

**Tooth Cave Spider (*Neoleptoneta myopica*),
Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), and
Tooth Cave Pseudoscorpion (*Tartarocreagris texana*)**

**5-Year Review:
Summary and Evaluation**

**U.S. Fish and Wildlife Service
Austin Ecological Services Field Office
Austin, Texas**

5-YEAR REVIEW
Tooth Cave Spider (*Neoleptoneta myopica*),
Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), and
Tooth Cave Pseudoscorpion (*Tartarocreagris texana*)

1.0 GENERAL INFORMATION

1.1 Reviewers:

Lead Regional Office: Southwest Regional Office, Region 2
Susan Jacobsen, Chief, Threatened and Endangered Species
505-248-6641
Wendy Brown, Recovery Coordinator, 505-248-6664
Julie McIntyre, Recovery Biologist, 505-248-6657

Lead Field Office: Austin Ecological Services Field Office
Cyndee Watson, Endangered Species Biologist
512-490-0057 x 223

1.2 Methodology used to complete the review:

The U.S. Fish and Wildlife Service (Service) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act (16 U.S.C. 1531 et seq.). The Service provides notice of status reviews via the Federal Register and requests information on the status of the species. This review was conducted by Cyndee Watson from the Austin Ecological Services Field Office (AESFO). This status review mostly relied on information summarized and cited in Balcones Canyonlands Preserve (BCP)¹ Annual Report (BCCP 2009a)² and the BCP cave assessment (BCCP 2009b). We also used the draft Bexar County Karst Invertebrate Recovery Plan (Bexar RP) (Service 2008a), which contains new karst invertebrate research and preserve design concepts; the Endangered Karst Invertebrates (Travis and Williamson Counties, Texas) Recovery Plan (Travis and Williamson RP) (Service 1994), and cave data contained within AESFO's files.

As a basic first step in assessing whether caves that contain the Tooth Cave spider, Kretschmarr Cave mold beetle, and the Tooth Cave pseudoscorpion met the downlisting recovery criteria in the Travis and Williamson RP, we compiled a list of some basic characteristics (further described in Section 2.2.3). While the Travis and Williamson RP discusses broad concepts regarding preserve design, the draft Bexar RP has an appendix that is a compilation of research to help more specifically delineate preserve boundaries

¹ BCP- A system of preserves permanently set aside to conserve habitat for 8 endangered species (including *T. reddelli*) and 27 species of concern as part of a joint regional 10(A)(1)(B) incidental take permit PRT 788841, held by the City of Austin and Travis County.

² BCCP - The incidental take permit mentioned above is also referred to as the Balcones Canyonlands Conservation Plan (BCCP).

that follow those basic concepts (Service 1994, Service 2008a). These preserve design principles and characteristics describe what is needed to protect each karst feature and its surrounding area. From the list of known locations of these species, we identified those that had the highest likelihood of meeting these characteristics. Our determinations (discussed in section 2.2.3) for each of these characteristics were based on site-specific information found in the AESFO files and on cave location and parcel data. Unless otherwise noted, all acreage estimates were calculated using Geographic Information Systems (GIS) (2008 digital aerial photography and 2006 Travis County parcel data) and are subject to typical margins of error associated with GPS units, GIS, and transferring data from paper sources to digital media. These acreages and respective cave locations need to be ground-truthed (i.e., verified by site visits).

1.3 Background:

These species are troglobites, which are species restricted to the subterranean environment that typically exhibit morphological adaptations to that environment, such as elongated appendages and loss or reduction of eyes and pigment. Their habitat includes caves and mesocavernous voids in karst limestone (a terrain characterized by landforms and subsurface features, such as sinkholes and caves, which are produced by solution of bedrock) in Travis County. Karst areas commonly have few surface streams; most water moves through cavities underground. Within this habitat this species depends on high humidity, stable temperatures, and nutrients derived from the surface. Examples of nutrient sources include leaf litter fallen or washed in, animal droppings, and animal carcasses. It is imperative to consider that while these species spend their entire lives underground, their ecosystem is very dependent on the overlying surface habitat.

The three species in this review were listed as endangered in 1988, based on the threats of: 1) habitat loss to development; 2) cave collapse or filling; 3) alteration of drainage patterns; 4) alteration of surface plant and animal communities, including the invasion of exotic plants and predators (i.e. the red-imported fire ant (RIFA), *Solenopsis invicta*), changes in competition for limited resources and resulting nutrient depletion, and the loss of native vegetative cover leading to changes in surface microclimates and erosion; 5) contamination of the habitat, including groundwater, from nearby agricultural disturbance, pesticides, and fertilizers; 6) leakages and spills of hazardous materials from vehicles, tanks, pipelines, and other urban or industrial runoff; and 7) human visitation, vandalism, and dumping; and mining, quarrying (limestone), or blasting above or in caves. Currently, these three species face the same threats that they did at the time they were listed.

At this time, a total of 13 caves are known to contain these 3 troglobite species. There are currently six caves known to contain the Tooth Cave spider (*Neoleptoneta myopica*), eight caves with the Kretschmarr Cave mold beetle (*Texamaurops reddelli*), and four caves that support the Tooth Cave pseudoscorpion (*Tartarocreagris texana*). Of these 13 caves, 1 cave supports all 3 species, and 2 caves support 2 of the 3 species, while the remaining caves each contain only a single species.

1.3.1 FR Notice citation announcing initiation of this review: 75 FR 20134, April 23, 2007

1.3.2 Listing history

Original Listing

FR notice: 53 FR 36029

Date listed: September 16, 1988

Entities listed: Tooth Cave spider (*Neoleptoneta myopica*),
Kretschmarr Cave mold beetle (*Texamaurops reddelli*),
Tooth Cave pseudoscorpion (*Tartarocreagris texana*)

Classification: Endangered

1.3.3 Associated rulemakings: Not applicable

1.3.4 Review History: Status reviews for these three species were conducted in 1988 for the final listing rule of the species (53 FR 36029) and in 1994 for the Travis and Williamson RP (Service 1994). No previous 5-year review has been conducted for these species.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 2C

1.3.6 Recovery Plan or Outline

Name of plan or outline: Endangered Karst Invertebrates Recovery Plan (Travis and Williamson Counties, Texas)

Date issued: 1994

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Are the species under review vertebrates? No, the three species are invertebrates, so the DPS policy does not apply.

2.2 Recovery Criteria

2.2.1 Do the species have a final, approved recovery plan? Yes

2.2.1.1 Does the recovery plan contain objective, measurable criteria? Yes

2.2.2 Adequacy of recovery criteria

2.2.2.1 Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and their habitats? Yes

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information: The recovery plan provides criteria only for downlisting from endangered to threatened (Service 1994).

Recovery Criteria: Each species will be considered for reclassification from endangered to threatened when:

- (1) Three karst fauna areas (KFA) (if at least three exist) within each karst fauna region (KFR) in each species' range are protected in perpetuity. If fewer than three KFAs exist within a given KFR, then all KFAs within that region should be protected. If the entire range of a given species contains less than three KFAs, then they should all be protected for that species to be considered for downlisting.
- (2) Criterion (1) has been maintained for at least five consecutive years with assurances that these areas will remain protected in perpetuity.

There are seven KFRs (adapted from the karst fauna areas in Figure 19 of Veni & Associates' 1992 report and reproduced in Figure 2 of the Travis and Williamson RP) in Travis and Williamson Counties that are known to contain endangered karst invertebrates. These regions are delineated based on geologic continuity, hydrology, and the distribution of rare troglobites.

Within each KFR, established karst preserves may be considered a KFA if they are of high quality and meet recovery criteria. For the purposes of the recovery plan, a KFA is an area known to support one or more locations of a listed species and is distinct in that it acts as a system that is separated from other KFAs by geologic and hydrologic features and/or processes that create barriers to the movement of water, contaminants, and troglobitic fauna. Karst fauna areas should be far enough apart so that if a catastrophic event (for example, contamination of the water supply, flooding, disease) were to destroy one of the areas, that event would not likely destroy any other area occupied by that species.

To be considered "protected," a KFA must be sufficiently large to maintain the integrity of the karst ecosystem on which the species depend. In addition, these areas must also provide protection from threats such as red-imported fire ants (*Solenopsis invicta*) (RIFA), habitat destruction, and contaminants.

Brief summary of preserve design principles:

Much of the conservation and recovery of these endangered and cryptic species is dependent upon the long-term preservation of their habitat. Because most endangered

karst invertebrates are difficult to detect during in-cave faunal surveys, their conservation strategies focus on the delineation, study, and management of occupied KFAs. Regarding size and configuration of KFAs, the Travis and Williamson RP provides some conceptual guidelines on habitat conditions that are important to karst invertebrates, including maintaining humid conditions, air flow, and stable temperatures in the air-filled voids. Also necessary are maintaining adequate nutrient supply; preventing contamination from the surface and groundwater entering the karst ecosystem; controlling the invasion of exotic species, e.g., RIFA; and allowing for movement of karst fauna and nutrients through voids between karst features (Service 1994).

Additional scientific information and karst preserve design guidelines are presented in the draft Bexar RP and help to further define a protected KFA (Service 2008a). According to these preserve design guidelines, KFAs should include the following: 1) surface and subsurface drainage basins of at least one occupied karst feature (i.e., cave); 2) ideally a minimum of 24 to 36 hectares (ha) (59 to 89 acres (ac)) of contiguous, unfragmented, undisturbed land to maintain native plant and animal communities around the feature and protect the subsurface karst community; 3) 105 meter (m) (345 foot (ft)) radius, undisturbed area, from each cave entrance for cave cricket foraging; and 4) at least 100 m (328 ft), undisturbed, from the cave footprint to the edge of the preserve to minimize deleterious edge effects (Service 2008a). The Bexar RP also recognizes various qualities of KFAs. A medium quality KFA is 16 to 24 ha (40 to 60 ac) and a high quality KFA is 24 to 36 ha (60 to 90 ac). Any karst preserve less than 16 ha (40 ac) will not count toward meeting the minimum Bexar RP recovery criteria. The quality of KFAs is defined based on the probability of long-term survival of the species in that area and the amount of active management necessary to maintain those species. High quality KFAs tend to be larger, require less active management, and have a higher probability of long-term species survival. Medium quality KFAs have some compromised characteristics of a high quality preserve, but still have potential for reasonable remediation. Additionally, the Bexar RP outlines perpetual management, maintenance, and monitoring necessary for ensuring a high probability of species survival at each site (Service 2008a). At a minimum, these activities should include: 1) controlling RIFA; 2) installing and maintaining fencing; 3) installing, if necessary, and maintaining cave gates; and 3) monitoring of karst invertebrates and the ecosystem upon which they depend (Service 2008a).

Analysis regarding whether downlisting criteria have been met:

Within the Central Austin KFR there is one cave that contains the Tooth Cave spider. In the Jollyville Plateau KFR there are five caves known to contain the Tooth Cave spider, eight caves that contain the Kretschmarr Cave mold beetle, and four caves that contain the Tooth Cave pseudoscorpion (Table 1, Map 1). Based on a review of available data, two of the caves in the Jollyville Plateau KFR that contain the Tooth Cave spider, three caves that contain the Kretschmarr Cave mold beetle, and two caves that contain the Tooth Cave pseudoscorpion may meet the definition of a KFA; however, more research is needed to make this determination. Below is a discussion of these caves and the three

tracts³ that they occur in with a description of how they have the potential to meet KFA status.

Jollyville Plateau KFR:

Cuevas (Tomen Park) – This Travis County-owned tract contains several caves with listed species; two of these caves that contain the species covered in this review, Gallifer Cave and Tooth Cave, may meet the definition of a KFA. Gallifer Cave contains the Tooth Cave spider and the Kretschmarr Cave mold beetle. Tooth Cave contains the Tooth Cave spider, Tooth Cave pseudoscorpion, and Kretschmarr cave mold beetle (Table 1), as well as the other two karst invertebrates (Tooth Cave ground beetle (*Rhadine persephone*) and the Bone Cave harvestman (*Texella reyesi*)) that occur in Travis County but are not covered in this review. This cave cluster is within a tract that is 772 ha (1,909 ac) (BCCP 2009b). While Gallifer Cave and Tooth Cave are the only two caves that have the potential to be considered a KFA for these species, all of the caves and karst features within this tract contribute to the long-term viability and stability of the potential KFA. The cave entrance for Gallifer Cave is 198 m (650 ft) and the cave footprint is about 189 m (620 ft) from the preserve edge, respectively (adjacent to planned development that is associated with the GDF Habitat conservation Plan (HCP) (Elliott 1997, Service 2008b)). The Tooth Cave entrance is 73 m (240 ft) from the preserve edge and the cave footprint is about 16 m (52 ft) from the preserve edge (i.e., disturbance via road or a development) (Elliott 1997, Service 2008b). The cave footprint distance was measured using the ground-penetrating radar map by Veni & Associates (2006). While the distance to the preserve edge is small, we have worked to design this preserve to ensure that all of the area above the lowest elevation of the cave floor is included in the preserve. The surface and subsurface drainage basins for these caves are included in this tract (Veni & Associates 2006). As part of management for these caves, Travis County BCP staff conducts quarterly cave cricket exit counts, maintains the perimeter fences, and conducts biannual surface monitoring to look for signs of trespass and RIFA (BCCP 2009a). They also conduct an annual faunal survey at Gallifer Cave and conduct quarterly faunal surveys at Tooth Cave (BCCP 2009a).

Stovepipe Cave – The City of Austin owns Stovepipe Cave and it is part of the BCP (BCCP 2009a). It is known to contain the Tooth Cave spider and the Kretschmarr Cave mold beetle. This 21 ha (52 ac) tract has a narrow connection to more than 1,695 ha (4,189 ac) of additional BCP land (BCCP 2009b), and the cave entrance and footprint are more than 105 m (345 ft) from any disturbance. The cave entrance is 167 m (550 ft) (BCCP 2009b) from the preserve edge. Based on Warton (1992) and aerial photos in our files, it appears that the cave footprint is about 115 m (380 ft) to the nearest edge (i.e., disturbance via road or a development). The surface drainage basin is protected and included in the tract; however, the subsurface drainage basin has not been delineated (BCCP 2009a, b). As part of management for the cave, the City of Austin maintains the perimeter fence, conducts quarterly surface monitoring looking for human intrusion and RIFA, and conducts biannual cave fauna surveys (BCCP 2009a, b). This cave is treated for RIFA using boiling water (BCCP 2009a, b).

³ Tract refers to a contiguous undeveloped piece of land.

Four Points – This privately-owned and managed 21 ha (52 ac) tract has been preserved for the benefit of the endangered karst invertebrate species that occur in it and is considered part of the BCP⁴ (Service 1995). Several caves on this tract contain listed species (not all of them are covered in this review), and one cave (MWA Cave) contains the Tooth Cave pseudoscorpion and Kretschmarr Cave mold beetle and has the potential to meet the definition of a KFA. However, all of the features within this tract contribute to the long-term viability and stability of the potential KFA. The cave entrance and cave footprint are about 128 m (420 ft) (BCCP2009b) and 115 m (380 ft), respectively, from the preserve edge (i.e., disturbance via road or a development) (Elliott 1997 and aerial photos). This tract is adjacent to more than 162 ha (400 ac) of BCP land. The surface drainage basin has been defined, but we are unsure if it is in the preserve (BCCP 2009b) and the subsurface drainage basin has not been delineated. As part of management for these caves, a perimeter fence was installed and RIFA are treated at least twice a year (ACI 2003, 2004, 2005, 2006, 2007).

Table 1. Distribution of Tooth Cave spider, Kretschmarr Cave mold beetle, and Tooth Cave pseudoscorpion

Jollyville Plateau KFR				
Tract	Cave Name	Kretschmarr Cave mold beetle	Tooth Cave pseudoscorpion	Tooth Cave Spider
BCP Jollyville/TC Tomen Park (Cuevas tract)	Amber Cave	Confirmed	Confirmed	
	Gallifer Cave	Confirmed		Confirmed
	Tardus Hole	Confirmed		
	Tooth Cave	Confirmed	Confirmed	Confirmed
	Kretschmarr Cave	Confirmed		
	Kretschmarr Double Pit Cave		Confirmed	
BCP private 10 (a) (4pts Cl. - Perot)	Geode Cave			Confirmed
	Stovepipe Cave	Confirmed		Confirmed
BCP	Japygid Cave	Confirmed		
BCP 4Points	MWA Cave	Confirmed		
BCP private 10(a)	New Comanche Trail Cave			Confirmed
Private	Jester Estates Cave		Confirmed	
Central Austin KFR				
Private	Moonmilk Cave			Confirmed

***Unless otherwise noted all acreage estimates were calculated using GIS (2008 digital aerial photography) and are subject to typical margins of error associated with GPS units and GIS. These acreages and respective cave locations need to be ground-truthed (i.e., verified by site visits).

⁴ If preserves are established within the BCCP acquisition boundaries, they are considered part of the BCCP and contribute to the total acreage of the preserve system (Rose Farmer, Travis County, pers. comm. 2008).

Climate Change

According to the Intergovernmental Panel on Climate Change (IPCC) (2007) “Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level.” Average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50-year period in the last 500 years and likely the highest in at least the past 1,300 years (IPCC 2007). It is very likely that over the past 50 years cold days, cold nights, and frosts have become less frequent over most land areas, and hot days and hot nights have become more frequent (IPCC 2007). It is likely that heat waves have become more frequent over most land areas, and the frequency of heavy precipitation events has increased over most areas (IPCC 2007). To date, these changes do not appear to have had a negative impact on the species covered in this review.

The IPCC (2007) predicts that changes in the global climate system during the 21st century are very likely larger than those observed during the 20th century. For the next two decades a warming of about 0.2°C (0.4°F) per decade is projected (IPCC 2007). Afterwards, temperature projections increasingly depend on specific emission scenarios (IPCC 2007). Various emissions scenarios suggest that by the end of the 21st century, average global temperatures are expected to increase 0.6°C to 4.0°C (1.1°F to 7.2°F) with the greatest warming expected over land (IPCC 2007). Localized projections suggest the southwest may experience the greatest temperature increase of any area in the lower 48 States (IPCC 2007). The IPCC says it is very likely hot extremes, heat waves, and heavy precipitation will increase in frequency (IPCC 2007). There is also high confidence that many semi-arid areas like the western United States will suffer a decrease in water resources due to climate change (IPCC 2007). Milly et al. (2005) project a 10–30 percent decrease in precipitation in mid-latitude western North America by the year 2050 based on an ensemble of 12 climate models.

Although climate change was not identified as a threat to these three species in the original listing document or in the recovery plan, their dependence on stable temperature and humidity opens the possibility of climatic change impacting these species. While it appears reasonable to assume that they may be affected, we lack sufficient certainty to know how climate change will affect the species.

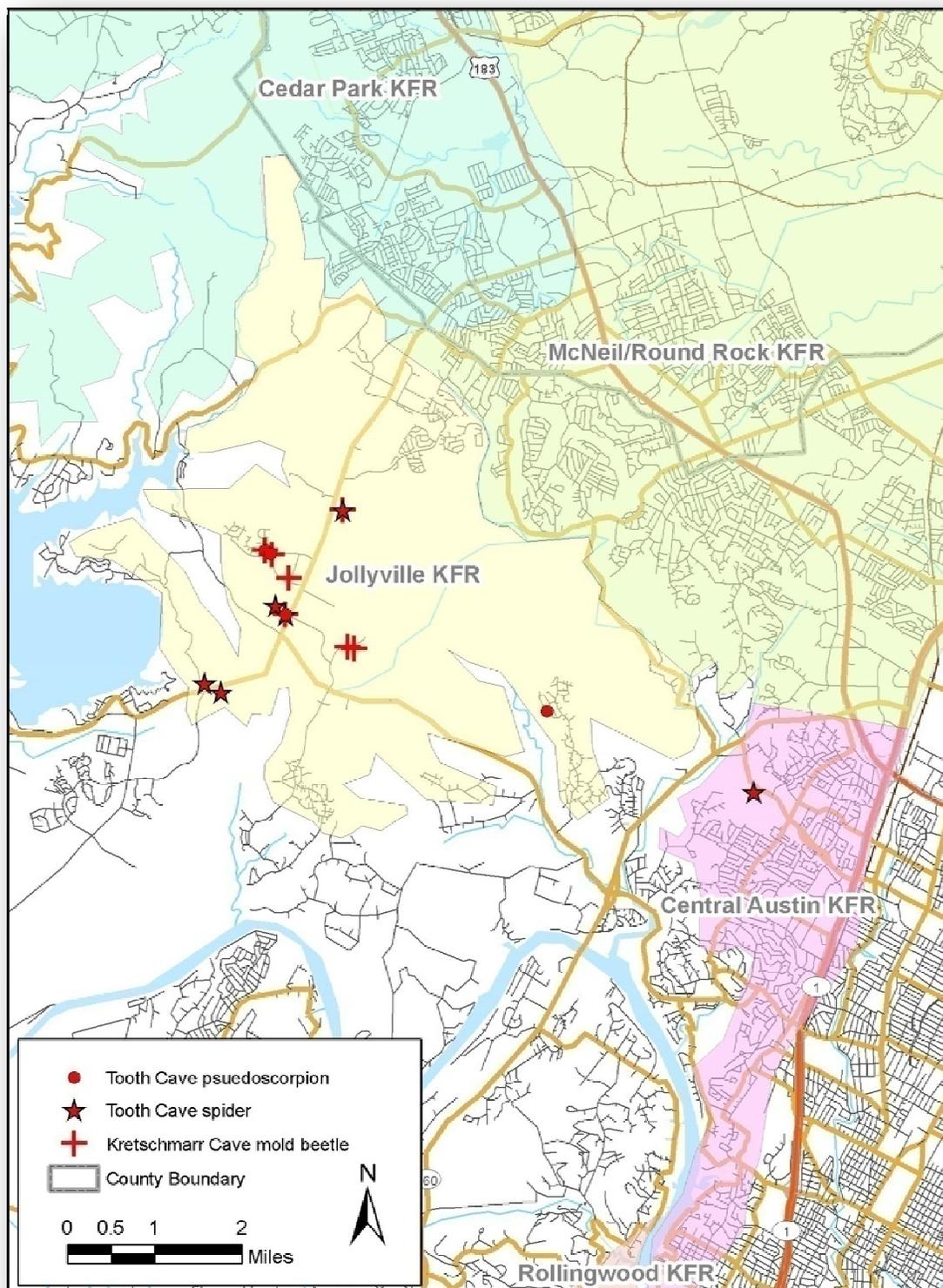
2.3 Synthesis

According to recovery criterion 1 in the Travis and Williamson RP, three KFAs within each KFR should be protected. Protection (or protected) is defined as sufficiently large to maintain the integrity of the karst ecosystem on which the species depend. These areas must also provide protection from threats such as RIFA, habitat destruction, and contaminants. Recovery criterion 2 requires at least five consecutive years of criterion 1 being met and that perpetual protection of these areas is in place. Since these species were listed in 1988, there have been significant steps toward protecting caves that they occur in and meeting the downlisting criteria.

The following tracts all occur on the Jollyville Plateau KFR and contain caves that likely meet the definition of a KFA. Tomen Park is a potential KFA for the Tooth Cave spider, Tooth Cave pseudoscorpion, and Kretschmarr Cave mold beetle. Stovepipe is a potential KFA for the Tooth Cave spider and Kretschmarr Cave mold beetle. Four Points is a potential KFA for Tooth Cave pseudoscorpion and the Kretschmarr Cave mold beetle. In total there could be three KFAs for the Kretschmarr Cave mold beetle, which is enough to meet recovery criterion 1 because this is the only KFR this species occurs in, and two KFAs for each of the other two species. With some additional research on the subsurface drainage basins and/or implementation/confirmation of certain management activities, we should be able to determine if these areas are indeed KFAs.

If a cave is determined to be a protected KFA, then information relating to recovery criterion 2 should be gathered and/or implemented to meet downlisting criteria; however, there does not appear to be enough potential KFAs per KFR to meet downlisting criteria. Until such time, we do not recommend a change in listing status for these species.

Map 1. Distribution of Tooth Cave spider, Kretschmarr Cave mold beetle, and Tooth Cave pseudoscorpion in Travis County, Texas.



3.0 RESULTS

3.1 Recommended Classification:

- Downlist to Threatened**
- Uplist to Endangered**
- Delist** (*Indicate reasons for delisting per 50 CFR 424.11*):
 - Extinction*
 - Recovery*
 - Original data for classification in error*
- No change is needed**

3.2 New Recovery Priority Number: No change

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS - THESE ARE THE HIGHEST PRIORITY ACTIONS FOR THE NEXT 5 YEARS -

- Confirm the subsurface drainage basins for Gallifer Cave, MWA Cave, and Stovepipe Cave.
- Confirm and/or implement RIFA control at Tooth Cave, Gallifer Cave, and MWA Cave.
- Confirm and/or implement monitoring of Kretschmarr Cave mold beetle and the cave ecosystem at MWA Cave.
- Confirm that there are no pipelines going through potential KFAs including: water, wastewater, natural gas, and petroleum.
- Find more locations for these species that could meet KFA status and protect them to meet downlisting criteria.

5.0 REFERENCES

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- construction and operation of a mixed use and residential development on portions of the 333-acre Four Points property, Austin Texas. 25 pp.
- U.S. Fish and Wildlife Service (Service). 2008a. Bexar County karst invertebrates draft recovery plan. U.S. Fish and Wildlife Service, Albuquerque, NM. 125 pp.
- U.S. Fish and Wildlife Service (Service). 2008b. Environmental Assessment/Habitat Conservation Plan for Issuance of an Endangered Species Act Section 10(a)(1)(B) Permit for Incidental Take of Golden-cheeked Warbler (*Dendroica chrysoparia*), Tooth Cave Pseudoscorpion (*Tartarocreagris texana*), Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*), Bone Cave Harvestman (*Texella reyesi*), Tooth Cave Spider (*Neoleptoneta myopica*), and Tooth Cave Ground Beetle (*Rhadine persephone*) During the Construction and Operation of a Residential, Commercial, and/or Retail Development on Portions of the Approximately 70-acre GDF Property, Austin, Travis County, Texas. 63 pp.
- Veni & Associates. 1992. Geologic controls on cave development and the distribution of cave fauna in the Austin, Texas, region. Revised February 1992. USFWS Austin, Texas. 77 pp.
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- Warton, M. 1992. Stovepipe Cave plan and profile view. 1 p.

FISH AND WILDLIFE SERVICE
5-YEAR REVIEW for the
Tooth Cave Spider (*Neoleptoneta myopica*), Kretschmarr Cave Mold Beetle (*Texamaurops reddelli*),
Tooth Cave Pseudoscorpion (*Tartarocreagris texana*)

Current Classification: endangered

Recommendation resulting from the 5-Year Review:

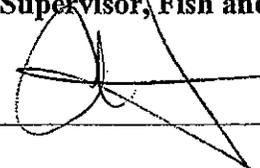
- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

Appropriate Listing/Reclassification Priority Number, if applicable: n/a

Review Conducted By: Cyndee Watson, Austin Ecological Services Field Office, Austin, Texas

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve  _____ Date 6/26/09

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, Fish and Wildlife Service, Region 2

Signature Nancy J. Gloman _____ Date 12-4-09