

ANNUAL PERFORMANCE REPORT

State: Florida

Study No. 7508

Study Title: Florida Panther Genetic Restoration and Management

Period Covered: 1 July 1996 - 30 June 1997

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Abstract: Telemetry data were collected on 24 radio-collared Florida panthers (Felis concolor coryi) and 7 Texas cougars (F. c. stanleyana) in south Florida during the reporting period. One instrumented panther died of unknown causes, and no Texas cougars died during the study period. Six additional panthers were collared during capture work. Three female panthers denned during the past year producing four litters of 10 neonate kittens (4 females, 6 males) that were examined and marked with transponders. Four female Texas cougars denned during the past year producing six neonate kittens (5 females, 1 male) that were also examined and marked with transponders. A total of 9 (2♂, 7♀) F1 kittens have been produced. Florida panthers showed spatial use patterns similar to previous years. Movements of Texas cougars were within habitat areas utilized by Florida panthers, and the occasional movements into atypical areas such as mangroves and suburban areas that occurred initially have ceased. All Texas cougars have settled into home ranges within panther habitat and are exhibiting routine movements and activities similar to Florida panthers. Social interactions have occurred between Texas cougars and both female and male Florida panthers.

INTRODUCTION

Florida panthers are endangered by a combination of population and habitat factors. Loss and fragmentation of habitat and unregulated killing over the past two centuries have reduced and isolated populations in the southeastern United States to the point that only one population estimated at 30-50 adults exists on approximately 88,097 km² (2.2 million acres) of habitat in south Florida (Maehr 1990). Small population size and geographic isolation increase the chance for extinction of Florida panthers due to demographic instability inherent in small numbers and erosion of genetic diversity from

restricted gene flow and inbreeding. Genetic diversity is the basis for production of fit individuals as well as providing the ability of the population to respond to changing environmental and habitat conditions. Demographic variation has been considered important in regulating populations for many years, but the role of social and genetic factors has only recently begun to be examined as modern techniques from field biology and molecular genetics have become available. Recovery of the Florida panther is complex, but not an uncommon situation as many species face similar circumstances. A unique opportunity exists to implement conservation and management strategies for Florida panthers and evaluate results that will benefit Florida panthers as well as other rare species.

Natural exchange of genetic material occurred historically among the Florida panther population in the southeastern United States and contiguous populations of *E. c. couguar* to the north, *E. c. hipolestes* the northwest and *E. c. stanleyana* to the west (Young and Goldman 1946). Genetic exchange between populations ceased as the coastal plain was gradually cleared and settled. Florida panthers steadily declined in abundance and distribution as a result. Gene flow occurs as individuals disperse and breed, but habitat fragmentation and insularation disrupt dispersal and natural population processes. Dispersal is not only the natural mechanism for mixing the gene pool but also minimizes inbreeding within populations. Inbreeding increases when dispersing breeders can no longer move among fragmented populations, and declining population size compounds demographic and genetic factors. Implications include inbreeding depression, loss of genetic variation, declining health, reduced survivability, lower numbers, and eventual

extinction. The compounding effects of these interrelated factors, perceived as an inward spiral or vortex (Gilpin and Soule 1986), have become a cornerstone of conservation biology. A computer program (VORTEX) has been developed and widely used to predict extinction for numerous species under similar situations (see Grier 1980, Lacy and Clark 1990, and Seal and Lacy 1989).

Resident adult panthers in Florida exhibit a relatively stable social organization with slow turnover. Adult male home ranges averaged 519 km² and usually overlapped several adult female home ranges that averaged 193 km² (Maehr et al. 1991). Subadult males wander widely, whereas subadult females remain closer to natal areas and may be recruited into the breeding population more quickly than subadult males. Intraspecific aggression resulted in about 35% of the documented mortalities of radio-collared panthers in south Florida. Social organization appears to be mediated by a dominance hierarchy and mutual avoidance system (Maehr et al. 1991) similar to that reported for western populations (Hornocker 1970, Seidensticker et al. 1973). The only notable exception is that dispersal and recruitment opportunities are limited because of availability and distribution of habitat in south Florida.

The proportion of adult females producing litters each year and average litter sizes and sex ratios for Florida panthers are similar to demographic characteristics of populations in western states (Lindzey et al. 1994). Reproduction and recruitment appear adequate to balance current levels of mortality. Intraspecific aggression is the leading cause of mortality and seems to exert strong selection pressure especially on subadult and non-reproducing males. Florida panthers appear to be functioning normally in a

demographic sense, but again restricted distribution and habitat in South Florida limit normal dispersal distances, recruitment, and breeding opportunities, which in turn further impedes population and genetic processes.

Genetic analysis of Florida panthers using mitochondrial DNA and nuclear markers indicated the existence of two distinct groupings within the population. Most panthers were in the Big Cypress grouping and probably descended from historic Florida panthers. An additional genetic marker present in cats from the Everglades ecosystem likely originated in South or Central America and was introduced from captive stock between 1957 and 1967 (O'Brien et al. 1990). Genetic health of the few remaining Florida panthers may be benefitting from the introgression of this additional genetic material into the wild population (O'Brien et al. 1990). Florida panthers of Big Cypress origin have remarkably low levels of genetic variation, which is 85% less than observed in western subspecies and 65% less than seen in the Everglades panthers or the Piper captive stock from which Everglades panthers are probably derived (Roelke et al. 1993).

Florida panthers exhibit numerous morphological abnormalities and health problems that may be associated with recent and close inbreeding. At least six panthers have died of various infectious agents and other cats have had difficulties coping with ringworm (Trichophyton sp.) and mange (Notoedres spp.) (Maehr et al. 1995) infestations. These infectious diseases may be manifestations of weakened immune systems (Roelke et al. 1993).

Florida panthers exhibit numerous morphological anomalies including cowlicks, kinked tails, atrial septal defects, cryptorchidism, and malformed sperm. The high prevalence of cowlicks and kinked tails (94% and 88%,

respectively) (Belden 1986) could be the result of inbreeding and rapid fixation in the small panther population. The current prevalence among radio-collared panthers from the Big Cypress ecosystem is 79% (15 of 19) for kinked tails and 84% (16 of 19) for cowlicks. In comparison, kinked tails and cowlicks occurred at lower frequencies (9% and 27%, respectively) in panthers from the Everglades (Roelke et al. 1993), supporting the traits' genetic basis and the rapid influence of genetic introgression to mask the expression of these characteristics. Kinked tails and cowlicks can be readily observed in both sexes and can be used to help gauge the progress of genetic introgression.

Genetic diversity and health of the Florida panther population needs to be restored to ensure survival, even with adequate habitat conservation and other enhancement measures. The complex interplay of social, demographic, genetic, and health factors dictates that a timely and aggressive program be implemented to address the many problems faced by Florida panthers. A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994). Genetic restoration is a direct and immediate action that will restore genetic variability and vitality for a healthier, more resilient population. Results from genetic restoration will enable implementation and refinement of management strategies to maintain levels of genetic diversity historically typical of the North American population.

Objectives to measure accomplishment of genetic restoration and management goals include: 1) releasing appropriate animals to bolster genetic diversity in south Florida, 2) monitoring released individuals and resident panthers to evaluate translocations, 3) comparing population performance and

other relevant ecological and health factors before, during, and after genetic restoration, 4) assessing genetic introgression, 5) publishing results and recommendations, and 6) developing a long-term management plan based on study results to maintain genetic diversity and health of the south Florida panther population.

STUDY AREA

The study area encompassed most of southern Florida south of the Caloosahatchee River and Lake Okeechobee and west of the Atlantic Ridge which runs along the entire coast of eastern Florida and is heavily settled (Fig.1). The area includes large blocks of low-lying public lands such as Everglades National Park, Big Cypress National Preserve, Fakahatchee Strand State Preserve, and the Florida Panther National Wildlife Refuge. Significant private lands, primarily used for cattle and crop production, lie on higher and more productive ground to the north of the public lands and constitute some of the most important habitat for Florida panthers.

METHODS

Florida panthers and Texas cougars were captured using trained hounds, anesthetized using ketamine hydrochloride or Telazol, and fitted with radio-collars. Texas cougars were health-screened and quarantined for at least 30 days before being translocated to south Florida for genetic restoration purposes (Appendix I). All animals were reinstrumented as necessary due to growth or age of transmitters. Biomedical treatments and research were conducted concurrently during recaptures. Instrumented animals were monitored

approximately every other day (M, W, F) from fixed-wing aircraft. Locations were plotted on 7.5 minute USGS topographic maps and recorded as universal transverse mercator points.

Mating and denning behavior, aggressive encounters among males, movements and home range shifts, dispersal, survival, recruitment, displacements and replacements of individuals, and other social and ecological interactions were interpreted from radiotelemetry data and field investigations. Instrumented subadults were monitored after dispersal to document recruitment into the resident adult population. Interactions with other panthers were examined to determine factors contributing to successful or unsuccessful recruitment. Successful recruitment is considered to have occurred if a subadult establishes a home range and eventually reproduces. Death of a dispersing subadult is considered unsuccessful recruitment and establishing a home range that does not overlap with a radio-collared panther of the opposite sex is considered marginally successful.

RESULTS AND DISCUSSION

Status of Instrumented Florida Panthers

The study period began with 19 radio-instrumented Florida panthers (8 males and 11 females) ranging in age from 2 to 16 years of age (Appendix II). We added four new panthers as study animals during winter capture efforts; #61 was a F1 female kitten of TX108, and panthers #62 and #64 were male kittens of panther #48. Panther #63 was an uncollared sub-adult male panther that was captured on the Big Cypress Seminole Indian Reservation. Female panthers #36 and #49 were recaptured following failure of transmitters prior to the study

period. One instrumented panther (#58 - Appendix III) died during the study period bringing the number of monitored panthers to 23 (11 males and 12 females) by 30 June 1997.

Locations of radio-instrumented panthers showed spatial use patterns similar to previous years (Fig. 2, 3, and 4). Home range sizes (convex polygon method) averaged 219 km² for female panthers and 348 km² for males; female ranges were generally smaller than male ranges (Table 1).

Three radio-instrumented panthers produced four litters and a total of 10 kittens during the reporting period (Appendix IV). We examined all kittens biomedically and marked them with transponders. Panther #56 denned in August 1996 and produced two female kittens (K29, K30) and denned again in June 1997, producing four kittens (2 ♂'s: K40, K43; 2 ♀'s: K41, K42). The August litter of panther #56 was presumed lost. Panther #48 denned in September 1996 and produced three male kittens (K31, K32, and K33), and panther #40 denned in May 1997, producing one male kitten (K37).

Status of female Texas cougars

Eight female cougars were released in south Florida from 29 March to 26 July 1995 (Table 2). The sites of releases are shown in Fig. 5. TX102 was struck by a vehicle and killed along County Road 833 in Hendry County between 20-21 September 1995.

Locations of the seven translocated Texas cougars during the reporting period (Fig. 4, 6, and 7) showed movements that were within panther habitat. All cougars appear to have settled into consistent use areas and are exhibiting routine movements and activities that are similar to Florida

panthers (Fig. 8 and 9-Table 1). TX101 has been consistently using the Big Cypress Seminole Indian Reservation and adjacent areas. TX103 has settled into a home range south of Highway 41 from Monroe Station and Loop Road to Turner River in the Big Cypress National Preserve. TX104 and TX106 spent the majority of their time in Fakahatchee Strand State Preserve and the Florida Panther National Wildlife Refuge, occasionally visiting adjacent private lands. TX107 has remained in the Monument Unit of Big Cypress National Preserve. TX105 and TX108 have consistently used the Long Pine Key area of the Everglades National Park since their release in July 1995.

No displacement of Florida panthers has occurred and no disruptions to the existing social organization have been observed. No Texas cougars have exhibited aberrant behaviors or unacceptable human interactions, and none have been removed from the study. Social interactions have occurred between Texas cougars and both female and male panthers in most areas. No Florida panthers are currently known to share the home range of TX103. We detected sign of an uncollared male in the area overlapping with TX107 (and panthers #23 and #55) in Big Cypress National Reserve. Two wild caught and captive raised panthers (#201 and #203) were released in late January 1997 into the southern Big Cypress National Preserve, but both died of similar, unknown causes within three months of their release.

Four Texas females denned during the study period, and we examined and marked with transponders three of these litters (Appendix IV). TX101 denned in December 1996 on the Big Cypress Seminole Indian Reservation, producing a female kitten (K36) and a male kitten (K35). The sire of this litter was panther #45. TX108 denned in July 1996 on Long Pine Key in Everglades

National Park, but we were unsuccessful at finding the kitten(s). We later captured a single female kitten (#61, March 1997) and were confident that there were no other siblings. The sire of this kitten was panther #16. TX105 denned in September 1996 on Long Pine Key in Everglades National Park and produced one female kitten (K34), also sired by panther #16. TX107 denned in May 1997 north of Oasis ranger station in BCNP and produced two female kittens (K38 and K39). The sire of this litter was either panther #201 or an uncollared male panther recently documented in this area.

Florida panthers produced larger litter sizes that were skewed toward male kittens; 8 of 10 kittens had kinked tails (Table 3). In contrast, Texas females had smaller litter sizes that were skewed toward female kittens, and none of the kittens had kinked tails (Table 4). Apparently genetic introgression is progressing toward elimination or at least reduction of kinked tails in the F1 generation of intercrossed kittens. The current status of F1 kittens is summarized in Table 5.

In summary, the genetic restoration of Florida panthers is proceeding. Five of the 7 female Texas cougars have successfully bred with panthers and produced 9 F1 kittens. Capturing and radio-collaring kittens, regardless of their parentage, continues to be difficult, however, all F1 kittens and the majority of panther kittens were marked permanently with transponders. These transponders may be the most important tool for measuring the success of genetic restoration.

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Table 1. Minimum convex polygon home range sizes (km²) of Florida panthers and Texas cougars in south Florida from 1 July 1996 to 30 June 1997.

Cat #	Sex	Age	Home Range Size (km ²)
TX101	F		61.7
49	F	7 ^a	67.7
32	F	10 ^a	85.9
48	F	4.5	107.1
19	F	11	118.4
63	M	2 ^a	137.1 ^b
TX105	F		154.3
TX106	F		154.5
09	F	15-16 ^a	162.7
56	F	5-6 ^a	168.0
11	F	15-16 ^a	190.7
TX108	F		193.4
36	F	11-12 ^a	198.2
58	M	2.5	218.5
46	M	7 ^a	246.8
40	F	9 ^a	263.6
TX103	F		284.2
59	M	2	295.6
57	F	5 ^a	317.5
54	M	5	327.4
TX107	F		347.0
51	M	8 ^a	358.8
45	M	6	377.6
55	F	4.5	378.0
23	F	10.5	452.5
TX104	F		462.2
60	M	1.5	521.9
16	M	11	611.2

^a Age estimated by tooth wear, pelage, and body condition.

^b Home range calculated with < 6 months of data.

Table 2. Release dates and release locations for female Texas cougars translocated to south Florida for genetic restoration from 29 March to 26 July 1995.

Cat #	Release Date	Release Location
TX104	29 March 1995	Fakahatchee Strand State Preserve
TX101	5 April 1995	NE Bear Island, Big Cypress National Preserve (BCNP)
TX102	5 April 1995	NE Bear Island, BCNP
TX106	9 April 1995	Fakahatchee Strand State Preserve
TX103	4 May 1995	Lostmans Pines, BCNP
TX107	4 May 1995	Raccoon Point, BCNP
TX105	5 July 1995	Long Pine Key, Everglades National Park (ENP)
TX108	26 July 1995	Long Pine Key, ENP

Table 5. Status of F1 kittens in south Florida from October 1995 to May 1997.

Cat #	Den date	Kitten(s)	Status
TX101	October 1995	K18♀, K19♂	dispersed
TX101	December 1995	K35♂, K36♀	with mother
TX105	September 1995	K34♀	with mother
TX106	November 1995	K23♀	dispersed
TX107	May 1997	K38♀, K39♀	with mother
TX108	June 1996	#61♀	collared

Table 3. Kittens produced by female and male Florida panthers from 1 July 1996 to 30 June 1997.

Panther #	Litter Size	Sex Ratio	Prevalence of kinked tail
56	2	sex undetermined	2 yes: 0 no
56	4	2 ♀: 2 ♂	3 yes: 1 no
48	3	0 ♀: 3 ♂	2 yes: 1 no
40	1	0 ♀: 1 ♂	1 yes
mean/total	2.5	2 ♀: 6 ♂	8 yes: 2 no

Table 4. F1 kittens produced by female Texas cougars and male Florida panthers from October 1995 to May 1997.

Cat #	Litter size	Sex ratio	Prevalence of kinked tail
TX101	2	1 ♀: 1 ♂	2 no
TX101	2	1 ♀: 1 ♂	2 no
TX105	1	1 ♀: 0 ♂	1 no
TX106	1	1 ♀: 0 ♂	1 no
TX107	2	2 ♀: 0 ♂	2 no
TX108	1	1 ♀: 0 ♂	1 no
mean/total	1.5	7 ♀: 2 ♂	0 yes: 9 no

Figure captions

Fig. 1. Florida panther genetic restoration study area in south Florida from 1 July 1996 to 30 June 1997.

Fig. 2. Locations of female Florida panthers in south Florida from 1 July 1996 to 30 June 1997.

Fig. 3. Locations of male Florida panthers in south Florida from 1 July 1996 to 30 June 1997.

Fig. 4. Locations of two female Florida panthers and two female Texas cougars in southern Big Cypress National Preserve from 1 July 1996 to 30 June 1997.

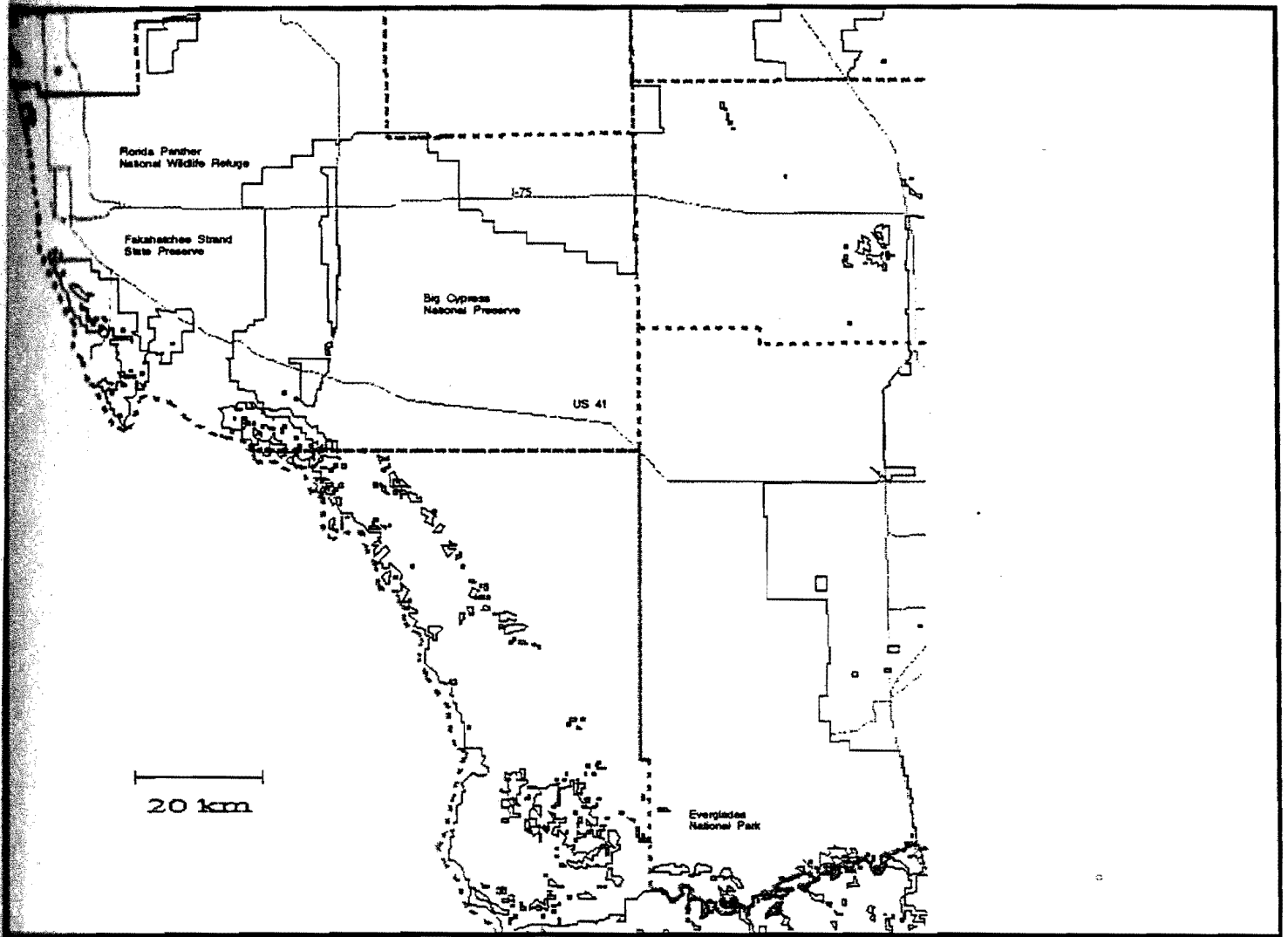
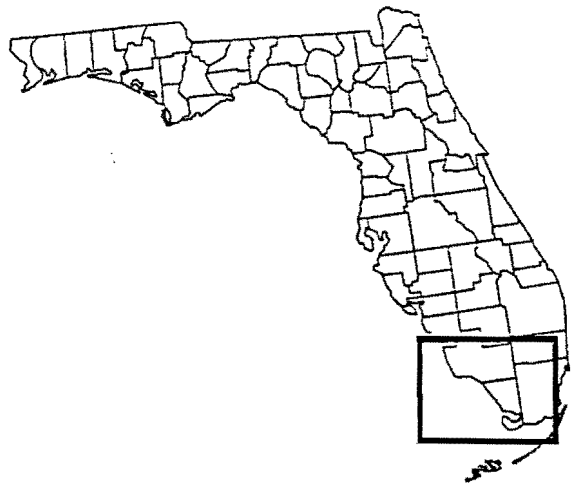
Fig. 5. Release sites of eight female Texas cougars translocated to south Florida for genetic restoration purposes from 29 March 1995 to 26 July 1995.

Fig. 6. Locations of five female Texas cougars in south Florida from 1 July 1996 to 30 June 1997.

Fig. 7. Locations of two female Texas cougars in Everglades National Park from 1 July 1996 to 30 June 1997.

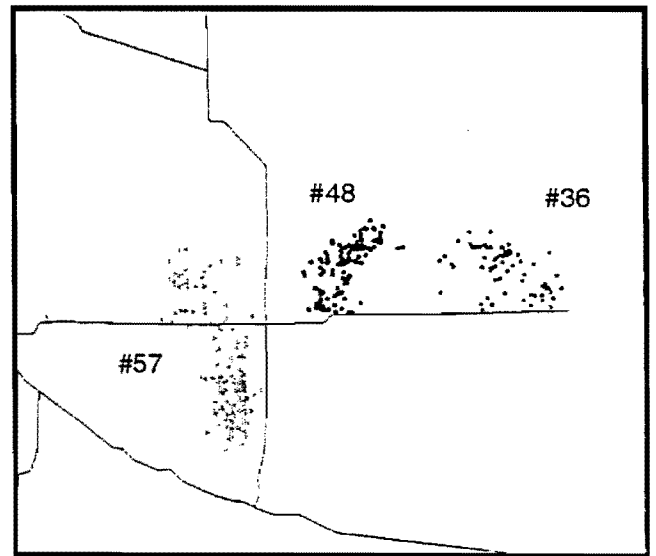
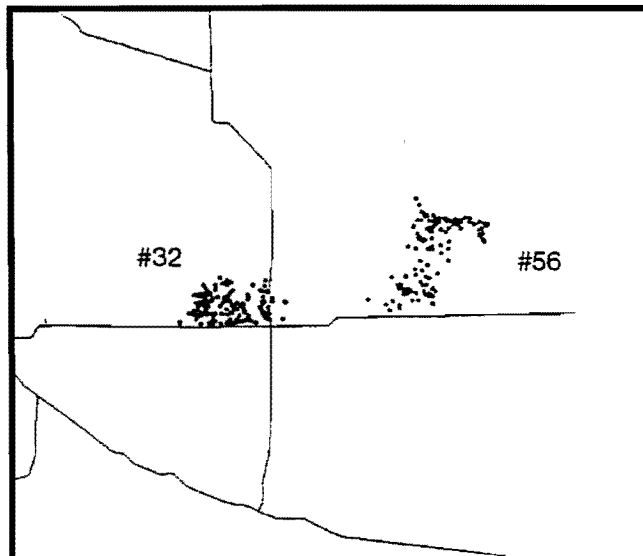
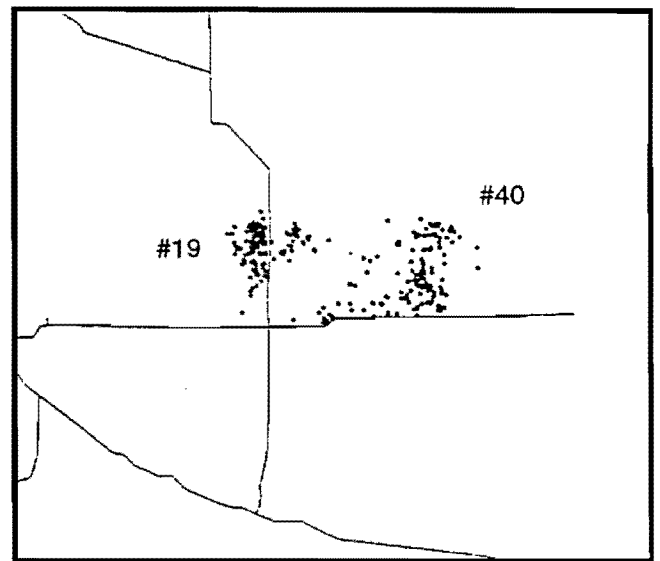
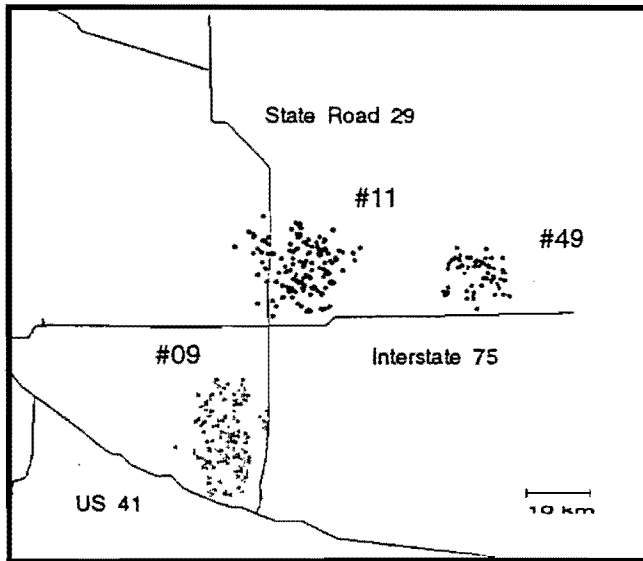
Fig. 8. Home ranges of five female Texas cougars showing overlap with Florida panther males in south Florida from 1 July 1996 to 30 June 1997.

Fig. 9. Home ranges of two female Texas cougars showing overlap with Florida panther #16 in Everglades National Park from 1 July 1996 to 30 June 1997.



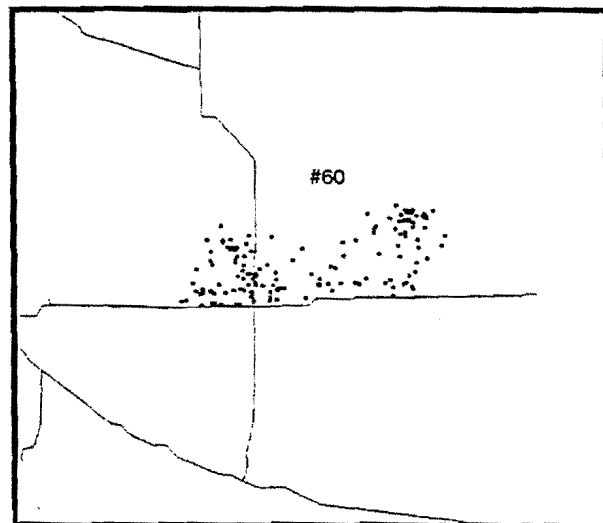
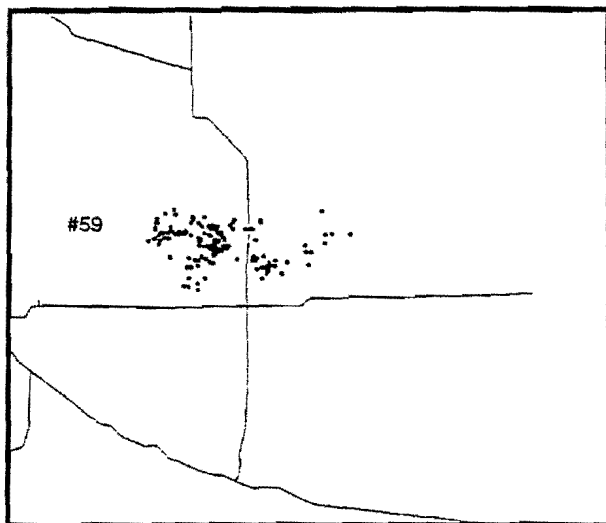
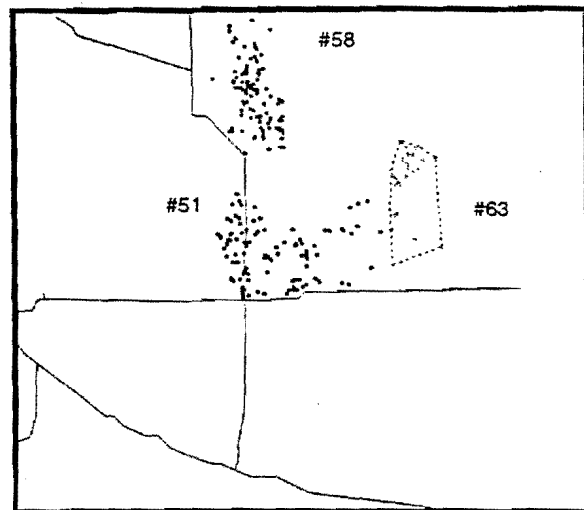
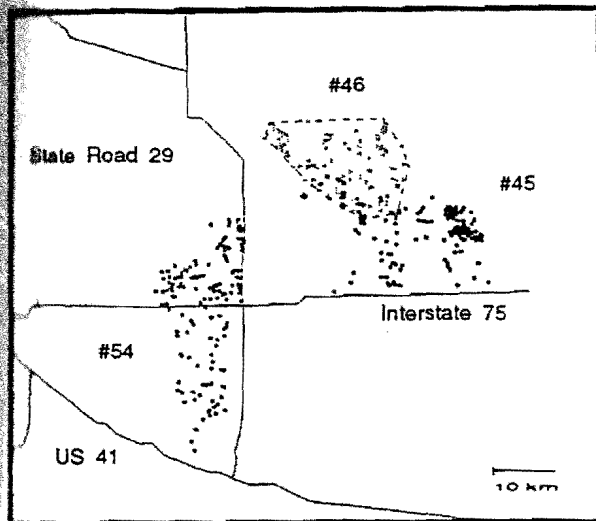
Locations of Female Florida Panthers

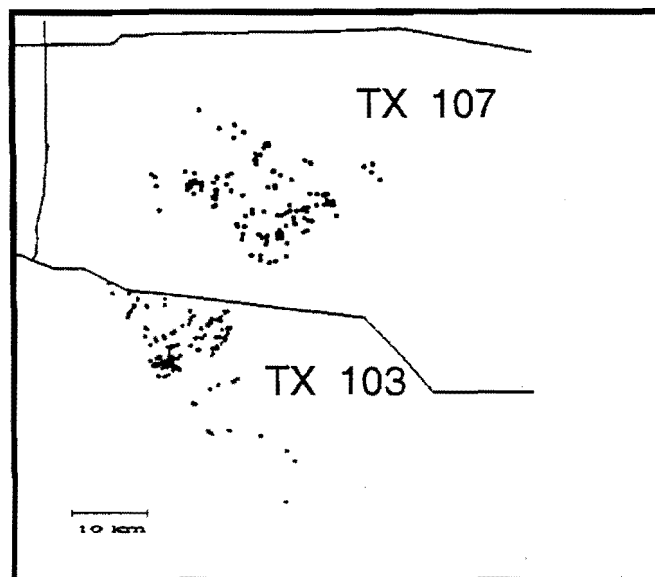
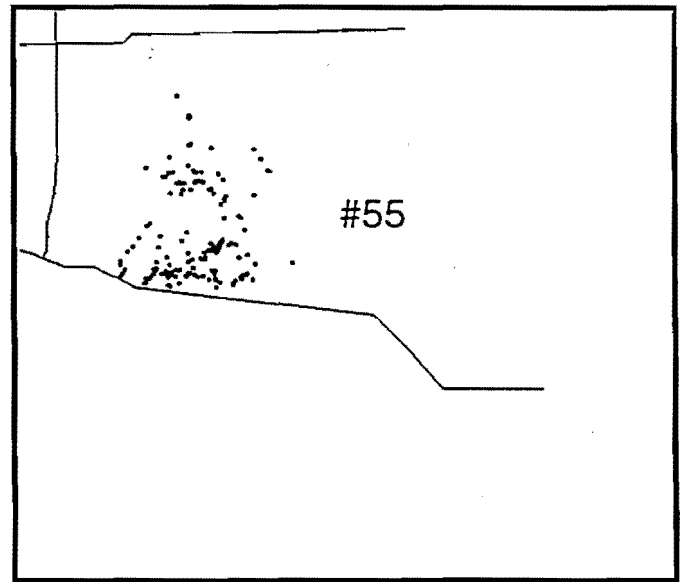
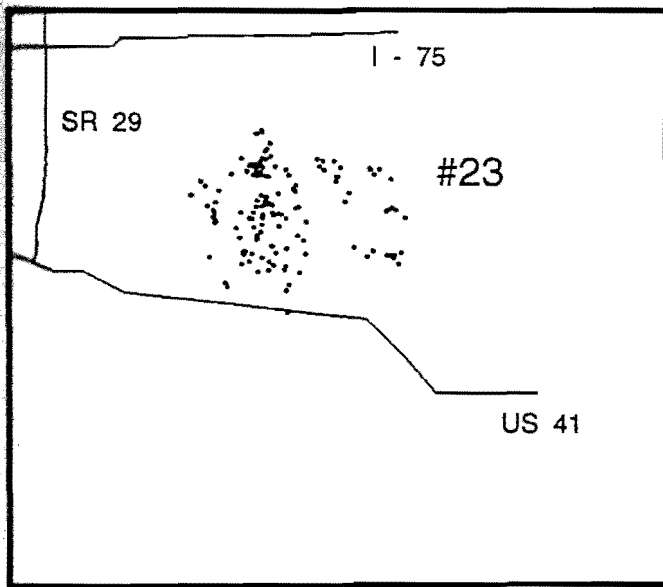
1 July 1996 - 30 June 1997

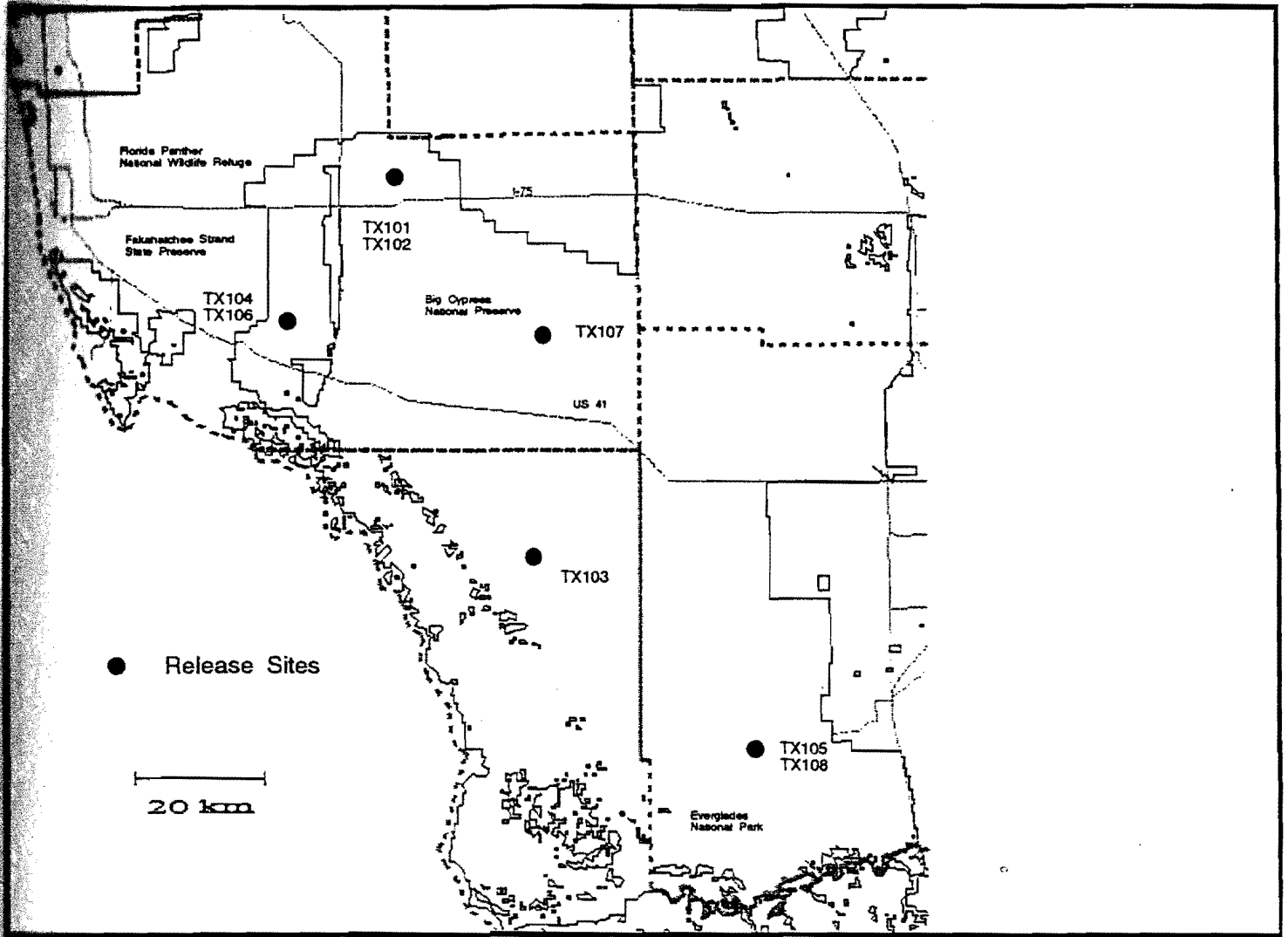
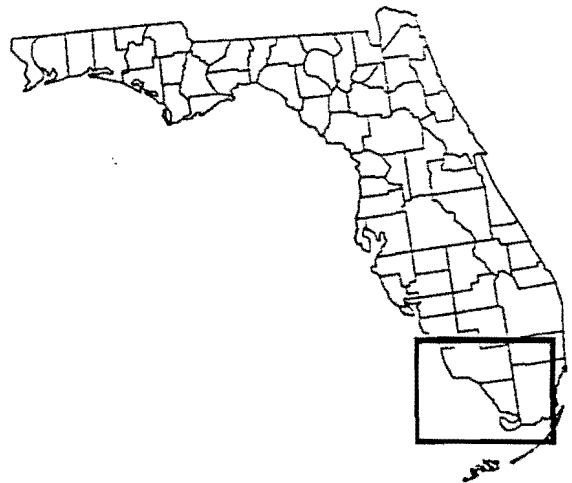


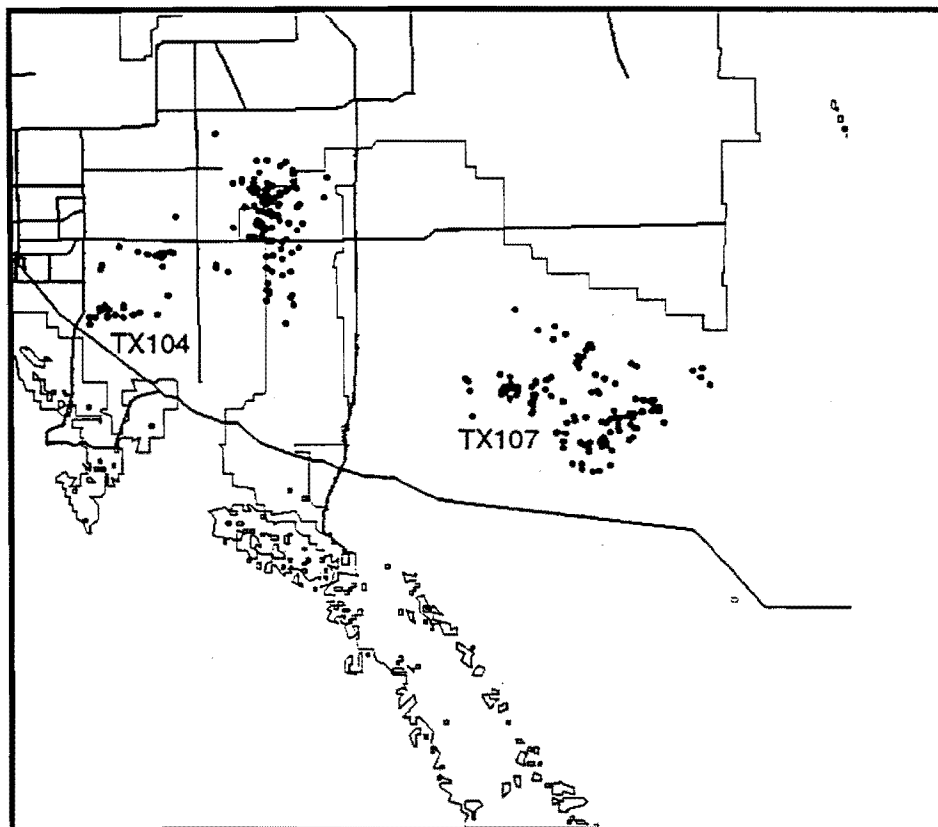
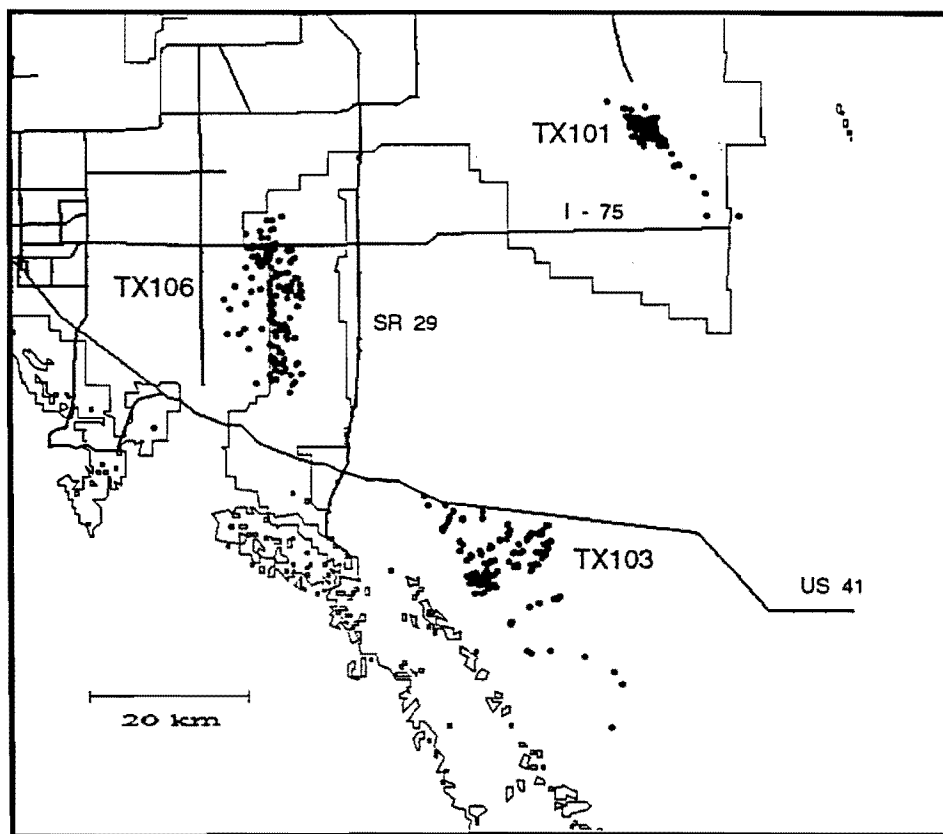
Locations of Male Florida Panthers

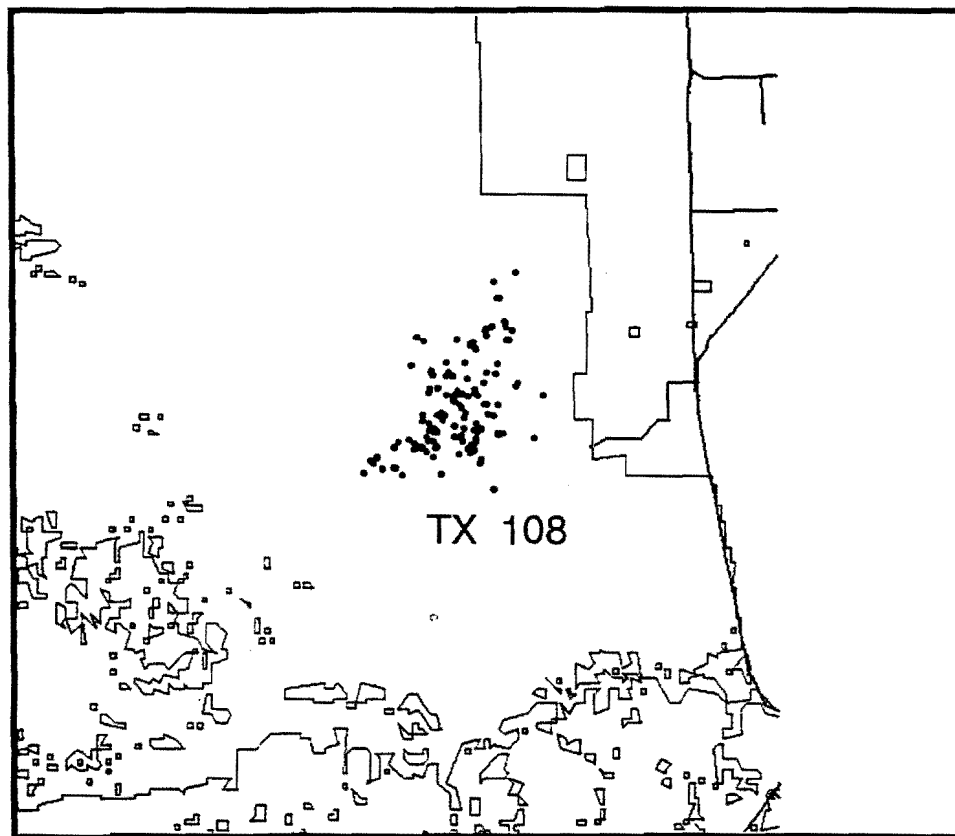
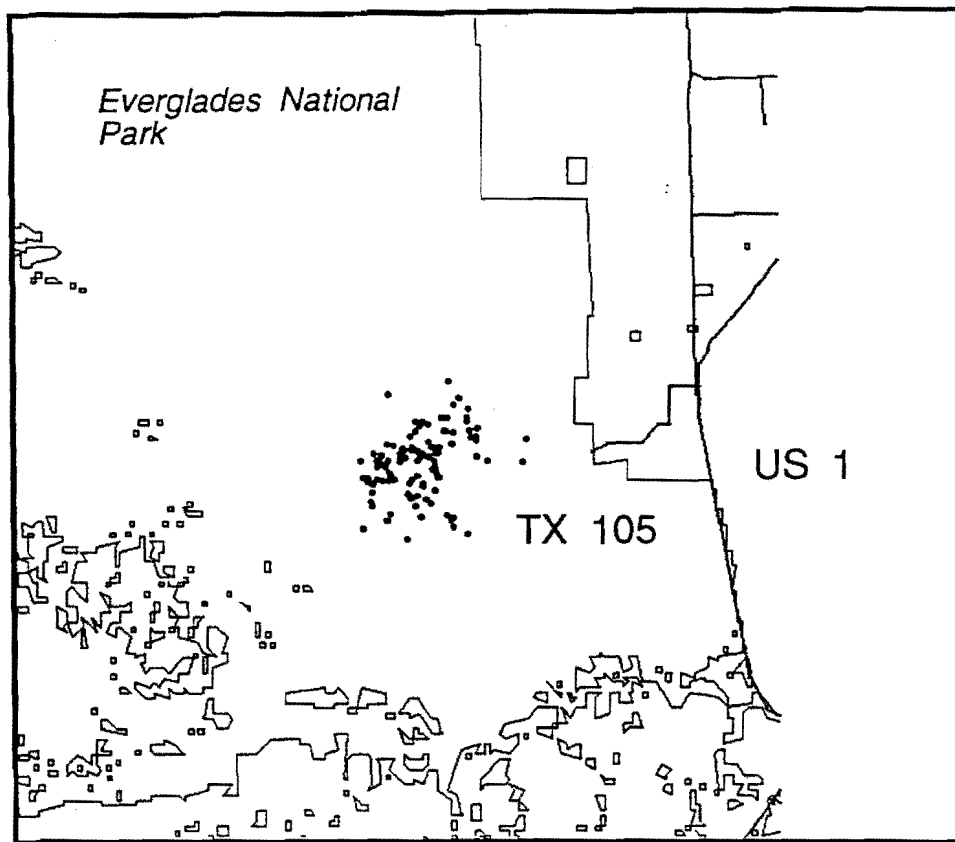
1 July 1996 - 1997

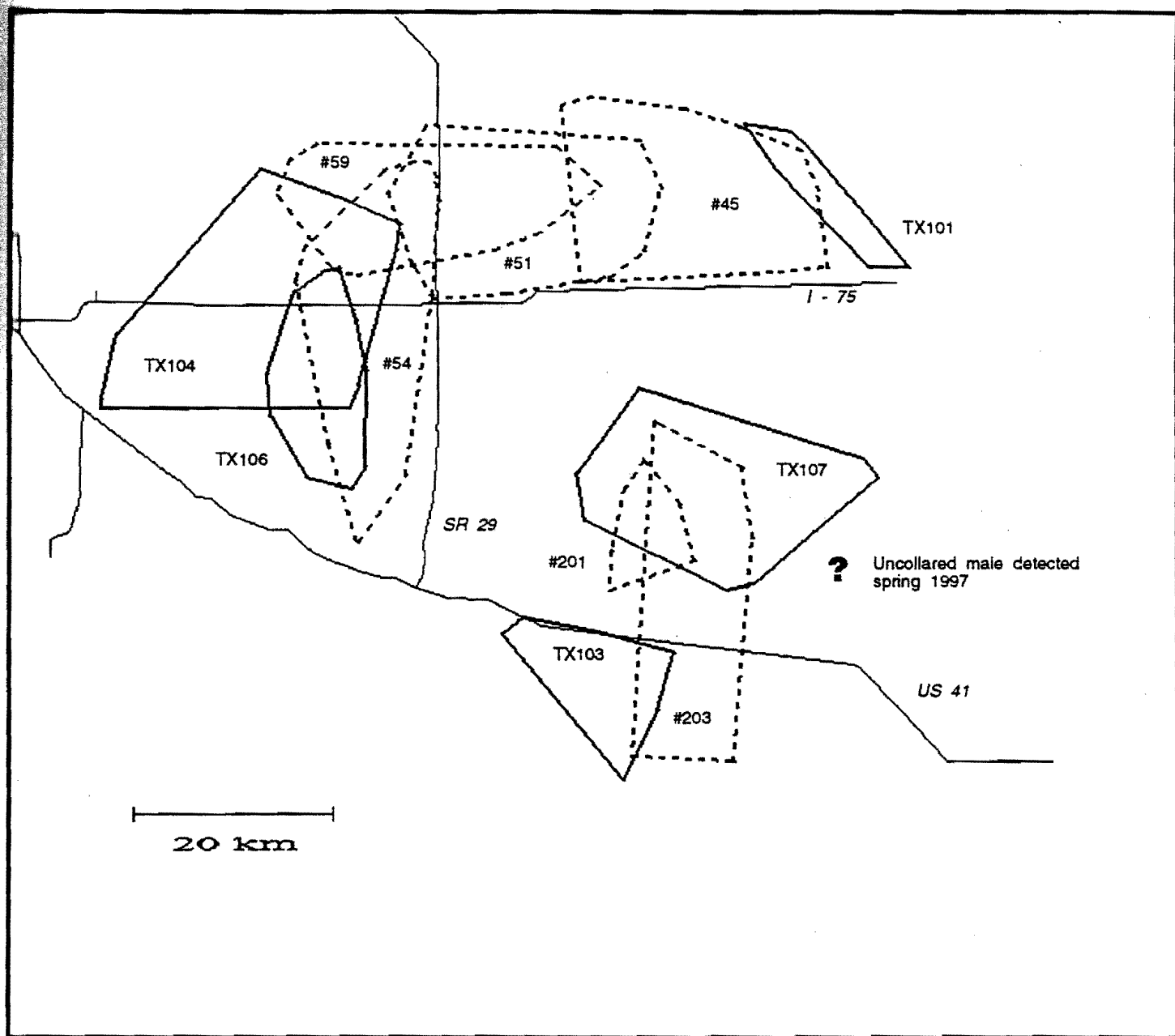












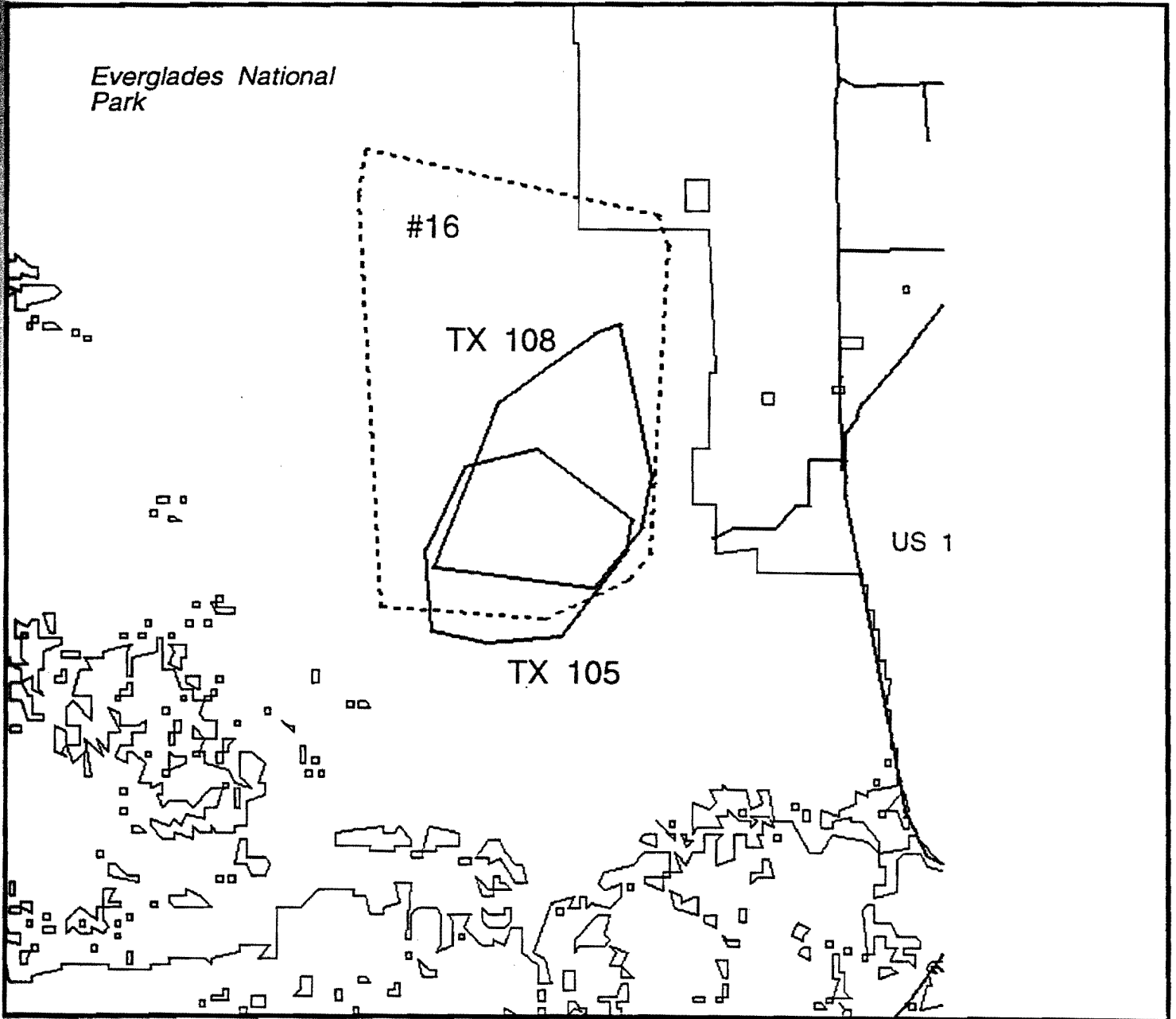
*Everglades National
Park*

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TX 108

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APPENDICES

Appendix I. Pre-release health protocol, sample collection, and selection criteria for cougars from west Texas being translocated to south Florida.

Appendix II. List of radio-instrumented Florida panthers and Texas cougars in south Florida from 10 February 1981 to 30 June 1997.

Appendix III. Summary of Florida panther mortalities and injuries in south Florida from 8 March 1978 to 30 June 1997.

Appendix IV. List of all known dens of radio-instrumented female Florida panthers in south Florida from June 1985 to June 1997.

Appendix I. Pre-release health protocol, sample collection, and selection criteria for cougars from west Texas being translocated to south Florida.

October 24, 1994

Mike R. Dunbar, MS, DVM

The threat of infectious disease in translocation programs is an issue of major concern because of the inherent risks involved with the introduction of pathogens into wild populations of naive animals. Conversely, introducing naive animals into populations harboring potential lethal organisms also has potential consequences. Therefore, biomedical information is needed for health screening of candidates prior to release. The following protocol will be used to assess the health and assure the release of healthy wild-caught cougars (*Felis concolor stanleyana*) from western Texas into southern Florida to co-mingle and breed with established Florida panthers (*F. c. coryi*).

This protocol also contains a list of samples and data to be obtained from each animal to be used in various research projects involved with genetics, toxicology, nutrition, parasitology, and others.

Finally, this document will serve as a treatment protocol to assure the release of healthy animals that will have the best chance of survival and least chance of transferring disease and parasites to the existing population in South Florida.

- I. Quarantine: Texas cougars destined for translocation from West Texas to South Florida will be isolated from all other animals upon capture, quarantine, and transportation. Animals will be quarantined for a period of at least 30 days, possibly extending to 60 days. Close observation shall be made to note appetite, attitude, behavior, and condition of each animal. The attending veterinarian will take

appropriate samples to diagnose any abnormal condition and administer appropriate therapy (note: it is important to make a definitive diagnosis of any abnormal condition before initiating any treatment).

Housing and feeding shall conform to established procedures for large captive felids. Human contact shall remain at a minimum.

- II. Physical Examination and Selection Criteria: Upon quarantine, each animal will receive a complete physical examination including body weight, measurements, dental exam (prophylaxis if needed), note of any congenital abnormalities, pregnancy determination (palpation, ultrasound, serum progesterone level), presence of heart murmurs (if positive, additional evaluation may include ECG, ultrasound, chest radiography, echogram, and other procedures if needed), and analysis of immune system function (optional).

Any animal with cowlicks, kinked tails, congenital cardiac abnormalities, or pregnant will be excluded from the project.

Near the end of the quarantine period, each animal will receive an additional follow-up examination, as deemed appropriate.

- III. Sample Collection: During the initial examination appropriate biomedical samples will be collected and the following tests and procedures will be conducted and evaluated:

1. Vaginal smear (evaluate cell types to determine stage of estrus, presence of infection, or abnormal cell types)
2. Complete blood count (CBC)
3. Serum Chemistry (panel)
4. Serology (initially and 2 weeks later, if needed)

- a. Feline infectious peritonitis virus (FIP)/Feline enteric corona virus (FECV)
 - b. Feline immunodeficiency virus (FIV)/puma lentivirus (PLV) (by Western Blot)
 - c. Feline leukemia virus (FeLK)
 - d. Feline panleukopenia virus (FPLV)
 - e. Feline calicivirus (FCV)
 - f. Feline viral rhinotracheitis virus (FVRV)
 - g. Pseudorabies virus (PRV)
 - h. Canine distemper virus (CDV)
 - i. Feline syncytia-forming virus (FeSFV)
 - j. Brucella (abortus, suis)
 - k. Toxoplasma gondii
 - l. Rabies (titer)
5. Culture (Bac-T and Virology) (swab)
- a. nasal
 - b. oro-pharyngeal/tonsillar crypt
 - c. rectal
 - d. fecal (Salmonella sp., Campylobacter sp., etc.)
6. Parasites:
- a. Blood parasites (Microfilaria, Cytauxzoon felis, Haemobartonella sp.) (In EDTA whole blood or methanol fixed blood smears)
 - b. fecal (flotation, sedimentation, and direct smear). On flotation, pay particular attention for presence of

- Cylicospirura subequalis. If present, use appropriate treatment and recheck.
- c. Perform Baermann test for presence of lungworm, especially for Vogeloides felis. If present, treat appropriately and recheck.
 - d. Identify representative samples of ectoparasites, remove, and preserve.
 - e. Perform eye exam for presence of Metathelazia californica. If present, use appropriate treatment, remove and preserve in alcohol for identification. Recheck.
7. Toxicology: (blood in heparin and fat (or muscle) biopsy)
- a. Heavy metal screen
 - b. Organochlorine screen
 - c. PCB (total)
 - d. others as needed
8. Nutritional
- a. Trace mineral screen
9. Metabolic
- a. T_3 and T_4
 - b. Cortisol (optional)
10. Genetics (blood and tissue biopsy)
11. Reproductive hormone
- a. Estradiol
 - b. Testosterone
 - c. FSH (optional)

- d. LH (optional)
- 12. Urinalysis
- 13. Hair (2.0 + gm desirable - freeze for storage)
- 14. Radiographs - survey (optional)
- 15. Bank (store) 10-20 mls serum (freeze)

IV. Treatment:

- 1. Vaccines: During quarantine and after collection of samples at two weeks (if needed), each animal will receive vaccinations with killed virus vaccines for the following:
 - a. FVR
 - b. FCV
 - c. FPLV
 - d. rabies
- 2. Anti-parasite treatment:
 - a. Each animal will be sprayed with an appropriate paracidal chemical for ticks, fleas, and lice. (Chemical will not be a known estrogenic or anti-androgenic insecticide such as Chlorpyrophos or synthetic pyrethroid.)
 - b. Ivermectin (S.Q.)
 - c. Praziquantel
 - d. Note: Evaluate effectiveness with fecal analysis (eggs/oocysts count, Baermann, eye exam).

- V. A health certificate will be issued for each animal by a licensed (state of Texas), accredited veterinarian not exceeding 30 days prior to entering the state of Florida.

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- VI. Complete necropsies will be performed on all animals that die during shipment or quarantine.

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Appendix II. List of radio-instrumented florida panthers and texas cougars

Cat #	Sex	Capture Date	Age	Birth Date	Parents	Use Area	Death Date	Cause of Death
1	M _o	2/10/81	10	-	-	Fakahatchee	12/14/83	vehicle (SR 84 mm18)
2	M	2/20/81	10	-	-	Fakahatchee	11/29/84	panther
3	F	1/23/82	9	-	-	Fakahatchee	1/17/83	capture
4	M	1/21/82	7-8	-	-	Fakahatchee	4/18/85	vehicle (SR 84 mm17)
5	F	2/23/82	7-8	-	-	Fakah. Conserv. Club	11/23/82	unknown
6	M	2/27/82	6-8	-	-	Raccoon Pt. (North Swamp)	4/16/82	unknown
7	M	3/2/82	6-7	-	-	Raccoon Pt. - Fakahatchee	10/26/85	vehicle (SR 29 C. prison)
8	F	3/25/84	9-10	-	-	Fakahatchee	8/20/88	liver failure, old age
9	F	1/26/85	3-4	-	-	Fakahatchee	-	-
10	M	1/15/86	5 mos.	8/85	#09, ?	GG Estates, Fakahatchee	1/27/87	panther #12
11	F	1/21/86	4-5	-	-	Bear Island, Price's	-	-
12	M	1/28/86	5	-	-	Bear Is., FPNWR, FSSP	11/7/94	panther #46
13	M	2/27/86	4-5	-	-	Bear Is. to Alico	12/14/87	vehicle (SR 29 Sunniland)
14	F	12/07/86	5-6	-	-	Everglades	6/20/91	unknown
15	F	12/13/86	5-6	-	-	Everglades	6/10/88	panther
16	M	1/12/87	12-14 mos.	-	#14, ?	Everglades to Stairsteps	-	-
17	M	1/20/87	6-7	-	-	Gun Swamp to Nobles	7/20/90	unknown

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Cat #	Sex	Capture Date	Age	Birth Date	Parents	Use Area	Death Date	Cause of Death
18	F	1/22/87	7-8	-	-	Gum Swamp, Scofield's, BCSIR	10/1/90	panther (#28?)
19	F	2/9/87	9 mos.	5/86	#11, #12	Bear Is., Prices, FPNWR	-	-
20	M	3/10/87	3-4	-	-	Allico to Bear Island	8/24/88	heart defect
21	F	3/16/87	12-14 mos.	-	#14?	Everglades	-	in captivity
22	F	3/18/87	5-6 mos.	-	#15?	Everglades	7/??/91	infection
23	F	3/18/87	5-6 mos.	-	#15?	Everglades, Raccoon Point	-	-
24	M	1/30/88	3-4	-	-	Highlands Co.	8/22/88	unknown
25	M	2/16/88	4-5	-	-	FPNWR	8/26/88	infection from panther fight
26	M	3/1/88	5-6	-	-	BCSIR, Nobles to Bear Is.	7/8/94	panther #46
27	F	4/11/88	2-3	-	-	Everglades	7/23/89	mercury
28	M	11/29/88	1.5	-	-	Ft. Myers, Lake Hippochee, Gum Swamp to Nobles	9/25/92	panther (#26?)
29	M	1/3/89	6.5 mos.	5/88	#11, #20	Bear Island, Gum Swamp	5/27/92	pseudorabies
30	M	1/6/89	9 mos.	3/88	#19, #13	Bear Is., Prices, FPNWR, FSSP	1/29/90	panther #37
31	F	1/12/89	1-9	-	-	FPNWR	3/3/94	vehicle (SR 29 Sunniland)
32	F	2/3/89	2-2.5	-	(#31?)	FPNWR	-	-
33	M	3/5/89	1.5-2	-	-	Loop Rd. to Gum Swamp	11/25/89	rabies
34	M	1/8/90	10 mos.	3/89	#31, #12?	FPNWR, BCSIR, Gum Swamp	11/15/93	esophageal puncture

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Cat #	Sex	Capture Date	Age	Birth Date	Parents	Use Area	Death Date	Cause of Death
52	F	5/5/92	6 mos.	10/91	#31, #12	FPNWR, Sadie Cypress	1/14/95	vehicle (CR 846 & Dupree Rd)
53	M	2/10/93	10 mos.	4/92	#19, #12	FPNWR	2/26/93	panther (uncollared ♂)
54	M	2/10/93	10 mos.	4/92	#40, 3d	Bakers, FPNWR, ESSP, Deep Lake	-	-
55	F	1/25/94	2 yrs.	12/92	#23, #42	Raccoon PL.	-	-
56	F	2/3/94	2-3	-	-	Nobles, Bakers	-	-
57	F	1/31/95	3	-	-	FPNWR	-	-
58	M	2/8/95	8 mos.	4/94	#56, ?	Addition Lands	-	-
59	M	1/4/96	6 mos.	6/95	#48, ?	Baker's, BI	-	-
60	M	3/6/96	5 mos.	?	#40, ?	Baker's, Add. Lands	-	-
TX101	F	4/5/95	-	-	-	BCSIR	-	-
TX102	F	4/5/95	-	-	-	E. Hendry County	9/22/95	vehicle (CR833 5 mi. N BCSIR)
TX103	F	5/4/95	-	-	-	Stairsteps, BCNP	-	-
TX104	F	3/24/95	-	-	-	Fakahatchee Strand	-	-
TX105	F	7/5/95	-	-	-	Everglades National Park	-	-
TX106	F	4/9/95	-	-	-	Fakahatchee Strand	-	-
TX107	F	5/4/95	-	-	-	Raccoon PL., BCNP	-	-
TX108	F	7/26/95	-	-	-	Everglades National Park	-	-
61	F	3/4/97	8 mos.	7/96	TX108, #16	Everglades National Park	-	-

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Cat #	Sex	Capture Date	Age	Birth Date	Parents	Use Area	Death Date	Cause of Death
62	M	3/18/97	6.5 mos.	9/96	#48.?	S Hendry Co., E Doctor's Hammock	-	-
63	M	4/13/97	2	-	-	BCSIR, Swamp Safari	-	-
64	M	5/24/97	8 mos.	9/96	#48.?	Bear Island	-	-

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Appendix III. Summary of Panther Mortality and Injury Since 1978 (as of 7/10/97)

ID#	DATE	SEX	AGE AT DEATH	LOCATION
Road Kills				
UF 9789	2/13/72	M	2-3	Glades County
G 80-4	12-23-79	F	1.5-2.5	SR 29 just No. of Alligator Alley
G 80-15	07-02-80	M	1.5-2.5	SR 29 near Sunniland
G 81-19	04-19-81	F	2-3	SR 29 near Copeland
G 83-22	03-18-83	M	2-3	US 27 - Palmdale
#01	12-14-83	M	12-14	Alligator Alley mm 18
G 84-26	11-18-84	F	8-10	Alligator Alley mm 16
G 85-BNZ	01-10-85	F	18-24 mos.	Alligator Alley mm 16
#04	04-18-85	M	12+	Alligator Alley mm 17
#07	10-26-85	M	10	SR 29, 4 mi. So. of Alligator Alley
—	11-15-86	F	4-5	Alligator Alley mm 16.5
#13	12-14-87	M	6-8	SR 29 - Sunniland
RK-850	01-25-89	M	3	CR 850 near Immokalee
RK-846	06-18-90	M	10 mos.	CR 846, 1 mi. E. of 833 - Hendry Co.
#37	11-26-90	M	4-5	SR 29, 1/2 mi. No. of I-75 - Collier Co.
Kitten of #11	02-04-91	F	9 mos.	SR 29, 6 mi. No. of I-75 - Collier Co.
Kitten of #19	11-09-92	F	7 mos.	SR 29 - Sunniland
—	08-09-93	M	2-3	Daniels Rd. 1 mi. E. of I-75
#50	12-06-93	M	2.5	CR 846 - 5 mi. E. of Immokalee
Kitten of #52	02-28-94	M	8 mos.	3 mi. No. along County Line Rd
#31	03-03-94	F	12-14	SR 29 - Sunniland
#52	1/14/95	F	3.3	CR 846 4 m E Immokalee. (Dupree Road)
TX102	9/21/95	F	4	CR 833 just N CR 835(846) Hendry Co.
♂ CR 832-96	4/24/96	M	3-5	CR832 5.5 mi. E of SR 29 - Keri

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ID#	DATE	SEX	AGE AT DEATH	LOCATION
Kitten of #55?	5/2/96	F	1	US 41 @ Turner River
Road Injuries				
Big Guy	11-02-84	M	-	US 41, 1/4 mi. E. of Turner River Rd.
—	05-12-85	F	-	CR 951, 2 mi. No. of US 41
#20	06-17-87	M	-	CR 858, .8 mi. E. of SR 29
#28	11-29-88	M	-	Near Daniels Rd. at Ft. Myers Airport
—	04-07-92	M	-	Alico Rd. - 1/3 mi. E. of I-75
Shootings				
G 78-65	03-08-78	M	2-3	L-28, Dade County
Canal Point	05-22-83	F	adult	L-8 canal near White Belt Ranch, Palm Bch Co.
G 83-75	12-01-83	M	3-6	Seminole Indian Reservation, Hendry Co. (James Billie)
G 84-20	10-30-84	F	2-3	Corbett WMA, Palm Bch. Co. (Elmer Brooker)
G 85-CS	03-26-85	F	2-3	CSSP, Collier Co. (skeleton)
#09	??-??-86	F	not fatal	Golden Gate Estates, So. of SR 84, Collier Co.
Intraspecific Aggression				
#02	10-27-84	M	14+	FSSP, panther fight
#10	01-27-87	M	16-20 mos.	Mud Lake Strand - by adult male panther
#25	08-26-88	M	4-5	FPNWR - bacterial infection from panther fight
#30	01-29-90	M	22 mos.	Killed by adult male #37 - FSSP
#41	09-26-90	F	2	Hendry Co. W. of Seminole Reservation - killed by male #28
#18	10-03-90	F	9	Hendry Co. So. of CR 846 near Rock Lake - killed by male #28

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ID#	DATE	SEX	AGE AT DEATH	LOCATION
#43	11-01-91	M	2	Indian Reservation, Hendry Co. - killed by adult male #26
#28	09-25-92	M	5.5	Indian Reservation, Hendry Co. - possibly killed by male #26
#47	02-19-93	M	18 mos.	Killed by male #51 in FSSP
#53	02-26-93	M	11 mos.	Killed by uncollared male No. of FPNWR
#44	07-06-93	M	2.5	Killed by adult male #42 - Raccoon Point
#26	07-08-94	M	11-12	4 mi. E. Hendry Prison - killed by male #46 - punctured skull
#12	11-08-94	M	13-14	Shouts property, Hendry County - died of infected injury from fight with #46
Other or Unknown Causes				
#06	04-16-82	M	6-7	NE BCNP - unknown cause
#03	01-17-83	F	9+	FSSP - capture mortality
#05	11-18-83	F	8-9	Fakahatchee Conserv. Club - unknown cause
#15	6-10-88	F	7-8	ENP - mercury?
#08	08-20-88	F	13-15	Gainesville - liver failure (old age)
#24	08-22-88	M	3-5	Glades Co. near Palmdale - unknown
#20	08-24-88	M	4-5	Bear Island - congenital heart defect
#27	7-23-89	F	3-4	ENP - mercury?
#33	11-25-89	M	3	2 mi. NW of Hendry Prison - rabies
#35	01-24-90	M	10 mos.	Gainesville - bacterial infection
#17	07-23-90	M	9	Addition lands near Tangerine Camp - unknown
#29	05-27-92	M	4	Hendry Co., Gum Swamp - pseudorabies
#34	11-15-93	M	5	SE Hendry Co. next to I28 interceptor - bacterial infection from lacerated esophagus
#38	8-4-94	F	9	Conservation Area 3A - pleuritis from chest puncture
#42	6-22-95	M	6	Turner River Unit - unknown

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ID#	DATE	SEX	AGE AT DEATH	LOCATION
#58	3-30-97	M	3	unknown septicemia with bite wounds

Appendix IV. List of all known dens of radio-instrumented female Florida panthers and Texas cougars. Kitten numbers preceded with K indicate natal den was visited.

Panther #	Den Date	Location	UTM Coordinates	Habitat	# of Kittens	Kittens handled	Sire
09	6/85	Golden Gate Estates	?	?	1	#10♂	unknown
	6/87	upper FSSP ¹	454.4, 2891.3	hardwood hammock	1♀	-	#12
	5/89	FSSP	461.1, 2878.6	mixed swamp	?	-	unknown
	7/90	FSSP	462.3, 2882.2	mixed swamp	2	#202♂ ² , 203♂	#37
	6/93	FSSP	456.0, 2873.8	hardwood hammock	unsuccessful?	-	#51
11	5/86	Bear Island	468.1, 2896.4	pine/palmetto	3	#19♀	#12
	5/88	Bear Island	468.1, 2896.4	pine/palmetto	1?	#29♂	#20
	4/90	Bear Island	469.9, 2898.7	pine/palmetto	1?	♀ (roadkill)	#12
	7/91	Price's	469.8, 2907.1	hardwood hammock	1?	#47♂	#12
	5/93	Bear Island	468.9, 2896.2	hardwood hammock	?	-	#12?
14	4/89	Long Pine Key	537.2, 2799.2	hardwood hammock	2	#42, ?	#16
	3/91	Long Pine Key	536.9, 2808.0	hardwood hammock	unsuccessful		#16
15	5/88	Long Pine Key	525.1, 2807.2	hardwood hammock	unsuccessful		#16
19	3/88	Price's	468.1, 2906.0	hardwood hammock	4	#30♂	#13
	7/89	FPNWR ³	460.6, 2893.7	hardwood hammock	1?	#43♂	#12
	11/90	Rock Spring Island	460.6, 2902.7	pine/palmetto	2	#205♀ ² , #45♂	#12
	3/92	NE Hog Pond	459.8, 2900.7	pine/palmetto	2	1♀ (roadkill), #53♂	#12
	5/94	FPNWR	464.6, 2902.9	pine/palmetto	2	K12♀, K13♀ ³	#51?
	4/96	Bartfields	463.1, 2904.5	palmetto/oaks	2	K27♀, K28♀	#54, #51?
23		Raccoon Point			1	#55	#42

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Panther #	Den Date	Location	UTM Coordinates	Habitat	# of Kittens	Kittens handled	Sire
31	3/89	Catherine Island	454.0, 2907.0	pine/palmetto	3	#34♂, #35♂	#12
	7/90	Regency Farms	459.9, 2903.9	pine/palmetto	2	#201♂ ² , #204♀ ²	#12
	9/91	Barfields	464.7, 2906.0	hardwood hammock	2	#48♀, #52♀	#12
32	3/89	Catherine Island	457.1, 2898.6	pine/palmetto	unsuccessful?	-	unknown
	5/92	FPNWR	457.4, 2897.4	pine/palmetto	1	#208♀ ²	#12
	4/96	FPNWR		pine/palmetto	1	dead ♀	
36	3/90	BCSIR ⁴	492.5, 2906.2	hardwood hammock	?	-	unknown
	5/91	Addition Lands	491.1, 2899.0	pine/palmetto	2	#207♂ ² , #50♂	#26
	10/93	N of BCSIR	489.1, 2909.4	pine/palmetto	1	-	#26 or #34
	6/95	Canoe Lake Strand	502.8, 2901.3	pine/palmetto	?	-	#45?
	2/96	Wilson Cypress	499.8, 2895.4	pine/palmetto	3 (remains of 4th)	K24♀, K25♂, K26♂ ³	#45
40	11/90	Baker's Grade	487.1, 2896.3	pine/palmetto	2	#206♀ ² , #44♂	#26
	3/92	Baker's Grade	485.0, 2897.7	pine/palmetto	2	#54♂(K01), K02♂	#28?
	6/93	Baker's Grade	486.9, 2896.9	pine/palmetto	3	K03♂, K04♀, K05♀	#26
	?	?	?	?	2	#60, ♀ (tracks)	?
	5/97	Addition Lands	488.1, 2899.2	pine/palmetto	1	K37♂ ³	#45
48	10/93	Bear Island	475.9, 2901.6	pine/palmetto	3	K06♂, K07♀, K08♀	#12
	6/95	Dozier Hammock	482.1, 2903.6	pine/palmetto	2	K16♂, K17♀ ³	unknown
	9/96	NE Doctor's Ham.	480.2, 2904.0	vines/ferns	3	K31♂, K32♂, K33♂ ³	?
52	7/93	Sadie Cypress	467.8, 2918.6	mixed swamp	2	1♂ (roadkill)	#46
	7/94	Sadie Cypress	469.6, 2919.0	cypress swamp	?	-	unknown

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Panther #	Den Date	Location	UTM Coordinates	Habitat	# of Kittens	Kittens handled	Sire
55	4/95		483.7, 2871.8	pine/palmetto	2	K14♀, K15♀	#42
56	4/94	Baker's Grade	485.8, 2897.3	pine/palmetto	3	K09♂, K10♀, K11♂	unknown
	10/95	North BCSIR	490.7, 2901.6	pine/palmetto	3	K20♂, K21♂, K22♂ ³	#45
	8/96	North BCSIR	490.7, 2907.4	palmetto	2	K29♀?, K30♀? ³	#45
	6/97	Baker's Grade	485.9, 2897.6	pine/palmetto	4	K40♀, K41♀, K42♀, K43♂ ³	#45
TX101	9/95	BCSIR	500.0, 2906.9	pine/palmetto	2	K18♀, K19♂ ³	unknown
	12/96	BCSIR	499.4, 2907.6	palmetto/oak	2	K35♂, K36♀ ³	#45
TX105	9/96	Long Pine Key	523.2, 2808.0	tropical hardwood	1	K34♀ ³	#16
TX106	11/95	South Blocks	447.1, 2885.2	cypress/mixed	1	K23♀ ³	#51
TX107	5/97	N of Oasis	496.5, 2869.1	pine/palmetto	2	K38♀, K39♀ ³	?
TX108	6/96	Long Pine Key	532.3, 2809.3	tropical hardwood	?	#61 ♀	#16

¹ Pakahatchee Strand State Preserve.

² Kittens removed from wild into captive breeding program.

³ Florida Panther National Wildlife Refuge.

⁴ Big Cypress Seminole Indian Reservation.

⁵ Kittens marked with transponders.