

Central Texas Karst Invertebrates Karst Zones and Karst Fauna Regions Overview



U.S. Fish and Wildlife
Service

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Introduction

Subterranean habitats are widespread within karst landscapes, and they are occupied by a variety of invertebrate species that have adapted to exclusively live underground (i.e., *karst invertebrates* or *troglobionts*). Karst invertebrates do not exclusively inhabit caves, but also dwell in other subterranean voids, including solution cavities, sinkholes, fractures, and other mesocavernous spaces that form via the dissolution of karst landscapes. Many such geologic features are inaccessible to humans given their small size or potential lack of surface expression. Consequently, defining the geographic distribution of karst invertebrate species requires different techniques compared to those used for studying surface-inhabiting species.

At present, fifteen (15) terrestrial karst invertebrate species are listed as endangered and protected under the Endangered Species Act (USFWS 1994a, 2000, 2022). These species were included in two separate listing packages, groups by their geographic association with (1) Bexar County and (2) Travis and Williamson Counties. Information regarding listed species is available at the Karst Invertebrate Library Collection (<https://www.fws.gov/library/collections/terrestrial-karst-invertebrates>).

In an effort to define biologically-informative *Recovery Units* that capture geographic areas that are inhabited by karst invertebrates, the U.S. Fish and Wildlife Service (Service) has implemented the use of *Karst Fauna Regions* and *Karst Zones* within the Recovery Plans for each species listing package (USFWS 1994b, 2011, 2019). The following overview defines both Karst Fauna Regions and Karst Zones, as well as provides guidelines for their use and implementation. As outlined in both Recovery Plans, reassessment of Karst Fauna Regions (and by extension Karst Zones) may occur as necessary when newly available data is available related to species distribution, genetic diversity, and environmental constraints. As such, the most updated versions of these data sets should always be used when informing survey efforts or consultation requirements. Updated versions of each data set will be publicly available at the previously linked Library Collection.

Karst Fauna Regions

For the purpose of both karst invertebrate Recovery Plans, Karst Fauna Regions (KFRs) are used by the Service as **Recovery Units**, defined in the *Recovery Planning Guidance Handbook* as “a special unit of the listed entity that is geographically or otherwise identifiable and is essential to the recovery of the entire listed entity” (NMFS 2020). Thus, listed karst invertebrate species must be recovered within each KFR they occupy before the entire species can be considered recovered.

KFRs are geographic areas that are delineated based on potential

environmental and biological **barriers** or **restrictions** that control the geographic distribution of karst invertebrates. **Barriers** are potential boundaries where migration is not possible owing to factors such as a lack of cavernous bedrock. **Restrictions** are potential boundaries where migration may be possible but is thought to be limited by spatiotemporal variation in factors that include geologic controls or biologic interactions (e.g., Species A was once widespread across varying karst areas; Species B actively colonizes subterranean habitats in a portion of the range of Species A; Species B outcompetes Species A and restricts its geographic range).

The first KFR boundaries were conceptualized in a report submitted to the Service in 1992 and later implemented within the Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties in 1994 (Veni 1992; USFWS 1994b). This group of KFR boundaries are informally referred to as the “**Austin Area**.” A separate study was conducted on behalf of the Service in 1994 to define the first KFR boundaries within Bexar County (Veni 1994). This group of KFR boundaries are informally referred to as the “**San Antonio Area**.” These KFR boundaries were later revised in 2003 and implemented within the Bexar County Karst Invertebrates Recovery Plan (Veni 2003; USFWS 2011).

All references from initial conception to revision of the KFR concept for both the Austin and San

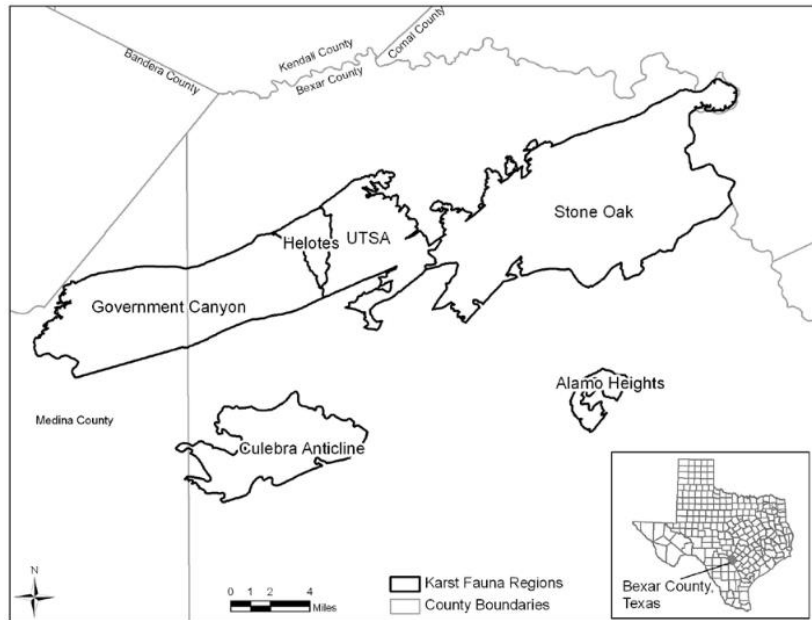


Figure 1: Karst Fauna Regions defined within the Bexar County Karst Invertebrates Recovery Plan (USFWS 2011).

Antonio Areas are listed below, along with details of each regions name and listed species associations. Full references are provided within the References section.

Austin Area

- 1992** Veni G. Geologic controls on cave development and the distribution of cave fauna in the Austin, Texas, region.
- 2007** Veni G, Martinez C. Revision of karst species zones for the Austin, Texas, area.
- 2021*^α** Veni G, Jones M. Statistical analysis and revision of endangered karst species distribution, Austin area, Texas

** Current version; ^α updated by the Service to reflect updated geologic mapping data*

Table 1: Formal and Informal Karst Fauna Regions within the Austin Area.

Formal KFR	Informal KFR
Central Austin East Cedar Park Georgetown Jollyville Plateau McNeil – Round Rock North Williamson Post Oak Ridge Rollingwood South Travis West Cedar Park	Blanco-Cypress Downtown Austin Hays County Marble Falls Pedernales Pflugerville South Bell County South Fort Hood Undesignated

Table 2: Austin Area Karst Fauna Regions known to be inhabited by listed karst invertebrate species.

<u>KFR</u>	<i>Batrisodes texanus</i>	<i>Rhadine persephone</i>	<i>Tartarocreagris texana</i>	<i>Tayshaneta myopica</i>	<i>Texella reddelli</i>	<i>Texella reyesi</i>	<i>Texamaurops reddelli</i>
Rollingwood				X	X		
Central Austin						X	
McNeil - Round Rock				X		X	
East Cedar Park		X				X	
Jollyville Plateau		X	X	X		X	X
West Cedar Park		X					
Georgetown	X					X	
North Williamson	X					X	

Note: this is the Service's current understanding of listed species distribution at the time of this document's publication. This is subject to change upon further survey and genetic study.

San Antonio Area

- 1994** Veni G. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, region.
- 2003** Veni G. Delineation of hydrogeologic areas and zones for the management and recovery of endangered karst invertebrate species in Bexar County, Texas
- 2024*** Veni G, Cooper J, Dickerson W. Statistical analysis and revision of endangered karst invertebrate species distribution, San Antonio area, Texas

* *Current version*

Table 3: Formal and Informal Karst Fauna Regions within the San Antonio Area.

Formal KFR	Informal KFR
Alamo Heights Culebra Anticline Government Canyon Helotes Stone Oak UTSA	Central Medina Central San Antonio Interstate Highway 35 New Braunfels Northern Bexar Western Comal

Table 4: San Antonio Area Karst Fauna Regions known to be inhabited by listed karst invertebrate species.

<u>KFR</u>	<i>Batrisodes venyivi</i>	<i>Cicurina baronia</i>	<i>Cicurina madla</i>	<i>Cicurina verspera</i>	<i>Tayshaneta microps</i>	<i>Rhadine exilis</i>	<i>Rhadine infernalis</i>	<i>Texella cokendolpheri</i>
Government Canyon	X		X	X	X	X	X	
Helotes	X		X			X	X	
UTSA	X		X			X	X	
Stone Oak			X			X	X	
Culebra Anticline			X	X	X	X	X	
Alamo Heights		X						X

Note: this is the Service's current understanding of listed species distribution at the time of this document's publication. This is subject to change upon further survey and genetic study.

Karst Zones

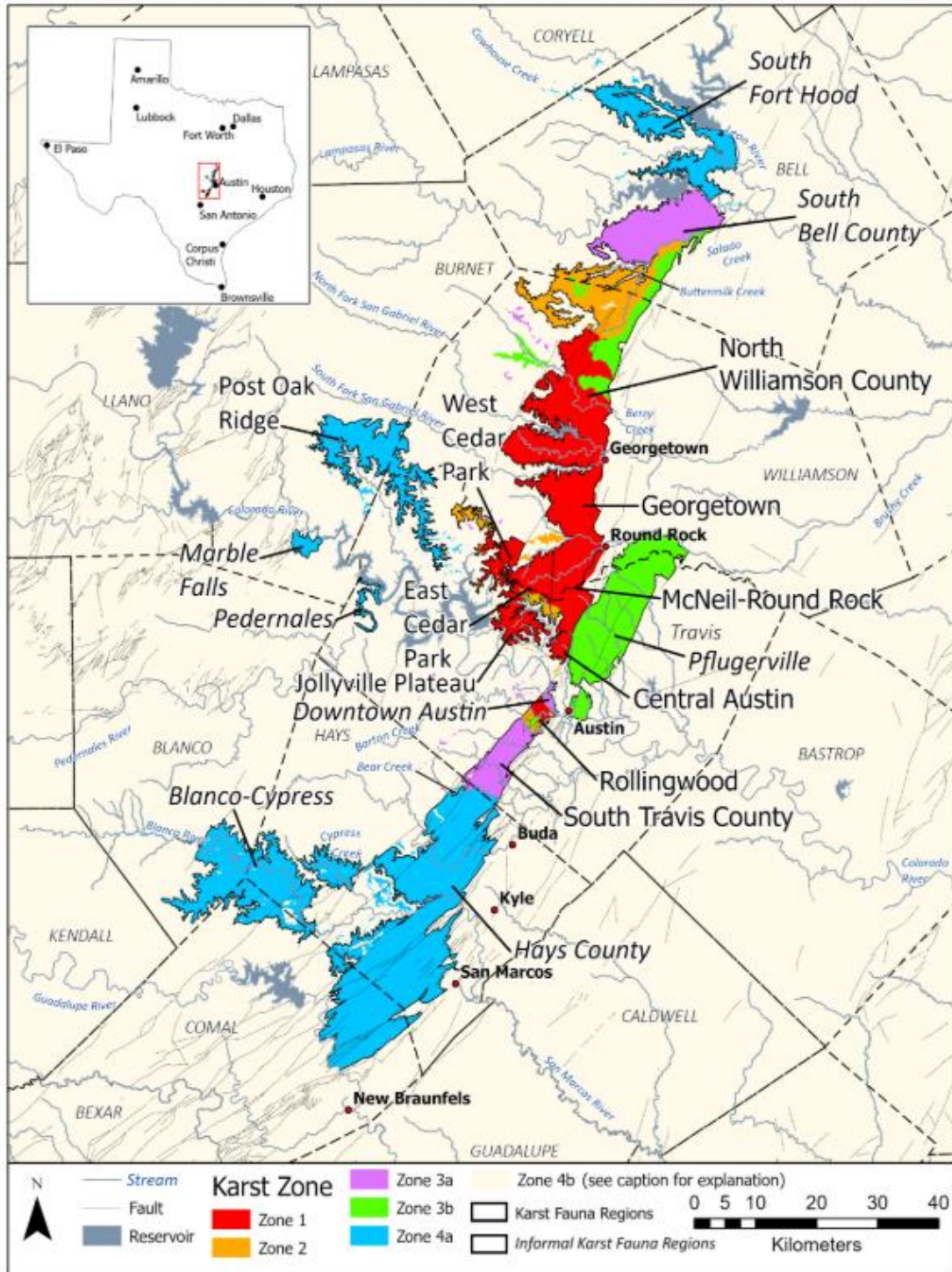


Figure 2: Karst Zone map for the Austin Area (Veni and Jones 2021).

While KFRs serve as *Recovery Units* for each listed karst invertebrate species, Karst Zones are delineated areas that inform the likelihood of rare or endangered species being present. Each Karst Zone is delineated within the boundaries of an established KFR, primarily based on lithology (i.e., the general physical characteristics of rock types). Presently, both the Austin and San Antonio Areas adhere to the same system of Karst Zone definitions (below).

- Karst Zone 1** Areas known to contain endangered karst invertebrate species.
- Karst Zone 2** Areas having a high probability of suitable habitat for endangered or other endemic karst invertebrate species
- Karst Zone 3a** Areas suitable for endangered karst invertebrate species but which have a low probability of containing endangered karst species because the habitat is occupied by other karst invertebrate species.
- Karst Zone 3b** Area which have a low probability of containing endangered karst invertebrate species because they are poorly suited for karst invertebrate species.
- Karst Zone 4a** Area suitable for karst invertebrate species but which do not contain endangered karst species because the habitat is occupied by other karst invertebrate species.
- Karst Zone 4b** Areas which do not contain karst invertebrate species.

Use of Karst Zones

Importantly, Karst Zones are predictive areas based on current understandings of geology and have inherent inaccuracy owing to the scale at which mapping efforts are based. For example, portions of the cavernous areas used to define both KFR and Karst Zone boundaries are based on the *Geologic Atlas of Texas*, which is digitally mapped at a scale of 1:250,000. This translates to a margin of error that exceeds 400 feet horizontally. As such, field evaluation is key to ensure that karst features and/or potential karst invertebrate habitat is present or absent within a subject property. The Service recommends that karst feature surveys be conducted within a subject property if it is within 500 feet of the boundaries of Karst Zones 1, 2, 3a, or 3b (as described in the *Section 10(a)(1)(A) Scientific Permit Requirements for Conducting Presence/Absence Surveys for Endangered Karst Invertebrates in Central Texas*).

References

National Marine Fisheries Service (NMFS). 2020. Recovery Planning Handbook, Version 1.0. U.S. National Oceanic and Atmospheric Administration, Silver Spring, Maryland. 246 pp.

U.S. Fish and Wildlife Service (USFWS). 1994a. Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to Delist Seven Texas Karst Invertebrates. Federal Register 59: 11755 – 11758.

_____. 1994b. Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas. Albuquerque, New Mexico. 154 pp.

_____. 2000. Endangered and Threatened Wildlife and Plants; Final Rule to List Nine Bexar County, Texas Invertebrate Species as Endangered. Federal Register 65: 81419 – 81433.

_____. 2011. Bexar County Karst Invertebrates Recovery Plan. USFWS, Albuquerque, New Mexico. 84 pp.

_____. 2019. Amendment 1 – Recovery Plan for Endangered Karst Invertebrates in Travis and Williamson Counties, Texas. Albuquerque, New Mexico. 42 pp.

_____. 2022. Endangered and Threatened Wildlife and Plants; Removing the Bracken Bat Cave Meshweaver from the List of Endangered and Threatened Wildlife. Federal Register 87: 51925 – 51928.

Veni G. 1992. Geologic controls on cave development and the distribution of cave fauna in the Austin, Texas, region. Report prepared for the Austin Ecological Field Services Office, Austin, Texas. 82 pp.

_____. 1994. Geologic controls on cave development and the distribution of endemic cave fauna in the San Antonio, Texas, region. Report prepared for Texas Parks and Wildlife Department and the Austin Ecological Field Services Office, Austin, Texas. 105 pp.

_____. 2003. Delineation of hydrogeologic areas and zones for the management and recovery of endangered karst invertebrate species in Bexar County, Texas. Report prepared for the Austin Ecological Field Services Office, Austin, Texas. 14 pp.

Veni G, Martinez C. 2007. Revision of karst species zones for the Austin, Texas, area. Report prepared for the Austin Ecological Services Field Office, Austin, Texas. 45 pp.

Veni G, Jones M. 2021. Statistical analysis and revision of endangered karst species distribution, Austin area, Texas. National Cave and Karst Research Institute Report of Investigation 10, Carlsbad, New Mexico. 58 pp.

Veni G, Cooper J, Dickerson W. 2024. Statistical analysis and revision of endangered karst invertebrate species distribution, San Antonio area, Texas. Prepared for the Texas Department of Transportation: Voluntary Conservation Measure for US 281 from Loop 1604 to the Comal County Line, Bexar County, Texas. 74 pp.

