Coffin Cave Mold Beetle
(Batrisodes texanus)

5-Year Review:
Summary and Evaluation

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

5-YEAR REVIEW
Coffin Cave Mold Beetle (*Batrisodes texanus*)

1.0 GENERAL INFORMATION

1.1 Reviewers:

A. Lead Regional Office: Southwest Regional Office, Region 2
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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 and Bill Seawell from the Austin Ecological Services Field Office (AESFO). This status review mostly relied on information summarized and cited in the Williamson County Regional Habitat Conservation Plan (WCRHCP) (SWCA 2008a); the draft Bexar County Karst Invertebrate Recovery Plan (Bexar RP) (Service 2008), which contains an appendix summarizing preserve design concepts and research relevant to preserve design; the Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas (Travis and Williamson RP) (1994); and cave data contained within AESFO's files.

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 that follow those basic concepts (Service 1994, 2008). As a basic first step in assessing whether caves containing *B. texanus* met the downlisting recovery criteria in the Travis and Williamson RP, we compiled a list of some basic characteristics of karst preserves/recovery criteria (further described in section 2.2.3) based on the draft Bexar RP appendix. These preserve design principles and characteristics describe what is needed to protect each karst feature and its surrounding area. From the list of known *B. texanus* locations, 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 AESFO's 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 2005 Williamson 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:

The Coffin Cave mold beetle is very small, less than 3mm (1/8 inch) in length. It is eyeless and dark colored, with short wings and long legs. The beetle is a troglobite, which is a species restricted to the subterranean environment that typically exhibits morphological adaptations to that environment, such as elongated appendages and loss or reduction of eyes and pigment. Troglobitic 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 Williamson 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.

Batrisodes texanus was 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; mining, quarrying (limestone), or blasting above or in caves. At present, *B. texanus* is found in 23 caves in Williamson County, Texas, and faces the same threats it did at the time it was listed.

Initially, this species was listed as the Kretschmarr Cave mold beetle (*Texamaurops reddelli*) then later split into two species: the Kretschmarr Cave mold beetle and Coffin Cave mold beetle (*Batrisodes texanus*). We published a technical correction stating that both species were listed because they were included as part of the *T. reddelli* species at the time *T. reddelli* was listed. More recent taxonomic revisions have been published by Chandler and Reddell (2001) further splitting *B. texanus* into *B. texanus* and *B. cryptotexanus*. Another publication by Chandler et al. (2009) again stated that these are two distinct species. The Service has not yet officially recognized this taxonomic revision. In this review, we are assessing the status of *B. texanus* as one species including the locations referred to by Chandler et al. (2009) as *B. cryptotexanus*.

Addressing this taxonomic revision is included in the recommended priorities for future actions later in this review.

1.3.1 FR Notice citation announcing initiation of this review: 70 FR 58191, August 16, 2005

1.3.2 Listing history

Original Listing
FR notice: 53 FR 36029-36033
Date listed: September 16, 1988
Entity listed: Coffin Cave mold beetle (*Batrisodes texanus*)
Classification: Endangered

1.3.3 Associated rulemakings: In a September 16, 1988, Federal Register notice (56 FR 43818), the Service gave *B. texanus* protection under the Act as a separate species. It had previously been listed as endangered as a part of the Kretschmarr Cave mold beetle (*Texamaurops reddelli*), which was subsequently re-classified into two species, and this notice was made to ensure that it continued to receive protection under the Act.

1.3.4 Review History: Status reviews for *B. texanus* were conducted in 1988 for the final listing of the species (72 FR 20134 20136) and in 1994 for the Travis and Williamson RP (Service 1994). In addition, in 2008 the WCRHCP included a review of available information on the 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: Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas
Date issued: 1994
Dates of previous revisions, if applicable: None

2.0 REVIEW ANALYSIS

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

2.1.1 Is the species under review a vertebrate? No, the species is a beetle, so the DPS policy does not apply.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing 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 its habitat? 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 Travis and Williamson RP only provides criteria 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 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 depends. In addition, these areas must also

provide protection from threats such RIFAs (*Solenopsis invicta*), habitat destruction, and contaminants.

Brief summary of preserve design principles:
Much of the conservation and recovery of this rare and cryptic species is dependent upon the long-term preservation of its 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 the 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 2008). 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 2008). 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 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 2008). At a minimum, these activities should include: 1) controlling RIFA; 2) installing and maintaining fencing; 3) installing, if necessary, and maintaining cave gates; and 4) monitoring of karst invertebrates and the ecosystem upon which they depend (Service 2008).

Analysis regarding whether downlisting criteria have been met:
Twenty three caves in Williamson County, Texas, have confirmed presence of *B. texanus* (Table 1). These caves are in the North Williamson County KFR and Georgetown KFR with 19 and 3 caves respectively (Map 1). Based on a review of available data, one *B. texanus* location (Priscilla's Well Cave) in the Northern Williamson KFR currently meets the KFA definition. However, with some additional data gathering and/or

confirmation/implementation of certain management activities, we believe there is potential for four more locations within this KFR to meet KFA status. Below we have described the Priscilla's Well KFA followed by a discussion of the *B. texanus* caves that have the potential to meet the KFA definition.

North Williamson County KFR:

Priscilla's Well KFA – The Williamson County Conservation Foundation owns this 20 ha (51 ac) Priscilla's Well tract[1] that was recently acquired by a land donation as part of participation in the WCRHCP for the Ronald Reagan Boulevard extension. The tract contains one *B. texanus* cave, Priscilla's Well, and two caves containing other listed species not covered in this review. The cave entrances and footprints for both caves are more than 105 m (345 ft) from the nearest disturbance (SWCA 2008b). The surface and subsurface drainage basins have been delineated based on topographic maps and are included in the preserve; however, onsite verification of the delineations has not been performed (SWCA 2008b). As part of the management for these caves, the Williamson County Conservation Foundation will maintain fencing, conduct quarterly site visits looking for human intrusion and RIFA, and conduct annual cave fauna surveys.

Shaman Cave – This >40 ha (>100 ac) tract is owned by Sun City and several other owners. Two caves on this tract contain listed species (some species are not covered in this review). One of these caves (Shaman Cave) (which is in a 4 ha (10 ac) preserve within the 28 ha (70 ac) tract), contains *B. texanus* 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 footprint is <15 m (<50) ft from the property boundary. However, the cave entrance and footprint for the cave are located within the tract and the nearest edge (i.e., disturbance e.g. road or a development) is >210 m (>700 ft) from the cave entrance (Verdorn 1994). Considering that the adjacent property is undeveloped there is opportunity to talk to the property owner about ways to protect the area 100 m (328 ft) from the cave footprint. The surface drainage basin is likely included within the preserve (Verdorn 1994); however, the subsurface drainage basin has not been delineated and to our knowledge this tract is not being actively managed for things such as trespass activity, RIFA, or monitoring of *B. texanus*.

Red Crevice Cave – This 42 ha (105 ac) preserve is owned by Texas Cave Management Association (TCMA) and is known as the Godwin Ranch Preserve. It was established as part of the mitigation for Lakeline Mall (Simon 1992). Two caves on this tract contain listed species and one cave (Red Crevice Cave) contains *B. texanus*. Thus this tract 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 footprint for the cave are located within the tract and the nearest edge (i.e., disturbance e.g. road or a development) is about 200 m (about 656 ft) from the cave entrance (Simon 1992). We do not have a map of the cave footprint so we are unsure how far the cave is from the edge of the preserve. The surface and subsurface drainage basins have not been delineated for this cave; therefore, we do not know whether they are included in this tract. As part of the management for this cave, TCMA contracts with

[1] Tract – refers to a contiguous undeveloped piece of land.

ZARA Environmental to conduct RIFA treatment; however, no cave fauna surveys are being conducted (ZARA 2008).

Karankawa Cave

This privately-owned cave contains *B. texanus* and is located in a tract that is approximately 52-ha (130-ac). This tract/cave has potential to meet the definition of a KFA because of the large amount of undeveloped land in and around this tract. The cave entrance is located >700 m (>2,296 ft) away from the nearest edge (i.e., disturbance via road or a development) and about 21 m (70 ft) from the property line of the adjacent undeveloped tract. We do not have a map of the cave footprint so we cannot measure the distance to the nearest edge. To our knowledge the surface and subsurface drainage basins have not been delineated for this cave, so we do not know if they are inside this tract. Also, we do not know if this cave receives any management.

Blowhole Cave

This privately-owned cave contains *B. texanus* and is located in a tract that is approximately 485 ha (1,200 ac). This tract/cave has potential to meet the definition of a KFA because of the large amount of undeveloped land in and around this cave. The cave entrance is located about 240 m (787 ft) away from the nearest edge (i.e., disturbance via road or a development) and about 105 m (344 ft) from the property line of the adjacent tract (quarry). We do not have a map of the cave footprint so we cannot measure the distance to the nearest edge. To our knowledge the surface and subsurface drainage basins have not been delineated for this cave, so we do not know if they are inside this tract. Also, we do not know if this cave receives any management.

Table 1. *B. texanus* Distribution

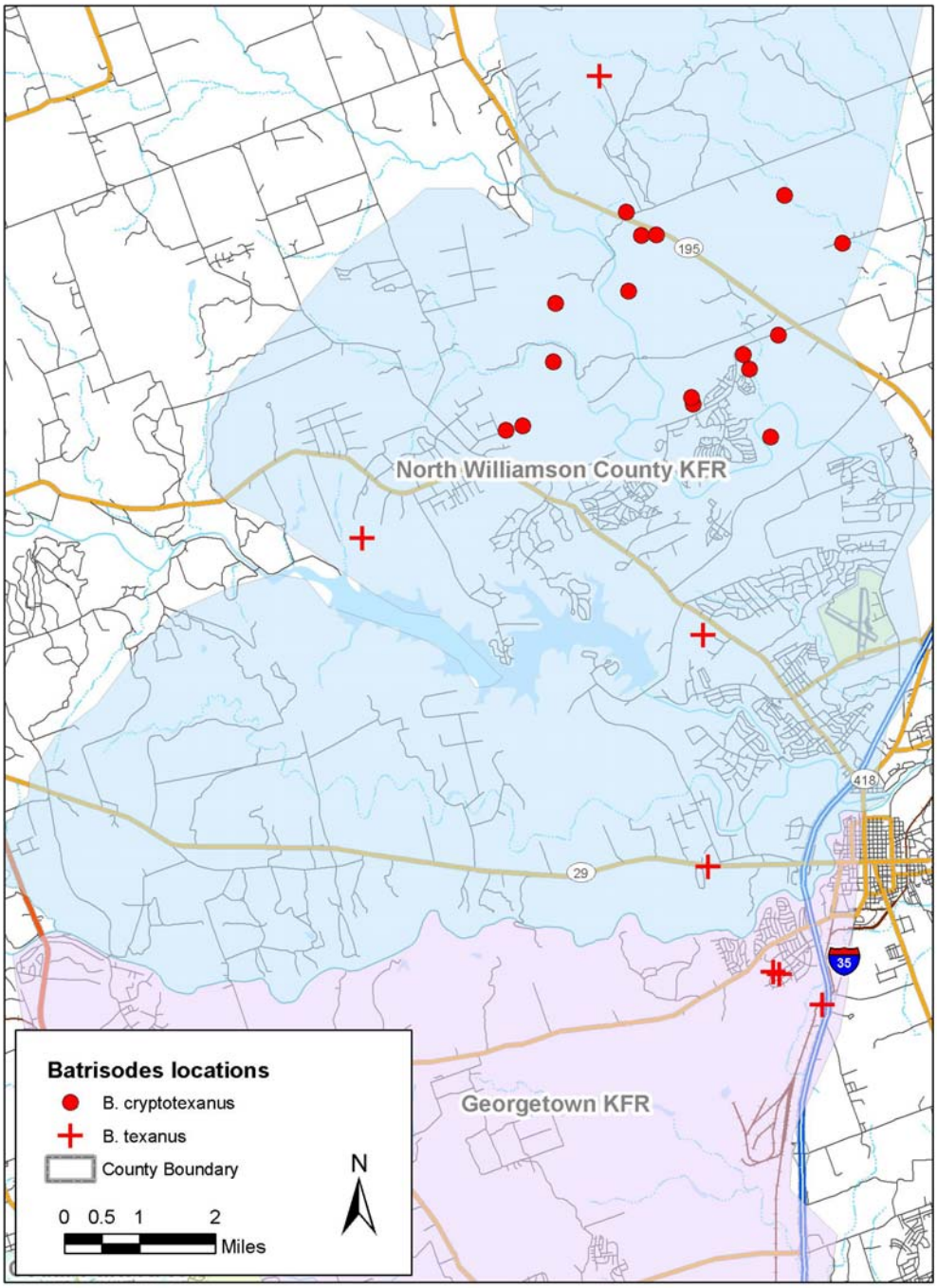
Cave name	Size of tract (acres)***	Notes
North Williamson KFR		
Priscilla's Well**	51	KFA
Shaman Cave**	100	In 10 ac setback; potential KFA because tract is undeveloped
Red Crevice Cave	105	Lakeline Mall mitigation preserve; potential KFA
Karankawa Cave**	130	Undeveloped; potential KFA
Blowhole Cave**	>1,200	Undeveloped. Potential KFA
Medicine Man Cave**	12*	In 8 ac setback; 20 m to an edge
Cobbs Cavern	64	Half of cave footprint in conservation easement
Dragonfly Cave**	13*	In 8 ac setback
Electro-Mag Cave**	15*	In 8 ac setback
Deliverance No. 2 Cave**	26*	In 13 ac setback
Reach Around Cave**	51*	In 2 ac setback; ~50 m to houses
Coffin Cave**	5	30 m to a road
Unearthed Cave**	37*	In 15 ac setback; ~40 m to an edge
Viper Cave**	70	~50 and 100 m to development
Corn Cobb Cave**	>900	~50 m to a road
Rattlesnake Inn Cave**	>1,000	~70 m to a road
Ventilator Cave**	70	<40 m to houses
Sunless City Cave	170	~ 25 m to a road
Hourglass Cave**	-	Within Hwy ROW
Georgetown KFR		
On Campus Cave	40	In school yard; <50 m to school
Off Campus Cave	0.3	Adjacent to school; 20 m to road
Inner Space Cavern	4	Show cave adjacent to I-35
Waterfall Canyon Cave	2	Close to house

*Acreage per Verdorn 1994

***B. cryptotexanus* per Chandler and Reddell 2001 and Chandler et al. 2009

***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).

Map 1. B. *texanus* Distribution



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 *B. texanus*.

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. Therefore, while it appears reasonable to assume that *B. texanus* may be affected, we lack sufficient certainty to know how climate change will affect the species.

Although climate change was not identified as a threat to *B. texanus* in the original listing document or in the recovery plan, the harvestman's dependence on stable temperature and humidity open the possibility of the species of being affected by climatic change. While it appears reasonable to assume that *B. texanus* 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 for downlisting. Protection is defined as an area sufficiently large to maintain the integrity of the karst ecosystem upon which the species depends. 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 this species was listed in 1988, there have been significant steps toward protecting

caves in which it occurs and meeting the downlisting criteria.

In the Georgetown KFR, there are currently no known caves or cave clusters that have potential for meeting the definition of a protected KFA. In the North Williamson County KFR, one cave (Priscilla's Well) is considered a protected KFA. There are at least four other caves (Shaman Cave, Red Crevice Cave, Karankawa Cave, and Blowhole Cave) that have the potential for meeting the definition of a protected KFA. With some additional field data gathered on hydrology and cave mapping and/or implementation/confirmation of certain management activities, we should be able to make this determination. In total, there could be 4 KFAs, enough to meet recovery criterion (1) for *B. texanus* in the North Williamson County KFR. However, if we considered the taxonomic split of *B. texanus* into *B. texanus* and *B. cryptotexanus*, there would be one potential KFA (Red Crevice Cave) in the Northern Williamson County KFR and none in the Georgetown KFR for *B. texanus*. Also, without including *B. cryptotexanus* data, there would only be three total *B. texanus* caves in the Williamson County KFR and four in the Georgetown KFR, a much smaller distribution. Settling the taxonomic issue of whether *B. texanus* comprises one species or two will help guide the next steps necessary to best protect the species.

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 status. While much progress has been made toward recovery, *B. texanus* does not yet meet either downlisting criterion and the taxonomic revision needs to be addressed in relation to the species listing status. Until these matters are addressed, we do not recommend a change in listing status for *B. texanus*.

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*
__X__ **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 -

- Work with Williamson County Conservation Foundation and TCMA to request their assistance in gathering additional information on caves that contain or may contain *B. texanus,* including that listed below.

- Delineate the surface and subsurface drainage basins for Shaman Cave, Red Crevice Cave, and Karankawa Cave to determine if they are within the preserve boundaries.

- Confirm and/or implement RIFA control at Priscilla's Well Cave, Shaman Cave, and Karankawa Cave.

- Confirm and/or implement monitoring of *B. texanus* and their cave ecosystem at Priscilla's Well Cave and Red Crevice Cave.

- Verify exact location information for all caves in potential KFAs.

- Confirm that all cave maps for caves in potential KFAs are accurate and that the cave footprint is at least 100 m (328 ft) from the preserve edge.

- Address the taxonomic revision proposed by Chandler and Reddell 2001.

- Identify potential KFAs (new locations) in Georgetown KFR.

5.0 REFERENCES

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW
Coffin Cave mold beetle (*Batrisodes texanus*)

Current Classification: endangered

Recommendation resulting from the 5-Year Review:

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

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

Review Conducted By: Cyndee Watson and Bill Seawell, Austin Ecological Services 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 G Gloman Date 12-4-09