PERFORMANCE REPORT – FINAL

As required by

STATE WILDLIFE GRANTS PROGRAM

TEXAS

State Wildlife Grant T-8

PROJECT 21: DEMOGRAPHY AND HABITAT SELECTION OF THE ALLIGATOR SNAPPING TURTLE, *MACROCHELYS TEMMINCKII*, IN THE MIDDLE TRINITY RIVER ECOSYSTEM

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November 10, 2010

ABSTRACT

Because of apparently declining populations throughout its range, there is considerable conservation concern for alligator snapping turtles. Despite their status as the largest freshwater turtle in the United States, we lack baseline data on populations throughout much of their geographic range. Focusing on Gus Engeling Wildlife Management Area (WMA) and Keechi Creek WMA in the Middle Trinity River Basin, we sampled for turtles using modified fyke traps, hoop nets and box traps. Between 2006 and 2009 we had a total effort of 1,239 net nights at Gus Engeling WMA and 88 net nights at Keechi Creek WMA. We have captured a total of 13 alligator snapping turtles at Gus Engeling WMA and 3 at Keechi Creek WMA. Alligator snapping turtles occur in very low densities at both sites and are also represented by very young age class turtles. The shallow water habitats at both sites may preclude higher densities and larger individuals. We used gradient analysis to determine habitat use by alligator snapping turtles in relation to other species of turtles at Gus Engeling WMA. The turtle community at Gus Engeling WMA is structured along gradients based on flow, substrate, and emergent vegetation, and is tied to Catfish Creek. Turtle communities at Keechi Creek WMA, which has lower habitat diversity, exhibit lower species richness and increased overlap of resource use than Gus Engeling WMA.

PERFORMANCE REPORT

State: Texas **Grant Number:** T-8

Grant Title: Wildlife Research

Program: Wildlife

Project No. and Title: Demography and Habitat Selection of the Alligator Snapping Turtle, (*Macrochelys Temminckii*) In the Middle Trinity River Ecosystem

Report Period: September 1, 2009 through September 30, 2010

I. INTRODUCTION

The alligator snapping turtle (*Macrochelys temminckii*) is a large, long-lived, fully aquatic species restricted to the southeastern United States. Because of a combination of its demographic lifestyle (long-lived, late maturing) and historic exploitation through largely unregulated harvest, this species is currently of conservation concern throughout most of its geographic range. In Texas, alligator snapping turtles are considered a state-threatened species. Despite these concerns, few data exist regarding baseline characteristics for populations in Texas. In 2006, West Texas A&M University and Texas Parks and Wildlife Department entered into a cooperative project in the Middle Trinity River Basin to better understand the life history of alligator snapping turtles, the possible interactions between terrestrial and aquatic management practices, and composition of aquatic turtle communities in this river basin.

II. BACKGROUND

Very little information is present in the literature on population dynamics of the alligator snapping turtle anywhere in its range. Most known work on alligator snapping turtle populations has been summarized for southeastern States. It is our intent to begin filling the knowledge gaps for the alligator snapping turtle on the western portion of its range. We propose to collect data at several sites and in several aquatic habitat types (larger rivers and smaller tributaries, oxbow lakes, and reservoirs) to better understand the ecology of alligator snapping turtles in Texas.

The methodology used for capturing alligator snapping turtles also results in the capture of all other aquatic turtles present at survey sites. Ancillary capture data was used to develop a baseline of aquatic turtle community structure. These aquatic turtle communities include the Ouachita map turtle, *Graptemys ouachitensis*, Mississippi map turtle, *G. psuedogeographica*, and the chicken turtle, *Deirochelys reticularia*, which are all listed as priority species on the Texas Comprehensive Wildlife Conservation Strategy. Given that all *Graptemys* were also listed in Appendix III of CITES by USFWS in December 2005, research on these species is particularly relevant.

The 10 year Land & Water Resources Conservation and Recreation Plan challenges TPWD with better understanding the natural resources associated with rivers, streams,

and springs, specifically by monitoring and researching aquatic species whose status is unknown. Our attempt to learn more about life history characteristics of the alligator snapping turtle, and habitat use and partitioning of all aquatic turtle species addressed those goals. Given these data gaps, our specific objectives were 1) Develop population estimates for alligator snapping turtles on WMAs of the Middle Trinity River Ecosystem Project, 2) Characterize the demography (with special emphasis on reproduction/ recruitment) of alligator snapping turtles (and other turtle species encountered) on the same areas, and 3) Develop a model of habitat variables that correlate with habitat use and selection by alligator snapping turtles (and other turtle species encountered) on these WMAs.

III. PROCEDURES

We intended to sample all aquatic habitat types on Gus Engeling Wildlife Management Area (WMA), and Keechi Creek WMA. Extensive flooding in 2007 precluded sampling of many areas on all WMA's, so we intensified effort on Gus Engeling WMA in 2008 to more adequately sample that site. In 2009 we shifted more effort to Keechi Creek WMA. Sampling was done using a variety of turtle sampling gear, including 0.91 m x 1.2 m modified fyke traps (= large fyke nets), 0.6 m x 0.91 m modified fyke traps (= mini fyke nets), 1-m hoop nets (= large hoop nets), 0.5-m diameter hoop nets (= mini hoop nets), 0.6 m x 0.45 m x 0.2 m box traps, and 0.97 m x 0.64 m x 0.51 m dome traps. Traps were baited with sardines or fresh fish, set in the afternoon and checked the next morning. Additional turtles were captured by hand during fortuitous encounters while doing other activities on the areas.

Data collected at each trap site included: habitat type, substrate, depth, stream flow, and canopy cover. Indirect gradient analysis (Detrended Correspondence Analysis) was used to determine spatial segregation of turtle species across Gus Engeling WMA. Detrended Correspondence Analysis uses a reciprocal averaging approach where species scores are based on the abundance of each species at each site. Direct Gradient Analysis (Canonical Correspondence Analysis) allowed us to add a multiple linear least-squares regression step to overlay environmental variables thus determining relationships of species abundances with their position along an environmental gradient. These variables are either displayed as discrete variables or points (habitat type) or continuous variables or vectors (substrate, flow, canopy cover, etc).

Five major aquatic habitat types (Creek, Backwater, Marsh, Lake, and Pond) are found at Gus Engeling WMA, while only two (Creek and Backwater) were observed at Keechi Creek WMA. We used Pianka's Indices of Niche Overlap to test for effects of decreasing habitat heterogeneity on species richness and resource use. Results of these indices are given as a 0 to 1 scale with 0 denoting no overlap of measured resources and 1 complete overlap of measured resources.

Species, sex, mass, and basic morphometric measurements (carapace length, plastron length, plastron width at the pectoral/abdominal seam) were recorded for all turtles captured. All species of Emydid and Kinosternid turtles were given individual marks by

notching the marginal scutes. Passive Integrated Transponder (PIT) Tags were placed in the hind leg of snapping turtles and softshell turtles.

IV. RESULTS

We had a total effort of 1,239 net-nights (1 net set for 1 night = 1 net-night) at Gus Engeling WMA and 88 net-nights at Keechi Creek WMA from 2006-2009. Total effort for this project resulted in 650 captures of 577 individuals representing 8 species at Gus Engeling WMA and 110 captures of 94 individuals representing 5 species at Keechi Creek WMA (Table 1). Net capture success for Gus Engeling WMA was 0.38 turtles/net-night and 1.3 turtles/net night for Keechi Creek WMA. Of these totals, there were 5 captures of alligator snapping turtles at Gus Engeling and 3 captures at Keechi Creek WMA.

We made 14 captures of 13 individuals of alligator snapping turtles at Gus Engeling WMA. Mean straight-line carapace length for those individuals was 214 mm (range: 44-319 mm). Sex and age ratio at Gus Engeling WMA was 0 males:1 female:12 juveniles. One individual captured in 2007 was captured again in 2009, distance from original capture point was ~100 m away. Growth between captures, based on straight-line carapace length, was 45 mm. We captured 3 alligator snapping turtles at Keechi Creek WMA, with a mean straight-line carapace length of 239 mm (range: 201-303 mm). Sex and age ratio at Keechi Creek WMA was 0 males:1 female:2 juveniles.

Indirect gradient analysis does reveal a strong spatial segregation of turtles, particularly among con-familial species, such as the two species of snapping turtles and three species of mud and musk turtles (Figure 1). When environmental variables are overlaid upon species scores in a direct gradient analysis we see that that segregation lies along both a gradient related to flow and emergent vegetation (Figure 2). In particular alligator snapping turtles at Gus Engeling WMA are most closely associated with creek habitat exhibiting flow, high percentage canopy cover, little to no emergent vegetation, and deeper water with sandy substrate.

Gus Engeling WMA exhibits a much higher degree of heterogeneity among aquatic habitats than does Keechi Creek WMA. In turn, Gus Engeling WMA exhibits higher species richness (Table 1). In general, larger net gear was most successful in trapping turtles, but smaller net gear was particularly useful for sampling eastern mud turtles, common snapping turtles, river cooters, and sliders (Table 2). Most particularly, river cooters were only captured in box trap. Based on species distributions amongst habitats, Gus Engeling WMA had a lower overlap index (0.651) than Keechi Creek WMA (0.869) among species shared between the two sites. This suggests that as habitat heterogeneity decreases, overlap in resource use among species will increase while species richness decreases. Additionally, turtles at Keechi Creek WMA tended to be larger than turtles at Gus Engeling WMA (Table 3).

V. ANALYSIS

Our failure to detect many alligator snapping turtles at Gus Engeling WMA is beginning to cause us some concern. Although they have been reported from the area by others, in four years of sampling (1,239 net-nights) we have managed to capture only 13 alligator snapping turtles at Gus Engeling WMA. All but one has been a juvenile. Normally, when alligator snapping turtles are present, they are relatively easy to capture using the methods we have employed. It may be that Catfish Creek is not ideal habitat for alligator snapping turtles, as it is fairly shallow during times of normal flow. Continually capturing new juvenile individuals though suggests recruitment is happening somewhere within the Middle Trinity River Basin. It may be that juveniles are using these smaller tributaries as refugia or nursery habitats. Although one capture in 2009 was a hatchling turtle that most likely born in late 2008. The one female turtle captured was at the minimum size of maturity for the species, so some limited reproduction may be taking place.

Our alligator snapping turtle captures for Keechi Creek were somewhat better. We sampled Keechi Creek WMA both in 2006 and 2009 for a total of 88 net nights and 3 alligator snapping turtle captures. Still, no large turtles were captured and only one of the three was of reproductive size. Dramatic fluctuations in water depth on Keechi Creek may preclude many larger individuals from occurring there.

Our trap success for alligator snapping turtles using large net gear types was 0.025 captures/net-night at Gus Engeling WMA and 0.065 captures/net-night at Keechi Creek WMA. In 1999, sampling at the same sites using similar net gear resulted in capture successes of 0.067 captures/net-night at Gus Engeling WMA and 0.178 captures/net-night at Keechi Creek WMA (Lee Fitzgerald, Texas A&M University, unpublished data). This apparent change in alligator snapping turtle abundance at both sites is troubling and suggests population declines even though the turtles are technically protected on these areas. Continued monitoring of these populations seems warranted.

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The turtle community at Gus Engeling WMA does exhibit structuring along a gradient originating along Catfish Creek then dispersing out from backwater and marsh habitats to man-made impoundments. Species richness decreases with increasing distance from Catfish Creek. This suggests that the turtle community at Gus Engeling is dependent upon Catfish Creek. The absence of chicken turtles at Gus Engeling WMA is of great concern, as they have been captured there as recently as the early 1990's, but none were captured by us during this study.

At Keechi Creek we observed a decrease in species richness with a decrease in habitat heterogeneity. Aquatic habitats at Keechi Creek WMA are the creek itself and an extensive oxbow lake. Missing from the turtle assemblage are the marsh dwelling eastern mud turtle, and river cooter, and the generalist common musk turtle. Common musk turtles normally occupy all aquatic habitats, although there seems to be some division of habitat use between it and its con-familials the eastern mud turtle and razorback musk turtle. Competition among these three species may be constraining common musk turtles to habitats not used by the other two at Gus Engeling WMA. At Keechi Creek WMA

there may not be enough marginally habitat unoccupied by razorback musk turtles to allow for the co-existence of common musk turtles.

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Date: November 10, 2010

Table 1. Number of captures and individuals for each aquatic turtle species captured at Gus Engeling Wildlife Management Area (1,239 net-nights plus fortuitous encounters), Anderson County, Texas, and Keechi Creek Wildlife Management Area (88 net-nights), Leon County, Texas, 2006-2009.

	Gus Engeling WMA		Keechi Creek WMA	
Species	Captures	Individuals	Captures	Individuals
Alligator Snapping Turtle	14	13	3	3
Common Snapping Turtle	29	25	5	5
Common Musk Turtle	26	26	0	0
Razorback Musk Turtle	51	46	4	4
Eastern Mud Turtle	22	20	0	0
Slider	491	430	90	74
River Cooter	6	6	0	0
Spiny Softshell	11	11	8	8
TOTAL	650	577	110	94

Table 2. Captures per net night partitioned by large (large hoop + fyke nets) and small (mini hoop, box, and dome traps) net gear for turtles captured at Gus Engeling Wildlife Management Area, Anderson County, Texas, and Keechi Creek Wildlife Management Area, Leon County, Texas, 2006-2009.

Species	Gus Engeling WMA		Keechi Creek WMA	
	Large net gear (434 net nights)	Small net gear (805 net nights)	Large net gear (46 net nights)	Small net gear (42 net nights)
Alligator Snapping Turtle	0.025	0.001	0.065	0
Common Snapping Turtle	0.018	0.019	0.087	0.024
Common Musk Turtle	0.035	0.006	0	0
Razorback Musk Turtle	0.062	0.016	0.087	0
Eastern Mud Turtle	0.009	0.021	0	0
Slider	0.207	0.325	1.065	0.833
River Cooter	0	0.004	0	0
Spiny Softshell	0.012	0.002	0.152	0

Table 3. Sex specific mean straight-line carapace lengths (SCL) at Gus Engeling Wildlife Management Area, Anderson County, Texas, and Keechi Creek Wildlife Management Area, Leon County, Texas, 2006-2009. Juveniles were excluded from calculations.

Species	Gus Engeling WMA				Keechi Creek WMA			
	Male		Female		Male		Female	
	n	Mean SCL (mm)	n	Mean SCL (mm)	n	Mean SCL (mm)	n	Mean SCL (mm)
Common Snapping Turtle	14	260.8	11	243.3	3	300	2	249.7
Alligator Snapping Turtle			1	319			1	303.0
Eastern Mud Turtle	13	84.7	8	88.1				
Razorback Musk Turtle	18	123.5	28	106.0	1	133.8	2	101.6
Common Musk Turtle	6	56.4	19	73.4				
Spiny Softshell Turtle			10	351.4			8	394.3
River Cooter	1	242.4	3	273.1				
Slider	132	165.6	166	202.1	50	178.4	17	213.3

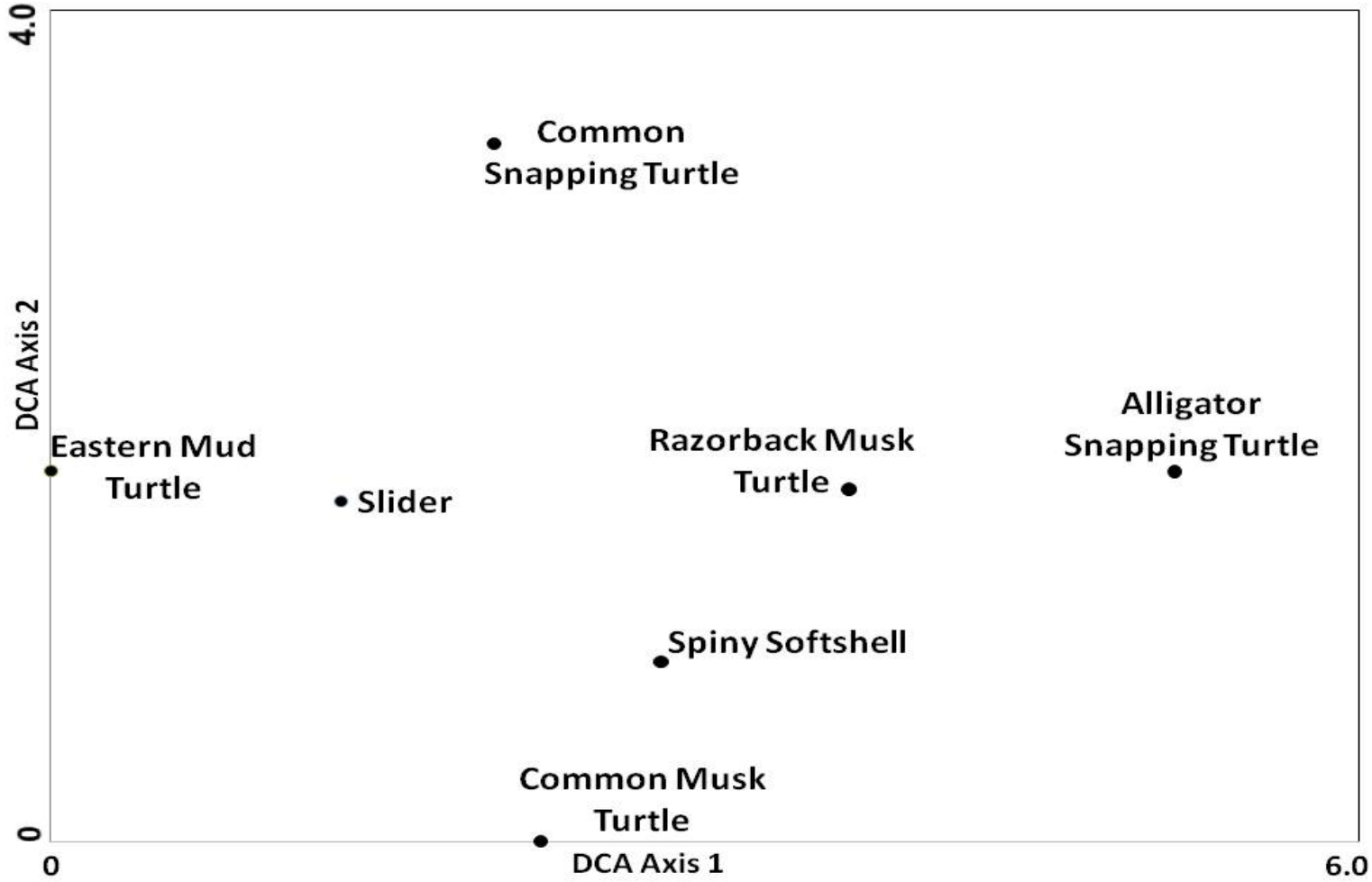

Figure 1. Axis 1 and Axis 2 of a Detrended Correspondence Analysis of the turtle community at Gus Engeling Wildlife Management Area.

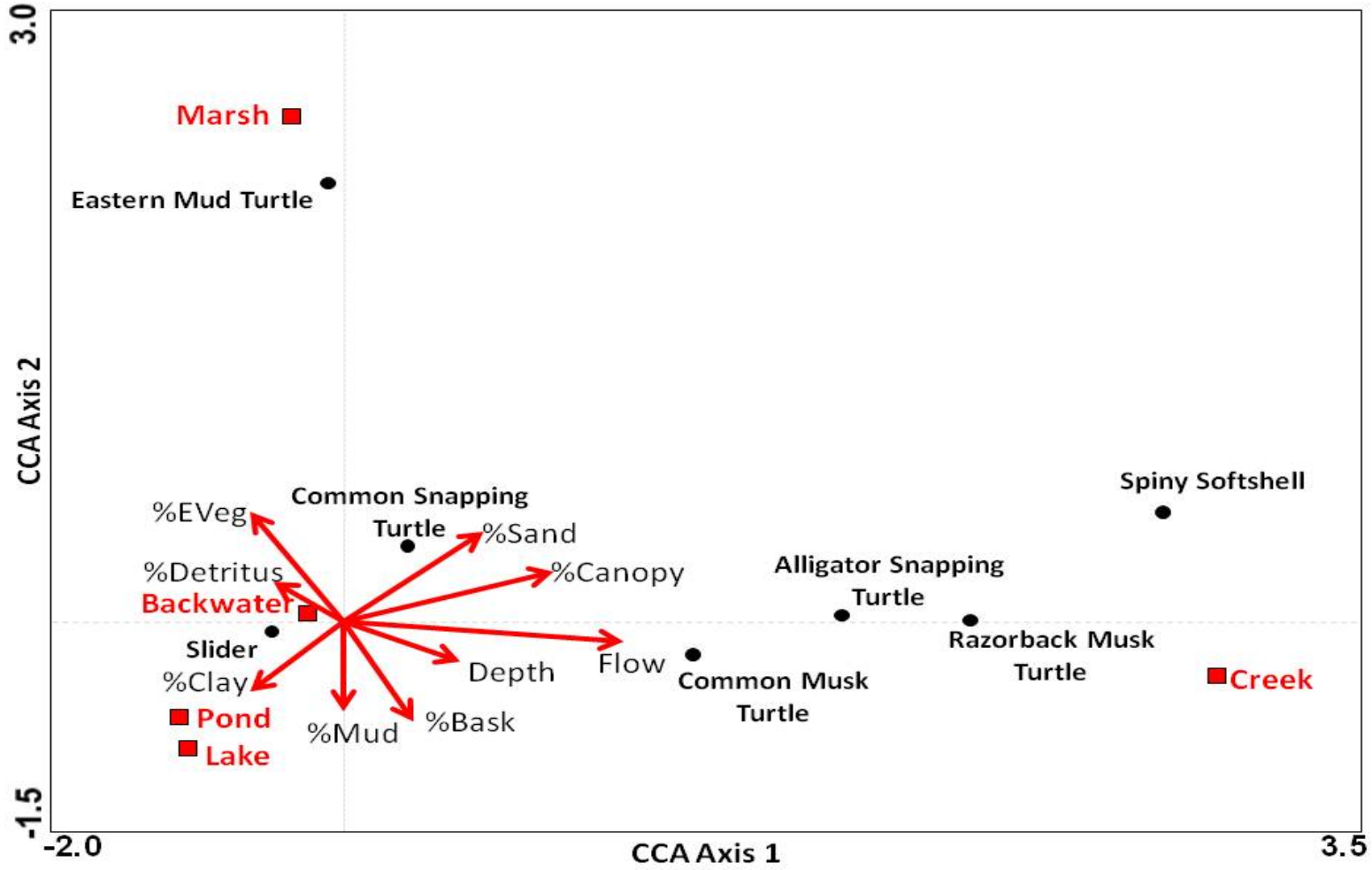

Figure 2. Axis 1 and Axis 2 of a Canonical Correspondence Analysis of the turtle community at Gus Engeling Wildlife Management Area, 2007-2009. Species scores are labeled dots. Discrete variables are labeled squares. Continuous variables are labeled vectors.