

# Mortality Patterns of Panthers in Southwest Florida

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*Abstract:* Mortality of Florida panthers (*Felis concolor coryi*) was examined from December 1979 through May 1991 in southwest Florida. Average annual mortality (17.2%) over a 4-year period (1987–1990) was similar to unhunted populations of mountain lions. Highway collisions caused 46.9% of documented mortality followed by natural causes (28.1%), illegal shooting (6.2%), and research activities (6.2%). Road mortality appears greater from November to January and more likely among male panthers and panthers residing adjacent to State Roads 29 and 84. Natural mortality, especially intraspecific aggression, was more prevalent than road mortality in radio-collared panthers.

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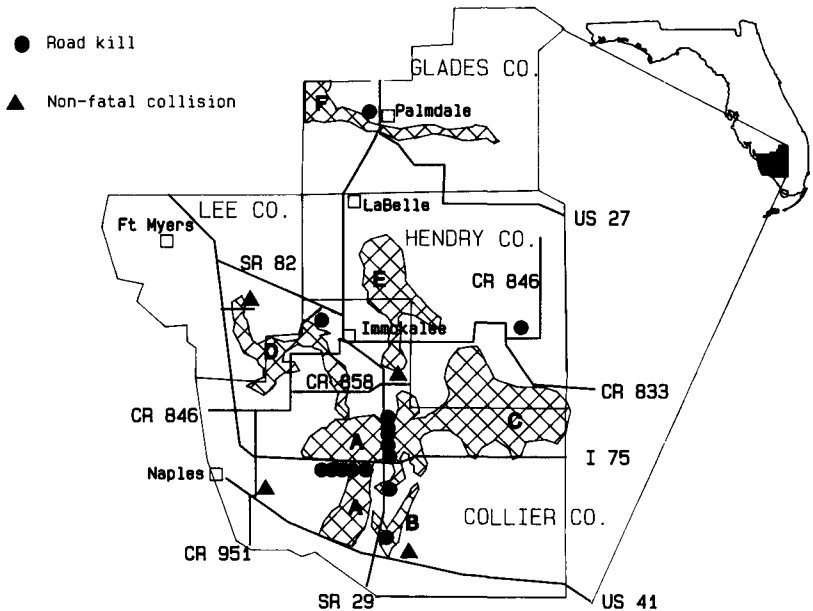
Mountain lion (*Felis concolor*) mortality in the western United States is due largely to hunting (Anderson 1983), and populations are managed for sustained yield or are viewed as pests. In Florida, panther (*F. c. coryi*) mortality is caused by a number of factors. The wild population of the 30–50 panthers in south Florida is considered endangered (U.S. Fish and Wildl. Serv. 1987), and management efforts are directed towards increasing numbers. Measurements of mortality are needed for developing extinction probabilities and estimating population trends. This paper summarizes panther mortality in southwest Florida over an 11-year period and examines geographic and temporal patterns in panther mortality.

Several people contributed to data collection and panther carcass recovery including J.W. McCown, J.C. Roof, R.T. McBride, S. Wright, J. Roboski, R.C. Belden, W.B. Frankenberger, and S.T. Schwikert. T. Logan, R.L. Downing, and J.C. Ozier made helpful comments on an earlier draft. The National Park Service and D. Jansen provided information on panther No. 33. Funding for this study was provided through Federal Endangered Species Project E-1 and the Florida Nongame Wildlife Trust Fund.

**Methods**

Southwest Florida is a biotically diverse region containing large tracts of wilderness interspersed with agricultural lands, urban centers, highways, and drainage canals. Major vegetation types include cypress (*Taxodium distichum*) swamps, slash pine (*Pinus elliottii*)/saw palmetto (*Serenoa repens*) forests, hardwood hammocks, freshwater marshes, and mixed swamps (Davis 1943). Major public lands inhabited by panthers include the Big Cypress National Preserve, Big Cypress Seminole Indian Reservation, Florida Panther National Wildlife Refuge, and Fakahatchee Strand State Preserve. Major highways include U.S. 41, S.R. 84 (currently being converted to interstate 75), S.R. 29, and several county highways (Fig. 1).

Dead panthers were collected when found along highways, confiscated by law enforcement officers, or when mortality signals from transmitters (Telonics, Inc., Mesa, Ariz.) on panthers radio-collared for study were detected. Location, date, sex, age, and cause of death were recorded when possible. Ages were estimated according to Shaw (1979) or were based on known birth dates. We calculated mortality rates following Heisey and Fuller (1985) for those intervals when  $N > 6$



**Figure 1.** Study area and distribution of major highways, road kills, and road injuries in southwest Florida 1979–1990. Irregular cross-hatched polygons represent large, continuous forest systems (A-Fakahatchee Strand; B-Deep Lake Strand; C-Gum Swamp/Tony Strand complex; D-Corkscrew Swamp/Camp Keais Strand complex; E-Okaloacoochee Slough; F-Fisheating Creek).

radio-collared animals. Annual intervals began on 1 May following the cessation of capture activities.

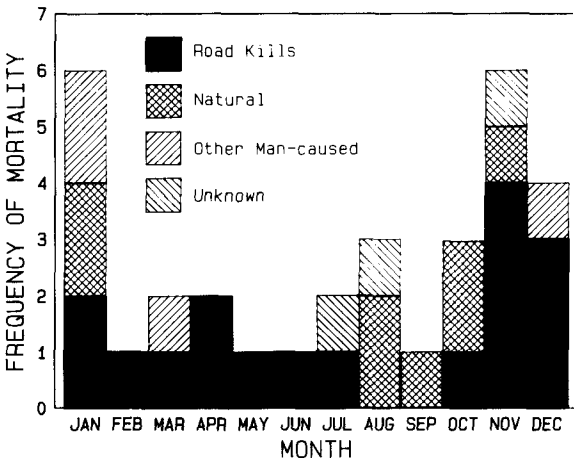
**Results and Discussion**

From December 1979 through May 1991, 32 panther deaths were documented (Table 1). These included 12 uncollared panthers. The most common cause of death was highway collision ( $N = 15, 46.9\%$ ). Four panthers (1 radio-collared) were hit by cars and survived. Road kills were distributed throughout southwest Florida, but were concentrated on S.R. 84 and S.R. 29 within and adjacent to the Fakahatchee Strand, Collier County (Fig. 1). Road mortality appeared heaviest from November through January, but occurred throughout the year (Fig. 2). Three adult males died (2 natural, 1 unknown) within 1 week in 1988 accounting for all August mortality. Nine natural mortalities included 6 (4 male, 2 female) resulting from intraspecific aggression. Other unnatural mortality included 2 related to capture activities and 2 caused by illegal shooting. Cause of death was not determined on 4 occasions.

Thirty-four Florida panthers were captured and radio-collared in southwest

**Table 1.** Frequency of mortality type among 4 sex and age classes of Florida panthers from December 1979–May 1991.

	Road-kill	Natural	Shootings	Research	Unknown	
Adult male	7	4	1		3	
Subadult male	2	2		1		
Adult female	3	3	1	1	1	
Subadult female	3					
Total	15	9	2	2	4	32

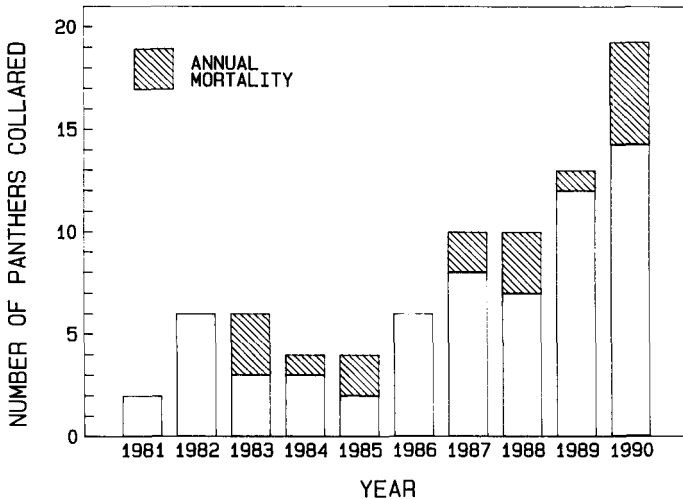


**Figure 2.** Seasonal variation in panther mortality in southwest Florida, 1979–1990.

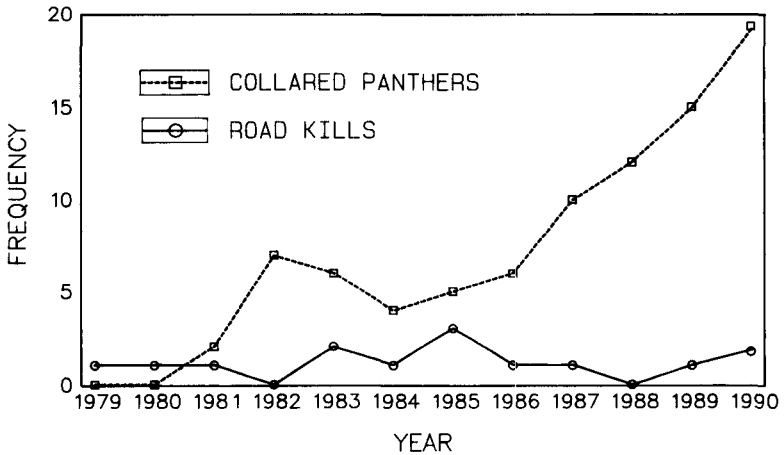
Florida between January 1981 and October 1990; however, only since 1987 has our sample size exceeded 6 animals (Fig. 3). Annual mortality of radio-collared panthers since 1987 averaged 17.2% (range 0–31.4, SE = 13.3). These figures are less than half the mortality measured by Anderson (1983) in a hunted population, are similar to mortality in an un hunted population of mountain lions (Lindzey et al. 1988), and are consistent with populations experiencing low turnover.

A popular notion of the public and some professionals is that all panthers are equally vulnerable to road mortality. While road mortality is the most frequently documented and most widely publicized cause of panther mortality, it accounts for only 1.1 deaths/year (range 0–3). We documented a steady number of road-kills per year even when the total number of radio-collared animals increased 4-fold (Fig. 4). At most, a slight rise in discovered road-kills would be expected if there was a significant detectability difference between uncollared and radio-collared carcasses. This potential bias was not apparent.

Distribution of road-kills was a function of geography and panther spatial patterns. Twelve of 15 road-kills occurred on 2 heavily used highways that bisect major swamp-forest systems, and all occurred within the remaining linkages of a once contiguous forest landscape. These forests represent the core use areas of panthers. Forest linkages exist primarily along S.R. 84, east of Golden Gate Estates, west of S.R. 29, and along S.R. 29 between County Road 858 and U.S. 41. Other portions of these highways that lack suitable forest cover were not crossed by panthers (Maehr et al. 1991). For example, no road kills were recorded on S.R. 84 east of S.R. 29 where it is crossed by narrow bands of forest at only 2 locations (Deep Lake and East Crossing Strands).



**Figure 3.** Annual mortality in radio-collared panthers studied in southwest Florida from 1981–1990.



**Figure 4.** Frequency of annual road mortality and number of panthers radio-collared in southwest Florida, 1979–1990.

Home ranges of most panthers captured since 1986 were not bisected by busy highways, or these panthers infrequently crossed roads (Maehr 1989). Interestingly, of the 13 female panthers captured since 1981, only 3 are known to have crossed either S.R. 29 or 84, and only 1 of these has crossed regularly. None were hit by vehicles. Three of 6 road-killed, uncollared females likely were dispersing (1.5–2.5 years old), 2 may have had S.R. 84 within their home ranges, and 1 was a dependent kitten. Only males have been documented to regularly cross S.R. 84 (Maehr 1989), and therefore appear more vulnerable to highway collisions (fatal and non-fatal) than females (14:7). The concentration of highway mortality from fall and early winter may be caused by increased traffic associated with tourism. An apparent decline in collisions on S.R. 84 may be due to the completion of highway underpasses designed for panthers and other wildlife use (first underpasses were completed in 1989).

Other forms of human-related mortality have occurred too infrequently to suggest any temporal or geographic patterns, and, based on the demographic stability exhibited by the population (Maehr et al. 1991), probably have had little impact on southwest Florida panthers. During years with 10 or more collared panthers (1987–1990), 12 of 27 study animals died. Eight of these died of natural causes, 2 of unknown causes, 1 of a research accident, and 1 due to highway collision. Natural mortality in the marked sample far outweighs human-caused mortality. Anderson (1983:55) reported that 63 (55%) of 115 monitored mountain lions studied from 1964–1980 in Arizona, Idaho, and Colorado, died from hunting and >10% died from research activities. Hunting (illegal) and research activities accounted for 0% and <7%, respectively, of mortality in 34 radio-collared panthers in southwest Florida.

Natural deaths of radio-instrumented panthers included rabies in an unvacci-

nated subadult male, a congenital heart defect in an adult male (Roelke 1990), and 6 cases of intraspecific aggression. Two of these instances involved deaths of subadult males that were dispersing from natal ranges through territories of resident males courting females in estrus. Two adult females were killed by a young adult male in September and October 1990. These female mortalities may have stemmed from the death of a resident adult male and the social disruption caused by his absence (Maehr et al. 1991). The other 2 instances of intraspecific aggression were between adult males. Hornocker (1969) observed that intraspecific aggression of Idaho mountain lions was unusual. However, in an unharvested population of mountain lions in New Mexico, this was the commonest form of mortality (K. Logan pers. commun.). Radio-collared resident adult males in southwest Florida all exhibit numerous scars and other injuries (i.e., tattered ears, puncture wounds, lacerated forelegs, damaged radio transmitters, etc.) that may be the result of fighting. The apparently common occurrence of fighting among Florida panthers may be related to a lack of unoccupied, suitable habitat for dispersing subadults. Limited space and infrequent mortality of resident adults increases the probability that dispersing subadults will encounter intolerant residents.

In summary, natural mortality accounted for a much larger percentage of the total than road mortality. Road kill patterns may be related to landscape features that influence panther movements. Further, all mortality combined has had little measurable impact on the demographics of panthers which exhibit low turnover in southwest Florida. Nonetheless, the small population size is of great concern to managers. Efforts that may be reducing mortality in southwest Florida include vaccinations during captures and construction of wildlife underpasses as S.R. 84 is converted to 1-75, especially through the Fakahatchee Strand. Increased efforts to protect occupied panther range and improve the quality of public lands inhabited by panthers could increase the survival probabilities of dispersing young and allow some natural population growth. Monitoring of radio-collared panthers should continue in order to determine the benefits of underpasses for animals in the Fakahatchee Strand area and document changes in mortality patterns.

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