Florida Panther
(Puma concolor coryi)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Southeast Region
South Florida Ecological Services Office
Vero Beach, Florida

5-YEAR REVIEW
Florida panther / *Puma concolor coryi*

I. GENERAL INFORMATION

A. Methodology used to complete the review: This review is based on monitoring reports, surveys, and other scientific and management information, augmented by conversations and comments from biologists familiar with the species. The review was conducted by the Service's Florida Panther Coordinator located at the South Florida Ecological Services Office and is based primarily on the Third Revision of the Florida Panther Recovery Plan. All recommendations resulting from this review are a result of thoroughly reviewing the best available information on the Florida panther. Comments and suggestions regarding the review were received from peer reviews from outside the Service (see Appendix A). No part of the review was contracted to an outside party. Comments were evaluated and incorporated as appropriate.

B. Reviewers

Lead Regional Office: Southeast Region, Kelly Bibb, 404-679-7132

Lead Field Office: South Florida Ecological Services Office, Chris Belden, 772-562-3909 x 237

C. Background

1. **FR Notice citation announcing initiation of this review:** June 21, 2005. 70 FR 35689.

2. **Species status:** Declining; 2008 Recovery Data Call.

3. **Recovery achieved:** 1 (0 to 25 percent)

4. **Listing history**
   Original Listing
   FR notice: 32 FR 4001
   Date listed: March 11, 1967
   Entity listed: Subspecies
   Classification: Endangered

5. **Associated rulemakings:** All other free-living *Puma concolor* to be threatened due to similarity of appearance wherever they may occur in Florida (56 FR 40265).

6. **Review History:**
   Final Recovery Plan – December 18, 2008.

Recovery Data Call – 2008, 2007, 2006, 2005, 2004, 2003, 2002, 2001, 2000, 1999, and 1998.

November 6, 1991 (56 FR 56882) 5-year review of listed species

July 22, 1985 (50 FR 29901) 5-year review for species listed before 1976 and in 1979 and 1980

May 21, 1979 (44 FR 29566) Review of species listed prior to 1975

No changes were recommended to the status of the panther in these 5-year reviews.

7. **Species' Recovery Priority Number at start of review (48 FR 43098):** 6c. This designation indicates that the subspecies is subject to a high degree of threat, has a low recovery potential, and its protection may conflict with development or some other economic interest.

8. **Recovery Plan or Outline:**
Name of plan: Florida Panther Recovery Plan, Third Revision
Date issued: December 18, 2008
Dates of previous revisions:
Second Revision – March 13, 1995
First Revision – June 22, 1987
Original Plan – December 17, 1981

II. REVIEW ANALYSIS

A. Application of the 1996 Distinct Population Segment (DPS) policy

1. **Is the species under review listed as a DPS?** No

2. **Is there relevant new information that would lead you to consider listing this species as a DPS in accordance with the 1996 policy?** No

B. Recovery Criteria

1. **Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes

2. **Adequacy of recovery criteria.**

a. Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes

b. Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria? Yes

3. List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

Reclassification will be considered when:
1. Two viable populations of at least 240 individuals (adults and subadults) each have been established and subsequently maintained for a minimum of twelve years (two panther generations; one panther generation is six years [Seal and Lacy 1989]).

2. Sufficient habitat quality, quantity, and spatial configuration to support these populations is retained / protected or secured for the long-term.

A viable population, for purposes of Florida panther recovery, has been defined as one in which there is a 95 percent probability of persistence for 100 years. This population may be distributed in a metapopulation structure composed of subpopulations that total 240 individuals. There must be exchange of individuals and gene flow among subpopulations. For reclassification, exchange of individuals and gene flow can be either natural or through management. If managed, a commitment to such management must be formally documented and funded. Habitat should be in relatively unfragmented blocks that provide for food, shelter, and characteristic movements (e.g., hunting, breeding, dispersal, and territorial behavior) and support each metapopulation at a minimum density of 2 to 5 animals per 100 square miles (259 square kilometers) (Seidensticker et al. 1973, Logan et al. 1986, Maehr et al. 1991a, Ross and Jalkotzy 1992, Spreadbury et al. 1996, Logan and Sweanor 2001, Kautz et al. 2006), resulting in a minimum of 4,800 – 12,000 square miles (12,432 – 31,080 square kilometers) per metapopulation of 240 panthers. The amount of area needed to support each metapopulation will depend upon the quality of available habitat and the density of panthers it can support.

The panther population has increased from an estimated 12 to 20 (excluding kittens) in the early 1970s to an estimated 100 to 120 in 2007. However, the panther continues to face numerous threats. The Florida panther has not met criteria to be considered for reclassification to threatened status. For further detail on recovery criteria, please see the recently released recovery plan at http://www.fws.gov/verobeach.

C. Updated Information and Current Species Status

1. Biology and Habitat

a. Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends: The panther population appears to be increasing or stable in the short-term. McBride (2000, 2001, 2002, 2003) reported documented panther counts (i.e., number known alive) based on panthers treed with hounds; physical evidence (e.g., tracks where radio-collared panthers were not known to occur); documentation by trail-camera photos; and sightings of uncollared panthers by a biologist or pilot from a monitoring plane or via ground telemetry. He counted 62, 78, 80, and 87 panthers (which includes adult and subadult panthers but not kittens at the den) in 2000, 2001, 2002, and 2003, respectively. The number of documented panthers were 78, 82, 97, 117, and 104 in 2004, 2005, 2006, 2007, and 2008, respectively (R. McBride, pers. comm. 2009). McBride (pers. comm. 2007) documented an increase in the number of uncollared panthers captured each year between 2000 and 2006 relative to 1981 through 1999, while Florida Fish and Wildlife Commission (FWC) (2006) reported data showing an apparent increase in the number of panthers killed by vehicles and number of known den sites since 1999. These data, along with an increase in the number of male panthers dispersing north of the Caloosahatchee River (Belden and McBride 2006), indicate an increasing trend in the panther population. In the long term, continued habitat loss and fragmentation could eventually lead to decline.

Male Florida panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. The first sexual encounters for males normally occur at about three years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991a). Based on genetics work, some males may become breeders as early as 17 months (W. Johnson, National Cancer Institute, pers. comm. 2005). Breeding activity peaks from December to March (Shindle et al. 2003). Litters (n = 82) are produced throughout the year, with 56 – 60 percent of births occurring between March and June (Jansen et al. 2005, Lotz et al. 2005). The greatest number of births occurs in May and June (Jansen et al. 2005, Lotz et al. 2005). Female panthers have bred as young as 18 months (Maehr et al. 1989) and successful reproduction has occurred up to 11 years old. Mean age of denning females is 4.6 ± 2.1 (standard deviation [sd]) years (Lotz et al. 2005). Age at first reproduction for 19 known-aged female panthers averaged 2.2 ± 0.246 (sd) years and ranged from 1.8 to 3.2 years. Average litter size is 2.4 ± 0.91 (sd) kittens. Seventy percent of litters are comprised of either two or three kittens. Mean birth intervals (elapsed time between successive litters) are 19.8 ± 9.0 (sd) months for female panthers (n = 56) (range 4.1 to 36.5 months) (Lotz et al. 2005). Females that lose their litters generally produce another more quickly; five of seven females whose kittens were brought into captivity successfully produced another litter an average of 10.4 months after the removal of the initial litter (Land 1994).

Intraspecific aggression accounts for 42 percent of all mortalities among radio-collared panthers (Jansen et al. 2005, Lotz et al. 2005). Unknown causes and collisions with vehicles account for 24 and 19 percent of mortalities, respectively. From 1990 to 2004, mean annual survivorship of radio-collared adult panthers was greater for females (0.894 ± 0.099 sd) than males (0.779 ± 0.125 sd) (Lotz et al. 2005). Most intraspecific aggression occurs between male panthers; but, aggressive encounters between males and females, resulting in the death of the female, have occurred. Defense of kittens and / or a kill is suspected in half (5 of 10) of the known instances through 2003 (Shindle et al. 2003).

Female panthers are considered adult residents if they are older than 18 months, have established home ranges and bred (Maehr et al. 1991a). Land et al. (2004) reported that all 24 female panthers first captured as kittens survived to become residents and 19 (79.2 percent) produced litters. Male panthers are considered adult residents if they are older than three years and have established a home range that overlaps with females. Thirty-one male panthers were captured as kittens and 12 (38.7 percent) of these cats survived to become residents (Jansen et al. 2005, Lotz et al. 2005). "Successful male recruitment appears to depend on the death or home-range shift of a resident adult male" (Maehr et al. 1991b). Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadults and non-resident males (Maehr et al. 1991b, Shindle et al. 2003).

b. Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): Three external characters—a right angle crook at the terminal end of the tail, a whorl of hair or cowlick in the middle of the back, and irregular, white flecking on the head, nape, and shoulders—not found in combination in other subspecies of *Puma* (Belden 1986), were commonly observed in Florida panthers through the mid-1990s. The kinked tail and cowlicks were considered manifestations of inbreeding (Seal 1994), whereas the white flecking was thought to be a result of scarring from tick bites (Maehr 1992, Wilkins et al. 1997). Four other abnormalities prevalent in the panther population prior to the mid-1990s included cryptorchidism (one or two undescended testicles), low sperm quality, atrial septal defects (the opening between two atria of the heart fails to close normally during fetal development), and immune deficiencies. These four abnormalities were also suspected to be the result of low genetic variability (Roelke et al. 1993).

Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago (Seal 1994). Isolation, reduced population size, and inbreeding resulted in loss of genetic variability and diminished health. Data on polymorphism and heterozygosity, along with records of multiple physiological abnormalities, suggest that the panther population had experienced inbreeding depression (Roelke et al. 1993, Barone et al. 1994). Measured heterozygosity levels indicate that the Florida panther had lost about 60 – 90 percent of its genetic diversity (Culver et al. 2000). Genetic problems in the Florida panther included heart murmurs, a high rate of unilateral cryptorchidism, low testicular and semen volumes, diminished sperm motility, and a high percentage of morphologically abnormal sperm.

A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994) and eight non-pregnant adult female Texas puma (*Puma concolor stanleyana*) were released in five areas of south Florida from March to July 1995. Since this introgression, rates of genetic defects, including crooked tails and cowlicks, have dramatically decreased (Land et al. 2004). In addition, to date neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, FWC, pers. comm. 2005). Semen examination of two introgressed panthers indicated that sperm volume, motility, and count were higher than for an uncrossed Florida panther. A preliminary assessment of genetic restoration suggested that the desired 20 percent introgression level had been achieved, but the contributions were primarily from two of the released females (Land and Lacy 2000). Genetic introgression is also reducing the occurrence of kinked tails and cowlicks in intercross progeny (Land et al. 2004). The effects of genetic restoration on color and cranial and dental measures have not been evaluated.

c. Taxonomic classification or changes in nomenclature: Since the first classification of felids by Linnaeus (1758), there have been a number of reclassifications. A brief review of cat species classification history is presented by Werdelin (1996) and shows a record of extremes in both “splitting” and “lumping” (Nowell and Jackson 1996). The most recent evaluation of the felid family is Wozencraft’s (1993) classification (Werdelin 1996). A considerable amount of work is still required before consensus can be reached regarding felid systematics and the consensus must involve both morphological and molecular work (Werdelin 1996). A consensus molecular, morphological, and ethological classification scheme would provide a framework for conservation programs and will become increasingly important as wild populations become smaller and increasingly isolated (O’Brien 1996a).

Although there is more agreement among felid taxonomists regarding recognition of cat species, there is considerable confusion with regards to subspecies, debate on subspecies definition, and debate on whether or not the traditional taxonomic concept is even valid in the light of contemporary knowledge of population biology and genetics (Nowell and Jackson 1996). There is general agreement that too many subspecies of cats have been described in the past on the basis of slim evidence (Nowell and Jackson 1996). Mayr (1940, 1963, 1970) defined a subspecies as "a geographically defined aggregate of local populations which differ taxonomically from other subdivisions of the species" (cited in O'Brien 1996b). O'Brien and Mayr (1991) and O'Brien (1996b) provide criteria for subspecies classification. Following their criteria, a subspecies includes members that share a unique geographic range or habitat, a group of phylogenetically concordant phenotypic characters, and a unique natural history relative to other subdivisions of the species.

The Florida panther was first described by Charles B. Cory in 1896 as *Felis concolor floridana* (Cory 1896). The type specimen was collected in Sebastian, Florida. Bangs (1899) believed that the Florida panther was restricted to peninsular Florida and could not intergrade with other *Felis* spp. Therefore, he assigned it full specific status and named it *Felis coryi* since *Felis floridana* had been used previously for a bobcat (*Lynx rufus*).

The taxonomic classification of the *Felis concolor* group was revised and described by Nelson and Goldman (1929) and Young and Goldman (1946). These authors differentiated 30 subspecies using geographic and morphometric (measurement of forms) criteria and reassigned the Florida panther to subspecific status as *Felis concolor coryi*. This designation also incorporated *F. arundivaga* which had been classified by Hollister (1911) from specimens collected in Louisiana into *F. c. coryi*.

The puma was originally named *Felis concolor* by Linneaus in 1771, but in 1834 Jardine renamed the genus *Puma* (Wozencraft 1993). Later taxonomists lumped most of the smaller cat species, including the puma, into subgenera under the genus *Felis* (Nowak and Paradiso 1983). Wozencraft (1993) promoted the subgenera of the old genus *Felis* to full generic status and placed a number of former *Felis* species, including the puma, in monotypic genera (Nowell and Jackson 1996). The taxonomic classification of the puma is now considered to be *Puma concolor* (Wozencraft 1993), making the accepted name for the Florida panther *P. c. coryi*.

A comprehensive molecular genetic analysis of pumas in southern Florida using mitochondrial DNA and nuclear markers reported by O'Brien et al. (1990) indicated the existence of two distinct genetic stocks with concordant morphological phenotypes. The close phylogenetic proximity of the southwest Florida population segment with representatives of other North American subspecies indicated this population segment was descended from historic *P. c. coryi*. The population segment in southeastern Florida, however, appeared to have evolved in South or Central America. This was accounted for by the release of seven captive animals (including three females) into Everglades National Park (ENP) between 1957 and 1967 (unpublished archives, ENP, National Park Service [NPS], Washington, D.C., cited in O'Brien et al. 1990). The subpopulation in ENP became effectively extirpated with the death of three resident females in June and July 1991 (Bass and Maehr 1991).

As people exterminated puma in eastern North America, the only population that remained was in peninsular Florida and they became isolated from other puma populations, eliminating gene flow. As the Florida panther was reduced to a small breeding population in southern Florida, the lack of gene flow and small population size fostered a higher rate of inbreeding as seen in reduced allozyme variation relative to other puma subspecies (Roelke et al. 1993a) and eight fixed loci (Culver et al. 2000). The inbreeding condition and reduction of genetic diversity appeared to have occurred during the 20^{th} century as Culver et al. (2000) found museum samples from the Florida population dating to the turn of the 19^{th} century to have much higher heterozygosity levels. The consequences of inbreeding included spermatozoal defects, cryptorchidism, cardiac abnormalities, and reduced immunity to infectious diseases (Roelke et al. 1993a).

Through the late 1980s and early 1990s, the frequency of individuals exhibiting physiological abnormalities increased. Approximately 90 percent of males born after 1990 had one or both testicles undescended (Pimm et al. 2006a). The Service (1994a) became concerned that the overall genetic health of the Florida panther was at a point where the panther's continued existence was doubtful without a proactive genetic restoration program. A plan for genetic restoration and management was developed (Seal 1994a). The level of introgression required to reverse the effects of inbreeding and genetic loss required the release of eight Texas puma into areas occupied by Florida panther (Seal 1994). These eight female Texas puma were released in 1995, five of which produced a total of 20 offspring (Land et al. 2004). The desired 20 percent introgression level was achieved (Land and Lacy 2000) and the genetic rescue of the Florida panther was determined to be successful (Pimm et al. 2006a). Three times as many introgressed kittens appear to reach adulthood as do uncrossed Florida panthers and introgressed adult females have lower mortality rates (Pimm et al. 2006a).

Subspecies can interbreed as a natural process whenever they are in contact (O'Brien and Mayr 1991) and this was the basis for choosing Texas puma (the closest extant adjacent subspecies) for genetic restoration of the Florida panther (Service 1994a). Prior to making the decision to conduct genetic augmentation to facilitate the recovery of the Florida panther, the Service made the determination that any resulting offspring would receive the full protections of the Endangered Species Act (ESA). This determination was the product of a rigorous policy and legal review at the highest levels of the agency (Service 1994b).

Culver et al. (2000) speculated that the moderate level of genetic variability found in North American puma was due to their extirpation during Pleistocene glaciations and then recolonization some 10,000 years ago. Modern puma eventually covered practically the entire North American continent (excluding the most northern latitudes) and had the largest range of any native mammal species in the Western Hemisphere (Hall and Kelson 1959). Within this extensive range, geographic variation was present and involved subtle differences in body measurements, pelage characteristics, and skeletal features. When puma subspecies were first described, it was this geographic variation that was used to delineate each subspecies. Characters previously used to describe *P. c. coryi* were quantified and re-evaluated using statistical methods by Wilkins et al. (1997). All historic and recent specimens from the southeastern U.S. (n = 79) were examined for pelage color, cranial profile and proportions, and other morphological traits. These specimens were compared to a sample of North and South American specimens. The characters measured provide a basis on which to describe the Florida population and discriminate between it and other populations (Wilkins et al. 1997).

Recent molecular genetic analyses have found that pumas in North America are very similar to each other (Culver et al. 2000, Sinclair et al. 2001, and Anderson et al. 2004). Culver et al. (2000) examined subspecies of puma by using three mitochondrial genes and ten microsatellite loci in biological samples collected from 315 pumas from throughout their range. They could not confirm the previous classification of 32 subspecies and, based on the subspecific criteria suggested by O'Brien and Mayr (1991), could only recognize six subspecies of *Puma*. Culver et al. (2000) suggested all North American pumas be reclassified as a single subspecies (*P. c. couguar*) due to lack of genetic structure. However, Culver et al. (2000) determined that the Florida panther was one of several smaller populations that had unique features, the number of polymorphic microsatellite loci and amount of variation were lower, and it was highly inbred (eight fixed loci).

The degree to which the scientific community has accepted the use of genetics in puma taxonomy is not resolved at this time. The existing Florida panther population represents the last remaining population of *Puma* in the eastern United States, and is therefore important to the genetic representation for pumas in North America. Additional research is needed to understand genetic and morphological similarities and differences of puma across North America. The Florida panther is listed under the ESA and any change in its listing status based on best available science would require completing the formal rulemaking process pursuant to the ESA. The panther and its habitat continue to receive ESA protections.

d. Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range: The Florida panther is the last subspecies of *Puma* still surviving in the eastern U.S. The panther once ranged throughout the southeastern U.S. from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee. Today the panther is restricted to less than 5 percent of its historic range in one isolated breeding population located in southern Florida.

Although generally considered unreliable, sightings of panthers regularly occur throughout the Southeast. However, no reproducing populations of panthers have been found outside of south Florida for at least 30 years despite intensive searches to document them (Belden et al. 1991, McBride et al. 1993, Clark et al. 2002). Survey reports and more than 70,000 locations of radio-collared panthers recorded between 1981 and 2004 clearly define the panther's current breeding range (see recovery plan at http://www.fws.gov/verobeach for relevant figures and maps). Reproduction is known only in the Big Cypress Swamp / Everglades physiographic region in Collier, Lee, Hendry, Miami-Dade, and Monroe Counties south of the Caloosahatchee River (Belden et al. 1991). Although confirmed panther sign, male radio-collared panthers, and uncollared males killed by vehicles have been recorded outside of south Florida in recent years, no female panthers have been documented north of the Caloosahatchee River since 1973 (Nowak and McBride 1974, Belden et al. 1991, Land and Taylor 1998, Land et al. 1999, Shindle et al. 2000, McBride 2002, Belden and McBride 2006).

e. Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem): Data from radio-collared panthers collected from 1981 through 2000 were used to delineate home ranges, which were geo-referenced with land cover and other relevant data. Compositional analysis was performed to evaluate the relative frequency of occurrence of various land cover types within panther habitat. A spatially-explicit raster model that identified forest patches potentially suitable for use by panthers as cover was used to refine the outer boundaries of the occupied zone, represented as overlapping minimum convex polygons of panther home ranges, and as a first step to identifying zones of potential use elsewhere. Cover components were combined with a least cost path analysis to delineate a dispersal zone connecting occupied habitat in southern Florida to the Caloosahatchee River.

Three priority zones were identified as important for panther habitat conservation: (1) Primary Zone – lands essential to the long-term viability and persistence of the panther in the wild; (2) Secondary Zone - lands contiguous with the Primary Zone, currently used by few panthers, but which could accommodate expansion of the panther population south of the Caloosahatchee River; and (3) Dispersal Zone - the area which may facilitate future panther expansion north of the Caloosahatchee River (Kautz et al. 2006), (Figure 3 in the recovery plan). The Primary Zone is currently occupied and supports the breeding population of panthers. Although panthers move through the Secondary and Dispersal Zones, they are not currently occupied by resident panthers. Some areas of the Secondary Zone would require restoration to support panthers.

These zones vary in size, ownership, and land cover composition. The Primary Zone is 3,548 mi^2 (9,189 km^2) in size, 73 percent of which is publicly owned, and includes portions of the Big Cypress National Preserve (BCNP), ENP, Fakahatchee Strand Preserve State Park (FSPSP), Florida Panther National Wildlife Refuge (FPNWR), Okaloacoochee Slough State Forest (OSSF), and Picayune Strand State Forest (PSSF). This zone's composition is 45 percent forest, 41 percent freshwater marsh, 7.6 percent agriculture lands, 2.6 percent prairie and shrub lands, and 0.52 percent urban lands (Kautz et al. 2006).

The Secondary Zone is 1,269 mi^2 (3,287 km^2) in size, 38 percent of which is public land. This zone's composition is 43 percent freshwater marsh, 36 percent agriculture, 11 percent forest, 6.1 percent prairie and shrub lands, and 2.3 percent low-density residential areas and open urban lands (Kautz et al. 2006).

The Dispersal Zone is 44 mi^2 (113 km^2) in size, all of which is privately owned. This zone's composition is 49 percent agriculture (primarily improved pasture and citrus groves), 29 percent forest (wetland and upland), 8.8 percent prairie and shrub land, 7.5 percent freshwater marsh, and 5.1 percent barren and urban lands (Kautz et al. 2006).

2. Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

a. Present or threatened destruction, modification or curtailment of its habitat or range: Habitat loss, fragmentation, and degradation, and associated human disturbance are the greatest threats to panther survival and among the greatest threats to its recovery. These threats are expected to continue in Florida and throughout the Southeast. Throughout Florida, between 1936 and 1987, cropland and rangeland increased 6,609 mi^2 (17,118 km^2) or 30 percent, urban areas increased by 6,172 mi^2 (15,985 km^2) or 538 percent, while herbaceous wetlands declined by 6,063 mi^2 (15,702 km^2) or 56 percent and forests declined by 6,719 mi^2 (17,402 km^2) or 21 percent (Kautz et al. 1993, Kautz 1994). Assuming that all of the forest lost was panther habitat, Kautz (1994) estimated that the 21 percent loss of forests was the equivalent of 35 to 70 male panther home ranges and 100 to 200 female panther home ranges. Between 1985 to 2003 an additional 5,019 mi^2 (13,000 km^2) (13 percent) of natural and semi-natural lands (including panther habitat) in the state were converted to urban / developed and agricultural uses (Kautz et al. 2006).

Expansion of urban areas on the coasts and the spread of agricultural and urban development in the interior of Florida continue to replace, degrade, and fragment panther habitat, placing the panther at greater risk. Over 83 percent of the 2,500 mi^2 (6,475 km^2) of agricultural land in southwest Florida has been categorized as rangeland. In Southwest Florida between 1986 and 1990, row crop acreage increased by 14 mi^2 (36 km^2) or 21 percent; sugarcane increased by 25 mi^2 (65 km^2) or 21 percent; citrus increased by 84 mi^2 (219 km^2) or 75 percent; and rangeland, much of it suitable for panther occupation, decreased by 250 mi^2 (647 km^2) or 10 percent (Townsend 1991). Rangeland losses were about evenly divided between agricultural and urban development (Townsend 1991).

The extent of land use conversions for southwest Florida (Collier, Lee, Hendry, Charlotte, and Glades Counties) between 1986 and 1996 was estimated using a change detection analysis performed by Beth Stys (FWC, unpublished data). The area of disturbed lands increased 31 percent in these five counties between 1986 and 1996, with the greatest increases in disturbed lands occurring in Hendry and Glades Counties. Most (66 percent) of the land use change over the 10-year period was due to conversion to agricultural uses. Forest cover types accounted for 42 percent of land use conversions, dry prairies accounted for 37 percent, freshwater marsh accounted for 9 percent, and shrub and brush lands accounted for 8 percent. Randy Kautz (FWC, pers. comm. 2003) estimated panther habitat loss to be 0.8 percent per year between 1986 and 1996 using a composite of three different methodologies. These included a review of U.S. Forest Service forest data between 1936 and 1995 using loss of forest as an index of the rate of panther habitat loss and an analysis to detect changes in land cover in five south Florida counties (Charlotte, Collier, Glades, Hendry, Lee) between 1986 and 1996 using classified Landsat imagery. The third methodology used the Cox et al. (1994) panther habitat model, where based on 1986 Landsat data, 1996 Landsat landcover data was overlaid and then areas originally mapped as panther habitat were subsequently converted to other uses over the 10-year period were tabulated. Kautz (Breedlove, Dennis, and Associates, pers. comm.

2005) believes the estimated annual habitat loss since 1996 may be 2 to 3 times higher than that calculated for the previous period.

More recently, Stys calculated the extent of semi-natural and natural lands that have been converted to agricultural and urban / developed in Florida between 1985 to 1989 and 2003 (B. Stys, FWC, pers. comm. 2005). Based upon this analysis, approximately 570 mi^2 (1,476 km^2) of natural and semi-natural lands in Glades, Hendry, Lee, Collier, Broward, Monroe, and Miami-Dade Counties were converted during this time period (FWC, unpublished data). Of these, approximately 340 mi^2 (880 km^2) were conversions to agricultural uses and 230 mi^2 (596 km^2) to urban uses.

Rapid development in southwest Florida has compromised the ability of landscapes to support a self-sustaining panther population (Maehr 1990, 1992). Maehr (1990) reported that there were approximately 3,401 mi^2 (8,810 km^2) of occupied panther range in south Florida and that approximately 50 percent is comprised of landscapes under private ownership. Kautz et al. (2006) found that approximately 27 percent of the land in the Primary Zone, 60 percent of the land in the Secondary Zone, and 100 percent of the land in the Dispersal Zone is in private ownership. Maehr (1990) indicated that development of private lands may limit panther habitat to landscapes under public stewardship. Given the panther's reliance on public land, the rising cost of land is an impediment to habitat protection and therefore panther conservation and recovery.

Highways in wildlife habitat are known to result in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. As a result, small populations may become isolated, subjecting them to demographic and stochastic factors that reduce their chances for survival and recovery. Two-lane 108 ft (33 m) and four-lane 328 ft (100 m) cleared rights-of-way, respectively, occupy 2.0 and 6.2 percent of each 640 ac (259 ha) of land through which they pass (Ruediger 1998). Highways can also stimulate land development as far away as 2 mi (3.2 km) on either side (Wolf 1981). Thus, for each 1 mi (1.6 km) a highway is extended, 2,500 ac (1,012 ha) are potentially opened to new development (Wolf 1981).

In addition to direct loss and fragmentation of habitat, constructing new and expanding existing highways may increase traffic volume and impede panther movement within and between frequently used habitat blocks throughout the landscape (Swanson et al. 2005). Increases in traffic volume, increasing size of highways (lanes), and habitat alterations adjacent to key road segments may limit the panther's ability to cross highways and may ultimately isolate some areas of panther habitat (Swanson et al. 2005). The addition of wildlife crossings and fencing has ameliorated this threat in the immediate vicinity of these structures. The addition of more wildlife crossings, especially in areas with a history of collisions and where traffic is projected to increase, can help address this significant threat.

Past land use activity, hydrologic alterations, and lack of fire management (Dees et al. 1999) have also affected the quality and quantity of panther habitat. The effect of invasive plants on panther habitat utilization, particularly melaleuca, is unknown. As the remaining forested uplands are lost, sloughs containing cypress, marsh, and shrub wetlands comprise a greater percentage of the remaining habitat available to panthers, relative to habitat historically available to the species.

Insight can be gained into expected rates of habitat loss in the future by reviewing human population growth projections for the south Florida region. Smith and Nogle (2001) developed low, medium, and high population growth projections for all Florida counties from 2000 through 2030. Using their medium projections, which they believe provide the most accurate forecasts, Smith and Nogle (2001) estimate that the human population of the 10 counties in south Florida will increase from 6.09 to 9.52 million residents by 2030, an increase of 56 percent.

Human population in the southeastern U.S. has increased 10-fold since 1850, expanding from 4.7 million to over 48 million in 2000 (cited in Swanson et al. 2005). In Florida, the population increased from 87,000 to over 18 million (cited in Swanson et al. 2005, U.S. Census Bureau 2008). From 1990 to 2004, the population in Collier County increased from 152,099 to 296,678 (U.S. Census Bureau 2002, 2004). During the same time period, the population in Lee County increased from 335,113 to 514,295 (U.S. Census Bureau 2002, 2004). The population of southwest Florida, particularly Collier and Lee Counties, is projected to increase 21 percent by 2010 (cited in Swanson et al. 2005).

Potential panther habitat throughout the Southeast continues to be affected by urbanization, residential development, conversion to agriculture and silviculture, mining and mineral exploration, lack of land use planning, and other sources of stress. With human population growth and increased human disturbance, the extent of potentially suitable habitat remaining in the Southeast is expected to decrease. Habitat loss, fragmentation, degradation, and disturbance from human activity throughout the Southeast are expected to remain among the greatest threats to the potential for reintroducing panther populations.

b. Overutilization for commercial, recreational, scientific, or educational purposes: There are no commercial or recreational uses of panthers. In rare cases where a panther is unable to survive in the wild, it may be captured and used for educational purposes. However, panthers are routinely captured and monitored for scientific purposes. Risks are associated with capture and monitoring, but the overall threat to the panther is considered low.

c. Disease or predation: Disease and parasites have not been documented to be a major mortality factor in the panther population (Maehr et al. 1991b, Taylor et al. 2002). However, this observation is largely based on the captured and vaccinated sample of the population. Disease expression and mortality events for the unmarked and unvaccinated segment of the population, including kittens, may be higher, especially for those diseases included in the vaccination regimen. Further, as the panther population density increases there is an increased risk of diseases transmitted by direct contact. A recent outbreak of Feline Leukemia Virus (FeLV) demonstrated the potential impact of infectious diseases on the population. Should a virulent pathogen enter the population, such as occurred with FeLV, there is no absolute barrier in south Florida that could prevent such a disease from impacting the entire population (Beier et al. 2003). Consequently, until additional populations of panthers can be established elsewhere in their historic range, infectious diseases and parasites remain a threat to the Florida panther.

d. Inadequacy of existing regulatory mechanisms: Development pressure in southwest Florida has been high; for example, data for Collier, Lee, and Hendry Counties, a stronghold for the panther population, indicate that from 1985 through 2003 more than 223 mi^2 (578 km^2) of natural and semi-natural lands were converted to agriculture (FWC, unpublished data). In addition, more than 145 mi^2 (375 km^2) of semi-natural and natural lands in this three-county area have also been lost to development (FWC, unpublished data). While not all of these habitat losses and conversions involved panther habitat, many projects involved wetland impacts, requiring permit review by the U.S. Army Corps of Engineers (COE) pursuant to section 404 of the Clean Water Act and / or coordination among regulatory agencies pursuant to the Fish and Wildlife Coordination Act. For projects with a Federal nexus, consultation pursuant to section 7 of the ESA was needed for actions that may affect the panther. Through compensation for some of these projects, the Service helped secure conservation of 62 mi^2 (161 km^2) in the Primary, Secondary, and Dispersal Zones from September 2003 to June 2008.

Florida Statute 373.414 requires that activities permitted in wetlands and surface waters of the state are not contrary to the public interest. If it is determined that an activity will adversely effect panthers or panther habitat, the governing board (Water Management District [WMD]) or the Florida Department of Environmental Protection (FDEP) can consider measures (e.g., on-site mitigation, off-site mitigation, purchase of credits from mitigation banks) that will mitigate the effects of the regulated activity.

In addition to the impacts of individual projects, the FDEP and WMD shall take into account cumulative impacts on water resources and manage those resources in a manner to ensure their sustainability (Chapter 373.016(2) F.S.). Cumulative impacts can be considered unacceptable when they provide significant impacts to functions of wetlands, including the utilization of the wetlands by wildlife species. In practice, evaluating cumulative impacts of development in southwest Florida on panthers has not been sufficient to prevent significant loss of panther habitat. Since the majority of panther habitat in southwest Florida has significant wetland components, provisions of 373.414 are usually a part of the review of proposed development. However, the state wetlands permitting authorities currently lack comparable regulatory mechanisms to assess impacts to panthers or panther habitat on project sites that do not have a wetland component.

Because of the project-specific focus of regulatory programs and other constraints such as high workloads, local, State, and Federal regulatory agencies sometimes find it difficult to complete the cross-government review that would be ideal to thoroughly review and effectively assess all potential impacts to panthers. In addition, local, State, and Federal agencies sometimes have difficulty monitoring permit compliance and tracking the precise impact on species and habitat from authorized actions, as well as tracking the impact from unauthorized actions. Assessing current baseline conditions and accurately predicting future impacts are also challenging because the panther is a wide-ranging species that uses a wide array of habitat types. Furthermore, baseline conditions for the panther are continually changing (e.g., impacts from development, conservation actions).

e. Other natural or manmade factors affecting its continued existence:
Mortality, Trauma, and Disturbance--One-hundred fifty-three panther mortalities have been documented from February 1972 through June 2004, with at least 58 (41 percent) of known deaths occurring in the latest four-year period (Land et al. 2004). Overall, documented mortality (n = 105) of radiocollared and uncollared panthers averaged 3.4 per year through June 2001. However, from July 2001 through June 2004, documented mortality (n = 48) increased with an average of 16.0 per year during these years (Land et al. 2004).

From February 1972 through June 2004, 36 panthers were documented to have died from intraspecific aggression (Land et al. 2004). Although most of these encounters are male-male, from July 2001 through June 2004, at least nine females have been killed in encounters with males (Land et al.

2004). Defense of kittens and / or a kill is suspected in five of these instances that occurred through 2003 (Shindle et al. 2003).

Eighty-six panther-vehicle collisions were documented between 1972 and 2005 of which 80 (52 percent) resulted in panther deaths (Lotz et al. 2005). However, panther-vehicle collisions were identified as the third most important source of mortality among radiocollared panthers (19 percent), a less biased sample (Land et al. 2004). Fifty-six percent (48) of panther-vehicle collisions have occurred since 2000 with all but two being fatal (Lotz et al. 2005). Approximately 53 percent of documented panther roadkills have occurred within the Primary Zone through 2004 (Swanson et al. 2005). Panther-vehicle collisions are a significant source of mortality and pose a serious on-going threat to the species. In addition, new and existing roads, expansion of highways, and increases in traffic volume and speed contribute to a loss of panther habitat and impede movement within and between high use habitat blocks throughout the landscape (Swanson et al. 2005). New and expanded highways are likely to increase the threat of panther mortality and injuries due to collisions.

Florida’s human population has been steadily growing and as a result, urban / suburban areas now interface with panther habitat. If human-panther interactions increase, the potential for complaints from the public and, in some cases, the need for subsequent management responses could result in take of panthers in the form of harassment through aversive conditioning in an attempt to teach individuals to avoid humans. In extreme cases, permanent removal from the wild is possible.

Loss of Genetic Diversity--Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago (Seal 1994). Isolation, habitat loss, reduced population size, and associated inbreeding resulted in loss of genetic variability and diminished health. Data on polymorphism and heterozygosity, along with records of multiple physiological abnormalities, suggest that the panther population has experienced inbreeding depression (Roelke et al. 1993, Barone et al. 1994). Measured heterozygosity levels indicate that the Florida panther has lost about 60 to 90 percent of its genetic diversity (Culver et al. 2000). Genetic problems in the Florida panther included heart murmurs, a high rate of unilateral cryptorchidism, low testicular and semen volumes, diminished sperm motility, and a high percentage of morphologically abnormal sperm.

To address these threats, a genetic management program was implemented with the release of Texas puma into south Florida in 1995. The results of genetic restoration have been successful (Pimm et al. 2006), with an increasing population, signs of increased genetic health, recolonization of areas in BCNP and ENP recently unoccupied, and increased dispersal

(McBride 2000, 2001, 2002; Maehr et al. 2002). To date, neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, pers. comm. 2005). Semen examination of a couple of introgressed panthers indicated that sperm volume, motility, and count were higher than for an uncrossed Florida panther. A preliminary assessment of genetic restoration suggested that the desired 20 percent introgression level had been achieved, but the contributions were primarily from two of the released females (Land and Lacy 2000). Genetic introgression is also reducing the occurrence of kinked tails and cowlicks in intercross progeny (Land et al. 2004).

Human Dimension--Sociopolitical obstacles to large carnivore management are often more daunting than biological ones (Clark et al. 2002). As more people have moved into panther habitat in recent years, there has been an increase in potential for human-panther interactions and disturbance associated with management responses to panthers that have interacted with humans. As human-panther interactions increase, the potential for complaints from the public and, in some cases, the need for subsequent management responses could result in take of panthers in the form of harassment through aversive conditioning in an attempt to teach individuals to avoid humans. Also, a lack of public support and tolerance could prevent the reintroduction of panthers outside of Florida. Public opinion and government apprehension about public opposition are the most critical impediments to reintroduction efforts and attainment of recovery goals.

Contaminants--Because the panther is a top carnivore, bioaccumulation of environmental contaminants, particularly mercury, remains a concern (Dunbar 1995, Newman et al. 2004). However, mercury in the Everglades ecosystem has decreased over the last several years (Frederick et al. 2002).

D. Synthesis

Historically occurring throughout the southeastern United States, today the panther is restricted to less than 5 percent of its historic range in one population located in south Florida. The panther population has increased from an estimated 12 to 20 (excluding kittens) in the early 1970s to an estimated 100 to 120 in 2007. The panther continues to face numerous threats due to an increasing human population and habitat development. Isolation, reduced population size, and inbreeding have resulted in loss of genetic variability, and because the panther occurs as a single, isolated population, a catastrophic event such as a disease outbreak could be devastating. Consequently, until further recovery actions can be implemented and additional populations can be established elsewhere in their historic range, the Florida panther remains in danger of extinction throughout all or a significant portion of its range.

III. RESULTS

A. Recommended Classification:

__X_ No change is needed

IV. RECOMMENDATIONS FOR FUTURE ACTIONS

The panther depends upon habitat of sufficient quantity, quality, and spatial configuration for long-term persistence, therefore the primary actions over the next 5 years should be aimed at habitat conservation and reducing habitat-related threats. Range expansion and reintroduction of additional populations are essential for panther recovery as is fostering greater public understanding and support. Therefore, actions aimed at expanding the existing breeding population into south-central Florida, reintroducing at least two additional viable populations within the historic range outside of south and south-central Florida, and facilitating panther recovery through public awareness, understanding, and support will also be important.

South Florida Habitat

- Maintain the quantity and quality of habitat in the Primary Zone, maintain habitat quantity and improve the quality in the Secondary Zone, and increase the quantity of protected acres and enhance the quality of the Dispersal Zone. The Dispersal Zone needs to provide the connection between south and south-central Florida and provide for expansion of the population. This indicates the need for an accounting of habitat in Primary, Secondary, and Dispersal Zones, tracking acres lost and restored over time.

- Continue population viability and sensitivity analyses as improved demographic data become available.

- Use and coordinate all non-regulatory incentive programs to maintain and secure habitat on private lands.

- Continue to secure lands, both fee simple and conservation easements, through existing and / or new land acquisition programs including Federal, State, county, and non-governmental organization programs. Ensure terms of conservation easements address panther needs and are consistent among agencies.

- Develop a land acquisition plan for FPNWR that will identify corridors, buffer zones, and adjacent primary habitat that need to be secured through fee title acquisition, management agreements and / or conservation easements.

- Identify and support local initiatives to protect panther habitat and purchase development rights. Encourage, assist, and provide resources to local governments to develop and implement land use plans that complement and advance panther recovery.

- Appropriately use local, State, and Federal regulatory programs to maximize their ability to maintain the overall quality, quantity, and functionality of panther habitat.

- Continue to improve regulatory procedures and guidance that avoid habitat loss, degradation, and / or fragmentation and increases in traffic volume as a result of federally funded or authorized projects and actions. If development, conversion of natural habitat types, and / or land use intensification cannot be avoided then such procedures and guidance should ensure that equivalent habitat protection and restoration are provided, especially within the Primary Zone, to compensate for both the quantity and functional value of the lost habitat.

- Continue to work with partners to improve regulatory procedures and guidance that avoid habitat loss, degradation, and / or fragmentation as a result of State or locally authorized projects that are not a part of a Federal review process.

- Develop a mechanism to compensate for projects that affect small acreages (e.g., single family residences) of panther habitat in south Florida. An effective mechanism will address loss of habitat and also cumulative degradation of habitat and could include panther conservation banks and / or regional off-site mitigation banks.

- Identify, maintain, enhance, and restore habitat corridors at multiple spatial scales to facilitate movements by resident panthers, promote dispersal, and prevent peripheral areas from becoming further isolated from habitat in the Primary Zone.

- Secure the Dispersal Zone through fee simple acquisition, compensation, or appropriate conservation easements.

- Secure Camp Keais Strand to maintain connectivity from FPNWR to Corkscrew Regional Ecosystem Watershed.

- Secure a corridor between BCNP and Okaloacoochee Slough to assure this pathway is not degraded or severed.

- Maintain existing panther home ranges and habitat conditions within the Primary Zone.

- Identify current and planned roads that could affect panthers, eliminate roads where possible, and retrofit priority areas with crossings and fencing as appropriate to promote connectivity and dispersal. Develop and distribute recommendations on improvements needed for specific road segments. In order to be effective, road-related mitigation must be specified and implemented before major developments are approved and permitted.

- Secure habitat adjacent or contiguous to areas of high risk for panther-vehicle collisions.

- Restore habitat in the Primary, Secondary, and Dispersal Zones.

- Ensure that panthers and their prey are adequately considered and provided for in management of public lands.

- Encourage habitat management on private lands to adequately provide for panthers and their prey.

- Provide incentives and work with landowners to encourage them not to convert their lands to less suitable habitat.

- Monitor panther habitat quantity and quality, land use changes, and response of the panther population to these changes (e.g., distribution, density, dispersal, reproductive success, mortality). Track land protection and habitat restoration with an emphasis on identifying where habitat is lost and restored.

South Florida Population

- Continue to determine and monitor demographic variables including age- and sex-specific reproduction and survival rates, litter size, recruitment, age at first reproduction, birth interval, proportion of individuals breeding, age and sex specific causes of mortality (including intraspecific aggression), dispersal, density, and minimum documented population size. Identify, evaluate, and use the least intrusive monitoring techniques or indices as appropriate (e.g., hair / genetics sampling, scats, cameras).

- Maintain and enhance genetic diversity.

- Continue to monitor physical and physiological characteristics correlated with inbreeding and depletion of genetic variability including kinked tails, cowlicks, cryptorchidism, sperm morphology, heart defects, immune function, and reproductive success.

- Develop and implement a genetics management plan. Convene a working group of appropriate geneticists, reproductive physiologists, veterinarians, and population biologists to develop a genetics management plan. Use field observations, existing data, and results from the genetic restoration and management project initiated in 1995.

- Monitor panther diseases and parasites and develop and implement appropriate management strategies.

- Revise vaccination protocols as appropriate considering new disease threats as they arise.

- Determine and monitor the presence, infection rate, mortality rates, and consequences of diseases and parasites in the panther population.

- Collect appropriate tissue and blood samples from all panthers handled, both live and dead, and analyze them for the presence of priority diseases and parasites**,** summarize and report results annually.

- Implement appropriate management strategies for diseases and parasites.

Expansion into South-Central Florida and Reintroduction

- Select reintroduction areas in coordination with the southeastern States within the historic range of the panther.

- Develop and conduct preliminary public scoping to allow effective preplanning of the NEPA process. This could include the use of focus / stakeholder meetings and opinion and attitude surveys in the Southeast.

Public Awareness and Education

- Build support for the recovery effort through education and outreach programs that increase public understanding of panther behavior and recovery needs.

- Conduct social science research to identify public attitudes, knowledge levels, and concerns about panthers and panther recovery efforts.

- Identify target audiences, content, strategic messages, and methods of getting the message out using social science research.

- Distribute materials and information to the public, landowners, and stakeholders.

- Provide materials and programs regarding human / panther interactions.

- Provide education and outreach to residents living in and adjacent to panther habitat. Include the realtor community. Include tips for living in panther habitat.

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U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of the Florida Panther

Current Classification _Endangered_
Recommendation resulting from the 5-Year Review

__X__ **No change is needed**

Review Conducted By ______Chris Belden______________________________

APPROVALS

FIELD OFFICE APPROVAL:

Field Supervisor, Fish and Wildlife Service

Approve ______________________________ Date 3/27/09

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

REGIONAL OFFICE APPROVAL:

The Regional Director or the Assistant Regional Director, if authority has been delegated to the Assistant Regional Director, must sign all 5-year reviews.

Regional Director, Fish and Wildlife Service

Approve Aaron L Valenta ______________________________ Date 4-28-09
Acting RD

APPENDIX A

Summary of peer review for the 5-year review of the Florida panther (*Puma concolor coryi*)

A. Peer Review Method: Recommendations for peer reviewers were solicited from Florida Department of Environmental Protection, Florida Fish and Wildlife Conservation Commission, Sarasota County Department of Natural Resources, and the Seminole Tribe of Florida. Additionally, two peer reviewers were selected by the Service. Eight peer reviewers participated in this review. Individual responses were requested and received from each peer reviewer.

B. Peer Review Charge: See attached guidance.

C. Summary of Peer Review Comments – Peer review comments involved primarily minor edits. Other concerns covered a variety of topics including existing knowledge of demographic data, along with uncertainties and limitations, as related to PVA modeling and the direct and indirect effects of human development on panther population persistence; road related impacts, particularly traffic volume as an indirect effect of development projects; the identification and protection of corridors at multiple spatial scales; the need to move female panthers north of the Caloosahatchee River to expand the breeding population in southern Florida; local opposition in potential reintroduction areas; the manpower necessary to carry out the recommendations; and the findings of the Scientific Review Team (Beier et al. 2006, Conroy et al. 2006).

D. Response to Peer Review – The Service was in agreement with all comments and concerns received from peer reviewers. Comments were incorporated into the 5-year review form as appropriate.

Guidance for Peer Reviewers of Five-Year Status Reviews

U.S. Fish and Wildlife Service, South Florida Ecological Services Office
June 7, 2006

As a peer reviewer, you are asked to adhere to the following guidance to ensure your review complies with Service policy.

Peer reviewers should:

1. Review all materials provided by the Service.

2. Identify, review, and provide other relevant data apparently not used by the Service.

3. Not provide recommendations on the Endangered Species Act (ESA) classification (e.g., endangered, threatened) of the species.

4. Provide written comments on:
   - Validity of any models, data, or analyses used or relied on in the review.
   - Adequacy of the data (e.g., are the data sufficient to support the biological conclusions reached). If data are inadequate, identify additional data or studies that are needed to adequately justify biological conclusions.
   - Oversights, omissions, and inconsistencies.
   - Reasonableness of judgments made from the scientific evidence.
   - Scientific uncertainties by ensuring that they are clearly identified and characterized, and that potential implications of uncertainties for the technical conclusions drawn are clear.
   - Strengths and limitation of the overall product.

5. Keep in mind the requirement that we must use the best available scientific data in determining the species' status. This does not mean we must have statistically significant data on population trends or data from all known populations.

All peer reviews and comments will be public documents, and portions may be incorporated verbatim into our final decision document with appropriate credit given to the author of the review.

Questions regarding this guidance, the peer review process, or other aspects of the Service's recovery planning process should be referred to Cindy Schulz, Endangered Species Supervisor, South Florida Ecological Services Office, at 772-562-3909, extension 305, email: Cindy_Schulz@fws.gov.