MIAMI CAVE CRAYFISH
Procambarus milleri

Order: Decapoda
Family: Cambaridae
FNAI Ranks: G1/S1
U.S. Status: none
FL Status: none

Description: Although stygobitic (dwelling in the aquifer), this medium-small crayfish still retains pigment and functional eyes and is more robust than most cave-adapted species. The body is a shade of orange, with one or two more intense dorsal stripes down the abdomen; eyes are faceted with a black pigment spot. Total body length (cephalothorax plus abdomen) of wild-caught specimens can be at least 38 mm (1.5 in.), and in captivity has reached 64 mm (2.5 in.); males and females are of similar size (Radice and Loftus 1995). Specific identification is based on fine morphological features. The first pleopod of form I (reproductive) males, in which the mesial process is sinuous and directed distally, is unique among troglobitic crayfishes (Hobbs 1971). The rostrum lacks tubercles and marginal spines. Hobbs (1971) provides detailed descriptions of both sexes, and Hobbs et al. (1977) illustrate diagnostic body parts.

Similar Species: No other cavernicolous crayfishes are known from southern Florida. Morphologically, *Procambarus milleri* shares characteristics with other members of the subgenus *Leconticambarus*, although it is the only troglobitic species in the group. Florida surface (epigean) species in the subgenus include *P. econfinae*, a threatened species endemic to Bay County in the Panhandle, and *P. alleni*, a common surface species in the southern peninsula and clearly the one from which *P. milleri* was relatively recently derived (Hobbs 1971). The last two are distinguished by the absence of marginal spines and tubercles on the rostrum of *P. milleri*, and the larger size at maturity (to 100 mm = 4 in.) and plain brown coloration of *P. alleni*. Because of similarities among Florida's many species of crayfishes, identifications should be confirmed by an expert.

Habitat: This species is found in subterranean karst habitats in a shallow freshwater aquifer within the limestone formation known as Miami Oolite. Nutrients enter this aquifer through holes and crevices in the overlying Florida pinelands and marshes, which allows bits of plants and other detritus to filter down into the cave system (Radice and Loftus 1995). Most specimens have been taken in traps associated with wells 5-7 m deep (Hobbs 1971,

Loftus et al. 2001).

Seasonal Occurrence: Loftus et al. (2001) speculated based on its fairly stable environment that *P. milleri* was potentially capable of reproductive activity year-round, as has been observed in captivity (Radice and Loftus 1995). The original series of specimens from Miami included form I males taken in February, March, and May; second form (non-reproductive) males were obtained in January, February, March, July, and August (Hobbs 1971, Franz et al. 1994).

Florida Distribution: All known sites are within a range measuring ca. 30 km x 7 km in Miami-Dade County (Radice and Loftus 1995; W. F. Loftus, unpublished data; A. G. Stern, unpublished data). Although known from more than a dozen sites (mostly wells drilled into the underlying aquifer), many, if not all, are probably interconnected.

Range-wide Distribution: This species is endemic to Florida.

Conservation Status: This may be one of the most threatened species of troglobites in Florida. Saltwater intrusion and sea level rise accompanying global warming represent serious threats to the freshwater aquifer of southeastern Florida. Occurrence in and near a major metropolitan-industrial-agricultural area (greater Miami and adjacent eastern Everglades) further exposes the species to extensive threats to its habitat. These threats will be difficult if not impossible to control in the future (Deyrup and Franz 1994). As a troglobitic species, it is probably quite fragile and sensitive to changes in habitat, especially water quality and salinity. In general, subterranean fresh waters, such as inhabited by this crayfish, face a variety of potential threats; these include chemical pollution, mining, and excessive water withdrawal to support human consumption, agriculture, and industry. Population data for this species are non-existent and virtually impossible to obtain given that most of its primary habitat is inaccessible. Thus, population declines, though possibly having occurred in the last several decades, are difficult to observe and may go unnoticed.

Protection and Management: As for all cave-inhabiting crustaceans, protection of groundwater quality and quantity must be the primary focus of conservation, management, and monitoring; this should be addressed in all formal conservation unit management plans along the Miami rockland ridge. Protection of even relatively small natural tracts in this heavily urbanized physiographic region can help to provide clean fresh water to the underlying aquifer. Potential state and federal listing of the species as endangered (under

evaluation in 2022 by the U.S. Fish and Wildlife Service) merit strong consideration.

References: Deyrup and Franz 1994, Franz et al. 1994, Hobbs 1971, Hobbs et al. 1977, Loftus et al. 2001, Radice and Loftus 1995.