Barbour's Map Turtle Biological Status Review Report

March 31, 2011

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

Biological Status Review
for the
Barbour's Map Turtle
(*Graptemys barbouri*)
March 31, 2011

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate 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 Barbour's map turtle was sought from September 17 through November 1, 2010. The 5-member biological review group (BRG) met on November 9-10, 2010. Group members were Bill Turner (FWC lead), Chris Lechowicz (Sanibel-Captiva Conservation Foundation), Peter Meylan (Eckerd College), Paul Moler (independent consultant), and Travis Thomas (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 Barbour's map turtle 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 Barbour's map turtle met at least one listing criterion. Based on the BRG findings, literature review, and information received from the public and independent reviewers, staff recommends that the Barbour's map turtle 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. Staff would also like to thank Dale Jackson for serving as a data compiler on the species and drafting much of this report.

BIOLOGICAL INFORMATION

Taxonomic Classification – Barbour's map turtle is the eastern-most in a series of five broad-headed map turtles (the "*pulchra* clade") that inhabit rivers of the lower Gulf Coastal Plain. Once subsumed in a single taxon, each of these turtles is now considered sufficiently distinct based on DNA and color pattern differences to merit specific status (Ennen et al. 2010).

Life History and Habitat Requirements – Barbour's map turtle inhabits lotic waters, from moderately broad alluvial rivers with relatively low clarity, such as the lower Apalachicola River, to clear, spring-fed streams such as Dry and Spring creeks in Jackson County. In rivers, the species typically occurs along mainstem channels and makes little use of quiet floodplain waters. Calcareous tributaries may support substantial populations, whereas blackwater tributaries are avoided, probably a reflection of differences in molluscan prey base. Salt tolerance is presumably low. The species seems to survive in impoundments, but the viability of such populations, if not supplemented from incoming rivers, is uncertain (Sanderson 1974, Ewert et al. 2006). The diet consists of aquatic invertebrates; as they age, the broad-headed females become mostly molluscivorous (Cagle 1952, Sanderson 1974, Lee et al. 1975, Ewert et al. 2006). Sexual size dimorphism is extreme, with females as much as 2.6 times longer and 12-16 times heavier than males (Cagle 1952, Sanderson 1974, Ewert et al. 2006). Females require as long as 20 years to attain maturity (Sanderson 1974, Ewert et al. 2006), whereas males may mature in only 3-4 years (Cagle, 1952). Nesting extends from late April to early August with females producing up to 3-5 clutches of 3-15 eggs per season (Sanderson 1974, Ewert et al. 2006). Many neonates apparently overwinter in the nest (Wahlquist and Folkerts 1973, Sanderson 1974, Ewert et al. 2006).

Population Status and Trend – In all likelihood, the combined effects of human take (food, pet trade), river impoundment, channel dredging, and pollution have reduced total numbers of Barbour's map turtles over many decades. However, no range-wide or even site-specific quantitative data exist that measure this adequately. Basking surveys provide relative but poorly repetitive pictures of presence and abundance; nonetheless, they do indicate that the species remains relatively common in some rivers (e.g., Chipola: Sash 2010). Recent discoveries of the species in river systems outside the Apalachicola drainage may suggest range expansion (perhaps human-enhanced), but data are insufficient to confirm this. Beginning in the 1970s, enactment of a series of protective rules by the former Florida Game and Fresh Water Fish Commission (GFC), now the FWC, may have reduced take. FWC's 2009 passage of a rule prohibiting take of all map turtles in the state may lead to population stability or even local increases.

Geographic Range and Distribution – Barbour's map turtle was long thought to be endemic to the Apalachicola River system, with populations extending far up into Georgia and Alabama in the Flint and Chattahoochee rivers, in addition to their occurrence downstream in the Apalachicola and Chipola Rivers in Florida. Recent discoveries of the species in rivers both to the east and west of the Apalachicola drainage have brought this assumption into question, although whether these are natural occurrences or the results of introductions is problematic. Thus, Barbour's map turtle is now known also from the Ochlockonee River (Enge et al. 1996; M. Aresco and D. Jackson, pers. commun.) and Aucilla River (Jackson 2003) systems east of the Apalachicola, and the Choctawhatchee River system (Wallace 2000, Godwin 2002) to the west.

Quantitative Analyses – We know of no PVA models that have been developed to estimate the probability of extinction of Barbour's map turtle.

BIOLOGICAL STATUS ASSESSMENT

Threats – Because Florida rivers are relatively stable and persistent, riverine species like Barbour's map turtle are less profoundly threatened by habitat destruction than much of the state's herpetofauna. Nonetheless, various human-generated threats to the integrity of lotic systems, including their floodplains, affect Florida's riverine turtles (Jackson 2005). The threat of chemical pollution (from industry, cities, boats, or highways) is especially dangerous to a species such as Barbour's map turtle that is confined to very few river systems, with but a single system (Apalachicola) harboring the vast majority of individuals. The problem is compounded by the Apalachicola receiving pollutants entering the system in Georgia and Alabama. Further, within Florida, the Apalachicola and Chipola drainages include a small number of Environmental Protection Agency Superfund Sites that have yet to be fully addressed by remedial actions (Ewert et al. 2006). Other factors affecting hydrology and flow of inhabited rivers have undocumented but potentially substantial effects on Barbour's map turtle. In Florida, two major impoundments (by dams designed to provide electricity, flood protection, and recreation) ─ Lake Seminole (Apalachicola River) and Lake Talquin (Ochlockonee River) ─ flooded major segments of river and floodplain habitat and converted them from lotic systems preferred by Barbour's map turtle (and their invertebrate prey) to suboptimal lentic-like systems. Other dams/impoundments exist upstream in Georgia and Alabama. In non-impounded sections of the Apalachicola River, channel maintenance operations for shipping have altered the river bottom profile, removed preferred basking sites (snags) essential to Barbour's map turtle, covered nesting sites with sediment (though incidentally creating some new ones: Ewert and Jackson 1994), and altered natural hydrological regimes in the floodplain. Beyond threats to its habitat, direct take by man (for food and for the pet trade) has negatively affected Barbour's map turtle for decades, but with unknown impact. Beginning with partial protection in the 1970s and culminating in 2009 with rules to protect all of Florida's freshwater turtles, the FWC has eliminated legal take of all map turtles (*Graptemys*) in the state. As for all turtles, predation accounts for the loss of most Barbour's map turtle eggs, and likely many hatchlings that do reach water. Raccoons and fish crows are the chief nest predators (Moulis 1997, Ewert et al. 2006; D. Jackson, *personal observations*). Nesting females also experience substantial predation, presumably by mid-sized mammals such as raccoons (Ewert et al. 2006). There is at least one documented occurrence of epidemic shell disease that appears to have affected a population of Barbour's map turtle in Lake Blackshear (Flint River), Georgia (Herrington 1994, Lovich et al. 1996). This suggests the need to monitor Florida populations regularly and to focus immediate attention on any suspicious observations. Boat strikes, though difficult to detect, may be a significant source of mortality in some areas more heavily used by man; large females are particularly vulnerable.

Population Assessment – Findings from the BRG are included in Biological Status Review Information Findings tables.

LISTING RECOMMENDATION

Staff recommends that the Barbour's map turtle be listed as a Threatened species because the species meets criteria B2 a+b [area of occupancy less than 772 mi^2, exists in less than ten

locations (rivers), and continuing declines projected] and D2 [species exists in less than 5 locations (rivers)].

SUMMARY OF THE INDEPENDENT REVIEW

Comments were received from three reviewers: John Jenson (Georgia Department of Natural Resources), Dr. Peter Lindeman (Edinboro University of Pennsylvania) and Dr. Don Moll (Missouri State University). All reviewers agreed with the findings of the BRG. They also supported staff recommendation to list the Barbour's map turtle as Threatened. The full text of peer reviews is available at MyFWC.com.

One reviewer provided information and commentary about the number of individuals in Florida, historic densities and interpretation of visual survey data. He explained that based on his own surveys of basking Barbour's map turtles and those conducted by others that the number of Barbour's map turtles in Florida is likely fewer than 10,000 individuals, although he admitted that, based on data variance, the number could be more than 10,000. Because there is so much variability in the data and the listing recommendation was not based on population numbers, no changes were made to the document. The reviewer's statement does highlight the need for better estimates of Barbour's map turtle populations and a further understanding of the correlation between basking survey data and other population estimates.

A reviewer discussed historic information about Barbour's map turtle densities (turtles per km) as an indicator of declines. He compared estimates of historic densities (turtles per river km) to current information and found that a decline has probably occurred. While staff and the BRG agree that there seems to have been a decline in Barbour's map turtles, there are insufficient data to determine the magnitude of the decline. Better data are needed to understand population trends of Barbour's map turtles.

Another reviewer suggested that the term "severely fragmented" be removed from the listing justification because the habitat is a continuous riverine system. The language was removed.

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Biological Status Review Information
Findings

Species/taxon: Barbour's map turtle
Date: November 9-10, 2010
Assessors: Chris Lechowicz, Peter Meylan, Paul Moler, Bill Turner and Travis Thomas
Generation length: 17.5 years (54 - 100 for three generations)

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]	insufficient data, though possible	S	N	
(a)2. An observed, estimated, inferred or suspected population size reduction of at least 30% over the last 10 years or 3 generations, whichever is longer, where the reduction or its causes may not have ceased or may not be understood or may not be reversible[1]	Over the last 50 yrs given combined stresses of harvest of turtles, shooting, habitat degradation; all-age basking surveys suggestive of decline, but directly comparable quantitative data are unavailable across this time span. Insufficient data to suspect a decline.	S	N	Sanderson 1974, Moler 1986, Ewert et al. 2006
(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]	unlikely with closure of legal take in 2009	I	N	FWC rule change July 20, 2009 prohibits sale of wild turtles
(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]	Possible due to stresses of harvest of turtles (past decades), die-offs, wanton shooting, habitat degradation; however, quantitative data are unavailable.	S	N	Sanderson 1974, Ewert et al. 2006
[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	ca. 4,600 mi^2	E	Y	D. Jackson GIS polygon
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	ca 140 km2	E	Y	D. Jackson GIS polygons
AND at least 2 of the following:				

a. Severely fragmented or exist in ≤ 10 locations	inhabits <5 separate river drainages, with the principal population in one river.	O	Y	Ewert et al. 2006, Florida Natural Areas Inventory (FNAI) data
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	Declines in number of individuals (v) and habitat quality (iii) are projected due to current stresses. These include water quality, water use and pollutants.	S	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	No; extreme fluctuations unlikely in long-lived species; rivers relatively stable.	O	N	Ewert et al. 2006, Jackson 2005,
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	no statewide census data available, but likely >10,000 in FL	S	N	Ewert et al. 2006
(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	Major inhabited river system (Apalachicola/Chipola) likely to degrade further in next 50 yrs; threats to water quantity & quality, molluscan food base, nest sites	S	Y	
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Declines in number of individuals (v) and habitat quality (iii) are projected due to current stresses. These include water quality, water use and pollutants.	I	N	
a. Population structure in the form of EITHER	probably >1000 in Apalachicola/Chipola system alone	S	N	
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation	Besides principal population (Apalachicola/Chipola), some adults also in Choctawhatchee and Ochlockonee rivers	O	N	Ewert et al. 2006
b. Extreme fluctuations in number of mature individuals	No; extreme fluctuations unlikely in long-lived species; rivers provide relatively stable habitat.	O	N	Ewert et al. 2006, Jackson 2005
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	probably >1000 in Apalachicola/Chipola system	E	N	
(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	≤5 locations: discounting Wacissa River (perhaps non-viable), inhabits only 3 separate river drainages (because of connectivity, can consider each as one location), with principal population in one (Apalachicola/Chipola; these might be considered as two locations in cases of upstream pollution event) Uses of the river make stochastic evens likely.	O	Y	Ewert et al. 2006, Florida Natural Areas Inventory (FNAI) data
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years	No adequate model available	P	N	

Initial Finding (Meets at least one of the criteria/sub-criteria OR Does not meet any of the criteria/sub-criteria)	Reason (which criteria/sub-criteria are met)
meets two criteria	B2 a+b, D2
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/sub-criteria OR Does not meet any of the criteria)	Reason (which criteria/sub-criteria are met)
meets two criteria	B2 a +b, D2

1	Biological Status Review Information Regional Assessment	Species/taxon:	Barbour's Map Turtle
2		Date:	November 9-10, 2010
3		Assessors:	Chris Lechowicz, Peter Meylan, Paul Moler,
4			Bill Turner and Travis Thomas
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.		do not know; unlikely in any drainage except Choctawhatchee
12	2c. Is the immigration expected to decrease? (Y/N/DK). If 2c is YES or DO NOT KNOW, go to line 13. If 2c is NO go to line 16.		
13	2d. Is the 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.		
14	If 2d is YES - Upgrade from initial finding (more imperiled)		
15	If 2d is NO or DO NOT KNOW - No change from initial finding		
16	If 2c is NO or DO NOT KNOW- Downgrade from initial finding (less imperiled)		
17	If 2b is NO or DO NOT KNOW - No change from initial finding		No change
18	2e. Are the conditions outside Florida deteriorating? (Y/N/DK). If 2e is YES or DO NOT KNOW, go to line 24. If 2e is NO go to line 19.		
19	2f. Are the conditions within Florida deteriorating? (Y/N/DK). If 2f is YES or DO NOT KNOW, go to line 23. If 2f is NO, go to line 20.		
20	2g. Can the breeding population rescue the Florida population should it decline? (Y/N/DK). If 2g is YES, go to line 21. If 2g is NO or DO NOT KNOW, go to line 22.		
21	If 2g is YES - Downgrade from initial finding (less imperiled)		
22	If 2g is NO or DO NOT KNOW - No change from initial finding		
23	If 2f is YES or DO NOT KNOW - No change from initial finding		
24	If 2e is YES or DO NOT KNOW - No change from initial finding		
25			
26	Final finding		No change

Notes: Calculations presented at the BSR group meeting

Generation Length estimated as follows. Age to maturity estimated at 15-20 years for females (Sanderson 1974, Ewert et al. 2006), 4 years for males (Cagle 1952). Longevity estimated at ca. 40 years for females, 20 years for males. Based on these, mean parental ages conservatively estimated at 25 years for females, 10 years for males (may be older). Generation length computed as (10 + 25)/2 = 17.5 years.

Population reduction. No directly comparable data for definitive assessment. Moler's (1986) sighting rate of basking map turtles (average 2.6/km) on Chipola River was much lower than Sanderson's (1974) encounter rate of 68.3/km, but the latter study was more intensive.

Appendix 1. Brief biographies of the Barbour's map turtle Biological Review Group members.

Chris Lechowicz is the Interim Director of the Wildlife Habitat Management Program and staff herpetologist at the Sanibel-Captiva Conservation Foundation where he has worked since 2002. He has a B.S. in Zoology and Computer Science from Southern Illinois University at Carbondale and will complete his M.S. in Environmental Science from Florida Gulf Coast University in 2010. Chris's focus is on riverine turtles with a specialty on the Genus *Graptemys.* Chris is a member of the IUCN/SCC Tortoise and Freshwater Turtle Specialists Group as well as a board member of the Florida Turtle Conservation Trust.

Dr. Peter A. Meylan received his Ph.D. from the University of Florida. He is a Professor of Biology at Eckerd College in Saint Petersburg, FL. His research interests include the evolutionary history, ecology, and conservation biology of amphibians and reptiles, especially turtles. Current research includes 2 sea turtle projects: an investigation of the ecology and migrations of sea turtles of Bocas del Toro Province, Panama (funded by the Wildlife Conservation Society) and the Bermuda Turtle Project, which is a cooperative project with the Bermuda Aquarium and the Caribbean Conservation Corporation (as well as continuing to work with Florida freshwater turtles with the Eckerd Herpetology Club on the Rainbow River). He has many scientific articles on turtles and is the editor of a book on the biology and conservation of Florida turtles.

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 more than 90 publications on amphibians and reptiles.

Travis Thomas received a Bachelor's Degree in 2008 from the University of Florida in Natural Resources Conservation. He is currently pursuing a Masters Degree in Wildlife Ecology and Conversation under the supervision of Dr. Perran Ross. His primary research focuses on the ecology and management of fauna in riparian systems. He was hired by FWC in 2008, and he has worked on numerous projects concerning reptile and amphibian ecology. He worked for 3 years in the Herpetology Dept. under Dr. Kenneth Krysko at the Florida Museum of Natural History. He has spent time as a volunteer on numerous projects in Kenya, Africa, under the supervision of Leigh Ecclestone and the Kenyan Wildlife Service. He has published several notes on the ecology and distribution of reptiles and is currently a co-author on a study of the ecology of *M. temminckii* in O'Leno State Park as well as the primary author on a study of the morphology of *M. temminckii*.

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 resource development 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 information about this species was received during the public information request period.