Florida Bog Frog Biological Status Review Report

March 31, 2011

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

BIOLOGICAL STATUS REVIEW
of the
Florida Bog Frog
(*Lithobates okaloosae*)
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 Florida bog frog was sought from September 17 through November 1, 2010. The five-member Biological Review Group (BRG) met on November 9-10, 2010. Group members were Bill Turner (FWC lead), Ryan Means (Coastal Plains Institute), Kelly Jones (Virginia Tech.), Paul Moler (Independent Consultant), and John Himes (FWC) (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 Florida bog frog using criteria included in definitions in 68A-27.001, F.A.C., and following 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 the Florida bog frog met at least one of the listing criteria. Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends that the Florida bog frog 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

Taxonomy – The Florida bog frog (*Lithobates okaloosae*), discovered by Paul Moler on July 21, 1982, during surveys for the pine barrens treefrog (*Hyla andersonii*) in Okaloosa County, FL, was named in recognition of that county (Moler 1985). Formally in the genus *Rana*, this species ,along with all other North American members of the genus *Rana*, has recently been proposed as *Lithobates* following Frost et al. (2006). FWC currently follows this taxonomic revision. Florida bog frogs are thought to occasionally hybridize with bronze frogs

(*Lithobates clamitans clamitans*), which are often found in close association with Florida bog frogs (Moler 1992, Bishop 2005).

Life History and Habitat Requirements – The life history and habitat requirements of the Florida bog frog have been summarized by Moler (1992) and Moler (2005). Only slightly exceeding 5 cm (2 inches), Florida bog frogs are the smallest member of the genus *Lithobates.* Florida bog frogs have been found in several aquatic habitats, including shallow, acidic spring seeps, boggy overflows of larger seepage streams, sluggish bends in streams, and the edges of ponds (Moler 1992, Bishop 2005). Some sites derive from steephead ravines, which are formed by the headward undercutting of sandy overburden by groundwater seepage (Gorman 2009). Bog frogs are frequently found in association with sphagnum moss (*Sphagnum* spp.). Among the dominant vegetation at many sites are black titi (*Cliftonia monophylla*), sweetbay magnolia (*Magnolia virginiana*), Atlantic white cedar (*Chamaecyparis thyoides*), swamp titi (*Cyrilla racemiflora*), and blackgum (*Nyssa sylvatica*) (Moler 1992, Gorman 2009). Bog frogs remain close to their breeding areas. The mean home range calculated by Bishop (2005) was 187.7 m^2. Males call from March to September with a series of guttural "chucks" to attract mates (Moler 1992, Bishop 2005). Bronze frogs commonly share bog frog breeding sites. Bog frog egg masses consist of a few hundred eggs that float on the water's surface (Moler 1992, Bishop 2005). Tadpoles are thought to overwinter and metamorphose the following spring (Moler 1992).

Population Status and Trend – The Florida bog frog is known from fewer than 100 sites. There are few data concerning population status and trends. Gorman (2009) thought detection of bog frogs on some monitoring sites was becoming less frequent than reported in the 1980s.

Geographic Range and Distribution – The Florida bog frog occurs only in small streams in Walton, Okaloosa, and Santa Rosa counties, Florida. The several dozen known sites are within the Titi Creek, East Bay River, and lower Yellow River drainages (Moler 1985, 1992, Endries et al. 2009, Bishop 2005). The Titi Creek sites are separated by > 30 km from the more westerly sites (Moler 1992, Gorman 2009). Titi Creek, East Bay River, and lower Yellow River drainages contain three separate demographic populations based on the likely dispersal capability of bog frogs (Bishop 2005, Gorman 2009). Most bog frog sites occur on Eglin Air Force Base (Bishop 2005).

Quantitative Analyses – Endries et al. (2009) conducted a Population Viability Analysis (PVA) for the Florida bog frog. They employed 74 sites with a 90 m site buffer. Potential habitat was mapped using the following FWC 2003 land-cover habitat types: shrub swamp, bay swamp, mesic upland, palustrine wetland and mixed wetland forest. The potential habitat model was limited to those habitat patches that intersected the East Bay River, Yellow/Shoal River, or Titi Creek. Two models were run; one considering only managed lands and the other on all identified potential habitat. About 79% of the potential habitat is on managed land. Both models calculated a 0% probability of extinction in the next 100 years.

BIOLOGICAL STATUS ASSESSMENT

Threats – The vast majority of the Florida bog frog habitat is within the boundaries of Eglin Air Force Base (EAFB), so persistence of the Florida bog frog is tied strongly to management actions on the base. Although funding for management of state-listed species is not mandatory, EAFB provides beneficial management actions for the Florida bog frog while managing for overall ecosystem health and federally listed species (U.S. Air Force 2010). The Florida bog frog thrives along seepage streams with a moderately open canopy of early successional vegetation (Jackson 2004). Threats to the quality and connectivity of this habitat are the main threats to the species. T he vegetative component of the Florida bog frog's habitat is maintained by fire. Succession of the plant community as a result of fire suppression renders the habitat less suitable for bog frogs. Introduction of invasive plants, particularly the Chinese tallow tree (*Sapium sebiferum*) can also degrade habitat (Jackson 2004). Feral hogs (*Sus scrofa*) are present on EAFB and are known to root in the seepage slopes and boggy ravines important to bog frogs (Printiss and Hipes 1999). The base has a Feral Hog Management Plan that aims to control this species (U.S. Air Force 2010). At some sites bog frogs are concentrated in power line rights-of-way, where the vegetation is maintained in an early successional stage (Paul Moler *pers. commun.* 2010). Jackson (2004) expressed concern about herbicide use by Gulf Power in such situations. Roads and their construction can increase silt and pollution in nearby bog frog breeding sites. Roads can also fragment bog frog habitat (Jackson 2004). Global warming could impact bog frog habitat by lengthening drought periods and/or increasing storm severity. The resulting sea level rise may cover bog frog habitat with salt water making it unsuitable (Field et. al. 2007). Severe drought has been implicated in the decline of several amphibian species, including the southern leopard frog (*Lithobates sphenocephala*), in South Carolina during a 26-year period (Daszak et. al. 2005). Pathogens and parasites also threaten Florida bog frogs. A chytridiomycete fungus (chytrid), *Batrachochytrium dendrobatidis*, has been implicated as a cause of disease epidemics and subsequent population declines of amphibians in many parts of the world, although chytrid is not yet known to be responsible for any amphibian die-offs in the Southeast (Daszak et. al. 2005). Ranaviruses are likely a greater threat to amphibians than chytrid in North America (Gray et al. 2009b). Catastrophic die-offs of wild amphibian populations from ranaviruses have occurred in >30 states and 5 Canadian provinces (Green et al. 2002, Gray et al. 2009a). Although ranaviruses are pathogenic to both adult and larval amphibians, mortality rates tend to be higher for larvae (Gray et al. 2009a). A die-off of hundreds of ranid tadpoles in 2 ponds in Withlacoochee State Forest, Hernando County, FL, was apparently caused by an unnamed *Perkinsus*-like (or alveolate) microorganism (Davis et al. 2007, Rothermel et al. 2008). The Florida bog frog is probably preyed on by many creatures that hunt in its habitat. Among potential vertebrate predators are the southern watersnake (*Nerodia fasciata*), cottonmouth (*Agkistrodon piscivorus*), and wading birds. Invertebrate predators such as dragonfly nymphs also likely prey upon tadpoles.

Population Assessment – Available data on the Florida bog frog population were evaluated relative to each of the five criteria for state listing under Rule 68A-1.004, F.A.C. There are two steps in assessing the status of a regional population: (1) use FWC criteria for a preliminary categorization, and (2) investigate whether conspecific populations outside the region may affect the risk of extinction within the region. Since the Florida bog frog is endemic to Florida, the second step was not taken. The BRG concluded from the biological assessment that the Florida bog frog met criterion D2 (population with a very restricted area of occupancy).

LISTING RECOMMENDATION

Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends that the Florida bog frog be listed as a Threatened species because the species met criteria as defined in 68A-27.001(3) F.A.C.

SUMMARY OF THE INDEPENDENT REVIEW

Comments were received from three reviewers: James Austin (University of Florida), David Bishop (U.S. Fish and Wildlife Service Black Bay National Wildlife Refuge), and Patrick Gault (Emerald Coast Wildlife Refuge). All three reviewers supported the findings of the BRG and staff's recommendation. The full text of peer reviews is available at MyFWC.com.

Two reviewers highlighted the need for monitoring of this species. Their recommendations will be considered in the development of the management plan.

A reviewer suggested revising several portions of the document concerning hybridization and genetics of the Florida bog frog. These changes were made.

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Biological Status Review Information
Findings

Species/taxon:	Florida Bog Frog
Date:	Oct 26, 2010
Assessors:	John Himes, Kelly Jones, Ryan Means
	Paul Moler, Bill Turner,
Generation length:	4 years based on information from the closely related bronze frog

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]	No declines indicated in literature.	E	N	Jackson 2004, Gorman 2009
(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 declines indicated in literature.	E	N	Jackson 2004, Gorman 2009
(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]	No declines indicated in literature.	E	N	Endries et al. 2009, Gorman 2009
(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 declines indicated in literature.	E	N	Endries et al. 2009, Gorman 2009
[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	126 km^2 (48 mi^2)	E	Y	Beth Stys pers. commun. 2010
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Area of occupancy is estimated to be < 8 mi^2. Using a 90-m generous buffer around each of their identified sites (n=74)	E	Y	Endries et al. 2009

AND at least 2 of the following:				
a. Severely fragmented or exists in ≤ 10 locations	4 locations, considering subpopulations in Titi Creek, north and south of Yellow River, East Bay River drainages.	O	Y	Gorman 2009, Beth Stys pers. commun. 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	No observed or estimated net declines. Historically, there has been some decline due to habitat impacts from fire exclusion.	E	N	Moler 1992, Bishop 2005, Endries et al. 2009, Gorman 2009
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 evidence of extreme fluctuations in the literature.	I	N	Moler 1992, Bishop 2005, Endries et al. 2009, Gorman 2009
(C) Population Size and Trend				
Population size estimated to number fewer than 10,000 mature individuals AND EITHER	Population estimated at less than 10,000.	I	Y	Endries et al. 2009, Bishop 2005, Gorman 2009
(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 observed or estimated net declines.	I	N	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	No observed or estimated net declines.	I	N	
a. Population structure in the form of EITHER		I	N	Bishop 2005, Endries et al. 2009, Gorman 2009
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR	Given range and number of sites, it is suspected that there are more than 1,000 mature individuals in at least one subpopulation			
(ii) All mature individuals are in one subpopulation	Subpopulations greater than one. Subpopulations exist at the following locations based on geographic isolation and maximum observed bog frog movement: Titi Creek, north and south of Yellow River, East Bay River.	S	N	
b. Extreme fluctuations in number of mature individuals	No extreme fluctuations indicated by literature on the species		N	
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	Population estimated to be greater than 1,000 individuals.	E	N	Bishop 2005, Endries et al. 2009, Gorman 2009, Moler pers. commun. 2010

(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	Area of occupancy is estimated to be < 8 mi^2. Using a 90-m buffer around each of their identified sites (n=74), Endries et al. suggest AOO is < 1 mi^2. Prone to effects of human activities. In fewer than 4 locations (see above).	I	Y	Bishop 2005, Endries et al. 2009, Gorman 2009
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years		P	N	Endries et al. 2009

Initial Finding (Meets at least one of the criteria/sub-criteria OR Does not meet any of the criteria/sub-criteria)	PVA analysis indicates probability of extinction in 100 years is 0%
Meets one criterion	
	Reason (which criteria/sub-criteria are met)
Initial Finding (Meets at least one of the criteria/sub-criteria OR Does not meet any of the criteria/sub-criteria)	Meets criterion D2
Is species/taxon endemic to Florida? (Y/N)	Y
Final finding	Meets listing criterion D2

APPENDIX 1: Brief biographies of the Florida bog frog Biological Review Group members

Dr. John H. Himes received his Ph.D. from the University of Southern Mississippi, M.S. from Louisiana State Medical Center, and B.S. from the University of Mississippi. He is currently a regional biologist for FWC. He has published many papers on southeastern herpetofauna.

Kelly Jones received his M.S. in Biology from Ball State University. He is currently the project manager for the Virginia Polytechnic Institute and State University team working with red-cockaded woodpeckers, Florida bog frogs, reticulated flatwoods salamanders, and gopher tortoises on Eglin Air Force Base. He has short notes in press on distribution and natural history of native and exotic herpetofaunal species in the Florida panhandle.

Ryan C. Means received both his M.S. in Wildlife Ecology and Conservation (2001) and his B.S. in Zoology (1996) from the University of Florida. He is a wildlife ecologist with the Coastal Plains Institute in Tallahassee, FL. His research interests focus on ecology and conservation of ephemeral wetlands and associated amphibian fauna in the southeastern Coastal Plain. Ryan has many other interests, including wilderness exploration, archaeology, paleontology, and anything related to being in the outdoors.

Paul E. Moler received his M.S. in Zoology from the University of Florida in 1970 and his B.A. in Biology from Emory University in 1967. He retired in 2006 after working for 29 years as a herpetologist with FWC, including serving as administrator of the Reptile and Amphibian Subsection of the Wildlife Research Section. He has conducted research on the systematics, ecology, reproduction, genetics, and conservation biology of a variety of herpetofaunal species in Florida, with primary emphasis on the biology and management of endangered and threatened species. He served as Chair for the Florida Committee on Rare and Endangered Plants and Animals in 1992–94, Chair of the Committee on Amphibians and Reptiles since 1986, and editor of the 1992 volume on amphibians and reptiles. Paul has >90 publications on amphibians and reptiles.

William M. Turner received his B.S. from Erskine College and M.S. in Biology from the University of South Alabama. From 2003 to 2007, he was the Herpetological Coordinator for the Wyoming Game and Fish Department. In Wyoming, he conducted statewide surveys for amphibians and reptiles, focusing on emerging amphibian diseases and the impacts of resources development on native reptiles. Since 2007, he has been the Herp Taxa Coordinator for FWC in the Division of Habitat and Species Conservation. He has conducted research on native amphibians and reptiles in Florida, Alabama, and Wyoming that has resulted in several published papers and reports.

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 comments were received on this species during the public comment solicitation period.