Crystal Darter 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
Crystal Darter
(*Crystallaria asprella*)
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 crystal darter was sought from September 17 to November 1, 2010. The three member biological review group (BRG) met on November 18 and 19, 2010. Group members were John R. Knight (FWC lead), William Tate (U. S. Fish and Wildlife Service), and Howard Jelks (U. S. Geological Survey) (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 crystal darter 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 Crystal Darter BRG found that the crystal darter met two listing criteria. Staff recommends listing the crystal darter 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. Staff would also like to thank Dr. Joseph Mitchell who served as a data compiler on the species.

BIOLOGICAL INFORMATION

Taxonomic Classification – This status report is for the crystal darter, *Crystallaria asprella* (Jordan 1878), in Florida. The species was formerly placed within the genus *Ammocrypta* until Simons (1991) determined it to be distinct from other darters and assigned this species to its own monotypic genus. Welsh and Wood (2008) described a second species of *Crystallaria, C. cincotta*, from the Cumberland, Elk, Green, and Muskingum River drainages of the Ohio River basin.

Life History References – Roberts et al. 2007, Evans and Page 2003, Grandmaison et al. 2003, Hatch 1998, George et al. 1996, Hubbs 1985, Kuehne and Barbour 1983, Page 1983, Williams 1975.

Geographic Range and Distribution – Crystal darters were historically distributed within the Mississippi River basin from Wisconsin and Minnesota east to Ohio, west to Oklahoma, and south to Louisiana and Florida (Boschung and Mayden 2004, Page 1983). The species occurs also in Gulf slope drainages such as the Escambia/Conecuh, Pearl, and Mobile River drainages (Page and Burr 1991). In Alabama, crystal darter distribution is primarily limited to larger rivers within the Mobile and the Conecuh (Escambia) River drainages (Grandmaison et al. 2003). Crystal darter records are sparse from the Conecuh River (Escambia) in Alabama to south of the Point A reservoir (Andalusia, Alabama). Crystal darters were collected in 1981 (2.7 miles south of Brewton, Alabama) and in 1985 (0.4 miles above the Florida state line). Popp (2005) reported only one collection record of the species during a 20-year study (1982-2002) from the Conecuh River (Escambia County, Alabama).

In Florida, crystal darters are only known to occur from the Escambia River. The species was first collected in Florida in 1972 (Gilbert 1992). Additional specimens were collected by Yerger and Beecher (1975) and Beecher et al (1977). FWC staff collected five individuals from the same location during 2003 and 2004 (Bass et al. 2004). Crystal darters were most recently collected (a single individual) from the Escambia River in 2009 (Knight et al. 2010).

Population Status and Trend – No population status or trend data are currently available for crystal darters. The species was once believed to be widespread, although the crystal darter is most likely rare throughout its historical range (George et al. 1996, Page and Burr 1991). Crystal darters were last collected from Indiana and Ohio in 1899, Kentucky in 1929, Tennessee in 1939, and Mississippi in 1981 (Grandmaison et al. 2003, Hatch 1998). Wood and Raley (2001) concluded that crystal darters were in serious decline throughout its range, and that the species may be approaching extinction. The upper Ohio River population (in the Cumberland, Elk, Green, and Muskingum river drainages, West Virginia, Ohio, Kentucky and Tennessee) is now recognized as *Crystallaria cincotta* (Welsh and Wood 2008). With recognition of some populations as a separate species, the crystal darter has a smaller range and smaller population than previously thought. Additionally, the species is considered cryptic, occupying difficult to sample habitats, often burying themselves in gravel and sand, preventing an accurate population estimate for the species in Florida.

Generation Length – Crystal darters reach sexual maturity at age one and the maximum age observed is four years (Boschung and Mayden 2004, Etnier and Starnes 1993, Page 1983). Therefore the estimated generation time is 2.5 years. Since the estimated time for 3 generations is less than 10 years (the default minimum for IUCN assessment), a 10-year timeframe was used for this assessment.

Quantitative Analyses – There have been no population viability analyses (PVA) or other quantitative models conducted that include in their results a probability of extinction.

BIOLOGICAL STATUS ASSESSMENT

Threats – The crystal darter in Florida represents a disjunct population, isolated from any potential source population capable of contributing to persistence of the species. Crystal darters typically occupy moderate to swift deep riffles with clean sand and gravel substrates (Boschung and Mayden 2004). Given the sporadic occurrence of this habitat even in unaltered rivers suggests that historically these fishes were not distributed continuously throughout their range (Wood and Raley 2001). The species is only known to inhabit approximately six river miles in Florida.

There is a lack of knowledge on the genetic structure of Florida's crystal darter population. Crystal darter populations are highly divergent from one another (Wood and Raley 2000), and the Conecuh River (Alabama) population is also likely limited in numbers and may not represent an adequate population size to repopulate the Escambia River, if a catastrophic event were to eliminate the species from Florida. In addition, crystal daters are fragmented from a source population north of Andalusia Alabama, due to the presence of Point A dam (Point A Reservoir). Additional threats include the destruction and degradation of critical habitats resulting from impounding, channelizing, dredging, and siltation of lotic environments (Grandmaison et al. 2003).

Population Assessment – Findings from the BRG are included in the Biological Status Review Information Findings tables. The BRG found that the crystal darter met two of the listing criteria.

LISTING RECOMMENDATION

Based on the findings of the crystal darter BRG and in subsequent consultation with other FWC fish experts, staff recommends that the crystal darter, *Crystallaria asprella*, be listed as a Threatened species.

SUMMARY OF THE INDEPENDENT REVIEW

Comments were received from 4 reviewers; Dr. Lawrence Page (University of Florida), Dr. Brett Albanese (Georgia Department of Natural Resources), Dr. Steven Herrington (The Nature Conservancy), and Dr. Catherine Phillips (U.S. Fish and Wildlife Service). Appropriate editorial changes recommended by the reviewers were made to the report. No changes were recommended that would affect the findings or staff recommendations. All reviewers concurred with the staff recommendation.

One reviewer indicated there was a need to incorporate additional specific habitat and genetic information into the BSR. These suggestions were incorporated into the document. Another reviewer requested clarification of generation time, which was also incorporated into the document. An additional reviewer agreed with the overall assessment, but did not feel that both criteria met under category "D" were applicable. Specifically this reviewer concluded that there was not enough information available to determine whether 1000 crystal darters resided in Florida (criterion D1). Since, no other reviewers objected to inclusion of this criterion, this measure was retained in the BSR. All detailed peer reviews are available at MyFWC.com.

LITERATURE CITED

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Biological Status Review Information
Findings

Species/taxon: *Crystallaria asprella*
Date: 11/19/10
Assessors: Tate, Jelks, and Knight

Generation length: 10 years

Criterion/Listing Measure	Data/Information	Data Type*	Sub-Criterion Met?	References
*Data Types - observed (O), estimated (E), inferred (I), suspected (S), or projected (P). Sub-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]	Data not available		No	
(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]	Data not available		No	
(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]	Data not available		No	
(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]	Data not available		No	
[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	Based on 2.59 sq km grid and known recent locations (8 grids). AOO was calculated as 23.5 sq km	E	Y	Bass et al. 2004, FWC GIS data, Knight et al 2010.
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Based on 2.59 sq km grid and known recent locations (8 grids). AOO was calculated as 23.5 sq km	E	Y	Bass et al. 2004, FWC GIS data, Knight et al 2010.
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	Total occupied river length ~12km. Considered one location	E	Y	Bass et al. 2004, FWC GIS data, Knight et al 2010.
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	Data does not support criteria, never found at high population numbers and/or difficult to collect	I	No	
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	Data does not support criteria, never found at high population	I	No	

individuals	numbers and/or difficult to collect			
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	six individuals collected in previous 10 years	S	Y	Bass et al. 2004, FWC GIS data, Knight et al 2010. Walsh and Tate 2003 (NG00-103)
(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	Data does not support criteria, never found at high population numbers and/or difficult to collect	I	No	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Data does not support criteria, never found at high population numbers and/or difficult to collect	I	No	
a. Population structure in the form of EITHER				
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation				
b. Extreme fluctuations in number of mature individuals				
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	six individuals collected in previous 10 years	S	Y	Bass et al. 2004, FWC GIS data, Knight et al 2009. Walsh and Tate 2003 (NG00-103)
(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	Total occupied river length ~12km. Considered one location	E	Y	Bass et al. 2004, FWC GIS data, Knight et al 2009.
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years			N	

Initial Finding (Meets at least one of the criteria /sub-criteria OR Does not meet any of the criteria/sub-criteria)	Reason (which criteria/sub-criteria are met)
Y	D1+2
Is species/taxon endemic to Florida? (Y/N)	no
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/sub-criteria OR Does not meet any of the criteria/sub-criteria)	Reason (which criteria/sub-criteria are met)
Y	D1+2

1	Species/taxon:	Crystallaria asprella
2	Biological Status Review Information Regional Assessment Date:	11/19/10
3	Assessors:	Tate, Jelks, and Knight
4		
5		
6		
7		
8	Initial finding	Supporting Information
9		
10	2a. Is the species/taxon a non-breeding visitor? (Y/N/DK). If 2a is YES, go to line 18. If 2a is NO or DO NOT KNOW, go to line 11.	N
11	2b. Does the Florida population experience any significant immigration of propagules capable of reproducing in Florida? (Y/N/DK). If 2b is YES, go to line 12. If 2b is NO or DO NOT KNOW, go to line 17.	DK
12	2c. Is the immigration expected to decrease? (Y/N/DK). If 2c is YES or DO NOT KNOW, go to line 13. If 2c is NO go to line 16.	
13	2d. Is the Florida population a sink? (Y/N/DK). If 2d is YES, go to line 14. If 2d is NO or DO NOT KNOW, go to line 15.	
14	If 2d is YES - Upgrade from initial finding (more imperiled)	
15	If 2d is NO or DO NOT KNOW - No change from initial finding	
16	If 2c is NO or DO NOT KNOW- Downgrade from initial finding (less imperiled)	
17	If 2b is NO or DO NOT KNOW - No change from initial finding	No change
18	2e. Are the conditions outside Florida deteriorating? (Y/N/DK). If 2e is YES or DO NOT KNOW, go to line 24. If 2e is NO go to line 19.	
19	2f. Are the conditions within Florida deteriorating? (Y/N/DK). If 2f is YES or DO NOT KNOW, go to line 23. If 2f is NO, go to line 20.	
20	2g. Can the breeding population rescue the Florida population should it decline? (Y/N/DK). If 2g is YES, go to line 21. If 2g is NO or DO NOT KNOW, go to line 22.	
21	If 2g is YES - Downgrade from initial finding (less imperiled)	
22	If 2g is NO or DO NOT KNOW - No change from initial finding	
23	If 2f is YES or DO NOT KNOW - No change from initial finding	
24	If 2e is YES or DO NOT KNOW - No change from initial finding	
25		
26	Final finding	No change

APPENDIX 1: Brief biographies of the Crystal darter Biological Review Group members

Bill Tate is the US Fish and Wildlife Service biologist responsible for assisting Eglin Air Force Base's Jackson Guard unit in protecting the endangered Okaloosa darter. Through their efforts and his guidance this darter species has been managed successfully enough for the last decade that it qualified for down-listing from federally endangered to threatened this year. His expertise extends to all North Florida darters and many other benthic (therefore cryptic) freshwater species.

Howard Jelks received his undergraduate education at FSU, then went to UF for his master's degree. Howard has diverse experience from wetland plants, aquatic invertebrates, fish, and wading birds. He has studied these organisms from the estuaries of Apalachicola Bay, freshwater marshes of the Everglades, and streams of the Piedmont and Coastal Plain. Although he specializes in fishes, he classifies himself as a general naturalist/ecologist. How the dynamic environment structures biotic communities is his broad interest. Imperiled freshwater fishes are his speciality, but nonindigenous and marine taxa are also studied. For the past 16 years, he has been a leader of Okaloosa darter monitoring and recovery planning at Eglin Air Force Base in northwest Florida. He has developed skills in sampling design, database development, geographical information system and statistical analyses. He is an active member of the American Fisheries Society Endangered Species Committee and directs their website at http://fl.biology.usgs.gov/afs/index.html

John R. Knight II received his B.S. in Fisheries from the University of Georgia in 2000. After graduation, he accepted a position with the University of Georgia, Institute of Ecology and Georgia Museum of Natural History, where he primarily worked on research of Federally Endangered and Threatened fish species. He accepted a graduate research assistantship at Auburn University and completed his master's research in 2005. Later that year he accepted a position with FWC's Fish and Wildlife Research Institute (FWRI). For the past five and a half years, he has worked primary on developing monitoring strategies/techniques to effectively characterize fish communities from streams and rivers in Florida. Additional duties while working for FWRI include; biological comments on the effects of development on state and federally listed species, provided consultation for scientific permit applications, assisted USFWS with sampling for federally listed fish and mussel species, and worked on numerous interagency technical committees and partnerships within the state of Florida.

APPENDIX 2. **Summary of letters and emails received during the solicitation of information from the public period of September 17, 2010 through November 1, 2010.**

No information about this species was received during the public information request period.