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AQUIFER SPECIES FOR EVALUATION



Eurycea tridentifera from type locality, Honey Creek Cave, Comal and Kendall counties

Prepared for:
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Abstract

We reviewed biological and hydrological literature to create a list of 34 taxa that should be evaluated by the EARIP (Edwards Aquifer Recovery Implementation Plan) in reference to coverage by the EAHCP (Edwards Aquifer Habitat Conservation Plan). These species are not currently listed as endangered by the USFWS (United States Fish and Wildlife Service), but have some likelihood of being affected by the covered activities and of being listed within the duration of the EAHCP take permit. Fifteen of those 34 taxa have been petitioned for listing, and nine of those 15 were recently ruled on and considered by USFWS as “may be warranted” for listing (USFWS 2009a and 2009b).

Methods

Literature review included a search of the Texas Memorial Museum database on subterranean species. James Reddell maintains this database, and it is considered the most complete and centralized source of information on localities of subterranean organisms for the state of Texas. We consulted original literature (e.g. species descriptions, locality accounts), the Hays County Regional Habitat Conservation Plan, and the federal register. In order to decide what species to include in Table 1, we focused on rare species that occur in the same localities as the species to be covered in the plan (San Marcos Springs, Comal Springs, Hueco Springs, Fern Bank Springs). The reason we focused on these localities is that the permit applicant may need relatively little additional resources to cover these rare species, in which case the relative benefit (of future coverage) for the small additional effort could be great.

Results

Table 1 shows 33 taxa for potential consideration as evaluation species. The Edwards Aquifer has many more rare species than are on this list, we narrowed down to these 33 based on the following reasons:

- similar range as species covered by EAHCP (San Marcos Springs, Comal Springs, Hueco Springs, Fern Bank Springs)
- similar habitat as species covered by EAHCP (springs, wells, caves, aquifer)
- similar threats as species covered by EAHCP (limited distribution, areas with high development threats, small populations)
- petitioned for federal listing (USFWS 2009)

Several of the sites that appear multiple times in this table deserve a brief discussion. Ezell’s Cave and the Artesian Well on Texas State University campus are very close to San Marcos Springs. They contain a similar faunal assemblage to San Marcos Springs, and the populations may in fact be the same. Ezell’s Cave was dye traced to San Marcos Springs with a very fast flow time (less than 2 days).

Discussion

The table of 34 taxa should be considered by the EAHCP permit applicant. The permit applicant may want to consider one of three routes (or others not covered here). First, the species could be treated as listed, and therefore fully covered by the permit in the eventuality of future listing. In the cases of taxa with similar habitats and threats as the listed species, there may be relatively little additional effort required to cover these rare species, in which case the relative benefit (of future coverage) for the small additional effort could be great. A major challenge with covering these species that little is known about is the task of linking specific harmful activities to specific estimates of take. Second, the

species could be treated as "evaluation species." In this case, the species may receive some benefit from the actions required by the permit holder for the covered species, and this additional benefit may help preclude the species from being listed. However if the species are listed in the future the permit holder receives no coverage. Finally, this list of species could be considered then discarded. The permit holder may not wish to burden their HCP obligations with additional species, or may decide that inadequate information is available about these species to include them in the plan.

This report is a casual accumulation of the data easily available, put together for the intent of a preliminary examination of the subject. If the permit applicant decides to go further on the subject, more information is available for review than what we presented herein.

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Personnel

Dr. Jean Krejca performed the biological reviews of all the species, managed the project, and wrote the text. She is a subterranean species specialist. Jean has a Bachelor's degree in Zoology, and a Ph.D. in Evolution, Ecology and Behavior from the University of Texas. Her dissertation work focused on cave adapted aquatic fauna, biogeography and hydrology of Texas and North Mexico. Since 1991 she has worked as a cave biologist and her experience in that area spans across the United States (Arkansas, California, Texas, Nevada, Illinois, Missouri, Indiana, Tennessee, North and South Carolina) as well as Mexico, Belize, Thailand and Malaysia. Her publication list on these areas is extensive. Texas cave biology experience started in 1997 and includes detailed collections of aquatic cave fauna for research, monitoring for endangered species, and working as a Karst Invertebrate Specialist for the U.S. Fish and Wildlife Service. In 2003 she co-founded Zara Environmental LLC where she continued her work from independent consulting and expanded to perform land management for landowners with endangered species, consult on endangered species permits, and perform custom research projects. In addition she has been involved with a variety of public outreach efforts such as public talks, field trips, and cave biology photography. She holds a USFWS endangered species permit (TE028652-0) and several state permits covering karst invertebrates and salamanders in Texas.

Marcus O. Gary reviewed the document. Marcus is a Ph.D. candidate hydrogeologist specializing in karst forming processes and the implications that karst geology has on natural resource management. Marcus received an Associate of Science degree in Marine Technology at the College of Oceanering, a B.S. degree in hydrogeology and environmental geology at the University of Texas, and is currently working on a volcanogenic karst dissertation project at the University of Texas. His research has been internationally recognized for investigating of the world's deepest underwater sinkhole and interpreting the geologic mechanisms that formed the karst system. For eight years he worked in the Texas Water Science Center of the U.S. Geological Survey, performing a multitude of tasks related to water resources. Projects included developing methods to quantify spring flow using acoustic technology, monitoring stage and water chemistry parameters at springs, performing a geochemical investigation of the Barton Springs Segment of the Edwards Aquifer, providing diving support for coring and karst monitoring projects, serving as a dive safety officer for the Central Region, and designing and implementing a variety of continuous monitoring projects at locations across Texas. His work at Zara since 2007 includes geologic assessments, drainage basin delineation, and dye tracing.

Table 1. List of potential Evaluation Species for EARIP. Abbreviations are as follows: Ezells = Ezell's Cave; Art. Well = the Artesian Well on Texas State University Campus; SMS = San Marcos Springs; Hueco = Hueco Springs; Honey CC = Honey Creek Cave; CWB Artesian Well = City Water Board Artesian Well No. 4; Verst. Well = Verstraeten Well (No. 1); OR Well = O.R. Mitchell Well; TMM = Texas Memorial Museum; Comal = Comal Springs; ** = USFWS determined listing may be warranted.

Order	Family	Species	Localities	Nearly identical range as EAHCP covered species?	Petitioned for listing?	Notes on rarity	Range	Comments	source of information
Tricladida	Kenkiidae	<i>Sphalloplana mohri</i>	Ezells, Art.Well	Yes	No	2 sites	Hays	Some taxonomy issues	TMM database 2001, Kenk 1977
Taenioglossa	Hydrobiidae	<i>Phreatodrobia conica</i>	Hueco, Honey CC, CWB Artesian Well	No	Yes	3 sites	Hays, Comal, Bexar		TMM database 2001 USFWS 2009a
Taenioglossa	Hydrobiidae	<i>Phreatodrobia imitata</i>	Verst. Well, OR Well	No	Yes**	2 sites	Bexar		USFWS 2009b
Taenioglossa	Hydrobiidae	<i>Phreatodrobia micra</i>	Hueco, SMS, Art.Well and others	No	No	6 reliable sites	Comal, Hays, Kendall		TMM database 2001
Taenioglossa	Hydrobiidae	<i>Phreatodrobia nugax</i>	Springs on S.A. River, SMS, and 9 others	No	No	11 sites	Bexar, Comal, Hays, Kendall, Travis, Uvalde	Subspecies with various ranges	
Taenioglossa	Hydrobiidae	<i>Phreatodrobia plana</i>	SMS, Art.Well, Natural Bridge Caverns	Yes	No	3 sites	Comal, Hays		TMM database 2001
Taenioglossa	Hydrobiidae	<i>Phreatodrobia punctata</i>	SMS, Barton Springs	No	No	2 sites	Hays, Travis		TMM database 2001
Taenioglossa	Hydrobiidae	<i>Phreatodrobia rotunda</i>	SMS, Art.Well	Yes	Yes	2 sites	Hays		TMM database 2001, USFWS 2009a
Pharyngobdellida	Erpobdellidae	<i>Mooreobdella</i> n.sp.	SMS, Art.Well, Ezells	Yes	No	3 sites	Hays		TMM database 2001, R. Gibson pers. comm. 2008
Thermosbaenacea	Thermosbaeniidae	<i>Tethysbaena texana</i>	Art.Well, SMS, Ezells, and 4 others	No	No	7 sites	Comal, Bexar, Hays, Uvalde		Stock and Longley 1981, Gibson et al. 2008, R. Gibson pers. comm. 2008
Amphipoda	Bogidiellidae	<i>Artesia subterranea</i>	Art.Well, Ezells, Comal, and 2 others in W. TX	No	Yes	5 sites	Comal, Hays, Terrell, Val Verde		Holsinger and Longley 1980, Gibson et al. 2008, USFWS 2009a

Table 1, continued. List of potential Evaluation Species for EARIP. Abbreviations are as follows: Ezells = Ezell's Cave; Art. Well = the Artesian Well on Texas State University Campus; SMS = San Marcos Springs; Hueco = Hueco Springs; Honey CC = Honey Creek Cave; CWB Artesian Well = City Water Board Artesian Well No. 4; Verst. Well = Verstraeten Well (No. 1); OR Well = O.R. Mitchell Well; TMM = Texas Memorial Museum; Comal = Comal Springs; ** = USFWS determined listing may be warranted.

Order	Family	Species	Localities	Nearly identical range as EAHCP covered species?	Petitioned for listing?	Notes on rarity	Range	Comments	source of information
Amphipoda	Bogidiellidae	<i>Parabogidiella americana</i>	Art. Well, Ezells, and 5 others	No	No	7 sites	Bexar, Comal, Hays	Also an undescribed spp. from Comal Springs	TMM database 2001
Amphipoda	Crangonyctidae	<i>Stygobromus flagellatus</i>	Art. Well, SMS, Comal, Ezells, and 6 others	No	No	10 sites	Bexar, Comal, Hays, Travis	Bexar and Uvalde specimens with taxonomic uncertainty	Holsinger 1966, Holsinger 1967, Holsinger and Longley, 1980, Gibson et al. 2008, Gibson pers. comm. 2009
Amphipoda	Hadziidae	<i>Allotexiweckelia hirsuta</i>	Art. Well and 2 others	No	No	3 sites	Hays, Bexar		TMM database 2001
Amphipoda	Hadziidae	<i>Holsingerius samacos</i>	Art. Well	Yes	Yes	1 site	Hays	One other possible locality in Bexar Co.	TMM database 2001, USFWS 2009b
Amphipoda	Hadziidae	<i>Mexiweckelia hardeni</i>	Comal, and 6.5 km E of Hondo	No	No	2 sites	Comal, Medina		TMM database 2001
Amphipoda	Hadziidae	<i>Texiweckelia texensis</i>	Art. Well, Ezells, SMS	Yes	No	3 sites	Hays		Holsinger and Longley, 1980, R. Gibson pers. comm.
Amphipoda	Hadziidae	<i>Texiweckeliopsis insolita</i>	Art. Well, SMS, Verst. Well	Yes	No	3 sites	Bexar, Hays		Holsinger and Longley, 1980
Amphipoda	Ingolfiellidae	<i>Ingolfiella</i> n.sp.	Comal, Finegan Springs	No	No	2 sites	Comal, Val Verde	Undescribed but recognized	Gibson et al. 2008

Table 1, continued. List of potential Evaluation Species for EARIP. Abbreviations are as follows: Ezells = Ezell's Cave; Art. Well = the Artesian Well on Texas State University Campus; SMS = San Marcos Springs; Hueco = Hueco Springs; Honey CC = Honey Creek Cave; CWB Artesian Well = City Water Board Artesian Well No. 4; Verst. Well = Verstraeten Well (No. 1); OR Well = O.R. Mitchell Well; TMM = Texas Memorial Museum; Comal = Comal Springs; ** = USFWS determined listing may be warranted.

Order	Family	Species	Localities	Nearly identical range as EAHCP covered species?	Petitioned for listing?	Notes on rarity	Range	Comments	source of information
Amphipoda	Sebidae	<i>Seborgia relict</i>	Comal, Art.Well, Ezells, SMS, 4 mi. E of Hondo	Yes	Yes	5 sites	Comal, Hays, Medina	(listed as <i>Texiweckelia relict</i> in fed. Reg.)	Holsinger and Longley 1980, Holsinger 1992, Gibson et al. 2008, USFWS 2009b
Isopoda	Asellidae	<i>Lirceolus pilus</i>	Comal, Hueco, SMS plus 3 others	No	No	6 sites	Bandera, Burnet, Comal, Hays, Medina		
Isopoda	Asellidae	<i>Lirceolus smithii</i>	Art.Well, SMS	Yes	Yes**	2 sites	Hays	Fed. Reg. notes this occurs in several counties – this is contrary to published literature	Bowman and Longley 1976, Gibson et al. 2008, USFWS 2009b
Decapoda	Palaemonidae	<i>Palaemonetes antrorum</i>	Art.Well, Ezells, Johnson's Well, OR Well, Verst. Well and others	No	No	8-10 sites	Bexar, Hays, possibly Uvalde		TMM database 2001
Decapoda	Palaemonidae	<i>Calathaemon holthuisi</i>	SMS, Ezells	Yes	Yes	2 sites	Hays	(listed as <i>Palaemonetes holthuisi</i> in fed. Reg.)	TMM database 2001, Strenth 1976, R. Gibson, pers. comm. 2008, USFWS 2009b
Coleoptera	Dytiscidae	<i>Comaldessus stygius</i>	Comal, Fern Bank Springs	Yes	Yes	2 sites	Comal, Hays		Gibson et al. 2008, USFWS 2009b
Coleoptera	Dytiscidae	<i>Haideoporus texanus</i>	Art.Well, Comal	Yes	Yes**	2 sites	Comal, Hays		Young and Longley 1976, 5 USFWS 2009b

Table 1, continued. List of potential Evaluation Species for EARIP. Abbreviations are as follows: Ezells = Ezell's Cave; Art. Well = the Artesian Well on Texas State University Campus; SMS = San Marcos Springs; Hueco = Hueco Springs; Honey CC = Honey Creek Cave; CWB Artesian Well = City Water Board Artesian Well No. 4; Verst. Well = Verstraeten Well (No. 1); OR Well = O.R. Mitchell Well; TMM = Texas Memorial Museum; Comal = Comal Springs; ** = USFWS determined listing may be warranted.

Order	Family	Species	Localities	Nearly identical range as EAHCP covered species?	Petitioned for listing?	Notes on rarity	Range	Comments	source of information
Caudata	Plethodontidae	<i>Eurycea pterophila</i>	Fern Bank Springs and others	No	No	Over 10 sites	Blanco, Hays, Kendall, possibly Comal		Sweet 1977, Chippindale et al. 2000, J. Krejca, pers. comm. 2008
Caudata	Plethodontidae	<i>Eurycea robusta</i>	Underneath Blanco River at I-35	Yes	Yes**	1 site	Hays	Not observed since 1951	
Caudata	Plethodontidae	<i>Eurycea</i> sp. (nana-sosorum) federally listed	Spillar Ranch Springs, Stuart Springs, Cold Springs, Barton Springs, Blowing Sink Cave	Yes	This species is already federally listed	5 sites	Hays, Travis	Not well documented in the literature	Bendik 2006
Caudata	Plethodontidae	<i>Eurycea tridentifera</i>	Honey CC and others	No	Yes**	Probably between 10-15 sites	Comal, Kendall, Bexar	Some taxonomic uncertainty as to exact spp. boundary with <i>E. latitans</i>	USFWS 2009b, Bendik 2006
Caudata	Plethodontidae	<i>Eurycea</i> "sp. 8"	Comal Springs	Yes	Yes**	1 site	Comal	Species not described, but recognized in literature	USFWS 2009b, Chippindale et al. 2000, Bendik 2006
Caudata	Plethodontidae	<i>Eurycea neotenes</i>	Comal Springs and others	No	Yes**	Less than 10 sites	Comal, Bexar, Medina	Recent taxonomic changes to exact spp. boundary	USFWS 2009b, Chippindale et al. 2000, Bendik 2006
Caudata	Ictaluridae	<i>Trogloglanis pattersoni</i>	Wells in Bexar Co.	No	Yes**	About 6 sites	Bexar	Not observed since 1970's	TMM database 2001
Caudata	Ictaluridae	<i>Satan eurystomus</i>	Wells in Bexar Co.	No	Yes**	About 5 sites	Bexar	Not observed since 1970's	TMM database 2001

