Supplemental Information for the Eastern Chipmunk

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 Dr. Brad Bergstrom

From: Bradley J. Bergstrom
To: Imperiled
Subject: RE: Deadline reminder for peer reviews of BSR reports
Date: Wednesday, January 26, 2011 2:27:33 PM
Attachments: Peer review of Eastern Chipmunk BSR.docx

Eastern chipmunk BSR peer review is attached.

_____

Brad Bergstrom, Ph.D., Professor
Department of Biology
Valdosta State University
Valdosta, GA 31698-0015 USA

Peer review of "Biological Status Review for the Eastern chipmunk (*Tamias striatus*)"
Reviewer: Dr. Brad Bergstrom, Biology Dept., Valdosta State University, Valdosta, GA
Date of Review: 3 December 2010 (draft); 26 January 2011 (final)

FWC proposes to remove the eastern chipmunk, currently listed as Species of Special Concern (SSC), from its list of T&E species. No population viability analysis has been conducted for the eastern chipmunk in Florida. The most recently published field data of any kind for the species in Florida is now at least 20 years old (Gore 1990), and the conclusion of that study is that the eastern chipmunk should retain its SSC status. The species was found to occur (in unknown abundances) at 18 different localities, in three disjunct clusters ($\geq$ 25 km separating neighboring clusters) along four major river drainages near the Alabama border in the extreme western Panhandle (Gore 1990). The outer (eastern and western) two clusters are relatively tiny, containing only 2-3 confirmed localities each and encompassing no more than 400 km^2 of area, each (boundaries based mostly on existing suitable habitat 20 years ago).

These panhandle localities for the eastern chipmunk are likely small populations at the margins of the geographic range of the species (Guo et al. 2005), and they are likely sink populations, with fluctuating abundances. Dispersal between clusters within Florida seems unlikely given the distances separating them (Snyder 1982), meaning that recolonization of any cluster following an extirpation would happen only via immigrants from Alabama—presumably the location of the source populations. The BSR provides no information on the distribution or abundance of eastern chipmunk populations in southern Alabama, nor the status of the habitat in that adjacent area of Alabama; Gore (1990) reports incidental observations of chipmunks from 6 Alabama counties bordering northwest Florida. Hall (1981) indicates that the species is absent from southwestern and extreme southeastern Alabama, giving somewhat of a "peninsular" distribution in south-central Alabama, ending in extreme northern Panhandle of Florida.

There is at least the suggestion (Gore 1990, and references therein) that the small eastern chipmunk populations in Florida represent isolated, Pleistocene relictual populations, which survived on ravines, bluffs, and steepheads and are thus most strongly associated with relatively rare and isolated hardwood forests of northern affinity, found in those same landforms. Several tree and shrub species of the upland hardwood forest reach the southernmost extents of their geographic ranges in these Florida localities, including American beech (*Fagus grandifolia*), black oak (*Quercus velutina*), and mountain laurel (*Kalmia latifolia*). It is not known what component(s) of remaining hardwood forests in northwest Florida, or combination of tree-species composition and landform, most strongly influence chipmunk occurrence.

The BSR finds that the eastern chipmunk meets 3 listing measures under the Geographic Range criterion, namely limited extent of occurrence, limited area occupied, and a severely fragmented population. One additional "Yes" in this category, either for extreme fluctuation in occurrrence/occupancy, or decline in occurrence/occupancy would have justified a Threatened status for this species. Alternatively, a finding of small total population, or of a declining population would have also justified a Threatened status. The most obvious problem with these latter conclusions of "Does not meet criterion" is the reference to 20-year old data, which were not quantitative to begin with. Estimates were based on low densities reported in the literature from the center of the species' range (where, again, densities might reasonably be expected to be

higher and less fluctuating; Guo et al. 2005) and area occupied determined largely by extent of suitable habitat in 1990. We still have to rely on the conclusion from 20-year-old, non-quantitative data that the population is not declining, and that there is not more population substructure than we assume there is, from the broad-brush occurrence maps in Gore (1990). One could conclude from Gore's (1990) Fig. 1 that there really is only one significant cluster of localities (appears to be 10-12 or so between the Yellow and Blackwater rivers), and 5 subpopulations rather than 3, with the single localities near Crestview and Paxton each separated from its nearest neighbor (within the ostensible largest cluster or "subpopulation") by 12-15 km. If one were to construct Minimum Convex Polygons around the apparently 5 clusters of actual confirmed localities, rather than the outer extent of suitable habitat as of 1990, one gets closer to 275 mi^2, rather than the 475 mi^2 the BSR reports. Granted, this leads to a population estimate that is still above the 10,000 threshold for the Population Size criterion.

Based on the above, I am reaching the conclusion that we simply do not know whether the eastern chipmunk in Florida warrants listing as a Threatened species, and the default conclusion seems to be that lack of knowledge means lack of evidence justifying the listing. Adopting this philosophy, in general, runs counter to the precautionary principle as applied to preserving rare biota. There do not seem to be any contemporary data whatsoever on extent of occurrence of eastern chipmunk in Florida. There are not really any quantitative data at all, contemporary or historic. There are certainly no genetic data that might address population structure. The BSR tabular findings state 5 times "…but clearing of deciduous forests may lead to decline." Can we not at least analyze some 1990 vs 2010 GIS data showing whether extent of mature hardwood forest in the shaded areas of Gore's (1990) Fig. 1 has increased, decreased or remained the same? What proportion of the known occupied hardwood forest area is in some kind of conservation protection?

I am also reviewing the BSR for Sherman's fox squirrel; there is a similar lack of certainty about the current status of that population, but in that case, the team is arguing for an extension of the SSC status until enough data can be collected to assess more accurately the current status. I would recommend a similar strategy for the eastern chipmunk. Admitedly, Sherman's fox squirrel is a rarer taxon globally, but I would argue that the small, fragmented, marginal populations of eastern chipmunk in Florida are globally important to the species, because marginal populations in unique habitats may possess unique genetic and ecological attributes (Lesica and Allendorf 1995, Bunnell et al. 2004).

Furthermore, species at the southern margins of their ranges face the additional threat (and existing-threat multiplier) of range contraction northward due to climate change (IPCC 1998). A range contraction of merely 30 km (18.6 mi) to the north would mean complete extirpation of the eastern chipmunk from Florida; this is less than many already documented range contractions, including an average of 45 miles over 40 years for wintering North American landbirds (NAS 2009), and northward shifts of 35-240 km over the past century for 63% of 35 species of European non-migratory butterfly (Parmesan et al., 1999).

I would prefer to see some discussion, if not modeling, of climate warming-induced northward range contraction for eastern chipmunk in Florida. I would also like to see some data on hardwood forest cover, especially how it has changed over the last 20 years. Ideally, I would

like to see some attempt to quantify the current eastern chipmunk population and collect sufficient demographic data to enable a viability analysis. If mark-recapture studies are not feasible, less labor-intensive yet robust molecular tools are now available for population modeling and viability analysis (Greenwald 2010).

References (not included in draft BSR)

Bunnell, F.L., R.W. Campbell, and K.A. Squires. 2004. Conservation priorities for peripheral species: the example of British Columbia. Canadian Journal of Forest Resources 34: 2240–2247.

Greenwald, K.R. 2010. Genetic data in population viability analysis: case studies with ambystomatid salamanders. Animal Conservation 13: 115–122.

Guo, Q., M. Taper, M. Schoenberger, and J. Brandle. 2005. Spatial-temporal population dynamics across species range: From centre to margin. Oikos 108: 47-57.

IPCC, 1998. The Regional Impacts of Climate Change: An Assessment of Vulnerability, (eds. R.T. Watson, M.C. Zinyowera, and R.H. Moss), Cambridge University Press, Cambridge, UK.

Lesica, P., and F.W. Allendorf. 1995. When are peripheral populations valuable for conservation? Conservation Biology 9: 753–760.

National Audubon Society (NAS). 2009. Birds and climate change: Ecological disruption in motion. 16 pp.
http://birds.audubon.org/sites/default/files/documents/birds_and_climate_report.pdf

Parmesan, C., et al. 1999. Poleward shifts in geographical ranges of butterfly species associated with regional warming. Nature 399: 579-583.

Peer review #2 from Dr. Holly Ober

From: Ober, Holly Karina
To: Imperiled
Subject: RE: Deadline reminder for peer reviews of BSR reports
Date: Wednesday, January 19, 2011 3:55:42 PM

Dr. Haubold,

I have reviewed the Biological Status Review compiled for the Eastern Chipmunk and believe the information and analyses used to determine how the species fits the 5 criteria is complete and accurate. I believe the available data have been appropriately interpreted, and the conclusion that this species no longer meets the criteria for listing is justifiable.

Holly Ober
Assistant Professor, Wildlife Ecology & Conservation
University of Florida
North Florida Research & Education Center
155 Research Rd
Quincy, FL 32351

Peer review #3 from Dr. Jack Stout

From: Jack Stout
To: Imperiled
Subject: review
Date: Tuesday, January 11, 2011 11:27:00 AM
Attachments: Eastern chipmunk Final BSR Draft 11-29-10.docx

I have complete confidence in this review.

Jack Stout

Copy of the Eastern Chipmunk BSR draft report that was sent out for peer review

Biological Status Review for the Eastern chipmunk (*Tamias striatus*)

EXECUTIVE SUMMARY

The Florida Fish and Wildlife Conservation Commission (FWC) directed staff to evaluate all species listed as Threatened or Species of Special Concern as of September 1, 2010. Public information on the status of the eastern chipmunk was sought from September 17 to November 1, 2010. The members of the biological review group (BRG) met on November 3-4, 2010. Group members were Jeff Gore (FWC lead), Bob McCleery, and Jack Stout. In accordance with rule 68A-27.0012 Florida Administrative Code (F.A.C.), the BRG was charged with evaluating the biological status of the eastern chipmunk using criteria included in definitions in 68A-27.001(3) and following the protocols in the *Guidelines for Application of the IUCN Red List Criteria at Regional Levels (Version 3.0)* and *Guidelines for Using the IUCN Red List Categories and Criteria (Version 8.1)*. Please visit http://myfwc.com/WILDLIFEHABITATS/imperiledSpp_listingprocess.htm to view the listing process rule and the criteria found in the definitions.

The eastern chipmunk Biological Review Group concluded from the biological assessment that the eastern chipmunk no longer met criteria for listing at any level. Based on the literature review and the biological review findings, staff recommends removing the species from the FWC list of Species of Special Concern.

This work was supported by a Conserve Wildlife Tag grant from the Wildlife Foundation of Florida.

BIOLOGICAL INFORMATION

Taxonomic Classification – This biological status report is for the eastern chipmunk (*Tamias striatus*) in Florida. Several subspecies of the eastern chipmunk have been named and the Florida population is typically included within *T. s. pipilans* (Snyder 1982; but see Jones and Suttkus 1979). However, the subspecies are not disjunct and are separated only by clinal gradation (Snyder 1982; Whitaker and Hamilton 1998). Therefore, this report does not consider subspecies in the assessment of the status of the Florida population of the eastern chipmunk.

Life History – The eastern chipmunk is a small ground squirrel that weighs around 80 to 125g and has prominent black and white lateral stripes (Snyder 1982). It inhabits deciduous forests, particularly areas with abundant crevices for refuge and numerous observation posts (Snyder 1982). Habitat in Florida is hardwood or mixed hardwood-pine forests having oaks as the dominant species (Gore 1990). Eastern chipmunks occur unevenly across their range in

Florida, and much of the apparently suitable deciduous forest habitat remains unoccupied (Gore 1990).

The eastern chipmunk lives in solitary and dispersed territories (Yahner 1978). Individuals are active during the day, mostly within 15m of the burrow system (Snyder 1982; Yahner 1978). Burrows are separated from each other by an average of 35m and core areas are intensely defended against conspecifics (Yahner 1978).

Density of eastern chipmunk populations varies both temporally and geographically and ranges from 0.3 to 37.6 individuals per hectare (Yerger 1953). Adult female breeding density is probably determined by the availability of food resources while male density seems to be dependent on female density (Galloway and Boonstra 1989). Clear-cutting of forests has no significant effect on eastern chipmunk population densities or age structure, but forest fragmentation does decrease chipmunk survival rates (Mahan and Yahner 1998; Nupp and Swihart 1998). Furthermore, in farmland woodlots, density decreases with increasing area and isolation of habitat (Reunanen and Grubb 2004).

Eastern chipmunk females breed once or twice a year in the spring and/or summer (Snyder 1982). Estrus lasts only a short period of time during which males intensively guard access to females (Yahner 1978). Litter size averages between 4 and 5 individuals and juveniles emerge at 5 to 7 weeks old at which time they are self-reliant (Snyder 1982; Yahner 1978). Most juveniles disperse to a new residence within two weeks of first emergence. Individuals usually become sexually mature after their first winter and average mean life expectancy is 1.3 years (Snyder 1982).

In the northern part of their range, eastern chipmunks spend most of their time from late fall to early spring underground in various degrees of torpor, but in favorable weather they sometimes appear above ground (Snyder 1982). This annual cycle of torpidity seems to be endogenous rather than determined by ambient temperature, and juveniles tend to delay its onset longer than do adults (as reviewed in Snyder 1982). It is unclear whether eastern chipmunks in the southern part of their range undergo this seasonal torpidity. Stevenson (1962) believed eastern chipmunks were inactive in winter in Florida, but Jones and Suttkus (1979) observed or collected individuals throughout the year. Food items (seeds, nuts, and acorns) for overwinter survival are cached in burrow systems (Snyder 1982).

Geographic Range and Distribution –The eastern chipmunk ranges from Lake Manitoba across eastern Canada and southward nearly to the Gulf of Mexico (Snyder 1982). It is listed as a species of Least Concern by the IUCN because it is widespread, abundant, and subject to no major threats (Linzey and Hammerson 2008).

Along the southern edge of its range the eastern chipmunk occurs in a few parishes in Louisiana near the Mississippi River; throughout much of Mississippi, Alabama, and Georgia; and in a small portion of northwest Florida (Snyder 1982). The eastern chipmunk's historical range in Florida is unknown, but its current range is restricted to west of the Apalachicola River along the Alabama line (Gore 1990; Snyder 1982). The range mapped by Gore (1990) covers at most about 475 square miles within 3 areas encompassing portions of Escambia, Santa Rosa,

Okaloosa, Walton, and Holmes counties and centered on the upper reaches of the Yellow, Blackwater, Escambia, and Choctawhatchee rivers. Chipmunks are not believed to occur throughout the mapped range (Gore 1990), and therefore, the area of occupancy is estimated to be less than 475 square miles.

Population Status and Trend – Gore (1990) found chipmunks over a larger area in northwest Florida than Stevenson (1962) reported earlier. However, the apparent increase was likely due to broader sampling effort rather than a real expansion of the extent of occurrence (Gore 1990). Chipmunk populations in Florida appear stable in number and distribution, but it is difficult to accurately quantify density and number of individuals in each population due to the chipmunk's secretive nature (Gore 1990).

Assuming the lowest reported density of 0.3 eastern chipmunks/hectare (Yerger 1953) occurs over the known Florida range of approximately 475 mi^2 (Gore 1990), the estimated number of chipmunks in Florida would be 36,900. Because eastern chipmunks in Florida have been found only in deciduous forests and primarily near streams (Stevenson 1962; Gore 1990), the actual area occupied and the population size are likely smaller. Nevertheless, the population is not known to be declining. More extensive sampling is needed to provide a better estimate of current population size and distribution of eastern chipmunks in Florida.

Quantitative Analyses – No population viability analysis has been conducted for the eastern chipmunk.

BIOLOGICAL STATUS ASSESSMENT

Threats – The greatest threat to eastern chipmunk populations in Florida is the destruction of habitat through the clearing of deciduous forests (Gore 1990). In Florida, this may be offset by the abandonment of planted pine forests and their succession into deciduous forests (Jones *et al*. 1992). The net effect of these two practices in Florida to chipmunk populations remains unknown (Jones *et al*. 1992).

Statewide Population Assessment – Findings from the Biological Review Group are included in a Biological Status Review information table and regional assessment table.

LISTING RECOMMENDATION – The eastern chipmunk Biological Review Group concluded from the biological assessment that the eastern chipmunk (*Tamias striatus*) no longer meets criteria for listing at any level. Based on the literature review and the biological review findings, staff recommends removing the species from the FWC list of species of special concern.

SUMMARY OF THE INDEPENDENT REVIEW – this will be completed after the peer review.

LITERATURE CITED

Galloway, M. and R. Boonstra. 1989. Response of the eastern chipmunk, *Tamias striatus*, to sex ratio manipulations. Oikos 55(1):3-10.

Gore, J.A. 1990. Distribution of the eastern chipmunk (*Tamias striatus*) in Florida. Florida Scientist 53:280-285.

Jones, C., C.A. Jones, and J.A. Gore. 1992. Eastern chipmunk *Tamias striatus striatus*. Pages 294-299 in S.R. Humphrey (ed.), Rare and endangered biota of Florida. Vol. I. Mammals. University Press of Florida. Gainesville, Florida.

Jones, C. and R.R. Suttkus. 1979. The distribution and taxonomy of *Tamias striatus* at the southern limits of its geographic range. Proc. Biol. Soc. Washington 91:828-839.

Linzey, A.V. and G. Hammerson. 2008. *Tamias striatus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. www.iucnredlist.org. Downloaded on 05 October 2010.

Mahan, C.G. and R.H. Yahner. 1998. Lack of population response by eastern chipmunks (*Tamias striatus*) to forest fragmentation. American Midland Naturalist 140:382-386.

Nupp, T.E. and R.K. Swihart. 1998. Effects of forest fragmentation on population attributes of white-footed mice and eastern chipmunks. Journal of Mammalogy 79(4):1234-1243.

Reunanen, P. and T.C. Grubb, Jr. 2004. Densities of eastern chipmunks (*Tamias striatus*) in farmland woodlots decline with increasing area and isolation. American Midland Naturalist 154(2):433-441.

Snyder, D.P. 1982. *Tamias striatus*. Mammalian Species 168:1-8.

Stevenson, H.M. 1962. Occurrence and habits of the eastern chipmunk in Florida. Journal of Mammalogy 43(1):110-111.

Whitaker, J.O., Jr. and W.J. Hamilton, Jr. 1998. Mammals of the eastern United States. Cornell University Press, Ithaca, New York.

Yahner, R.H. 1978. The adaptive nature of the social system and behavior in the eastern chipmunk, *Tamias striatus*. Behavioral Ecology and Sociobiology 3(4):397-427.

Yerger, R.W. 1953. Home range, territoriality, and populations of the chipmunk in central New York. Journal of Mammalogy 34:448-458.

Biological Status Review Information
Findings

Species/taxon:	Eastern chipmunk (*Tamias striatus*)
Date:	4 Nov 2010
Assessors:	Jeff Gore, Bob McCleery, Jack Stout
Generation length:	Individuals usually become sexually mature after their first winter and average mean life expectancy is 1.3 years (Snyder 1982). Therefore, generation time is about **1 year**.

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 evidence to suggest Florida populations are declining, but clearing of deciduous forests may lead to decline.		N	Gore 1990
(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 evidence to suggest Florida populations are declining, but clearing of deciduous forests may lead to decline.		N	Gore 1990
(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 evidence to suggest Florida populations are declining, but clearing of deciduous forests may lead to decline.		N	Gore 1990
(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 evidence to suggest Florida populations are declining, but clearing of deciduous forests may lead to decline.		N	Gore 1990
[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	< 7,722 mi^2 (approximate area of	E	Y	Gore 1990

	rectangle that includes ranges of all 3 known subpopulations (occupied areas) is about 90 mi x 19 mi = 1710 mi^2)			
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	< 772 mi^2 (sum of polygons around each of 3 known occupied areas is <475 mi^2)	E	Y	Gore 1990
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	Severely fragmented.	O	Y	Gore 1990
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	Unknown, i.e. no data available to assess population change and no evidence of population decline. But clearing of deciduous forests (iii) might lead to decline.		N	Gore 1990
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 fluctuations.		N	Snyder 1982
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	Assuming lowest reported density of 0.3 chipmunks/hectare over 475 mi^2 of area occupied = 36,900 chipmunks in Florida	E	N	Yerger 1953; Gore 1990
(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	Even if pop size is much lower than estimated above, there is no evidence of continuing decline			
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:				
a. Population structure in the form of EITHER				
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation				
b. Extreme fluctuations in number of mature individuals				
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	No	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	AOO > 8mi^2 but species occurs in 3 subpopulations. However, no threat is apparent that would adversely impact all 3 within a short period of time.	O	N	Gore 1990
(E) Quantitative Analyses				
e1. Showing the probability of extinction in the wild is at least 10% within 100 years	No PVA carried out.		N	

Initial Finding (Meets at least one of the criteria OR Does not meet any of the criteria)	Reason (which criteria are met)
Does not meet any of the criteria.	
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 any of the criteria.	

2	Regional Assessment Date:	11/4/10
3	Assessors:	Jeff Gore, Bob McCleery, Jack Stout
4		
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.	No
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.	Likely but don't know.
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 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 from initial finding.

Appendix 1. Biological Review Group Members Biographies

Jeff Gore has a Ph.D. in Wildlife Biology from the University of Massachusetts. He has worked for FWC since 1986 and since 2004 has been the leader of the Terrestrial Mammal Research Subsection. Dr. Gore has over 25 years of experience working on conservation of wildlife species in Florida, particularly small mammals such as bats and beach mice.

Robert McCleery has a Ph.D. in Wildlife Science from Texas A & M University. He currently serves as an assistant professor in the Department of Wildlife Ecology and Conservation at the University of Florida. Dr. McCleery has over 15 years experience in research and conservation of wildlife and has worked extensively on the ecology of fox squirrels, Key Largo woodrats, Keys marsh rabbits, Florida Key deer and Indiana bats.

Jack Stout has a Ph.D. from Washington State University. He is currently a Professor Emeritus at the University of Central Florida. Dr. Stout has worked over 30 years on the ecology and conservation of wildlife habitats and species in Florida, including Florida mice and beach mice.

Appendix 2. Summary of letters and emails received during the solicitation of information from the public.

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

Appendix 3. Information and comments received from the independent reviewers.