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FOOD HABITS OF THE FLORIDA PANTHER IN EVERGLADES NATIONAL
PARK, FLORIDA

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Abstract: We examined the diet of Florida panthers (Felis concolor coryi) in Everglades National Park from 1984 to 1991 using data from 113 kills sites of nine radio collared panthers, and 272 scats. Nine prey were identified at kill sites and 15 prey types from scats, for a total of sixteen prey species. White-tailed deer (Odocoileus virginianus) was the most important prey species based on frequency and percent of occurrence at kill sites. The most important deer from kills were adult bucks and does. The average number of days spent at a kill was 3.86 (s.e. = 0.19). The longest average stay at kill sites was for adult bucks (4.79 days, s.e. = 0.56). The main prey from scats were white-tailed deer, marsh rabbits (Sylvilagus palustris), and raccoons

(Procyon lotor). There was a significant difference in the frequency of occurrence and percent of total prey in scats when they were divided into scats from kill sites (toilets) and from elsewhere (non-toilets). Feeding habits were variable between panthers. The assumption that a single prey (e.g. raccoons) may be the source of mercury poisoning for all cats from southern Florida is not clearly reflected in our data.

The objective of this report was to determine the diet and feeding habits of the Florida panther (Felis concolor coryi) in the Everglades National Park (ENP) based on data from kill sites and scats. Maehr, Belden, Land, and Wilkins (1990) determined that wild hog (Sus scrofa), and white-tailed deer (Odocoileus virginianus) were the most common prey in the diet of the panther in southwestern Florida. They emphasized that while hog was most important in the northern portion of their study area, that white-tailed deer and raccoon were the dominant prey in the southern portion (below 260 11' N in Collier County) of their study area, within the Big Cypress National Preserve (BICY). Their findings have played an important role in restriction of white-tailed deer hunting in BICY, and in identifying prey species, especially the raccoon, that may be sources of mercury poisoning in the panther's diet (Roelke, Schultz, Facemire, Sundlof, and Royals, 1991). Because hunting is illegal in Everglades National Park, it is important to determine how a large predator may impact one of the few deer populations protected from hunting in the southeastern United States. Moreover, wild hogs are very rare in ENP and this leads to increased pressure on the local deer population (Smith and Bass, in press). Finally, high mercury levels in some panthers from the park, make it essential to determine how commonly panthers use various prey.

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STUDY AREA

Panthers discussed in this study were all radio collared in Everglades National Park. Scats were collected at kill sites, and during regular tracking and searching of panther habitat in and adjacent to the park. The study area included Everglades National Park (ENP), Big Cypress National Preserve (BICY), the East Everglades, and surrounding areas. The majority of the area is dominated by sawgrass prairies and marshes. The principal waterflow is through Shark River Slough. The upland habitat of the Long Pine Key region was a core area for most of the panthers. This upland of approximately 4000 hectares (ha) is dominated by rocky pineland. Adjoining the Long Pine Key region is an area of former farmland known as the Hole in the Donut (about 4000 ha), currently dominated by a nearly monotypic stand of the exotic pest plant Brazilian Pepper, Schinus

terbinthefolius. The major landmarks referred to in the text were described in depth by Smith and Bass (in press).

METHODS

Radio collaring procedures.

Panthers were immobilized with ketamine hydrochloride and xylazine hydrochloride delivered by a compressed air dart gun (Roelke, Jacobson, Koliass, and Forrester, 1985; Smith and Bass, in press). During immobilization dental and foot impressions were made and each panther was weighed, measured (body length, girth, feet and teeth), aged (according to tooth wear and coloration of the enamel, Shaw 1983), sexed, and fitted with a radio-collar. The radio-collars were equipped with a transmitter designed by Telonics of Mesa, Arizona, and employed conventional solid-state circuitry powered by lithium cell batteries and included mortality and activity sensors. Collars weighed approximately 900 grams (2 lbs) and had an operational life of 24 months.

Radio-collared panthers were monitored daily. Standard ground and aerial telemetry techniques were used for tracking and monitoring. A fixed-wing aircraft was equipped with directional "H" antennas mounted on each strut and attached to a switch box for selecting right, left, or both antennas (Belden 1983). A hand-held directional antenna and receiver were used for ground tracking.

Scats and kills.

Through monitoring of nine radio-collared panthers, data were gathered on 113 kill sites, 99 of which had identifiable prey. When it was determined or suspected that a panther had made a kill, a ground search of the area was made and the remains collected and identified, and all scats from the kill site were collected. Scats were also collected while tracking or searching known panther habitat. A total of 272 scats were analyzed at the Florida State Museum by methods described in Maehr et al (1990).

We analyzed the entire scat sample, and we separated the scats into two categories: scats from toilets (at kill sites) and scats from nontoilets (randomly collected and not attributable to a particular cat), in order to determine whether there were differences in representation of prey types by scat type.

How did you separate collected from panther?

Andersen (1983) reviewed the literature on the diet of mountain lions, and commented on the minimum sample required for statistical accuracy for a given time period (season, year, or period of study). He suggested a sample of 90-100 scats or stomach contents to be within +/- 10% of a true value (at $p = 0.05$). Our sample sizes for total scats, and for scats divided into kill sites (toilets) and non-kill sites (non-toilets), exceed this minimum suggestion for our study period. Both parametric and nonparametric tests were used for small data sets using means and medians. Mean

values are followed by the standard error, or 95 % confidence interval, as noted in the text and tables.

We follow Ackerman, Lindzey and Hemker (1984) in presenting the results for scat analysis as frequency of occurrence (the percent of total scats with a prey type), and as percent occurrence (number of times a prey type was found as a percent of all prey items). They developed a method for estimating the relative biomass and numbers of prey from occurrence in scats. Maehr et al (1990) used the mass estimates of prey of Chapman and Feldhammer (1982) and the procedures of Ackerman et al (1984) to evaluate scats data from southwest Florida, and they restricted the analysis to the more common prey species found in scats. We followed the above procedures to allow for comparison of our data to the previous studies.

Individual variation versus sample statistics.

Good
Generalizations about diet in large predators are often misleading in that they give the impression that the sample is homogeneous, while most biologists who work with such data are only too aware of the degree of individual variation among their subjects. While sample size of kills or scats may be relatively large, they still come from a small sample of animals, and they are not equally distributed among the subjects. In order to make it clear that many variables, including age, sex, reproductive condition, season, and habitat use all play a role in the diet of the panthers

studied, we briefly list the history of each cat separately in the results section. This should make it clear how careful we must be in generalizing about large predator habits, when we work with small numbers of large predators. If we have learned anything about large predators, it is that they are dynamic, flexible, and sometimes unpredictable.

RESULTS

A total of nine panthers were captured in ENP between December 1986 and March 1990 (Table 1). In the first year (1986-1987) of the study, six panthers were captured and radio-collared: two adult females, each with twin kittens. A young adult female panther was radio-collared in 1988. During 1989 no new panthers were located in ENP. In 1990 two males were captured and radio-collared. Panthers were radio-tracked daily from fixed wing aircraft, and kill sites were investigated on foot (see Smith and Bass, in press, for details).

Kills.

While a total of 113 kill sites were inspected, no prey were found at fourteen, leaving a total of 99 kill sites. Nine species of prey were identified at kill sites. A total of 108 prey items were found at the 99 sites. White-tailed deer was the most important prey based on frequency of occurrence 56 of the 99 kill sites or 57 %), and percent

occurrence (61 deer out of 108 prey or 57 %), followed by raccoon, alligator, oppossum, hog, marsh rabbit, otter, armadillo, and bobcat (Table 2, Fig. 1). The most common deer category from kills, based on relative age and sex, was adult bucks (47.5 %, Tables 3). There were significantly more bucks, than would be expected from a random sample (chi square = 11.4, $p < 0.05$).

The ages of deer from a subsample of 35 deer skeletons taken at kill sites were determined from teeth and long bones. Age estimates from long bones ranged from one to 15 years old (Figure 2). The average age, based on bone data ($n = 32$), was 5.5 years (s.e. = 0.76), and the median age was 5.5. In the sample of premolars ($n = 12$), ages ranged from one to 19, with an average of 6.8 (s.e. = 1.76), and the median was 3 years. There was no significant tendency to take immature and older deer, as opposed to prime age deer.

The average number of days spent at all kill sites for all prey types was 3.86 days (s.e. = 0.19), but this is biased by the large proportion of deer in the diet. To compare average days at kills for different categories of prey, only prey for which at least five kill sites were available were used (and the few sites with multiple deer remains were excluded, leaving 54 individual deer kill sites). The longest average stay at kill sites was for adult bucks (4.74 days, s.e. = 0.411), and the shortest average stay was for opossum (1.6, s.e. = 0.245, Table 4). There were significantly more days spent at kills for deer versus

alligator ($t = 3.86$), raccoon ($t = 5.16$), and opossum ($t = 4.07$), but there is no difference for deer versus hog ($t = 0.13$, one sided probability = 0.29 (independent t-tests, one tailed). There were no significant differences between the number of days at a kill for the different deer age categories.

Kills by month.

Panthers typically concentrated their activity along edges of pine and hardwood forests, where most of the deer kill sites were found. Immature panthers dispersed to the edges of their natal ranges and beyond, into unprotected, peripheral habitats where they fed on small prey such as raccoons and marsh rabbits. In the wet season, panthers reduced their home ranges, and concentrated activity at higher elevations (Smith and Bass, in press).

Kills per month varied from a high of ten for the month of February, to a low of one kill in September. There were fewer kills during the wet season months of May through September. The month with the highest percentage of deer kills recorded was April. The month with the highest percentage of small prey killed was January. However, there is no statistical evidence of a shift in reliance on deer versus smaller prey during the year from the available data (Figure 3a).

The panthers varied greatly, with regard to their use of deer versus other prey: 93 % of the deer kills (57 of the

61 sites) were by three panthers (numbers 14, 15, and 16). Since these three cats had the largest, and most thorough data sets they were used to evaluate seasonal trends in kills of deer versus other prey types (Figure 3b). The tendency for fewer deer kills in the wetter months (June through September) is evident in this subset, as it was from the overall data set. Number 14 killed deer in every month and rarely took other prey (88% of kill sites were for deer). Number 15 took deer in 7 of 12 months (86% of kill sites were deer), and small prey only in November. Neither numbers 14 nor 15 showed any sign of increased small prey kills in months when fewer deer were taken. In contrast, number 16 took mostly smaller prey (78% of sites were for prey other than deer, primarily raccoons and alligators), but also killed deer in six of 12 months. Again, there is no evidence of a seasonal shift in diet between deer and other prey.

Kills of individual panthers.

Panther #14, an adult female, approximately 5-6 years old, was captured in December 1986. At the time of initial capture, she had two yearling kittens: one male (#16) and one female (#21). Between December 1986 and July 1991, panther #14 was radio-tracked in the Long Pine Key and Hole-in-the-Donut area and southern Taylor Slough. She primarily ate white-tailed deer (88% of kill sites) and killed 29 radio-collared deer. She also ate one each of the following

prey: marsh rabbit, raccoon, aligator, and opossum. On June 21, 1991, panther #14 was found dead on the east side of the Hole-in-the-Donut. Her death may have been caused by a combination of chronic renal diseases, mercury contamination, and stress of a recent pregnancy.

Panther #15, an adult female, was captured December 1986. At time of capture she had two kittens. Both kittens (#22 and #23) were captured in March 1987. Between December 1986 and June 1988 she was located 505 times. She was commonly located in the western portion of Long Pine Key and eastern edge of Shark Slough. Based on kill remains she ate 14 deer (including bucks, does, yearlings and fawns), and a marsh rabbit, and an opossum. Panther #15 was located 1300 times, the longest period of data collection for any individual in this study. She was commonly located in the eastern portion of Long Pine Key. She was found dead in 1988. The necropsy report listed the cause as natural, due to bacterial infection from a puncture wound.

Panther #16 is an adult male, presently 5-6 years old. Captured in January 1987, as an 18-month-old yearling still with his mother, #14. In March 1987, he separated from his mother and moved north into the East Everglades. Between March 1987 and March 1989, his home range included eastern portions of ENP as far north as Tamiami Trail and south to the Long Pine Key area. During March 1989, he crossed Shark Slough and moved into southern BICY. In late October 1989,

he returned to the eastern side of Shark Slough (ENP). He occupied the largest home range of all the study animals (estimated at about 900-square-miles), including most of ENP and southern BICY, and had the most diverse diet including: 7 deer, 5 hogs, 11 alligators, 8 raccoons, a marsh rabbit, an otter, and a bobcat.

Panther #21 is an adult female approximately 5-6 years old. She was captured in March 1987, as an 18-month-old yearling still with her mother, #14. She separated from her mother in late March 1987 and travelled east and left ENP. She was struck by a vehicle on July 21, 1988. Between April 1987 and July 1988, panther #21 was radio-tracked 469 times. During this period more than 45 crossings of major roads occurred. The areas she used were primarily abandoned farm lands, and sawgrass marshes with buttonwood hammocks. Prey at three kill sites were two deer and an armadillo.

Panther #22, an adult female was captured along with her litter (male #23) in March 1987. At five kills the prey was not found, but prey at six other kills sites were three deer and three opossum. She separated from her mother (#15) in December 1987 at 16 months old. Between December 1987 and March 1989, panther #22 was located 504 times in the the Long Pine Key/Hole-in-the-Donut area and southern Taylor Slough. On March 19, 1989, radio transmission was lost. Subsequent searches of her home range during the 1989 and 1990 capture seasons were unable to locate her. In February

1991, panther #22 was recaptured and the malfunctioning collar replaced. Between February and July 1991, she was radio-tracked three times a week. During this period of time she used the same general area (western portion of Long Pine Key/Hole-in-the-Donut). One July 22, 1991, panther #22 was found dead at the bottom of a solution hole in western Long Pine Key. Preliminary cause of death was by a subcutaneous bacterial infection. At the time of her death, she had lost 50 percent of her body weight. This suggests that the infection was progressive over a relatively long period, one to two weeks.

Panther #23 is an adult female 4 years old. She was captured as a 6-month-old kitten along with her sister #22 in March 1987. Prey at four kill sites were four raccoons. As a result of capture-related activity, she was abandoned by her mother and spent the majority of the first 3 years (June 1987 - January 1989) in captivity. In late February 1989, she was returned to ENP and released on Long Pine Key. Between February 1989 and February 1990, she had an extensive home-range, covering the eastern portion of ENP, extending from the mangrove forests to agricultural lands in the East Everglades. In early March 1990, she crossed Shark Slough and moved into southern BICY, using much of the same area as male panther #16. In late June 1990, she crossed U.S. 41, entering the eastern BICY. By mid-July 1990, she showed signs of denning, and remained at the same location

for the next month. On August 13, 1990, panther #23 moved north from the den site location and did not return. This movement pattern indicated that she had lost the kitten(s) at about a month old. A subsequent search of the den site area was unable to locate any sign of the kitten(s). At present panther #23 occupies the eastern portion of BICY north of Tamiami Trail.

Panther #27, a 3-4 year old female, was captured and radio-collared in April 1988. Prey at three kill sites were two raccoons and an otter. She has been located 451 times between April 1988 and July 1989. During this 15-months of radio-tracking she occupied portions of northern Long Pine Key, the East Everglades, and northern Shark Slough. On July 26, 1989, panther #27 was found dead in a tree island in northeast Shark Slough. A necropsy, performed by the Florida Game and Fish Commission veterinarian on this animal, found no obvious cause of death. As a result of recent findings of high levels of mercury in freshwater fish in ENP (Roelke et al, 19XX), the animal was screened for pesticides and heavy metals, and high levels of mercury (98 ppm) and selenium (22 pm) were found in the animals liver. Mercury toxicosis was the most likely cause of death of panther #27 (Dr. M. Roelke, pers.comm.).

Panther #39, an adult male, approximately 3-4 years old, was captured on a tree island in lower Shark Slough on February 19, 1990. Prey from two kill sites were two deer. At the time of capture he weighted 102 pounds. From

February to May 1990, he was radio-tracked only 81 times, representing the shortest period of data collection for any of the study animals. During this period, panther #39 ranged from Long Pine Key and East Everglades area, to the west side of Shark Slough. He crossed Shark Slough frequently. Between May 4 and May 18, 1991, he confined himself to a hardwood hammock and willow stand on the west side of Shark Slough. On May 16, 1990, a ground check of the area was made to determine the condition of the animal. The cat was approached on the ground and exhibited only limited movement remaining out of sight. The decision was made to recapture the panther for examination. On the day of capture, May 18, 1990, the panther was found dead. The necropsy report listed cause of death as severe pyothorax from a puncture wound to the chest cavity (Dr. M. Roelke, pers. comm).

Panther #42 is a sub-adult male, presently 2 years old. Captured in March 1990, as a 10-month-old yearling still with his mother, he is the offspring of a backcross between Panther #14 (mother) and #16 (#14's son). In May 1990, he separated from his mother and moved north into the East Everglades. The next 12-month period, May 1990-May 1991, he confined himself to the northeast Shark Slough in East Everglades. In early May 1991, he moved his center of activity into northern Shark Slough and west of Shark Valley Tower. He presently occupies the area between Shark Valley

Tower Road west to ENP-BICY boundary. No kill sites were found for this panther.

Scats.

Fifteen prey species were represented in a total of 272 scats, including white tailed deer, marsh rabbit, raccoon, armadillo, otter, alligator, fox squirrel, cotton rat, marsh rat, gray fox, wild hog, bobcat, panther, wading bird, and small (non-wading) bird (Table 5; the three rodents and two types of bird species were lumped into the categories "rodents" and "birds" for analysis). A total of 291 prey items were identified in the scats. White-tailed deer (Odocoileus virginianus) was the most important prey species based on frequency of occurrence (69.1 % of scats) and percent occurrence (64.6 % of the prey items), followed in importance by marsh rabbits (Sylvilagus palustris), and raccoons (Procyon lotor) (Table 5, Fig. 4a).

There was a significant difference in the frequency of occurrence of prey from the scats from toilets vs. non-toilets (Chi square = 83.2 , $p < 0.001$, $df = 7$). Deer make up over 80 % of the prey and occur in over 80 % of the scats from toilets, while they make up only about half that amount from scats from non-toilets. Marsh rabbits are much more important in the non-toilet scats, occurring in 39.6 % of the scats, and composing 35.9 % of the prey items (Table 5).

The scat sample was analysed using Ackerman et al's (1984) equations and Chapman and Feldhammer's (1982)

estimates of prey mass (see Methods). In order to better compare the results to those of Maehr et al (1990) for panthers from Southwestern Florida, the analysis was restricted to the prey categories that they used (see Discussion). In Everglades National Park, deer composed 78.4 % of the estimated biomass consumed, followed by marsh rabbits with 10.4 %. Marsh rabbits were the most common prey consumed based on this analysis, composing 57.6 % of the prey by numbers (Table 6, Fig. 4b.).

DICSUSSION

Comparison of kill and scat data.

Deer were consistently identified as the most important prey item from kills and scats. But alligators, and raccoons were the second and third most common prey identified at kill sites, while marsh rabbits were clearly second most common in scats (57.6 % of prey items, based on estimates of biomass consumed). When the scats are further subdivided between toilets and non-toilets the disparity in the kill and scat data sets becomes clearer. Scats found away from kill sites have many more marsh rabbits and other small prey in them. It would appear that kill sites are generally places where large prey are taken and where several days are spent depositing scat. Such sites are dominated by scat filled with large prey (predominantly deer). Scats found away from kill sites reflect foods taken while cats are moving, and they appear to take a wider range of prey, and

smaller prey, especially marsh rabbits while they are moving about.

Remains of alligators were found in only a few scats (0.74 % of prey items) and were only found in scats from kill sites. Five of the ten alligator kill sites were for a single panther, # 16. This panther ate a wide range of foods (11 alligators, 7 deer, 5 hogs, 8 raccoons, one marsh rabbit, one otter, one bobcat). Number 16 was the male offspring of female number 14. Only three kill sites were found for number 16's sibling, number 21, and this young adult ate two deer and an armadillo. These two cats had very different homeranges. Number 16 moved over the largest area of any panther studied, and commonly used marshland in the Everglades and BICY. Number 21, before she died, used former farmland habitat to the east of ENP.

The most obvious inconsistency between kill and scat data is the complete absence of opossum from the scats even though they made up 6.6 % of the prey from kill sites (5 kill sites had opossum remains). Three of the five opossum were at kill sites of number 22, and one each were found at sites for numbers 14, and 15. Panther 22 ranged throughout Long Pine Key and the adjoining Hole in the Donut (former agricultural area).

Comparison to other studies of the Florida Panther.

Maehr, Belden, Land, and Wilkins (1990) identified 14 species in 270 scats in southwestern Florida, while we found

15 species in 272 scats. Maehr et al (1990) found seven species of prey at 38 kills in their study, while we found nine species at 90 kills where the prey was found. We compared the data from the total scat sample from Everglades National Park to the data from the Big Cypress region of southwestern Florida by estimating the percent of total biomass consumed by the methods of Ackerman et al (1984) as used by Maehr et al (1990). Two of the categories, livestock and panther, used by Maehr et al (1990) did not occur in the data from ENP, but are included to make the comparison more complete (Fig. 5). The contribution of prey in scats from panthers described by Maehr et al (1990) was less skewed toward deer or hogs than in ENP. Hogs, which were especially important in the diet of the panther in the northern portion of their study area, were insignificant in the Everglades region. Raccoons which were the second most important prey for panthers in the Big Cypress region were less common in the Everglades. The reliance of at least some panthers in this study on alligators appears to be a distinctive characteristic of the Everglades ecosystem. How much of the alligator predation is related to a three year drought in the study area is not clear, only further study will permit determination of the regularity of alligator predation. Comparison to other mountain lion studies.

Iriarte, Franklin, Johnson, and Redford (1990) analyzed puma diet data from the entire geographic range of the species, including South, Central, and North America. They

noted a general tendency for pumas to consume a wider variety of prey in the tropics. They considered prey availability and vulnerability, habitat characteristics, and potential competition from jaguars (Panthera onca) to be possible reasons for the differences they found between North America and Central and South America. They noted that the panther data of Maehr et al (1990) in southwestern Florida did not follow the North American pattern of reliance on large ungulate prey that they described, and they emphasized the fact that the southwestern Florida data revealed a low rate of deer consumption. The data that we have summarized for the panther in the Everglades National Park show characteristics of both the North American pattern of reliance on white-tailed deer, and the wider food niche breadth they described for tropical pumas, and hence, the wider food niche breadth of Florida panthers is not explained merely by a lack of deer in parts of the Florida panther's range.

Whether competition from bobcats within parts of southern Florida is important has not been explored. Competition from other cats is not the only, or most important reason for such dietary diversity in southern Florida. Human competition from recreational hunting of white tailed deer has been raised as an in the Big Cypress region, where panthers show a higher use of wild hogs, raccoons, and livestock. Where such hunting does not occur, as within the confines of Everglades National Park, there is

a clear preference, and reliance on deer by panthers. Moreover, the seasonal variation in standing water levels, and the lower densities of prey populations in this region may require an opportunistic feeding strategy by panthers, and the data from scats found away from kill sites make it clear that a wide range of small prey species are taken as panthers wander about.

Iriarte et al (1990:188) related diet to body size in pumas, suggesting that smaller varieties of puma may forage selectively on smaller prey. They relied on the data from scat analysis by Maehr et al (1990) to argue that: "Low deer densities in much of the puma's range in Florida may explain, in part, the low MWVP [mean weight of vertebrate prey] value of Florida pumas when compared with the rest of North America. Deer populations and densities of alternative prey species in portions of Florida may actually be critically low as pumas in areas of low deer densities are smaller, are in poorer condition, and have lower reproductive rates..." Maehr and Moore (1992) compared growth rates of southwestern Florida panthers to pumas from California, and determined that adult mass and growth rates were not different. They stressed the fact that the California pumas that were compared came from a study where wild hogs were an important prey source and deer were not common as prey. However, several issues should be clarified before any conclusions are drawn regarding Florida panthers as a whole. First, Maehr et al (1990) were discussing only

panthers from southwestern Florida. Second, Maehr et al (1990) relied on scat data for their estimates of prey importance, and as has been shown in this study (above) scat data should be separated into toilet and non-toilet categories, because non-toilet scats have a higher frequency of smaller prey in them, which may bias results. Third, Roelke et al (1991) have pointed out that much of the poor condition in some southern Florida panthers may be due to high mercury poisoning levels that again confuse the question of body condition and size. Fifth, the analysis of duration of stay with prey in the current study revealed no significant difference in the duration of stays for deer and hog, which may mean that as large a portion of the mass of a hog is taken as from a deer. This last point is conjectural, but indicates how little we actually know about this species. The most important issue to remember is that Maehr et al (1990, 1991) made it clear that they were studying panthers from one portion of the state of Florida, and that conditions for this species may vary appreciably in other areas, as has been demonstrated in the current study.

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Table One. Number of kills recorded for each of nine panthers from Everglades National Park. Kills subdivided into deer and other prey species.

Panther	Sex	Total Kills	Deer	Other	Comments
14	Female	25	21	4	80% deer
15	Female	18	16	2	60% deer
16	Female	20	6	14	deer, hog alligator # 14's cub
21	Female	3	2	1	# 14's cub
22	Female	11	8	3	# 15's cub
23	Female	2	0	2	raccoon, marsh rabbit, # 15's cub
27	Female	3	0	3	raccoons otter
39	Male	2	2	0	deer
42	Male	7	4	3	deer raccoons

Table Two. Summary of kills of nine Florida panthers in Everglades National Park from 99 sites for 108 prey items by species.

PREY TYPE	NUMBER OF KILL SITES	FREQUENCY OF OCCURRENCE	NUMBER OF ITEMS	PERCENT OCCURRENCE
Deer	59	59.6	61	56.5
Rabbit	3	2.8	3	2.8
Raccoon	16	16.2	18	16.7
Armadillo	1	1.0	1	0.9
Otter	2	2.0	2	1.9
Hog	5	5.1	5	4.6
Alligator	11	11.1	12	11.1
Opposum	5	5.1	5	4.6
Bobcat	1	1.0	1	0.9

Table Three. Frequency and percent of total of 54 white-tailed deer from kill sites of radio-collared Florida panthers, numbers in parentheses are the percent of deer of known sex/sizecategories, i.e. excluding Unspecifiable.

Deer Category	Frequency	Percent of total deer
Adult buck	19	36.2 (47.5)
Adult doe	9	16.7 (22.5)
Yearling	6	11.1 (15.0)
Fawn	6	11.1 (15.0)
Unspecifiable	14	25.9

Table Four. Days at kill for prey types with at least five cases, for radio-collared panthers in Everglades National Park. All Deer include deer whose sex or age were not specified. N = sample size of prey type.

Prey	Mean	Median	Maximum	Minimum	Standard Error	N
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All Deer	4.50	5	11	1	0.214	54
Adult buck	4.74	5	11	2	0.411	19
Adult doe	3.67	4	6	1	0.500	9
Yearlings	4.50	4	6	3	0.563	6
Fawn	3.50	3	7	1	0.806	6
Raccoon	2.12	2	6	0.66*	0.368	14
Alligator	2.50	2	4	1	0.307	10
Opossum	1.60	2	2	1	0.245	5
Hog	4.60	4	9	3	1.123	5

* The minimum number of days at a raccoon kills is less than one day because more than one raccoon was found at several individual kills sites.

Table Five. Summary of scat data of Florida panthers in Everglades National Park. Percent occurrence and frequency of occurrence are given for total scats, and for scats separated into scats from kill sites (toilets), and non-kill sites. PERC = percent occurrence (the percent of all the prey items in scats), FREQ = frequency of occurrence (the percent of the scats with the prey type.)

PREY SPECIES	TOTAL	TOILET	NON-TOILET	TOTAL PERC FREQ	TOILET PERC FREQ	NON-TOILET PERC FREQ
Deer	188	143	45	64.6 69.1	82.2 86.1	38.5 42.5
Rabbit	54	12	42	18.6 19.9	6.9 7.2	35.9 39.6
Raccoon	19	9	10	6.5 7.0	5.2 5.4	8.6 9.4
Armadillo	9	2	7	3.1 3.3	1.2 1.2	5.9 6.6
Rodents	5	0	5	1.7 1.8	0.0 0.0	4.3 4.7
Otter	6	4	2	2.1 2.2	2.3 2.4	1.7 1.9
Birds	3	1	2	1.0 1.1	0.6 0.6	1.7 1.9
Hog	2	1	1	0.7 0.7	0.6 0.6	0.9 0.9
Alligator	2	2	0	0.7 0.7	1.2 1.2	0.0 0.0
Grey Fox	1	0	1	0.3 0.4	0.0 0.0	0.9 0.9
Skunk	1	0	1	0.3 0.4	0.0 0.0	0.9 0.9
Snake	1	0	1	0.3 0.4	0.0 0.0	0.9 0.9
Prey	291	174	117			
Scats	272	166	106			

Table Six. Estimated biomass and number of prey consumed by Florida panthers based on the use of total scat data set from panthers in Everglades National Park and the formula of Ackerman et al (1984). No correction factor for prey was used when the estimated mass of a prey type was less than two kg., as suggested by the authors.

PREY TYPE	FREQ	ESTIMATED MASS	CORRECTION FACTOR	TOTAL BIOMASS	PERCENT BIOMASS	NUMBER CONSUMED	PERCENT CONSUMED
Deer	188	36.0	3.2	609.12	78.36	16.9	18.1
Rabbit	54	1.5	---	81.00	10.42	54.0	57.6
Raccoon	19	5.0	2.2	40.94	5.27	8.2	8.7
Armadillo	9	6.0	2.2	19.71	2.54	3.3	3.5
Otter	6	8.0	2.3	13.56	1.74	1.7	1.8
Hog	2	23.0	2.8	5.57	0.72	0.2	0.3
Alligator	2	8.0	2.3	4.52	0.58	0.6	0.6
Skunk	1	2.5	2.1	2.07	0.27	0.8	0.9
Rodents	5	0.1	---	0.50	0.06	5.0	5.3
Birds	3	0.1	---	0.30	0.04	3.0	3.2

Table Seven. Comparison of estimates of percent of total biomass consumed by Florida panthers, based on formula of Ackerman et al (1984), for Everglades National Park total scat data versus data from Big Cypress region study by Maehr et al (1990)

PREY	EVERGLADES NATIONAL PARK	BIG CYPRESS	
		NORTH	SOUTH
Deer	78.36	27.00	43.00
Rabbit	10.42	1.70	3.40
Raccoon	5.27	3.00	19.00
Armadillo	2.54	4.60	9.30
Otter	1.74	0.00	0.00
Hog	0.72	58.70	22.70
Alligator	0.58	0.00	0.00
Skunk	0.27	0.00	0.00
Rodent	0.06	0.05	0.10
Birds	0.04	0.00	0.00
Livestock	0.00	4.90	0.00
Panther	0.00	0.00	2.00

LIST OF FIGURES.

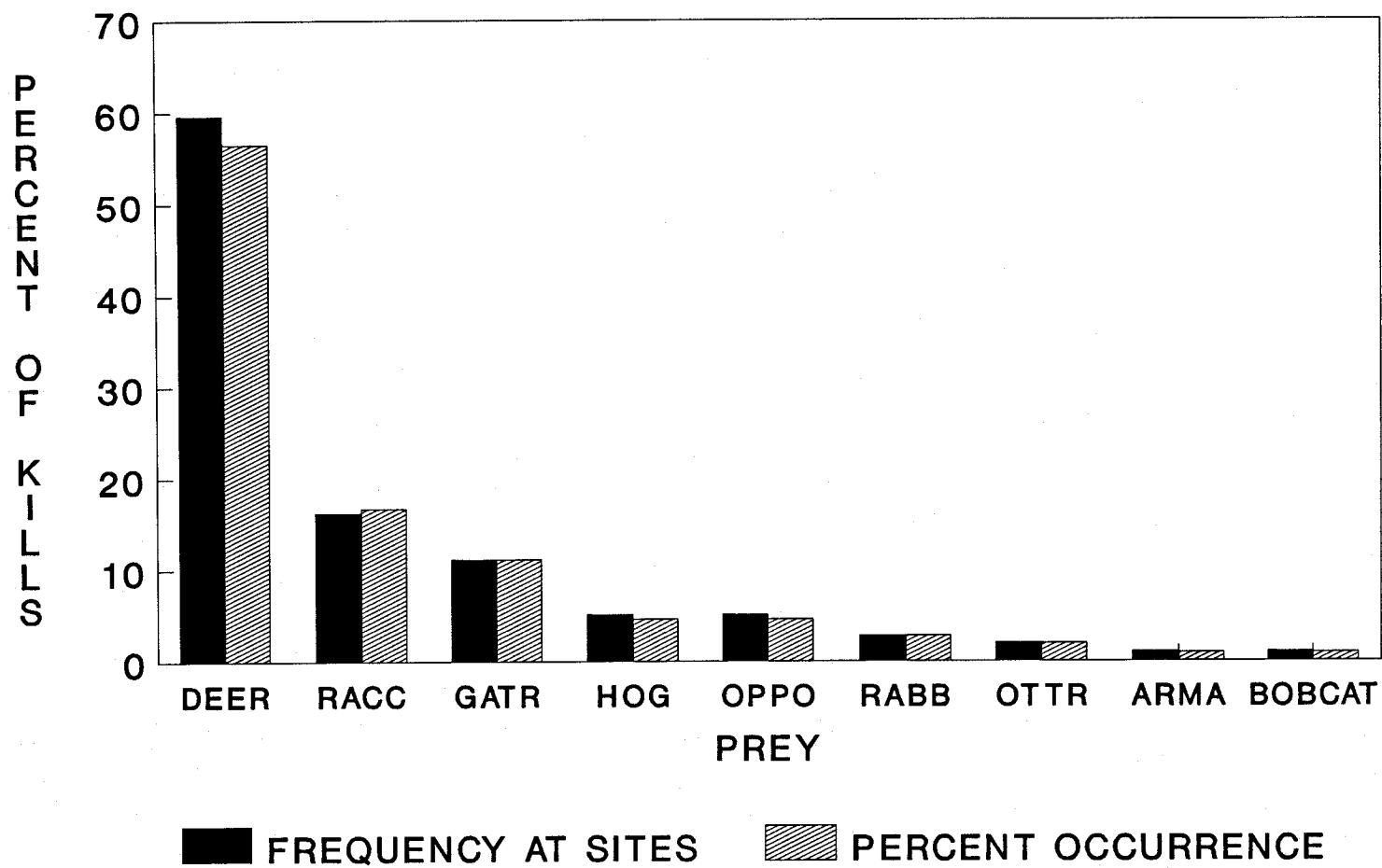
Figure One. Frequency of occurrence and percent occurrence (as defined in Methods section) for all prey identified at 99 kill sites of nine Florida panthers in Everglades National Park.

Figure Two. Frequency of 35 deer from kill sites of panthers, separated into size/age categories based on analysis of dentition.

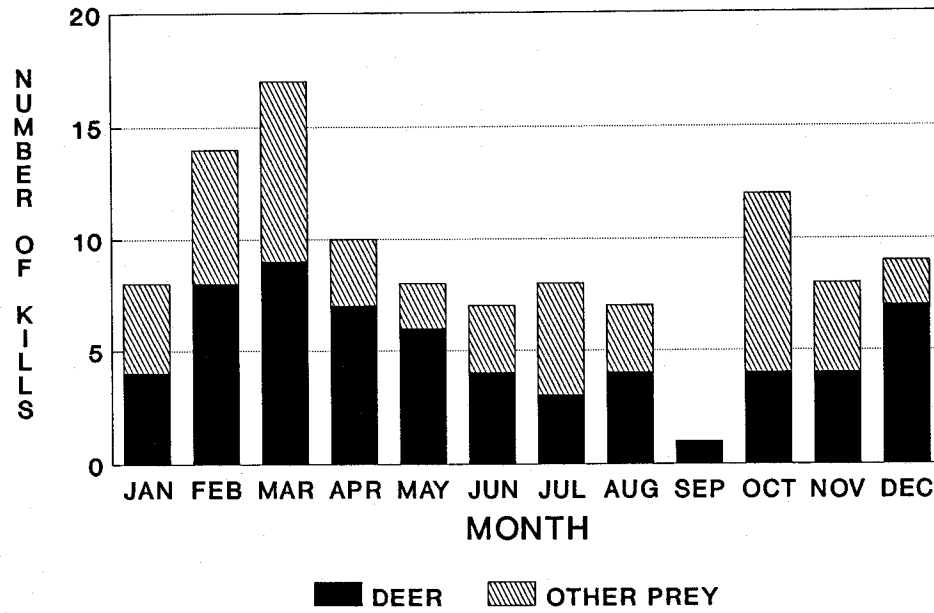
Figure Three. A. Kills per month for all nine Florida panther kill sites, separated into the categories deer and other prey. B. Kills per month for three Florida panthers, #'s 14, 15, and 16, separated into the categories deer and other prey. The graphic is restricted to these three cats because they had the largest, and longest data sets for kills. They alone took 50 deer (out of a total of 61 deer) and 32 other prey (out of a total of 47 other prey).

Figure Four. A. Frequency of occurrence of all prey types found in scats, using Log (base 10) scale for ease of interpretation. Scats are presented as total sample, scats at toilets at kill sites, and scats from non-toilets. B. Estimates of percent of biomass consumed by Florida panthers in Everglades National Park, based on scat data, using Log (base 10) scale. Only the prey categories that were also used in studies in southwestern Florida (by Maehr et al, 1990) are included.

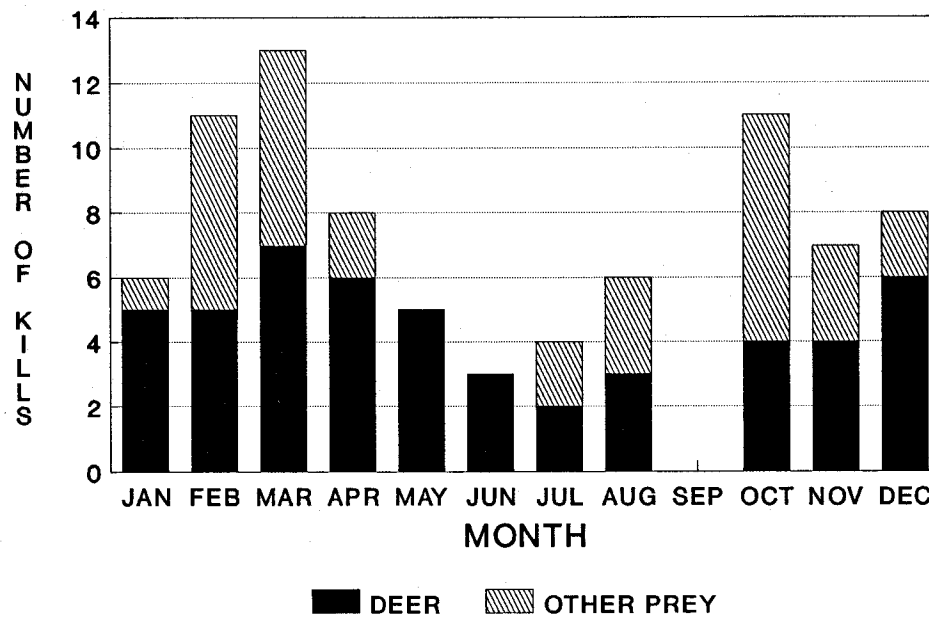
Figure Five. Estimated percent of biomass consumed from scat data for Florida panthers in Everglades National Park compared to data from the Big Cypress region of southwestern Florida from Maehr et al (1990).



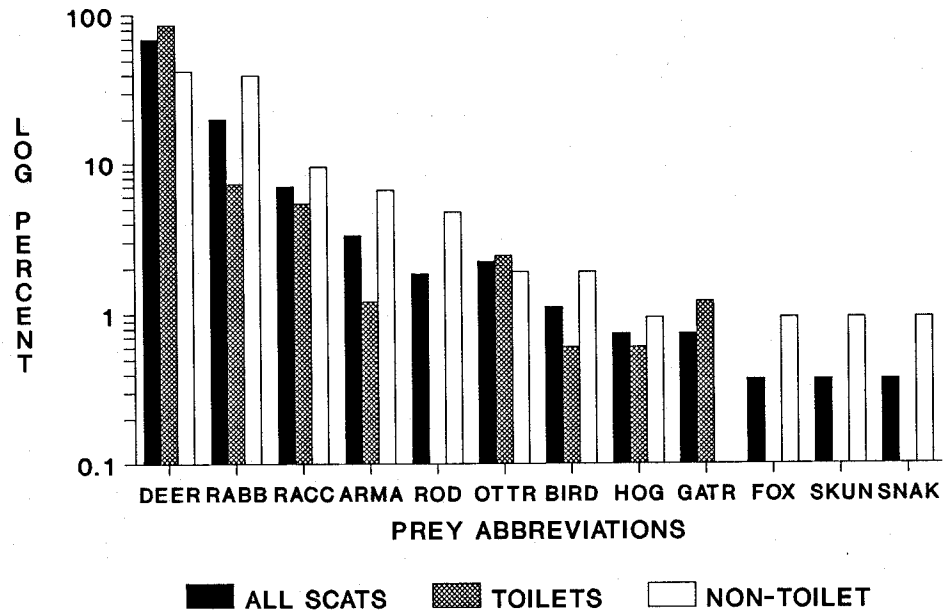
A.



B.



A.



for Freq. of Occurrence for all prey

B.

