Government Canyon Bat Cave Spider

(Tayshaneta [=*Neoleptona*] *microps)*

5-Year Review:

Summary and Evaluation

U.S. Fish and Wildlife Service

Austin Ecological Services Field Office

Austin, Texas

November 9, 2021

5-YEAR REVIEW

Government Canyon Bat Cave Spider (*Tayshaneta* [=*Neoleptoneta*] *microps)*

1.0 GENERAL INFORMATION

1.1 Listing History

Species: Government Canyon Bat Cave Spider (*Tayshaneta* [=*Neoleptoneta*] *microps*)

Date listed: December 26, 2000

FR citation(s): 65 FR 81419

Classification: Endangered species

Critical habitat:
February 22, 2011 (76 FR 9872) Proposed critical habitat
August 2, 2011 (76 FR 46234) Extended comment period for proposed revised critical habitat
February 14, 2012 (77 FR 8450) Final revised critical habitat

1.2 Methodology used to complete the review:

The U.S. Fish and Wildlife Service (Service) most recently evaluated the biology and status of the Government Canyon Bat Cave spider as part of a status review conducted on August 29, 2011 (Service 2011b, entire). We examined whether new information was available and whether that new information would alter or affect analyses and conclusions made in the previous status review. Data for this current review were solicited from interested parties through a Federal Register notice announcing the review on May 5, 2021 (86 FR 23976). No new information was received from this solicitation. We also contacted state agencies, species experts, and partners to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

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

86 FR 23976, May 5, 2021

2.0 REVIEW ANALYSIS

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

requires that we determine whether a species meets the definition of "endangered species" or "threatened species" due to any of the five factors described below.

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

2.1 Updated Information and Current Species Status

2.1.1 Biology and Habitat:

The Government Canyon Bat Cave spider (Arachnida: Araneae: Leptonetidae: *Tayshaneta* [=*Neoleptoneta*] *microps* [Gertsch 1974]) is one of 19 species in the genus *Tayshaneta* that are associated with caves in Texas (Ledford et al. 2011, pp. 375-385; Ledford et al. 2012, pp. 28-65). Gertsch (1974, pp. 168-169) originally described the Government Canyon Bat Cave spider as *Leptoneta microps* followed by a transfer to the genus *Neoleptoneta* by *Brignoli* (1977, p. 216). Ledford et al. (2011, p. 386) transferred the species to *Tayshaneta* in a phylogenetic assessment of *Neoleptoneta*.

The Government Canyon Bat Cave spider is found in the Government Canyon Karst Fauna Region (KFR) in northern Bexar County and Medina counties, Texas (Figure 1). KFRs are geographic areas that were delineated based on potential geologic continuity, hydrology, and the distribution of rare troglobites (Veni 1994, entire) and were used in the final rule to define the ranges of the listed species.

This species was recorded as occurring in two caves at the time of listing, Government Canyon Bat Cave and Surprise Sink. Ledford et al. (2011, p. 48) examined specimens from both caves in detail during the reassessment of *Neoleptoneta*. The specimens from Surprise Sink had reduced eyes similar to the Government Canyon Bat Cave spider; however, they were immature and mature males are necessary for accurate species identification. In 2017, one additional specimen was collected from Surprise Sink and, although it was morphologically closer to *T. madla*, which is found in caves in the Helotes and Stone Oak Karst Fauna Regions, the genetic data were not clear. Additional sampling and genetic analysis would be needed to reassess the species limits of *T. microps* and *T. madla* in order to be confident of the species identification for specimens in Surprise Sink (Joel Ledford, personal communication, September 20,

2019). Efforts to locate additional populations of this species have yet to discover any new locations.

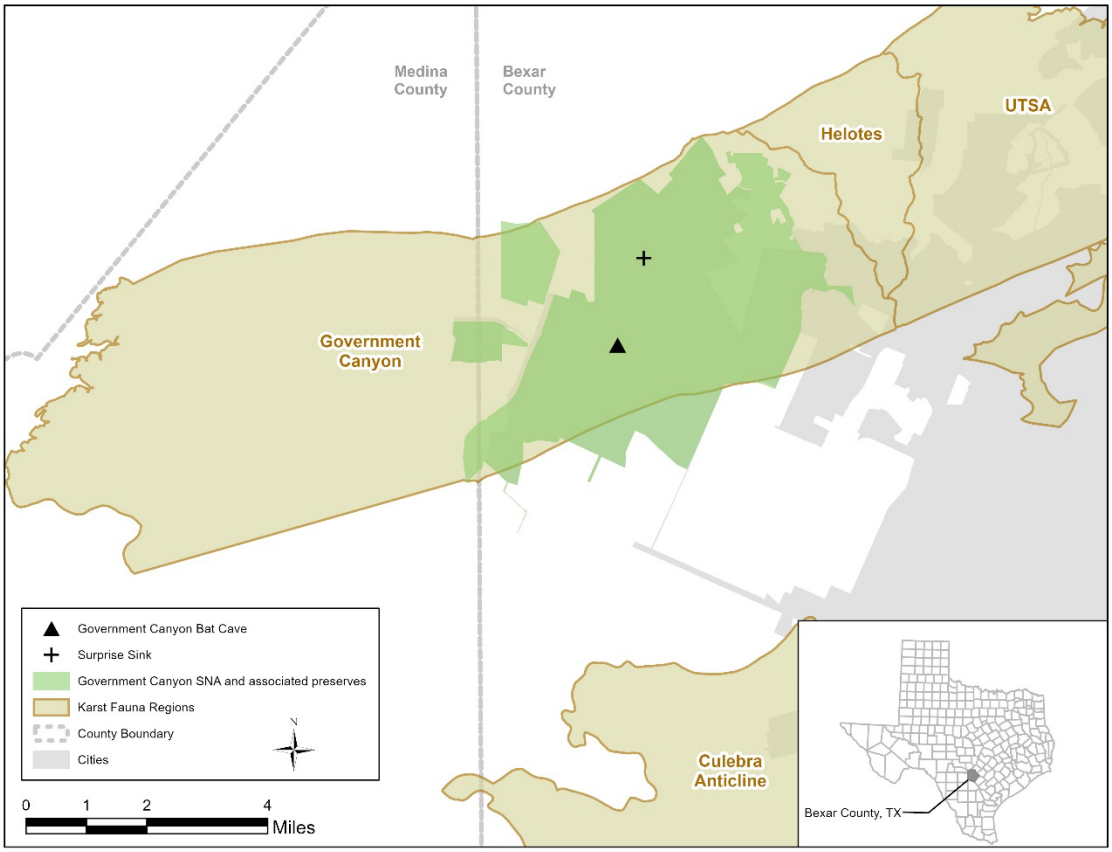

Figure 1. Current distribution of the Government Canyon Bat Cave spider in Bexar County, Texas

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

The Government Canyon Bat Cave spider was listed as endangered due to its restricted distribution and threats from urban development. The stressors that most influence the Government Canyon Bat Cave spider are habitat destruction, degradation and fragmentation that results from urban development.

The Government Canyon Bat Cave spider, and its subterranean habitat, is reliant on functional surface ecological systems. The plant communities that overlay and surround cave systems aid in buffering subterranean ecosystems from stressors, support nutrient flow, and aid in the maintenance of microclimatic conditions (Barr 1968, pp. 47-48; Poulson and White 1969, pp. 971-972; Howarth 1983, p. 376; Culver and Pipan 2009, p. 23; Simões et al. 2014, p. 168; Pellegrini et al. 2016, pp. 28, 32-34). As a site is developed, native plant communities are often mechanically cleared and replaced

with a highly modified urban to exurban landscape (Theobald et al. 1997, p. 26; McKinney 2002, pp. 884, 886; McKinney 2008, p. 168; Zipperer 2011, pp. 188-189).

Construction activities may also modify cave entrances and other openings to the surface (Watson et al. 1997, p. 11; Veni et al. 1999, p. 55; Waltham and Lu 2007, p. 17; Frumkin 2013, pp. 61-62; Hunt et al. 2013, p. 97), which could affect climatic conditions within the cave as well as water infiltration (Pugsley 1984, pp. 403-404; Elliott and Reddell 1989, p. 7; Culver and Pipan 2009, p. 202). The abundance and species richness of native animals may decline due to decreased foraging or sheltering habitat, increased predation, competition with non-native species, or lack of connectivity among populations (Rebele 1994, p. 177; McKinney 2002, pp. 885-886; Taylor et al 2007, pp. 2, 37, 41-44; Pellegrini et al. 2016, pp. 28, 34).

Population projections from the Texas State Data Center predict many of the large urban counties will continue to experience high growth rates with Bexar County being one of the counties expected to add a million more people by the year 2050 (You et al. 2019, pp. 5-6). Bexar County is also one of three counties expected to grow faster than the state (You et al. 2019, p. 2). The human population in Bexar County increased between 1980 and 2018, from 988,800 people to 2,009,324 people (U.S. Census Bureau 1982, p. 8; U.S. Census Bureau 2021) and is expected to increase to 3,353,060 people by the year 2050 (Texas Demographic Center 2018).

Approximately 12,000 acres on the eastern portion of the Government Canyon KFR is protected within the Government Canyon State Natural Area and several additional adjacent preserves. However, although not exhaustive, surveys to date in these protected areas have failed to find additional Government Canyon Bat Cave spider populations. While these areas are protected from land conversion to residential and commercial development, given the human population and urbanized land growth projections, it is expected that any areas within the Government Canyon KFR not currently within preserves will likely be impacted without additional protections. In addition, because areas outside preserve lands are privately owned, surveys generally only happen when development is proposed. (Factor A).

Threats from red-imported fire ants (*Solenopsis invicta*), including competition with cave crickets and potential predation on Government Canyon Bat Cave spiders continue to be a concern for this species. Recent research underscores the importance of human disturbance to red-imported fire ant invasion. Although habitat disturbance facilitates red-imported fire ant establishment in affected natural communities (LeBrun et al. 2012, pp. 891-893; King and Tschinkel 2013, p. 73), the absence of disturbance does not preclude invasion of undisturbed areas. A study in southern Texas, found that red-imported fire ants were able to establish colonies in undisturbed grassland and achieve abundances comparable to dominant native ant species, however, their abundance was lower than in disturbed grasslands (LeBrun et al. 2012, p. 888, 891-892). Red-imported fire ant prevalence can decline following the cessation of disturbance but several decades may be required before populations reach the lower levels observed in undisturbed habitats (LeBrun et al. 2012, p. 892).

Since the 2011 5-year review, a new non-native invasive ant species has established colonies at sites in Bexar County. The tawny crazy ant (*Nylanderia fulva*), native to South America, was documented in Texas in 2002 and has established populations along the state's Gulf Coast and some central Texas counties (Wang et al. 2016, p. 4). This ant has exhibited a potential to affect native animal and plant communities (LeBrun et al. 2013, p. 2439; Wang et al. 2016, p. 5).

Tawny crazy ant colonies are often polygynous forming dense infestations that can dominate the local ant community (LeBrun et al. 2013, pp. 2430, 2433) and may cause declines in arthropod species richness in areas they infest (LeBrun et al. 2013, pp. 2434-2435; Wang et al. 2016, pp. 5, 7). Tawny crazy ants also appear capable of eliminating red-imported fire ants from areas where the species co-occur (LeBrun et al. 2013, pp. 2436-2437). Unlike red-imported fire ants that generally prefer open-habitat types, the tawny crazy ant can reach high densities in forested habitats along with grasslands and other open-habitat types (LeBrun et al. 2013, pp. 2439-2440). Sites with dense canopies, therefore, would be afforded some decreased susceptibility to red-imported fire ants but not the tawny crazy ant (Factor C).

LeBrun (2017, entire) assessed the effects of tawny crazy ants at two caves in Travis County, Texas. Based on observations at these two sites, use of caves by ants was tied to surface temperatures and moisture with tawny crazy ants most prevalent in caves during hot, dry summer conditions (LeBrun 2017, p. 35). Tawny crazy ants preyed on cave crickets and other karst invertebrates with one species, the spider *Cicurina varians*, experiencing decreased abundance associated with that ant's presence (LeBrun 2017, pp. 21-22, 35-36). No declines were noted for other karst invertebrates examined, although results may be limited by the small sample size (LeBrun 2017, pp. 22, 35). No populations of tawny crazy ant have been identified near Government Canyon Bat Cave; however, tawny crazy ants have been document in caves in northern Bexar County. Additional research is needed to determine the potential for the tawny crazy ant to affect Government Canyon Bat Cave spider populations (Factor C).

Climate change also has the potential to affect Government Canyon Bat Cave spider populations. Over the last 115 years, the global averaged surface air temperature has increased by 1.0°C (1.8°F) with recent decades being the warmest in 1,500 years (Vose et al. 2017, pp. 186, 188). In Texas, average temperatures in 2036 are projected to increase by 0.89°C (1.6°F) compared to 2000 to 2018 (Nielsen-Gammon et al. 2020, p. 5). Periods of extreme heat are expected to be more frequent, with number of days exceeding 38°C (100°F) increasing by an additional 30-60 days per year by the end of the 21st century (NOAA 2016, pp. 1, 3; Kloesel et. al. 2018, pp. 990, 996). By 2036, the number of days with extreme temperatures in Texas are expected to increase from 12 days per year to 21 per year compared to 2000 to 2018 (Nielsen-Gammon et al. 2020a, p. 6). Accompanying projected higher temperatures is the potential for more frequent drought and increasing aridity for Texas and the southwestern U.S. (Seager et al. 2007, pp. 1181, 1183; NOAA 2016, p. 3; Park et al. 2017, pp. 71-72; Wendt et al. 2018, p. 587; Marvel et al. 2019, p. 64).

The climatic conditions of caves and other subterranean voids, while relatively stable compared to surface habitats, are subject to variation in prevailing air temperature and relative humidity (Culver 1982, p. 9; Culver and Pipan 2009, pp. 3-4). Cave morphology (e.g., size, shape, and volume), number and size of entrances, seasonal changes in airflow, and annual range of surface temperatures among other factors interact to influence subterranean climate (Tuttle and Stevenson 1978, pp. 110-120; de Freitas and Littlejohn 1987, p. 568). With increasing distance into the cave, climatic conditions stabilize within a narrow range of humidity and temperature (Poulson and White 1969, p. 972; Howarth 1980, p. 398; Howarth 1993, p. 69; Prous et al. 2004, pp. 377-378; Tobin et al. 2013, p. 206).

Subterranean temperatures are influenced by the average annual temperature of the surface, with deep cave settings varying much less than surface environment (Howarth 1983, pp. 374-375; Dunlap 1995, pp. 76; Badino 2010, p. 429; Covington and Perne 2015, p. 365, Mammola et al. 2017, p. 7- EV). The thermal stability of deep subterranean spaces is attributable to the buffering effect of heat accumulation and conduction from overlying bedrock (Domínguez-Villar et al. 2015, pp. 578-579). Shifts in subterranean temperatures, driven by changes on the surface, are typically of reduced intensity and time-lagged with increasing depth underground (Domínguez-Villar et al. 2013, pp. 164-165-167; Tobin et al. 2013, p. 206, 211; Domínguez-Villar et al. 2015, pp. 576-578). Any potential increases in surface temperature may take months to years to increase temperatures in deep subterranean voids, depending upon void depth and/or distance from the surface as well as duration of temperature change (Domínguez-Villar et al. 2013, pp. 164; Tobin et al. 2013, p. 206; Domínguez-Villar et al. 2015, pp. 577; Mammola et al. 2019b, p. 101-103).

The adaptation of troglobitic arthropods to relatively stable temperatures has been suggested as imparting restricted thermal tolerances that may reduce a species' ability to survive temperatures outside those limits (Novak et al. 2014, pp. 267-270; Mammola et al. 2019b, p. 104; Mammola et al. 2019c, p. 646). Some studies suggests that arthropod species with greater degrees of troglomorphy are more sensitive (i.e., mortality to sub-lethal effects) to temperature extremes (Pallarés et al., 2019, pp. 13735-13736; Pallarés et al., 2020 pp. 5-8). Mammola et al. (2019c, entire) examined the thermal tolerance of cave-inhabiting spiders, in the genus *Troglohyphantes*, with representative species exhibiting varying degrees of troglomorphy. In that study, *Troglohyphantes* species with moderate to high degrees of subterranean specialization displayed the most limited tolerance to increased temperatures (Mammola et al., 2019a, pp. 1645-1646). Those species reached their critical temperature at 1-4°C (1.8-7.2°F) above natural ambient temperatures while less specialized were able to withstand increases of 7-19°C (12.6-34.2°F) (Mammola et al. 2019a, p. 1646).

The specific temperature and/or humidity physiological tolerances for the Government Canyon Bat Cave spider are unknown. Unlike more mobile species that may disperse to suitable habitat under a changing climate, this species will only persist within its current geographic range. The subterranean voids the species occupies, particularly shallower caves, could become uninhabitable due to climatic conditions that exceed the

species' physiological tolerances (Tobin et al. 2013, p. 212; Mammola et al. 2019b, p. 104). Permanent occupation of deeper subterranean spaces, if available, may not be realistic given decreasing availability of nutrients with depth or increasing distance from openings to the surface (Tobin et al. 2013, p. 212; Mammola et al. 2019b, p. 106). Thus, if surface temperatures increase and longer dry periods and reduced soil moisture lead to changes in the climate of the deep cave zones, it could reduce or eliminate available habitat within occupied caves, thus affecting Government Canyon Bat Cave spider populations (Factor E).

For species that occur only in one KFR, recovery criterion (1) in the Bexar County Karst Invertebrates Recovery Plan (Service 2011a, p. 25) recommends that at least six Karst Fauna Areas (KFAs) across the range of a species be protected, with a minimum of three high quality and three medium quality in order to ensure the species' long-term survival in the wild is secure. Protection is defined as an area sufficiently large to maintain the integrity of the karst ecosystem on which the species depends. These areas must also provide protection from threats such as habitat destruction, red-imported fire ants, and contaminants. Recovery criterion (2) recommends conducting sufficient research to conclude that these areas provide a high probability of species long-term survival.

The only confirmed location for the Government Canyon Bat Cave spider is Government Canyon Bat Cave in the Government Canyon State Natural Area. As mitigation for the Southern Edwards Plateau Habitat Conservation Plan, the City of San Antonio has worked with Texas Parks and Wildlife Department to establish high quality preserves surrounding several areas containing caves with listed species in the Government Canyon State Natural Area, which is owned by Texas Parks and Wildlife Department. Government Canyon Bat Cave is within the approximately 40 ha (100 ac) Government Canyon Bat Cave KFA. This preserve encompasses the cave cricket foraging area and the surface and subsurface drainage basin for this cave. Management for this preserve is being conducted under the Southern Edwards Plateau Habitat Conservation Plan Government Canyon State Natural Area Karst Fauna Areas Management and Monitoring Plan (Bowman Consulting 2017, entire) and through an inter-local agreement between Texas Parks and Wildlife Department and the City of San Antonio. The Service is currently working with the City of San Antonio to recognize this area as a high quality KFA for the Government Canyon Bat Cave spider.

2.2 Synthesis:

Based on a review of the available data, the Government Canyon Bat Cave spider is known from one cave in the Government Canyon KFR, and the Service is working with the City of San Antonio to recognize this area as a high quality KFA for this species. The recovery strategy for the Government Canyon Bat Cave spider includes the perpetual protection and management of an adequate quantity and quality of habitat that spans the geographic range of the species. Our current recovery goal of protecting at least six populations within the Government Canyon KFR provides redundancy to the species by providing multiple populations to provide a margin of safety to withstand a catastrophic event to capture a

representation of the breadth of their genetic diversity in order to conserve their adaptive capabilities. This is especially important for species such as the Government Canyon Bat Cave spider since they cannot easily move long distances to other areas to re-establish themselves and because this will allow more flexibility in coping with potential effects of climate change.

While there may be a potential for additional populations in the currently protected areas within the Government Canyon KFR, surveys to date have failed to identify any additional populations. Potential habitat exists in areas outside the park and adjacent preserves; however, those areas will continue to be subject to increasing development pressures. Given the current status of the species in relation to these ongoing threats, we do not recommend a change in listing status for Government Canyon Bat Cave spider at this time.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*

____ *The species is extinct*

____ *The species does not meet the definition of an endangered species or a threatened species (i.e., is recovered, or new information on status and threats indicate species does not meet definitions)*

____ *The listed entity does not meet the statutory definition of a species.*

__x__ No change is needed

3.2 New Recovery Priority Number:

No Change Recommended

Brief Rationale:

A Recovery Priority Number of 2C is indicative of a taxon with a high degree of threat, a high recovery potential, and the taxonomic standing of a species. The C indicates that the species' recovery conflicts with water demands, development projects, or other forms of economic activity. The Government Canyon Bat Cave spider continues to be threatened by habitat destruction, disturbance, and degradation across its range. However, we consider this species' potential for recovery to be feasible through the concerted efforts of Service personnel and our partners to identify, restore, enhance, and protect habitat.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

I. Continue efforts to find additional populations of Government Canyon Bat Cave spider and establish karst fauna areas or other protected sites throughout its range.
II. Apply recovery criterion 2 to karst fauna areas that qualify.
III. Gather additional specimens and morphological character and DNA data to further refine the species limits of *T. microps* and *T. madla* to help resolve uncertainties of species identification for *Tayshaneta* specimens from Surprise Sink.
IV. Reassess the current karst fauna regions of Bexar County, Texas using current data and revise regions as necessary to better inform recovery efforts.

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U.S. FISH AND WILDLIFE SERVICE

5-YEAR REVIEW of *Government Canyon Bat Cave Spider (Tayshaneta* [*=Neoleptoneta*] *microps)*

Current Classification: Endangered

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened

____ Uplist to Endangered

____ Delist

__X_ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service, Austin Ecological Services Field Office

Approve ADAM ZERRENNER Digitally signed by ADAM ZERRENNER Date: 2021.11.09 13:02:10 -06'00'

Adam Zerrenner