



United States Department of the Interior

FISH AND WILDLIFE SERVICE
FLORIDA PANTHER RECOVERY COORDINATOR
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MEMORANDUM

DATE: June 17, 1997

TO: Florida Panther Recovery Team Members:
Jim Stevenson, Florida DEP, Tallahassee, FL
Suzette Kimball, National Park Service, Atlanta, GA
Tom Logan, Florida GFWFC, Tallahassee, FL

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Relax

FROM: Florida Panther Coordinator, FWS, Gainesville, FL

SUBJECT: Recovery Plan Revision

The attached material will be discussed at our meeting on Friday. I apologize for not getting it to you earlier. However, if you have an opportunity it would be helpful if you could review it prior to the meeting. I look forward to seeing you Friday (in Tom's office, 101 Bloxham Bldg., 10:30 am).

Dennis B. Jordan
Dennis B. Jordan
Recovery Team Leader

Attachment

6/27/97

Sunny -

*Here is draft material on F.P. Remember
all of this is subject to significant change.
We will basically be starting over w/ recovery
outline. Earlier draft of this was sent to
Recovery Team members (for review & comment
by field people) on March 26, 1997 (see last
page.)*

wp51\rpr.617

D. Jordan

FLORIDA PANTHER RECOVERY PLAN
THIRD REVISION
June 17, 1997 Draft

EXECUTIVE SUMMARY

I. INTRODUCTION

A. Background

The Florida panther is one of the most endangered large mammals in the world. It is also Florida's state animal. A small population in south Florida, estimated to number between 30 and 50 adults (30 to 80 total individuals), represents the only known remaining wild population of an animal that historically ranged throughout most of the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida and parts of South Carolina and Tennessee. This large cat presently occupies one of the largest remaining contiguous tracts of public and private lands in the eastern United States; these lands in Collier, Dade, Broward, Palm Beach, Lee, Hendry, and Glades Counties make up a contiguous system of wildlands totaling more than two million acres.

Geographic isolation, habitat loss, population decline, and associated inbreeding have resulted in a significant loss of genetic variability and health of the Florida panther. Natural gene exchange between the Florida panther and other contiguous subspecies of *Puma (Felis) concolor* ceased to occur when the panther became geographically isolated from other populations of its species. Population viability projections in 1989 and 1992 concluded that, under demographic and genetic conditions prevailing at that time, the Florida panther would likely go extinct within two to four decades. A catastrophic event could accelerate extinction significantly.

B. Species Description

The Florida panther is a medium-sized subspecies of puma or mountain lion, that is described as being relatively dark tawny in color, with short, stiff hair (Bangs 1899), and relatively longer legs and smaller feet (Cory 1896) than other subspecies. Adult male panthers reach a length of around 2.15 m from the nose to the tip of their tail and have reached or exceeded 68 kg in weight, but typically average around 54.5 kg. They stand approximately 60 to 70 cm at the shoulder. Female panthers are considerably smaller with an average weight of around 34 kg and length of about 1.85 m. Skulls of the Florida panther have been described as having a broad, flat, frontal region, and broad, high-arched or upward-expanded nasals (Young and Goldman 1946).

The coat of adult Florida panthers is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. The long cylindrical tail is relatively slender compared to some of the other subspecies (Belden 1988).

Florida panther kittens are gray with dark brown or blackish spots and have five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are six months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

Three external characters are often observed in Florida panthers in southwest Florida which are not found in combination in other subspecies of *F. concolor*. These characters are: 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, light flecking on the head, nape, and shoulders (Belden 1986). The kinked tail and cowlick are considered manifestations of inbreeding (Seal et al. 1994). The light flecking may be a result of scarring from tick bites (Maehr 1992a).

C. Taxonomy

The Florida panther was first described by Charles B. Cory in 1896 as *F. c. floridana*. The type specimen was collected by Cory in Sebastian, then considered a part of Brevard County (Hall and Kelson 1959). Bangs (1899), however, noted that *F. floridana* had previously been used for a bobcat and, believing that the Florida panther was restricted to peninsular Florida and could not intergrade with any other form, assigned it full specific status as *F. coryi*. The taxonomic classification of the *Felis concolor* group was revised by Nelson and Goldman (1929), wherein the Florida panther was reassigned subspecific status as *F. c. coryi*. This designation also incorporated *F. arundivaga*, which had been classified by Hollister (1911) from specimens collected in Louisiana. Detailed descriptions of each of the 27 subspecies are provided in Young and Goldman (1946) and Hall (1981).

D. Population Distribution

Historically, the Florida panther was distributed "from eastern Texas or western Louisiana and the lower Mississippi River valley east through the Southeastern States in general (Figure 1), intergrading to the north with *F. c. cougar*, and to the west and northwest with *F. c. stanleyana* and *F. c. hippolestes*" (Young and Goldman 1946). The distribution map accompanying the account in Young and Goldman (1946), indicates that the Florida panther historically ranged throughout Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida and parts of South Carolina and Tennessee. Marginal records exist from Arkansas, Mississippi, Alabama, and Louisiana (Hall and Kelson 1959).

The only known remaining panther population is centered in and around the Big Cypress Swamp physiographic region of southwest Florida (Figure 2). Data on the radio-instrumented segment of this population indicate that it is centered in Collier and Hendry Counties of southwest Florida. Instrumented panthers have also been documented in Broward, Dade, Glades, Hardee, Highlands, Lee, Monroe, and Palm Beach Counties. There are still large areas of private land in Charlotte, Collier, Hendry, Lee, and Glades Counties where uncollared individuals may reside (Maehr 1992b) (Figure 3).

Private lands account for approximately half the occupied panther range in south Florida (Logan et al. 1993). This estimate is supported by over 14 years of telemetry data. The greatest concentration of unprotected, occupied panther habitat is found on private land in eastern Collier County and southern Hendry County (Maehr 1992b). In general, these private lands are located north of important panther habitat on key publicly owned lands (Maehr 1988). For the most part, privately owned lands are higher in elevation, better drained, have a higher percentage of hardwood hammocks and pine flatwoods, and are

higher in natural fertility/productivity than public lands south of I-75. A difference in soils and drainage patterns is reflected in more upland vegetation and more abundant prey in lands north of 26° 11' N latitude, which approximates the latitudinal position of I-75. These factors, in combination with management practices that tend to make the area more attractive to and increase carrying capacities for white-tailed deer (*Odocoileus virginianus*) and feral hogs (*Sus scrofa*) result in panthers that are in better physical condition and more productive than individuals utilizing habitat only on public lands (Maehr 1990a, 1990b).

E. Habitat

Native landscapes within the Big Cypress Swamp region are dominated by pine, cypress, and freshwater marshes, interspersed with mixed-swamp forests, hammock forests, and prairies (Duever *et al.* 1979). Private lands represent about 50 percent of occupied panther range in south Florida. The largest contiguous tract of panther habitat is the BCNP. Suitable habitat extends into Lee, Monroe, and Hendry Counties. Poorer quality soils prevalent south of I-75 do not produce the quality or volume of forage required to support large herds of deer and other panther prey items. Therefore, as a result of the nature of parent soil materials and their influence on primary productivity, it is unlikely that habitat in areas of BCNP south of I-75 is as productive as that in northern and western Collier County in terms of panther health, reproduction, and density. Private lands contain some of the most productive panther habitat in south Florida but are also more suitable for intensive agriculture and urban growth than public lands due to soil and drainage features (Maehr 1992a).

Native upland forests are preferred by panthers in southwest Florida (Maehr 1990a). Highly preferred habitat types are relatively limited in availability but are sought by panthers as daytime resting cover (Maehr *et al.* 1991a). Understory thickets of tall, almost impenetrable, saw palmetto have been identified as the most important resting and denning cover for panthers (Maehr 1990a). Early radio-telemetry investigations (n=6) indicated that panther use of mixed swamp forests and hammock forests were greater than expected in relation to their availability within the panthers' home range area (Belden *et al.* 1988). As investigations expanded onto private lands between 1985 and 1990, it was determined that panthers preferred native upland forests, especially hardwood hammocks and pine flatwoods over wetlands and disturbed habitats (n=26) (Maehr *et al.* 1991a). Hardwood hammocks were consistently preferred by panthers, followed by pine flatwoods. This may be related to the fact that, among major vegetation types in south Florida, hammocks had the greatest potential for producing white-tailed deer, an important panther prey species (Harlow 1959, Belden *et al.* 1988, Maehr 1990a, 1992a, Maehr *et al.* 1991a).

Male Florida panthers use more cover types and have larger home ranges than females. The home range size of male panthers is influenced by the percentages of hardwood hammock, hardwood swamp, water, grass and agricultural land, barren land, and scrub and brush in the landscape. Smaller male home ranges have greater percentages of hardwood hammocks and hardwood swamp, while larger home ranges have greater percentages of water, grass and agricultural land, barren land, and shrub and brush. Female home range size has been positively correlated with higher percentages of dry prairie, shrub swamp, and shrub and brush with; larger home ranges of females have greater amounts of these cover types (Maehr 1992b). Similarly, female panther home range size is inversely related to habitat quality and may also influence reproductive success (Maehr 1992b, Maehr *et al.* 1989b).

Dispersing males may wander widely through unforested and disturbed areas. Agricultural and other disturbed habitats, freshwater marsh, thicket swamp, and mixed swamp are not preferred, and are either used in proportion to their availability or are avoided (Maehr 1990a). Habitats avoided by panthers include agricultural, barren land, shrub and brush, and dry prairie. Panthers have not been found in pastures during daytime, radio-telemetry flights but may travel through them at night (Maehr *et al.* 1991a, Maehr 1992a).

F. Behavior

Florida panthers are essentially solitary. Interactions between panthers were infrequent during a 1985 through 1990 study (Maehr *et al.* 1991a). Most interactions occurred between adult females and their kittens. Interactions between adult male and female panthers were second in frequency, but were not common. Interactions between males and females lasted from one to seven days and usually resulted in pregnancy. Documented interactions between males were not uncommon and resulted in serious injury or death to several individuals. Between 1981 and 1996, intraspecific aggression was the second greatest cause of panther mortality (based on GFC data). Aggressive encounters between females have not been documented (Maehr *et al.* 1991a).

1. Reproduction and Demography

The pattern of Florida panther distribution involves several males maintaining large, mutually exclusive home ranges containing several adult females and their dependent offspring. This spatial arrangement seems to be a prerequisite for successful reproduction (Maehr 1993).

Male Florida panthers are polygynous. Breeding activity peaks in fall and winter (Maehr 1992a). Parturition is distributed throughout the year with 81 percent of births occurring between March and July (July being the month with the greatest number of births). Litter sizes range from one to four kittens, with a mean of 2.2 kittens per successful litter¹. Intervals between litters range from 16 to 37 months (Land 1994).

Den sites are usually located in dense, understory vegetation, typically saw palmetto (*Serenoa repens*) (Maehr 1990a). Den sites are used for up to 2 months by female panthers and their litters from parturition to weaning. Female panthers losing their litters generally produce replacement litters. Five of seven females whose kittens were brought into the captive breeding program successfully reproduced an average of 10.4 months after the removal of the litter (Land 1994).

Age at first reproduction has been documented at 18 months for females (Maehr *et al.* 1989a). The first sexual encounters for males has occurred at approximately 3 years of age (Maehr *et al.* 1991a). Dispersal of young typically occurs around 1.5 to 2 years of age, but may occur as early as 1 year of age (Maehr 1992a).

The kitten survival rate between age six months and one year has been estimated at 0.895 (Land 1994). This is based on a sample of 15 radio-instrumented kittens monitored from six months to one year of age. Young panthers are considered recruited into the population when they have successfully reproduced. Of the 21 dependent kittens radio-instrumented and followed beyond

¹ A successful litter is one in which the kittens have survived to an age of at least 6 months.

independence, 71% of females (5 of 7) and 29% of males (4 of 14) were recruited into the population (D. Land, GFC, Personal Communication, 1997). The longevity of resident male panthers and subsequent infrequent home range vacancies makes the likelihood of male recruitment low (Maehr 1990a).

Females are readily recruited into the population as soon as they are capable of breeding (Maehr *et al.* 1991a). Males appear to have more difficulty being recruited. Without large areas of suitable habitat to accommodate dispersal, young males have few opportunities for recruitment as residents. As a result, the panther's ability to increase and outbreed has been severely restricted. Successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr *et al.* 1991a).

Mortality from various sources is a concern for the Florida panther. Forty panther deaths were detected from January 1986 through December 1996, an average of 3.5 deaths/year. Roadkills claimed 14 (35%) of these panthers (1.3 deaths/year). These numbers reflect all known panther mortality (radio-instrumented and uninstrumented individuals) and are biased toward roadkills because the only documented uninstrumented deaths were the result of collisions. Whereas, of the 31 deaths (2.8 deaths/year) of radio-instrumented panthers during this same time, only 16% (5) were the result of roadkill, an average of 0.45 roadkills/year (D. Land, GFC, personal communication, 1997). Turnover in the resident population is low, with higher mortality rates for sub-adult and non-resident males (Maehr *et al.* 1991b).

2. Food Habits

Food habit studies of panthers in southwest Florida indicated that the feral hog was the most commonly taken prey followed by white-tailed deer, raccoon (*Procyon lotor*), and 9-banded armadillo (*Dasypus novemcinctus*). Deer and hogs accounted for 85.7 percent of consumed biomass north of I-75, and 66.1 percent south of I-75 (Maehr 1990a). No seasonal variation in diet was detected; however, panthers inhabiting an area of better soils north of I-75 consumed more large prey. In addition, deer abundance was up to 8-fold greater north of I-75. Estimated number of deer consumed did not differ between the areas north and south of I-75. Hog numbers were lower south of I-75. Fewer large prey may, in part, explain the poorer physical condition, larger home ranges, and lower reproductive output of panthers in the south. Hogs dominated the diet of panthers in the north in terms of both estimated biomass and numbers. In the south, deer accounted for the greatest estimated biomass consumed, whereas raccoons were the highest estimated number of consumed prey. Domestic livestock were found infrequently in scats or kills, although cattle were readily available (McCown 1991).

3. Movements and Dispersal

Adult Florida panthers space themselves throughout available habitat in southwest Florida in a pattern similar to that of western cougars (Land 1994). Over 7,000 telemetry locations on 26 radio-instrumented panthers between 1985 and 1990 indicated that home-range size varied from 53 to 1183 km², averaging 519 km² for resident males and 193 km² for resident females. Home ranges of resident adults were stable unless influenced by the death of other residents. Home-range overlap was extensive among resident females and limited among resident males (Maehr *et al.* 1991a).

There are no known differences in seasonal movements and wet and dry season habitat use, seasonal variation in diet, or effects of season on road crossing. There may be a response to fluctuations in water levels; however, the response is believed to be undetectable (Maehr 1989; Maehr *et al.* 1990b, 1991a).

Other factors that may affect panther movements include activities associated with hunting. Panther use of the Bear Island Unit of BCNP is significantly lower during the hunting season than during non-hunting periods; however, much of the data recorded represented one female panther and her litter which may not accurately represent the response of panthers to human recreational use (Maehr 1990a).

Prior to conversion of State Road 84 to Interstate 75 and the associated construction of wildlife crossings in the early 1990's, only male panthers were detected crossing this corridor. A female panther was roadkilled on SR 84 in 1986. This highway may have been a deterrent to female movements (Maehr *et al.* 1991a). Since the completion of I-75 and associated wildlife crossings, numerous male panthers and a female panther have been regular users of the wildlife crossings (Lotz, *et al.* 1996).

No radio-instrumented panthers (n=60) have ever been documented crossing the Caloosahatchee River. This dispersal ability has, however, been documented in black bears (*Ursus americanus floridanus*). The Caloosahatchee River is a potential landscape barrier that may restrict effective dispersal northward for the panther (Maehr 1996).

Dispersal distances average 58.7 km for subadult males and 16 km for an adult female. Mean dispersal age was 17.9 months. Dispersing males wander widely through unforested and disturbed areas (Maehr 1992a). The limited dispersal opportunities for subadult males may encourage fighting among males (Maehr *et al.* 1991a).

Activity levels for Florida panthers peak around sunrise and sunset. The lowest activity levels occur during the middle of the day. Female panthers at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly crepuscular (Maehr *et al.* 1990b).

G. Relationship to Other Species

The Florida panther requires extensive, biotically diverse landscapes to survive. Large carnivores are considered critical in maintaining ecological integrity of many large forest systems (Terborgh 1988). Landscapes through which the panther ranges support a vast array of south Florida's rich faunal and floral diversity including the Florida black bear (*Ursus americanus floridanus*), Big Cypress fox squirrels (*Sciurus niger avicennia*), American swallow-tailed kite (*Elanoides forficatus*), various species of owls, and neotropical migratory birds (K. Dryden, GFC, personal communication 1996).

As a result of human induced changes in animal populations and habitat fragmentation, it is possible that competition between key members of the faunal community may develop. However, comparisons of food habits, habitat use, and movements among bobcat (*Lynx rufus*), Florida panther, and black bear (*Ursus americanus*) revealed a low probability for competitive interactions (Maehr 1996).

Aside from habitat preferences, perhaps the most important relationship for the future of the Florida panther is its relationship with man. Human activities including road construction, residential and commercial development, and agriculture have had the greatest impact on distribution, abundance, mortality, dispersal and colonization opportunities for the panther.

After its relationship with humans, the most important species association is the relationship the Florida panther has with its prey species. Deer, hog, and raccoon have already been mentioned as the most important prey species taken in term of biomass and numbers (Maehr *et al.* 1990). Early theories on possibly augmenting panther numbers involved stocking or releasing potential prey species including hog and goats (Alvarez 1993, Mohair *et al.* 1989c).

H. Status and Trends

Of the 27 recognized subspecies of *F. concolor*, the Florida panther is the sole remaining subspecies that occurs in the eastern U.S. The population of this large cat may have numbered as many as 500 at the turn of the century (Seal and Lacy 1989). Hunting, habitat loss through residential and agricultural development, loss of the panther's prey base, and other forms of persecution have led to the decline of this species since that time (Belden *et al.* 1988, Maehr 1992a,). In 1950, the Florida panther was declared a game species in the State of Florida. This action resulted in the first regulation of panther harvest. By 1958 it was listed under state law as an endangered species. The population was estimated at 100 to 300 statewide in 1966 (Smith 1970, Schemnitz 1972). The federal government followed suit, and listed the species as endangered in 1967. The FWS cited heavy hunting and trapping pressures, the inability of the species to adapt to changes in the environment, and developmental pressures as the reason for the decline of the Florida panther (32 FR 4001).

In the 1970s, uncertainty as to the status of the panther in Florida led to the establishment of a Record Clearinghouse by the GFC. Records were compiled as a precursor to extensive surveys, captures, and radio-tagging of the remaining animals (Belden 1977). The first field searches for the cat began in 1972, with radiotelemetry investigations beginning in 1981. Initial radio-telemetry investigations on the Florida panther (1981 - 1983) were basically limited to public lands in southwest Florida (Fakahatchee Strand State Preserve and Big Cypress National Preserve). The program has gradually expanded to include all publicly-owned land in south Florida as well as many adjacent private lands. At the end of February, 1997, 20 panthers were radio-instrumented in an area encompassing Everglades National Park, Big Cypress National Preserve, Florida Panther NWR, Fakahatchee Strand State Preserve, and private lands in Collier and Hendry Counties.

The current population numbers between 30 and 50 adults. The persistence of this subspecies outside of Florida is purely conjectural with the only verified, consistent sign of reproducing animals being in south Florida (Carter 1979, Maehr 1992). The density of panthers in southwest Florida between February and July 1990 was estimated at 1.0 panther/110 km². When extrapolated over the entire study area thought to be occupied by radio-instrumented panthers in southwest Florida (5040 km²), the estimated population of the area was 46 adults (9 resident males, 28 resident females, and 9 transient males) during the study period (December 1985 through October 1990). This population estimate assumed homogeneous density and similar age and sex composition over time and space. The total population in south Florida was likely higher, because the estimation technique excluded panthers inhabiting or possibly inhabiting Everglades National Park, eastern Big Cypress National Preserve, and areas north of the Caloosahatchee River (Maehr *et al.* 1991a).

The Florida panther's existence is severely threatened by both rapid and gradual extinction processes. Population viability analysis projections indicate that under existing demographic and genetic conditions the Florida panther will likely be extinct in only a few decades (24-63 years) (Seal *et al.* 1992). Environmental factors affecting the Florida panther include: habitat loss and fragmentation, environmental contaminants, prey availability, human-related disturbance and mortality, disease, and genetic erosion (Dunbar 1994).

1. Threats

In a population with low numbers, any form of mortality is a concern. Annual panther mortality averaged 3.5 deaths per year from January 1986 through December 1996, with thirty-five percent of that attributable to roadkills (D. Land, GFC, personal communication, 1997).

A. Genetic and Physiological: Gene exchange between the Florida panther and other *F. concolor* subspecies historically occurred from the north through *F. c. cougar*, and from the west and northwest through *F. c. stanleyana* and *F. c. hippolestes* (Young and Goldman 1946). This natural gene exchange ceased to occur when the panther became geographically isolated from other populations of the species (Seal *et al.* 1994), probably over a century ago (D. Jordan, FWS, personal communication 1997). This isolation, as well as habitat loss, and the resulting small population size and associated inbreeding, have resulted in significant loss of genetic variability and health of the Florida panther population. Data on polymorphism and heterozygosity when combined with multiple physiological abnormalities suggest that the Florida panther is experiencing inbreeding depression (Roelke *et al.* 1993, Barone *et al.* 1994). Inbreeding depression has been related to decreased semen quality, lowered fertility and neonatal survival, and congenital heart defects in a variety of domesticated and wild species (Lasley 1978, Rails and Ballou 1982, Wildt *et al.* 1982, O'Brien *et al.* 1985, Roelke 1991). The Florida panther exhibits many of these traits.

Congenital heart defects were documented in 11 animals in 1990 and 1991 (Roelke 1991). Some heart defects were severe enough to cause death. All eight of the kittens examined that year had heart murmurs, as well as 30 percent of the adult animals examined. These severe defects are believed to result from close inbreeding, and may interfere with survival and reproduction in the Florida panther (Roelke 1991, Dunbar 1993, Barone *et al.* 1994).

In addition to heart defects, the Florida panther exhibits poorer male reproductive characteristics than other populations of mountain lions in North or Latin America (Barone *et al.* 1994). Of 16 Florida panthers and 51 other *F. concolor* ssp. more Florida panthers were unilaterally cryptorchid (one testicle not descended into the scrotum, 43.8 percent vs 3.9 percent), had lower testicular and semen volumes, poorer sperm progressive motility, and more morphologically abnormal sperm than did individuals from other *F. concolor* populations from Texas, Colorado, Latin America, and North American zoos. Genetic investigations led to the conclusion that the extant Florida panther population is comprised of two genetic stocks. Those originating in the Big Cypress Swamp region descended from historic *F. c. coryi* (Type A), and those from the Everglades region containing additional genetic markers indicative of mountain lions with Latin American heritage (Type B) (O'Brien *et al.* 1990). The Latin American genetic material is believed to have originated from captive "Piper" stock released into the Everglades region between 1956 and 1966 (Vanas 1976, Mounger 1991). Piper and Type B animals show a

genetic link to Latin American *F. concolor* cats. The presence of the Latin American genetic material is believed to be the factor responsible for the lack of cryptorchidism and congenital heart defects in Type B animals. None of the Type B individuals tested in one investigation (Everglades ancestry, n=5) were cryptorchid, whereas 63.6 percent of the Type A (Big Cypress ancestry, n=11) exhibited this trait (Barone *et al.* 1994).

In addition to the physical abnormalities, geographic isolation and accompanying population declines and inbreeding have resulted in the loss of genetic diversity and health. Low heterozygosity levels indicate that the Florida panther has lost approximately half of its genetic diversity (Roelke 1990). The level of mtDNA variation in the Florida panther is the lowest reported in any similarly studied feline population, including leopards, cheetahs, and other puma subspecies (Roelke *et al.* 1993). Electrophoretic analyses also indicate that the Florida panther has less variation than any other puma subspecies and is nearly as low as the level of allozyme variation reported in the two cheetah subspecies (Roelke *et al.* 1993). DNA fingerprint variation seen in the Florida panther is nearly as low as the extremely compromised genetic variation in Asiatic lions from the Gir Forest Sanctuary in India (Roelke *et al.* 1993).

B. Disease: Disease is another threat to small inbred populations (Roelke 1991, Barone *et al.* 1994, Seal and Lacy 1989). Six of 20 free-ranging Florida panthers (30 percent) captured from the Everglades National Park, Big Cypress National Preserve and nearby areas in southern Florida between 1986 and 1988 tested positive to antibody test for feline immunodeficiency virus (FIV) (Barr *et al.* 1989). In 1992, five out of 19 panthers (26.3 percent) examined tested positive to FIV (Roelke and Glass 1992). FIV has a long incubation period but leads to non-specific immunosuppression and death in domestic cats (Roelke 1991). Its significance to the Florida panther is not known. Other diseases are also present in varying degrees in the extant population of Florida panthers (Roelke 1991, Roelke and Glass 1992, Dunbar 1993).

C. Urbanization: Transportation infrastructure to accommodate for increased agricultural and urban growth and the associated increase in traffic volumes have resulted in significant threats to the panther. Collision with motor vehicles is a major source of mortality in the Florida panther, accounting for 49.6 percent of documented deaths between December 1979, and May 1991, (Maehr *et al.* 1991a). Although the relative significance of highway deaths to other sources of mortality is not known, it has the most often documented source of mortality (Maehr 1989, Maehr *et al.* 1991b). Wildlife underpasses have been used as a tool to reduce risks in some problem areas (Foster and Humphrey 1995). However, highways may also affect panthers through fragmentation of suitable habitat. Because of their wide-ranging movements and extensive spatial requirements, panthers are particularly sensitive to habitat fragmentation (Harris 1985).

The expansion of transportation infrastructure in southwestern Florida threatens the long-term persistence of the Florida panther in the wild. Rapidly increasing human populations and expanding agriculture in this portion of the state are compromising the ability of natural habitats to support a self-sustaining panther population. Continued expansion of Florida's urbanized east coast, increasing growth on the west coast, and the spread of agricultural development in the interior have placed increasing pressures on forested tracts in Collier, Glades, Highlands, and Hendry Counties (Maehr 1990b, Maehr *et al.* 1991a, Maehr 1992a). In 1900 all of Hendry County was classified as "natural" land; by 1973, 48.6 percent of the county was in intensive

agriculture (Maehr 1990b). For this trend to change, strategic tracts of private land must be targeted for long-term panther management. Where current uses on these lands are compatible with panthers, owners must be economically encouraged to continue these practices (Maehr 1992a, 1992b).

I. Management

Early conservation and management efforts benefitting the Florida panther involved land acquisition. After nearly a decade of planning, Everglades National Park was established in 1947. The Corkscrew Swamp Sanctuary was established in 1954 when the National Audubon Society and The Nature Conservancy purchased a tract of old growth cypress from the Lee Tidewater Cypress Company. The panther was designated as endangered by the State of Florida in 1958, and by the FWS in 1967. The Fakahatchee Strand State Preserve was established in 1974, and the NPS began acquiring the Big Cypress National Preserve in 1978. Speed limits were reduced at night on S.R. 84 and S.R. 29 in 1984 in an effort to minimize the number of vehicle/panther collisions. The Florida Panther National Wildlife Refuge acquisition was initiated in 1989, the same year that panthers were first noted using underpasses installed when S.R. 84 was converted to I-75 (Maehr 1992a).

Present day conservation efforts include accelerating and completing state acquisition of the Save Our Everglades Project, including Fakahatchee Strand State Preserve and Picayune Strand State Forest (formerly South Golden Gate Estates and Belle Meade) with matching federal funds. The Okaloacoochee Slough, the first publicly owned land in Hendry County, was purchased by the South Florida Water Management District and the FWS in 1996. Lands were added to the BCNP and FPNWR when the Collier-Phoenix land exchange was finalized late in 1996. The State of Florida is investigating the use of less than fee methods to protect panther habitat. Landowners are participating in a grassroots effort to reform inheritance tax laws.

Current public opinion necessitates that state and federal agencies make every effort to prevent extinction of the Florida panther (Maehr 1990b). An interagency committee was established in 1986 to provide a cooperative, coordinated recovery program for the panther. The FPIC provides guidance and direction to the recovery program and is comprised of the FWS, NPS, GFC, and Florida Department of Environmental Protection.

Present recovery efforts have placed emphasis on three major areas: (1) protection and enhancement of the sole remaining wild population and associated habitats; (2) improving genetic health and population viability; and (3) reestablishing populations within the historic range.

The protection and enhancement of the wild population and its associated habitat is critical to maintaining a self-sustaining population of panthers in south Florida. This action needs to be accomplished through appropriate management of existing public lands and the preservation of key private lands, especially well-drained and productive forested uplands (Maehr 1990b, 1992b, Maehr *et al.* 1991a). A Habitat Preservation Plan for panther habitat in south Florida was developed in 1993. This plan identifies occupied and potential panther habitat, threats to these habitats, and options available to maintain sufficient habitat for a self-sustaining population of panthers in south Florida (Logan *et al.* 1993). Implementation of the Habitat Preservation Plan, however, has been somewhat difficult. Certain private landowners fear losing land-use opportunities and oppose many research and conservation efforts.

Managers of public lands currently occupied by panthers must be encouraged to maintain habitat quality where panther density is high (e.g., Florida Panther National Wildlife Refuge and areas of the BCNP north of I-75), and improve habitat conditions where panther density is low in order to accommodate dispersal of subadults (e.g., southern BCNP, Fakahatchee Strand State Preserve, Picayune Strand State Forest, and Everglades National Park). Although panther density may be limited by environmental conditions on some public lands, their importance as panther range in light of decreasing habitat on private lands is a compelling reason for improving conditions for panthers on these preserves (Maehr *et al.* 1991a, Maehr 1992b).

The second area being emphasized in the panther recovery effort is genetic health and population viability. The persistence of the Florida panther population appears dependent upon successful restoration of genetic health and viability. A genetic management program was implemented with the release of eight female Texas cougars (*F. c. stanleyana*) into south Florida in spring and summer of 1995 (Figure 4). This program should augment the depressed Florida panther genetic pool through the introduction of material from this formerly contiguous subspecies without significant alteration in the basic genetic makeup of the panther or swamping the existing gene pool which may be adapted to local environmental conditions (FWS 1994). Five litters of kittens have been born as of February 1996. Potentially, three kittens from two litters have reached dispersal age and are no longer with their mothers. One goal of the program is to radio-instrument all offspring so that the progress of the genetic restoration may be closely monitored. It may be some time before we are able to determine if these offspring are successfully recruited into the population.

Population reestablishment is the third major recovery task under investigation and is the third, essential link to prevention of extinction for the Florida panther (Belden and McCown 1996). The recovery objective identified in the 1987 Recovery Plan is to achieve at least three viable, self-sustaining populations within the panther's historic range (FWS 1987). To achieve this objective, at least two populations will have to be reestablished. The feasibility of reintroducing the panther into a north Florida site has been studied and evaluated in two experiments. This process involved site selection, evaluation, and surrogate population establishment and monitoring (Jordan 1994, Belden and Haegedorn 1993, Belden and McCown 1994). During a two-phase study (1988 to 1989 and 1993 to 1995), 26 mountain lions (*F. c. stanleyana*) were released in the north Florida/south Georgia study area as surrogate panthers (Belden *et al.* 1989, Belden and McCown 1996). Six of the released mountain lions were born and raised in captivity. The remaining 20 were captured in the wild in western Texas and translocated to Florida. Of the translocated mountain lions, all but three were released into the wild shortly after arriving in Florida. The other three were part of an early study to develop captive breeding techniques and technology for the Florida panther. These three individuals had been held in captive breeding facilities in Florida for two to eight years prior to release.

The mountain lions were monitored using radio-telemetry at least three days per week. Many of the animals established overlapping home ranges. All individuals of the Phase I study made kills of large prey at predicted frequencies, and generally adapted well to their new environment (Belden *et al.* 1989). Captive-raised animals tended to establish home ranges more quickly, and were more likely to be in association with other study animals than were wild-caught animals. However, captive-raised animals, particularly males, were more likely to be seen and were associated with most of the human/lion interactions that created negative attitudes toward the program by some individuals. The mean distance from the release site to the home range center and the mean home range size were significantly greater for the wild-caught males (Belden and McCown 1996).

Both studies concluded that reestablishment into portions of the historical range is biologically feasible. (Belden and Haegedorn 1993, Belden and McCown 1996). Habitat and prey available in northern Florida and southern Georgia is sufficient to support a viable, self-sustaining population of Florida panthers. The risk of extinction for the panther can only be significantly reduced through reestablishment of additional populations. However, complex social issues identified during the reintroduction studies would have to be satisfactorily addressed prior to reestablishing a population of Florida panthers (Belden and McCown 1996). In response to these issues, the FPIC voted to initiate a sociological study of the issues most prevalent in those opposed to panther introductions. This study will identify the most challenging issues and ways to manage them. In any case, population reestablishment will create new challenges to governmental agencies and the public.

J. Recovery Thrusts, Conservation Measures and Accomplishments

1. Existing Population and Habitats
2. Population/Genetic Health
3. Population Reestablishment

II. RECOVERY

A. Goals and Objectives

NOTE: The recovery objective for the Florida panther, as reflected in the current recovery plan, is to achieve three viable, self-sustaining populations within the historic range of the panther. Whether this objective will change will be determined during the revision process of the recovery plan.

B. Narrative Outline

1. Protect/Monitor/Enhance Existing South Florida Panther Population, Associated Habitats, and Prey Resources.

1.1 Protect/monitor/enhance existing panther population. Although there are frequent reports of Florida panthers from many areas of the species' historic range, the only confirmed surviving population is in south Florida. The survival of the Florida panther depends on the continued existence of this population.

1.1.1 Continue/expand investigations and monitoring of panther population. It is essential that monitoring of the extant population continue and expand. In order to accomplish this task and the needs identified under Task 2.1.1, consideration should be given to the establishment of a Interagency Backup Capture Team. The purpose of this capture team would be to support, compliment and expand the capabilities of the existing capture team. This team could explore alternative capture methods and emphasize capture of uncollared animals outside of the core population area. As a minimum, backup personnel should be trained to assist the existing capture team as needed and fill in in the absence of team members.

1.1.1.1 Continue/expand population demographic investigations.

1.1.1.1.1 Continue current activities and expand to areas north of Caloosahatchee River. The Habitat Preservation Plan identified approximately 512,000 acres of suitable panther habitat, contained within three ecological units north of the Caloosahatchee River. Limited capture efforts in 1988 resulted in the capture and radio-instrumentation of a male panther. Emphasis should be placed on systematic field surveys to ascertain the existence of

panthers north of the river. Actions should be taken to radio-instrument panthers verified north of the river.

1.1.1.1.2 Strive to achieve expanded tracking capability. Continue to investigate the use of satellite tracking equipment. This type of equipment would better enable us to determine how panthers move through the landscape by gathering data at night when the animals are most active.

1.1.1.2 Continue population health investigations. This task is essential when determining the success of the genetic restoration program as well as monitoring general population health. It should be continued and expanded as needed.

1.1.1.3 Continue/expand population genetic investigations. This is a requirement for maintaining scientific control over the population genetics of the Florida panther, and will be essential when determining where reestablished population stock will come from.

1.1.1.4 Define use patterns in mosaic landscapes. In order to identify conflicting and compatible land use changes, we must first understand how panthers move through and use landscapes kept in a mosaic of native, agriculture, and residential/commercial development.

1.1.2 Identify and minimize causes of panther injury and mortality. In a small population such as the Florida panther, excessive mortality could be catastrophic. All mortality should be closely monitored and actions to minimize human-related causes of mortality should be emphasized.

1.1.2.1 Address highway risks. Wildlife crossings that benefit the panther have been installed on several major roadways in areas of high density panther use or areas with a high incidence of road mortality. As additional areas of concern are identified, appropriate measures should be implemented. Likewise, additional design options should be investigated in order to identify the most cost efficient type of structure that wildlife will utilize.

1.1.2.2 Continue monitoring mercury and other environmental contaminants in panthers and take appropriate action. Mercury investigations should continue. One panther mortality has been attributed to mercury toxicity, with other panthers containing mercury at levels of concern. Concerns have also been raised regarding possible environmental contaminants/estrogenic related problems in panthers. Efforts to determine effects of environmental contaminants on the panther and actions to address identified problems must be emphasized.

1.1.2.3 Address other threats. In general, threats to the panther revolve around the fact that the single, small population provides little security against extinction, population health appears to be compromised by numerous physiological and reproductive abnormalities, and suitable habitats for occupation are limited and under immense developmental pressure. Programs are underway to address these obvious risk factors, however, emphasis must be placed on continuing population monitoring actions for other threats and be prepared to address them.

1.1.3 Manage existing panther population. The implementation of the genetic restoration program and the continuing loss of habitat has resulted in the need to actively manage the extant panther population. Management, primarily, will be through continued population monitoring and the use of individual translocations to address population demographic needs.

1.1.3.1 Translocate panthers as appropriate to address demographic needs and achieve better utilization of available habitat. In order to manage existing population genetics, expand the existing range, and provide stock for population reestablishment sites, translocation of subadult animals may be necessary. A protocol for translocations will be developed and presented to the FPIC for approval.

1.1.3.1.1 Monitor translocation efforts. Any translocation project will have to be carefully planned and closely monitored to determine if the expected results are achieved. Monitoring

would include telemetry, health examinations, and radio-instrumentation of any offspring produced in a translocation project. The results of these monitoring endeavors would indicate if changes in the existing protocol are needed.

1.2 Protect/monitor/enhance panther habitat in south Florida. The HPP will provide guidance for this recovery task. The HPP should be updated as appropriate.

1.2.1 Develop and implement a panther habitat preservation strategy and monitoring program. This task should integrate the HPP into a GIS system in order to analyze how the landscape and Priority 1 and 2 lands have changed since the HPP was developed in 1993. This project should result in revision of the HPP as appropriate.

1.2.2 Preserve panther habitat. Habitat loss, degradation, and loss of connectivity continue to be the major limiting factor in panther recovery. Native vegetative communities need to be preserved in order for the extant population to survive.

1.2.2.1 Emphasize cooperative habitat preservation programs with landowners. This program should involve perpetual conservation easements, cooperative agreements, management funds through partners in wildlife of the Farm Bill, and other means as appropriate or available. In addition, a compensation program aimed at encouraging private landowners to maintain panther habitat or important corridors on their lands should be developed.

1.2.2.2 Continue to acquire additional lands. Identify willing sellers. Land acquisition can involve fee simple and less than fee simple means.

1.2.3 Manage/enhance panther habitat.

1.2.3.1 Continue efforts to develop/identify effective habitat management techniques. Efforts to increase prey base and restore habitat to better serve the panthers life history needs should be continued.

1.2.3.2 Implement/continue management actions on public lands. Public lands in south Florida constitute the largest contiguous block of land protected from developmental or agricultural pressures. These lands should be better managed to optimize ecosystem functions and better benefit the Florida panther.

1.2.3.2.1 Manage habitat to enhance conditions for panthers. Fire management, removal of exotic vegetation that affords minimum value to wildlife species, and other actions as appropriate should be implemented.

1.2.3.2.2 Manage public use activities to minimize panther disturbance, harassment and competition for prey resources. Although scientific data may be somewhat limited, human recreational activity can disturb/disrupt normal panther activity. Efforts to develop a better understanding of this relationship is needed. Disturbance related to human recreational activity needs to be minimized, particularly during the denning season.

1.2.3.3 Establish habitat management partnerships with private landowners. In addition to the preservation mechanisms identified in 1.2.2.1, programs to cooperate with private landowners by providing technical assistance and funding sources for appropriate management of panther habitat on private lands need to be developed.

1.2.3.4 Maintain/reestablish important habitat linkages. This task is essential in maintaining and expanding the present panther population in South Florida and will also be an important ingredient for population reestablishment sites.

1.3 Protect/monitor/enhance prey resources. Identify areas where prey availability may be a limiting factor to panther use and develop programs to enhance the prey base in these locations.

1.3.1 On public lands. Establish prey density baselines for newly acquired lands and identify, implement and monitor management actions designed to address prey resource issues.

1.3.2 On private lands. Where available, evaluate prey density data to determine if prey availability may be a limiting factor to panther use. Offer to work with private landowners in the development, implementation and monitoring of management plans to ensure an adequate prey resource. Incorporate this information into Task 1.2.1 in order to assess the effects mosaic land uses have on prey densities and use patterns.

2. Take Actions to Address Population Health

2.1 Continue implementation/monitoring of genetic restoration program. The approved Genetic Management Plan will provide the guidance and direction for the genetic restoration program. In addition, management considerations must include rationale for leaving/removing Texas cougar females, guidelines for achieving/maintaining scientific control, using translocations and intercross progeny for identified genetic/demographic needs. Monitoring of this program includes radio-instrumentation of all progeny produced by female Texas cougars and Florida panthers.

2.1.1 Identify and implement actions to aid in maintaining scientific control. Radio-instrumentation of progeny is essential in this program. Likewise, eliminating the likelihood of male progeny backcrossing with female Texas cougars is paramount. Protocols to address these issues need to be developed and should identify male genetic restoration progeny, where they were born, when they are collared, when they may reach breeding age, as well as potential translocation areas. Translocations of these animals should follow the protocol developed in Task 1.1.3.1. An analysis of the need to eliminate backcrossing should also include the option of removing Texas cougar females.

2.2 Continue to implement actions to address other population health concerns, i.e. immunizations, etc. Continue immunization of all cats captured/placed in the wild (ID immunizations). In addition, when cats are captured for recollaring, their health is assessed and recommendations on any course of action to be undertaken are made, this portion of the biological investigation program should continue.

2.3 Manage/utilize captive population as appropriate to enhance population health. The captive population should be appropriately managed and used to enhance the health of the wild population, where possible. This may involve implementation of the captive breeding program for genetic management purposes or to provide stock for population reestablishment needs. As appropriate, the captive population should be used to develop/refine assisted reproductive techniques and technology (AI & IVF). A protocol for captive propagation should be developed as necessary and presented to the FPIC for consideration.

3. Reestablish Panther Populations.

3.1 Continue identification/evaluation of potential population reestablishment sites. Efforts to develop baseline information on candidate sites, including landowner information, should continue.

3.1.1 Seek assistance/participation of State Wildlife Agencies and other appropriate entities.

3.1.2 Conduct feasibility studies using western cougars as surrogate panthers as appropriate.

3.2 Develop strategy/means to address sociological/political issues.

3.3 Identify/develop source stock for reestablishment purposes.

3.4 Reestablish and manage populations where determined feasible.

3.5 Preserve/manage habitat within population reestablishment areas.

3.5.1 Maintain/reestablish habitat linkages between population areas where feasible.

4. Expand Public Information/Education/Outreach.

4.1 Establish Public Outreach Subcommittee within the Florida Panther Interagency Committee.

4.2 Utilize captive population as a tool to achieve outreach and other recovery objectives.

4.2.1 Develop captive management plan.

4.2.2 Update captive management and health protocol as appropriate.

4.2.3 Develop/maintain emergency treatment/rehabilitation/holding capabilities at appropriate captive facilities and establish a field facility in south Florida. In addition to maintaining captive treatment/rehab capabilities, a field treatment/rehab facility should be developed on public land in south Florida. This facility would assist in treating injured or sick panthers closer to their territories. The GFC veterinarian would decide which facility an injured or sick animal would be placed in. This facility could also enable conditioning operations for captive held cats to take place in proximity to release sites. The facility could also serve as a soft-release site.

4.2.2 Utilize captive population as appropriate to enhance the wild population. The captive population may be used to augment and supplement the wild population, particularly in instances where one gender is not present. A conditioning/translocation protocol should be developed. Every precaution should be taken when releasing captive-held animals into the wild, and the candidate should be conditioned as close to the release site as practicable.

5. Coordinate Recovery Activities, Monitor and Evaluate Progress; and Update/Revise the Recovery Plan.

5.1 Continue active role of the Florida Panther Interagency Committee and its Technical Subcommittee in recovery program.

5.2 Update/revise recovery plan.

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III. IMPLEMENTATION SCHEDULE

IV. APPENDICES

Genetic Restoration Plan



United States Department of the Interior

FISH AND WILDLIFE SERVICE
FLORIDA PANTHER RECOVERY COORDINATOR
117 NEWINS-ZIEGLER HALL, U. OF FLA.
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GAINESVILLE, FLORIDA 32611-0450

MEMORANDUM

DATE: March 26, 1997

TO: Florida Panther Recovery Team Members:
Jim Stevenson, Florida DEP, Tallahassee, FL
Suzette Kimball, National Park Service, Atlanta, GA
Tom Logan, Florida GFWFC, Tallahassee, FL

FROM: Florida Panther Coordinator, FWS, Gainesville, FL

SUBJECT: Recovery Plan Revision

As you recall, we have been tasked to revise the Florida Panther Recovery Plan. As a start, I have developed a first cut draft plan outline (attached). Also attached is species account information on the panther that will form the basis for the Introduction section of the plan. Please review these materials (and have other agency staff review as you deem appropriate). Your comments and input are needed by April 15, 1997. My desires are to have a comprehensive plan outline and Introduction section drafted and available for public review and comment by May.

Dennis B. Jordan
Recovery Team Leader