Supplemental Information for the Everglades Mink

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

Table of Contents

Peer review #1 from Dr. Mel Sunquist

From: Sunquist,Melvin E
Sent: Wednesday, January 19, 2011 5:09 PM
To: Gore, Jeff
Subject: mink BSR

Hi Jeff:

I've read through the review document and I agree with your assessment. The species needs to be Listed. Basically we know very little about the Everglades mink or mink in Florida. Data deficient characterizes the species. About 2 years back I saw some photos of two mink on the beach in Ft. Clinch State Park near Ferandina. The photos were taken by Dr. Pat Foster-Turley, who at one time was the chairperson of the IUCN Otter group. She lives in Ferandina Beach.

With best wishes,

Mel

Peer review #2 from Terry Zinn

From: floridawildflower@att.net
To: Imperiled
Subject: Re: Everglades mink Draft BSR Report
Date: Thursday, January 13, 2011 1:13:56 PM

Dear Imperiled Review committee: I have reviewed the documentation provided me in the email requesting by review of the status of the Everglades Mink BSR Report. I have also reviewed the literature cited in the report. I find the report to be a fair and accurate report on the status of this little studied subspecies. Further genetic study may ultimately move this subspecies to species status. The limited distribution, and susceptibility to diseases such as distemper will continue to make this subspecies success doubtful particularly as further encroachment on its habitat and exposure to human vectors increases. I find the assumptions about population numbers to be reasonable in light of the secretive nature of this animal and the difficulty in monitoring populations of the animal. The conclusions reached are consistent with the data and the reasonable interpretation of that data. Thank you for the opportunity to review the material. It brought back many found memories of my time in South Florida.

Terry L. Zinn
Wildflowers of Florida, Inc.
27715 NW 107 Street
Alachua, Florida 32615

Peer review #3 from Dr. Martin Main

From: Main,Martin B
To: Imperiled
Cc: Main,Martin B
Subject: Everglades Mink Review
Date: Tuesday, January 25, 2011 9:10:05 PM
Attachments: MMain Review_Everglades Mink_2011.docx
M Main comments_Everglades mink Final Draft BSR 11-22-10.docx
MMain comment_Neovison_vison_mink_factsheet.doc

Three documents attached.

Please confirm the files have been received, thanks.

Best regards,

Martin B. Main, PhD
Professor, Wildlife Ecology and Conservation
Program Leader, Florida Master Naturalist Program (www.MasterNaturalist.ifas.ufl.edu)
University of Florida
SW Florida Research and Education Center
2685 State Road 29 North
Immokalee, FL 34142

Everglades Mink Review

Martin Main, PhD.
Professor of Wildlife Ecology and Conservation, University of Florida

General Comments

I concur with the recommendation of the Biological Review Group (BRG) to retain the current status of the Everglades mink (*Neovison vison evergladensis*) as a threatened species in Florida.

The major issue associate with evaluating the status of the Everglades mink is the paucity of data. Nearly all the relatively current information on the Everglades mink comes from studies conducted (Humphrey and Zinn 1982) or specimens collected (Cunningham et al. 2009) from the Fakahatchee Strand. The only exceptions include historical reports and a single study from Everglades National Park (Smith 1980).

Although these data suggest the Everglades mink may have a very restricted distribution, the lack of systematic surveys for the mink in other regions that might support breeding populations render such a conclusion speculative at best. The lack of information on whether or where these animals might occur and the extent to which localized breeding units are isolated or not makes it difficult to evaluate the appropriate conservation status of this animal. In short, the BRG was challenged with a lack of information.

What the BRG can and did conclude, however, is that the Everglades mink appears to be rare throughout its range in south Florida. If the Everglades mink were not rare, there would presumably be more records from roadkill specimens and other sources. For example, a roadkill study conducted in southwest Florida did not include Everglades mink among specimens (Smith et al. 2006) and the Audubon Corkscrew Swamp Sanctuary, which has an active management and research program that includes camera traps and other survey methods, has never reported an Everglades mink on site (E. Carlson, pers. comm.). Even in the Fakahatchee where the Everglades mink is reported to be most commonly observed and where roadkill is opportunistically monitored (M. Owens, pers. comm.) produced only five specimens over a 10-year period (Foster et al. 2007).

Consequently, although there not sufficient data to definitively conclude that the Everglades mink is not more widespread, there is sufficient evidence to conclude it is not regionally abundant and is probably rare and geographically restricted to extreme southern Florida (Humphrey 1992).

Specific Response to Questions and Additional Comments

I was asked to comment on

(1) the completeness and accuracy of the biological information and data analyses in the BSR,

Answer: The BRG was complete in their review of the literature and did a good job of interpreting the available data.

The taxonomic revision is consistent with taxonomic nomenclature as reported by the Integrated Taxonomic Information System (ITIS; online: http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=727333;

accessed Jan 2011). ITIS is provides authoritative taxonomic information on plants, animals, fungi, and microbes of North America and the world through a partnership of U.S., Canadian, and Mexican agencies (ITIS-North America); other organizations; and taxonomic specialists. For more about ITIS (http://www.itis.gov/index.html).

(2) the reasonableness and justifiability of our assumptions, interpretations of the data, and conclusions.

Answer: I felt conclusions were reasonable. However, in the Biological Status Review Information Findings table, I think the BRG overstates the case in that "Current evidence suggests taxon occurs only in Fakahatchee Strand. However, even a GIS analysis of all potential habitat results in EOO of only 2,921 mi2."

The distributional extent of the Everglades mink is not known because there has not been an adequate effort invested into looking for the Everglades mink and learning about the ecology of the species. I suggest the statement be modified slightly to state "Current evidence of a breeding population of E mink is limited to the Fakahatchee Strand…."

I did not have sufficient information on how the EOO was calculated, so I am unable to comment on the estimate that "analysis of all potential habitat results in EOO of only 2,921 mi2."

I made comments throughout the Biological Status Review in red font for the BRG to incorporate or not as they deem appropriate.

I've provided the following in response to the letter submitted by the Conservancy of Southwest Florida that raised concerns regarding habitat loss due to projected population growth in Florida:

Much of the area in extreme south Florida that may support suitable habitat for the Everglades mink is under conservation protection managed by various state and federal agencies. Some of the more significant conservation areas include the Picayune Strand SF, Fakahatchee Strand SP, Florida Panther and 10,000 Islands NWR, Big Cypress NP, and Everglades NP. Further north, important conservation areas that could potentially support the Everglades mink include the Corkscrew Regional Ecosystem Watershed and Okaloacoochee Slough SF, although mink have not been documented in these areas. While not all area under conservation protection is suitable mink habitat, available mink habitat has been estimated at approximately 3,000 mi2. Although conservation lands are not at direct risk due to loss of habitat from development, regional development and land use changes may impose indirect effects such as alteration of regional hydrology that could affect habitat quality for mink at critical times during their life cycle. For example, Humphrey and Zinn (1982) reported the behavior of Everglades mink to respond to changes in the hydrological cycle, with mating being initiated late in the wet season and raising of young to coincide with drying of wetlands and concentration of prey, which is similar to the breeding patterns observed among wading birds. Consequently, regional hydrological health is an issue that could affect Everglades mink populations.

Everglades mink species fact sheet

Population trend: Stable

A1,A2, A3, A4- There have been no official counts indicating that Everglades mink populations are in decline (Humphrey 1992). Historical losses may have occurred around Lake Okeechobee and in the northern Everglades (Humphrey 1992). There is probably continued reduction in habitat quality and an increased effect of pollutants but the extent of these impacts is difficult to quantify (Humphrey 1992; Humphrey and Zinn 1982; Smith 1980).

Generation time: Males and females begin mating at around 10 months of age and maximum lifespan is around 10 years (as summarized in Schlimme 2003). That gives an approximate generation time of **4.5 years**.

Number (mature breeding individuals): Densities 0.1-0.7/km^2 (Lariviere 1999) = 0.26-1.81/mi^2. ➔ **759 to 5287 mink** based on GIS analysis estimate of EOO and AOO.

Geographic Range:

Extent of Occurrence: Everglades National Park (2186 mi^2) and Big Cypress National Preserve (1139 mi^2). GIS analysis gives EOO = 2921 mi^2. **Total < 7,722 mi^2.**

Area of Occupancy: Same as for extent of occurrence. **Total AOO > 772 mi^2**

Comment [MB1]: Typo - 7722

Fluctations: No

Fragmented? No

Number of locations: One? But is the area too big to be considered one location?

Population structure:

All in one? Yes? Or is the area too big to be considered one location?

Largest subpopulation <1000: Yes if the minimum estimate of mink is used (861 mink); No if you consider the entire range of mink to be one subpopulation and the maximum estimate of mink (6028 mink) or an average is used. Yes if you do not consider the entire range of mink to be one subpopulation but you estimate that the largest subpopulation has <1000 mink.

Quantitative analysis estimate of p extinction: None carried out.

Biological Status Review
for the
Everglades mink
(*Neovison vison evergladensis*)

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 Everglades mink 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), David Shindle, and Dan Pearson. In accordance with rule 68A-27.0012 Florida Administrative Code (F.A.C.), the BRG was charged with evaluating the biological status of the Everglades mink 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 Everglades mink Biological Review Group concluded from the biological assessment that the Everglades mink (*Neovison vison evergladensis*) met criteria for listing. No additional information was received during solicitation of information from the public. Based on the literature review and the biological review findings, staff recommends retaining the species on the FWC list of threatened species.

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 Everglades mink (*Neovison vison evergladensis*), a subspecies of the American mink (*N. vison*) in Florida. The American mink was formerly included in the genus *Mustela*, but biochemical, molecular, cytogenetic, and morphological evidence indicate that it should be elevated to the new genus*Neovison* (Kurose *et al*. 2008; Reid and Helgen 2008). The taxon was originally listed by FWC as a Threatened species under the genus name *Mustela*, but in the most recent rule change in 2010 the genus name was updated to *Neovison.*

Mink occur in at least three disjunct, peripheral populations in Florida: the saltmarshes of the gulf coast of northern Florida probably from Pasco County to Franklin County; the saltmarshes of the Atlantic coast from southern St. Johns County, Florida northwards into Georgia and South Carolina; and southern Florida freshwater marshes in the Everglades, Big Cypress Swamp, and Lake Okeechobee (Humphrey and Setzer 1989; Smith 1980). In addition, specimens and observations from northwest Florida indicate that mink occur in saltmarsh habitat along most of northwest Florida (J. Gore, Florida Fish and Wildlife Conservation Commission,

personal observation; Humphrey 1992). When first described, the Everglades mink population was considered a separate subspecies (*Mustela vison evergladensis*) based on a single road-killed specimen from Big Cypress Swamp (Hamilton 1948). A morphometric analysis of the three known populations of mink confirmed that they were distinct, but *M. v. evergladensis* was subsumed as a disjunct population of *M. v. mink* (Humphrey and Setzer 1989). That conclusion has been criticized and subsequent authors have accepted *evergladensis* as a distinct subspecies pending additional study (Whitaker and Hamilton 1998).

Regardless if Everglades mink (*N. v. evergladensis*) is taxonomically distinct based on morphometric differences in dentition as suggested by Humphrey and Setzer (1989), the best available evidence suggests the Everglades mink is geographically isolated from northern populations.

Life History – Much of the behavior and ecology of the Everglades mink is unknown and the summary here is based largely on studies of mink outside Florida. Mink are larger than New World members of the genus *Mustela* with a longer body length (>500mm) and heavier weight (>500g) than the weasels (Larivière 1999). Pelage of the Everglades mink is uniformly dark brown but some individuals have a white chin spot and a few have a white chest patch (Humphrey 1992). There is slight sexual size dimorphism with males being larger than females (Humphrey 1992; Larivière 1999). Evidence based on scent post surveys suggests that Everglades mink breed in autumn to coincide with the late wet season, which is earlier than north temperate populations, which typically breed in late winter and spring (Humphrey and Zinn 1982). Gestation for mink averages 51 days and average litter size is 4.

Mink typically live and forage along streams, marshes, and other wetlands, but they can live in drier habitats if food is plentiful. Males have larger home ranges than females and densities of adults vary from 0.1-0.7/km^2. In general, densities are generally higher in coastal habitats because of smaller home ranges and greater intersexual overlap. Mink are usually solitary, but pairs may occur during the breeding season (Larivière 1999).

In a year-long study of the Everglades mink in Everglades National Park, Smith (1980) observed animals primarily during the wet season, but captured none. The Everglades mink does not seem to avoid human activity and frequently makes use of man-made structures such as canals and levees (Smith 1980). Examination of digestive tracts from mink carcasses showed that mink fed on crayfish, snakes, fish, mammals, and birds (Smith 1980).

A study of the Everglades mink's response to conspecific scents suggests that habitat use may be seasonal and dependent on water levels in the marshes (Humphrey and Zinn 1982). Spikerush marshes and salt marshes between the mangroves and freshwater habitats are used during the wet season while swamp forests are used during the dry season. Mating potentially occurs in autumn when water levels are high. As water levels recede, the Everglades mink may relocate to more permanent ponds and concentrated food sources, particularly in March and April when young are not yet weaned (Humphrey 1992; Humphrey and Zinn 1982).

Geographic Range and Distribution – The Everglades mink exists as a disjunct population of the American mink that inhabits southern Florida and in particular the shallow freshwater marshes of the Everglades (2186 mi^2) and Big Cypress Swamp region (1139 mi^2;

Humphrey 1992; Humphrey and Setzer 1989). Most sightings and specimens have come from either Collier County or Dade County (Smith 1980), but the Everglades mink presumably inhabits northern and eastern Monroe County as well (Humphrey 1992). In the 1930s, Seminole Indians trapped mink extensively in the Everglades and Big Cypress Swamp and many others were collected near Lake Okeechobee (Allen and Neill 1952). Since that time, however, there have been no subsequent records of mink in the Lake Okeechobee area and also no information on the occurrence of mink in the northern Everglades (Humphrey 1992). Although the range of the Everglades mink formerly may have extended from Lake Okeechobee south through much of the Everglades (Allen and Neill 1952; Humphrey and Setzer 1989; Humphrey 1992), mink have recently been found only in and near Fakahatchee Strand (D. Shindle, personal observation).

However, it is important to recognize that other than studies by Humphrey and Setzer (1989) in the Fakahatchee and by Smith (1980) in Everglades National Park near Shark Valley, there have been no systematic regional surveys to document Everglades mink populations in south Florida. Consequently, although the absence of documented sightings or roadkill specimens suggest mink are not common and may not be widely distributed throughout south Florida, the lack of evidence of mink outside of locations where studies have been conducted is not sufficient evidence to conclude that mink do not also occur in other areas.

Population Status and Trend – The Everglades mink is difficult to detect and few museum specimens have been collected (Humphrey 1992). Consequently, population size and extent of occurrence are poorly known and trends can only be inferred from sparse data. Although no extensive systematic surveys have been conducted, some researchers have speculated that mink are locally common and several have noted that mink are more common in the Big Cypress Swamp than in the Everglades (Allen and Neill 1952; Humphrey and Zinn 1982; Humphrey 1992). Observations of mink have been too limited to make precise quantitative assessments about current population status or trends.

The IUCN currently lists *N. vison* as a species of Least Concern because it is widely distributed and is relatively common and secure across its range despite some local population declines (Reid and Helgen 2008). This assessment, however, applies to the entire species and not to the disjunct population that comprises *N. v. evergladensis.*

Quantitative Analyses – No population viability analysis has been conducted for the Everglades mink.

BIOLOGICAL STATUS ASSESSMENT

Threats – Changes to the natural water levels in the Everglades pose a potential threat to the Everglades mink (Smith 1980). Human disturbance and modifications to the wetlands that might impact mink include logging, drainage, road construction, canal construction, dike construction, control of hydroperiod, reapportionment of water to competing interests, and the introduction of fire into the forest (Humphrey 1992; Humphrey and Zinn 1982). Changes in water levels within the marshes can lead to destruction of habitat and encroachment of exotic vegetation (Humphrey and Zinn 1982).

Conversion of natural habitats to agriculture and urban areas may impact mink populations by reducing habitat, changing water levels, and introducing pollution from

pesticides, fertilizers, and heavy metals (Humphrey 1992). Because of their position in the food chain, mink serve as bio-indicators of pollution in aquatic environments (as summarized in Larivière 1999) and they may be particularly sensitive to bioaccumulation of mercury (Yates et al. 2004).

Cunningham et al. (2009) found four Everglades mink that had been infected by or exposed to canine distemper virus. They suspected the distemper epizootic was extensive and caused significant mortality, particularly within Fakahatchee Strand Preserve State Park. Anecdotal observations suggest that the mink population declined and subsequently recovered following the epizootic (Cunningham et al. 2009). An additional new threat to Everglades mink may be the introduction of invasive species, especially the Burmese python (*Python molurus bivittatus*).

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 Everglades mink Biological Review Group concluded from the biological assessment that the Everglades mink (*Neovison vison evergladensis*) met criteria for listing as described in 68A-27.001(3) F.A.C. Staff recommends listing the Everglades mink as a Threatened species. Based on the literature review and the biological review findings, staff recommends retaining the species on the FWC list of threatened species. The taxon was originally listed as a Threatened species under the genus name *Mustela*, but the Review Group concurs with the current listing of the genus as *Neovison.*

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

LITERATURE CITED

Allen, E.R. and W.T. Neill. 1952. Notes on the abundance of the Everglades mink. Journal of Mammalogy 33(1):102-118.

Cunningham, M. W., D. B. Shindle, A. B. Allison, S. P. Terrell, D. G. Mead, and M. Owen 2009. Canine distemper epizootic in Everglades mink. Journal of Wildlife Diseases, 45:1150–1157.

Cox, J. A., and R. S. Kautz. 2000. Habitat conservation needs of rare and imperiled wildlife in Florida. Florida Fish and Wildlife Conservation Commission, Tallahassee.

Hamilton, W. J., Jr. 1948. A new mink from the Florida everglades. Proceedings of the Biological Society of Washington 61:139-140.

Humphrey, S.R. 1992. Southern Florida population of mink *Mustela vison mink* (in part). Pages 319-327 in S.R. Humphrey (ed.), Rare and endangered biota of Florida. Vol. I. Mammals. University Press of Florida. Gainesville, Florida.

Humphrey, S.R. and H.W. Setzer. 1989. Geographic variation and taxonomic revision of mink (*Mustela vison*) in Florida. Journal of Mammalogy 70(2):241-252

Humphrey, S.R. and T.L. Zinn. 1982. Seasonal habitat use by river otters and Everglades mink in Florida. The Journal of Wildlife Management 46(2):375-381

Kurose, N., A.V. Abramov, and R. Masuda. 2008. Molecular phylogeny and taxonomy of the genus *Mustela* (Mustelidae, Carnivora), inferred from mitochondrial DNA sequences: New perspectives on phylogenetic status of the back-striped weasel and American mink. Mammal Study 33:25-33

Larivière, S. 1999. *Mustela vison*. Mammalian Species 608:1-9

Reid, F. and K. Helgen. 2008. *Neovison vison*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. www.iucnredlist.org. Downloaded on 05 October 2010.

Smith, A.T. 1980. Report T-555: An environmental study of Everglades mink (*Mustela vison*). South Florida Research Center.

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

Yates, D. E. D.T. Mayack, K. Munney, K, D.C. Evers, A.Major, T. Kaur, and R. J. Taylor. 2004. Mercury levels in mink (*Mustela vison*) and river otter (*Lontra canadensis*) from northeastern North America. Ecotoxicology, 14, 263–274

Biological Status Review Information
Findings

Species/taxon:	Everglades mink (*Mustela vison evergladensis*)
Date:	4 Nov 2010
Assessors:	Jeff Gore, David Shindle, and Dan Pearson
Generation length:	Approximate generation time estimated to be 3-5 years. Inferred from 1st reproduction in year one and maximum age of 10 years.

Comment [MB2]: Genus correction: *Neovison*

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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009;

	to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.			Larivière 1999
(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
[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	Current evidence suggests taxon occurs only in Fakahatchee Strand. However, even a GIS analysis of all potential habitat results in EOO of only 2,921 mi^2.	E	Y	Humphrey 1992; Humphrey and Setzer 1989; Cox and Kautz 2000; M. Endries, FWC, unpublished data
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Unknown. All documented occurrences in the last 12 years have been in Fakahatchee Strand. However, current occurrence in Big Cypress National Preserve and Everglades National Park is unknown.	O, I	N	Mike Owen, Florida Park Service, pers. comm.; David Shindle, Conservancy of Southwest Florida, pers. obs.
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	One location, all mink affected by disease, pollutants, and hydrologic manipulations.	I	Y	

Comment [MB3]: All documentation during last decade has been in Faka, but lack of surveys in other areas makes this statement too strong to defend. We really don't have info to estimate distribution. Suggest:
Current evidence of breeding pop of E mink is limited to the Fakahatchee Strand….

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 (i) extent of occurrence or (ii) area of occupancy. May also be a decline in (iii) quality of habitat and (v) number of individuals due to disease, pollutants, and hydrologic manipulations.	O, I, P	Y	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
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	Fluctuations occur in (iv) number of individuals due to canine distemper but degree of fluctuation is unknown. In other mustelids, canine distemper has contributed to extirpation of the species.	O	N	Cunningham *et al*. 2009
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	Based upon reported densities of 0.1-0.7/km^2, estimate 759 to 5287 mink using GIS estimate of EOO	E	Y	Larivière 1999; M. Endries, FWC, unpublished data
(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	Continuing decline inferred but rate of decline unknown.	S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Continuing decline in (i) extent of occurrence or (ii) area of occupancy. May also be a decline in (iii) quality of habitat and (v) number of individuals due to disease, pollutants, and hydrologic manipulations.	S	Y	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
a. Population structure in the form of EITHER	Unknown but may be < 1000	I	N	
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation	Yes	S	Y	
b. Extreme fluctuations in number of mature individuals	Unknown. Fluctuations occur in number of individuals due to canine distemper but degree of fluctuation is unknown. In other mustelids, canine distemper has contributed to extirpation of the species.	I	N	Cunningham *et al*. 2009
(D) Population Very Small or Restricted, EITHER				
(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	Unknown, but may be < 1000		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 not < 8 mi^2 but < five locations. Entire population may be impacted by disease (canine distemper). Mercury pollution may also be a contributing factor.	I	Y	Cunningham *et al*. 2009; Larivière 1999
(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)
Meets at least one of the criteria.	B1ab(i,ii); C2a(ii); D2
Is species/taxon endemic to Florida? (Y/N)	Y
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)
Meets at least one of the criteria.	B1ab(i,ii); C2a(ii); D2

Copy of the Everglades mink BSR draft report that was sent out for peer review

Biological Status Review for the Everglades mink (*Neovison vison evergladensis*)

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 Everglades mink 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), David Shindle, and Dan Pearson. In accordance with rule 68A-27.0012 Florida Administrative Code (F.A.C.), the BRG was charged with evaluating the biological status of the Everglades mink 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 Everglades mink Biological Review Group concluded from the biological assessment that the Everglades mink (*Neovison vison evergladensis*) met criteria for listing. No additional information was received during solicitation of information from the public. Based on the literature review and the biological review findings, staff recommends retaining the species on the FWC list of threatened species.

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 Everglades mink (*Neovison vison evergladensis*), a subspecies of the American mink (*N. vison*) in Florida. The American mink was formerly included in the genus *Mustela*, but biochemical, molecular, cytogenetic, and morphological evidence indicate that it should be elevated to the new genus*Neovison* (Kurose *et al*. 2008; Reid and Helgen 2008). The taxon was originally listed by FWC as a Threatened species under the genus name *Mustela*, but in the most recent rule change in 2010 the genus name was updated to *Neovison.*

Mink occur in at least three disjunct, peripheral populations in Florida: the saltmarshes of the gulf coast of northern Florida probably from Pasco County to Franklin County; the saltmarshes of the Atlantic coast from southern St. Johns County, Florida northwards into Georgia and South Carolina; and southern Florida freshwater marshes in the Everglades, Big Cypress Swamp, and Lake Okeechobee (Humphrey and Setzer 1989; Smith 1980). In addition,

specimens and observations from northwest Florida indicate that mink occur in saltmarsh habitat along most of northwest Florida (J. Gore, Florida Fish and Wildlife Conservation Commission, personal observation). When first described, the Everglades mink population was considered a separate subspecies (*Mustela vison evergladensis*) based on a single road-killed specimen from Big Cypress Swamp (Hamilton 1948). A morphometric analysis of the three known populations of mink confirmed that they were distinct, but *M. v. evergladensis* was subsumed as a disjunct population of *M. v. mink* (Humphrey and Setzer 1989). That conclusion has been criticized and subsequent authors have accepted *evergladensis* as a distinct subspecies pending additional study (Whitaker and Hamilton 1998).

Life History – Much of the behavior and ecology of the Everglades mink is unknown and the summary here is based largely on studies of mink outside Florida. Mink are larger than New World members of the genus *Mustela* with a longer body length (>500mm) and heavier weight (>500g) than the weasels (Larivière 1999). Pelage of the Everglades mink is uniformly dark brown but some individuals have a white chin spot and a few have a white chest patch (Humphrey 1992). There is slight sexual size dimorphism with males being larger than females (Humphrey 1992; Larivière 1999). Gestation for mink averages 51 days and average litter size is 4. Mink typically live and forage along streams, marshes, and other wetlands, but they can live in drier habitats if food is plentiful. Males have larger home ranges than females and densities of adults vary from 0.1-0.7/km^2. In general, Densities are generally higher in coastal habitats because of smaller home ranges and greater intersexual overlap. Mink are usually solitary, but pairs may occur during the breeding season (Larivière 1999). .

In a year-long study of the Everglades mink in Everglades National Park, Smith (1980) observed animals primarily during the wet season, but captured none. The Everglades mink does not seem to avoid human activity and frequently makes use of man-made structures such as canals and levees (Smith 1980). Examination of digestive tracts from mink carcasses showed that mink fed on crayfish, snakes, fish, mammals, and birds (Smith 1980).

A study of the Everglades mink's response to conspecific scents suggests that habitat use may be seasonal and dependent on water levels in the marshes (Humphrey and Zinn 1982). Spikerush marshes and salt marshes between the mangroves and freshwater habitats are used during the wet season while swamp forests are used during the dry season. Mating potentially occurs in autumn when water levels are high. As water levels recede, the Everglades mink may relocate to more permanent ponds and concentrated food sources, particularly in March and April when young are not yet weaned (Humphrey 1992; Humphrey and Zinn 1982).

Geographic Range and Distribution – The Everglades mink exists as a disjunct population of the American mink that inhabits southern Florida and in particular the shallow freshwater marshes of the Everglades (2186 mi^2) and Big Cypress Swamp region (1139 mi^2; Humphrey 1992; Humphrey and Setzer 1989). Most sightings and specimens have come from either Collier County or Dade County (Smith 1980), but the Everglades mink presumably inhabits northern and eastern Monroe County as well (Humphrey 1992). In the 1930s, Seminole Indians trapped mink extensively in the Everglades and Big Cypress Swamp and many others were collected near Lake Okeechobee (Allen and Neill 1952). Since that time, however, there have been no subsequent records of mink in the Lake Okeechobee area and also no information

on the occurrence of mink in the northern Everglades (Humphrey 1992). Although the range of the Everglades mink formerly may have extended from Lake Okeechobee south through much of the Everglades (Allen and Neill 1952; Humphrey and Setzer 1989; Humphrey 1992), mink have recently been found only in and near Fakahatchee Strand (D. Shindle, personal observation).

Population Status and Trend – The Everglades mink is difficult to detect and few museum specimens have been collected (Humphrey 1992). Consequently, population size and extent of occurrence are poorly known and trends can only be inferred from sparse data. Although no extensive systematic surveys have been conducted, some researchers have speculated that mink are locally common and several have noted that mink are more common in the Big Cypress Swamp than in the Everglades (Allen and Neill 1952; Humphrey and Zinn 1982; Humphrey 1992). Observations of mink have been too limited to make precise quantitative assessments about current population status or trends.

The IUCN currently lists *N. vison* as a species of Least Concern because it is widely distributed and is relatively common and secure across its range despite some local population declines (Reid and Helgen 2008). This assessment, however, applies to the entire species and not to the disjunct population that comprises *N. v. evergladensis.*

Quantitative Analyses – No population viability analysis has been conducted for the Everglades mink.

BIOLOGICAL STATUS ASSESSMENT

Threats – Changes to the natural water levels in the Everglades pose a potential threat to the Everglades mink (Smith 1980). Human disturbance and modifications to the wetlands that might impact mink include logging, drainage, road construction, canal construction, dike construction, control of hydroperiod, reapportionment of water to competing interests, and the introduction of fire into the forest (Humphrey 1992; Humphrey and Zinn 1982). Changes in water levels within the marshes can lead to destruction of habitat and encroachment of exotic vegetation (Humphrey and Zinn 1982).

Conversion of natural habitats to agriculture and urban areas may impact mink populations by reducing habitat, changing water levels, and introducing pollution from pesticides, fertilizers, and heavy metals (Humphrey 1992). Because of their position in the food chain, mink serve as bio-indicators of pollution in aquatic environments (as summarized in Larivière 1999) and they may be particularly sensitive to bioaccumulation of mercury (Yates et al. 2004).

Cunningham et al. (2009) found four Everglades mink that had been infected by or exposed to canine distemper virus. They suspected the distemper epizootic was extensive and caused significant mortality, particularly within Fakahatchee Strand Preserve State Park. Anecdotal observations suggest that the mink population declined and subsequently recovered following the epizootic (Cunningham et al. 2009). An additional new threat to Everglades mink may be the introduction of invasive species, especially the Burmese python (*Python molurus bivittatus*).

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 Everglades mink Biological Review Group concluded from the biological assessment that the Everglades mink (*Neovison vison evergladensis*) met criteria for listing as described in 68A-27.001(3) F.A.C. Staff recommends listing the Everglades mink as a Threatened species. Based on the literature review and the biological review findings, staff recommends retaining the species on the FWC list of threatened species. The taxon was originally listed as a Threatened species under the genus name *Mustela*, but the Review Group concurs with the current listing of the genus as *Neovison.*

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

LITERATURE CITED

Allen, E.R. and W.T. Neill. 1952. Notes on the abundance of the Everglades mink. Journal of Mammalogy 33(1):102-118.

Cunningham, M. W., D. B. Shindle, A. B. Allison, S. P. Terrell, D. G. Mead, and M. Owen 2009. Canine distemper epizootic in Everglades mink. Journal of Wildlife Diseases, 45:1150–1157.

Cox, J. A., and R. S. Kautz. 2000. Habitat conservation needs of rare and imperiled wildlife in Florida. Florida Fish and Wildlife Conservation Commission, Tallahassee.

Hamilton, W. J., Jr. 1948. A new mink from the Florida everglades. Proceedings of the Biological Society of Washington 61:139-140.

Humphrey, S.R. 1992. Southern Florida population of mink *Mustela vison mink* (in part). Pages 319-327 in S.R. Humphrey (ed.), Rare and endangered biota of Florida. Vol. I. Mammals. University Press of Florida. Gainesville, Florida.

Humphrey, S.R. and H.W. Setzer. 1989. Geographic variation and taxonomic revision of mink (*Mustela vison*) in Florida. Journal of Mammalogy 70(2):241-252

Humphrey, S.R. and T.L. Zinn. 1982. Seasonal habitat use by river otters and Everglades mink in Florida. The Journal of Wildlife Management 46(2):375-381

Kurose, N., A.V. Abramov, and R. Masuda. 2008. Molecular phylogeny and taxonomy of the genus *Mustela* (Mustelidae, Carnivora), inferred from mitochondrial DNA sequences: New perspectives on phylogenetic status of the back-striped weasel and American mink. Mammal Study 33:25-33

Larivière, S. 1999. *Mustela vison*. Mammalian Species 608:1-9

Reid, F. and K. Helgen. 2008. *Neovison vison*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. www.iucnredlist.org. Downloaded on 05 October 2010.

Smith, A.T. 1980. Report T-555: An environmental study of Everglades mink (*Mustela vison*). South Florida Research Center.

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

Yates, D. E. D.T. Mayack, K. Munney, K, D.C. Evers, A.Major, T. Kaur, and R. J. Taylor. 2004. Mercury levels in mink (*Mustela vison*) and river otter (*Lontra canadensis*) from northeastern North America. Ecotoxicology, 14, 263–274

Biological Status Review Information
Findings

Species/taxon:	Everglades mink (*Mustela vison evergladensis*)
Date:	4 Nov 2010
Assessors:	Jeff Gore, David Shindle, and Dan Pearson
Generation length:	Approximate generation time estimated to be 3-5 years. Inferred from 1st reproduction in year one and maximum age of 10 years.

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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999

(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(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]	Unknown. However, there has been a documented outbreak of canine distemper that is believed to have caused a decline in the mink population. In other mustelids, canine distemper has contributed to extirpation of the species. Other potential impacts are mercury contamination and changes in hydrological regime and introduction of exotic species, particularly Burmese python.	I, S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
[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	Current evidence suggests taxon occurs only in Fakahatchee Strand. However, even a GIS analysis of all potential habitat results in EOO of only 2,921 mi^2.	E	Y	Humphrey 1992; Humphrey and Setzer 1989; Cox and Kautz 2000; M. Endries, FWC, unpublished data
(b)2. Area of occupancy < 2,000 km^2 (772 mi^2)	Unknown. All documented occurrences in the last 12 years have been in Fakahatchee Strand. However, current occurrence in Big Cypress National Preserve and Everglades National Park is unknown.	O, I	N	Mike Owen, Florida Park Service, pers. comm.; David Shindle, Conservancy of Southwest Florida, pers. obs.
AND at least 2 of the following:				
a. Severely fragmented or exist in ≤ 10 locations	One location, all mink affected by	I	Y	

	disease, pollutants, and hydrologic manipulations.			
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 (i) extent of occurrence or (ii) area of occupancy. May also be a decline in (iii) quality of habitat and (v) number of individuals due to disease, pollutants, and hydrologic manipulations.	O, I, P	Y	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
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	Fluctuations occur in (iv) number of individuals due to canine distemper but degree of fluctuation is unknown. In other mustelids, canine distemper has contributed to extirpation of the species.	O	N	Cunningham *et al*. 2009
(C) Population Size and Trend				
Population size estimate to number fewer than 10,000 mature individuals AND EITHER	Based upon reported densities of 0.1-0.7/km^2, estimate 759 to 5287 mink using GIS estimate of EOO	E	Y	Larivière 1999; M. Endries, FWC, unpublished data
(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	Continuing decline inferred but rate of decline unknown.	S	N	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
(c)2. A continuing decline, observed, projected, or inferred in numbers of mature individuals AND at least one of the following:	Continuing decline in (i) extent of occurrence or (ii) area of occupancy. May also be a decline in (iii) quality of habitat and (v) number of individuals due to disease, pollutants, and hydrologic manipulations.	S	Y	Humphrey 1992; Humphrey and Zinn 1982; Smith 1980; Cunningham *et al*. 2009; Larivière 1999
a. Population structure in the form of EITHER	Unknown but may be < 1000	I	N	
(i) No subpopulation estimated to contain more than 1000 mature individuals; OR				
(ii) All mature individuals are in one subpopulation	Yes	S	Y	
b. Extreme fluctuations in number of mature individuals	Unknown. Fluctuations occur in number of individuals due to canine distemper but degree of fluctuation is unknown. In other mustelids, canine distemper has contributed to extirpation of the species.	I	N	Cunningham *et al*. 2009
(D) Population Very Small or Restricted, EITHER				

(d)1. Population estimated to number fewer than 1,000 mature individuals; OR	Unknown, but may be < 1000		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 not < 8 mi^2 but < five locations. Entire population may be impacted by disease (canine distemper). Mercury pollution may also be a contributing factor.	I	Y	Cunningham *et al.* 2009; Larivière 1999
(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)
Meets at least one of the criteria.	B1ab(i,ii); C2a(ii); D2
Is species/taxon endemic to Florida? (Y/N)	Y
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)
Meets at least one of the criteria.	B1ab(i,ii); C2a(ii); D2

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.

David Shindle has a M.S. in Wildlife Science from Texas A & M University. He has worked as a wildlife biologist for the Conservancy of Southwest Florida since 2005. Mr. Shindle has over 15 years experience in research and conservation of wildlife, with emphasis on the mammals of south Florida.

Daniel Pearson has a M.S. Wildlife Ecology and Conservation from University of Florida, Gainesville. He has worked as a biologist with the Florida Park Service for >20 years and has conducted surveys for several wildlife species including the Homosassa Shrew.

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.