

**Evaluation of the S.R. 46 Wildlife Crossing in Lake
County, Florida**

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TITLE: EVALUATION OF THE S.R. 46 WILDLIFE CROSSING IN LAKE COUNTY, FLORIDA¹

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INTRODUCTION

Habitat loss is perhaps the greatest threat to the bear's future in Florida, but habitat fragmentation and roadkill mortality due to highways and vehicle traffic also pose serious threats. Gilbert and Wooding (1994) examined black bear roadkills in Florida from the period 1976-93, finding 12 areas in the state where black bear roadkills were concentrated.

The worst of the 12 problem sites occurred in Lake County on a portion of S.R. 46, a heavily traveled two-lane highway. A one-year study of bear crossings of S.R. 46 was completed in 1989 (Wooding 1990).

Construction on the S.R. 46 wildlife crossing began in the summer of 1994; it was completed in the first week of December, 1994. The crossing was located about 200 m east of C.R. 433 and 3.75 km west of the Wekiva River. State-owned property was on both sides of S.R. 46 at the crossing: Rock Springs Run State Reserve on the south and Seminole Woods State Forest on the north.

The inside dimensions of the crossing were 14.3 m long, 7.3 m wide, and 2.4 m tall. The floor of the crossing was at ground level, and the road was elevated over the culvert. This design was intended to allow animals to easily see through the opening. The floor of the crossing was dirt. Barrier fencing (3 m chain-link topped with three strands of barbed wire) was erected on publicly owned lands on both sides of the wildlife crossing and on both sides of the highway. The fencing extended 0.6 km to the west and 1.1 km to the east of the crossing; it ended where private property began.

The forests on each side of the crossing were modified to help bears find the crossing. The south side of the crossing was wooded. Two trails were bulldozed through the forest in the summer of 1995 to serve as walking paths that would lead bears to the crossing. The north side of the crossing, which had been open pasture, was planted in pines in 1993. The pines were planted in the shape of a funnel to guide bears to the wildlife crossing. Four trails were bulldozed in 1995 on the north side of S.R. 46 to serve as walking paths.

CROSSING EVALUATION

Field work was completed in two phases. The first phase was conducted from November, 1993 through June, 1995. This phase was administered and conducted by the Game and Fresh Water Fish Commission, Bureau of Wildlife Research. The second phase of the field work began

¹This report was excerpted from Roof and Wooding 1996.

in August, 1995 and ended in December, 1995. This phase was administered by the Florida Cooperative Fish and Wildlife Research Unit. No field work was performed in July, 1995, because of funding delays associated with the transition between agencies responsible for research administration.

Roadkill Survey

Animal roadkills squirrel-sized and larger were counted three times/week from 22 November 1993 through 30 December 1995 along 6.2 km of C.R. 46-A and 13.1 km of S.R. 46. This was considered the likely area of influence for the wildlife crossing and barrier fencing. Data recorded for each roadkill included species, date, and location. Carcasses were removed from the road after they were documented.

Seven bears were roadkilled on S.R. 46 and C.R. 46-A during the study period of November, 1993 - December, 1995. Two of the seven bears were killed before the wildlife crossing was built. No bears were killed in the fenced area during the study.

Roadkills of 37 other species were documented during 302 counts along 6.2 km of C.R. 46-a and 13.1 km of S.R. 46 (Table 1). The roadkills included 95 opossums, 74 raccoons, 25 rabbits, 22 armadillos, and 20 gopher tortoises.

Ninety-eight animals were roadkilled in the 11 month pre-fence period (1 December 1993 - 30 November 1994, minus July, 1994). Eighty-eight of these were killed outside the area that was to be fenced (17.5 km of highway), and 10 were killed in the 1.75 km area of the highway that was to be fenced (the 10 animals were two raccoons, three opossums, two rabbits, one deer, one armadillo, and one box turtle).

One hundred eighty-eight animals were killed in the 11 month post-fence period (1 December 1994 - 30 November 1995, minus July, 1995). One hundred seventy-five of these were killed outside the fenced area, and 13 were killed inside the fenced area (the 13 animals killed in the fenced area were three raccoons, four opossums, one rabbit, one armadillo, two box turtles, one cooter, and one gopher tortoise -- all are believed to have crawled under the fence). A chi-square analysis indicated that there was no significant difference in roadkills in the fenced area before and after the fence and wildlife crossing were completed ($P=0.332$, 1 df).

Although the fence was ineffective for keeping some of the smaller species off the road, it appeared that the fence was effective in keeping larger animals off the road. There were no instances in which bears, deer, foxes, or bobcats traveled under or over the fence, and there was only one instance out of 69 coyote fence encounters in which the coyote traveled under the fence (Table 2).

Animal/Fence Encounters

A 3 m wide strip of bare soil was disked along the outside of the fencing (the side of the fence opposite the road) to serve as a substrate for animal tracks. Bare soil extended at least 3 m past the end of the fence. Animal response to the barrier fencing was documented three times/week through observations of animal tracks in the soil. The tracks revealed the following: the number of animals that went over or under the fence to cross the road, the number that walked around the ends of the fence to cross the road, and the number that approached the fence but were turned by it and, thus, did not cross the road. Observations were recorded by species, date, and location. The track counts were conducted from 9 December 1994 to 29 December 1995.

Bears encountered the barrier fencing 50 times based on tracks observed in the dirt strip bordering the fencing (Table 2). There were no instances among the bear/fence encounters in which the bear attempted to either climb or dig under the fence. However, in two instances, bears walked around the end of the fence to cross the highway. Most (64%) bears encountering the fence walked the fence for <25 m before leaving the roadway. Only 20% of the bears walked the fence for ≥ 100 m. The greatest distances walked by bears were 400 m and 500 m. The first ended its fence walk by crossing S.R. 46 using the wildlife crossing and the second bear walked around the west end of the fence where it then crossed S.R. 46.

A total of 719 fence encounters were documented (Table 2). Fifty of these involved bears, as outlined above; the other 669 encounters involved 10 other species (Table 2).

Wildlife Crossing Use

Two methods were used to document animal use of the wildlife crossing. The first method used animal tracks visible in the dirt floor of the culvert. Track observations were made three times/week from 9 December 1994 to 29 December 1995. Data on species, date, and direction of travel were recorded. The second method used an automatic camera and infrared beam. The camera was mounted in the center of the tunnel at a height of 40cm. All animals that interrupted the infrared beam were photographed.

Twelve species were documented using the wildlife crossing (Table 2). Most crossings were made by rabbits (n=68), raccoons (n=61), armadillos (n=36), opossums (n=36), and gray foxes (n=29).

Bears crossed S.R. 46 using the wildlife crossing on five occasions. Bears entered the crossing on two other occasions, but they turned around in the structure and exited the way they entered. One bear approached the crossing entrance but turned around without entering.

Photographs were taken of each bear that entered the crossing. By comparing body size and marks on these bears, it was determined that at least six different bears entered the crossing.

Bear Movements

Bear movements in the study area were documented using radio telemetry. Trapping efforts were concentrated in the immediate vicinity of the wildlife crossing, with the intent of catching those bears that would most likely cross S.R. 46. Radio-collared bears were located three times/week from fixed-wing aircraft or from the ground. Movement data were collected for 41 bears (5,128 locations).

Sixteen (39%) of the 41 radio-instrumented bears were documented crossing highways in the study area a total of 105 times. The home ranges of the other 25 radio-monitored bears did not contain highways. Eight collared bears were documented crossing S.R. 46 at least 26 times after the wildlife crossing was completed. Only three (12%) of the 26 crossings were through the underpass. Many of the other highway crossings occurred 100-300 m west of the fence and at the Wekiva River.

CONCLUSIONS

Black bears and at least 11 other species safely traveled under S.R. 46 through the wildlife crossing. This indicates that the size and design of the structure was adequate as a wildlife crossing for a two-lane highway such as S.R. 46.

The barrier fencing was effective in keeping bears and other large mammals off the fenced section of highway. There were no bear roadkills in the fenced area, but five bears were killed in the unfenced area after the crossing was completed. Smaller animals were able to crawl through gaps under the fence, but this could be addressed in future projects by burying a few inches of the fence bottom. The fence height and design seems suitable for use on other highway projects where the goal is to keep animals off the road.

Most (64%) bears encountering the fence walked it for <25 m before leaving the roadway. The greatest distances that bears walked the fence were 400 m and 500 m. This information could be useful for determining wildlife crossing spacing in future projects. For example, if a situation required a series of wildlife crossings, the structures should be spaced no further than 1 km apart. They should be located at points where bears and other species cross the highway with the greatest frequencies. These locations can be predicted using landscape features, through the use of roadkill mortality data, and by other methods that document wildlife travel routes.

While the fence did not guide most bears to the wildlife crossing, it may be possible to funnel bears towards wildlife crossings by habitat modification. This was attempted on S.R. 46 by bulldozing several walking paths that converged at the crossing and by reforesting an open pasture on the north side of S.R. 46. These steps were not completed until the last six months of the study, and it may be several years before these steps actually guide animals to the crossing. If these steps work as hoped, bear use of the crossing will increase with time.

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Table 1. Species and numbers of roadkills on 13.1 km of S.R. 46 and 6.2 km of C.R. 46-A, November, 1993 - December, 1995.

Species	Number killed	Species	Number killed
Opossum	95	Turkey vulture	3
Raccoon	74	Black vulture	3
Rabbit	25	Gray fox	3
Armadillo	22	Water moccasin	3
Gopher tortoise	20	Unknown	2
Gray squirrel	16	Dog	2
Box turtle	11	Red shoulder hawk	2
Soft shell turtle	9	Cardinal	2
Bear	7	Starling	2
Deer	7	Coral snake	2
Domestic cat	6	Barred owl	1
Unknown snake	6	Alligator	1
Unknown bird	6	Eastern phoebe	1
Yellow rat snake	5	Meadowlark	1
Red rat snake	5	Nighthawk	1
Black racer	4	Pine snake	1
Cattle egret	4	Quail	1
Cooter	4	Rattle snake	1
Unknown turtle	3	Turkey	1

Table 2: Wildlife crossing use and the behavior of animals encountering the barrier fence on S.R. 46, December, 1994 - December, 1995.

Species	Crossed through crossing	Walked along fence ^a	Turned around ^b	Around end of fence	Under fence
Bear	5	13	30	2	0
Deer	2	313	18	22	0
Raccoon	61	162	3	4	4
Fox	29	31	2	0	0
Opossum	36	12	1	1	0
Coyote	4	63	1	0	1
Bobcat	27	37	0	1	0
Armadillo	36	19	0	0	0
Hog	0	7	0	1	0
Turkey	0	2	0	0	0
Alligator	0	1	0	0	0
Rabbit ^c	68				
Gopher tortoise ^c	2				
Snake ^c	12				
Cattle	1				
Egret ^c					

a: Animals that walked along the fence for >25m.

b: Animals that walked along the fence for <25m.

c: The response of these animals to the fence was not documented.