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Spatial Data for *Eurycea* Salamander Habitats Associated with Three Aquifers in South-Central Texas

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Introduction

Eurycea salamander taxa comprise 12 known species that inhabit springs and caves in south-central Texas (Chippindale and others, 2000). Many of these are threatened or endangered species, and some are found only at one location. A number of the neotenic salamanders might be at risk from habitat loss associated with declines in ground-water levels.

Eurycea salamander habitats are associated with three aquifers in south-central Texas: (1) the Edwards-Trinity (Plateau) aquifer, (2) the Edwards (Balcones Fault Zone) aquifer, and (3) the Trinity aquifer. The Edwards (Balcones fault zone) aquifer (Ashworth and Hopkins, 1995) is commonly separated into three segments: from southwest to northeast, the San Antonio segment, the Barton Springs segment, and the northern segment. The San Antonio segment is hydrologically separated from the Barton Springs segment by a ground-water divide near Kyle in Hays County. The Barton Springs segment is hydrologically separated from the northern segment by the Colorado River. The Trinity aquifer south of the Colorado River can be divided into three permeable zones. Barker and Ardis (1996) referred to these zones as the upper, middle, and lower zone. North of the Colorado River, permeable units of the Trinity aquifer commonly are referred to by their geologic-unit name. A principle geologic unit of the Trinity aquifer in this area is the Glen Rose Limestone, which was referred to as the Glen Rose aquifer in the USGS Source Water Assessment Program (SWAP) (N.A. Houston, U.S. Geological Survey, unpub. data, 2005).

Purpose and Scope

The U.S. Geological Survey (USGS), in cooperation with the U.S. Fish and Wildlife Service (USFWS), developed this report (geodatabase) to aggregate the spatial data necessary to assess the potential effects of ground-water declines on known *Eurycea* habitat locations in south-central Texas. The geodatabase provides information about spring habitats, spring flow, cave habitats, aquifers, and projected water levels for the middle zone of the Trinity aquifer in south-central Texas. Projected water levels are only for the middle zone of the Trinity aquifer because that zone is the focus of a three-dimensional, numerical ground-water-flow model of the Trinity aquifer in south-central Texas (Mace and others, 2000). The geodatabase does not address the issue of whether *Eurycea* habitats will be adversely affected by ground-water withdrawals nor does it assign vulnerability to particular habitat locations. These data were produced or extracted in a geographic information system (GIS).

Approach

Eurycea spring and cave habitat locations were provided to the USGS by the USFWS in shapefile format. These locations and associated tabular data were organized in a geodatabase. Spring habitat locations were compared to known spring locations in a GIS (Heitmuller and Reece, 2003), and data for those that matched were added to the geodatabase. A 60-meter digital elevation model was used to assign an elevation to spring and cave orifices. Recent (late 1990s) and projected (to 2050) water-level data for the middle zone of the Trinity aquifer (Mace and others, 2000) were obtained from the Texas Water Development Board (TWDB) in tabular and shapefile format, and these data were imported into the geodatabase. Existing GIS datasets of aquifer structure and properties were obtained from the SWAP (N.A. Houston, U.S. Geological Survey, unpub. data, 2005), and these were used to identify the source of water to spring habitats.

The sources of water to spring habitats were identified in a GIS using spring orifice elevations, an arbitrarily assigned spring-orifice depth, and SWAP aquifer datasets. First, spring-orifice depth was arbitrarily set at 100 feet. This value is expected to adequately represent the maximum depth of springs in the region, although several of the largest springs might exceed this depth. Second, SWAP GIS datasets were used to detect (1) all aquifers encountered between the land-surface and the 100-foot depth of the spring, (2) the vertical order of the aquifers, and (3) the percentage of spring-orifice depth accounted for by each aquifer encountered. Precedence was given in assigning an aquifer as water source to the aquifer closest to land surface or to aquifers that accounted for the largest percentage of spring-orifice depth. Most aquifers were automatically selected during the computational procedure; however, a few were manually selected to ensure appropriate designation. Quantitative values characterizing aquifer structure and properties extracted from the SWAP datasets were added to the geodatabase. Finally, using the TWDB dataset derived from the Trinity aquifer ground-water-flow model of Mace and others (2000), recent (late 1990s) and projected (to 2050) ground-water levels were extracted for spring habitats associated with the middle zone of the Trinity aquifer.

Spatial Data

One-hundred eighty-one springs and 36 caves were identified as *Eurycea* habitats in south-central Texas (fig. 1). Using the SWAP aquifer datasets and nomenclature, 68 springs flow from the Edwards-Trinity (Plateau) aquifer, 53 springs flow from the upper zone of the Trinity aquifer, 24 springs flow from the Edwards (Balcones fault zone) aquifer—north (northern segment), 19 springs flow from the middle zone of the Trinity aquifer, 8 springs flow from the Edwards (Balcones fault zone) aquifer—south (San Antonio and Barton Springs segments combined), 8 springs flow from the Glen Rose aquifer, and 1 spring was of indeterminate source. For those springs flowing from the middle zone of the Trinity aquifer, projected water levels for both average recharge conditions and drought-of-record conditions (Mace and others, 2000) show drawdown at every spring. In 2050 under average recharge conditions, aquifer water levels at 15 of 19 springs are projected to decline from recent (late 1990s) water levels by more than 10 feet; in 2050 under drought-of-record conditions, aquifer water levels at 12 of 19 springs are projected to decline from current (late 1990s) by more than 50 feet. Projected water levels for each decade from 2010 to 2050 are in the geodatabase for springs flowing from the middle zone of the Trinity aquifer.

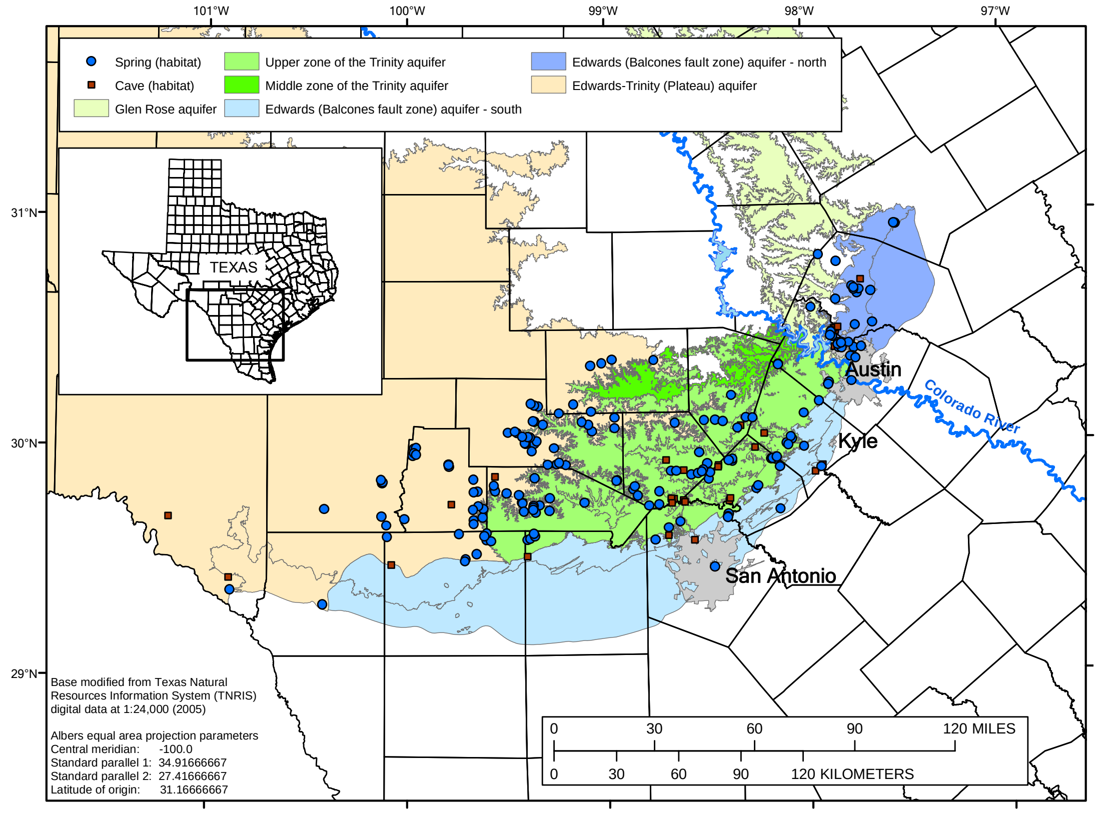

Figure 1. *Eurycea* salamander habitats in south-central Texas.

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