Santa Fe Cave Crayfish Biological Status Review Report

March 31, 2011

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
620 South Meridian Street
Tallahassee, Florida 32399-1600

Biological Status Review
for the
Santa Fe Cave Crayfish
(*Procambarus erythrops*)
March 31, 2011

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate all species listed as Threatened or Species of Special Concern as of November 8, 2010 that had not undergone a status review in the past decade. Public information on the status of the Santa Fe cave crayfish (*Procambarus erythrops*) was sought from September 17 to November 1, 2010. The members of the Biological Review Group (BRG) met on November 18, 2010. Group members were David Cook (FWC lead), Paul Moler (independent consultant), and Richard Franz (University of Florida/Florida Museum of Natural History, Emeritus) (Appendix 1). In accordance with rule 68A-27.0012, Florida Administrative Code (F.A.C.), the BRG was charged with evaluating the biological status of the Santa Fe cave crayfish using criteria included in definitions in 68A-27.001, F.A.C., and following the protocols in the *Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0)* and *Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1)*. Please visit http://myfwc.com/wildlifehabitats/imperiled/listing-action-petitions/ to view the listing process rule and the criteria found in the definitions.

In late 2010, staff developed the initial draft of this report which included BRG findings and a preliminary listing recommendation from staff. The draft was sent out for peer review and the reviewers' input has been incorporated to create this final report. The draft report, peer reviews, and information received from the public are available as supplemental materials at http://myfwc.com/wildlifehabitats/imperiled/biological-status/.

The BRG concluded that this species met three listing criteria: Criterion B (geographic range), Criterion C (population size and trend), and Criterion D (population very small or restricted). Staff recommends that the Santa Fe cave crayfish be listed as a Threatened species.

This work was supported by a Conserve Wildlife Tag grant from the Wildlife Foundation of Florida. FWC staff gratefully acknowledges the assistance of the biological review group members and peer reviewers.

BIOLOGICAL INFORMATION

Life History References – Franz 1982, Franz 1994, Streever 1996, Florida Natural Areas Inventory (FNAI) 2001, NatureServe 2010.

Taxonomic Classification – The current scientific name for the Santa Fe cave crayfish is *Procambarus* (*Ortmannicus*) *erythrops*, with no recognized subspecies (Relyea and Sutton

1975). It is a member of the *lucifugus* complex (Franz and Lee 1982). Alternative common names for this species include Sims Sink cave crayfish and red-eyed cave crayfish.

Population Status and Trend – This species is known historically from 6 sites, although it may have been extirpated at one site due to the dumping of garbage (Franz 1994, Franz et al. 1994, Tom Morris pers. comm.). Only 2 sites contain significant subpopulations. One is the type locality, Sims Sink, which is owned and managed by The Nature Conservancy; the other site, Azure Blue Sink, may need protection (Franz 1994, NatureServe 2010). The subpopulation at Sims Sink was estimated to number 500, mostly mature, individuals. No subpopulation is estimated to contain more than 1000 individuals, although the rangewide population may be >1000 (Franz 1982, Streever 1996).

Geographic Range and Distribution – This species is endemic to Florida and is known only from sites in southern Suwannee and southwestern Columbia counties (Franz 1994, Franz et al. 1994, NatureServe 2010, Tom Morris pers. comm.).

Quantitative Analyses – We are not aware of a population viability analysis that has been done for the Santa Fe cave crayfish.

BIOLOGICAL STATUS ASSESSMENT

Threats – Potential threats include changes in hydrology and detrital flow (Franz 1982, Franz 1994, NatureServe 2010), garbage dumping, and mining (Florida Natural Areas Inventory 2001). A kill and post-kill recovery of a related cave crayfish, *P. pallidus*, was reported for a Suwannee County cave due to physicochemical changes associated with flushing of contaminants or Suwannee River water during a flood event (Walsh 2001).

Population Assessment – The BRG concluded that this species met three criteria: Criterion B (geographic range), Criterion C (population size and trend), and Criterion D (population very small or restricted). This assessment is specifically written as B1+2ab(ii,iii,v); C2a(i); D2. Specific findings from the BRG, including justification and pertinent references, are included in the Biological Status Review Information Findings tables below.

LISTING RECOMMENDATION

Staff recommends that the Sim's Sink or Santa Fe Cave crayfish, *Procambarus erythrops*, be listed as a Threatened species because it meets listing criteria as described in 68A-27.001, F.A.C.

SUMMARY OF THE INDEPENDENT REVIEW

Comments were received from two reviewers, Dr. Keith Crandall (Brigham Young University) and Dr. Dale Jackson (Florida Natural Areas Inventory). Appropriate editorial changes recommended by the reviewers were made to the report. This included a recommendation to adopt "Santa Fe cave crayfish" as the primary common name to use in reference to this species. One reviewer stated that "More information on the population structure

and gene flow across karst systems would help in understanding the population size and threats of this species." He also pointed out that while the findings table indicates that there are no data to support a decline in the population, there are also no data to support that the population is stable. He was concerned that this suggests that the conclusion is we assume populations are stable when we have no data. Staff understand the concern and agree that we cannot assume a population is stable in the absence of data; nor do we mean to imply this is the case and the Santa Fe crayfish met several other listing criteria indicating that the species is at risk. Both reviewers concurred with the staff recommendation to include the Santa Fe cave crayfish on the State-designated Threatened list. Peer reviews are available at MyFWC.com.

LITERATURE CITED

Florida Natural Areas Inventory. 2001. Santa Fe Cave crayfish, *Procambarus erythrops*. Field guide to the rare animals of Florida. Florida Natural Areas Inventory, Tallahassee, Florida.

Franz, R. 1982. Species of Special Concern: Red-eyed cave crayfish. Pp. 112-113 in Franz, R. (ed.). Rare and endangered biota of Florida. Volume Six. Invertebrates. University Presses of Florida.

Franz, R. 1994. Rare: Santa Fe Cave crayfish. Pp. 195-197 in Deyrup, M. and R. Franz (eds.). Rare and endangered biota of Florida. Volume IV. Invertebrates. University Press of Florida.

Franz, R., J. Bauer, and T. Morris. 1994. Review of biologically significant caves and their faunas in Florida and South Georgia. Brimleyana 20: 1-109.

Franz, R. and D.S. Lee. 1982. Distribution and evolution of troglobitic crayfishes of Florida. Bulletin of the Florida State Museum 28: 53-78.

FWC staff. 2010. Created from http://en.wikipedia.org/wiki/List_of_counties_in_Florida and http://dlis.dos.state.fl.us/library/flcollection/landWater.cfm

NatureServe. 2010. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed October 12, 2010.) Note that FNAI provides the data on Florida species to NatureServe.

Relyea, K. and B. Sutton. 1975. A new troglobitic crayfish of the genus *Procambarus* from Florida (Decapoda: Astacidae). Tulane Studies in Zoology and Botany 19: 8-16.

Streever, W.J. 1996. Energy economy hypothesis and the troglobitic crayfish *Procambarus erythrops* in Sim's Sink cave, Florida. American Midland Naturalist 135: 357-366.

Walsh, S.J. 2001. Freshwater macrofauna of Florida karst habitats. Pp. 78-88 in E.L. Kuniansky, ed. U.S. Geological Survey Karst Interest Group Proceedings, Water-Resources Investigations Report 01-4011.

Biological Status Review Information
Findings

Species/taxon: Sims Sink/Santa Fe Cave Crayfish (Procambarus erythrops)
Date: 11/18/10
Assessors: David Cook, Paul Moler, Richard Franz

Generation length: unknown, but est. average 15 yrs; 3 generations = 45 yrs

Criterion/Listing Measure	Data/Information	Data Type*	Criterion Met?	References
*Data Types - observed (O), estimated (E), inferred (I), suspected (S), or projected (P). Criterion met - yes (Y) or no (N).				
(A) Population Size Reduction, ANY of				
(a)1. An observed, estimated, inferred or suspected population size reduction of at least 50% over the last 10 years or 3 generations, whichever is longer, where the causes of the reduction are clearly reversible and understood and ceased[1]	No data supporting 50% decline		N	
(a)2. An observed, estimated, inferred or suspected population size reduction of at least 30% over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible[1]	No data supporting 30% decline		N	
(a)3. A population size reduction of at least 30% projected or suspected to be met within the next 10 years or 3 generations, whichever is longer (up to a maximum of 100 years) [1]	If hydrology and water quality stay the same, projection of 30% decline not anticipated.	P	N	
(a)4. An observed, estimated, inferred, projected or suspected population size reduction of at least 30% over any 10 year or 3 generation period, whichever is longer (up to a maximum of 100 years in the future), where the time period must include both the past and the future, and where the reduction or its causes may not have ceased or may not be understood or may not be reversible.[1]	No data supporting 30% decline		N	
[1] based on (and specifying) any of the following: (a) direct observation; (b) an index of abundance appropriate to the taxon; (c) a decline in area of occupancy, extent of occurrence and/or quality of habitat; (d) actual or potential levels of exploitation; (e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites.				
(B) Geographic Range, EITHER				
(b)1. Extent of occurrence < 20,000 km^2 (7,722 mi^2) OR	Southern Suwannee County, southwestern Columbia County; estimated EOO < 375 mi^2	E	Y	Franz 1994, Franz et al. 1994, FWC staff 2010, Tom Morris pers. comm.
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Southern Suwannee County, southwestern Columbia County; estimated EOO < 375 mi^2	E	Y	Franz 1994, Franz et al. 1994, FWC staff 2010, Tom Morris pers. comm.
AND at least 2 of the following:				

a. Severely fragmented or exist in ≤ 10 locations	6 known localities, some of which may be considered to be the same location; ≤ 6 locations	O	Y	Franz 1994, Franz et al. 1994, FWC staff 2010, Tom Morris pers. comm.
b. Continuing decline, observed, inferred or projected in any of the following: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent, and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals	Continuing decline in area of occupancy (ii), quality of habitat (iii), and number of individuals (v) based on ongoing mining activity	O, P	Y	Florida Natural Areas Inventory 2001, P. Moler pers. obs.
c. Extreme fluctuations in any of the following: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals	No extreme fluctuations documented	O	N	R. Franz unpub. data
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	Population estimated to be substantially < 10,000	E	Y	Franz 1982; Streever 1996
(c)1. An estimated continuing decline of at least 10% in 10 years or 3 generations, whichever is longer (up to a maximum of 100 years in the future) OR	No data supporting 10% decline		N	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Decline in number of individuals inferred based on continuing decline in area of occupancy and quality of habitat	I	Y	P. Moler and R. Franz pers. comm.
a. Population structure in the form of EITHER	No subpopulation estimated to contain more than 1000 mature individuals	E	Y	Franz 1982; Streever 1996
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation	Not applicable		N	
b. Extreme fluctuations in number of mature individuals	No extreme fluctuations		N	
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	Subpopulation at Sim's Sink estimated to be 500, mostly mature; rangewide population may be >1000	E	N	Franz 1982; Streever 1996
(d)2. Population with a very restricted area of occupancy (typically less than 20 km^2 [8 mi^2]) or number of locations (typically 5 or fewer) such that it is prone to the effects of human activities or stochastic events within a short time period in an uncertain future	6 known localities, some of which may be considered to be the same location due to potential hydrological connectedness; ≤ 6 locations; cave entrances are energy input zones especially susceptible to local threats	O, I	Y	Franz 1994, Franz et al. 1994, Tom Morris pers. comm.
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years	No probability of extinction model done		N	

Initial Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Reason (which criteria are met)
Meets at least one of the criteria	B1+2ab(ii,iii,v); C2a(i); D2
Is species/taxon endemic to Florida? (Y/N)	Y
If Yes, your initial finding is your final finding. Copy the initial finding and reason to the final finding space below. If No, complete the regional assessment sheet and copy the final finding from that sheet to the space below.	
Final Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Reason (which criteria are met)
Meets at least one of the criteria	B1+2ab(ii,iii,v); C2a(i); D2

Appendix 1. Brief biographies of the Santa Fe/Sims Sink cave crayfish Biological Review Group members.

David Cook received his B.S. in Biology from Brown University and his M.S. in Zoology from the University of Florida. He has worked for 24 years as a nongame biologist with GFC/FWC, with primary emphasis on reptiles, amphibians, and invertebrates. He currently serves as the Invertebrate Taxa Coordinator in the FWC's Species Conservation Planning Section, and has drafted management plans on the flatwoods salamander, Panama City crayfish, and Miami blue butterfly.

Richard Franz received his M.S. at the University of Montana. He is an Emeritus, Associate Scientist in Ecosystem Conservation with the Florida Museum of Natural History and an Emeritus, Affiliate Associate Scientist in Wildlife Ecology and Conservation at the University of Florida. He has been studying the ecology and systematics of Florida crayfish for more than forty years. He has conducted field studies and surveys on both the Black Creek and Santa Fe cave crayfish, and published scientific papers on both of these species.

Paul Moler received his B.A. in Biology from Emory University and his M.S. in Zoology from the University of Florida. He worked for 29 years as a research biologist with GFC/FWC, with primary emphasis on reptiles and amphibians. He retired in 2006. Over the last 10 years, he has increasingly focused on research and conservation of Florida's freshwater crayfish and is currently completing a Commission funded genetic assessment of the cave crayfishes of Florida.

Appendix 2. Summary of letters and e-mails received during the solicitation of information from the public.

None received.