

description of physical and biological features. Specifically, our regulations state that primary constituent elements may include, but are not limited to, the following: Roost sites, nesting grounds, spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, host species of plant pollinator, geological formation, vegetation type, tide, and specific soil types.

Using the best scientific information available to us, we have determined that the primary constituent elements required by the karst invertebrates consist of: (1) The physical features of karst-forming rock containing subterranean spaces with stable temperatures, high humidities (near saturation) and suitable substrates (for example, spaces between and underneath rocks suitable for foraging and sheltering); and (2) the biological features of a healthy surface community of native plants (for example, juniper-oak woodland) and animals (for example, cave crickets) living in and near the karst feature that provide nutrient input and buffer the karst ecosystem from adverse effects (from, for example, nonnative species invasions, contaminants, and fluctuations in temperature and humidity).

Information Sources

As required by the Act and regulations (section 4(b)(2) and 50 CFR 424.12, respectively), we used the best scientific information available to determine critical habitat areas that contain the physical and biological features and primary constituent elements that are essential for the conservation of the karst invertebrate species. This information included: (1) Peer-reviewed scientific publications; (2) the final listing rule for the nine Bexar County karst invertebrate species (65 FR 81419); (3) unpublished field data, survey reports, notes, and communications from qualified biologists or experts; (4) published descriptions of the regional geology (Soil Conservation Service 1962; Veni 1988, 1994, 2002); and (5) recent digital orthophotographs (March 2001) and parcel maps (generated in early 2002) obtained from the Bexar County Appraisal District to determine the current status of habitat surrounding the known occupied caves.

In the proposed rule, we referred to Veni's 1994 karst zone maps to ensure that the majority of the lands within each proposed unit overlaid a contiguous deposit of karst-bearing rock either known to contain the listed species (Zone 1) and/or having a high

probability of suitable habitat for the listed species (Zone 2) to maintain subsurface connectivity for species movement throughout the contiguous karst deposit. Recognizing that a significant amount of additional information has become available, either as a result of the discovery of new caves containing the listed species, or additional biological surveys conducted in previously mapped caves and/or as a result of the release of information not available at the time of the 1994 report, we contracted with George Veni & Associates to re-evaluate and, where necessary, redraw the boundaries of the Bexar County karst zones. The resulting report (Veni 2002) also estimated the surface and subsurface drainage areas associated with each occupied cave in Bexar County with the exception of several caves which occur on cliffs and several for which sufficient information was not available. We received the report during the public comment period and used the information to ensure that each unit overlaid a contiguous deposit of karst-bearing rock and that the estimated drainage basins associated with each occupied cave were, where possible, designated as critical habitat. Contiguous deposits of karst-bearing rock associated with occupied caves subterranean spaces were included to protect subsurface voids believed to maintain populations of the listed species and provide for species movement. The drainage basins associated with occupied caves were included in order to protect the quantity and quality of water entering the karst ecosystem which, in turn, maintains stable temperatures and high humidities required by the listed species and protects the system from contamination.

Information on the status and location of occupied caves was obtained from presence/absence survey reports submitted during project consultations conducted with the Service under section 7 of the Act, annual reports on research and conservation activities conducted under a section 10(a)(1)(A) scientific permit, section 6 species status reports, and literature published in peer reviewed journals. Survey reports and scientific permit annual reports typically contained cave location information in the form of a cave location indicated on a U.S. Geological Survey topographic maps and/or UTM coordinates, and a map of the cave footprint.

To improve the accuracy of our cave location information, we submitted a request to the Texas Speleological Survey (TSS) for any available digital location data (UTM coordinates) for Bexar County caves known to contain

one or more of the nine endangered species. TSS is a non-profit corporation established in 1961 to collect, organize, and maintain information on Texas caves and karst for scientific, educational, and conservation purposes, and to support safe and responsible cave exploration, and is affiliated with the Texas Memorial Museum, the Texas Speleological Association, and the National Speleological Society. TSS provided the majority of the digital location data, and reviewed and confirmed our location data for caves where no digital information was available. The precision of the locations for which digital location data were available ranges from 1 m to 10 m (3 ft to 33 ft) and data documented on topographic maps was estimated to be accurate to within 10 m to 20 m (33 ft to 66 ft). This variability in precision was taken into account when delineating unit boundaries. We further agreed that any requests for such information would be directed to TSS as owners of the data. The precise location of the caves within each unit is not specified on the critical habitat maps in order to protect these caves from potential vandalism and to protect private landowners from potential increases in trespassing.

Criteria Used To Delineate Critical Habitat

Using the best scientific data available (as summarized in the "Background" section), we developed the following criteria to identify and delineate lands for designation as critical habitat: caves known to be occupied by one or more of the listed karst invertebrate species; the cave footprint; the surface and subsurface drainage areas associated with each cave, to the extent possible; a 150 m (492 ft) area around each cave to encompass the cave cricket foraging area of 50 m (164 ft) on the surface, measured from the cave entrance(s) and a 100 m (328 ft) area around the cave cricket foraging area to buffer the animal community, including cave crickets, against the effects of urban edges and red imported fire ant invasion; and, where possible, a minimum of 16 ha (40 ac) around each cave or cave cluster. This minimum 16 ha core area consists of a minimum 13 ha (33 ac) needed to support at least 15 of 24 species of the vegetative community commonly found on the Edwards Plateau, plus a 3 ha (7 ac) area to buffer the vegetative community against edge effects associated with urban disturbances. This surface area also acts to incorporate areas of contiguous karst deposit around an occupied cave, which likely contains the listed species that occupy the cave.