

National Park Service  
U.S. Department of the Interior

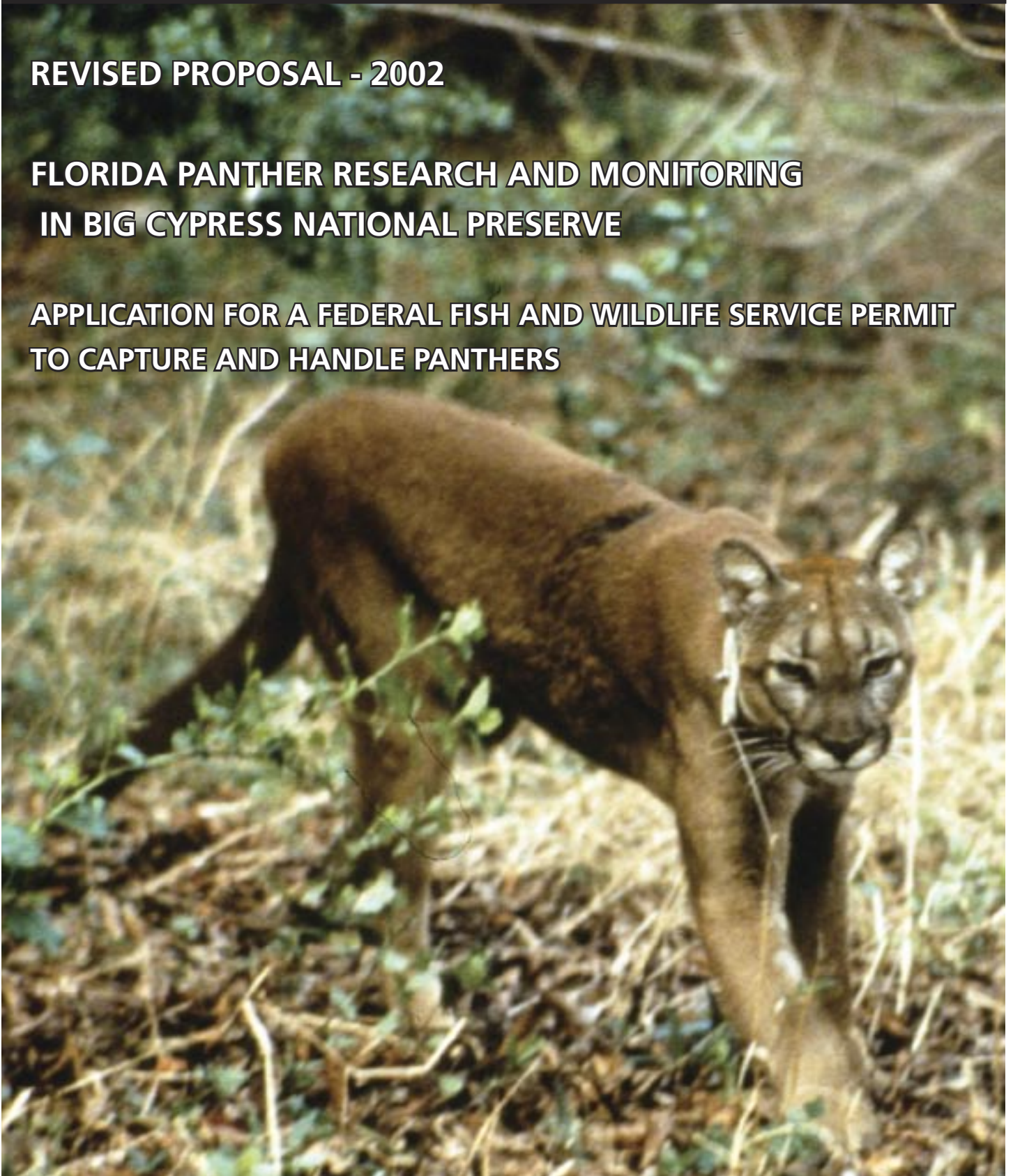


Big Cypress National Preserve  
Ochopee, FL

**REVISED PROPOSAL - 2002**

**FLORIDA PANTHER RESEARCH AND MONITORING  
IN BIG CYPRESS NATIONAL PRESERVE**

**APPLICATION FOR A FEDERAL FISH AND WILDLIFE SERVICE PERMIT  
TO CAPTURE AND HANDLE PANTHERS**



**REVISED PROPOSAL**

**FLORIDA PANTHER RESEARCH AND MONITORING  
IN BIG CYPRESS NATIONAL PRESERVE**

**APPLICATION FOR A FEDERAL FISH AND WILDLIFE SERVICE  
PERMIT TO CAPTURE AND HANDLE PANTHERS**

**Submitted February 19, 2002**

**by**

**John J. Donahue, Superintendent**

**and**

**Deborah K. Jansen, Wildlife Biologist**

**National Park Service**

**Big Cypress National Preserve**

## **BACKGROUND**

A wealth of information about the Florida panther has been acquired since monitoring began in 1981 and most agree that this critically endangered species is faring better today than it was then. Regulatory and management actions, including the restoration of historic genetic variability, have resulted in a more robust population. However, sufficient suitable habitat, a key component to sustaining any wildlife population, is threatened more today than 21 years ago in south Florida. For this reason, the lands held in the public trust will likely become critically important to the long-term survival of the panther. The potential of these lands, therefore, to support panthers must be ascertained and proper management strategies must be determined and implemented.

For the past 21 years, panther research in South Florida has been administered by the State agency, the Florida Fish and Wildlife Conservation Commission (FWC), under a permit from the US Fish and Wildlife Service (USFWS). This research encompassed public lands under the jurisdiction of the National Park Service (NPS), namely, Everglades National Park (Everglades) and Big Cypress National Preserve (Big Cypress). Within these two park units, FWC has maintained responsibility for capturing panthers for collar attachment and biomedical assessment, whereas the NPS has provided funding and personnel to survey and monitor panthers to determine their distribution, habitat use, prey availability, social interactions, reproductive capability, and causes of mortality.

Such information is vital to Big Cypress. As a “preserve” within the National Park System, Big Cypress provides for recreational and consumptive uses in addition to resource protection. Legislative mandates clearly state that recreational and consumptive activities must not compromise the area’s natural and cultural resources. The Park Service is tasked with determining management strategies for resource protection and public enjoyment of the lands under its trust, while at the same time not compromising the recovery of the endangered species within its boundaries. For this reason, it relies on a comprehensive monitoring regimen for the Florida panther.

The data obtained by NPS has contributed to the overall information base on panthers. Since NPS began panther monitoring in Big Cypress in 1989, it has contributed 17% of the location data to date, and has refuted earlier perceptions that the area could not support a viable population of panthers. Currently, Big Cypress supports 33 of the 75 (44%) verified panthers in South Florida (McBride 2001). The data collected by Big Cypress has been incorporated into annual reports, publications, and internal documents prepared by NPS, USFWS, and

FWC. More importantly, it has provided the background for decision-making on issues such as habitat protection, genetic restoration, game harvest levels, prescribed fire, wildfire control, oil and gas exploration, and visitor interpretive sites.

FWC has recently completed its genetic restoration study involving panther work in Big Cypress. Their 2001-2002 Panther Capture Season Plan (FWC 2002; D. Land pers. comm.) includes handling three panthers within Big Cypress, two to replace kitten collars with adult collars and one to replace a malfunctioning collar. Their current study plans will examine the feasibility of using techniques that may provide intensive monitoring of individuals on private lands and the determination of population estimates. Their study plans include:

- a) the deployment of four GPS collars on panthers in human-altered landscapes north of the public lands;
- b) the extraction of DNA from scats for the purpose of assessing population genetic characteristics; and
- c) the utilization of cameras to determine population estimates on the Florida Panther National Wildlife Refuge and Everglades National Park (FWC 2001).

The use of GPS collars for panther work may become the norm in the future. At this time, however, the equipment requires testing and refinement in the South Florida ecosystem before it can provide sufficient information on the status and distribution of panthers as well as how they are impacted by natural events, human activities, and management actions.

Since FWC's study plans do not encompass Big Cypress and do not provide for the capture of additional panthers required to determine the impacts of human activities on their behavior, this request for Big Cypress to conduct its own work is warranted. Although Big Cypress staff has worked only south of Interstate-75 (I-75) for the past 13 years, this proposal encompasses all lands within the boundaries of Big Cypress National Preserve in the event it becomes necessary to expand to the Bear Island and the Addition Lands units north of I-75. This expansion will depend on whether the sample of panthers marked and monitored will provide the information required to address Big Cypress' management needs, to protect panthers under the Endangered Species Act requirements for land managers, and to meet USFWS' Conservation Recommendations for proposed management plans and environmental assessments in those areas.

During the spring of 2000, Big Cypress held a permit under FWC to capture and collar Florida panthers. This permit has expired and, due to two injuries to panthers in 2001, FWC and USFWS determined that a Section 7 permit is required to handle panthers. This proposal,

therefore, is a request for a permit to conduct Florida panther work within the boundaries of Big Cypress National Preserve, including capturing for attachment of radio collars and handling kittens at dens. Big Cypress concurs that a Federal permit is the appropriate vehicle for this work.

## JUSTIFICATION

### Management Needs

National Park Service policy mandates that plans be prepared when a major action may impact natural or cultural resources. A number of significant plans and their accompanying Environmental Assessments (EAs) and USFWS Biological Opinions (BOs) have been prepared since Big Cypress was established in 1974. These documents have addressed potential impacts to wildlife, and particularly to the 10 species in Big Cypress listed as federally threatened or endangered.

Effects on the panther by proposed activities within Big Cypress and recommendations to assure the long-term survival of this endangered species have been addressed in each plan. In every case, the need to monitor its status and responses to proposed activities has been emphasized. Following are some examples:

In the early 1990s, Alligator Alley (SR 84) was incorporated into the interstate system (I-75) in Collier County and three access points for recreational use of Big Cypress were authorized. The level of development and use at each site was established in the ***Big Cypress National Preserve I-75 Recreational Access Plan Environmental Assessment*** (NPS 1990). The USFWS' 1990 BO (Ferrell 1990) and NPS' subsequent plan approval and FONSI both stated that baseline information should be obtained on the levels of public use and panther activities prior to opening the access points to hunting.

In 1991, the ***Big Cypress National Preserve General Management Plan Environmental Impact Statement*** (NPS 1991) was finalized. It addressed the management of a wide range of activities within Big Cypress, including hunting, ORV use, hiking, camping, fire management, and interpretation. The Conservation Recommendations provided by USFWS included monitoring panther responses to proposed backcountry shelters, changes in ORV access points, designated trails and areas, and the number of ORV permits issued.

The preparation of a general management plan for the Addition lands was initiated in 2001. In its response to the I-75 Recreational Access Plan, USFWS recommended that the ***Addition Lands GMP*** include "strict controls on the numbers of permitted hunters and the harvest of

deer". They further stated that "these activities should be phased in over several years, starting with a low level, to allow monitoring of any adverse effects on the panther" (Ferrell 1990). To accomplish this, it is necessary to continue to monitor panthers in these areas through telemetry to determine their response, if any, to changes in the levels of hunting and ORV activities. This is especially important since several authors (Maehr 1990, Janis and Clark 1999) have reported a response by panthers to activities associated with hunting.

In 2000, the ***Recreational Off-road Vehicle Management Plan/Supplemental Environmental Impact Statement*** (NPS 2000) was prepared to address off-road vehicle (ORV) use within Big Cypress. The non-discretionary "Terms and Conditions" in the USFWS BO for the plan mandated that NPS; 1) continue panther monitoring, 2) initiate a study similar to the Janis and Clark study concurrent with the ORV carrying capacity and level of use study, and 3) implement studies to determine the ORV carrying capacity for management units that will minimize negative impacts on panthers (Slack 2000).

In 2001, the ***Scenic Corridor Visitor Safety Highway Improvements EA*** (NPS 2001) was prepared to address the impacts of new and improved interpretive sites on and near Tamiami Trail. Based on past panther monitoring efforts, one site was removed from the plan because it would likely have negatively affected panther use of a significant crossing site (Jansen 2000). However, the plan states that the site may be developed in the future if monitoring indicates decreased use by panthers.

The ***Big Cypress Oil and Gas Management Plan*** (2002) addresses proposals for extensive surface activity in the extraction of the privately owned subsurface mineral resources within Big Cypress. To date, 24 plans of operation, including seismic exploration and drilling activities that encompass 500,000 acres, have been submitted. Past monitoring has indicated that panthers will occupy areas in the vicinity of access roads and production pads, however, known denning attempts have not been successful within two miles of oil-related activities in Raccoon Point. In addition, panther response to the construction of roads and production pads or to oil activity on such a broad scale has never been determined.

The hydrologic restoration proposed in the ***Comprehensive Everglades Restoration Plan*** (CERP) encompasses the eastern region of Big Cypress. Three components of CERP, i.e., the Seminole Tribes of Florida Conceptual Water Conservation System Design (1995), the Big Cypress L-28 Interceptor Modifications, and the Tamiami Trail Culverts Critical Restoration Project may result in water level changes that may affect panthers in Big Cypress. Increased water depth and duration in eastern Big Cypress as well as Shark River Slough and Conservation Area 3A that border Big Cypress may decrease the panther's prey base. These

water level changes may also lessen the likelihood of panthers traversing Shark River Slough, thereby exacerbating the inbreeding problems in Everglades.

In 1999, the ***Tamiami Trail Culverts Critical Restoration Project*** (USCOE 1999) was initiated to remedy the hydrologic problems that resulted from the building of Tamiami Trail. Project plans include the repaving and addition of safety features such as striping and reflectors. These improvements will likely result in an increase in nighttime road traffic and speeds, which may result in increased panther mortality or home range shifts due to avoidance of roadway disturbance.

Three panther injuries or deaths have been documented on Tamiami Trail in Big Cypress since research began in 1981. With the expansion of the panther population in Big Cypress, the frequency of documented crossings has also increased. In 1997, the legal speed limit was increased and traffic volumes increased 30% over a 2-year period (1997-1999) (National Park Service 2001).

The USFWS Biological Opinion (Boggs 1999, Ferrell 1999) noted that potential long-term consequences could arise from the increased use of Tamiami Trail when road improvements contained in the culverting project are completed. They further stated that this increased use “would likely” increase collisions with wildlife, including the Florida panther. USFWS also recommended that the US Army Corps of Engineers integrate animal crossings for Florida panthers with the construction of culverts to increase panther dispersal potential. Discussions on the need for such wildlife underpasses have been reiterated at recent meetings with project planners. The locations for such underpasses can only be determined with continued monitoring of dispersing subadult panthers and those with home ranges encompassing Tamiami Trail. If panther mortality on Tamiami Trail reaches the level that was the impetus for the construction of underpasses on I-75 and State Road 29, information on panther crossing preferences will facilitate site selection.

Since agencies are often criticized for decision-making without “sound science”, Big Cypress has endeavored to obtain and provide information on listed species to facilitate comprehensive EAs and BOs. Plans and assessments involving Big Cypress have been and will continue to be prepared using the best available science. However, if sufficient information is not available with which to make management decisions, it will be necessary to utilize what has been termed the “precautionary principle”, that is, to err on the side of the resources. Big Cypress further recognizes that, with the continued loss of habitat on private lands, it will likely be the core of panther activity, and, therefore, will have an even greater responsibility in making management decisions that will not negatively impact this endangered species.

## **Habitat Assessment Needs**

The status of the Florida panther in Big Cypress has changed over the past 21 years of research and monitoring. Survey work between 1981 and 1995 indicated that few panthers inhabited Big Cypress south of I-75, and only one kitten was raised there. However, since the introduction of the subspecies *stanleyana* in 1995, it has become apparent that inbreeding problems, rather than unsuitable habitat, were largely responsible for the small number of panthers. Figure 1 is a compilation of all panther data points in Big Cypress over the 21-year period. It shows areas used by panthers, but not necessarily areas suitable for reproduction. Figure 2 covers a recent 6-month period, showing that currently only about 50% of Big Cypress south of I-75 has documented panther activity. The suitability of the remaining habitats to support breeding females is unknown. A reliable estimate, therefore, of the carrying capacity for panthers in Big Cypress is unknown.

Female productivity, as indicated by successful denning and kitten rearing, are good indicators of habitat suitability and prey abundance. Of five known female panthers that reached breeding age this past year, only two of them have bred and are raising kittens. The other three have reached breeding age, yet have not shown denning behavior. Their lack of reproduction may be due to habitat unsuitability, habitat saturation, a limiting prey base, or physical or genetic problems.

Thirty-six denning attempts have been documented in Big Cypress (Figure 3). Successful dens are defined as those in which the female has reared the kittens to eight weeks of age, the approximate time they leave the den site. No denning has been documented in the 12,000 ha Deep Lake Unit or the 60,000 ha Stairsteps Unit. No successful denning has been documented within 2 miles of Raccoon Point where active subsurface oil extraction is occurring. Only one den has been documented in the 23,500 ha Loop Unit. At this point, it is unknown if denning has not been documented in some areas of Big Cypress because of capture effort, unsuitable habitat, or human disturbance. Continued and expanded monitoring will provide insight into what parameters are affecting productivity.

## **Population Expansion Assessment Needs**

Everglades consists of 223,000 ha, or one-third of the panther habitat on public lands in South Florida. A small group of panthers first collared in Everglades in the mid-1980s dwindled to a solitary male until two female *stanleyana* were introduced in 1995.

Although the population had been described as ephemeral (Bass and Maehr 1991), it has shown the ability to interconnect with panthers in Big Cypress. Over the past 21 years of monitoring, three panthers have been known to traverse Shark River Slough, one of which did so on a repeated basis (Figure 1).



The importance of the public lands to the Florida panther cannot be overstated. For this reason, it is necessary to determine whether an expanding population in Big Cypress would offset the recurring inbreeding problems in Everglades by establishing home ranges in and near Shark River Slough, thus providing a more consistent link to the core panther population. An opportunity exists this year to radio-collar the two-plus offspring of female #88 that inhabit the portion of Big Cypress that borders Everglades. Without collars, their dispersal movements and survival will not be ascertained. Without information on the numbers and behaviors of panthers in the Big Cypress-Everglades interface, management actions to offset inbreeding in Everglades will continue to be delayed, and the effects of CERP on panther use in this vital linkage between the two parks will not be known.

### **Genetic Sampling Needs**

The Genetic Restoration Project has been a landmark effort to avert the downhill spiraling of a small population into extinction. Preliminary indications from physical and biomedical parameters suggest that, for the time being, the negative effects of inbreeding are being reversed. Genetic sampling of third and fourth generation offspring and comprehensive genetic analysis must be completed to determine the true impacts of the managed intermingling of two subspecies. The panther population should continue to be monitored via telemetry until other techniques can provide definitive answers on the genetic progression of this restoration project, the results of which will significantly influence similar efforts in other small population situations.

Known relatedness of individuals in the Big Cypress panther population thus far indicates that representation of *stanleyana* is exceeding restoration goals. One of the concerns stated in the **Genetic Restoration Plan** (USFWS 1994), is genetic swamping. This may be occurring, based on known and suspected relatedness of panthers in Big Cypress south of I-75. Figure 4 shows the status of known panthers, their family linkages, and the extent of *stanleyana* genetic influence. The dominant male in southern Big Cypress is a first generation offspring of one of the introduced *stanleyana* females. Although 4 *coryi* males, #s 33, 44, 76, and 89, have entered the area, they all died prior to siring any offspring. All of the known sires, therefore, have either been descendants of *stanleyana* (#79) or of captive cougars of unknown origin (Piper stock) (#16, 42).

Of the known lineage panthers currently with functioning collars in southern Big Cypress, none are pure Florida panthers (*coryi*). The only 5 panthers (#s 55, 102, K15, K49, K50) without *stanleyana* genes are descendants of cougars of unknown origin (Piper stock) released into Everglades. The following shows the breakdown of known and suspected *stanleyana* genes:

## Extent of *stanleyana* Influence in Southern Big Cypress

Status	Lineage	0%	25%	38%	50%	75%	100%	Total
Collared	Known	1	0	1	4	1	0	7
Collared	Suspected	1	2	0	0	0	0	3
Uncollared	Known	1	1	0	7	1	0	10
Uncollared	Suspected	2	4	2	2	0	0	10
	Totals	5	7	3	13	2	0	

The **Genetic Restoration Plan** (USFWS 1994) identified a goal over time as a total panther population consisting of 80% *coryi* and 20% *stanleyana*. One-third of the estimated 30 panthers in southern Big Cypress have been collared. Of those, 80% are known or suspected to carry *stanleyana* genes. Of the 20 panthers not collared, 85% are known or suspected to carry *stanleyana* genes (Figure 5). Although this is a rough estimate of the actual *stanleyana* influence in southern Big Cypress, it does indicate that this group of panthers has the strong potential to be genetically swamped and that the progression of *stanleyana* influence should be monitored until formal genetic analysis provides population management direction.

### STATEMENT OF PURPOSE

To have adequate information on the behavioral and/or demographic responses of panthers to existing or proposed management actions within Big Cypress National Preserve that will ensure that management decisions will not be detrimental, and preferably will enhance, the recovery of the Florida panther in South Florida.

### GOALS

**Goal 1.** Provide the necessary information to make sound management decisions, evaluate the effects of restoration projects and management strategies, and meet the recommendations and stipulations of the Environmental Impact Assessments and Biological Opinions related to the management of Big Cypress.

**Goal 2.** Assess the potential of the habitat in Big Cypress to support panthers.

**Goal 3.** Assess the potential for the expanding population of panthers in Big Cypress to link with the relatively disconnected population of panthers in Everglades National Park.

**Goal 4.** Continue to provide the samples necessary to assess of the impacts of the Genetic Restoration Project on the panthers in Big Cypress south of Interstate-75 to determine whether it will remain predominately *stanleyana* intercrosses.

## **METHODS**

Most of the information needs of Big Cypress are related to the response, either behavioral or demographic, of panthers to specific or proposed management actions (see examples and methods provided for goal #1). Thus, the general framework for our sampling design would be the same to accomplish each goal. We will first describe the general sampling design and methodological framework that would be applied to our radio telemetry efforts, then will present more specific applications for each of our goals.

### **General Scheme for Obtaining Individuals for Monitoring using Radio Telemetry**

To address the management questions most important to Big Cypress, it is essential that we maintain a sample of radio-tagged panthers that is representative of Big Cypress. Our sampling scheme, therefore, is intended to ensure representation of animals throughout Big Cypress. Our target is to maintain a sample of 20 animals to provide a reasonable number for statistical analyses. However, we fully recognize that because the panther is rare and elusive, maintaining our target sample size may be difficult. However, our general design is such that the data collected could be used in a cumulative capacity over time should we fail to meet our target in any given year.

To accomplish our geographic representation, we would use a stratified random sampling design. Big Cypress would be divided into 10 units that are each approximately equal in size (approx. 24,000 ha.) and based on recognizable geographic features. We would then randomly select from the pool of these units from which to initiate obtaining a sample (i.e., capture). The houndsman and other team members would survey the selected unit to determine if panthers are present (see capture techniques below). Should there be evidence of panther activity, capture efforts would be initiated. We would survey and hunt the area until we are reasonably sure we have captured the panthers inhabiting that unit. In units, however, where we have handled a family group member, we would cease hunting in order to ensure reunion and a return to normal activities by the family.

The stratified random sampling approach would provide data in two contexts. First, the survey efforts would provide good geographic representation for the presence or absence of panthers throughout Big Cypress. Such information would be complementary to our goals and would provide valuable information on the distribution and habitat use of panthers within Big Cypress. Second, it would provide a basis for ensuring geographic representation of our sample of radio-tagged animals for the questions being addressed.

Currently there is a paucity of information from animals in three areas that have important implications to managing Big Cypress. The Deep Lake Unit (12,000 ha) has been closed to ORVs and been designated an archery hunting area only. To date, only juvenile male panthers have been documented using the area to any extent. Similarly, only one female has successfully denned in the Loop and Stairsteps Units (totaling 83,000 ha). It is not known whether habitat limitations, current recreational use levels, or other factors are affecting panther use of these areas.

A third area of concern is the region of Big Cypress that will be affected by the Comprehensive Everglades Restoration Plan (CERP). Alterations to Levee-28 along the eastern boundary of Big Cypress are expected to affect the hydro-period in the Corn Dance, Stairsteps, and Loop Units (approx. 78,000 ha). It is not known whether CERP implementation will have negative or positive effects on panther and their prey's use of the area.

Because of these deficiencies, we would stratify our sample to ensure the likelihood of obtaining samples from these areas. To accomplish this, we would randomly select units from within these regions to initiate capture efforts. Capture efforts would continue until at least six panthers (two in Deep Lake, two in eastern Corn Dance, and two in Loop and Stairsteps combined) are captured or until all areas have been surveyed and it is determined to be infeasible to capture additional panthers in those regions. We would then resume capture efforts using a random sampling of units over the entire Big Cypress.

For the age distribution of our sample, we would give priority to adults within any family group without radio transmitters because these animals would likely have established home ranges and thus could better meet the management information needs. Further, we would try to avoid juvenile males, except south of U.S. 41, because there is adequate information on their dispersal and survival. The exception south of U.S. 41 is to ensure the possibility of monitoring males that have a higher likelihood of establishing a home range south of Hwy. 41 and a possible link to Everglades through Shark River Slough.

### **Methodology per Goal**

**Goal 1.** Provide the necessary information to make sound management decisions, evaluate the effects of restoration projects and management strategies, and meet the recommendations and stipulations of the Environmental Impact Assessments and Biological Opinions related to the management of Big Cypress.

### **Methods to Determine the Response of Panthers to Aspects of the Comprehensive Everglades Restoration Plan (CERP) Related to Big Cypress**

The most likely impacts of CERP on panthers in Big Cypress would be through direct or indirect effects of changing water levels. Thus, the emphasis of our approach would be to determine the suitability of habitat within Big Cypress relative to changes in water levels. This would be accomplished primarily through an analysis of use versus availability with respect to water levels.

Water level data would be obtained from the South Florida Water Management Model (SFWMM). This model produces hydrologic output for a 2-mile by 2-mile grid that includes Big Cypress. This grid would provide the basis for our analysis, which would be comprised of testing the goodness of fit between available water depths and those used by radio-tagged panthers. The use of the habitat by panthers would be derived from three times per week locations of radio-tagged animals. Each location would be assigned to a grid cell corresponding to the grid of the model. The availability of water depths would be derived from the SFWMM for the time period of the analysis. Within the model, each cell within the grid is assigned an average water depth for comparison with the relative use by panthers. Although panther locations reflect daytime resting sites, which may be on higher ground than the surrounding area, this should be accommodated by this approach because the SFWMM produces an average depth for the cell, thus taking into account the variation in topography.

Because not all locations within Big Cypress could be considered as available to a given panther, we would compare use versus availability for each radio-tagged panther over a specific time interval using the home range as the extent of cells that are potentially available to that individual. This approach would enable comparisons at two levels. First, use versus availability of cells within a given individual's home range would enable comparisons for each individual. A second level of analysis would compare the use versus availability between cells within the home ranges of all radio-tagged panthers collectively and those outside the known home ranges of all panthers based both on radio telemetry and survey data.

***Feasibility of Alternative Approaches to Radio Telemetry.***— Certainly the indirect effects of CERP on the habitat and/or prey populations could be assessed using alternative approaches to radio telemetry, and such alternatives are currently being considered outside the context of this proposal. However, in the absence of information on the response of panthers to such changes, these approaches would be inadequate to address the information needs of Big Cypress.

Other techniques, such as scat analysis and trail cameras, may provide information about individual panthers and broad population estimates. They, however, are insufficiently developed to meet the management needs of Big Cypress at this time, and would likely be

biased because of the necessity to place cameras and/or collect scats on well-used trails, at limited times of the year, etc. Thus, we would consider such alternatives potentially complementary, but insufficient to meet the needs of Big Cypress at this time.

**Methods to Determine the Response of Panthers to Management Activities Addressed in Documents such as the Big Cypress General Management Plan (GMP), Addlands GMP, ORV Plan, and Oil and Gas Plan.**

The management plans of Big Cypress address a wide range of activities (e.g. hiking, hunting, camping, ORV use, mineral extraction) within Big Cypress that could potentially affect the panther. For each of these activities the information needs of Big Cypress relate to how animals respond to such management activities. The number of specific questions we would ask from our monitoring would be lengthy and variable, depending on the management issues that arise in Big Cypress. Following, however, are a few examples of specific questions we might ask within the general framework as described:

- 1) Do panthers avoid centers of activity such as recreational access points or designated campsites?
- 2) Do they avoid particular types of trails?
- 3) If so, does this avoidance change in relation to the level of activity?
- 4) Does panther use and/or reproductive rate in a given area change if the level of hunting or ORV use in an area changes?
- 5) Are there home range shifts due to oil extraction activities? If so, is this shift only temporary?

Because there are a multitude of management activities that could be assessed using a wide variety of response variables over different spatial and temporal scales, we have outlined here a general design framework that would work in conjunction with our proposed sampling scheme. We fully recognize that each type of response or management activity may have subtle differences in specific analyses. In each case, the response of interest occurs over space (e.g., in relation to proximity to designated campsites, trails, access points, etc.), time (e.g., in relation to the occurrence of a management action or intensity of activity), or both (e.g., shifts in spatial distribution over time in relation to management activity). We address each of these conditions below.

***Response over Space.***— For responses related to space (e.g., the location of trails, campsites, etc.) we would evaluate the spatial distribution of panthers relative to some management feature, i.e. designated trails, campsites, of the landscape. This could be at a variety of scales depending on the specific management strategy. If units have differing hunting management schemes, we may conduct comparisons of the distribution of locations in similar habitats, but with differing hunting regulations. For example, we could compare the relative

use between the Deep Lake Unit where hunting has been limited to archery only, with units of similar habitat, but differing hunting regulations. At a finer scale, we could make comparisons of locations within an individual panther's home range, examining how it uses the habitat relative to distance classes of some landscape feature (e.g., trails, campsites, production pads). In each case the response variable would likely be the use of space (as determined through radio locations), and the analysis would likely be some form of goodness-of-fit testing to determine if there is avoidance or selection of particular classes of space relative to a management feature.

***Response over Time.***— Responses over time would be slightly different in that the response variable would no longer be the use of a particular point in space, but rather would be a change in behavior or demographic parameter (e.g., reproduction) over time. This too could occur at a variety of scales depending on the specific management strategy. For example, the use of an area by an animal could be compared in response to (e.g., immediately before and after) the occurrence of changes in activity (e.g., the opening or closing of hunting season or the opening or closing of designated trails). An example of such an analysis at longer time scales might be a comparison of reproductive rates over multiple-year intervals within units that have undergone a change in management (e.g., Deep Lake Unit).

***Response over Space and Time.***— Responses over space and time would be focused on shifts in spatial distribution over time, and also could be assessed for a variety of management activities at a variety of spatial and temporal scales. For example, we could compare the distribution of panther use relative to proximity to trails before, during, and after hunting seasons. Similarly we may evaluate shifts in the home range. There are a variety of statistical techniques that are available for such analyses. For example, multiple response permutation procedure (Mielke and Berry 1982, Zimmerman et al 1985) enables the comparison of two or more samples of XY coordinates (e.g., panther locations).

***Feasibility of Alternative Approaches to Radio Telemetry.***— Although information regarding management activities could be derived using alternatives to radio telemetry, the response of the panthers to such activities requires specific knowledge of their location and/or activity at particular points in time. Alternative methods currently available will not be adequate to make such determinations. Thus, we see no alternative to radio telemetry to obtain the information needed for sound management decisions.

## **Methods to Evaluate the Frequency and/or Characteristics of Sites Used by Panthers for Crossing Roads**

The specific objectives would be to:

- 1) determine stretches of highways that have high frequency of panthers crossings,
- 2) determine whether there are specific attributes of those stretches that could provide a basis for predicting other such sites where there is a potential to initiate management that could minimize the risk of road-related mortality.

Sites used for road crossing would be determined using concurrent pairs of radio locations on opposite sides of a given roadway. Because it is not entirely clear how panthers might approach a given crossing, we would initially use two approaches to make this determination. First, the intersection (with the road) of the straight line between the consecutive points on each side of a road could be used as an estimate. However, anecdotal evidence from past radio telemetry suggests that animals may in some cases traverse parallel to the roadway until they reach the site of preferred crossing. Thus, an alternative to straight-line distance between consecutive points would be to use the intersection of a bearing perpendicular to the roadway from the first point after crossing the roadway.

To determine the characteristics of sites used for crossing, each stretch of roadway could be assigned a value based on attributes hypothesized to affect the suitability for crossing. Such attributes might include the presence of canal crossovers, the width or depth of adjacent canals, or the type of vegetative cover on each side of the roadway. The frequency of crossings could then be compared for stretches of highway having different characteristics. Since not all stretches of roadway may be available, this could be refined to include only stretches of roadway within the latitude (or longitude) of the home range boundaries.

***Feasibility of Alternative Approaches to Radio Telemetry.***— Given that this evaluation would require precise pairs of locations before and after crossing a roadway, we see no alternative to radio telemetry for obtaining such locations.

## **Goal 2. Assess the potential of the habitat in Big Cypress to support panthers.**

### **Methods**

This goal would augment more specific information needs for the management of Big Cypress, and would be obtainable within the scope of previously stated Goal 1. The Florida Panther Subteam of MERIT has established an estimate of the population potential for Florida based on home range sizes, panther habitat characteristics and preferences, forest patch size, and panther locations in relation to forest patches and urban areas. However, there has been insufficient data from some areas (e.g., south of U.S. 41) to reliably estimate home ranges or to estimate the breeding potential for all areas within Big Cypress. Thus, the specific objectives would be to (1) better estimate home range size for panthers within all management units of Big Cypress, and (2) to estimate reproduction of the resident females within Big



Cypress. The only additional field methods would be to obtain ground confirmation of radio-tagged females suspected of having kittens. The methods would only require further analysis of the data already being collected to meet the specific management needs of Big Cypress, as described in Goal 1.

***Feasibility of Alternative Approaches to Radio Telemetry.***— Some aspects of habitat suitability (e.g., prey abundance) could be addressed with alternative methods to radio telemetry. However alternative methods currently available will not be adequate to estimate the home range of resident panthers; nor would they be adequate to enable estimation of reproduction. The use of trail cameras may be useful for estimating reproduction in the future, but there is no evidence at this time that they could provide reliable estimates within such a widespread and diverse landscape such as in Big Cypress. Thus we view this approach as being potentially complementary in the future, but inadequate to meet our information needs at the present time.

**Goal 3. Assess the potential for the expanding population of panthers in Big Cypress to link with the relatively disconnected population of panthers in Everglades National Park.**

**Methods**

This is a goal that is descriptive in nature, and augments the information being obtained for management of Big Cypress. The specific objective is only to determine if panthers south of U.S. 41 disperse (juveniles) or move (resident adults) across the Shark River Slough into Everglades National Park given the inbreeding problems that have occurred in that population. Thus, this objective does not require additional methodology or analysis other than which has been described above to meet the information needs for management of Big Cypress.

**Goal 4. Continue to provide the samples necessary to assess of the impacts of the Genetic Restoration Project on the panthers in Big Cypress south of Interstate-75 to determine whether it will remain predominately *stanleyana* intercrosses.**

**Methods**

It is not our intention to take the lead on any evaluation of genetic restoration, even within Big Cypress. Rather, it is our intention to contribute to the broader collective effort currently being orchestrated by the National Cancer Institute and through the study documents of FWC. We believe, however, that efforts to evaluate genetic restoration would be incomplete without continued assessment of the influence of *stanleyana* in Big Cypress. Thus, it is our intention

to provide data from Big Cypress, as we have in the past, which could be used in the broader collective effort.

The methods required to contribute to this effort would be limited to the collection of blood, skin biopsies and other requested samples obtained during our capture efforts. Blood would be collected only under the supervision of a qualified veterinarian, and would be handled and deposited in accordance with existing protocols.

## **TIMEFRAME**

Because the response of panthers to management actions can greatly affect current and future management decisions, we are extremely concerned about not making Type II statistical errors (failing to detect a response to a management action when a response really exists). Our goal, therefore, is to collect a sufficient sample for reasonable statistical power (e. g.  $> 0.80$ ).

The timeframe required to obtain this power will depend upon the implementation of a particular management action (e.g. designating trails or campsites, the initiation of hunting in the Addlands). It will also depend on the frequency in which radio-collared panthers encounter particular management situations, which, in turn will be influenced by the number of panthers with radio collars. Based on past experience with panther behavior and given our targeted sample size, we expect two to three years for any given management effect. We acknowledge that we won't have to assess every trail or campsite, for example, to obtain a reasonable expectation of the effect. However, if we delineate zones from a designated trail, for example, we must have a sufficient sample size to obtain an adequate value for any given cell. We also plan to do a partial analysis on an annual basis to determine whether we need to continue sampling.

## **CAPTURE PROTOCOL**

Florida panthers have been safely captured during every month of the year. The optimum time, however, is during the cooler months, beginning with the onset of the first cool front, usually in October. Captures during warmer weather have been safely accomplished by beginning pre-dawn and terminating before rising temperatures may cause overheating of the panther.

Big Cypress has an established deer and hog hunting season that begins in September and ends on January 1. To avoid potential disruption of an individual's hunting experience, panther capture work has been postponed in the past until after the first of the year. Situations may

occur, however, in which a failing collar or some other emergency warrants panther hunting during the deer and hog hunting season.

Water levels also influence the initiation of the panther capture season and often are another reason that capture work doesn't begin in Big Cypress until after the first of the year. The panther monitoring flights three times per week will provide an accurate assessment of the water level situation in the randomly selected survey and capture unit. Unless an emergency situation, panther captures will not occur where water levels may compromise the safety of the animal.

For the past 22 years, panthers have been effectively and selectively captured by trained hounds. The capture team will not exceed four members, the houndsman, team coordinator, tree climber, and veterinarian. The houndsman works alone from predawn to when the scent trails left by panthers during the night are erased by sun and wind. On cool, overcast days panthers can be hunted all day, but, in most cases, the hunt ends when the rising temperatures reach a threshold that poses a threat to a safe capture. The houndsman is in the best position to make this call.

When a panther is treed, the houndsman arrives at the tree first and assesses the situation. He advises the veterinarian of the sex, age (adult or kitten), and approximate weight of the treed panther. The veterinarian, the tree climber, and the team coordinator bring the capture equipment within 100-200 meters of the treed panther. The veterinarian prepares the tranquilizer dart and quietly brings the loaded dart and dart gun to the houndsman. Other team members remain out of sight of the panther until after the houndsman fires the dart to prevent frightening the panther from the tree. If the panther is in a low tree, only the capture net is deployed. If the panther is in a tall tree, the crash bag (McCown et al 1990) is inflated prior to the darting. The tree climber puts on his climbing gear prior to darting the panther.

If the panther falls out of the tree, he is caught in the net or net-crash bag combination. If the panther hangs in the tree, the tree climber must quickly reach the panther, tie a rope around his forequarters, and lower him to the net. The tree climber plays a crucial role at this time because of the possibility of the panther asphyxiating.

Once the panther is safely on the ground, any other additional people aside from the four-member capture team may approach the tree. The workup will be swift and efficient, in order to minimize the length of time the panther is sedated. Additional drug dosing will be kept to a minimum and only the amount necessary to collect essential samples. This is especially important for kittens that must recover quickly from the drug in order to rejoin their family

group. The medical workup encompasses overall assessment of the health of the animal, administration of vaccines, and collection of biomedical samples. All team members will work together in collecting samples, fitting the radio collar securely, taking basic measurements, and data recording. All gear will be stowed and moved from the site as soon as possible and only the veterinarian will remain to watch the recovering panther and decide when it is safe to leave. Drugged panthers will not be left near wet areas to awaken and recover.

## **COORDINATION WITH OTHER CAPTURE TEAMS**

We will provide our capture season plans to other capture teams by October 1 of each year. Since our sampling design involves pre-selection of units in which to hunt, we can inform other panther capture teams several days in advance of our working area. This will preclude any potential conflicts.

On occasion, panthers radio-collared in one study area have entered an area where monitoring is conducted by another agency (e.g., panthers moving between Everglades and Big Cypress; panthers crossing I-75). In these cases, the two project leaders have agreed to handle the monitoring while the panther is within their study area. If, in the future, this arrangement is not acceptable for the panthers radio-collared under this permit, Big Cypress will retain responsibility for monitoring any panthers that would leave its boundaries. If concerns arise regarding overlapping flights in a given area, Big Cypress will alter its flight schedule to avoid any conflicts.

## **DELIVERABLES**

Biomedical samples will be provided to support ongoing studies and these will be determined by consultation with FWC prior to the onset of capture activities this year and at the annual capture season meeting thereafter. An annual report will be provided to the USFWS by September 30, including a preliminary analysis of data collected in relation to management actions implemented.

## LITERATURE CITED

Bass, O. L. and D.S. Maehr. 1991. In Maehr et al. Social ecology of Florida panthers. National Geographic Research and Exploration 7 (4):414-431.

Boggs, J. F. 1999. Fish and wildlife coordination act report for the Tamiami Trail culverts project, Collier County, Florida. 15 pp.

Ferrell, D. L. 1990. USFWS biological opinion on the I-75 recreational access plan, dated August 15, 1990. 10 pp.

Ferrell, D. L. 1991. USFWS biological opinion on the Big Cypress general management plan, dated February 11, 1991. 9 pp.

Ferrell, D.L. 1999. Letter to J. C. Duck, US Corps of Engineers, dated March 19, 1999. 2 pp.

Florida Fish and Wildlife Conservation Commission. 2001. Project proposal titled, "Feasibility of using GPS radiocollars on Florida panthers. 8 pp.

Florida Fish and Wildlife Conservation Commission. 2001. Project proposal titled, "Feasibility of extracting Florida panther DNA from scats. 6 pp.

Florida Fish and Wildlife Conservation Commission. 2001. Project proposal titled, "Feasibility of using remote cameras to survey Florida panthers. 12 pp.

Florida Fish and Wildlife Conservation Commission. 2002. Panther capture priorities and season update. February 6, 2002 fax. 3 pp.

Janis, M.W. and J.D. Clark. 1999. The effects of recreational deer and hog hunting on the behavior of Florida panthers. Final Report to Big Cypress National Preserve. 107 pp.

Jansen, D. K. 2000. Potential impacts of proposed Turner River boardwalk on panthers. Memorandum to Superintendent John J. Donahue, dated June 20, 2000. Big Cypress National Preserve. 2 pp.

Maehr, D.S. 1990. Florida panther movements, social organization, and habitat utilization. Final Report, Bureau of Wildlife Research, Florida Game and Fresh Water Fish Commission. 115 pp.

McBride, Roy. 2001. Current Panther Distribution and Habitat Use; Highlights of Field Work: Fall 2000-Winter 2001. Report to the Florida Panther Subteam of MERIT. U.S. Fish and Wildlife Service.

McCown, J. W., D. S. Maehr, and J. Roboski. 1990. A portable cushion as a wildlife capture aid. Wildl. Soc. Bull. 18:34-36.

Mielke, P. W., Jr. and K. J. Berry. 1982. An extended class of permutation techniques for

matched pairs. *Commun. Stat.* 11:1197-1207.

National Park Service. 1990. I-75 recreational access plan environmental assessment. Big Cypress National Preserve, Ochopee, Florida. 108 pp.

National Park Service. 1991. General management plan final environmental impact statement. Vol.1. Big Cypress National Preserve. Ochopee, Florida. 423 pp.

National Park Service. 2000. Final off-road vehicle management plan supplemental environmental impact statement. Big Cypress National Preserve, Ochopee, Florida. 603 pp.

National Park Service. 2001. Scenic corridor visitor safety highway improvements environmental assessment. Big Cypress National Preserve. Ochopee, Florida. 66 pp.

Slack, J. J. 2000. USFWS biological opinion on the ORV management plan for Big Cypress National Preserve, dated July 14, 2000. 40 pp.

U. S. Army Corps of Engineers. 1999. Tamiami trail culverts final report. 64 pp.

U.S. Fish and Wildlife Service. 1994. Final environmental assessment-genetic restoration of the Florida panther. Atlanta, Georgia. 53 pp.

Zimmerman, G. M., H. Goetz, and P. W. Mielke, Jr. 1985. Use of an improved statistical method for group comparison to study effects of prairie fire. *Ecology* 66:606-611.













