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Authors

Gilbert, Terry
Kautz, Randy
Eason, Thomas
et al.

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PRIORITIZATION OF STATEWIDE BLACK BEAR ROADKILL PROBLEM AREAS IN FLORIDA

Terry Gilbert (850-488-6661, gilberd@gfc.state.fl.us), Randy Kautz (850-488-6661, kautz@fwc.state.fl.us), Thomas Eason (850-413-7379, easont@fwc.state.fl.us), Robert Kawula (850-488-6661, kawular@fwc.state.fl.us), and Cory Morea (850-627-9674, moreac@fwc.state.fl.us), Florida Fish and Wildlife Conservation Commission, 620 South Meridian Street, Tallahassee, Florida 32399-1600. FAX (850) 922-5679

Abstract: Florida's population growth and tourism have created a demand for highway improvements that can seriously impact important habitat resources and fish and wildlife populations. This paper presents results of a cooperative effort by our agency in prioritizing the importance ranking of black bear roadkill areas for use by the Florida Department of Transportation (FDOT) in siting wildlife underpasses on a statewide basis, and for impact avoidance and mitigation. Our agency documented 729 known locations of black bear roadkills in Florida from 1976 through 1999. A GIS analysis revealed that approximately 34 percent of the roadkills were clustered at 15 chronic problem areas located in seven counties. We prioritized these problem areas by analyzing and evaluating the density, sex and age, and current history of bear roadkills. Landscape level habitat quality also was measured by creating a new statewide bear habitat map that represents a composite score for various GIS data layers depicting public lands, land cover types, habitat composition within large roadless areas, proximity to existing conservation areas, and habitat diversity. The roadkill problem area highway segments were digitized, and a 30-km-wide buffer zone was created and overlaid on the habitat map to determine a mean score. The values for the seven roadkill and habitat parameters were normalized and a total score was determined to compare and rank the 15 roadway segments. State Road 46 in Lake County was ranked as the highest priority in the state for the placement of a wildlife underpass, followed by SR-40 in Marion County in the Ocala National Forest, and US-98 in Jefferson County near the Aucilla River in North Florida's Big Bend region.

Introduction

Florida's population is now over 15 million people, while about 40 million tourists visit the state annually. Population growth, coupled with residential and commercial development and tourism, have created a strong demand for new roads or improvements, which can seriously impact important habitat systems and the fish and wildlife populations they support. Direct, secondary, and cumulative impacts of roads are well known (Wooding and Brady 1987, Mader 1984, Skoog 1982) and include loss of habitat, habitat fragmentation or degradation, and road mortality. In order to address these problems, the Florida Fish and Wildlife Conservation Commission (FWC) works in cooperation with the Florida Department of Transportation (FDOT) to avoid, minimize, or mitigate the impacts of highways on fish and wildlife resources. Our agency biologists provide technical assistance during the highway planning phase by recommending alternate alignments and designs on new roads or improvement projects to enhance habitat connectivity, protect large habitat systems on public and private lands, and reduce roadkills. A top mitigation priority in this ongoing effort is public land acquisition to increase the size of protected areas of high quality habitat.

This paper presents the results of a cooperative effort in 2000 by our agency to provide a prioritized importance ranking of black bear roadkill areas to FDOT for guidance in siting wildlife underpasses on a statewide basis, and to better focus our agency efforts in impact avoidance and mitigation. The Florida black bear, which is listed by our agency as a threatened species, serves as a good focal species for transportation-related habitat connectivity and mortality issues because black bears utilize habitat at the landscape level. Bears also serve as an umbrella species for numerous other mammals, amphibians, and reptiles that occur in similar plant community types, and would benefit from highway structures installed to overcome the barrier effects of roads.

Methods

We prioritized 15 black bear roadkill problem areas (Gilbert and Wooding 1996) by analyzing and evaluating the roadkill history and the landscape level habitat quality at each site. This was accomplished by converting existing statewide natural resource data, including public lands, Florida black bear Strategic Habitat Conservation Areas (SHCAs) (figure 1), and a ranked Florida black bear habitat map (figure 2) (Cox et. al. 1994, Kautz and Cox 2000) into a GIS (ARCVIEW Version 3.2) grid (196 m pixel).



Fig. 1. Florida public lands as of April 2001 and Florida black bear strategic habitat conservation areas (Cox et al. 1994).

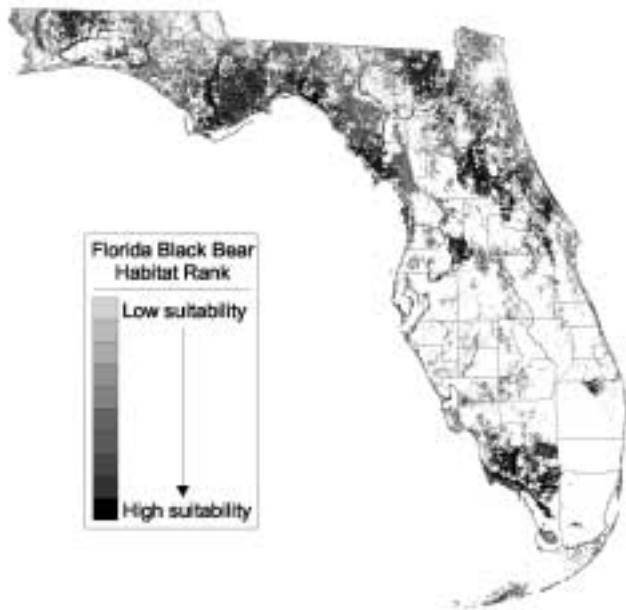


Fig. 2. Florida black bear habitat ranked according to habitat preference, proximity of black bear habitat to large parcels of public land, roadless area patch size, and cover type diversity (Cox et al. 1994)

The data layers depict public conservation lands; strategic habitat areas on private land in need of protection or acquisition; and a bear habitat map scored 1 to 10 based on land cover types, proximity to conservation areas, habitat composition within large roadless areas, and habitat diversity. The public conservation lands and strategic conservation areas grids were merged together to create a single grid in which lands that were either in public ownership, or were a strategic habitat were given a value of "1", and all other areas were given a value of "0". Then, the public lands/strategic habitats grid was added to the scored black bear habitat grid to

produce a grid with values ranging from 1 to 11. Scores of 11 reflected areas of Florida that were considered to be high quality habitats occurring on public land or within a strategic habitat. Scores of 1 reflected low quality bear habitat not occurring on public land or in a strategic habitat. The merged data layers resulted in a new scored statewide resource map that places greater emphasis on both existing and potential conservation lands available to bears, and shows defined areas where bear habitat protection and land acquisition should occur. The highway segments representing the problem areas were then digitized, and buffered outward 15 km. The result was a 30-km-wide elliptical zone around each problem area which was overlaid on the habitat map to determine a mean buffer habitat score.

We also re-analyzed the bear roadkill data, which were systematically collected statewide by our agency from 1976 through 1999 to determine the current roadkill history at each problem area. Seven parameters were calculated for each problem area, and a total value was determined using the following formula to compare and rank the roadway segments: (% of total statewide road kills) + (% of kills in the past 10 years) + (kills per mile) + (adult female kills per mile) + (mean buffer habitat score) + (% of buffer encompassed by conservation lands) + (% of buffer composed of the bear SHCA). To account for differences in scale, the scores were normalized by taking each value as a percentage of the total values within each column for each parameter.

Results and Discussion

Based on our analysis, black bear vehicle collisions occurred statewide, but tended to cluster at 15 chronic bear roadkill problem areas. The 15 roadkill problem areas varied in length from 2.4 to 34.0 miles, and collectively totaled 130 highway miles with a mean length of 8.7 miles. The problem areas were located within four FDOT Districts (1,3,5,7), which included Lake, Marion, Gulf, Hernando, Highlands, Jefferson, and Collier counties. Approximately 34.4 percent of the 729 bear roadkills with known kill locations recorded by our agency from 1976 through 1999 occurred within the problem areas.

Table 1 is the prioritized list, while figure 3 depicts the actual location of the 15 chronic bear roadkill problem areas ranked according to the total sum of the normalized scores for each parameter. According to our analysis, the roadkill problem area on SR-46 in Lake County should receive the highest priority for construction of wildlife underpasses, followed by SR-40 through the Ocala National Forest, and US-98 in Jefferson County near the Aucilla River. The results of this study are now being used to address underpass placement to improve habitat connectivity of natural systems bisected by roads, and to reduce highway mortality of the black bear and other wildlife. FDOT began design work for the construction of a new wildlife underpass for the black bear on SR-46 in Lake County in the spring of 2000.



Fig. 3. Locations of 15 roadkill problem area highway segments prioritized with respect to Florida black bear roadkill history and landscape level habitat quality. Problem areas are shown in relation to primary and secondary ranges of black bear subpopulations in Florida.

Table 1
 Prioritized list and associated values and scores of 15 chronic black bear roadkill areas.

Table 1. Prioritized list and associated values and scores of 15 chronic black bear roadkill areas.

Rank	Total Score	Road	County	Length (Miles)	Total # Bear Kills	% of All Kills (Value)	% of All Kills (Score)*	% Kills Last 10 Years (Value)	% Kills Last 10 Years (Score)*	Kills/Mile (Value)	Kills/Mile (Score)*
1	76.85	S. R. 46	Lake	5.90	41	5.62	18.33	70.70	6.81	6.95	16.75
2	68.45	S. R. 40-E	Marion	4.50	24	3.29	9.56	75.00	7.22	4.90	11.81
3	60.08	U. S. 98	Jefferson	8.30	11	1.51	4.39	63.65	6.32	1.75	4.22
4	58.90	S. R. 40	Lake	5.70	27	3.70	10.75	77.80	7.49	4.74	11.42
5	56.89	S. R. 40-W	Marion	2.40	8	1.09	3.17	75.00	7.22	3.33	8.02
6	47.30	S. R. 19-S	Marion	4.80	15	2.06	5.98	80.00	7.70	3.13	7.54
7	47.13	S. R. 44	Lake	6.70	16	2.47	7.38	77.65	7.49	2.69	6.48
8	45.78	S. R. 29	Collier	24.30	13	1.78	5.17	76.90	7.40	0.53	1.28
9	41.58	S. R. 19-N	Marion	4.20	12	1.65	4.80	66.70	6.42	2.86	6.89
10	40.42	U. S. 41	Collier	34.40	21	2.88	8.37	71.45	6.37	0.61	1.47
11	37.42	C. R. 42	Lake	5.30	12	1.66	4.82	58.30	5.61	2.26	5.45
12	35.79	U.S. 27-N	Jefferson	8.00	19	2.60	7.86	89.50	8.62	2.38	5.73
13	31.67	S. R. 71	Gulf	6.50	9	1.23	3.57	68.70	6.42	1.38	3.33
14	27.43	U. S. 27-S	Highlands	6.70	13	1.78	5.17	76.90	7.40	1.94	4.67
15	24.50	U. S. 19	Hernando	3.90	8	1.09	3.17	12.50	1.20	2.05	4.94
+	46.67	Average	--	8.67	16.73	2.29	6.67	69.25	6.67	2.77	6.67
--	700	Total	--	130.00	251	34.41	100	+	100	41.50	100

*To account for differences in scale, scores were derived by taking each value as a percentage of the total values within its column.

Table 1 Continued.

Rank	Road	Adult Female Kills/Mile (Value)	Adult Female Kills/Mile (Score)*	Buffer Score (Value)	Buffer Score (Score)*	% Buffer in CLs** (Value)	% Buffer in CLs** (Score)*	% Buffer in SHCAs (Value)	% Buffer in SHCAs (Score)*
1	S. R. 46	2.03	20.88	3.08	4.15	24.37	3.58	10.69	8.35
2	S. R. 40-E	1.63	16.77	7.42	10.02	79.49	11.57	1.83	1.43
3	U. S. 93	0.49	4.94	6.02	8.11	29.35	4.31	35.85	28.00
4	S. R. 40	0.53	5.45	6.76	9.13	73.04	10.72	5.03	3.93
5	S. R. 40-W	1.25	12.86	6.85	9.23	64.72	8.50	8.57	6.69
6	S. R. 19-S	0.42	4.32	6.60	8.89	68.85	10.11	3.52	2.75
7	S. R. 44	0.30	3.09	4.25	5.73	37.53	5.31	14.93	11.66
8	S. R. 29	0.24	2.16	4.87	6.56	55.19	8.10	19.34	15.10
9	S. R. 19-N	0.48	4.94	5.89	7.93	65.99	9.69	1.17	0.91
10	U. S. 41	0.12	1.23	6.09	8.20	61.80	12.01	2.89	2.26
11	C. R. 42	0.19	1.95	4.25	5.73	42.87	6.29	9.68	7.56
12	U.S. 27-N	0.25	2.57	5.06	6.82	2.34	0.34	5.32	4.15
13	S. R. 71	0.31	3.19	4.54	6.12	12.46	1.83	9.23	7.21
14	U. S. 27-S	0.75	7.72	1.42	1.91	3.76	0.55	0.00	0.00
15	U. S. 19	0.77	7.92	1.11	1.50	38.29	5.77	0.00	0.00
+	Average	0.65	6.67	4.95	6.67	45.41	6.67	8.54	6.67
-	Total	8.72	100	74.23	100	681.09	100	128.05	100

** CL = Public Conservation Lands

This information is also currently being used in the decision making process to prioritize habitat protection and mitigation efforts associated with our review of highway improvements, and it indicates where public land acquisition is needed to benefit the bear on a regional and statewide basis. At the request of our agency's land acquisition staff, we have provided our study results to the state's Conservation and Recreational Lands program to help justify the purchase of a 22,260-acre tract associated with the Aucilla River Project in the Big Bend area of north Florida. This tract ranked third on our priority list, and public acquisition would provide long-term benefits for the bear and many other species of wildlife.

In conclusion, while our experience has shown that use of wildlife underpasses at strategic locations is sometimes necessary to reduce roadkills and maintain habitat connectivity, a strong commitment to public land acquisition, habitat protection, and proper land management are also paramount actions which are essential in order to successfully enhance the long-term survival potential of the black bear in Florida.

Biographical Sketch: Terry Gilbert has been employed as a wildlife biologist in Tallahassee with the Office of Environmental Services of the Florida Fish and Wildlife Conservation Commission for the past 25 years. He performs impact assessments and provide technical assistance to state and federal agencies on large scale development projects such as highways, channel dredging, mining, and residential and commercial developments in an effort to avoid, minimize or mitigate impacts to fish and wildlife resources in both fresh water and marine habitats. Terry earned his B.S. in forestry and wildlife ecology from the University of Florida, and his M.S. in wildlife management and fisheries from Auburn University.

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