

EVALUATION OF STATE ROAD 29 WILDLIFE CROSSINGS

by

Mark A. Lotz, E. Darrell Land, and Kenneth G. Johnson

Ref 1/2/96

Final Report

Study Number: 7583

Study Period: 1 July 1993 - 30 June 1996

Florida Game and Fresh Water Fish Commission
620 South Meridian Street
Tallahassee, Florida 32399-1600
September 1996

EVALUATION OF STATE ROAD 29 WILDLIFE CROSSINGS

Mark A. Lotz

Biological Scientist I, Florida Game and Fresh Water Fish Commission, Big Cypress Wildlife Field Office, 566 Commercial Boulevard, Naples, FL 33942

E. Darrell Land

Biological Scientist III, Florida Game and Fresh Water Fish Commission, Big Cypress Wildlife Field Office, 566 Commercial Boulevard, Naples, FL 33942

Kenneth G. Johnson

Biological Administrator I, Florida Game and Fresh Water Fish Commission, Big Cypress Wildlife Field Office, 566 Commercial Boulevard, Naples, FL 33942

Abstract: Wildlife use was documented in two wildlife crossings constructed concurrent with realignment of state road (SR) 29 using infrared game monitors connected to cameras. Construction was completed in March 1995. Two additional crossings of a different design were monitored on Interstate (I)-75 for comparative purposes. Over 1,000 photographs were taken of > 20 species of wildlife, domestic animals, and humans. The SR 29 wildlife crossings were utilized by Florida panthers (*Felis concolor coryi*) (n=4), black bears (*Ursus americanus*) (n=5), bobcats (*Felis rufus*) (n=152), deer (*Odocoileus virginianus*) (n=32) and raccoons (*Procyon lotor*) (n=276). Panther use of the I-75 wildlife crossings has increased over time. The new design of wildlife crossing on SR 29 was a cost effective way of allowing the safe passage of many species of wildlife.

INTRODUCTION

Highway mortality is one of the most visible sources of mortality for many wildlife species. Often, wildlife populations can absorb this unnatural mortality without suffering declines, but, for endangered large mammals like the Florida panther, additional sources of mortality could imperil their existence. A contiguous system of wild lands is necessary to accommodate the spatial needs of the population. Adult male and female panthers maintain home ranges of >500 km² and >190 km², respectively, with limited overlap among males (Maehr et al. 1991a). These home ranges often include many miles of improved and unimproved roads that are regularly traversed. As a result of the interspersed roads within panther habitat, road-kill mortality among panthers can be expected. Twenty-three panthers died from vehicle collisions between

1979 and 1996 (Maehr et al. 1991b, GFC unpublished data). Twenty percent of mortality to radio-collared panthers was by vehicle collisions.

Efforts to reduce this unnatural source of mortality have included the creation of night time speed reduction zones, installation of special roadside headlight reflectors, adding rumble strips to the highway surface, and posting signs alerting drivers that they were in panther habitat. These efforts may have prevented some mortality but did not eliminate all deaths. A new approach to the problem involved separating traffic flow and wildlife through underpasses.

Prior to 1972, I-75 extended from the Florida-Georgia state line south to Tampa. A study completed in 1972 for the Florida Department of Transportation affirmed the need for I-75 across south Florida (Lochner, H.W., 1972). Reasons cited included human population growth and a resultant

increase in traffic volume, military and civil defense, and safety concerns. State Road 84, a two-lane highway also known as Alligator Alley, was chosen as the I-75 corridor. Environmental considerations included the opportunity to improve surface water flow, and no new right of way was needed which would have impacted additional wetlands. Engineering factors considered this the safest, most efficient highway corridor between the Naples-Ft. Myers and Ft. Lauderdale-Miami urban areas and was the lowest-cost alternative. "Wild animal crossings" were proposed although no need had previously been established. Further evaluation of animal crossings was recommended during the planning phase.

The value of wildlife underpasses was just beginning to be recognized in the U.S. as a means to manage highway mortality of wildlife. Earlier work throughout the United States to create safer highways for wildlife and people was focused first on limiting ungulate/vehicle collisions. An experimental underpass was employed along I-70 west of Vail, Colorado, to assist migratory mule deer (*Odocoileus hemionus*) in crossing the interstate (Reed et al. 1975). A concrete box culvert 3.05 m high, 3.05 m wide, and 30.48 m long was placed under the highway. Mule deer were reluctant to use this underpass, and Reed et al. (1975) suggested a wider design of shorter length would make the underpass more acceptable to wildlife.

These suggestions were used to develop underpasses for I-75 in panther habitat (Logan and Evink 1985, 1988). An underpass on I-75 was 21.2-25.8 m wide by 48.5 m long including the open median separating the 2 bridges that elevated traffic 3-4 m above the ground (Foster and Humphrey 1995). These strategically-placed structures offered safe passage to wildlife that was beneath the flow of traffic. Use of these underpasses was further

encouraged by erecting a 3.4-m chain-link fence topped with 3 strands of outrigged barbed wire to help direct animals to the underpasses and deter crossings in areas with no underpasses. This design was utilized by panthers, bobcats, white-tailed deer, black bears, alligators (*Alligator mississippiensis*), raccoons, and a host of wading birds (Foster and Humphrey 1995).

Our objectives were to evaluate the effectiveness of an adaptation of the I-75 underpass design installed in a 6.4-km stretch of SR 29 just north of I-75, compare use between the two types of wildlife crossings, and make recommendations based on our findings.

STUDY AREA

The study area was in central Collier County, Florida, along the two-lane SR 29 corridor north of I-75 as well as a 15 km stretch along I-75 extending west from SR 29 (Fig. 1). The 6.4-km section of roadway on SR 29 where crossings were built separated the Florida Panther National Wildlife Refuge (FPNWR) to the west from the Bear Island Unit of the Big Cypress National Preserve to the east. The SR 29 wildlife crossings were located 1.4 km and 4.5 km north of I-75 and designated as 29S and 29N respectively.

The section of highway containing the previously built wildlife crossings on I-75 separates the FPNWR to the north from the Fakahatchee Strand State Preserve (FSSP) to the south. There are 12 crossings on I-75 west of SR 29, two of which were monitored for comparative purposes. Wildlife crossing #8 was located 5.3 km west of SR 29 just west of mile marker 83. The crossing was situated on an old railroad tram that traveled north and south between FSSP and the FPNWR. Crossing #2 was 12.3 km west of SR 29 near mile marker 88. These areas

encompassed habitats ranging from seasonally flooded mixed swamp lands to dry pine lands.

METHODS

Placement of wildlife crossings (Fig. 2) was determined by examining radio-telemetry data (Fig. 3), locations of road-kills, and habitat characteristics. Radio-instrumented Florida panthers and black bears have been monitored in the study area for 13 and 5 years, respectively, and over 30,000 locations have been collected. These data were analyzed with a Geographic Information System to characterize patterns of large carnivore use of the study area. This long-term monitoring yielded many observations of how these large mammals use this portion of their habitat and where they tended to cross SR 29. Important crossing areas were delineated by coupling this extensive telemetry database with locations of road kills. Exact placement of the underpasses was determined by identifying important habitat features such as forested cover or the presence of bridges across the roadside canal.

Radio-instrumented panthers and bears were located three times a week from a Cessna 172 aircraft. Universal Transverse Mercator coordinates, habitat type, and activity were recorded for each animal located. Most flights were conducted between 0630 and 1030. The crossing areas were searched for tracks and other sign when radio-instrumented animals were known to have crossed the SR 29 study area.

The wildlife crossings on SR 29 consisted of a pre-formed box culvert 2.4 m high, 7.3 m wide, and 14.6 m long. These culverts rested at ground level and the roadway gradually rose over the structures. The crossings also included a concrete span that formed a bridge across the adjacent canal. The surface of the span contained a layer of soil to

support growth of natural vegetation. Chain link fencing 3.4 m in height with a 1 m overhang of barbed wire enclosed the highway.

Monitoring of the SR 29 wildlife crossings began on 27 and 30 March 1995 and the two on I-75 began on 12 and 14 April 1995 using TrailMaster (Goodson and Associates, Lenexa, KS) game monitors. Each monitoring unit consisted of an infrared beam transmitter and receiving unit coupled with a digital counter and automatic flash camera. A picture was taken when the infrared beam was broken, and the date, time of day, event and frame number were recorded. The cameras were equipped with a feature which printed the date and time directly on the film. TrailMaster units and cameras were mounted on 61 cm tall 2 by 4's screwed into a 40 cm square plywood base. The transmitter was attached to one stand and the other held the receiver and camera. The equipment was housed later in metal boxes bolted directly to the crossing structures to deter theft. Six cameras and 5 TrailMaster units were stolen during the study. One camera was sufficient to cover the entire span of the crossings on SR 29, but the wider crossings on I-75 (> 30 m) required two cameras. The TrailMasters were positioned so that the infrared beam was at a height of approximately 40 cm above the ground, and the camera was mounted about 61 cm above the ground.

Cameras were deployed continually except when theft, high water, depleted film or batteries and occasional equipment failure caused interruptions.

Photographs were analyzed to discriminate between a crossing event and foraging behavior. An event counted as a crossing when an animal traveled through the structure in one direction and did not return within three minutes. Foraging behavior was noted when several photos were taken within a short time of each other and by noting the activity of the animal.

Tracking surfaces were created in an attempt to document use, avoidance, or indifference to the structures.

RESULTS AND DISCUSSION

Panther use of the crossings began during the early stages of construction prior to camera monitoring. Female panther #32, whose normal range lies almost entirely within FPNWR, was found in Bear Island east of the southern crossing (29S) on 17 June 1994. This was the first documented crossing of SR 29 by #32. Panther tracks showed that #32 crossed the highway 100 m north of the partially completed crossing and then travelled south along the canal until encountering the concrete and earth span across the canal. Panther #32 walked across the span to access Bear Island. She returned to FPNWR via the same crossing, after spending a week in the Preserve, this time using the span and the box culvert. About 2 years later, on 3 June 1996, #32 returned to Bear Island, this time using 29N and returned to FPNWR by 10 June via the same crossing. Male #12 was documented using the southernmost crossing (29S) on 27 July 1994. Telemetry data coupled with tracks showed the male had crossed from Bear Island to FPNWR, using both the span and culvert. This male consistently used both sides of SR 29 until his death in November 1994.

Panther use of the SR 29 wildlife crossings was documented on 6 occasions following intensive monitoring efforts; 4 by photos (Fig. 4) and 2 by tracks. Following the death of male panther #12, #51 expanded his range eastward adding this vacant territory in Bear Island to his previous range which encompassed FSSP and the FPNWR. Panther #51 was photographed using the 29N wildlife crossing on three occasions. Tracks verified two crossings by

#32 in June 1996. TX 101, a cougar released for genetic restoration, was photographed once in 29S (Table 1).

Panther #51 crossed SR 29 a minimum of 31 times to the north of the wildlife crossings. Likewise, female panthers #11 and #19 crossed 23 and 8 times, respectively, all north of the current wildlife crossings. These crossings were concentrated near Bear Island Grade, Pistol Pond, and Sunniland.

Use of the wildlife crossings on SR 29 will likely increase as panthers learn these new safe crossing locations and new cats enter the population. Panther use of the older crossings on I-75 has apparently increased as the animals learned their locations. Panther crossings were substantially greater during this study ($n=41$, Fig. 4) than reported by Foster and Humphrey (1995) ($n=10$, Fig. 5). Wildlife crossing #8 was monitored during both studies. Foster and Humphrey reported 2 crossings by panthers during 16 months of monitoring at this location. Our study documented 11 crossings by panthers during 9 months. Panthers habitually cross at the same place, therefore, immediate use of any new crossing is unlikely. No radio-instrumented female panther had a home range bisected by the I-75 corridor prior to wildlife crossings, whereas males crossed frequently. Panther #57 was the first female to regularly cross I-75 via wildlife crossings and likely entered the population following the completion of the wildlife crossings. Frequency of all panther crossings combined exhibited a mostly nocturnal pattern with most crossings occurring between 1700 and 0600 hours (Fig. 6).

One-hundred eighty-one bobcat crossings were photographed (Table 1), with 152 crossings occurring at the SR 29 structures (Fig. 7). A minimum of 70 crossings were by the same 2 bobcats as determined by their unique markings. Often times

they would return within 15 minutes. During a period when water levels were >3 cm no bobcats were photographed using the SR 29 wildlife crossings. Bobcats were photographed crossing I-75 29 times (Fig. 7). Six crossings occurred at #8, and 23 photos of bobcat crossings were collected at #2 during the monitoring period. Bobcat activity was relatively consistent throughout the 24-hour period, with crossings peaking at 0500 and 1700 hours (Fig. 6).

One-hundred sixty-two deer crossings were recorded, with 32 crossings occurring at the SR 29 wildlife underpasses (Fig. 8). Preferred habitat and forage in the crossing area may account for the greater use in the vicinity of the I-75 crossings. Deer crossings were mainly diurnal; peak use occurred between 0700 and 1500 hours (Fig. 6).

Raccoons were photographed in the crossings 316 times. The majority of activity occurred at the SR 29 wildlife crossings (Fig. 9), perhaps the result of raccoons foraging in this newly created habitat. Activity of raccoons was primarily nocturnal (Fig 6).

Other species documented using the SR 29 wildlife crossings included turkey (*Meleagris gallapavo*) (n=23), gray fox (*Urocyon cinereoargenteus*) (n=15), opossum (*Didelphis virginianus*) (n=5), black bear (n=5), armadillo (*Dasypus novemcinctus*) (n=2), barred owl (*Strix varia*) (n=1), domestic cats (*Felis catus*) (n=8), and wading birds (n=58) (Table 1).

Poor tracking substrates and high water for much of the study period precluded collecting consistent track data. Wildlife crossing #8 on I-75 was not monitored for four months due to high water. The dry ground in both wildlife crossings on SR 29 consisted of hardened clay, hampering efforts to maintain tracking surfaces.

MANAGEMENT RECOMMENDATIONS

The wildlife crossings on SR 29 were effective in permitting the safe passage of many species of wildlife across the roadway. As more animals learn the locations of these crossings, they will likely use them at greater frequencies. Panther use of the I-75 wildlife crossings apparently increased over time. Placing wildlife crossings at traditional places where panthers tend to cross may lead to quicker acceptance and use of the structures. Additional wildlife crossings are warranted on SR 29 north of the current structures in areas where panthers #11, #19, and #51 cross.

No design changes to the current style of wildlife crossing on SR 29 are needed. Both the bridge and the precast box culvert style of crossing are acceptable to wildlife. Circumstances such as roadway design and cost will dictate which design should be utilized.

Standing water was present in the wildlife crossings on SR 29 during part of the year. Excessive water depth likely reduces use of the wildlife crossings. Grade adjustments should be made to ensure against excessive standing water.

TrailMasters were far more effective than track observations in detecting crossing activity, despite some loss of date and time data, as they function independently of tracking conditions.

The cost of the SR 29 pre-cast concrete structure was \$110,000 (R. Hall, FDOT, pers. comm.). The I-75 bridge-style crossing structures were \$175,000 each (one structure was required for each two lanes) about 10 years ago (R. Hall, FDOT, pers. comm.). There were additional expenditures for both types of crossing structures, including fill material needed to elevate the roadway over the crossing, traffic control and re-routing, and other roadway items such as guard rails. Such additional expenditures were

variable, and dependent upon on characteristics of the sites where crossing structures were installed. The less expensive SR 29 wildlife crossing structures were readily used by wildlife and should be considered when designing wildlife crossings for in the construction or upgrading of two-lane highways.

highway underpass. J. Wildl. Manage.
39:361-367.

LITERATURE CITED

- Foster, M.L. and S.R. Humphrey. 1995. Use of highway underpasses by Florida panthers and other wildlife. Wildlife Society Bulletin. 23(1):95-100.
- Hall, Ronny. Personal communication. Florida Department of Transportation. August, 1996
- Lochner, H.W., Inc. 1972. Location Report Interstate Route 75. A Report for the State of Florida Department of Transportation, Division of Planning and Programming in cooperation with the U.S. Department of Transportation Federal Highway Administration. 147 pp.
- Logan, T. and Evink, G. 1985. Safer Travel for the Panther. Florida Naturalist. Spring:6-7.
- Logan, T. and Evink, G. 1988. A Plan for Florida Safety on Collier County Highways. A report for the Technical Subcommittee of the Florida Panther Interagency Committee. November. 5 pp.
- Maehr, D.S., E.D. Land, and J.C. Roof. 1991a. Social ecology of Florida panthers. Nat. Geo. Res. and Expl. 7:414-431.
- Maehr, D.S., E.D. Land, and M.E. Roelke. 1991b. Mortality patterns of panthers in southwest Florida. Proc. Ann. Conf. Southeast. Fish and Wildl. Agencies 45:201-207.
- Reed, D.F., T.N. Woodard, and T.M. Pojar. 1975. Behavioral response of mule deer to a

Table 1. Use of wildlife crossings (WLC), based on photos taken by TrailMaster game monitors from 27 March 1995 - 30 June 1996.

Species	Number of Photographs				
	WLC 29N	WLC 29S	WLC I-75 #8	WLC I-75 #2	Total
Florida Panther	3	1 ^a	11	31	46
Bobcat	44	108	6	23	181
White-tailed Deer	20	12	69	61	162
Raccoon	176	111	25	4	316
Otter	6	82	1	0	89
Gray Fox	4	11	0	0	15
Opossum	0	5	1	0	6
Armadillo	2	0	0	0	2
Bear	5	0	0	0	5
Rabbit	0	0	3	0	3
Alligator	0	0	5	5	10
Turkey	23	0	0	16	39
Subtotal	283	330	121	140	874
Wading Bird ^b	0	58	13	17	88
Human	12	2	1	4	19
Other ^c	2	12	11	3	28
Total	297	402	146	164	1009

a. Texas cougar, TX 101.

b. Photos indicate foraging behavior; not actual crossing. Species include great blue heron (*Ardea herodias*), little blue heron (*Florida caerulea*), green heron (*Butorides striatus*), great egret (*Casmerodius albus*), and snowy egret (*Egretta thula*).

c. Species include barred owl (*Strix varia*), black vulture (*Coragyps atratus*), common grackle (*Quiscalus sp.*), green anole (*Anolis carolinensis*), frog (*Rana sp.*), sphinx moth (*Celerio sp.*), domestic cat (*Felis catus*), and domestic dog (*Canis sp.*)

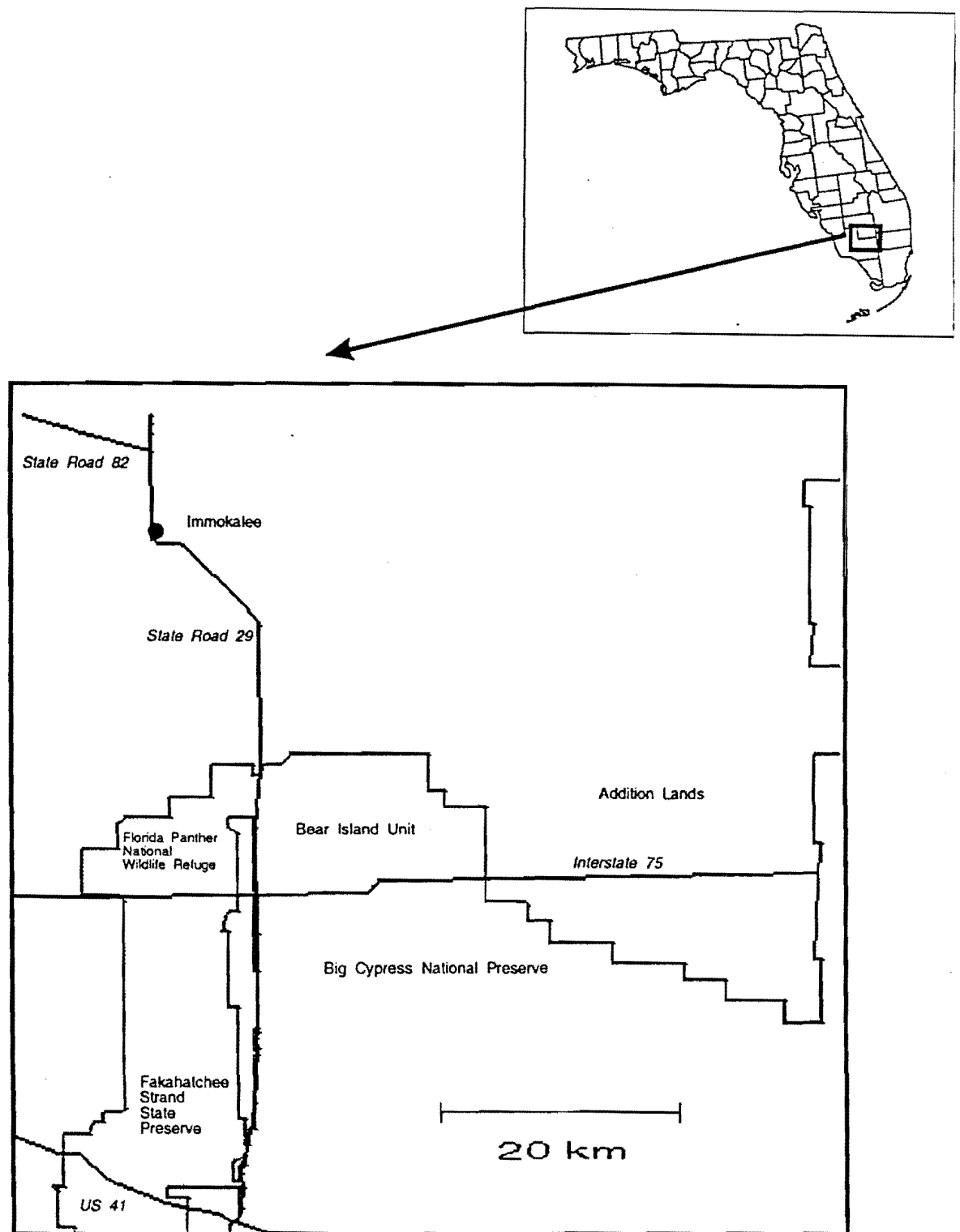


Fig. 1. Evaluation of SR 29 wildlife crossing study area in Collier County, FL showing the SR 29 and I-75 corridors.

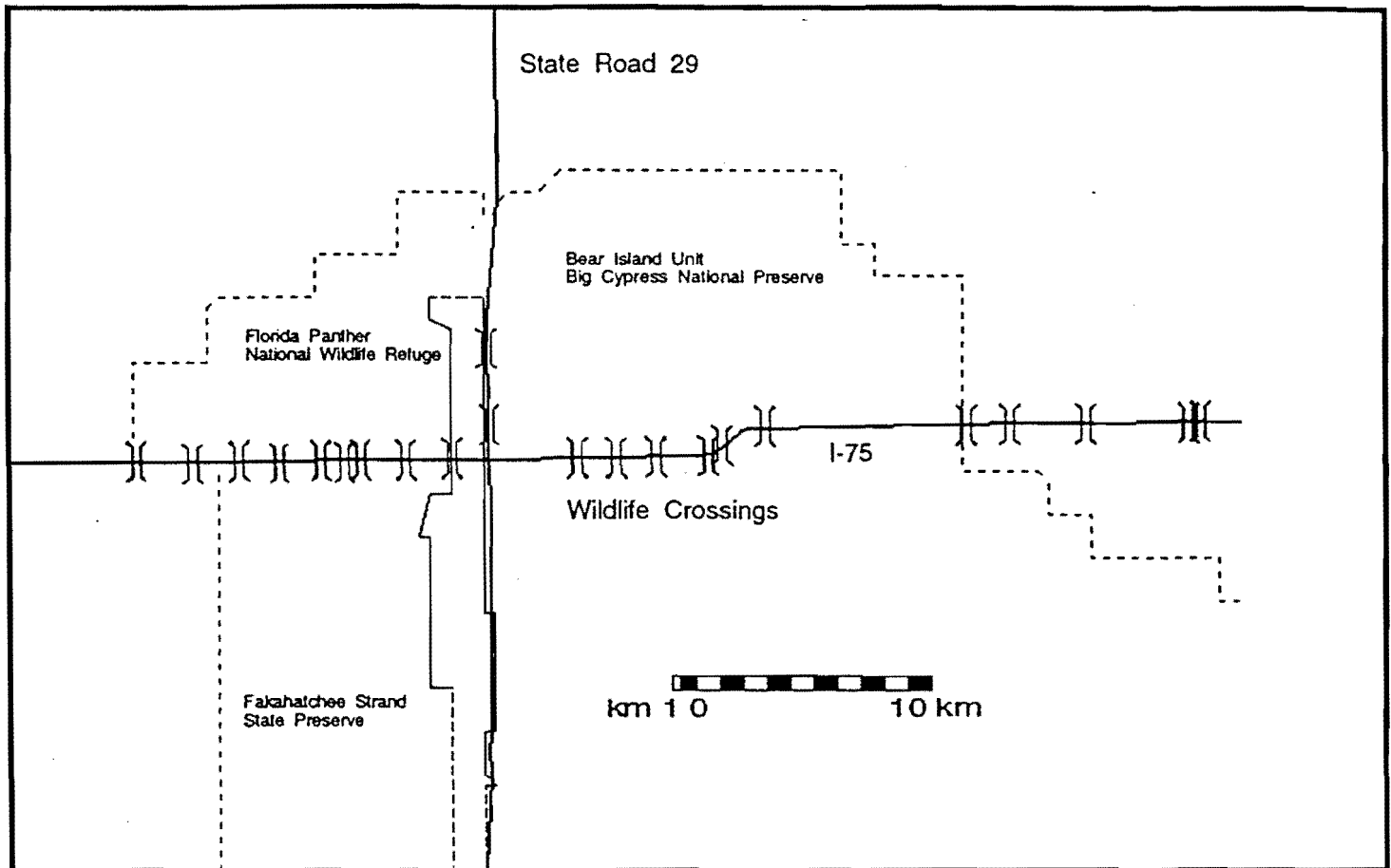


Fig. 2. Wildlife crossing locations along the SR 29 and I-75 corridors in the study area.

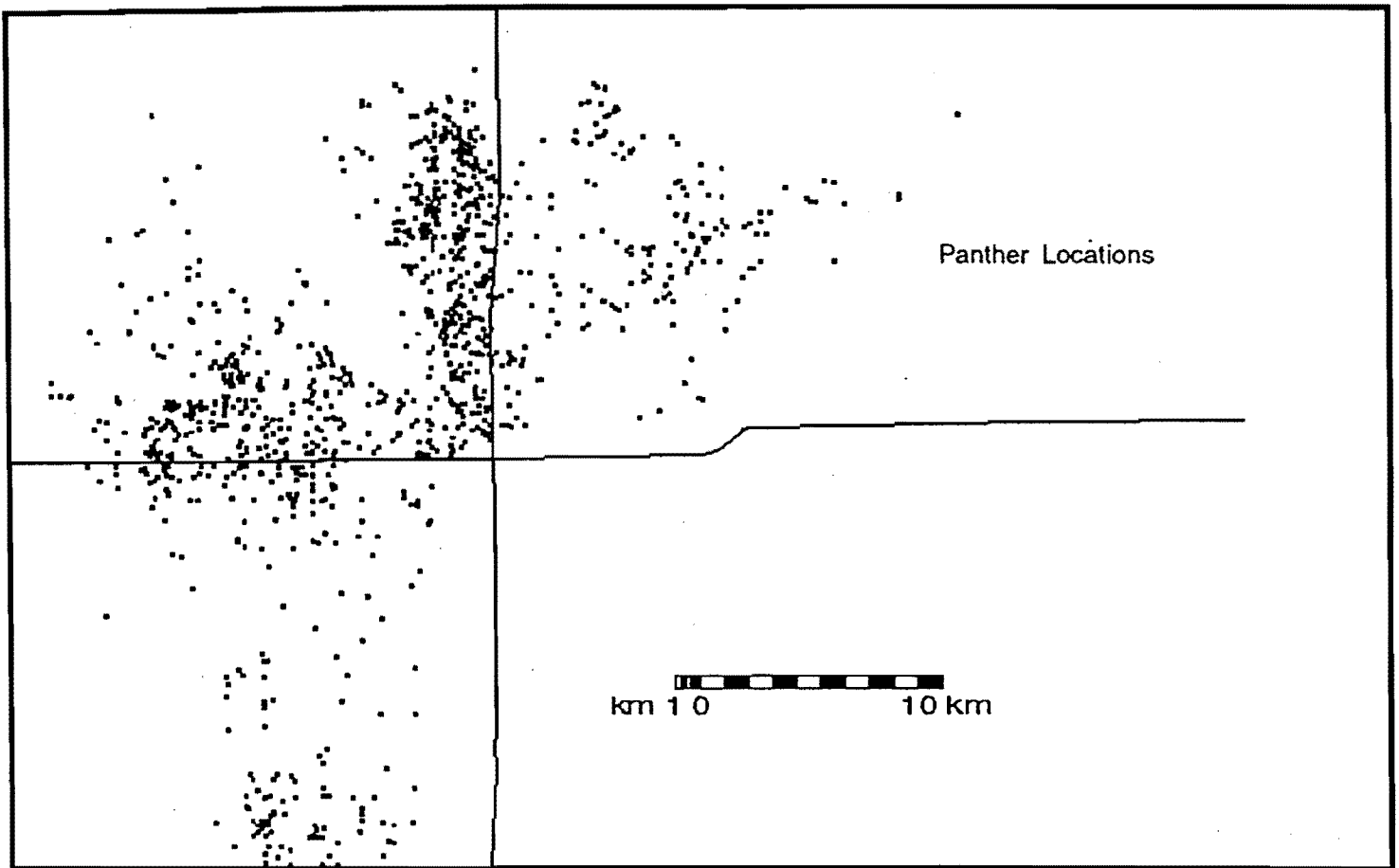


Fig. 3. Panther locations in the study area.

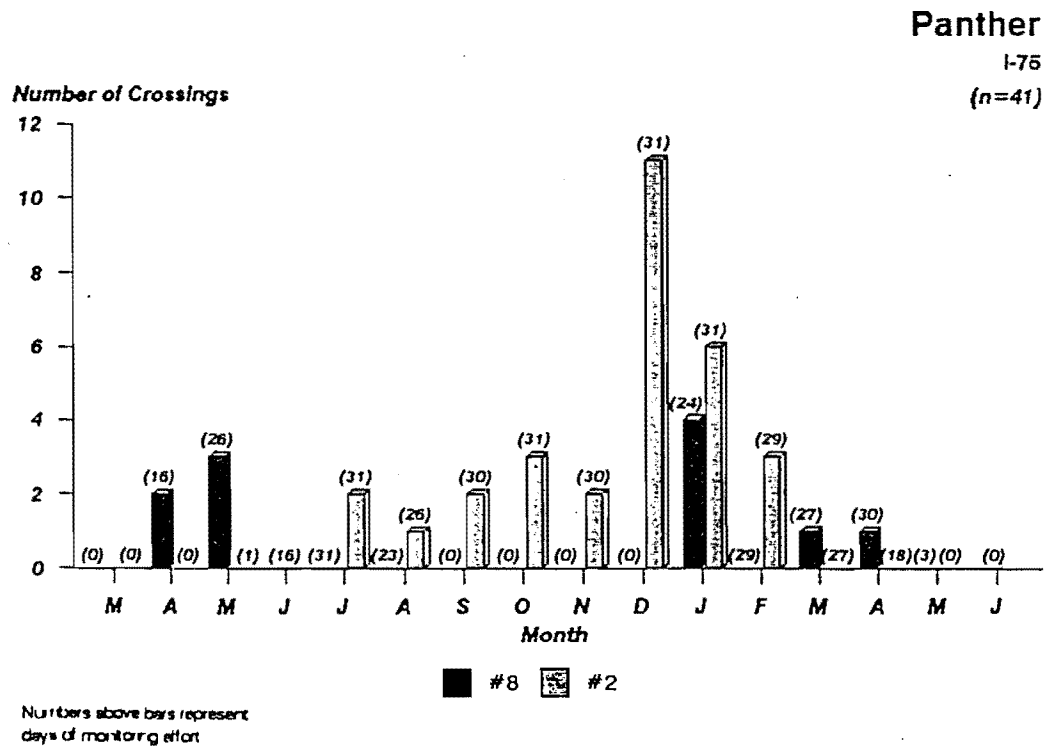
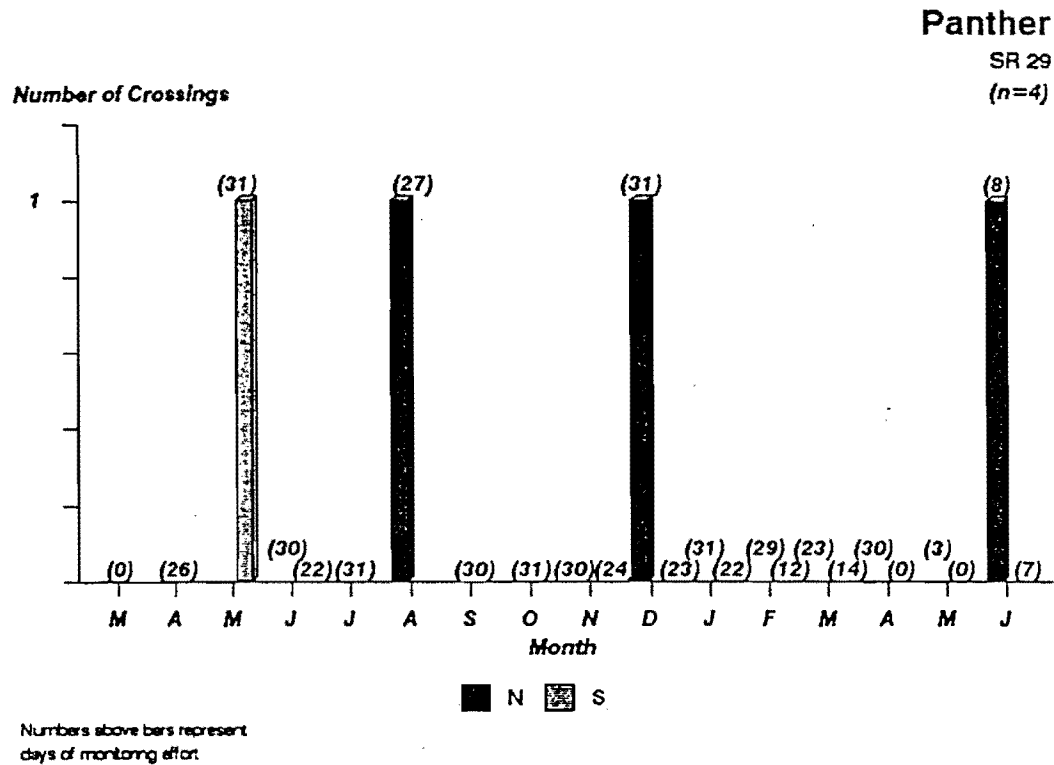


Fig. 4. Number of crossings per month by Florida panthers for each style of crossing from 27 March 1995 - 30 June 1996.

Comparison of Wildlife Crossing Use

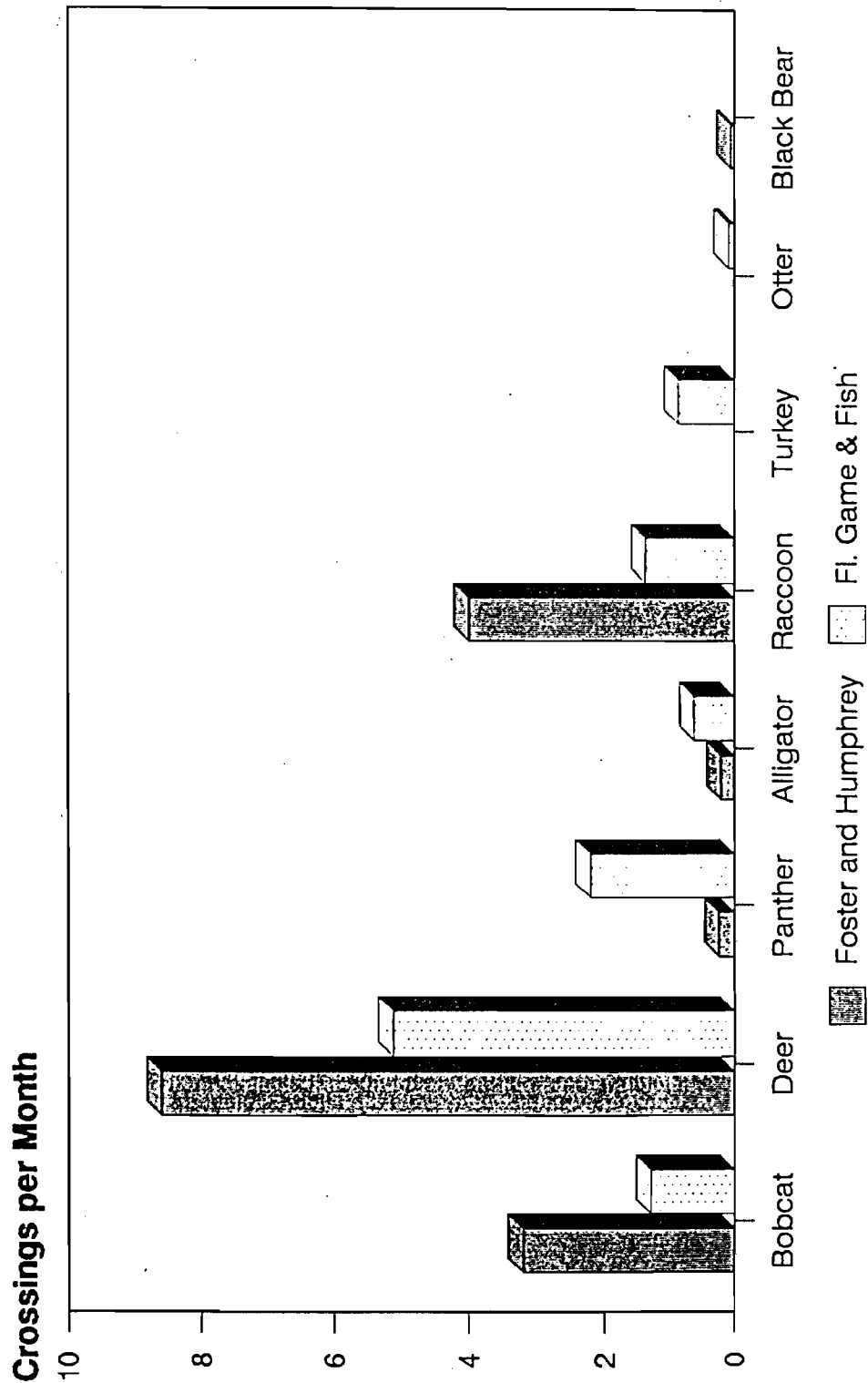


Fig. 5. Comparison of wildlife crossing use between Foster/Humphrey and GFC studies.

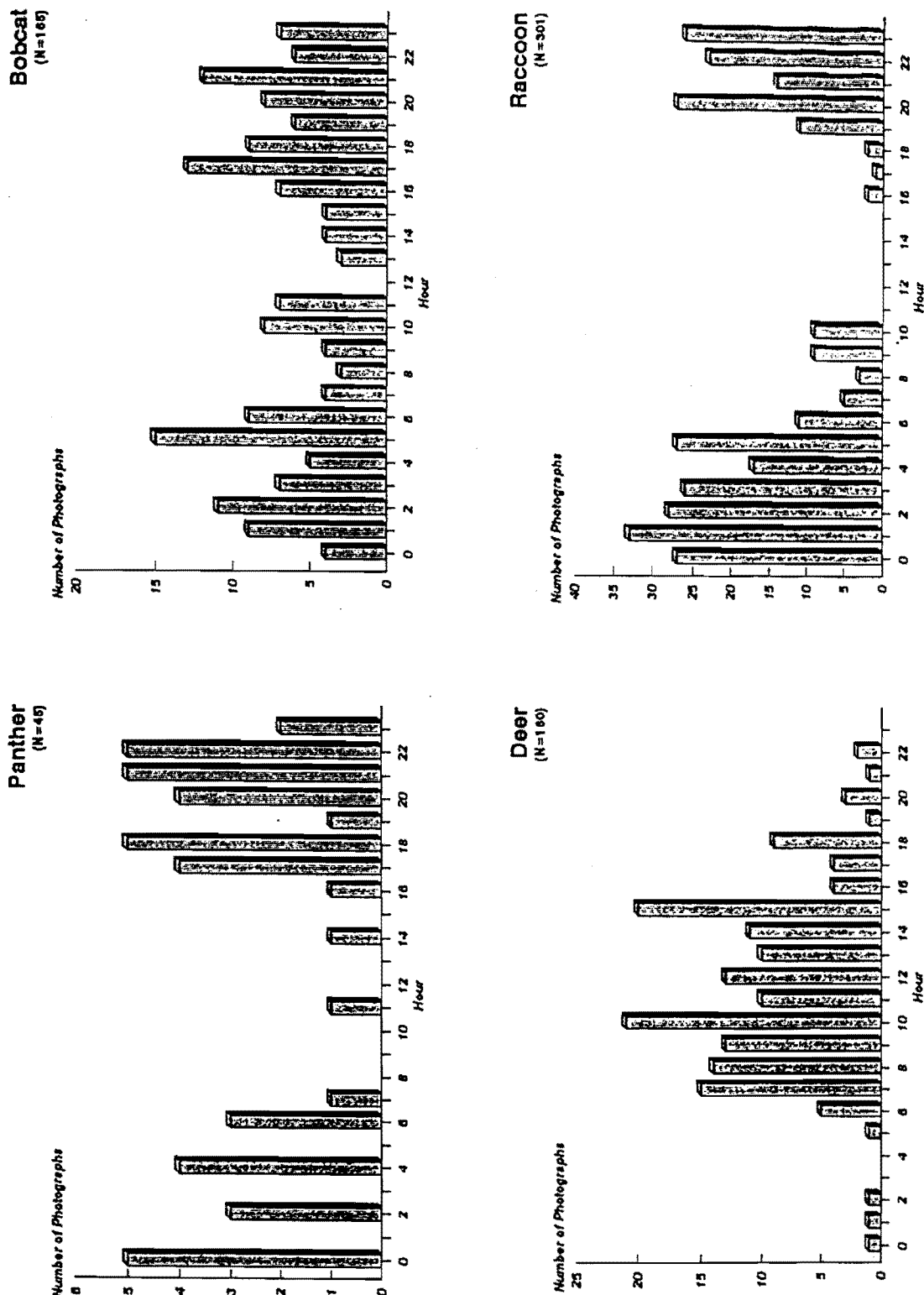


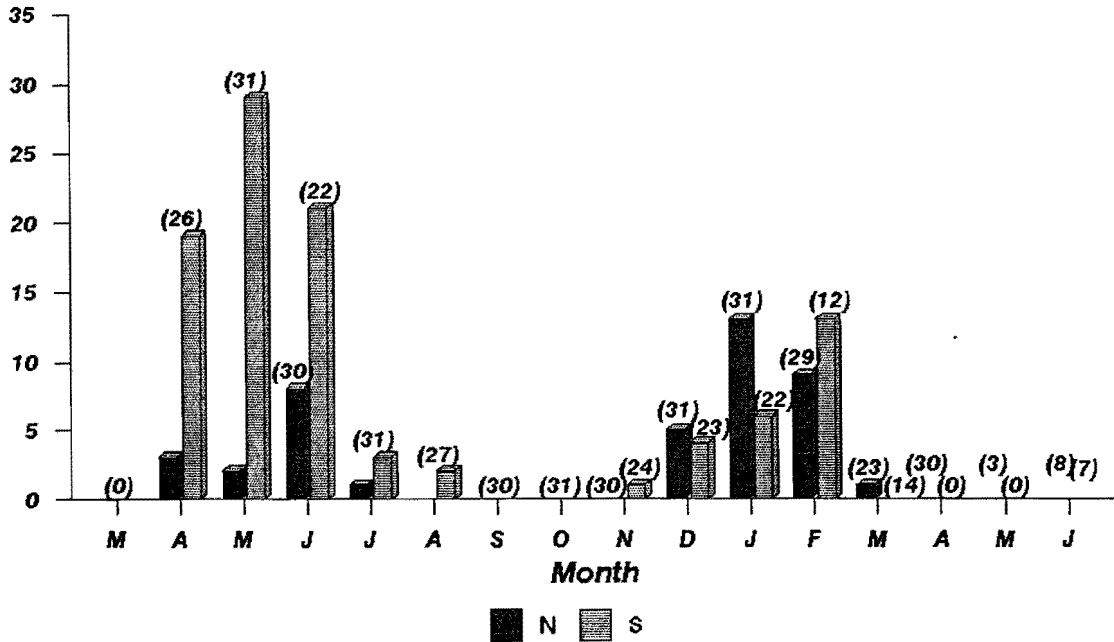
Fig. 6. Time of day of use of wildlife crossings by panther, bobcat, deer, and raccoon for all crossings from 27 March 1995 - 30 June 1996.

Bobcat

SR 29

(n=152)

Number of Crossings



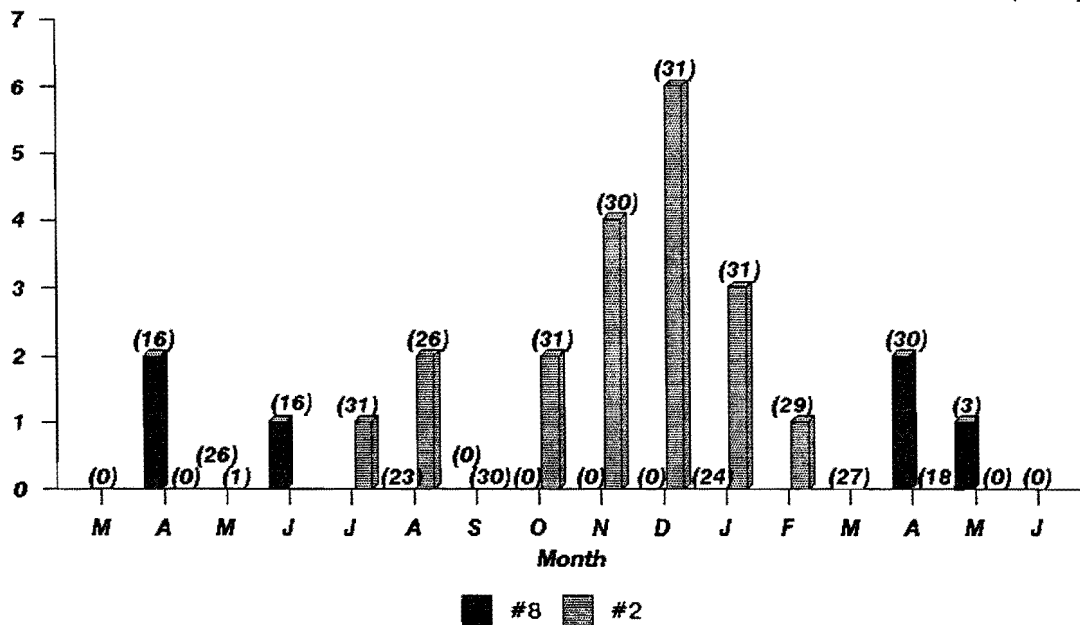
Numbers above bars represent
days of monitoring effort

Bobcat

I-75

(n=29)

Number of Crossings



Numbers above bars represent
days of monitoring effort

Fig. 7. Number of crossings per month by bobcats for each style of crossing from 27 March 1995 - 30 June 1996.

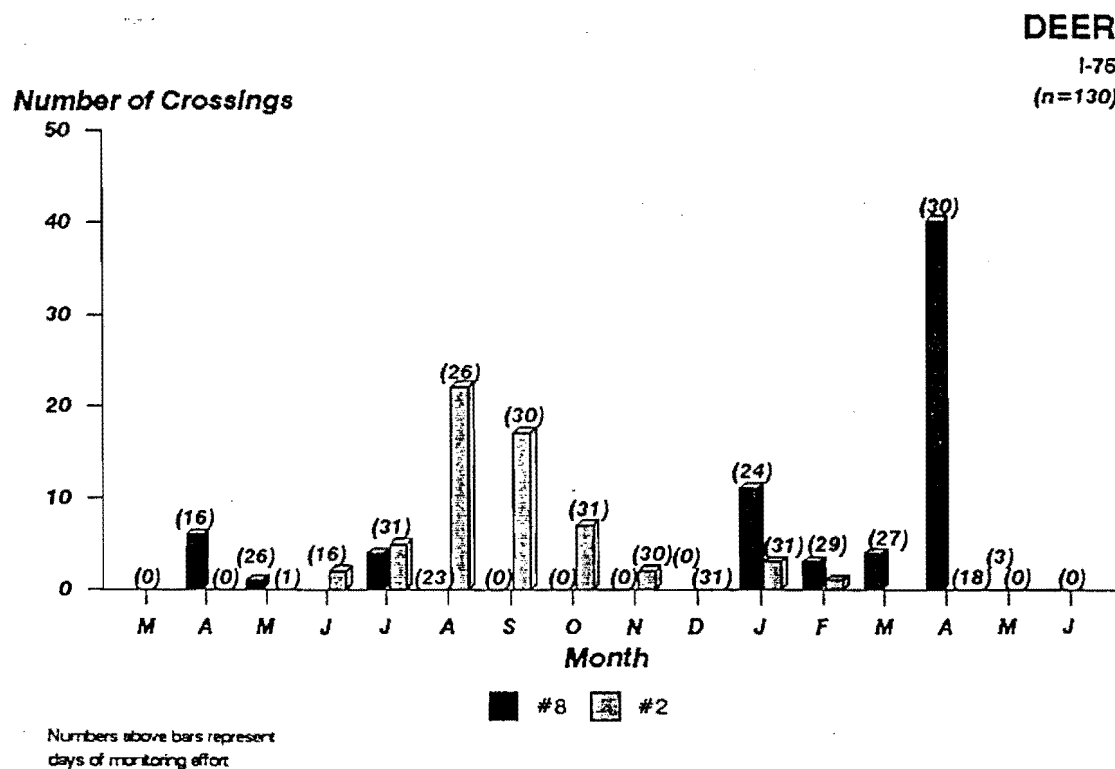
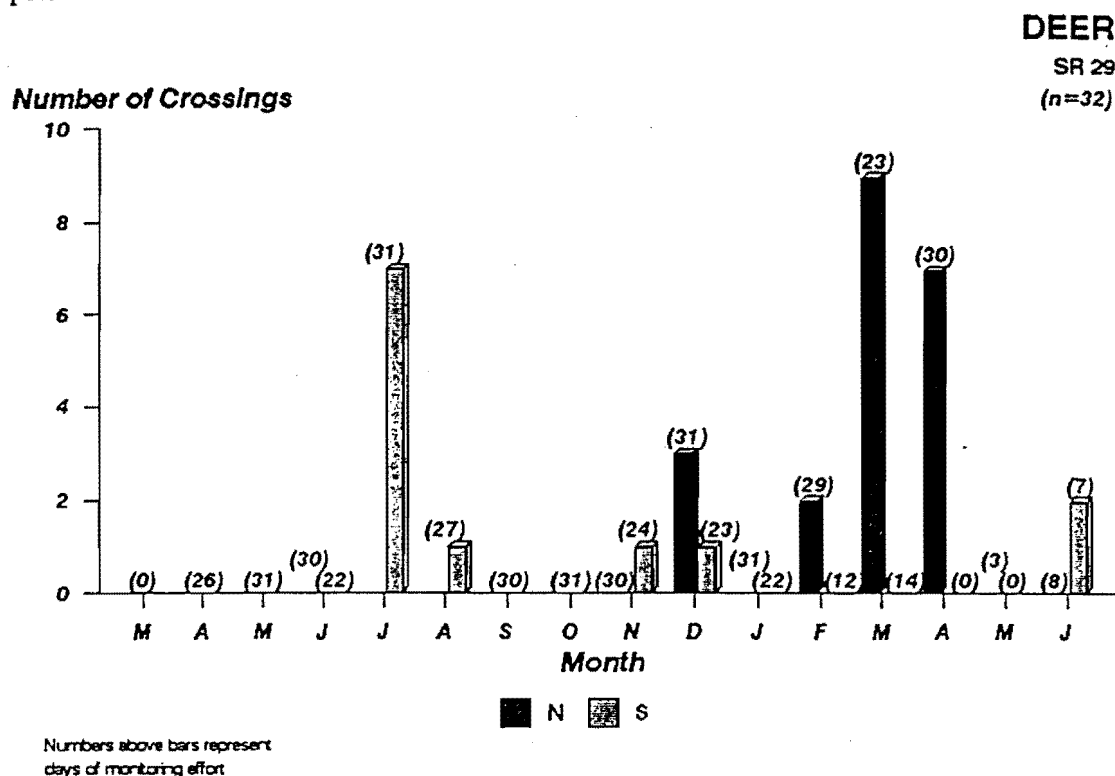


Fig. 8. Number of crossings per month by deer for each style of crossing from 27 March 1995 - 30 June 1996.

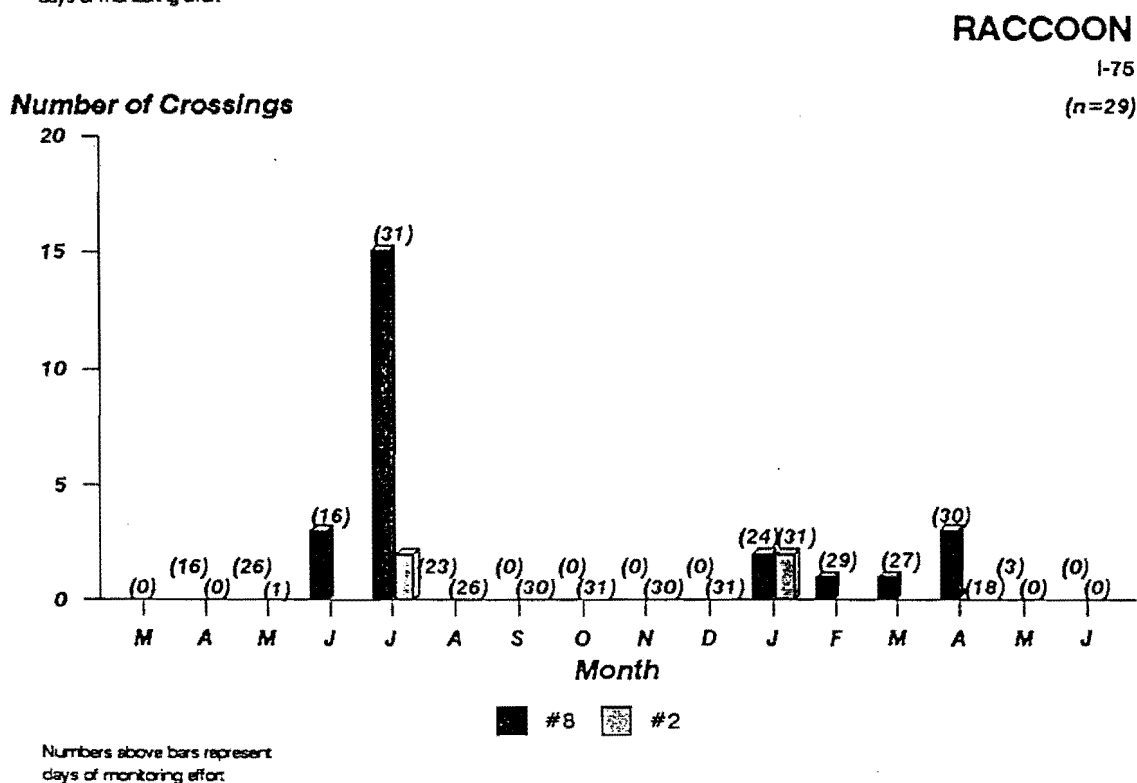
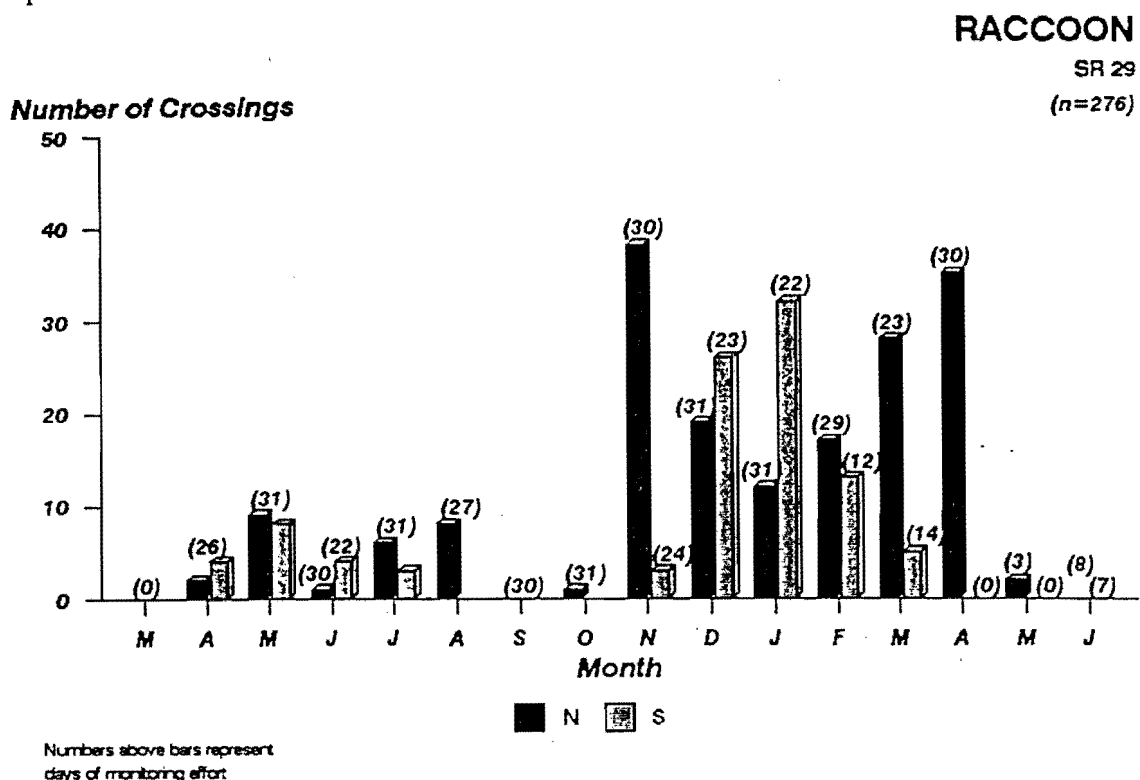


Fig. 9. Number of crossings per month by raccoons for each style of crossing from 27 March 1995 - 30 June 1996.

Appendix. Photographs of the two styles of wildlife crossings and species documented utilizing the structures.

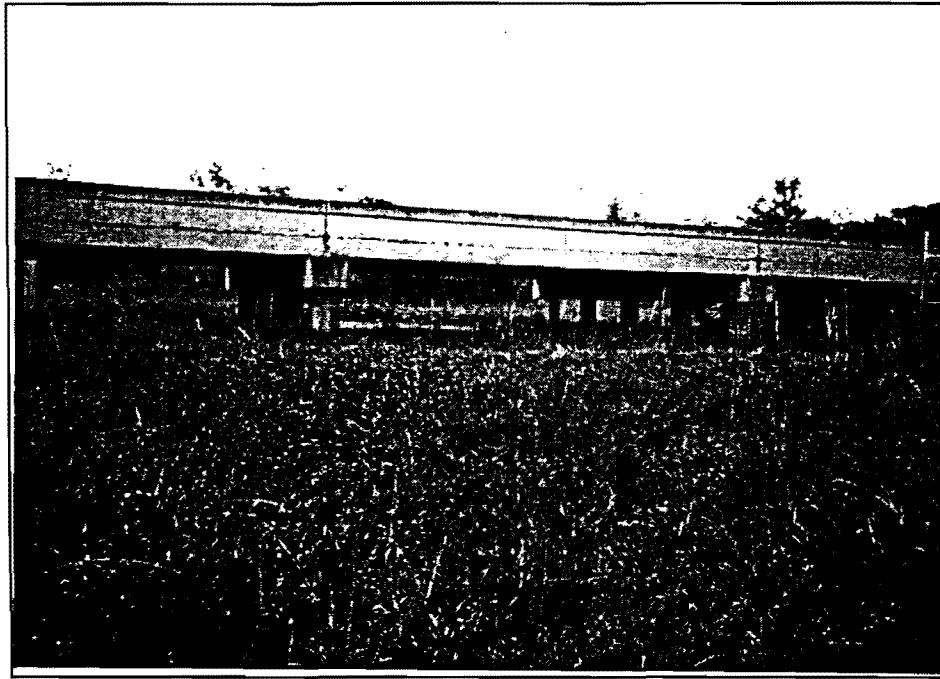


Fig. A1. I-75 wildlife crossing.

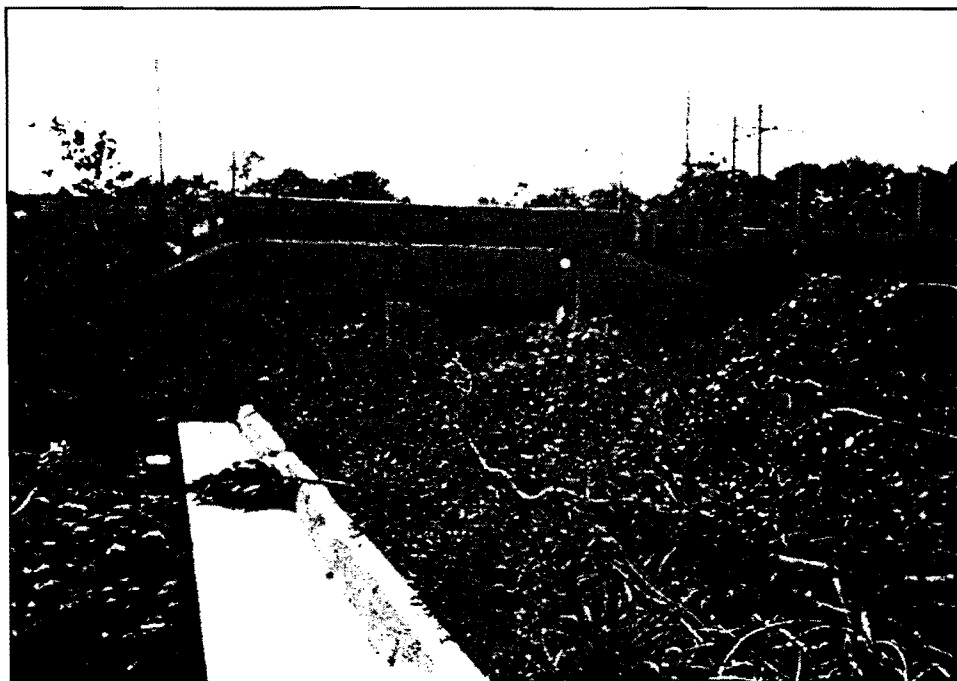


Fig. A2. SR 29 wildlife crossing.



Fig. A3. Bobcat.

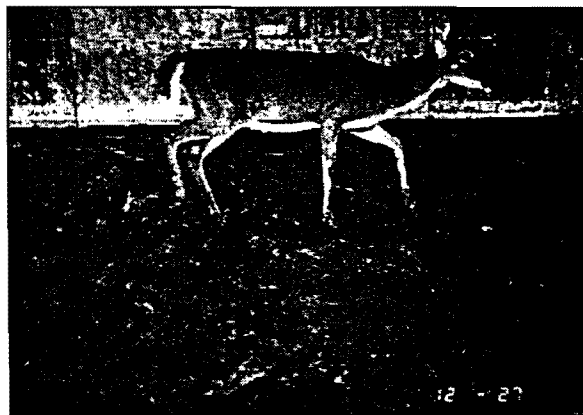


Fig. A4. White-tailed deer.

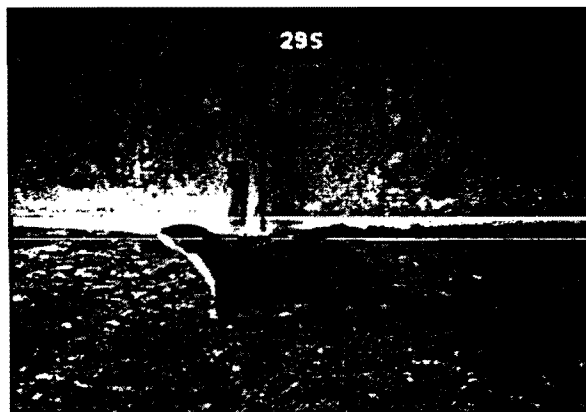


Fig. A5. Otter.



Fig. A6. Raccoon.



Fig. A7. Florida panther.



Fig. A3. Bobcat.

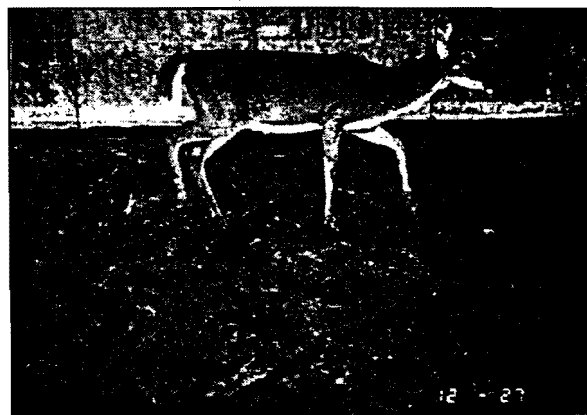


Fig. A4. White-tailed deer.

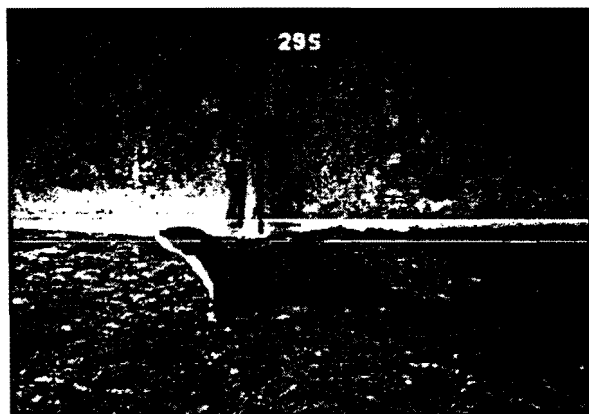


Fig. A5. Otter.



Fig. A6. Raccoon.



Fig. A7. Florida panther.