Supplemental Information for the Florida Bog Frog

Biological Status Review Report

The following pages contain peer reviews received from selected peer reviewers, comments received during the public comment period, and the draft report that was reviewed before the final report was completed

March 31, 2011

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Peer review #1 from David Bishop

From: David Bishop
To: Imperiled
Subject: Bog frog comments
Date: Monday, December 13, 2010 10:36:14 AM

Dear team,

I reviewed the status review you prepared for the FL Bog frog. I agree with your conclusions and have no significant comments. In section (E) of table it states the bog frog is not endemic to Florida. That appears to be a mistake or else I did not fully grasp the item. No need to respond to this comment; I just wanted to bring it to your attention. I see no immediate threats to this species besides its limited distribution. I think the bulk of the management efforts for this species should be focused on monitoring (and perhaps coming up with a rigorous protocol) both on and off of Eglin. On another note, in case you need bio info on me. As of January I will be working with the US Fish and Wildlife Service and moving to VA. I don't have an email/phone yet but my address is below.

Merry Christmas.

David Bishop
US Fish and Wildlife Service
Back Bay National Wildlife Refuge
Virginia Beach, VA 23456

Peer review #2 from Jim Austin

From: JIM AUSTIN
To: Imperiled
Subject: Re: Florida bog frog Draft BSR Report
Date: Tuesday, December 14, 2010 2:58:16 PM
Attachments: Florida bog frog BSR 12-8-10_Austin.docx
ATT00001.htm

Attached are comments using track changes.

Jim

BIOLOGICAL STATUS REVIEW
of the
Florida Bog Frog
(*Lithobates okaloosae*)

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate all species listed as Endangered, Threatened or Species of Special Concern as of 1 September 2010. 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 F.A.C, the BRG was charged with evaluating the biological status of the Florida bog frog using criteria included in definitions in 68A-1.004 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/imperiledSpp_listingprocess.htm to view the listing process rule and the criteria found in the definitions. The BRG concluded that the Florida bog frog met criterion D2 (population with a very restricted area of occupancy). Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends continued listing of the Florida bog frog at the level of "Threatened." This work was supported by a Conserve Wildlife Tag grant from the Wildlife Foundation of Florida.

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). Although originally included in the genus *Rana*, the species along with all other North American members of the genus *Rana*, have recently been transferred to *Lithobates* following Frost et al. (2006). Florida bog frogs occasionally hybridize with bronze frogs (*Lithobates clamitans clamitans*), which are often found in close association with Florida bog frogs (Moler 1992, Austin et al. 2003, Bishop 2005).

Comment [JA1]: I would suggest stating this in a more neutral manner, given that there is no 'formal' deciding body on such things in herps, and the fact that there is considerable problems and controversy with the overall analysis and reclassification conducted by Frost. Suggested: "Formerly in the genus Rana, the FWC has adopted the new Genus Lithobates for this and all Florida species of Rana as put forth by Frost et al. 2006."

Comment [JA2]: Remove this reference. This paper does not state that okaloosae occasionally hybridizes with clamitans, it merely discusses hybridization as one of a number of possible mechanism to explain the pattern of shared mtDNA polymorphism.

Life History and Habitat Requirements – The life history and habitat requirements of the Florida bog frog have been summarized by Moler (1992) and Moler in Lannoo (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. a. 2009, Bishop 2005). The Titi Creek sites are seperated 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 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).

Comment [JA3]: Needs clarification as to whether this document is referring to evolutionary sense, or demographic populations. If you are defining based on dispersal, then certainly there are more than three demographic populations, possible based on stream capture. The unpublished genetic data supports a Yellow R. and a East Bay R. genetic (evolutionary population). If there are still frogs at Titi Cr. then that is likely a third entity as there certainly would be no demographic mixing and likely have been isolated long enough for there to be genetic differences as well, but we do not have the samples to determine this. These data are in a FWC non-game report (07-007), but have not yet been submitted to peer review.

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. The 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. The Florida bog frog is also known to occasionally hybridize with bronze frogs, although the hybridization probably does not pose a threat (Austin et al. 2003).

Comment [JA4]: This manuscript does not support this statement, please remove citation. I am not willing to say that hybridization does pose a threat at this point. Not enough work has been done.

Statewide 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.

LISTING RECOMMENDATION

The BRG concluded from the biological assessment that the Florida bog frog met criterion D2 (population with a very restricted area of occupancy). Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends listing the Florida bog frog as a Threatened species because the species met criteria as defined in 68A-27.001(3) F.A.C. FWC staff gratefully acknowledges the assistance of the BRG members and independent reviewers.

Comment [JA5]: This all that is needed as I understand. I support this conclusion, though it is important to note that other threats (outlined above) need careful consideration. Including whether populations have declined over the past decades, and whether hybridization is increasing.

SUMMARY OF THE INDEPENDENT REVIEW

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Peer review #3 from Patrick Gault

Comments on the Biological Status Review for the
Florida bog frog and pine barrens tree frog.

Respectfully submitted by Patrick Gault, 1 February 2011

I appreciate the opportunity to comment on these documents. My experience with both species is primarily based on field work assisting several graduate students studying the bog frog, along with, in the case of the pine barrens tree frog, personal observations and call counts with fellow biologist.

In brief, I agree the findings of the committee based upon the criteria set forth. I would encourage the FWC to encourage further study of the bog frog due to its uniqueness, relative small range, and the potential impacts of future changes in the mission of Eglin Air Force Base Reservation. Although this species is relatively common in its range, there is much more to be learned concerning its home use area and natural history.

Although there is little documented evidence showing a decline in the population of pine barrens tree frogs in the Florida range, I have witnessed the possible loss (based on the lack of calling males during breeding season) of at least two and possibly three historic sites since @ 1995. One site is located on the Eglin reservation, and two on or near power line r.o.w.s and subdivisions in Okaloosa County near Crestview. In all three cases, significant alteration to adjacent habitat could be involved. I appreciate the call for protection of this species from commercial trade and again would ask for further study of the Florida population to establish a baseline for the population and develop a clearer picture of the species future status.

As an aside, our facility is in the process of building an education/wildlife rehabilitation center that will include a series of native species zoos, as a former zoo herpetologist, I would welcome the opportunity to work with these species in a captive setting, primarily in an educational role to raise awareness of their existence, and the plight of amphibians worldwide, and also to study their biology and reproduction.

I thank you again for allowing me to have input on this important issue, please feel free to contact me if you have any further questions.

Sincerely,
Patrick Gault

Letters and emails received during the solicitation of information from the public period of September 17, 2010 through November 1, 2010

Email from Diana Pepe

From: Pepe, Diana
To: Imperiled
Subject: FL bog frog
Date: Wednesday, October 06, 2010 2:00:12 PM
Attachments: Yellow River Bog Frogs.doc
Bog Frog Survey Data.xls

Please find the attached data and survey protocol for FL bog frog calling surveys conducted by FWC staff on Yellow River WMA.

Diana Pepe
Assistant Regional Biologist, NW
Florida Fish and Wildlife Conservation Commission
3911 Highway 2321
Panama City, Florida 32409-1658

Florida Bog Frog Surveys, Yellow River Wildlife Management Area

In 2009, FWC staff from the Terrestrial Habitat Conservation and Restoration Section (THCR) established calling survey points for the Florida bog frog (*Lithobates okaloosae*) on two parcels within the Yellow River Wildlife Management Area (Figure 1). Thick vegetation on both parcels prevented staff from setting up equidistant survey points along streams. Instead, staff located sites where streams crossed roads, trails, or powerlines. Ten survey points were established on the Yellow River Ravines parcel and 5 on the Escribano Point parcel. Thick vegetation and poor access made establishing points on Escribano Point especially difficult.

Staff conducted surveys according to methods outlined in Gorman (2009) and the United States Geological Survey North American Amphibian Monitoring Program (USGS 2009). Surveys were conducted once during May, June, and July during the time period when bog frogs call most actively (Gorman 2009). At each point, staff listened for 5 minutes then recorded each species calling. For each species, staff recorded the estimated number of individuals, call index, and call frequency. Habitat variables including air temperature, relative humidity, light conditions, wind scale, sky condition, and precipitation were also recorded.

L. okaloosae was detected only at survey point BF05 on the Yellow River Ravines parcel (Figure 2). In 2009, 3 individuals were detected in May, 2 in June, and none in July. In 2010, 1 individual was detected in May only.

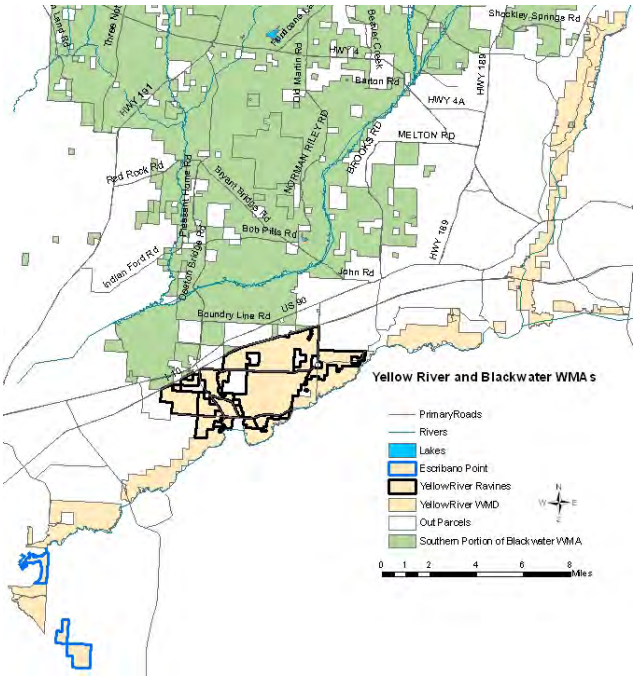
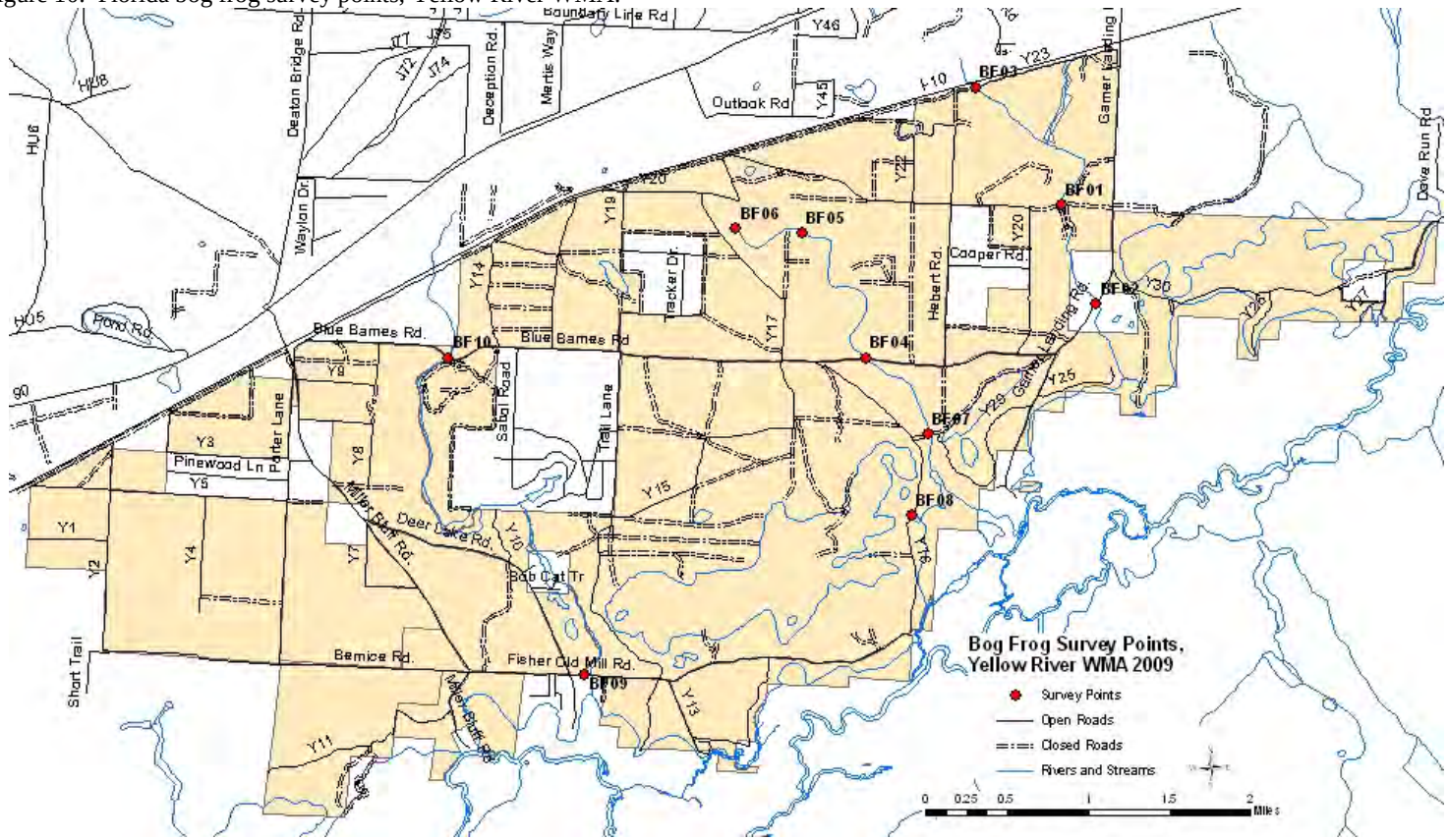


Figure 1. Yellow River WMA, located south of Blackwater WMA in Santa Rosa and Okaloosa counties. Outlined areas denote Escribano Point and Yellow River Ravines, parcels within the WMA.

Figure 10. Florida bog frog survey points, Yellow River WMA.



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Date	Start Time	End Time	Survey Point	Lat	Long	y-pro	x-pro	Air Temp (C)	Relative Humidity	Light	Wind	Sky	Precipitation	Bog Frog Present	Est # Individuals	Call Index	Call Frequency	Other Species Present	Other Species: Individuals, Call Index, Call Frequency	Comments
5/21/2009	2002	2010	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	27.1	65	2	1	2	N	N	-	-	-	Y	BUFTER: 1,1,11111 RANCLA: 4,1;	rained about 2 hrs ago; saw 2 BUFTER adults
5/21/2009	2025	2033	YRBF02	30.66131688	-86.79419856	3408542.91462740	1095089.03436845	27.1	65	2	1	2	N	N	-	-	-	Y	BUFTER: 3,1; ACRGRY: 2,1 RANCLA: 2,1,01011;	
5/21/2009	2056	2102	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	25.2	70	2	1	1	N	N	-	-	-	Y	ACRGRY: ≥5,2, 11111	
5/21/2009	2122	2129	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	27.2	71	2	1	1	N	N	-	-	-	Y	RANCLA: ≥5,1,11111	RANCLA respond to call back of RANOKA
5/21/2009	2158	2206	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	25.2	68	2	1	1	N	Y	3	1	00011	Y	RANCLA: 1,1,10010; ACRGRY: ≥5,2,11111	
5/21/2009	2215	2227	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	25.3	70	2	1	1	N	N	-	-	-	Y	RANCLA: 1,1,00001; ACRGRY ≥5,2,11111; BUFTER: 1,1,10111; HYLFEM 1,1,10001	
5/21/2009	2245	2250	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	26.2	81	2	1	1	N	N	-	-	-	N	-	
5/21/2009	2300	2305	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	28.0	81	2	1	1	N	N	-	-	-	Y	RANCLA: 1,1; ACRGRY: 2,1: HYLFEM: ≥5,2; BUFTER: ≥5,2; HYLCHR ≥5,2	
5/21/2009	2315	2321	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	29.6	81	2	1	1	N	N	-	-	-	N	-	
5/21/2009	2331	2337	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	29.6	81	2	1	1	N	N	-	-	-	Y	RANCLA: ≥5,1	
6/26/2009	2020	2025	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	26.9	78	2	1	0	N	N	-	-	-	Y	RANCLA: 3, 1, 11111; BUFTER: ≥5, 2, 11111	
6/26/2009	2039	2044	YRBF02	30.66131688	-	3408542.91462740	1095089.03436845	27.0	78	2	1	0	N	N	-	-	-	Y	RANCLA: 3, 1,	

					86.79419856														11111; BUFTER: ≥5, 2, 11111; ACRGRY: 1, 1, 00001 RANCLA: 4,1,11111;	
6/26/2009	2104	2109	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	27.3	45	2	1	0	N	N	-	-	-	Y	ACRGRY: ≥5,2,11111	
6/26/2009	2128	2133	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	27.2	45	2	1	0	N	N	-	-	-	Y	RANCLA: 2,1,10011; BUFTER: 4,2,11111	
6/26/2009	2195	2211	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	27.0	45	2	0	0	N	Y	2	1	10101	Y	RANCLA: 4,1,11111; ACRGRY: ≥5,2,11111; BUFTER: 1,1,11111	caught 1 individual RANOKA
6/26/2009	2235	2240	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	25.4	45	2	0	0	N	N	-	-	-	Y	BUFTER: 3,1,11111	dry saw BUFTER
6/26/2009	2248	2253	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	25.8	76	2	0	0	N	N	-	-	-	Y	RANCLA: 2,1,11111	adult
6/26/2009	2315	2320	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	31.0	84	2	0	0	N	N	-	-	-	Y	RANCLA: 3,1,11111	
6/26/2009	2330	2335	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	29.2	84	2	0	0	N	N	-	-	-	Y	RANCLA: 1,1,01000	
6/26/2009	2345	2350	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	26.2	84	2	0	0	N	N	-	-	-	Y	RANCLA: 4,1,11111; ACRGRY: 4,1,01100; BUFTER: 3,1,00001	
7/29/2009	2010	2015	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	27.5	79	2	0	0	N	N	-	-	-	Y	BUFTER: 3,1,11111	
7/29/2009	2028	2033	YRBF02	30.66131688	-86.79419856	3408542.91462740	1095089.03436845	29.5	71	2	0	0	N	N	-	-	-	Y	RANCLA: 1,1,10101; BUFTER: 3,1,11111	
7/29/2009	2035	2038	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	28.0	60	2	0	0	N	N	-	-	-	Y	RANCLA: 4,1,11111; BUFTER: 3,1,11111; ACRGRY: ≥5,2,11111	
7/29/2009	2118	2123	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	27.4	60	2	0	0	N	N	-	-	-	N		
7/29/2009	2150	2155	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	27.5	60	2	0	0	N	N	-	-	-	Y	RANCLA: 3,1,00111; HYLFEM: ≥5,1,11111;	

																			ACRGRY: ≥5,1,11111
7/29/2009	2209	2214	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	28.4	60	2	0	0	N	N	-	-	-	Y	BUFTER: 3,1,11111
7/29/2009	2228	2233	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	26.5	58	2	0	0	N	N	-	-	-	Y	RANCLA: 1,1,11111
7/29/2009	2239	2244	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	29.5	53	2	0	0	N	N	-	-	-	Y	RANCLA: 3,1,11111; BUFTER: 2,1,11111
7/29/2009	2255	2300	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	27.6	38	2	0	0	N	N	-	-	-	Y	HYLCIN: 1,1,00100
7/29/2009	2312	2317	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	25.7	38	2	0	0	N	N	-	-	-	Y	RANCLA: 4,1,11111
5/26/2010	2255	2300	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	24.3	75	4	0	0	N	N	-	-	-	Y	RANCLA: 3,1,01100
5/26/2010	2016	2021	YRBF02	30.66131688	-86.79419856	3408542.91462740	1095089.03436845	24.5	81	4	0	0	N	N	-	-	-	Y	ACRGRY: ≥5,1,1,11111 RANCLA: 4,1,1111; ACRGRY: ≥5,3,1111;
5/26/2010	2050	2055	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	26.9	76	4	0	0	N	N	-	-	-	Y	RANHEC: 1,1,00001
5/26/2010	2118	2123	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	26.2	69	4	0	0	N	N	-	-	-	N	
5/26/2010	2137	2142	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	29.2	88	4	0	0	N	Y	1	1	10100	Y	RANCLA: 1,1,01111; ACRGRY: ≥5,3,11111
5/26/2010	2158	2203	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	25.8	83	4	0	0	N	N	-	-	-	N	
5/26/2010	2216	2221	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	23.9	72	4	0	0	N	N	-	-	-	Y	RANCLA: 1,1,00100
5/26/2010	2227	2232	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	29.2	77	4	0	0	N	N	-	-	-	Y	RANCLA: 1,1,00110
5/26/2010	2241	2246	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	27.3	70	4	0	0	N	N	-	-	-	N	
5/26/2010	2255	2300	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	24.3	75	4	0	0	N	N	-	-	-	Y	RANCLA: 2,1,01101; ACRGRY: ≥5,2,11111; BUFTER: 1,1,00001
6/29/2010	2016	2021	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	28.8	88	2	0	2	N	N	-	-	-	N	
6/29/2010	2031	2036	YRBF02	30.66131688	-86.79419856	3408542.91462740	1095089.03436845	28.7	76	2	0	2	N	N	-	-	-	Y	BUFTER:1,1,01100
6/29/2010	2051	2056	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	27.5	82	2	0	5	N	N	-	-	-	Y	RANCLA:3,2,11111; ACRGRY:≥

																			5,3,11111
6/29/2010	2125	2130	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	25.6	89.5	2	0	5	N	N	-	-	-	Y	RANCLA: 1,1,10101
6/29/2010	2145	2150	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	27.0	86.8	2	0	2	N	N	-	-	-	Y	ACYGRY: ≥ 5,3,11111
6/29/2010	2707	2712	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	27.0	85.4	2	0	2	N	N	-	-	-	N	
6/29/2010	2226	2231	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	27.6	85.2	2	0	2	N	N	-	-	-	Y	RANCLA: 1,1,10000; ACRGRY: 1,1,10000; RANGRY: 1,1,00001
6/29/2010	2239	2244	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	25.9	92.2	2	1	2	N	N	-	-	-	Y	ACRGRY: 1,1,00111
6/29/2010	2257	2304	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	28.0	83.2	2	0	5	N	N	-	-	-	Y	ACRGRY: 2,1,01110
6/29/2010	2319	2324	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	23.9	82.3	2	2	2	N	N	-	-	-	Y	RANCLA: 2,1,11111
7/26/2010	2012	2017	YRBF01	30.67013715	-86.79802917	3409502.73399665	1094666.68560329	25.9	87.6	4	0	0	N	N	-	-	-	Y	RANCLA: 2,1,11001
7/26/2010	2027	2032	YRBF02	30.66131688	-86.79419856	3408542.91462740	1095089.03436845	27.8	95	4	0	0	N	N	-	-	-	N	
7/26/2010	2054	2059	YRBF03	30.68044270	-86.80728455	3410598.75889344	1093714.17979528	28	93.4	4	0	0	N	N	-	-	-	Y	RANCLA: 4,2,11111; ACRGRY: ≥5, 3, 11111
7/26/2010	2116	2121	YRBF04	30.65598238	-86.81798346	3407823.61546509	1092836.71446320	28.1	99.8	4	0	0	N	N	-	-	-	N	
7/26/2010	2142	2147	YRBF05	30.66703962	-86.82491915	3409015.62470204	1092102.55804304	27.5	99.9	4	0	0	N	N	-	-	-	Y	ACRGRY: ≥5, 3, 11111; HYLFEM: 3, 2, 11111
7/26/2010	2207	2212	YRBF06	30.66732796	-86.83170673	3409011.70334810	1091448.74683112	26.6	94.8	4	0	0	N	N	-	-	-	Y	ACRGRY: ≥5, 3, 11111
7/26/2010	2224	2229	YRBF07	30.64927611	-86.81133636	3407113.62934464	1093516.54927592	27.6	87.7	4	0	0	N	N	-	-	-	Y	RANCLA: 1,1,11001
7/26/2010	2236	2241	YRBF08	30.64192518	-86.81285634	3406288.63811660	1093415.64747289	27.2	86.1	4	0	0	N	N	-	-	-	Y	RANCLA: 1,1,01101; HYLFEM: ≥5, 3, 11111; ACRGRY: ≥5, 3, 11111; RANGRY: 1,1,00100
7/26/2010	2253	2258	YRBF09	30.62699206	-86.84632192	3404451.95229526	1090291.12921098	27	90.6	4	0	0	N	N	-	-	-	Y	RANCLA: 2,1,11111
7/26/2010	2308	2313	YRBF10	30.65513916	-86.86123207	3407501.22896185	1088686.76261430	26.3	86.7	4	0	0	N	N	-	-	-	Y	RANCLA: 1,1,11111

Copy of the Florida bog frog BSR draft report that was sent out for peer review

BIOLOGICAL STATUS REVIEW of the Florida Bog Frog (*Lithobates okaloosae*)

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate all species listed as Endangered, Threatened or Species of Special Concern as of 1 September 2010. 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 F.A.C, the BRG was charged with evaluating the biological status of the Florida bog frog using criteria included in definitions in 68A-1.004 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/imperiledSpp_listingprocess.htm to view the listing process rule and the criteria found in the definitions. The BRG concluded that the Florida bog frog met criterion D2 (population with a very restricted area of occupancy). Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends continued listing of the Florida bog frog at the level of "Threatened." This work was supported by a Conserve Wildlife Tag grant from the Wildlife Foundation of Florida.

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). Although originally included in the genus *Rana*, the species along with all other North American members of the genus *Rana*, have recently been transferred to *Lithobates* following Frost et al. (2006). Florida bog frogs occasionally hybridize with bronze frogs (*Lithobates clamitans clamitans*), which are often found in close association with Florida bog frogs (Moler 1992, Austin et al. 2003, 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 in Lannoo (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. a. 2009, Bishop 2005). The Titi Creek sites are seperated 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 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. The 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. The Florida bog frog is also known to occasionally hybridize with bronze frogs, although the hybridization probably does not pose a threat (Austin et al. 2003).

Statewide 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.

LISTING RECOMMENDATION

The BRG concluded from the biological assessment that the Florida bog frog met criterion D2 (population with a very restricted area of occupancy). Based on the BRG findings, literature review, and information received from independent reviewers, staff recommends listing the Florida bog frog as a Threatened species because the species met criteria as defined in 68A-27.001(3) F.A.C. FWC staff gratefully acknowledges the assistance of the BRG members and independent reviewers.

SUMMARY OF THE INDEPENDENT REVIEW

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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 *	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 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 km² (7,722 mi²)	126 km² (48 mi²)	E	Y	Beth Stys pers. commun. 2010

OR				
(b)2. Area of occupancy < 2,000 km² (772 mi²)	Area of occupancy is estimated to be < 8 mi². 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 km² [8 mi²]) 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 mi². Using a 90-m buffer around each of their identified sites (n=74), Endries et al. suggest AOO is < 1 mi². 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 OR Does not meet any of the criteria)	PVA analysis indicates probability of extinction in 100 years is 0%
Meets one criterion	
	Reason (which criteria are met)
Initial Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Meets criterion D2
Is species/taxon endemic to Florida? (Y/N)	N
Final finding	Meets listing criterion D2

APPENDIX 1. Biological Status Review Group Biographies.

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 public comments that were received 17 September–3 November 2010 regarding the proposed reclassification of the Florida bog frog.

No comments were received on this species during the public comment solicitation period.

APPENDIX 3. Information and comments received from independent reviewers.