Pine Barrens Treefrog 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 Pine Barrens Treefrog (*Hyla andersonii*) March 31, 2011

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 November 8, 2010 that had not undergone a status review in the past decade. Public information on the status of the Florida population of the Pine Barrens treefrog was sought from September 17 through November 1, 2010. A 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 Polytechnic Institute and State University), 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 Pine Barrens treefrog 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 from the biological assessment that the Pine Barrens treefrog did not meet listing criteria. Based on the BRG findings, literature review, and information received from the public and independent reviewers, staff recommends that the Pine Barrens treefrog not be listed as a Threatened species and that it be removed from the Species of Special Concern list.

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

Taxonomic Classification – The Pine Barrens treefrog (*Hyla andersonii* Baird, 1854) is a distinct species within a highly speciose genus. The specific epithet *andersonii* reflects the Anderson, S.C. post mark of the first specimen sent to the Smithsonian Museum of Natural History. It seems unlikely that the specimen came from Anderson because the town is at least 100 miles from the nearest Pine Barrens treefrog population (Steve Bennett pers. commun.).

Florida populations differ slightly from the other (Carolina and New Jersey) populations in their color pattern, call and body measurements (Means and Longden 1976). When protein electrophoresis was used to compare the disjunct Pine Barrens treefrog populations to those of the continuously distributed green treefrogs (*Hyla cinerea*) from the same sites, the green treefrog populations showed more genetic (electromorphic) distance between populations than did the Pine Barrens tree frogs (Karlin et al. 1982).

Life History and Habitat Requirements – The life history characteristics and habitat requirements of the Pine Barrens treefrog have been summarized by Means and Moler (1978), Means (1992), and Means (2005). Breeding occurs in low pH (acidic, generally < 4.5) wetlands called seepage bogs. These bogs are created when rains saturate sands overlying an impermeable clay layer. Unable to pass through the clay, the rainwater moves laterally and seeps out on the nearby hillsides. Near the seepage, the vegetation consists mainly of herbs (herb bog), but downslope the bog is often dominated by woody plants (shrub bog). Herb bogs are characterized by sundews (*Drosera* spp.), pitcher plants (*Sarracenia* spp.), sedges, and grasses with extensive *Sphagnum* moss. Pine Barrens treefrogs breed in shallow (usually < 10 inches), clear pools of water in the herb bogs. Adults forage in the shrub bogs, which contain black titi (*Cliftonia monophylla*), swamp titi (*Cyrilla racemiflora*), tall gallberry (*Ilex coriacea*), and sweet bay (*Magnolia virginiana*). When fire is suppressed, woody plants can encroach on herb bogs. The increased evapotranspiration from woody plants can reduce seepage and make sites less suitable for Pine barrens treefrogs (Means and Moler 1978). Disturbances that remove woody vegetation, such as power line rights-of-way, mimic historically fire-maintained seepage conditions (Means and Moler 1978). Male Pine Barrens treefrogs call sporadically when seepage water fills breeding pools (Moler 1981). Pine Barrens treefrogs have been heard calling as early as March and as late as the third week in September in Florida (Means 1992). Pine Barrens treefrog choruses often have fewer than 10 calling males (Means and Moler 1978, Moler 1981). Tadpoles have been collected from May through August (Means 1992). Pine Barrens treefrogs are known to forage up to 105 m from breeding sites (Means 2005). Egg masses contain between 800 and 1,000 eggs, which hatch in 3-4 days. If Florida populations have development times similar to New Jersey populations, the tadpoles would metamorphose in 50-75 days (Means 2005). Pine Barrens treefrogs raised at the River Banks Zoo in S.C. were sexually mature at 11 months and lived as long as 4 years (Steve Bennett pers. commun.).

Population Status and Trend – The population status of the Pine Barrens treefrog in Florida is poorly understood because of its relatively recent discovery (Christman 1970). Populations are thought to have declined since pre-settlement times as a result of habitat degradation from fire suppression and other factors (Means and Moler 1978, Enge 2002, Means 2005).

Geographic Range and Distribution – Pine Barrens treefrogs are known from three disjunct enclaves in the southeastern U.S. found in the following areas: the Florida Panhandle and adjacent Alabama, the New Jersey Pine Barrens (which give the species its common name), and the Fall Line Sand Hills of the Carolinas (NC and SC) (Means 2005). Unknown in Florida until 1970 (Christman 1970), the species has now been recorded from 177 sites in Santa Rosa, Okaloosa, Walton, and Holmes counties (Endries et al. 2009), as well as from adjacent Escambia, Geneva, and Covington counties, Alabama (Moler 1981, Moler pers. commun. 2010).

Black Water State Forest and Eglin Air Force Base are important public lands for Pine Barrens treefrogs.

Quantitative Analyses – Two PVA models have been calculated for Pine Barrens treefrogs in Florida (Endries et al. 2009). One of these models considered all potential habitats, while the other considered only potential habitats on managed lands. The predicted baseline growth rate for both models was 0.9979. The probability of extinction in the next 100 years under both of these demographic parameters was 0%, although running the model on all potential habitat showed a high probability of a decline (i.e., 54% probability of a 60% decline) (Endries et al. 2009).

BIOLOGICAL STATUS ASSESSMENT

Threats – Pine Barrens treefrogs are adapted to low pH bogs. This habitat is a low nutrient ecosystem that is very sensitive to changes in water chemistry and flow (Means 2005, Bunnell and Ciraolo 2010). Bunnell and Ciraolo (2010) found that the Pine Barrens treefrog was vulnerable to water depth reduction at breeding sites from water table drawdowns. Pine Barrens treefrogs are dependent on early successional fire-maintained bog habitat. Fire suppression allows woody plants to invade the bog habitat, increasing evapotranspiration and reducing seepage from the soil. The availability of seepage water is critical to Pine Barrens treefrog breeding habitat (Means and Moler 1978). Blackwater State Forest and Eglin Air Force Base (EAFB) make extensive use of prescribed fire, which should benefit local populations of Pine Barrens treefrogs (Printiss and Hipes 1999, U.S. Air Force 2010). Encroachment by invasive plants, particularly Chinese tallow tree (*Sapium sebiferum*), likewise degrades the bog habitat (Jackson 2004). Feral hogs (*Sus scrofa*) are present on EAFB and can damage treefrog habitat through their rooting. EAFB has a Feral Hog Management Plan for reducing the feral hog population (U.S. Air Force 2010). Global warming threatens Pine Barrens treefrogs through longer drought periods, more severe storms and floods, less available water, the effects of increasing temperatures, and sea level rise (Field et al. 2007). Severe droughts, like those predicted from climate change, have been implicated in declines of several amphibian species, including the southern leopard frog (*Lithobates sphenocephalus*) in South Carolina during a 26-year period (Daszak et. al. 2005). Pathogens and parasites also threaten Florida bog frogs. A chytridiomycete fungus, *Batrachochytrium dendrobatidis* (chytrid), has been implicated as a cause of disease epidemics and subsequent population declines of amphibians in many parts of the world. 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). Pine Barrens treefrogs and their larvae are probably preyed on by many creatures that hunt in their habitat. Bronze frogs (*Lithobates c. clamitans*), two-toed amphiumas (*Amphiuma means*), red salamanders (*Pseudotriton ruber*), banded pigmy sunfish (*Elassoma zonatum*), and turtles are all potential predators of larval Pine Barrens treefrogs.

Banded water snakes (*Nerodia fasciata*) and common ribbon snakes (*Thamnophis sauritus*) feed on adults (Means 2005). Eastern mudsnakes (*Farancia a. abacura*), eastern gartersnakes (*Thamnophis s. sirtalis*) and cottonmouths (*Agkistrodon piscivorus*) are also possible predators of Pine Barrens tree frogs in Florida (Enge 2002). Human use of Pine Barrens treefrog habitat on unprotected lands continues habitat fragmentation and degradation. Some of the threats from human uses are habitat fragmentation due to roads, new construction, wetland draining, agricultural development, and conversion of native pine habitat to silvaculture.

Population Assessment – Available data on Florida Pine Barrens treefrog populations were evaluated with the five listing criteria. 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. The BRG concluded from the biological assessment that the Pine Barrens treefrog did not meet listing criteria, although it met some sub-criteria. The Pine Barrens treefrog has a sufficiently small extent of occurrence and area of occupancy to meet the first part of the Geographic Range Criterion, but it meets only one of the three other sub-criteria (b. continuing decline). The BRG thought that declines in habitat (b.) would continue, but that the species was not severely fragmented (a.) or subject to extreme fluctuations (c.).

LISTING RECOMMENDATION

Staff recommends that the Pine Barrens treefrog not be listed as a Threatened species and that it be removed from the Species of Special Concern list based on the findings of the BRG and current biological information about the species. Staff also recommends that protecting the Pine Barrens treefrog from commercial take be specified in the management plan because both staff and the BRG feel the species could be targeted for the pet trade.

SUMMARY OF THE INDEPENDENT REVIEW

Comments were received from four reviewers: John Cely (South Carolina Department of Natural Resources, retired), Dr. Bruce Means (Coastal Plains Institute and Land Conservancy), Patrick Gault (Emerald Coast Wildlife Refuge), and Steve Bennett (South Carolina Department of Natural Resources). The comments of the peer reviewers are summarized below. The full text of peer reviews is available at MyFWC.com.

The reviewers agreed the BRG conducted an adequate review using the FWC listing criteria and that the BSR was a sufficient review of the data on the species. Two peer reviewers suggested changes to the taxonomic section. One provided literature to support his comments. After reviewing the comments and literature, this additional information was added to the taxonomic section. A reviewer (Bennett) provided a personal communication about the reproduction of the Pine Barrens tree frog in captivity in S.C. These data were added to the text.

A reviewer suggested including estimates of the number of populations in Florida and dividing the geographic distribution section into private and public lands. The text includes the number of known sites, but there were insufficient data available to determine occupancy of these sites.

A reviewer suggested that the reason for the original listing of the Pine Barrens tree frog be included as context. All of the species previously listed by FWC, except federally listed species, are being reviewed using the new listing criteria regardless of the original reason for listing. The Pine Barrens treefrog was listed in Florida because it was thought to have a very limited range in Florida. Additional surveys showed it to be more prevalent than previously thought, but it remained listed because of concerns about its management and collection for the pet trade. The BRG recommended that the Pine Barrens treefrog be protected from the pet trade in the management plan.

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Biological Status Review Information
Findings

Species/taxon: Pine Barrens Treefrog
Date: Oct 26.2010
Assessors: John Himes, Kelly Jones, Ryan Means, Paul Moler, Bill Turner

Generation length: 1 - 2 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]	There are no data to suggest a 50% decline in the last ten years.	S	N	Endries et al. 2009, Means 1992
(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]	There are no data to suggest a 30% decline in the last ten years.	S	N	Endries et al. 2009, Means 1992
(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]	There are no data to suggest a 30% decline in the next ten years, but potential of collection for the pet trade should be addressed in the management plan by suggesting protective rules.	S	N	Endries et al. 2009, Means 1992
(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]	There are no data to suggest a 30% decline in the next ten years.	S	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	Using areas of counties of occurrence, estimate is 3862 mi^2.	E	Y	using GIS data Beth Stys pers. commun. 2010
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Area of occupancy estimated at 220 mi^2 from FWC habitat coverage.	E	Y	using GIS data Beth Stys pers. commun. 2010 and Endries et al. 2009
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	Estimated more than 10 locations from GIS, not severely fragmented.	E	N	Treated every site in a tributary as location using GIS
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 habitat quality of plant succession due to ongoing fire suppression	I	Y	
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	Although most frog populations fluctuate, no extreme fluctuations are indicated in literature. Frog populations fluctuate naturally, but this was not considered extreme by the group.	I	N	
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	The group had great difficulty reaching a conclusion, but majority vote (3 to 2) was for more than 10,000 individuals.	E	N	Means 1992, Endries et al. 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	The group had great difficulty reaching a conclusion because of concerns over future habitat decline.	S	N	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Some continuing decline is probable from habitat loss.	I	Y	Endries et al. 2009
a. Population structure in the form of EITHER	Suspect that at least one sub-population (Yellow River) is greater than 1,000 individuals.	S	N	
(i) No subpopulation estimated to contain more than 1,000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation		I	N	
b. Extreme fluctuations in number of mature individuals	Surveys indicate relative stability of calling males across years.	I	N	K. Jones pers. commun.
(D) Population Very Small or Restricted, EITHER				

(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	The number of localities was stated as 177 in Endries et al. 2009. Means (1992) stated that most sites had fewer than 10 calling males. Assuming a 1:1 sex ratio, there would be about (20 x 177) 3,540 PBTFs	E	N	Endries et al. 2009
(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	Greater than 8 mi^2 (see above).	E	N	Endries et al. 2009
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years	A PVA model run on all potential habitats showed a high probability of a decline (i.e., 54% probability of a 60% decline over 100 years). Approximately 48% of the potential habitat was on managed lands, which resulted in a much smaller abundance than the model using all potential habitats. Given the reduced abundance on managed lands, an increased risk of a decline was evident (i.e., 94% probability of a 60% decline), but the risk of extinction remained 0%.	E	N	Means 1992, 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)	Reason (which criteria/sub-criteria are met)
Initial finding is that species does not meet criteria for listing.	
Is species/taxon endemic to Florida? (Y/N)	N
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)
	Does not meet criteria

1	Biological Status Review Information Regional Assessment	Species/taxon:	Pine Barrens Treefrog
2		Date:	Oct 26.2010
3		Assessors:	John Himes, Kelly Jones, Ryan Means
4			Paul Moler, Bill Turner
5			
6			
7			
8	Initial finding		
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.		Y
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.		Do Not Know, although likely
13	2d. Is the regional 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.		No
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		No change
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		
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 Pine barrens tree 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 species conservation 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.

Although he did not make a comment, John F. Bunnell, Chief Scientist of the Pinelands Commission, New Lisbon, NJ, submitted several publications during the commenting period for which we are thankful.