

Reg-copy

FLORIDA PANTHER GENETIC RESTORATION

STATUS REPORT

January 2000

Florida panther genetic restoration began with the release of 8 female Texas cougars into areas occupied by Florida panthers during the spring and summer of 1995. Most of these released cougars established home ranges that encompassed their release sites. TX101 was the only exception; her home range was established on the Big Cypress Seminole Indian Reservation after traveling throughout Collier and Hendry counties following her release in the Bear Island Unit of Big Cypress National Preserve. Three of the Texas females were bred before the end of 1995, although only 2 gave birth to kittens. TX102 was struck by a car and killed in September 1995 and was found to be pregnant with 3 kittens.

Today, there are 5 Texas cougar females alive. TX104 was shot and killed illegally, TX103 died of metabolic complications from her pregnancy, and TX102 died in a collision with a car. None of these three female cougars gave birth to litters. Of the remaining 5 Texas females, all have produced F₁ kittens and their reproductive history is summarized in the following table.

F₁ Kittens Produced by Female Texas Cougars

Cat #	Den date	Litter size	Sex ratio	Prevalence of kinked tail
TX101	10/95	2	1 ♀: 1 ♂	2 no
TX101	12/96	2	1 ♀: 1 ♂	2 no
TX105	9/96	1	1 ♀: 0 ♂	1 no
TX105	8/99	?	?	?
TX106	11/95	1	1 ♀: 0 ♂	1 no
TX106	2/98	1	0 ♀: 1 ♂	1 no
TX106	6/99	2	2 ♀: 0 ♂	2 no
TX107	5/97	2	2 ♀: 0 ♂	2 no
TX108	6/96	1	1 ♀: 0 ♂	1 no
TX108	2/98	2	1 ♀: 1 ♂	2 no
Mean/Total		1.6/14	10 ♀: 4 ♂	0 yes: 14 no

TX105 denned in August 1999 but repeated attempts to locate the kittens were unsuccessful due to the inaccessible nature of her chosen den site. Two of these cougars have produced at least two surviving offspring that have been recruited into the population. As a result, we have implanted TX101 with a contraceptive and have plans to implant TX107 with a similar device during the 2000 capture season. The last three cougars have yet to produce the target number of surviving and recruited young. With the death of male panther #16 (Jan. 2000), the only known male in Everglades National Park, it is unlikely that TX105 (currently raising a litter) and TX108, who did not appear to be pregnant when re-captured December 1999, will be producing new litters in the immediate future. TX106 is currently raising a litter of 2 kittens.

Some of the F_1 offspring have reached maturity and have produced litters of their own. These litters fall into 3 categories: 1) F_2 progeny, kittens produced by matings of 2 F_1 panthers, 2) 75% panther backcross, kittens produced by a mating between an F_1 and an "original" stock Florida panther and 3) 75% Texas cougar backcross, kittens produced by a mating between an F_1 male and a Texas cougar female. These intercrosses are detailed in the following table.

F_2 and Backcross Kittens Produced by Radiocollared Females

Panther #	Den Date	Litter Size	Sex Ratio	Prevalence of Kinked Tail	Pedigree/Suspected Sire
#66 F_1	9/98	3	1 ♀: 2 ♂	0 yes: 3 no	backcross w/ Fl. Panther #54 or #60
TX107	3/99	3	2 ♀: 1 ♂	0 yes: 3 no	backcross w/ #79 F_1
#61 F_1	3/99	1	0 ♀: 1 ♂	0 yes: 1 no	backcross w/ Fl. Panther #16
#55	4/99	2	1 ♀: 1 ♂	1 no: 1 yes	backcross w/ #79 F_1
#70 F_1	6/99	3	2 ♀: 1 ♂	0 yes: 3 no	F_2 progeny by #79 F_1
#71 F_1	6/99	4	2 ♀: 2 ♂	0 yes: 4 no	F_2 progeny by #79 F_1
#66 F_1	12/99	3	2 ♀: 1 ♂	0 yes: 3 no	backcross w/ Fl. Panther #60
Mean/Total		2.7/19	10 ♀: 9 ♂	1 yes: 18 no	

Combining data from both of the above tables, there have been a minimum of 33 intercross progeny produced (either F_1 , F_2 , or backcross generations). Six of these intercross progeny are assumed to have died (TX106's 1998 litter, 1 of TX108's 1998 litter, #66 F_1 's 1998 litter, and one of #71 F_1 's 1999 litter) based on subsequent tracking and/or a change in their mother's behavior indicative of a panther without dependent kittens.

Genetic Sampling and Monitoring Intercrosses Via Radiotelemetry

We have genetic samples from 18 of the remaining 27 (67%) intercrossed progeny. This percentage will increase in the future because we are now utilizing a new technique developed by Dr. Steve O'Brien's laboratory in the Genetics Section of the National Cancer Institute that allows us to take minute skin samples from neonate kittens for subsequent genetic analysis. We began taking these new, small samples the summer of 1999. Currently, we have genetic samples from 8 of 12 extant F_1 's, 7 of 7 F_2 's and 3 of 9 backcrosses. Panther #71 $_{F1}$ is not represented by a genetic sample; this sample will be obtained at her next scheduled capture. The 10 kittens unrepresented by genetic samples are top priorities for this capture season; six of these cats (3-75% Texas cougar backcrosses and 3-75% Florida panther backcrosses) are still dependent upon their mothers.

Dr. Steve O'Brien is conducting analyses of all genetic samples. Preparations are underway for analyzing all of the above genetic material, plus samples from >100 Florida panthers, 8 female Texas cougars, and 8 Seminole Indian captive cougars. Dr. O'Brien has stated that he will be able to produce a report containing the genetic and pedigree analyses within 6 months once the samples have been prepared. The samples should be ready by the end of February 2000, therefore, we anticipate a report from Dr. O'Brien before autumn 2000.

We have captured and placed radiocollars on 7 of the 12 extant F_1 progeny, however, the transmitter on #61 $_{F1}$ failed in May 1999. Our capture plan incorporates the need to re-establish contact with this cat. All 15 of the extant F_2 and backcross kittens were born in 1999, therefore, they are just now reaching the age at which captures can be conducted safely and are listed as priorities for this season.

Florida Panther Studbook and Analyses

Data on 187 *Puma concolor* have been entered into a Florida panther studbook using SPARKS (Single Population Analysis and Records Keeping System) software. These 187 records are comprised of the following groups: 81 captured Florida panthers, 22 uncollared panthers, 67 neonate panther kittens handled at dens (and were not later handled as older cats), 8 Texas cougar females used for genetic restoration, and 9 cougars maintained as a semi-captive population by the Big Cypress Seminole Indians. Data fields include the *Puma* origin, sire and dam (if known or suspected), presence of kinked tails, cowlicks, atrial septal defects, vaginal papillomas, and the number of descended testicles. Consultations continue with Dr. Bob Lacy, Department of Conservation Biology, Brookfield Zoo, concerning fine-tuning panther data entry into the studbook.

Dr. Lacy has begun analyses using the draft panther studbook and the following are excerpted from that work (November 1999):

"I quickly ran some genetic analyses on the studbook data. There are various things we can do with those data, but as a start I looked at the representation of TX genes in the population. The first thing that jumped out at me was that TX101 has 19 descendants in the population!

Although this sounds high (and it is), it was also interesting to see that 2 of the FPs have even greater representation in the population. TX107 also has passed on her genes to a number of descendants (12), while each of TX105, TX106, and TX108 have not yet contributed more genes than has the typical FP in the wild.

It was also interesting to see that if the SEM cats are considered part of the "wild" population (i.e., if they aren't yet adequately contained), then they may be contributing as many or more foreign genes to the population as are the TX cats. If we assume that the kittens which were observed at the den (or with mom) and not subsequently recorded as having died are all still alive (which is the assumption made now by SPARKS), then the TX cats have now passed on (via offspring and grand-offspring) 13.75 copies of the TX genetic material. Out of a total wild population of perhaps 70 cats, this would be almost exactly the 20% representation which had been suggested for the genetic restoration. Of course, many of the F1, F2, and Backcross kittens are still young, and some will likely die (or have already died) before reaching maturity."

As a follow-up to Dr. Lacy's initial analyses utilizing the panther studbook, we provided Dr. Lacy with data projecting the maximum number of offspring that each remaining female Texas cougar could produce in her remaining reproductive years. We used 11 years-of-age as the reproductive age limit for the cougars, based on our observations of female Florida panthers, and estimated future litter size at 2-3 kittens. The following table shows those projections:

Cat #	Est. Birth Year	denning years	# of kittens	est. den years	total kittens known + estimate.
TX101	1991	1995	1F:1M		
		1996	1F:1M		
				none	4 (2F:2M)
TX105	1991	1995	1F		
		1999	??		
				2001	5??
TX106	1991	1995	1F		
		1998	1M (died)		
		1999	2F		
				2001	6??
TX107	1992	1997	2F		
		1999	2F:1M (75% stanley.)		
				2001	
				2003	10?? (8-75% Stan)
TX108	1992	1996	1F		
		1998	1F:1M		
				2001	
				2003	6??
Totals			17		31

These projected reproductive outputs assume that all kittens born will survive, an unlikely scenario. The following is again excerpted from Dr. Lacy's follow-up analyses (January 2000)

utilizing the above data:

"Taking the data you provided, I have done some calculations that might be useful indicators of where the genetic restoration stands now. If we assume that there are about 70 F.c. (either Fcc or Fcs) in Florida, then the current 13 F1 kittens and the three 75% kittens would amount to about 12.5% TX genes in the population if the TX females all stopped breeding immediately. (I.e., I didn't include the TX females themselves in this calculation.) Using your projections of how many more kittens the TX females might produce, I calculated that you would end up with about 24% TX genes as of 2003. (This assumes that the TX females are all by then implanted, re-captured, dead, or post-reproductive.) This suggests that we may be over-shooting the 20% target, but not by a huge amount. If female 107 is immediately implanted to prevent production of more 75% TX backcross kittens, then your guesses about future reproduction lead to an estimate of about 19% TX genes when the TX females are all finished.

The estimates above are based on tallying what percent of TX genes would result from the presence of the TX-FL (and 75% TX) cats in the population. However, there are several ways in which these estimates might be misleading. First, some of the F1 cats may already have produced F2 or backcross (to FL panthers) kittens. If the F1 cats are already breeding, then the % TX genes in the population may go up a little. (But a F1 crossed with a pure FL cat produces kittens that are 25% TX, which isn't far off from what we want the population average to be anyway.)

More importantly, the F1 cats are almost all right now just at or entering prime reproductive age, while presumably some of the pure FL cats out there are older and have less reproductive capacity left in their lifetimes. Based on the demographic rates we used in Maehr et al. [PVA paper] and again at the workshop, I calculated the expected future reproduction (the "reproductive value") of each of the F1 cats. These numbers can then be used to project what percent of the population will eventually become TX genes. Accounting for the long future reproductive lifespans of those young F1 cats, I estimated that if all TX females were now contracepted or otherwise prevented from reproducing again, you would end up with about 18% TX ancestry in the population. If the TX females are not contracepted (other than TX101), and we add in the statistically expected future reproduction by the remaining 4 TX females, then I estimate that you would end up at about 22% TX genes. This is a bit lower than the estimate I got when I used your estimates for maximum future reproduction by the TX females, because I accounted for the possibility that some TX females may die before producing their full potential that you estimated.

All of these calculations suggest to me that you are heading toward a modest overshoot of the 20% goal. The slight overshoot wouldn't worry me much (though I can't speak for others on this matter), but it and some inbreeding could be avoided if TX107 were contracepted soon. Ideally, we would want to get about the same number of progeny from each TX female. If TX107 is contracepted, and if your guesses about future reproduction by other TX

females hold up, then you will get pretty close to that ideal.”

Dr. Lacy's analyses shows that we are on track to achieving our goal of integrating 20% Texas cougar genes into the Florida panther population. TX107 is targeted for capture and contraception this capture season and that will ensure that we will not “swamp” the Florida panther population with Texas genes. We plan on continuing to provide Dr. Lacy with periodic updates and requests for on-going analyses as we collect more data. One interesting scenario is currently unfolding within the Everglades sub-population of panthers. Male panther #16 died this month leaving no known male in the area. One of the 3 known females in the Everglades is currently raising a litter of kittens (TX105) and if the other 2 females (#61_{F1}, TX108) are not now pregnant, future reproduction will be delayed until a male panther disperses into the area.

SUMMARY

All available data show that Florida panther genetic restoration is on-track to achieving the goal of 20% integration of Texas cougar genes into the panther population. To date, we have documented the production of 33 intercross progeny, 27 of which are thought to be still alive. Of these 27 cats, we have genetic samples from 18 (67%). These samples coupled with the > 100 samples from Florida panthers, are currently being analyzed by Dr. Steve O'Brien. Within the next 6-7 months, we expect to have a report from Dr. O'Brien that will detail genetic-based pedigrees and will provide the best “profile” of individuals within the population. We have created a Florida panther studbook that includes data on 137 Florida panthers, 33 intercrosses, 8 female Texas cougars, and 9 semi-captive cougars held by the Seminole Tribe. These studbook and genetic data will be fully analyzed and synthesized into a final report on Florida panther genetic restoration at a future date.

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