed (Table 2).

The territory density estimates derived by Mathewson et al. (2012) were also well within the range of most available information for the species (Table 1). Relationships between warbler density and patch-scale metrics used by Mathewson et al. to predict abundance across the species' range were consistent with patch-scale metrics previously shown to affect warbler density at local scales (Magness et al. 2006; Baccus et al. 2007). While the Mathewson et al. model should not be used at the local scale, as noted by the authors in their peer-reviewed manuscript, the Mathewson et al. study provided patch-specific predictions of warbler density across the species' breeding range and represents the best available warbler breeding population estimate. That some individuals misapply the Mathewson et al. work does not in any way negate its validity.

D. Survival

Using data collected from a small portion of the warbler's breeding range (Fort Hood Military Reservation, Coryell and Bell counties, Texas) and assuming metapopulation dynamics (but see Lindsay et al. 2008 below), Alldredge et al. (2004) developed the population viability model used to guide conservation decisions by the FWS. Results of their analyses suggest that the probability of warbler extinction over the next 100 years is low as long as enough habitat exists to support more than 3,000 breeding pairs in each of the eight defined recovery regions.

More recent studies confirm the total amount of available warbler habitat exceeds this threshold (Mathewson et al. 2012), and Hatfield et al. (2012) recently suggested that recovery region boundaries should be re-established to reflect warbler biology as opposed to watershed boundaries. Under this paradigm, recovery metrics would not include estimates of abundance across the eight recovery regions, which currently require a minimum of 3,000 males per recovery region, since these initial estimates were based off small-scale studies. We now know that density varies widely across the warbler's breeding range, and warblers do not exist as a metapopulation (Lindsay et al. 2008). The survival of the species thus depends on the number of warblers as a whole, not the number of warblers in each artificially constructed recovery region.

In a more recent analysis, Duarte et al. (2014) found (again using data collected at Fort Hood) that adult survival rates were only slightly lower than those initially estimated by Alldredge et al. (2004) (mean apparent survival for Duarte et al. = 0.47 and mean apparent survival for Alldredge et al. = 0.56). The Duarte et al. study further recognized

that warbler survival rates coincided with those obtained for other closely related warbler species.

E. Productivity

Pairing success of the species is generally high (typically >70%) and studies suggest that estimates of this metric depend on factors such as tree species composition (Marshall et al. 2013), male age (Jetté et al. 1998), and warbler territory density (Farrell et al. 2012). Territory success (proportion of territories that successfully fledge young) is also relatively high (typically >50%) and exhibits similar trends with tree species composition (Marshall et al. 2013), male age (Pruett 2014), and warbler territory density (Farrell et al. 2012). Fecundity is difficult to compare across years due to inconsistencies in measuring, reporting, and that warblers split broods (biasing fledging counts low), but estimates of fecundity are consistently high on the Fort Hood Military Reservation (1.13–2.06 young per territory; Anders 2000) and City of Austin properties (1.82–3.04 young per territory; City of Austin 2011, 2012, 2013).

While warbler management guidelines identify large-tracts of oak-juniper woodland with greater than 70% cover as high quality breeding habitat, more recent research indicates that relationships between woodland stand characteristics and fledging success vary regionally (Campomizzi et al. 2012). In the Limestone Cut Plain Ecoregion, where most warbler research has been conducted, the predicted probability of warbler fledging success increased with increasing patch size, decreasing patch edge-to-area ratio, and increasing percent cover. This coincides with site-specific nest survival data obtained at the Fort Hood Military Reservation and in the Austin area (Stake 2003; Peak 2007; Reidy et al. 2009b; Peak and Thompson 2014). These relationships are not consistent across ecoregions (Campomizzi et al. 2012), however, and warblers will fledge young in areas with less than 20% canopy cover, especially in the southern portion of their breeding range (Klassen et al. 2012). In addition, experimental, song-playback studies provide evidence that warblers can be drawn into previously unoccupied woodland stands with less canopy cover and successfully fledge young outside the habitat conditions typically considered suitable for the species (Farrell et al. 2012).

Alliance for the Conservation of Mesoamerican Pine-Oak Forests (2008) estimated that 74% of the original pine-oak forest cover remains on the warbler's wintering grounds in Mexico and Central America, and that 7% of the warbler's existing habitat is located in protected areas. Primary conversion threats include unsustainable forestry practices that are incompatible with conservation, forest fires, and commercial logging (ACMPOF 2008). Parks and protected areas exist along the migration route, but no data exists regarding the amount of potential stopover habitat.

F. Genetics

Genetic studies performed using DNA collected from 109 individuals at seven

study sites across the warblers' range in 2004 and 2005 showed no evidence of genetic bottlenecks or genetic differentiation (Lindsay et al. 2008). The latter results indicate that current allelic richness and heterozygosity are relatively high and similar to those of other warbler species, and suggests no genetic basis for managing warblers as separate population entities (i.e., there is no genetic basis for assuming metapopulation dynamics; Lindsay et al. 2008).

4. Disease, predation, and brood parasitism have never been a basis for listing this species as endangered

Although the final rule listing the species in 1990 suggests that fire ants could become a threat to young warblers, there has been no evidence supporting this supposition.⁷³ Documented warbler predators (adults and young) include snakes, birds, mammals, and red-imported fire ants (*Solenopsis invicta*) (Stake et al. 2004; Reidy et al. 2008; Reidy et al. 2009a). Stake et al. (2004) noted that the height of warbler nests reduced the risk of fire ant predation and that warblers are not the main target of other birds or mammals. Brood parasitism varies annually, but is uncommon and represents a small risk to overall warbler nest survival (Groce et al. 2010). Anders (2000) recorded no brood parasitism by cowbirds during her study of warbler territories within Fort Hood. This factor thus also supports delisting the species.

At most there is one documented outbreak in 2012 of avian pox that was confirmed on Balcones Canyonlands Preserve in Austin, Texas properties after several warblers were reported with swollen and bleeding feet, legs, and lesions on the face, legs and feet.⁷⁴ City of Austin researchers recommended exercising care when handling the birds in those locations to minimize the spread of the infection.⁷⁵ This appears to be an isolated event and there are no other disease detection records for this species. Therefore, this factor continues to support delisting this species.

5. The warbler habitat is secure and the warbler will remain protected after delisting

Due to overlap and redundancy in state and federal regulatory mechanisms, delisting the golden-cheeked warbler under the federal Endangered Species Act will not deprive it of any significant regulatory protections. Apart from the Endangered Species Act, many other regulatory mechanisms exist to ensure that the populations and habitat of the golden-cheeked warbler remain protected after delisting. These include the Migratory Bird Treaty Act of 1918,⁷⁶ the 1975 Texas Endangered Species law,⁷⁷ the Balcones

⁷³ 55 Fed. Reg. at 53,158.

⁷⁴ The City of Austin, State of Our Environment Report 19 (2012).

⁷⁵ *Id.*

⁷⁶ 16 U.S.C. §§ 703–12.

Canyonlands National Wildlife Refuge, conservation plans on Fort Hood, approximately 160 habitat conservation plans on private lands that are enforceable by FWS, and the Alliance for the Conservation of Mesoamerican Pine-Oak Forests that protects the warbler's wintering habitat in Central America. Warbler habitat is actively managed on many Texas Parks and Wildlife Management Areas, Nature Conservancy properties in Texas, and on other public and private lands.⁷⁸

FWS has never designated critical habitat for the golden-cheeked warbler. FWS declined to designate critical habitat in both the 1990 emergency listing⁷⁹ and final listing.⁸⁰ And in a 1994 letter to the Governor of Texas, the Secretary of the Interior stated:

[T]he designation of critical habitat for the warbler will be neither necessary nor prudent because it will provide no net benefit to the species. I have therefore instructed the U.S. Fish and Wildlife Service to cease work on warbler critical habitat designation.⁸¹

Since the environmental baseline is that the warbler as listed does not have any of the regulatory benefits of critical habitat designation, delisting the species does not remove any of those protections—the critical habitat baseline remains the same regardless of whether the species is listed.

A. Migratory Bird Treaty Act

Delisting will not affect the populations of the golden-cheeked warbler, which will continue to be protected under the federal Migratory Bird Treaty Act.⁸² The Migratory Bird Treaty Act makes it unlawful

to pursue, hunt, take, capture, kill, attempt to take, capture, or kill, possess, offer for sale, sell, offer to barter, barter, offer to purchase, purchase,

⁷⁷ Tex. Acts 1975, 64th Leg., p. 1405, ch. 545 (codified at 5 Tex. Parks & Wildlife Code § 68.001 et seq.).

⁷⁸ See, e.g., The Nature Conservancy, Texas: Golden-Cheeked Warbler, at <http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/texas/explore/bird-s-golden-cheeked-warbler.xml> (“The Nature Conservancy is actively protecting habitat for the rare bird at the Barton Creek Habitat Preserve and Love Creek Preserve. The Nature Conservancy also participates in numerous private and public partnerships aimed at preserving essential breeding habitat such as our community-based conservation work along the Blanco, Pedernales, Frio, and Nueces and Sabinal Rivers.”).

⁷⁹ 55 Fed. Reg. at 18,844.

⁸⁰ 55 Fed. Reg. at 53,159.

⁸¹ Letter from Bruce Babbitt, Sec’y of Interior to Gov. Ann Richardson (Sep. 22, 1994).

⁸² Migratory Bird Treaty Act of 1918, 40 Stat. 755 (codified at 16 U.S.C. §§ 703–12).

deliver for shipment, ship, export, import, cause to be shipped, exported, or imported, deliver for transportation, transport or cause to be transported, carry or cause to be carried, or receive for shipment, transportation, carriage, or export, any migratory bird, any part, nest, or egg of any such bird, or any product, whether or not manufactured, which consists, or is composed in whole or part, of any such bird or any part, nest, or egg thereof⁸³

Violations are punishable by fine and imprisonment, as well as forfeit of equipment used in such acts.⁸⁴

FWS also recently announced that it was considering various approaches to regulating incidental take of migratory birds.⁸⁵ The approaches could include

issuance of general incidental take authorizations for some types of hazards to birds associated with particular industry sectors; issuance of individual permits authorizing incidental take from particular projects or activities; development of memoranda of understanding with Federal agencies authorizing incidental take from those agencies' operations and activities; and/or development of voluntary guidance for industry sectors regarding operational techniques or technologies that can avoid or minimize incidental take.⁸⁶

Such rulemaking would also “establish appropriate standards for any such regulatory approach to ensure that incidental take of migratory birds is appropriately mitigated, which may include requiring measures to avoid or minimize take or securing compensation.”⁸⁷ This announcement is further evidence that FWS has options available to it under the Migratory Bird Treaty Act to protect the golden-cheeked warbler, even after delisting.⁸⁸

⁸³ 16 U.S.C. § 703(a).

⁸⁴ 16 U.S.C. § 707; *see, e.g., Pacificorp Pleads Guilty To Violating Migratory Bird Treaty Act*, N. AM. WINDPOWER (Dec. 22, 2014), *at* http://www.nawindpower.com/e107_plugins/content/content.php?content.13781; Linda Chiem, *Citgo Could Pay \$2M After Judge Backs Bird Death Conviction*, LAW360 (Sep. 10, 2012), *at* <http://www.law360.com/articles/376571>.

⁸⁵ Migratory Bird Permits; Programmatic Environmental Impact Statement, 80 Fed. Reg. 30,032 (May 26, 2015).

⁸⁶ 80 Fed. Reg. at 30,033.

⁸⁷ *Id.*

⁸⁸ *See, e.g.,* U.S. Fish & Wildlife Serv., Migratory Bird Program: Management, *at* <http://www.fws.gov/birds/management.php> (“To manage birds and their habitats, [FWS] work[s] with bird conservation partnerships comprising federal and state agencies,

B. Texas Endangered Species Act

The warbler also remains separately listed and protected under the Texas Endangered Species Act, which provides:

No person may capture, trap, take, or kill, or attempt to capture, trap, take, or kill, endangered fish or wildlife . . . possess, sell, distribute, or offer or advertise for sale endangered fish or wildlife . . . possess, sell, distribute, or offer or advertise for sale any goods made from endangered fish or wildlife...sell, advertise, or offer for sale any species of fish or wildlife not classified as endangered under the name of any endangered fish or wildlife.⁸⁹

C. Balcones Canyonlands National Wildlife Refuge

Nor will delisting affect the protection of prime golden-cheeked warbler habitat in the Balcones Canyonlands National Wildlife Refuge, a 30,000-acre area in Travis County, Texas that was set aside in 1996 and is managed to protect the populations of the golden-cheeked warbler, black-capped vireo, and six invertebrates. The City of Austin and Travis County are required to report annually to FWS on warbler populations, habitat protection and scientific research—none of which will be altered by delisting.⁹⁰

Fort Hood has the largest populations of two listed migratory songbirds—the golden-cheeked warbler and the black-capped vireo.⁹¹ “Fort Hood contains an estimated 22,591 h[ectares] (roughly 25% of the total area of the installation) of habitat suitable for the federally endangered golden-cheeked warbler (*Setophaga chrysoparia*; warbler), which supports between 4,482 and 7,236 territorial male warblers”⁹² Fort Hood developed an Endangered Species Management Plan, established core and non-core habitat areas, and regularly monitored the populations of these two songbirds.⁹³

Tribes, nongovernment organizations, universities, corporations, individuals with expertise in bird conservation, and private landowners. These partnerships develop and implement management plans that provide explicit, strategic and adaptive sets of conservation actions required to return and maintain species to healthy and sustainable levels.”).

⁸⁹ 5 Tex. Parks & Wildlife Code § 68.015.

⁹⁰ Travis Cnty., Tex., The Balcones Canyon Conservation Plan, at <https://www.traviscountytexas.gov/tnr/bccp>.

⁹¹ Charles E. Pekins, Dep’t of the Army Env’tl. Div., Conserving Biodiversity on Military Lands: A Guide for Natural Resources Managers chpt. 5, available at http://www.dodbiodiversity.org/case_studies/ch_5_2.html.

⁹² David W. Wolfe et al., *Regional Credit Market for Species Conservation: Developing the Fort Hood Recovery Credit System*, 36 WILDLIFE SOC’Y BULLETIN 423, 424 (2012).

⁹³ Pekins, *supra* note 91, at chpt. 5.

According to an Army case study, “Fort Hood has greatly exceeded population and habitat goals” for the warbler and vireo.⁹⁴ And a study by Anders (2000) found that the warbler population within Fort Hood had increased in number and density since the early 1990s. The conservation status of the warbler at Fort Hood will not be impacted by delisting the warbler.

In addition, Executive Order 13,186 requires “each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations is directed to develop and implement, within 2 years, a Memorandum of Understanding (MOU) with the Fish and Wildlife Service . . . that shall promote the conservation of migratory bird populations.”⁹⁵ Through this Executive Order, federal agencies are required to incorporate warbler conservation considerations into their plans and report annually on implementation of the Order.

D. The Recovery Credit System

The Recovery Credit System (RCS), a voluntary natural resource management program developed by the Texas Department of Agriculture, also provides technical guidance and assistance to private landowners near the Fort Hood Military Reservation with qualifying lands that support warbler habitat. The goal of this program is to mitigate adverse impacts to habitat that result from military training activities. Since July 2006, the total investment for implementation of the RCS is \$1,954,666 and the 20 participating landowners’ cost share is \$451,295. Contract terms range from 10–25 years and the program protects approximately 881 hectares of warbler breeding habitat on private land. The Robertson Consulting Group conducted a third-party, independent peer review of the RCS, published in 2010, that details the program’s success.⁹⁶ And a study by Wolfe et al. (2012) determined that by using the Recovery Credit System, “[c]lear benefits have been achieved in terms of acres under conservation management for the species.”

E. Habitat Identification/Treatment Criteria

The black-capped vireo and golden-cheeked warbler Habitat Identification/Treatment Criteria developed by the U.S. Department of Agriculture’s Natural Resource Conservation Service (NRCS) Brush Management Consultation provides technical guidance for brush clearing to avoid warbler breeding habitat on properties with NRCS contracts.

⁹⁴ *Id.*

⁹⁵ Executive Order 13,186 of January 10, 2001: Responsibilities of Federal Agencies to Protect Migratory Birds, 3 C.F.R. 13,186 (2002).

⁹⁶ Third Party Evaluation of the Recovery Credit System Proof of Concept (March 2010), *available at* http://rcs.tamu.edu/media/277203/final_rcs_eval_report_march_2010.pdf.

F. Alliance for the Conservation of Mesoamerican Pine-Oak Forests

Protection of warbler wintering habitat outside the United States (which is beyond the jurisdiction of the Endangered Species Act) remains after delisting under the Alliance for the Conservation of Mesoamerican Pine-Oak Forests, established in 2003. This voluntary international cooperative partnership includes members from many national nongovernmental organizations in Mexico, Guatemala, El Salvador, Honduras, Nicaragua, and the United States (including the Nature Conservancy, Texas Parks and Wildlife Department, and the Zoo Conservation Outreach Program). The Alliance's conservation plan, published in 2008, directs management and preservation actions in the pine-oak ecoregion in Central America, where most warbler wintering habitat is located.

G. Habitat conservation plans

FWS has issued Endangered Species Act permits to approximately 160 landowners who have entered into habitat conservation agreements to protect warbler habitat, enforceable by FWS. The agreements are not affected by delisting and will continue to protect the warbler as well as other listed species.⁹⁷

6. Other natural and manmade factors support delisting

Because FWS erroneously concluded that few birds existed and little habitat was available for the species, FWS mistakenly concluded that any encroachments on warbler habitat would threaten the continued survival of the species. Current studies show that FWS was wrong in its original conclusions.

From 1992–2001, Groce et al. (2010) examined National Land Cover Data (NLCD) and estimated a net loss of 116,549 hectares (roughly 6%) of woodland within the warbler's breeding range during that time period. The highest conversion rates were identified near urban areas and were attributed to development and population growth. More recent Texas Land Trends analyses support this trend, as most land conversion from 1997–2012 occurred along with population expansion in the state's 25 fastest growing counties (txlandtrends.org).

Habitat fragmentation of existing breeding habitat represented a major concern at the time of the warbler's listing. Since then, range-wide studies conducted during the breeding season indicate that the predicted probability of occupancy increases from north to south with increasing patch size and mean percentage of woodland cover in the

⁹⁷ See, e.g., 72 Fed. Reg. 59,109 (Oct. 18, 2007) (giving notice of a proposed habitat conservation plan that would set aside land for an on-site preserve and pay Balcones Canyonlands Preserve to purchase additional warbler habitat); 72 Fed. Reg. 74,323 (Dec. 31, 2007) (proposing to set aside on-site mitigation land to be managed as part of the Balcones Canyonlands Preserve in perpetuity).

surrounding landscape (Collier et al. 2012). Site-specific research conducted by Butcher et al. (2010) found that warblers establish territories in patches as small as approximately 2.6 hectares in rural landscapes. Follow-up research conducted in the Austin area found that minimum patch size requirements for territory establishment were of similar size (~13 hectares; Robinson 2013). Combined, the Collier et al., Butcher et al., and Robinson studies emphasize the importance of large and small patches to sustain the warbler population on its breeding ground.

This coincides with site-specific research (Magnesss et al. 2006; Baccus et al. 2007; Peak and Thompson 2013). Though again, small patches do support warblers and the importance of these smaller areas should not be discounted. Patch size can also influence avian reproduction. Coldren (1998) found that pairing and fledging success increased with increased patch size. Minimum patch size for reproductive success is 16–18 hectares in a rural landscape (Butcher et al. 2010) and about 21 hectares in an urban environment (Arnold et al. 1996). However, in a range-wide study that included productivity data from 1,382 territories, Campomizzi et al. (2012) did not find consistent relationships between territory success and patch size or patch edge-to-area ratio across their breeding range.

A. Habitat degradation

In a study conducted in the western portion of the warbler's breeding range, Stewart et al. (2014b) found that the presence of oak wilt (a defoliating tree disease caused by the fungus *Ceratocytis fagacearum*) did not affect warbler territory placement, but pairing success for males whose territories included some proportion of oak wilt had 27% lower pairing success. Stewart et al. (2014b) found no difference in fledging success between territories in oak wilt affected and unaffected forests. In a similar study conducted in the eastern portion of the warbler's breeding range, Appel and Camilli (2010) examined post-breeding habitat use in warblers in relation to oak wilt and found no difference in the use of affected and unaffected forest. Studies suggest that oak wilt is more likely to occur outside warbler habitat (Appel and Camilli 2010, Stewart et al. 2014a); Stewart et al. (2014a) found that oak wilt occurred in 4.1% of their study area and predicted that the amount of habitat affected will double by 2018 as the disease spreads.

Deer can limit oak survival when the saplings are browsed (Russell and Fowler 2002, 2004). No direct evidence suggests, however, that herbivory by native or non-native browsers is contributing to reduced habitat (or habitat suitability) for the warbler. Murray et al. (2013) investigated local declines in Texas red oak (*Quercus buckleyi*) at Balcones Canyonlands National Wildlife Refuge, but concluded that fire suppression and drought were likely the cause of reduced oak density. Similarly, Yao et al. (2012) suggested fire could have a dual effect on warbler habitat (such that reduced tree density could reduce suitability), but oak recruitment is typically high following moderate to high intensity fires. Yao et al. showed that properly managed fires can increase future habitat

suitability for warblers by increasing tree diversity.

B. Management practices

At the time of listing, FWS assumed that any Ashe juniper removal from warbler habitat would have a negative effect on the species.⁹⁸ Marshall et al. (2012) found, however, that a higher proportion of territories successfully fledged young in areas where understory juniper was thinned when compared to untreated control sites. Warbler territory density was also similar between the thinned sites and control sites, which suggests that the pattern of higher productivity in the treated areas did not result from density dependent mechanisms.

C. Noise

Lackey et al. (2012) found similar warbler abundance, pairing success, and fledging success across road-noise-only sites, road construction sites, and control sites, and there was no relationship between warbler reproductive success and distance from the roadway. Similarly, warblers at the Fort Hood Military Reservation occupy and breed in patches exposed to active military activity and there is no correlation between warbler reproductive success and noise level (Lopez et al. 2012). Both studies suggest that warblers habituate to noise disturbance.

Conclusion

Because golden-cheeked warbler populations and habitat are far greater than FWS believed in 1990, the species should not have been listed as endangered and, based on new scientific, peer-reviewed studies and evidence confirming the species is not in danger of extinction throughout all or any significant part of its range, the species should be removed from the federal endangered species list.

Respectfully submitted,

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⁹⁸ 55 Fed. Reg. at 53,154.

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Exhibit 1: Texas A&M Survey

Tex. A&M Inst. of Renewable Natural Resources, Conservation Status of the Federally Endangered Golden-cheeked Warbler (unpublished research summary, June 2015), *available at* <http://irnr.tamu.edu/publications/research-reports/>.

Exhibit 2: Enclosed bibliography

Mathew W. Alldredge et al., *Golden-Cheeked Warbler (Dendroica chrysoparia) in Texas: Importance of Dispersal toward Persistence in a Metapopulation*, in SPECIES CONSERVATION AND MANAGEMENT: CASE STUDIES (2004).

Alianza para la Conservación de los Bosques de Pino-Encino de Mesoamérica, Plan de Conservación de los Bosques de Pino-Encino de Centroamérica y el Ave Migratoria *Dendroica chrysoparia* (2008).

Angela D. Anders, *Demography of golden-cheeked warblers on Fort Hood, Texas in 2000: productivity, age structure, territory density, and adult return rates*, in ENDANGERED SPECIES MONITORING AND MANAGEMENT AT FORT HOOD, TEXAS (2000).

David N. Appel & Kim S. Camilli, *Assessment of Oak Wilt Threat to Habitat of the Golden-Cheeked Warbler, an Endangered Species, in Central Texas*, in U.S. DEP'T OF AGRIC., 1 ADVANCES IN THREAT ASSESSMENT AND THEIR APPLICATION TO FOREST AND RANGELAND MANAGEMENT 61 (2010).

Keith A. Arnold, Cade L. Coldren, & Mark L. Fink, *The Interactions Between Avian Predators and Golden-cheeked Warblers in Travis County, Texas* (Tex. Transp. Inst. Research Study Number 7-1983) (1996).

Giridhar Athrey et al., *Crumbling diversity: comparison of historical archived and contemporary natural populations indicate reduced genetic diversity and increasing genetic differentiation in the golden-cheeked warbler*, 12 CONSERV. GENET. 1345 (2011) (doi:10.1007/s10592-011-0235-8).

John T. Baccus, Maria E. Tollé, & John D. Cornelius, *Response of golden-cheeked warblers (Dendroica chrysoparia) to wildfires at Fort Hood, Texas*, 7 TEX. ORNITHOLOGICAL SOC'Y (2007).

Jerrold A. Butcher et al., *Evidence of a Minimum Patch Size Threshold of Reproductive Success in an Endangered Songbird*, 74 J. WILDLIFE MGMT. 133 (2010) (doi:10.2193/2008-533).

Andrew J. Campomizzi et al., *Species Conservation at a Broad Spatial Scale: Reproductive Success of Golden-Cheeked Warblers Across Their Breeding Range*, 36 WILDLIFE SOC'Y BULLETIN 440 (2012) (doi:10.1002/wsb.172).

City of Austin Water Util. Wildlife Conservation Div., Golden-cheeked Warbler (*Setophaga chrysoparia*) and Black-capped Vireo (*Vireo atricapilla*) Monitoring

- Program, in BALCONES CANYONLANDS PRESERVE ANNUAL REPORT FISCAL YEAR 2010–11 (2011).
- City of Austin, Travis Cnty, Dep't of Transp. & Natural Res., & U.S. Forest Serv., 2012 Annual Report: Golden-cheeked Warbler (*Setophaga chrysoparia*) Monitoring Program—Balcones Canyonlands Preserve.
- City of Austin, Travis Cnty, Dep't of Transp. & Natural Res., & U.S. Forest Serv., 2013 Annual Report: Golden-cheeked Warbler (*Setophaga chrysoparia*) Monitoring Program—Balcones Canyonlands Preserve.
- Cade Lawrence Coldren, The Effects of Habitat Fragmentation on the Golden-cheeked Warbler (Aug. 1998) (unpublished Ph.D. dissertation, Texas A&M Univ.).
- Bret A. Collier et al., *Predicting patch occupancy in fragmented landscapes at the rangewide scale for an endangered species: an example of the American warbler*, 18 DIVERSITY & DISTRIB. 158 (2012) (doi:10.1111/j.1472-4642.2011.00831.x).
- Timery S. DeBoer & David D. Diamond, *Predicting Presence-Absence of the Endangered Golden-cheeked Warbler*, 51 SW. NATURALIST 181 (2006).
- David D. Diamond, Range-wide Modeling of Golden-cheeked Warbler Habitat (2007) (submitted to Tex. Parks & Wildlife Dep't).
- Adam Duarte et al., *Spatiotemporal variation in range-wide Golden-cheeked Warbler breeding habitat*, 4 ECOSPHERE 152 (2013) (doi:10.1890/ES13-00229.1).
- Adam Duarte et al., *Age-specific survival of male Golden-cheeked Warblers on the Fort Hood Military Reservation, Texas*, 9 AVIAN CONSERV. & ECOLOGY art. 4 (2014) (doi:10.5751/ACE-000693-090204).
- Shannon L. Farrell et al., *Conspecific cues and breeding habitat selection in an endangered woodland warbler*, 81 J. ANIMAL ECOLOGY 1056 (2012) (doi:10.1111/j.1365-2656.2012.01995.x).
- Julie Groce et al., Five-year Status Review: Golden-Cheeked Warbler (Apr. 15, 2010) (prepared for Tex. Parks & Wildlife under Grant No. TX E-102-R).
- Jeff S. Hatfield, Floyd W. Weckerly, & Adam Duarte, *Shifting Foundations and Metrics for Golden-cheeked Warbler Recovery*, 36 WILDLIFE SOC'Y BULLETIN 415 (2012) (doi:10.1002/wsb.181).
- Leslie A. Jetté, Timothy J. Hayden, & John D. Cornelius, Demographics of the Golden-cheeked Warbler (*Dendroica chrysoparia*) on Fort Hood, Texas (Mar. 1998) (U.S. Army Corps of Eng'rs Technical Report 98/52).
- Jessica A. Klassen et al., *Canopy Characteristics Affect Reproductive Success of Golden-cheeked Warblers*, 36 WILDLIFE SOC'Y BULLETIN 54 (2012) (doi:10.1002/wsb.100).

- Oliver Komar, Winter ecology, relative abundance and population monitoring of Golden-cheeked Warblers throughout the known and potential winter range (May 4, 2011) (submitted to Tex. Parks & Wildlife).
- Melissa A. Lackey et al., *Experimental Determination of the Response of Golden-cheeked Warblers (Setophaga chrysoparia) to Road Construction Noise*, 74 ORNITHOLOGICAL MONOGRAPHS 91 (2012) (doi:10.1525/om.2012.74.1.91).
- Clifton Ladd & Leila Gass, Golden-cheeked Warbler (*Dendroica chrysoparia*), The Birds of North America Online (A. Poole ed., 1999), at <http://bna.birds.cornell.edu/bna/species/420>.
- Denise L. Lindsay et al., *Habitat fragmentation and genetic diversity of an endangered, migratory songbird, the golden-cheeked warbler (Dendroica chrysoparia)*, 17 MOLECULAR ECOLOGY 2122 (2008) (doi: 10.1111/j.1365-294X.2008.03673.x).
- Loomis Austin Eng'g, Land Surveying & Env'tl. Consulting, Mapping Potential Golden-cheeked Warbler Breeding Habitat Using Remotely Sensed Forest Canopy Cover Data (Aug. 12, 2008) (prepared for Cnty. of Hays, LAI Proj. No. 051001).
- Roel Lopez et al., Support to Military Land Management and Training on Fort Hood, Texas: Year 5 Final Annual Report (Cumulative) (2012).
- Darryl I. MacKenzie & J. Andrew Royle, *Designing occupancy studies: general advice and allocating survey effort*, 42 J. APPLIED ECOLOGY 1105 (2005).
- Dawn R. Magness, R. Neal Wilkins, & Sallie J. Hejl, *Quantitative Relationships Among Golden-Cheeked Warbler Occurrence and Landscape Size, Composition, and Structure*, 34 WILDLIFE SOC'Y BULLETIN 473 (2006).
- Michael E. Marshall, Michael L. Morrison, & R. Neal Wilkins, *Tree Species Composition and Food Availability Affect Productivity of an Endangered Species: The Golden-Cheeked Warbler*, 115 CONDOR 882 (2013) (doi:10.1525/cond.2013.130013).
- Heather A. Mathewson et al., *Estimating Breeding Season Abundance of Golden-Cheeked Warblers in Texas, USA*, 76 J. WILDLIFE MGMT. 1117 (2012) (doi:10.1002/jwmg.352).
- Jeffrey K. McCrary et al., *A contribution to Nicaraguan ornithology, with a focus on the pine-oak ecoregion*, 31 COTINGA 89 (2009).
- Michael L. Morrison et al., *The Prevailing Paradigm as a Hindrance to Conservation*, 36 WILDLIFE SOC'Y BULLETIN 408 (2012) (doi:10.1002/wsb.170).
- Darrel B. Murray, Joseph D. White, & Pamela Swint, *Woody Vegetation Persistence and Disturbance in Central Texas Grasslands Inferred From Multidecadal Historical Aerial Photographs*, 66 RANGELAND ECOLOGY & MGMT. 297 (2013) (doi:10.2111/REM-D-11-00180.1).
- Rebecca G. Peak, *Forest edges negatively affect golden-cheeked warbler nest survival*, 109 CONDOR 628 (2007).

- Rebecca G. Peak & Frank R. Thompson III, *Amount and type of forest cover and edge are important predictors of golden-cheeked warbler density*, 115 CONDOR 659 (2013) (doi:10.1525/cond.2013.120043).
- Rebecca G. Peak & Frank R. Thompson III, *Seasonal productivity and nest survival of Golden-cheeked Warblers vary with forest type and edge density*, 116 CONDOR 546 (2014) (doi:10.1650/CONDOR-14-51.1).
- Sandra Hernández Potosme & Francisco Muñoz, The Nature Conservancy, *Establecimiento de prioridades para la conservación del Hábitat invernal de la reinita dorada *Dendroica chrysoparia* en Nicaragua* (2007).
- Hannah Lucy Pruett, *Age Structure of Golden-Cheeked Warblers in Areas of Low Abundance* (Aug. 2014) (unpublished M.S. thesis, Texas A&M Univ.).
- WARREN M. PULICH, *THE GOLDEN-CHEEKED WARBLER: A BIOECOLOGICAL STUDY* (1976).
- John H. Rappole, David I. King, & Jeffrey Diez, *Winter- vs. breeding habitat limitation for an endangered avian migrant*, 13 ECOLOGICAL APPLICATIONS 735 (2003).
- Jennifer L. Reidy et al., *Golden-cheeked warbler nest mortality and predators in urban and rural landscapes*, 110 CONDOR 458 (2008) (doi:10.1525/cond.2008.8473).
- Jennifer L. Reidy, Mike M. Stake, & Frank R. Thompson III, *Nocturnal Predation of Females on Nests: An Important Source of Mortality for Golden-cheeked Warblers?*, 121 WILSON J. ORNITHOLOGY 416 (2009a).
- Jennifer L. Reidy, Frank R. Thompson III, & Rebecca G. Peak, *Factors Affecting Golden-Cheeked Warbler Nest Survival in Urban and Rural Landscapes*, 73 J. WILDLIFE MGMT. 407 (2009b).
- Dianne Hali Robinson, *Effects of habitat characteristics on occupancy and productivity of a forest-dependent songbird in an urban landscape* (May 2013) (unpublished M.S. thesis, Texas A&M University).
- Gareth A. Rowell, *Remote Sensing and GIS of Golden-cheeked Warbler Breeding Habitat and Vegetation Types on the Edwards Plateau* (Nov. 30, 1995) (Final Report for Grant No. E-1-7, Texas Parks & Wildlife Dep't).
- F. Leland Russell & Norma L. Fowler, *Failure of Adult Recruitment in Quercus buckleyi Populations on the Eastern Edwards Plateau, Texas*, 148 AM. MIDLAND NATURALIST 201 (2002).
- F. Leland Russell & Norma L. Fowler, *Effects of white-tailed deer on the population dynamics of acorns, seedlings and small saplings of Quercus buckleyi*, 173 PLANT ECOLOGY 59 (2004).
- Mike M. Stake, *Golden-cheeked warbler nest predators and factors affecting nest predation* (Dec. 2013) (unpublished M.S. thesis, University of Missouri-Columbia).

- Mike M. Stake, John Faaborg, & Frank R. Thompson III, *Video identification of predators at Golden-cheeked Warbler nests*, 75 J. FIELD ORNITHOLOGY 337 (2004).
- Laura R. Stewart et al., *Spatial and Temporal Distribution of Oak Wilt in Golden-Cheeked Warbler Habitat*, 38 WILDLIFE SOC'Y BULLETIN 288 (2014a) (doi:10.1002/wsb.395).
- Laura R. Stewart et al., *Effects of a Forest Pathogen on Habitat Selection and Quality for the Endangered Golden-Cheeked Warbler*, 38 WILDLIFE SOC'Y BULLETIN 279 (2014b) (doi:10.1002/wsb.386).
- SWCA Env'tl. Consultants, Preliminary Deliverable: Golden-Cheeked Warbler Status Review (May 1, 2007) (prepared for Tex. Dep't of Transp.).
- Tex. Parks & Wildlife, Management Guidelines for the Golden-cheeked Warbler in Rural Landscapes, *available at* https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_0013_golden_cheeked_warbler_mgmt.pdf.
- Tex. Parks & Wildlife, Golden-cheeked Warbler, *available at* https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_w7000_0013_golden_cheeked_warbler.pdf.
- Travis Cnty. Dep't of Transp. & Natural Res., Monitoring of the Golden-cheeked Warbler (*Dendroica chrysoparia*) in Western Travis County, Texas: 2009 Field Season (2010).
- U.S. Fish & Wildlife Serv., Golden-Cheeked Warbler Population and Habitat Viability Assessment Report: Report of Workshop Arranged by the U.S. Fish and Wildlife Service (Carol Beardmore et al., eds. 1995).
- David W. Wolfe et al., *Regional Credit Market for Species Conservation: Developing the Fort Hood Recovery Credit System*, 36 WILDLIFE SOC'Y BULLETIN 423 (2012) (doi:10.1002/wsb.184).
- Jian Yao et al., *Fire in a sub-humid woodland: The balance of carbon sequestration and habitat conservation*, 280 FOREST ECOLOGY & MGMT. 40 (2012) (doi:10.1016/j.foreco.2012.05.042).

Table 1: Summary of patch-specific golden-cheeked warbler territory density estimates⁹⁹

Source	Density (males/ha)	Location	Survey method
Pulich 1976	0.03–0.13	Dallas, Bosque, Kendall counties	Census
Kroll 1980	0.12–0.20	Bosque county	Territory mapping
Wahl et al. 1990	0.08–0.63	Rangewide	1.6 km Emlen strip census
Jetté 1998	0.14–0.28 (1992–1996)	Fort Hood (Coryell County)	Territory mapping
Peak 2003	0.10–0.22 (Site 1, 1999–2003) 0.25–0.37 (Site 2, 1999–2003)	Fort Hood (Coryell County)	# males / size of study site
Peak and Lusk 2009	0.21–0.29 (2003–2009)	Fort Hood (Coryell County)	# males / size of study site
Peak and Grigsby 2011, 2012, 2013	0.27–0.32 (2011–2013)	Fort Hood (Coryell County)	# males / size of study site
City of Austin & Travis County 2013	0.17–0.44 (1999–2013)	BCP (Travis County)	Territory mapping
Cooksey & Edwards 2008	0.04–0.20 (1991–2008)	Camp Bullis (Bexar County)	Point counts along transects
Mathewson et al. 2012	0.23	Rangewide	Point counts at random points in patches

⁹⁹ Adapted from Ex. 1, Texas A&M Survey at 9 tbl.2.

Table 2: Summary of golden-cheeked warbler breeding habitat and population estimates¹⁰⁰

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Pulich 1976	130,017	Used Soil Conservation Service definition of ‘‘virgin Ashe juniper’’ (stands 20–40 ft. trees >75 years old), reduced by author; no imagery used	"good" = 0.125 pairs/ha; "average" = 0.05 pairs/ha; "marginal" = 0.03 pairs/ha	Spot-mapping with marked population in Dallas, Bosque, Kendall counties; Census surveys conducted in 1962 and 1974	1962: 15,630 individuals; 1974: 14,950 individuals	Calculated proportion of total habitat for each of 3 habitat quality ranks (23%, 31%, and 46%, respectively), multiplied by respective density estimates	Calculated proportion of total habitat for each of 3 habitat quality ranks (23%, 31%, and 46%, respectively), multiplied by respective density estimates	Site-specific estimates from a small number of sites applied to entire range; Narrow habitat definition; Assumed constant density across the warbler's breeding range; Projected density within 3 qualitative habitat assessment ranks.
Wahl et al. 1990	337,993 236,984 (corrected)	Corrected values for habitat loss and patch size; 1974, 1976, and 1981 Landsat imagery, unsupervised and supervised classification from known breeding locations (see Shaw 1989); 1989 value is corrected for estimated habitat loss	0.149 pairs/ha	Median estimate for 16 sites in 11 counties determined primarily by 1-mile transect method (Emlen 1971); surveys conducted in 1987, 1988	Carrying capacity: 4,822–16,016 pairs	Median density estimate projected to total potential habitat estimates after corrections	First attempt to use remote sensing for warbler habitat mapping	Assumed constant density across the warbler's breeding range; Imagery for habitat map did not include all portions of the breeding range; Used asynchronous remote imagery to define habitat; Corrected based on assumed habitat change and warbler-habitat relationships (e.g., patches <0.02 mi ² unoccupied); Site-specific estimates applied range-wide; Data collected primarily on public lands

¹⁰⁰ Adapted from Ex. 1, Texas A&M Survey at 4–6 tbl.1.

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
FWS 1992	329,447	Used Wahl et al. (1990) habitat total estimate for 1989 adjusted for estimated habitat loss; included the assumption that 34% of patches <0.02 mi ² are occupied. Estimates included counties with > 3.8 mi ² of potential warbler habitat.	Used Pulich (1976): "good" = 0.125 pairs/ha; "average" = 0.05 pairs/ha; "marginal" = 0.03 pairs/ha	Estimates for each of 3 habitat ranks from Pulich (1976)	13,800 territories	Followed Pulich (1976) proportions of habitat quality assuming same proportions apply to habitat delineated by Wahl et al. (1990); not corrected for patch size	See above	See above
Rowell et al. 1995	116,549 (method 1) 545,970 (method 2)	Method 1 used unsupervised classification of polygons; derived from generalized locations constraining typical warbler habitat. Method 2 used supervised classification from point locations; derived using limited warbler detections and included patches < 0.2 mi ² . Used 1990–1992 Landsat, Ashe juniper-deciduous woodlands with >75% canopy cover and patches >0.02 mi ² .	0.3 individuals/ha	Estimates from Wahl et al. (1990)	Carrying capacity: 64,520 individuals	Projected density to total habitat from Method 2 for patches >0.02 mi ² because less variation in spectral reflectance compared to Method 1	Based on improved imagery from a narrow period of time; Habitat classifications based on larger warbler occurrence data sets	Did not conduct range-wide field surveys; Vegetation data used to drive classification collected at few study sites; Assumed constant density across the warbler's breeding range; Corrected based on assumed warbler-habitat relationships (e.g., patches <0.02 mi ² unoccupied; estimated at 40% of the total area classified as potential habitat)

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Diamond & True 1998	1,652,153 (1986) 1,676,240 (1996–1997)	1986 and 1996–1997 Landsat; land cover classified as Ashe juniper, or mixed juniperoak forest/woodland, or mixed or primarily deciduous forest	NA	NA	NA	NA	Clearly identified limitations	Occupancy within potential habitat unknown; classification accuracy questioned
Rappole et al. 2003	653,353	Used Diamond and True (1998) classification but removed patches <0.02 mi ²	0.188 territorial males/ha 89% pairing success	Estimates from 167 males from monitored population on Fort Hood, Coryell and Bell counties from 1992 to 1996 (Jetté et al. 1998)	228,426 (95% CI: 227,142–229,710) individuals	Adjusted mean density of males by 89% pairing success to estimate number of females	More inclusive habitat classification (included patches >0.02 mi ²)	Site-specific estimates from a small number of sites applied to entire range; Assumed constant density across the warbler's breeding range; Excluded ~29,000 hectares of potential warbler habitat; Adjusted based on pairing success at small number of study sites
DeBoer & Diamond 2006	756,536	Grouped forest cover types based on NLCD data; Included only patches >246 ft. from edge; Conducted occupancy surveys in 2002	NA	NA	NA	NA	Used metrics obtained at local and landscape scales; Collected data on 36 patches of privately owned land and 13 patches of publicly owned land	Limited field sampling across the range; Does not incorporate interpatch heterogeneity

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Diamond 2007	1,678,571 (model C) 1,721,824 (model D)	Evergreen / forest / woodland or deciduous forest / woodland within 100 m of evergreen. Model C: adjusted for edge; Model D: with reduction for low canopy cover and addition for high canopy cover	NA	NA	NA	NA	Compared multiple models	Narrow habitat definition and included qualitative classification of habitat "quality"; Limited field data; unclear methodology
SWCA 2007	552,186	2004 digital imagery; >50% canopy closure composed of large Ashe juniper and deciduous trees; patches >0.02 mi	"high" = 0.22 pair/ha; "low" = 0.025 pair/ha	"High" estimate from long-term monitoring study on Fort Hood, Bell and Coryell counties (Peak 2003); "low" estimate from surveys Government Canyon SNA, Bexar Co.	13,931–116,565 pairs; 20,445–26,978 pairs (adjusted)	Estimated using the SWCA habitat model; adjusted estimate based on personal opinion, based on assumptions of density with goal of deriving a "satisfactory minimum population estimate"	Considered several landscape- scale metrics: density of woodland, proportions of Ashe juniper and deciduous trees, size of trees, patch size, land use	Site-specific estimates from a small number of sites applied to entire range; Included only high quality habitat, therefore narrow definition of warbler habitat not based on quality as it relates to productivity; Personal opinion used to adjust population estimates downward "We looked at the results of this application and did not like it."
Loomis Austin 2008	1,679,348	2001 NLCD average canopy cover in a 7 x 7 cell (cell = 98 ft.) neighborhood; potential habitat = all areas within 3 cells of areas with at least 50% mean canopy cover	NA	NA	NA	NA	Broad range in canopy cover considered potential habitat	Included qualitative classification of habitat "quality" based on canopy cover metrics; Limited field data collected small number of sites over long period of time (2001–2008); unclear methodology

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Collier et al. 2012	1,678,053	2007 and 2008 Landsat 5; unsupervised classification; used NLCD to remove any cover types misclassified as woodland and pixels identified as woodland, but with <30% canopy cover; used road layer to further define habitat patches	NA	NA	NA	NA	Data collection and statistical procedures were appropriate for the scale and scope of the project (patches were randomly sampled across the warbler's breeding range, imagery was current to the study); Included data collected public and private land; Used biological covariates known to influence warbler occurrence; High predictive accuracy; Provided probabilistic prediction of the likelihood of patch occupancy	Did not incorporate interpatch heterogeneity

Reference	Total potential habitat (hectares)	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Mathewson et al. 2012	1,678,053	2007 and 2008 Landsat 5; unsupervised classification; used NLCD to remove any cover types misclassified as woodland and pixels identified as woodland, but with <30% canopy cover; used road layer to further define habitat patches. (Collier et al. 2012)	0.23 males/ha (mean patch-specific density)	Abundance point counts done in 301 patches, such that each patch surveyed was given a density estimate	263,339 singing males (95% CI: 223,927–302,620)	Used predicted patch-specific density estimates as a function of predicted patch-specific occupancy probability and based on 1,000 simulated realizations of population distribution	Data collection and statistical procedures were appropriate for the scale and scope of the project (patches were randomly sampled across the warbler's breeding range, imagery was current to the study); Included data collected within 306 patches on public and private land; More conservative estimate than would have been projected by including detection probability	2009 population estimate; Cannot be applied to local-scale; Patch-specific, so does not incorporate interpatch heterogeneity
Duarte et al. 2013	1,678,281	GIS data and Landsat imagery quantifying breeding habitat change from 1999–2001 to 2010–2011	NA	NA	NA	NA		

CONSERVATION STATUS OF THE FEDERALLY ENDANGERED GOLDEN-CHEEKED WARBLER

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I. Agency Description

At the Texas A&M Institute of Renewable Natural Resources, we conduct problem-driven research addressing today's challenging wildlife and habitat management questions. Our mission is to solve complex natural resource issues through discovery, engagement, innovation, and land stewardship. The Institute's capacity to conduct interdisciplinary research is a result of our team's broad range of capabilities and expertise, and is enhanced by our strong partnerships and collaborations with universities, government agencies, nongovernmental organizations, and other stakeholders. We are invested in generating reliable science that can be used to promote sustainable wildlife populations through sound management and policy decisions.

II. Executive Summary

The Golden-cheeked Warbler (*Setophaga chrysoparia*; hereafter warbler), a small, insectivorous, migratory songbird that breeds exclusively in mixed oak-juniper (*Quercus-Juniperus*) woodland of central Texas (Pulich 1976, Ladd and Gass 1999), was emergency listed in 1990 as federally endangered (USFWS 1990). At the time of its listing, research conducted on a small number of study sites located in the eastern portion of the warbler's breeding range suggested that there was ~1,270 mi² of potential warbler habitat in Texas supporting 13,800 warbler territories (Wahl et al. 1990; USFWS 1992). The USFWS (USFWS 1992) then developed warbler recovery criteria under the notion that there were few warblers existing in spatially structured populations across small, disjunct patches of warbler habitat. After ~25 years of research, recent and comprehensive studies indicate that there is ~5 times more warbler breeding habitat (~6,480 mi²) and that there are ~19 times more warblers (263,339 males; 95% CI = 223,927–302,620) than assumed at the time of the emergency listing decision (Collier et al. 2012, Mathewson et al. 2012). In addition, molecular work suggests there is no genetic basis for managing warblers as separate population entities (Lindsay et al. 2008). Collectively, these studies indicate that recovery criteria were based on a fundamental misunderstanding of the existing abundance and population structure of the species, and a re-examination of the warbler's federally endangered listing status is strongly warranted by the USFWS.

III. Background

The U.S. Fish and Wildlife Service (USFWS) listed the Golden-cheeked Warbler (*Setophaga chrysoparia*; hereafter warbler), a small, insectivorous, migratory songbird that breeds exclusively in mixed oak-juniper (*Quercus-Juniperus*) woodland of central Texas (Pulich 1976, Ladd and Gass 1999), as federally endangered in 1990. During the breeding season (March–July), warblers require shredded bark from mature Ashe juniper for nest material and a combination of Ashe juniper, oaks, and associated hardwoods for nesting and foraging (Pulich 1976, Ladd and Gass 1999). Most warblers leave the breeding grounds in late July and migrate through Mexico and Central America to their wintering grounds in southern Mexico, Guatemala, Honduras, El Salvador, and Nicaragua, where they remain until spring migration begins in late February (Pulich 1976, Ladd and Gass 1999). Primary concerns at the time of the emergency listing decision included habitat loss and fragmentation, urban encroachment, lack of oak recruitment, and brood parasitism by brown-headed cowbirds (*Molothrus ater*) (USFWS 1990).

Recovery goals and most subsequent research efforts operated under the assumptions that warblers are rare and exist within spatially separated populations (Morrison et al. 2012). However, more recent research suggests (1) there is more warbler breeding habitat and the species is more abundant than previously assumed, (2) woodland patches are not separated or isolated by large distances, (3) warblers occupy and successfully breed across a much wider range of habitat conditions than initially identified, and (4) gene flow is panmictic. As such, criteria for species recovery and recommendations for management are based on a limited understanding of the species at the time of their inception, warranting further review of the warbler's federally endangered status in the future. As part of that effort, this report summarizes the abbreviated history and current knowledge of warbler habitat distribution, population trends, potential threats, and existing regulatory mechanisms for the species and provides a biological foundation for future conservation measures.

IV. Federal Listing History

- Emergency listed as federally endangered May 1990; final rule published December 1990
- Recovery Plan published by USFWS September 1992
- USFWS announced 5-year Status Review and solicited new information April 2006
- Spotlight Species Action Plan posted to the Federal Register by USFWS August 2009
- Scientific Evaluation for the 5-year Status Review published November 2010
- Scientific Evaluation for the 5-year Status Review published August 2014

V. Criteria for Species Recovery (USFWS 1992)

- Sufficient breeding habitat protection to ensure continued existence of at least one viable, self-sustaining population in each of the eight regions outlined in the plan
- Potential for gene flow across regions between demographically self-sustaining populations needed for long-term viability
- Sufficient and sustainable non-breeding habitat to support the breeding populations
- All existing warbler populations on public lands protected and managed to ensure their continued existence
- All criteria met for 10 consecutive years

VI. Habitat and Population

Breeding Habitat Estimates

At the time of its listing, research conducted on a small number of study sites located in the eastern portion of the warbler's breeding range suggested that there was ~1,270 mi² of potential warbler habitat in Texas (Wahl et al. 1990; USFWS 1992). Since that time, there have been numerous attempts to update the warbler breeding habitat estimate (Table 1). Results have been highly variable due to differences in land cover classification techniques, source imagery (year collected, image quality, resolution), post-hoc adjustments (minimum patch size requirements, estimated conversion rates, personal opinion), counties included as part of the warbler's breeding range, access to private land for surveys, and actual change in

ground cover over time, among others (Table 1). However, more recent estimates based on randomly sampled patches on public and private land across the warbler's breeding range, congruent satellite imagery, and biological covariates known to influence warbler occurrence identified ~6480 mi² of potential warbler breeding habitat (Collier et al. 2012). This estimate falls within the range of potential warbler breeding habitat identified by others since the listing decision (~2,130–6,840 mi²; Table 1). However, the Collier et al. (2012) habitat model provided the first probabilistic predictions for the likelihood of patch occupancy by warblers and was constructed using data and statistical procedures that were appropriate for the scale and scope of the project (Collier et al. 2012). Information obtained from Collier et al. (2012) indicates that there is ~5 times more warbler breeding habitat than identified at the time of the warbler's listing, that there are a large number of warbler habitat patches across their breeding range, and that these patches are not separated by large distances.

Table 1. Summary of Golden-cheeked Warbler breeding habitat and population estimates.

Reference	Total potential habitat	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Pulich 1976	502 mi ²	Used Soil Conservation Service definition of "virgin Ashe juniper" (stands 20–40 ft trees >75 years old), reduced by author; no imagery used	"good" = 0.125 pairs/ha; "average" = 0.05 pairs/ha; "marginal" = 0.03 pairs/ha	Spot-mapping with marked population in Dallas, Bosque, Kendall counties; Census surveys conducted in 1962 and 1974	1962: 15,630 individuals; 1974: 14,950 individuals	Calculated proportion of total habitat for each of 3 habitat quality ranks (23%, 31%, and 46%, respectively), multiplied by respective density estimates	First comprehensive field-based study	Site-specific estimates from a small number of sites applied to entire range; Narrow habitat definition; Assumed constant density across the warbler's breeding range; Projected density within 3 qualitative habitat assessment ranks
Wahl et al. 1990	Uncorrected: 1305 mi ² ; Corrected for habitat changes post-imagery collection: 915 mi ² ; Habitat in patches >50 ha: 124–412 mi ²	Corrected values for habitat loss and patch size; 1974, 1976, and 1981 Landsat imagery, unsupervised and supervised classification from known breeding locations (see Shaw 1989); 1989 value is corrected for estimated habitat loss	0.149 pairs/ha	Median estimate for 16 sites in 11 counties determined primarily by 1-mile transect method (Emlen 1971); surveys conducted in 1987, 1988	Carrying capacity: 4,822–16,016 pairs	Median density estimate projected to total potential habitat estimates after corrections	First attempt to use remote sensing for warbler habitat mapping	Assumed constant density across the warbler's breeding range; Imagery for habitat map did not include all portions of the breeding range; Used asynchronous remote imagery to define habitat; Corrected based on assumed habitat change and warbler-habitat relationships (e.g., patches <0.02 mi ² unoccupied); Site-specific estimates applied range-wide; Data collected primarily on public lands
USFWS 1992	1272 mi ² (Adapted from Wahl et al. 1990; estimates included counties with >3.8 mi ² of potential warbler habitat)	Used Wahl et al. (1990) habitat total estimate for 1989 adjusted for estimated habitat loss; included the assumption that 34% of patches <0.02 mi ² are occupied	Estimates from Pulich (1976) for good, average, and marginal	Estimates for each of 3 habitat ranks from Pulich (1976)	13,800 territories	Followed Pulich (1976) proportions of habitat quality assuming same proportions apply to habitat delineated by Wahl et al. (1990); not corrected for patch size	See above	See above
Rowell et al. 1995	Method 1 (derived from generalized locations containing typical warbler habitat): 450 mi ² ; Method 2 (derived using limited warbler detections - included patches <0.2 mi ²): 2108 mi ²	1990–1992 Landsat, Ashe juniper-deciduous woodlands with >75% canopy cover and patches >0.02 mi ² ; Method 1: unsupervised classification of polygons; Method 2: supervised classification from point locations	0.3 individuals/ha	Estimates from Wahl et al. (1990)	Carrying capacity: 64,520 individuals	Projected density to total habitat from Method 2 for patches >0.02 mi ² because less variation in spectral reflectance compared to Method 1	Based on improved imagery from a narrow period of time; Habitat classifications based on larger warbler occurrence data sets	Did not conduct range-wide field surveys; Vegetation data used to drive classification collected at few study sites; Assumed constant density across the warbler's breeding range; Corrected based on assumed warbler-habitat relationships (e.g., patches <0.02 mi ² unoccupied; estimated at 40% of their total area classified as potential habitat)

Reference	Total potential habitat	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Diamond and True 1998	1986: 6379 mi ² ; 1996-1997: 6472 mi ²	1986 and 1996-1997 Landsat; land cover classified as Ashe juniper, or mixed juniperoak forest/woodland, or mixed or primarily deciduous forest	NA	NA	NA	NA	Clearly identified limitations	Occupancy within potential habitat unknown; classification accuracy questioned
Rappole et al. 2003	2484 mi ²	Used Diamond and True (1998) classification but removed patches 0.02 mi ²	0.188 territorial males/ha; 89% pairing success	Estimates from 167 males from monitored population on Fort Hood, Coryell and Bell counties from 1992 to 1996 (Jette et al. 1998)	228,426 (95% CI: 227,142-229,710) individuals	Adjusted mean density of males by 89% pairing success to estimate number of females	More inclusive habitat classification (included patches >0.02 mi ²)	Site-specific estimates from a small number of sites applied to entire range; Assumed constant density across the warbler's breeding range; Excluded ~112 mi ² of potential warbler habitat; Adjusted based on pairing success at small number of study sites
DeBoer and Diamond 2006	2921 mi ²	Grouped forest cover types based on NLCD data; Included only patches >246 ft from edge; Conducted occupancy surveys in 2002	NA	NA	NA	NA	Used metrics obtained at local and landscape scales; Collected data on 36 patches of privately owned land and 13 patches of publicly owned land	Limited field sampling across the range; Does not incorporate interpatch heterogeneity
Diamond 2007	Model C: 6841 mi ² ; Model D: 6648 mi ²	Evergreen/forest/woodland or deciduous forest/woodland within 100 m of evergreen. Model C: adjusted for edge; Model D: with reduction for low canopy cover and addition for high canopy cover	NA	NA	NA	NA	Compared multiple models	Narrow habitat definition and included qualitative classification of habitat "quality"; Limited field data; unclear methodology
SWCA 2007	2132 mi ²	2004 digital imagery; >50% canopy closure composed of large Ashe juniper and deciduous trees; patches >0.02 mi ²	"high" = 0.22 pair/ha; "low" = 0.025 pair/ha	"High" estimate from long-term monitoring study on Fort Hood, Bell and Coryell counties (Peak 2003); "low" estimate from surveys Government Canyon SNA, Bexar Co. (USFWS 2004)	Estimated using the SWCA habitat model: 13,931-116,565 pairs; Adjusted estimate based on personal opinion: 20,445-26,978 pairs	Adjusted estimate based on assumptions of density with goal of deriving a "satisfactory minimum population estimate"	Considered several landscape-scale metrics: density of woodland, proportions of Ashe juniper and deciduous trees, size of trees, patch size, land use	Site-specific estimates from a small number of sites applied to entire range; Included only high quality habitat, therefore narrow definition of warbler habitat and not based on quality as it relates to productivity; Personal opinion used to adjust population estimates downward "We looked at the results of this application and did not like it."
Loomis Austin 2008	6484 mi ²	2001 NLCD average canopy cover in a 7 x 7 cell (cell = 98 ft) neighborhood; potential habitat = all areas within 3 cells of areas with at least 50% mean canopy cover	NA	NA	NA	NA	Broad range in canopy cover considered potential habitat	Included qualitative classification of habitat "quality" based on canopy cover metrics; Limited field data collected small number of sites over long period of time (2001-2008); unclear methodology

Reference	Total potential habitat	Habitat delineation method	Density estimate	Density method	Total population	Population method	Advantages	Limitations
Collier et al. 2012	6479 mi ²	2007 and 2008 Landsat 5; unsupervised classification; used NLCD to remove any cover types mis-classified as woodland and pixels identified as woodland, but with <30% canopy cover; used road layer to further define habitat patches	NA	NA	NA	NA	Data collection and statistical procedures were appropriate for the scale and scope of the project (patches were randomly sampled across the warbler's breeding range, imagery was current to the study); Included data collected public and private land; Used biological covariates known to influence warbler occurrence; High predictive accuracy; Provided probabilistic prediction of the likelihood of patch occupancy	Did not incorporate interpatch heterogeneity
Mathewson et al. 2012	6479 mi ²	2007 and 2008 Landsat 5; unsupervised classification; used NLCD to remove any cover types mis-classified as woodland and pixels identified as woodland, but with <30% canopy cover; used road layer to further define habitat patches. (Collier et al. 2012)	mean patch-specific density: 0.23 males/ha	Abundance point counts done in 301 patches, such that each patch surveyed was given a density estimate	263,339 (95% CI: 223,927–302,620) singing males	Used predicted patch-specific density estimates as a function of predicted patch-specific occupancy probability and based on 1,000 simulated realizations of population distribution	Data collection and statistical procedures were appropriate for the scale and scope of the project (patches were randomly sampled across the warbler's breeding range, imagery was current to the study); Included data collected within 306 patches on public and private land; More conservative estimate than would have been projected by including detection probability	2009 population estimate; Cannot be applied to local-scale; Patch-specific, so does not incorporate interpatch heterogeneity

Winter and Migratory Habitat Estimates

Warblers winter in pine-oak forests of southern Mexico, Guatemala, Honduras, El Salvador, Nicaragua, and possibly Costa Rica at elevations between ~2,600 and 8,500 ft (Komar et al. 2011). Infrequently, warblers may also be found in pine, cloud or broadleaf forests, scrub habitat or agricultural areas (Rappole et al. 2000, Potossem and Muñoz 2007, McCrary et al. 2009). Using U.S. Geological Survey (USGS) data and Landsat imagery, Rappole et al. (2003) estimated ~2,600 mi² of potential pine oak-habitat on the wintering grounds (excluding Nicaragua). However, the authors acknowledged that known detections fell into a USGS land cover class of “evergreen needleleaf forest”, which they did not include in their initial analyses and could add ~1,700 mi² to their estimate of potential winter habitat, resulting in ~4,300 mi² of potential winter habitat. Alliance for the Conservation of Mesoamerican Pine-Oak Forests (ACMPOF) estimated ~7,500 mi² of potential warbler wintering habitat (ACMPOF 2008). Parks and protected areas exist along the migration route. However, data regarding warbler use of those areas during migration is lacking.

Breeding Population Estimates

Population estimates extrapolated from research conducted on a small number of study sites located in the eastern portion of the warbler’s breeding range suggested that there were 13,800 warbler territories in Texas at the time of the warbler’s emergency listing as federally endangered (Wahl et al. 1990; USFWS 1992). Subsequent population estimates based on improved imagery (though still quantified using a small number of site-specific observations, qualitative definitions of warbler habitat quality based on personal opinion, and assumptions of constant density across the warblers breeding range) indicated that there were ~13,000–230,000 individuals (Table 1). Most recently, Mathewson et al. (2012) estimated the warbler population size using models of patch-specific densities derived from randomly located range-wide abundance surveys, then developed a predictive equation that related biological metrics to patch-scale density. They found that patch-specific occupancy probability (which is a function of patch size and landscape composition; Collier et al. 2012) was the best predictor of patch-specific densities, and estimated the population of male warblers at 263,339 (95% CI = 223,927–302,620). Without accounting for detection probability, which would have increased the overall population estimate, this indicates that there are ~19 times more warblers than assumed at the time of the emergency listing decision.

The most recent warbler status review suggests that the Mathewson et al. (2012) model may have over-predicted warbler density estimates, and, therefore, resulted in inflated population estimates (USFWS 2014). More specifically, the USFWS (2014) noted concerns that patch-specific territory density estimates with known warbler numbers are lower than predicted by the range-wide estimates. This is a misapplication of the model results, which the authors explained should only be applied at the range-wide scale. Mathewson et al. (2012) used data and statistical procedures that were appropriate for the scale and scope of the project (i.e., patches were randomly sampled on public and private land across the warbler’s breeding range, imagery was current to the study). In addition, their overall estimates align with other habitat and population estimates when assumptions regarding habitat quality are removed (Table 1). Furthermore, the territory density estimates derived by Mathewson et al. (2012) were well within the range of most available information for the species (Table 2). It is also important to note that relationships between warbler density and patch-scale metrics used by Mathewson et al. (2012) to predict abundance across the species’ range were consistent with patch-scale metrics previously shown to affect warbler

density at local scales (Magness et al 2006, Baccus et al. 2007). While the Mathewson et al. (2012) model should not be used at the local scale, which again was acknowledged by the authors in their peer-reviewed manuscript, their work provided patch-specific predictions of warbler density across the species' breeding range and represents the best available warbler breeding population estimate.

Table 2. Summary of patch-specific Golden-cheeked Warbler territory density estimates.

Source	Density (males/ha)	Location	Survey method
Pulich 1976	0.03–0.13	Dallas, Bosque, Kendall counties	Census
Kroll 1980	0.12–0.20	Bosque county	Territory mapping
Wahl et al. 1990	0.08–0.63	Rangewide	1.6 km Emlen strip census
Jette 1998	1992–1996; 0.14–0.28	Fort Hood (Coryell County)	Territory mapping
Peak 2003	1999–2003; Site 1: 0.10–0.22, Site 2: 0.25–0.37	Fort Hood (Coryell County)	# males / size of study site
Peak and Lusk 2009	2003–2009; 0.21–0.29	Fort Hood (Coryell County)	# males / size of study site
Peak and Grigsby 2011, 2012, 2013	2011–2013; 0.27–0.32	Fort Hood (Coryell County)	# males / size of study site
City of Austin & Travis County	1999–2013; 0.17–0.44	BCP (Travis County)	Territory mapping
Cooksey & Edwards 2008	1991–2008; 0.04–0.20	Camp Bullis (Bexar County)	Point counts along transects
Mathewson et al. 2012	0.23	Rangewide	Point counts at random points in patches

Winter Population Estimates

Estimates of the warbler population on the winter range vary substantially. Rappole et al. (2003) estimated a winter habitat carrying capacity of 34,425 birds, using their estimate of density (0.05 birds/ha) and an estimate of ha of pine-oak above ~4000 ft (~2,600 mi²; see above). When the “evergreen needleleaf” class was included, their winter population estimates increased to 56,674 birds. Using the habitat estimate from ACMPOF (2008) and their own warbler density estimate (0.3 birds/ha), Komar et al. (2011) estimated a total warbler population of 585,000 birds, with 345,000 adult males, although the authors admit that the amount of habitat is likely overestimated. Komar et al. (2011) detected decreased warbler abundance in each year of their range-wide study of wintering warblers (2007–2010), suggesting potential declines in the overall warbler populations, insufficient sampling, or observer bias.

Survival

Using data collected from a small portion of the warbler’s breeding range (Fort Hood Military Reservation, Coryell and Bell counties, TX) and assuming metapopulation dynamics (but see Lindsay et al. 2008 below), Alldredge et al (2004) developed the population viability model used to guide conservation decisions by the USFWS. Results of their analyses suggest that the probability of warbler extinction over the next 100 years is low as long as enough habitat exists to support $\geq 3,000$ breeding pairs in each of the eight defined recovery regions. The total amount of available warbler habitat exceeds this threshold (Mathewson et al. 2012) and Hatfield et al. (2012) recently suggested that recovery region boundaries should be reestablished to reflect warbler biology as opposed to watershed boundaries. Under this paradigm, recovery metrics would not include estimates of abundance across the 8 recovery regions, which currently require a minimum of 3,000 males per recovery region, since these initial estimates were based off small-scale studies, we now know that density varies widely across the warbler’s breeding range, and warblers do not exist as a metapopulation (detailed below).

In a more recent analysis, Duarte et al. (2014) used data (again collected at Fort Hood) and found adult survival rates slightly lower than those initially used by Alldredge et al. (2004) (mean apparent survival for Duarte et al. 2014 = 0.47 and mean apparent survival for Alldredge et al. 2004 = 0.56). However, Duarte et al. (2014) additionally recognized that warbler survival rates coincided with those obtained for other closely related warbler species and acknowledged that their calculations should not be used to simulate range-wide population dynamics. Duarte et al. (2014) found no evidence that survival at this study location exhibits spatial or temporal variation and there are no known studies that address range-wide variation in warbler survival rates. Such information would be necessary to infer broad-scale population dynamics and set informed conservation targets identified by Alldredge et al. (2004) and used by USFWS.

Productivity

Pairing success is generally high (typically >70%) and studies suggest that estimates of this metric depend on factors such as tree species composition (Marshall et al. 2013), male age (Jette et al. 1998), and warbler territory density (Farrell et al. 2012). Territory success (proportion of territories that successfully fledge young) is also relatively high (typically >50%) and exhibits similar trends with tree species composition (Marshall et al. 2013), male age (Pruett 2014), and warbler territory density (Farrell et al.

2013). Fecundity is difficult to compare across years due to inconsistencies in measuring, reporting, and that warblers split broods (biasing fledging counts low), but estimates of fecundity are consistently high on the Fort Hood Military Reservation (1.13–2.06 young per territory; Anders 2000) and City of Austin properties (1.82–3.04 young per territory; COA 2010, 2011, 2012, 2013).

While warbler management guidelines identify large-tracts of oak-juniper woodland with >70% cover as high quality breeding habitat, more recent research indicates that relationships between woodland stand characteristics and fledging success vary regionally (Campomizzi et al. 2012). In the Limestone Cut Plain Ecoregion, where most warbler research has been conducted, the predicted probability of warbler fledging success increased with increasing patch size, decreasing patch edge to area ratio, and increasing percent cover. This coincides with site-specific nest survival data obtained at the Fort Hood Military Reservation and in the Austin area (Stake 2003, Peak 2007, Reidy et al. 2009b, Peak and Thompson 2014). However, these relationships are not consistent across Ecoregions (Campomizzi et al. 2012) and warblers will fledge young in areas with <20% canopy cover, especially in the southern portion of their breeding range (Klassen et al. 2012). Furthermore, there is experimental song playback evidence that warblers can be drawn into previously unoccupied woodland stands with less canopy cover and successfully fledge young outside the habitat conditions typically considered suitable for the species (Farrell et al. 2012).

Genetics

Athrey et al. (2011) examined temporal changes in genetic variation using 134 samples collected from 1890–2008 at locations in Travis, Bexar, and Kerr counties, Texas. They divided the samples into historic (1890–1915) and contemporary (2005) time periods and found reduced allelic richness (20% decline) and heterozygosity (13% decline) in the contemporary samples compared to the historic samples. Athrey et al. (2011) suggested that habitat fragmentation in the 20th century resulted in reduced gene flow and increased spatial structuring of the warbler population. However, previous research using DNA collected from 109 individuals at seven study sites across the warblers' range in 2004 and 2005 found no evidence of genetic bottlenecks or genetic differentiation (Lindsay et al. 2008). The latter results indicate that current allelic richness and heterozygosity are relatively high and similar to those of other warbler species, and suggests that there is no genetic basis for managing warblers as separate population entities (i.e., there is no genetic basis for assuming metapopulation dynamics; Lindsay et al. 2008).

VII. Over-utilization for Commercial, Recreational, Scientific, or Educational Purposes

There is no evidence that the warbler has been subject to overuse for commercial, recreational, scientific, or educational purposes. Birds of many species are captured for the pet trade or killed for recreational hunting on the wintering grounds, but it is unlikely that these activities pose a threat to the warbler's continued existence. Research that includes mist nesting and banding of warblers is organized and regulated by the USFWS, TPWD, and BBL and these activities rarely cause harm to individuals.

VIII. Disease, Predation, and Brood Parasitism

In 2012, avian pox was confirmed on Balcones Canyonlands Preserve (Austin, TX) properties after several warblers were reported with swollen and bleeding feet, legs, and lesions on the face, legs and feet. City of Austin researchers recommended exercising care when handling the birds in those locations to

minimize the spread of the infection. This appears to be an isolated event and there are no other disease detection records for this species.

Documented warbler predators (adults and young) include snakes, birds, mammals, red-imported fire ants (*Solenopsis invicta*) (Stake et al. 2004, Reidy et al. 2008, Reidy et al. 2009a). Brood parasitism varies annually, but is uncommon and represents a small risk to overall warbler nest survival (Groce et al. 2010).

IX. Natural or Manmade Factors

Habitat Loss

From 1992–2001, Groce et al. (2010) examined National Land Cover data (NLCD) and estimated a net loss of $\sim 450 \text{ mi}^2$ ($\sim 6\%$) of woodland within the warbler's breeding range during that time period. The highest conversion rates were identified near urban areas and were attributed to development and population growth. More recent Texas Land Trends analyses support this trend, as most land conversion that occurred between 1997–2012 occurred with population expansion in the states 25 fastest growing counties (txlandtrends.org). Duarte et al. (2013) used Landsat imagery to quantify range-wide changes in golden-cheeked warbler breeding habitat over a 10-year period between 1999–2000 and 2010–2011. They identified a total $\sim 8,570 \text{ mi}^2$ of potential golden-cheeked warbler habitat in 1999–2000 (more than any other estimates of potential warbler habitat; see above) and $\sim 6,090 \text{ mi}^2$ in 2010–2011 (similar to other estimates of potential warbler habitat; see above). They determined that the degree of fragmentation and loss was uneven across the range with the greatest reductions in mean patch size the southern portion of the warblers' range.

ACMPOF (2008) estimated that 74% of the original pine-oak forest cover remains on the warbler's wintering grounds in Mexico and Central America; $\sim 7\%$ of the existing habitat is located in protected areas. Primary conversion threats include unsustainable forestry practices that are incompatible with conservation, forest fires, and commercial logging (ACMPOF 2008). Parks and protected areas exist along the migration route, but no data exists regarding the amount of potential stopover habitat. Similarly, many conservation groups and NGOs work in the region, but there is no data to quantify the scope of their efforts.

Habitat Fragmentation

Fragmentation of existing breeding habitat represented a major concern at the time of the warbler's listing. Range-wide studies conducted during the breeding season indicate that the predicted probability of occupancy increases from north to south with increasing patch size and mean percentage of woodland cover in the surrounding landscape (Collier et al. 2012). Site-specific research conducted by Butcher et al. (2010) found that warblers establish territories in patches as small as $\sim 0.01 \text{ mi}^2$ in rural landscapes. Follow-up research conducted in the Austin area found that minimum patch size requirements for territory establishment were larger ($\sim 0.05 \text{ mi}^2$; Robinson 2013). Combined, the Collier et al. (2012), Butcher et al. (2010), and Robinson (2013) studies emphasize the importance of large and small patches to sustain the warbler population on its breeding ground.

Range-wide, warbler density also increased from north to south, which ecologically represents increasing patch size and mean percentage of woodland cover in the surrounding landscape (Mathewson et al. 2012). This coincides with site-specific research (Magness et al. 2006, Baccus et al. 2007, Peak and Thompson

2013). Though again, small patches do support warblers and the importance of these smaller areas should not be discounted. Patch size can also influence avian reproduction. Coldren (1998) found that pairing and fledging success increased with increased patch size. Minimum patch size for reproductive success is 0.06–0.07 mi² in a rural landscape (Butcher et al. 2010) and ~0.08 mi² in an urban environment (Arnold et al. 1996). However, in a range-wide study that included productivity data from 1,382 territories, Campomizzi et al. (2012) did not find consistent relationships between territory success and patch size or patch edge-to-area ratio across their breeding range.

Habitat Degradation

In a study conducted in the western portion of the warbler's breeding range, Stewart et al. (2014b) found that the presence of oak wilt (a defoliating tree disease caused by the fungus *Ceratocytis fagacearum*) did not affect warbler territory placement, but pairing success for males whose territories included some proportion of oak wilt had 27% lower pairing success. With that said, Stewart et al. (2014b) found no difference in fledging success between territories in oak wilt affected and unaffected forests. In a similar study conducted in the eastern portion of the warbler's breeding range, Appel and Camilli (2010) examined post-breeding habitat use in warblers in relation to oak wilt and found no difference in the use of affected and unaffected forest. Studies suggest that oak wilt is more likely to occur outside warbler habitat (Appel and Camilli 2010, Stewart et al. 2014a); Stewart et al. (2014a) found that oak wilt occurred in 4.1% of their study area and predicted that the amount of habitat affected will double by 2018 as the disease spreads.

Deer can limit oak survival when the saplings are browsed (Russell and Fowler 2002, 2004). However, there is no direct evidence to suggest that herbivory by native or non-native browsers is contributing to reduced habitat (or habitat suitability) for the warbler. Murray et al. (2013) investigated local declines in Texas red oak (*Q. buckleyi*) at Balcones Canyonlands National Wildlife Refuge, but concluded that fire suppression and drought were likely the cause of reduced oak density. Similarly, Yao et al. (2012) suggested fire could have a dual effect on warbler habitat (such that reduced tree density could reduce suitability), but oak recruitment is typically high following moderate to high intensity fires.

Management Practices

At the time of listing, it was assumed that any Ashe juniper removal from warbler habitat would have a negative effect on the species. However, Marshall et al. (2012) found that a higher proportion of territories successfully fledged young in areas where understory juniper was thinned when compared to untreated control sites. Warbler territory density was also similar between the thinned sites and control sites, which suggests that the pattern of higher productivity in the treated areas did not result from density dependent mechanisms.

Climate Change

A combination of long-term fire suppression and drought exacerbated by climate change could increase the risk of wildfires and restrict warbler breeding habitat (EPA 2009), but whether this will influence the long-term survival of the species is unknown.

Noise

In the original listing decision, road construction noise and activity was cited as a potential threat to the warbler. Lackey et al. (2012) found similar warbler abundance, pairing success, and fledging success across road noise only sites, road construction sites, and control sites, and there was no relationship between warbler reproductive success and distance from the roadway. Similarly, warblers at the Fort Hood Military Reservation occupied and breed in patches exposed to active military activity and there is no correlation between warbler reproductive success and noise level (Lopez et al. 2012). Both studies suggest that warblers habituate to anthropogenic noise disturbance.

X. Regulatory Mechanisms

Direct take of warblers is prohibited by the Migratory Bird Treaty Act of 1918 and by the Texas Parks and Wildlife Department. Listing of the warbler as federally endangered by the USFWS provided protection for warbler breeding habitat on public and private land. In addition, there are several conservation-based programs that preserve existing warbler habitat on private land. These include:

- 160 Habitat Conservation Plans and one Safe Harbor Agreement supported by the USFWS
- The Recovery Credit System (RCS), a voluntary natural resource management program developed by the Texas Department of Agriculture provides technical guidance and assistance to private landowners near the Fort Hood Military Reservation with qualifying lands that support warbler habitat. The goal of this program is to mitigate adverse impacts to habitat on the installation that result from military training activities. Since July 2006, the total investment for implementation of the RCS is \$1,954,666 and the cost-share for the 20 participating landowner's cost share is \$451,295. Contract terms range from 10–25 years and the program protects ~3.4 mi² of warbler breeding habitat on private land.
- The *Black-capped Vireo and Golden-cheeked Warbler Habitat Identification/Treatment Criteria for the NRCS Brush Management Consultation* was developed by the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). This program provides technical guidance for brush clearing to avoid warbler breeding habitat on properties with NRCS contracts.
- The Alliance for the Conservation of Mesoamerican Pine-Oak Forests in was established in 2003. This voluntary international cooperative partnership includes members from many national nongovernmental organizations in Mexico, Guatemala, El Salvador; Honduras, Nicaragua, and the U.S. (including the Nature Conservancy, Texas Parks and Wildlife Department, and the Zoo Conservation Outreach Program). The organization's conservation plan, published in 2008, directs management and preservation actions in the pine-oak ecoregion on Central America, where most warbler wintering habitat is located.

XI. Conclusion

At the time of the Golden-cheeked Warbler's emergency listing as federally endangered in 1990, research conducted on a small number of study sites located in the eastern portion of the warbler's breeding range suggested that there was ~1,270 mi² of potential warbler habitat in Texas supporting 13,800 warbler territories (Wahl et al. 1990; USFWS 1992). The USFWS (USFWS 1992) then developed warbler recovery criteria under the notion that there were few warblers existing in spatially structured

populations across small, disjunct patches of warbler habitat. Specifically, the warbler recovery criteria require:

- Sufficient breeding habitat protection to ensure continued existence of at least one viable, self-sustaining population in each of the eight regions outlined in the plan
- Potential for gene flow across regions between demographically self-sustaining populations needed for long-term viability
- Sufficient and sustainable non-breeding habitat to support the breeding populations
- All existing warblers populations on public lands protected and managed to ensure their continued existence
- All criteria met for 10 consecutive years

After ~25 years of research, recent and comprehensive studies indicate that there is ~5 times more warbler breeding habitat (~6,480 mi²) and that there are ~19 times more warblers (263,339 males; 95% CI = 223,927–302,620) than assumed at the time of the emergency listing decision (Collier et al. 2012, Mathewson et al. 2012). Regardless of the actual warbler population size, it is clear that there are substantially more warblers than assumed at the time of listing (Mathewson et al. 2012), the available warbler breeding habitat is much more widely distributed than initially thought (Collier et al. 2012), and that breeding warblers inhabit a much wider range of habitat conditions than identified during early studies (e.g., Klassen et al. 2012). In addition, there is no genetic evidence that warblers have demographically self-sustaining populations, and thus, there is no basis for managing warblers as separate population entities across the recovery regions (Lindsay et al. 2008). Scientific studies also fail to support the notion that the spatial extent of wintering habitat is a limiting factor for this migratory species. Finally, maintaining warbler populations on public lands is certainly a part of warbler conservation. However, this criterion was developed under the assumption that there was limited warbler breeding habitat and that the remaining warbler breeding habitat was highly fragmented and separated by large distances, which recent studies no longer support. Long-term and comprehensive research conducted over the last 25 years offers a different perspective on the species, strongly warranting a re-examination of the warbler's federally endangered listing status by the USFWS.

XII. Literature Cited

- Allredge, M.W., J. S. Hatfield, D. D. Diamond, and C. D. True. 2004. Golden-cheeked warbler (*Dendroica chrysoparia*) in Texas: Importance of dispersal toward persistence in a metapopulation. Pages 372–383 in H. R. Akçakaya, M. A. Burgman, O. Kindvall, C. C. Wood, P. Sjögren-Gulve, J. S. Hatfield, and M. A. McCarthy, editors. Species conservation and management: case studies. Oxford University Press, New York, New York, USA.
- Alliance for the Conservation of Mesoamerican Pine-Oak Forests [ACMPOF]. 2008. Plan de Conservación de los Bosques de Pino-Encino de Centroamérica y el Ave Migratoria *Dendroica chrysoparia*. Fundación Defensores de la Naturaleza and The Nature Conservancy Guatemala.
- Anders, A.D. 2000. Demography of golden-cheeked warblers on Fort Hood, Texas in 2000: productivity, age structure, territory density, and adult return rates. Chapter 5 in Endangered species

- monitoring and management at Fort Hood, Texas: 2000 annual report. The Nature Conservancy, Fort Hood Project, Fort Hood, Texas, USA.
- Appel, D.N., and K.S. Camilli. 2010. Assessment of oak wilt threat to habitat of golden-cheeked warbler, an endangered species, in central Texas. In: Advances in threat assessment and their application to forest and rangeland management, eds. J.M. Pye, H.M. Rauscher, Y. Sands, D.C. Lee, and J.S. Beatty. United States Department of Agriculture, Forest Service Pacific Northwest Research Station, General Technical Report PNW-GTR-802, pp. 61–72.
- Arnold, K.A., C.L. Coldren, and M.L. Fink. 1996. The interactions between avian predators and golden-cheeked warblers in Travis County. Texas Transportation Institute. The Texas A&M University System, Texas Department of Transportation. Report 1983–2.
- Athrey, G., D.L. Lindsay, R.F. Lance, P.L. Leberg. 2011. Crumbling diversity: comparison of historical archived and contemporary natural populations indicate reduced genetic diversity and increasing genetic differentiation in the golden-cheeked warbler. *Conservation Genetics* 12:1345–1355.
- Baccus, J.T., M.E. Tolle, and J.D. Cornelius. 2007. Response of golden-cheeked warblers (*Dendroica chrysoparia*) to wildfires at Fort Hood, Texas. Texas Ornithological Society.
- Butcher, J.A., M.L. Morrison, D. Ransom, Jr., R.D. Slack, and R.N. Wilkins. 2010. Evidence of a minimum patch size threshold of reproductive success in an endangered songbird. *Journal of Wildlife Management* 74:133–139.
- Campomizzi, A.J., S.L. Farrell, T.M. McFarland, H.A. Mathewson, M.L. Morrison, and R.N. Wilkins. 2012. Species conservation at a broad spatial scale: reproductive success of golden-cheeked warblers across their breeding range. *Wildlife Society Bulletin* 36:440–449.
- City of Austin [COA]. 2010. Golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*) monitoring program. Balcones Canyonlands Preserve annual report fiscal year 2009–2010.
- _____. 2011. Golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*) monitoring program. Balcones Canyonlands Preserve annual report fiscal year 2010–2011.
- _____. 2012. Golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*) monitoring program. Balcones Canyonlands Preserve annual report fiscal year 2011–2012.
- _____. 2013. 2013 Annual report: Golden-cheeked warbler (*Setophaga chrysoparia*) monitoring program. Balcones Canyonlands Preserve. City of Austin Water Utility, Wildland Conservation Division and Balcones Canyonlands Preserve Program, Austin, Texas, USA.
- Coldren, C.L. 1998. The effects of habitat fragmentation on the golden-cheeked warbler. Dissertation, Texas A&M University, College Station, Texas, USA.

- Collier, B.A., J.E. Groce, M.L. Morrison, J.C. Newnam, A.J. Campomizzi, S.L. Farrell, H.A. Mathewson, R.T. Snelgrove, R.J. Carroll, and R.N. Wilkins. 2012. Predicting patch occupancy in fragmented landscapes at a range-wide scale for an endangered species: an example of an American warbler. *Diversity and Distributions* 18:158–167.
- DeBoer, T.S., and D.D. Diamond. 2006. Predicting presence-absence of the endangered golden-cheeked warbler (*Dendroica chrysoparia*). *Southwestern Naturalist* 51:181–190.
- Diamond, D.D. 2007. Range-wide modeling of golden-cheeked warbler habitat. Final Report to Texas Parks and Wildlife Department, Austin, Texas, USA.
- Diamond, D.D., L.F. Elliott, C. Blodgett, C.D. True, D. German, and A. Treuer-Keuhn. 2010. Texas ecological systems classification project. Missouri Resource Assessment Partnership (MoRAP), University of Missouri, Columbia, and the Texas Parks and Wildlife Department, Austin USA. <http://morap.missouri.edu/index.php/texas-ecological-systems-classification/>. Accessed 15 July 2014.
- Duarte, A., J.L.R. Jensen, J.S. Hatfield, and F.W. Weckerly. 2013. Spatiotemporal variation in range-wide golden-cheeked warbler breeding habitat. *Ecosphere* 4:152.
- Duarte, A., J.E. Hines, J.D. Nichols, J.S. Hatfield, and F.W. Weckerly. 2014. Age-specific survival of male Golden-cheeked Warblers on the Fort Hood Military Reservation, Texas. *Avian Conservation and Ecology* 9:4.
- Environmental Protection Agency [EPA]. 2009. A framework for categorizing the relative vulnerability of threatened and endangered species to climate change. Global Change Research Program, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.
- Farrell, S.L., M.L. Morrison, A.J. Campomizzi, and R.N. Wilkins. 2012. Conspecific cues and breeding habitat selection in an endangered woodland warbler. *Journal of Animal Ecology* 81:1056–1064.
- Groce, J.E., H.A. Mathewson, M.L. Morrison, and N. Wilkins. 2010. Scientific evaluation for the 5-year status review of the golden-cheeked warbler. Report prepared for the United States Fish and Wildlife Service.
- Hatfield, J.S., F.W. Weckerly, and A. Duarte. 2012. Shifting foundations and metrics for golden-cheeked warbler recovery. *Wildlife Society Bulletin* 36:415–422.
- Jette, L.A., T.J. Hayden, and J.D. Cornelius. 1998. Demographics of the golden-cheeked warbler (*Dendroica chrysoparia*) on Fort Hood, Texas. U.S. Army Corps of Engineers Technical Report 98/52. State University, San Marcos, Texas, USA.
- Klassen, J.A., M.L. Morrison, H.A. Mathewson, G.G. Rosenthal, and R.N. Wilkins. 2012. Canopy characteristics affect reproductive success of golden-cheeked warblers. *Wildlife Society Bulletin* 36:54–60.
- Komar, O., J.K. McCrary, J.V. Dort, A.J. Cobar, and E.C. Castellano. 2011. Winter ecology, relative abundance and population monitoring of golden-cheeked warblers (*Dendroica chrysoparia*)

- throughout the known and potential winter range. Final report to Texas Parks and Wildlife Department for Section 6 Grant TX E-69-R. Austin, Texas, USA.
- Lackey, M.A., M.L. Morrison, Z.G. Loman, B.A. Collier, and R.N. Wilkins. 2012. Experimental determination of the response of golden-cheeked warblers to road-constriction noise (*Setophaga chrysoparia*). *Ornithological Monographs* 74:91–100.
- Ladd, C. G., and L. Gass. 1999. Golden-cheeked warbler (*Dendroica chrysoparia*). Account 420 in A. Poole, editor. *The Birds of North America online*. Cornell Lab of Ornithology, Ithaca, New York, USA.
- Lindsay, D.L., K.R. Barr, R.F. Lance, S.A. Tweddale, T.J. Hayden, and P.L. Leberg. 2008. Habitat fragmentation and genetic diversity of an endangered, migratory songbird, the golden-cheeked warbler (*Dendroica chrysoparia*). *Molecular Ecology* 17:2122–2133.
- Loomis-Austin, Inc. 2008. Mapping potential golden-cheeked warbler breeding habitat using remotely sensed forest canopy cover data. Report LAI Proj. No. 051001.
- Lopez, R., B. Hays, S. Farrell, M. Marshall, A. Long, and H. Pruett. 2012. Support to military land management and training on Fort Hood, Texas. Year 5 Annual Report (Cumulative) to Department of Defense. Agreement No. W912DY-07-0030.
- Magness, D.R., R.N. Wilkins, and S.J. Hejl. 2006. Quantitative relationships among golden-cheeked warbler occurrence and landscape size, composition, and structure. *Wildlife Society Bulletin* 34:473–479.
- Marshall, M.E., M.L. Morrison, and R.N. Wilkins. 2013. Tree species composition and food availability affect productivity of an endangered species: the golden-cheeked warbler. *Condor* 115:882–892.
- Mathewson, H.A., J.E. Groce, T.M. McFarland, M.L. Morrison, J.C. Newnam, R.T. Snelgrove, B.A. Collier, and R.N. Wilkins. 2012. Estimating breeding season abundance of golden-cheeked warblers in Texas, USA. *Journal of Wildlife Management* 76:1117–1128.
- McCrary, J.K., W.I. Arendt, L. Chavarría, L.J. López, P.A. Somarriba, P.O. Boudrault, A.L. Cruz, F.J. Muñoz, and D.G. Mackler. 2009. A contribution to Nicaraguan ornithology, with the focus on the pine-oak ecoregion. *Contina* 31:89–95
- Morrison, M.L., B.A. Collier, H.A. Mathewson, J.E. Groce, and R.N. Wilkins. 2012. The prevailing paradigm as a hindrance to conservation. *Wildlife Society Bulletin* 36:408–414.
- Murray, D.B., J.D. White, and P. Swint. 2013. Woody vegetation persistence and disturbance in central Texas grasslands inferred from multi-decadal historical aerial photographs. *Rangeland Ecology and Management* 66:297–304.
- Peak, R.G. 2007. Forest edges negatively affect golden-cheeked warbler nest survival. *Condor* 109:628–637.

- Peak, R.G., and F.R. Thompson III. 2013. Amount and type of forest cover and edge are important predictors of golden-cheeked warbler density. *Condor* 115:659–668.
- _____. 2014. Seasonal productivity and nest survival of Golden-cheeked Warblers vary with forest type and edge density. *Condor* 116:546–559.
- Potosme, S.H., and F. Muñoz. 2007. Establecimiento de prioridades para la conservación del hábitat invernal de la reinita dorada *Dendroica chrysoparia* en Nicaragua. Report to The Nature Conservancy, San Antonio, Texas, USA.
- Pulich, W.M. 1976. The golden-cheeked warbler: A bioecological study. Texas Parks and Wildlife Department. Austin, Texas, USA.
- Rappole, J.H., D.I. King, and P. Leimgruber. 2000. Winter habitat and distribution of the endangered golden-cheeked warbler. *Animal Conservation* 2:45–59.
- Rappole, J.H., D.I. King, and J. Diez. 2003. Winter- vs. breeding-habitat limitation for an endangered avian migrant. *Ecological Applications* 13:735–742.
- Reidy, J.L., M.M. Stake, and F.R. Thompson, III. 2008. Golden-cheeked warbler nest mortality and predators in urban and rural landscapes. *Condor* 110:458–466.
- _____. 2009a. Nocturnal predation of females on nests: An important source of mortality for golden-cheeked warblers? *Wilson Journal of Ornithology* 121:416–421.
- Reidy, J.L., F.R. Thompson, III., and R.G. Peak. 2009b. Factors affecting golden-cheeked warbler nest survival in urban and rural landscapes. *Journal of Wildlife Management* 73:407–413.
- Robinson, D.H. 2013. Effects of habitat characteristics on occupancy and productivity of a forest dependent songbird in an urban landscape. Masters Thesis. Texas A&M University, College Station, Texas, USA.
- Rowell, G.A., D.P. Keddy-Hector, D.D. Diamond, J. Lloyd, B. McKinney, R.C. Maggio, and T.L. Cook. 1995. Remote sensing and GIS of golden-cheeked warbler breeding habitat and vegetation types on the Edwards Plateau. Texas Parks and Wildlife Department Grant No. 1 E-1-7, Project No. 39. Austin, Texas, USA.
- Russell, F. L., and N. L. Fowler. 2002. Failure of adult recruitment in *Quercus buckleyi* populations on the eastern Edwards Plateau, Texas. *American Midland Naturalist* 148:201–217.
- _____. 2004. Effects of white-tailed deer on the population dynamics of acorns, seedlings and small saplings of *Quercus buckleyi*. *Plant Ecology* 173:59–72.
- Stake, M.M. 2003. Golden-cheeked warbler nest predators and factors affecting nest predation. Masters Thesis, University of Missouri, Columbia, Missouri, USA.
- Stake, M.M., J. Faaborg, and F.R. Thompson, III. 2004. Video identification of predators at golden-cheeked warbler nests. *Journal of Field Ornithology* 75:337–344.

- Stewart, L.R., M.L. Morrison, D.N. Appel, and R.N. Wilkins. 2014a. Spatial and temporal distribution of oak wilt in golden-cheeked warbler habitat. *Wildlife Society Bulletin* 38:288–296.
- Stewart, L.R., M.L. Morrison, M.R. Hutchinson, D.N. Appel, and R.N. Wilkins. 2014b. Effects of a forest pathogen on habitat selection and quality for the endangered golden-cheeked warbler. *Wildlife Society Bulletin* 38:279–287.
- SWCA. 2007. Preliminary deliverable golden-cheeked warbler status review. Prepared for Texas Department of Transportation. Austin, Texas, USA.
- United States Fish and Wildlife Service [USFWS]. 1990. Endangered and threatened wildlife and plants: final rule to list the golden-cheeked warbler as endangered. *Federal Register* 55:53153–53160.
- _____. [USFWS]. 1992. Golden-cheeked warbler (*Dendroica chrysoparia*) recovery plan. Albuquerque, New Mexico, USA.
- _____. 2014. Golden-cheeked warbler (*Setophaga chrysoparia*) 5-Year Review: Summary and Evaluation. Austin Ecological Services Field Office, Austin, Texas, USA.
- Wahl, R., D.D. Diamond, and D. Shaw. 1990. The golden-cheeked warbler: a status review. Austin, Texas, USA.
- Yao, J., D.B Murray, A. Adhikari, and J.D. White. 2012. Fire in a sub-humid woodland: the balance of carbon sequestration and habitat conservation. *Forest Ecology and Management* 280:40–51.

90-DAY FINDING ON A PETITION TO REMOVE THE GOLDEN-CHEEKED WARBLER FROM THE LIST OF ENDANGERED AND THREATENED WILDLIFE

Background

Section 4(b)(3)(A) of the Endangered Species Act (Act) requires that we make a finding on whether a petition to list, delist, or reclassify a species presents substantial scientific or commercial information indicating that the petitioned action may be warranted. Our standard for substantial scientific or commercial information with regard to a 90-day petition finding is "that amount of information that would lead a reasonable person to believe that the measure proposed in the petition may be warranted" 50 C.F.R. § 424.14(b).

Petition History

On June 30, 2015, we received a petition dated June 29, 2015, from Nancie G. Marzulla (Marzulla Law, LLC – Washington, DC) and Robert Henneke (Texas Public Policy Foundation – Austin, TX) requesting that the golden-cheeked warbler be removed from the list of endangered and threatened wildlife ("delisted") due to recovery or error in information. The petition clearly identified itself as a petition and included the requisite identification information for the petitioner, as required by 50 C.F.R. § 424.14(a).

On December 11, 2015, we received supplemental information from the petitioners that included additional published studies and an unpublished report. These studies, as well as others known to the Service and in our files at the time the supplement was received, are addressed as appropriate in this finding. This finding addresses the petition.

Evaluation of a Petition to Delist the Golden-cheeked Warbler Under the Act

Species and Range

Does the petition identify an entity that may be eligible for removal from listing (delisting) (that is, is the entity a species, subspecies, or DPS)?

Yes

No

The American Ornithologists' Union adopted a new classification of the Parulidae based on a phylogenetic analysis by Lovette et al. (2010, p. 763) that resulted in all *Dendroica* species being placed into of a single clade for which the generic name *Setophaga* has taxonomic priority (Chesser et al. 2011, p. 608). Hereafter, the Service recognizes the golden-cheeked warbler as *Setophaga chrysoparia*, formerly placed in the genus *Dendroica*.

If yes, list common name (scientific name), and range.

Golden-cheeked warbler (*Dendroica chrysoparia* = *Setophaga chrysoparia*, hereafter warbler), breeding exclusively in Texas; wintering in the highlands of Mexico (Chiapas) and Central America (Guatemala, Honduras, Nicaragua, El Salvador).

Information in the Petition

Factor A

1. Does the petitioner claim the entity warrants delisting based on the lack of the present or threatened destruction, modification or curtailment of the species' habitat or range?

Yes

No

- a. If the answer to 1 is yes:

Do the sources cited in the petition provide substantial information to support the claim?

Yes

No

If yes, indicate for which activity(ies) present or threatened destruction, modification or curtailment of the species habitat or range (e.g., logging, agriculture, overgrazing, etc.) is a threat and list the citations with page numbers for each purpose. If no, please indicate for which activity(ies) and explain.

The petition asserts that none of the statutory factors pose a significant threat to the continued existence of the warbler (p. 15) and that "the warbler was either listed in error or has recovered since listing" (p. 13). The petition states that because the numbers of warblers and extent of warbler habitat is far greater than the Service determined in 1990, the warbler should not have been listed as endangered, and further cites several studies known to the Service (2014) indicating the species is not in danger of extinction throughout all or any significant portion of its range and requests that the warbler be removed from the federal endangered species list (Petition, p. 29).

The petition states that recent studies confirm there are more warblers and more warbler habitat than at the time the Service listed the warbler as endangered (p. 18). Much of this argument is based on Mathewson *et al.* (2012, p. 1,123) which employed a spatially-explicit model to estimate the range-wide population of male warblers to be 263,330 and the amount of warbler habitat to be 4,147,123 acres (1,678,281 hectares). The Mathewson *et al.* (2012) study was considered by the Service and discussed in our most recent 5-year review for the warbler, which was completed in 2014 (Service 2014, p. 5). The Mathewson *et al.* (2012, entire) study estimated a range-wide population number of warblers by applying warbler density estimates to the Collier *et al.* (2011, entire) model, which estimated the

probability of warblers occupying given patches of woodland habitats throughout the breeding range of the warbler. Previous estimates of the total adult golden-cheeked warbler population range from 14,950 individuals to 26,978 pairs (Service 2014, p. 5). Previous estimates of potential golden-cheeked warbler breeding habitat range from 326,000 to 4,378,148 acres with differences due primarily to varying definitions of breeding habitat associated with vegetation types and habitat patch size, differing parameters included in habitat models, and remote sensing techniques and data sets (Service 2014, pp. 6–7). We acknowledge that the known potential range is geographically more extensive than when the golden-cheeked warbler was originally listed. However, population estimates are very difficult to determine and threats described in the original listing rule remain and recovery criteria have not been accomplished. This and other pertinent information was evaluated in the 2014 5-year review where we recommended that the species remain listed as in danger of extinction throughout its range (Service 2014, p. 15).

Efforts to model warbler habitat, estimate patch-level occupancy probabilities, and draw inferences about distribution and abundance of warblers across the landscape will ultimately be useful to the Service in planning and implementing recovery actions and conservation measures designed to provide for the continued existence of the warbler (Mathewson *et al.* 2012, p. 1,127). However, the Service does not agree with the petitioner's assertion that the 2015 Texas A&M Survey (Petition, Exhibit 1) "confirms that the warbler is not and never has been endangered in Texas" (Petition, p. 14). The Survey (Petition, Exhibit 1) summarizes information already known to the Service and discussed in the 5-year review (Service, 2014), which represents the best available body of science known to the Service pertaining to the status of the warbler. The Service recognizes that the modeling studies described in the 2015 Texas A&M Survey (Petition, Exhibit 1) do represent the most recent and comprehensive efforts to estimate range-wide warbler habitat and population size to date.

However, these efforts represent new estimates rather than indicators of positive trends in warbler habitat and population size, and thus do not imply recovery. Further, a recent study reported results of a similar modeling effort to infer warbler density from landscape and habitat relationships that performed well at sites with high known densities but tended to overestimate plots with lower known densities (Reidy *et al.* 2016, p. 379) and it is apparent that uncertainty still exists, especially for habitats occupied by warblers at lower-densities. Habitat destruction, fragmentation and degradation remain a real and significant threat to the continued existence of the warbler (Service 2014, pp. 8–10). The Service does plan to apply these and other modeling efforts, in the context of all that is known about the warbler and warbler habitat, to help inform and guide recovery efforts for the warbler now and in the future (Service 2014, p. 16). A recent population modeling study found that movement rates were high among warbler breeding habitat patches, immigration (i.e., natal dispersal) appears to be an important driver of local warbler population dynamics. Because these complex

processes occur on a landscape scale, the authors recommended that future conservation efforts be implemented at a larger spatial extent (Duarte *et al.* 2015 pp. 70–72).

The petition discusses habitat fragmentation generally (pp. 27–28), but fails to articulate whether or not habitat fragmentation is a significant threat to the warbler, instead stating simply that “studies emphasize the importance of large and small patches to sustain the warbler population on its breeding ground”. While we agree that all patches are important because they provide potential habitat for the warbler, we believe that larger more connected habitat patches are especially important for supporting a viable warbler population given that occupancy probability increases with patch size (Collier *et al.* 2010, Figure 4, p. 144). McFarland *et al.* (2012, p. 438) concluded that large patches are important for maintaining high rates of warbler occupancy, small isolated patches have a lower probability of occupancy, and habitat connectivity is especially important in areas where habitat patches are small. A recent study found that significant losses of warbler breeding habitat have occurred over the past decade, warbler habitats are far more likely to be diminished than regenerated, dispersal of juvenile warblers among patches of breeding habitat is essential for maintaining local warbler populations, and concluded that the conservation of large blocks of habitat is especially important for ensuring the long-term viability of the species (Duarte *et al.* 2016, pp. 57–60).

The petition briefly mentions warbler habitat loss from 1992–2001 (p. 27), but does not cite any new studies showing increasing urbanization, habitat loss, and habitat fragmentation within the range of the golden-cheeked warbler. As we describe in the 2014 5-year review, warbler habitat loss and habitat fragmentation are mostly driven by rapid suburban development and human population growth in Travis, Williamson, and Bexar Counties (Service 2014, pp. 8–9). In the warbler breeding range, the human population has increased by nearly 50 percent from 1990 to 2010 (Groce *et al.* 2010, p. 123). Further, population projections from 2010 to 2050 for 35 counties within the warbler breeding range report a 64 percent increase in the human population from 4.7 to 7.8 million, and with the population of Williamson and Hays Counties expected to more than double (Potter and Hoque 2014, entire). The threat of habitat fragmentation is ongoing and is expected to threaten the continued existence of the golden-cheeked warbler into the foreseeable future (Service 2014, p. 9). The petition does not provide any information on these significant threats.

- b. Provide additional comments, if any.

Factor B

2. Does the petitioner claim the entity warrants delisting based on the lack of overutilization for commercial, recreational, scientific, or educational purposes (Factor B)?
 Yes

No

a. If the answer to 2 is no:

Do sources cited in the petition provide substantial information indicating the entity may warrant delisting based on factor B, even though the petitioner does not make this claim?

Yes

No

If yes, indicate for which purpose(s) overutilization is a threat and list citations with page numbers for each purpose. If no, please explain.

Factor B (overutilization) is not specifically discussed in the petition, despite the assertion that none of the statutory factors apply and that the warbler should not be listed (Petition, p. 14). However, the Service does not consider overutilization to be a threat to the warbler (Service 2014, p. 10).

c. Provide additional comments, if any.

Factor C

3. Does the petitioner claim the entity warrants delisting based on the lack of disease or predation (Factor C)?

Yes

No

a. If the answer to 3 is yes:

Which does the petitioner claim is not a threat such that delisting may be warranted? (check all that apply)

Disease

Predation

b. If the answer to 3 is yes:

Do the sources cited in the petition provide substantial information to support the claim?

Yes

No

If yes, indicate which (disease, predation, or both) is a threat and list the citations with page numbers for each. If no, please indicate disease and/or predation and provide an explanation.

The petitioners claim that neither disease nor predation constitutes a significant threat to the continued existence of the warbler and that the warbler should not be listed (Petition, p. 22). Information provided in the petition is refuted by the 2014 5-year review, in which we conclude that multiple factors such as urbanization and fragmentation have likely resulted in increased rates of predation of warbler

nests by a wide variety of animal predators (Service 2014, p. 11), especially rat snakes (*Elaphe spp*). This increase in nest predation by rat snakes has been proposed as a proximate explanation for the observed negative effects of forest edge on warbler nest survival and productivity (Peak and Thompson 2014, p. 554–557).

No diseases in golden-cheeked warblers have been reported; therefore, we do not consider disease to be a threat to this species (Service 2014, p. 11). However, nest parasitism and nest depredation, both of which occur to a varying degree across the range of the warbler, are exacerbated by habitat fragmentation and are considered a moderate threat (Service 2014, p. 11). The petition does not provide any new information indicating that predation is no longer a threat to the warbler.

- c. If the answer to 3 is no:

Do sources cited in the petition provide substantial information indicating the entity may warrant delisting based on factor C, even though the petitioner does not make this claim?

Yes

No

If yes, indicate which (disease, predation, both) is a threat and list citations with page numbers for each. If no, please explain.

- d. Provide additional comments, if any.

Factor D

4. Does the petitioner claim the entity warrants delisting because existing regulatory mechanisms (Factor D) are adequate?

Yes

No

- a. If the answer to 4 is yes:

Do the sources cited in the petition provide substantial information to support the claim?

Yes

No

If yes, list the citations with page numbers. If no, please explain.

The petition asserts that, even with protections of the Act removed, the warbler will be protected by existing regulatory mechanisms including: the Migratory Bird Treaty Act of 1918, and the 1975 Texas Endangered Species law (pp. 22–25). However, as discussed in the 2014 5-year review, while these regulations do provide some protections for the birds neither “prohibits habitat destruction, which is an immediate threat to the warbler” (Service 2014, p. 12).

The petition also claims that warbler habitat is protected by the Balcones Canyonlands National Wildlife Refuge, the Balcones Canyonlands Preserve, and approximately 160 habitat conservation plans (HCPs). While we did not consider these long-term land protections as "existing regulatory mechanisms" under Factor D in the 5-year review, we did consider these land protection efforts under Factor A (Service 2014, p. 10). Many but not all of these protected lands are managed for the warbler and there have been important strides in regional planning in central Texas that include the county-wide HCPs that occur along the I-35 corridor from Williamson County to Bexar County. Despite these land protections and regional HCPs, an estimated 29 percent of existing breeding season habitat was lost between 1999–2001 and 2010–2011 (Duarte *et al.* 2013, p. 7) indicating that, but for protections of the Act, adequate regulatory mechanisms do not exist to prevent continued destruction of warbler breeding habitat in Texas. Given the projected population growth, the loss of warbler habitat is expected to continue.

- b. If the answer to 4 is no:

Do sources cited in the petition provide substantial information indicating the entity may warrant delisting based on Factor D, even though the petitioner does not make this claim?

Yes

No

If yes, list citations with page numbers. If no, please explain.

- c. Provide additional comments, if any.

The petition (p. 25) seems to confuse the Balcones Canyonlands National Wildlife Refuge, which is an approximately 24,000-acre Federal land unit of which 19,079 acres are actively managed for the warbler (Service 2015 p. 40), with the Balcones Canyonlands Preserve (BCP), which is a system of preserves managed under a regional Habitat Conservation Plan by the City of Austin and Travis County (Texas) to benefit multiple species including the warbler as well as several species of karst invertebrates. To date the BCP has protected 30,540 acres of golden-cheeked warbler and black-capped vireo habitat (Travis County-City of Austin 2014, p. 1).

Factor E

2. Does the petitioner claim the entity warrants delisting based on the lack of other natural or manmade factors affecting its continued existence (Factor E)?

Yes

No

- a. If the answer to 5 is yes:

Identify the other natural or manmade factors claimed by the petitioner to not be a threat such that delisting may be warranted.

- Habitat fragmentation (Petition, pp. 27–28)
- Habitat degradation (Petition, pp. 28–29)
- Forest management practices (Petition, p. 29)
- Noise (Petition, p. 29)

b. If the answer to 5 is yes:

Do the sources cited in the petition provide substantial information to support the claim?

Yes

No

If yes, indicate for which other natural or manmade factors (e.g., climate change, road mortality, or small population dynamics) are a threat and list the citations with page numbers for each factor. If no, please indicate for which factor(s) and explain.

The Service maintains that habitat fragmentation, habitat degradation, inappropriate habitat management practices, and excessive noise all contribute to reductions in overall warbler habitat quantity and quality and present a real and significant threat to the long term viability of the species (Service 2014, p. 15). We analyzed the threats of habitat fragmentation, habitat degradation, and poor forest management practices in our 2014 5-year review. Specifically, we described how the quality of habitat for warblers is reduced by small patch sizes, reduced oak recruitment, and unsustainable forestry practices (Service 2014, p. 9). The petition addresses some of these threats by describing research on warbler habitat quality that has resulted in some conflicting conclusions about the effects of oak wilt (described below), wildfire, vegetation management, road and construction noise, and patch size on warbler reproductive success (Petition, p. 28). While we agree that there is some uncertainty regarding the magnitude of threats these activities present to warbler habitat quality (and thus, warbler reproductive success and survival), the research cited in the petition does not allow us to conclude that oak wilt, wildfire, vegetation management, and patch size are not threats to the species.

Oak wilt is a fungal infection that can affect all oak species, especially red and live oaks, frequently occurs in warbler habitat, and has the potential to negatively affect warblers and their habitat (Stewart *et al.* 2014, entire).

Wildfire is known to be an important process for maintaining oak-dominated ecosystems throughout eastern North America (Brose *et al.* 2014, entire). However, catastrophic wildfires have the potential to significantly diminish occupancy by warblers in previously occupied habitat, and that effect can last for over a decade (Reernts and Hansen 2008, p. 8).

Vegetation management designed specifically to benefit warblers and warbler habitat is encouraged by state and federal agencies (Campbell 1995, pp. 23–27). However, inappropriate conversion of potential warbler habitat to other vegetation

types for agricultural and other practices remains a threat to the species. A recent study found that warbler breeding habitats, once lost, were not likely to be restored (Duarte *et al.* 2016, p. 56.)

The petition cites two studies conducted in 2012, which found no effect of noise disturbance on golden-cheeked warbler abundance, survival, or reproduction. While the literature on other songbird species has demonstrated profound behavioral responses to manmade noise pollution (Ortega 2012, entire), we currently have no evidence that noise pollution is affecting golden-cheeked warbler populations. Because the findings of these studies were not significant, noise from roads and construction was not discussed as a potential threat in our 2014 5-year review. We still do not consider noise to be a significant threat above and beyond the observed negative effects of edge on warbler occupancy and productivity.

Patch size is an important aspect of warbler habitat in that nest survival decreases as forest edge increases (Peak 2007, pp. 7–8) and “with an overall shift to smaller and more fragmented patches within the northern portions of the range, the probability of warbler occurrence declines significantly, even for large patches of woodland habitats” (Collier *et al.* 2011, p. 7). The combined effects of reduced patch size and increased forest edge on warbler reproductive success was recently evaluated by Peak and Thompson (2014) who demonstrated a negative relationship between forest edge density and period nest survival (p. 554). Nest depredation is one causal factor that may help explain this phenomenon. Fragmentation of woodland habitats resulting in reduced patch size and increased forest edge continues to be a threat to the warbler.

There are additional threats that we evaluated and identified in the 2014 5-year review, such as the potential consequences of climate change (that is, increased risk of catastrophic wildfire and range shifts or restrictions; Service 2014, pp. 12–14). Additionally, the 5-year review noted that recreation was a threat to the warbler (Service 2014, p. 14). The petition did not present any information to address these threats.

- c. Provide additional comments, if any.

Cumulative Effects

6. Does the petitioner claim that factors they have identified may have synergistic or cumulative effects such that the entity may warrant delisting?

Yes

No

- a. If the answer to 6 is yes:

Do the sources cited in the petition provide substantial information to support the claim?

Yes

No

If yes, indicate which factors the petitioner claims may have synergistic or cumulative effects and list the citations with page numbers. If no, please indicate which threats and explain.

Cumulative effects are not discussed in either the petition or the Service's 2014 5-year review.

b. Provide additional comments, if any.

Petition Finding

The petition provided information indicating that the population was larger than estimated at the time of listing and that threats considered at the time of listing were no longer threatening the species. A 5-year review for the golden-cheeked warbler was completed on August 26, 2014, in which we recommended that the current classification as endangered should not change. The petition does not present substantial information not previously addressed in the 2014 5-year review for this species and does not offer any substantial information indicating that the petitioned action to delist the species may be warranted. We acknowledge that the known potential range is more extensive than when the golden-cheeked warbler was originally listed. However, threats of habitat loss and habitat fragmentation are ongoing and expected to impact the continued existence of the warbler in the foreseeable future. This and other pertinent information was evaluated in the 2014 5-year review.

No new information is presented that would suggest that the species was originally listed due to an error in information. The golden-cheeked warbler is a taxonomically unique species and was shown to be in danger of extinction at the time of the listing. The golden-cheeked warbler has not been recovered, and due to ongoing wide-spread destruction of its habitat, the species continues to be in danger of extinction throughout its range (Service 2014, p. 15).

Based on our review of the petition, sources cited in the petition, and information in our files, we find that the petition does not provide substantial scientific or commercial information indicating that the petitioned action may be warranted.

Author

The primary authors of this notice are the staff members of the Austin Ecological Services Field Office, U.S. Fish and Wildlife Service.

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Date: 5/25/16



Director
U.S. Fish and Wildlife Service

References

See enclosed.



Evaluation of a Petition to Delist the golden-cheeked warbler Under the Act

References/Literature Cited

- Brose, P.H., D.C. Dey, and T.A. Waldrop. 2014. The fire-oak literature of eastern North America: synthesis and guidelines, Gen. Tech. Rep. NRS-135. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 98 pp.
- Campbell, L. 1995. Endangered and threatened animals of Texas their life history and management. Texas Parks and Wildlife Department, Austin, Texas. 130 pp.
- Chesser, R.T., R.C. Banks, F.K. Barker, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovette, P.C. Rasmussen, J.V. Remsen, J.D. Rising, D.F. Stotz and K. Winker. 2011. Fifty-second supplement to the American Ornithologists' Union check-list of North American birds. *The Auk* 128: 600-613.
- Collier, B.A., M.L. Morrison, S.L. Farrell, A.J. Campomizzi, J.A. Butcher, K.B. Hays, D.I. Mackenzie, and R.N. Wilkins. 2010. Monitoring golden-cheeked warblers on private lands in Texas. *Journal of Wildlife Management* 74: 140-147.
- Collier, B.A., J.E. Groce, M.L. Morrison, J.C. Newnam, A.J. Campomizzi, S.L. Farrell, H.A. Mathewson, R.T. Snelgrove, R.J. Carroll, and R.N. Wilkins. 2011. Predicting patch occupancy in fragmented landscapes at the rangewide scale for an endangered species: an example of an American warbler. *Diversity and Distributions* 18: 158-167.
- Duarte, A., J.L.R. Jensen, J.S. Hatfield, and F.W. Weckerly. 2013. Spatiotemporal variation in range-wide golden-cheeked warbler breeding habitat. *Ecosphere* 4(12): Article 152 (12 pp.).
- Duarte A., F.W. Weckerly, M. Schaub, and J.S. Hatfield. 2015. Estimating golden-cheeked warbler immigration: implications for the spatial scale of conservation. *Animal Conservation* 19: 65-74.
- Duarte A., J.S. Hatfield, T.M. Swannack, M.R.J. Forstner, M.C. Green, and F.W. Weckerly. 2016. Simulating range-wide population and breeding habitat dynamics for an endangered woodland warbler in the face of uncertainty. *Ecological Modelling* 320: 52-61.
- Groce, J.E., H.A. Mathewson, M.L. Morrison, and N. Wilkins. 2010. Scientific evaluation for the 5-year status review of the golden-cheeked warbler. Texas A&M University, College Station, Texas. 194 pp. (office file) *available at* http://www.fws.gov/southwest/es/Documents/R2ES/Groce_et_al_2010_GCWA_Status_Review.pdf
- Lovette, I.J., J.L. Perez-Eman, P.P. Sullivan, R.C. Banks, I. Fiorentino, S. Cordoba-Cordoba, M. Echeverry-Galvis, F.K. Barker, K.J. Burns, J. Klicka, S.M. Lanyon, and E. Bermingham. 2010.

A comprehensive multilocus phylogeny for the wood-warblers and a revised classification of the Parulidae (Aves). *Molecular Phylogenetics and Evolution* 57: 753-770.

Mathewson, H.A., J.E. Groce, T.M. McFarland, M.L. Morrison, J.C. Newnam, R.T. Snelgrove, B.A. Collier, and R.N. Wilkins. 2012. Estimating breeding season abundance of golden-cheeked warblers in Texas, USA. *Journal of Wildlife Management* 76: 1117-1128.

McFarland, T.M., H.A. Mathewson, J.E. Groce, M.L. Morrison, J.C. Newman, R.T. Snelgrove, K.S. Skow, B.A. Collier, and R.N. Wilkins. 2012. Utilization of a species occupancy model for management and conservation. *Wildlife Society Bulletin* 36: 432-439.

Ortega, C.P. 2012. Effects of noise pollution on birds: a brief review of our knowledge. *Ornithological Monographs* 74: 6-22.

Peak, R.G. 2007. Forest edges negatively affect golden-cheeked warbler nest survival. *Condor* 109: 628-637.

Peak, R.G. and F.R. Thompson. 2014. Seasonal productivity and nest survival of Golden-cheeked Warblers vary with forest type and edge density. *Condor* 116: 546-559.

Petition to remove the golden-cheeked warbler from the list of endangered species. 2015. 42 pp. *available at* <http://lonestarsuccess.com/wp-content/uploads/2015/06/Petition-to-delist-the-golden-cheeked-warbler-6-29-2015.pdf>

Petition – Exhibit 1. Texas A&M Institute of Renewable Natural Resources, Conservation Status of the Federally Endangered Golden-cheeked Warbler (unpublished research summary, June 2015), *available at* <http://irnr.tamu.edu/publications/research-reports/>.

Potter, L.B. and N. Hoque. 2014. Texas Population Projections, 2010 to 2050. Office of the State Demographer. Austin, Texas. 5pp. *available at:* http://osd.texas.gov/Resources/Publications/2014/2014-11_ProjectionBrief.pdf *and see* 2014 Texas Population Projections by Migration Scenario Data Tool *available at:* <http://osd.texas.gov/Data/TPEPP/Projections/Report?id=ecfed13ab2764820be160547009ff6c4>

Reemts, C.M. and L.L. Hansen. 2008. Slow recolonization of burned oak-juniper woodlands by Ashe juniper (*Juniperus ashei*): ten years of succession after crown fire. *Forest Ecology and Management* 255: 1057-1066.

Reidy, J.L., F.R. Thompson, C. Amundson, and L.O'Donnell. 2016. Landscape and local effects on occupancy and densities of an endangered wood-warbler in an urbanizing landscape. *Landscape Ecology* 31: 365-382.

Service. 2014. Golden-cheeked warbler 5-Year Review: Summary and Evaluation (Aug 26, 2014) 24 pp. (office file) *available at* http://ccus.fws.gov/docs/five_year_review/doc4434.pdf

Service. 2015. Draft Habitat Management Plan Balcones Canyonlands National Wildlife Refuge Marble Falls, Texas. 129 pp. (office file)

Stewart, L.R., M.L. Morrison, D.N. Appel, and R.N. Wilkins. 2014. Spatial and temporal distribution of oak wilt in golden-cheeked warbler habitat. *Wildlife Society Bulletin* 38: 288-296.

Travis County-City of Austin. 2014. Balcones Canyonlands Conservation Plan. Annual Report. Executive Summary. 2 pp. (office file)

