

June 27, 1997

Dear Mr. Miller:

Here is a copy of my thesis paper. Thank you so much for your help and cooperation with this project.

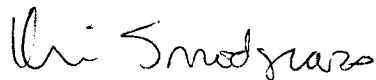
I should let you know that the results of the trapping that I did were not included in the paper because I could not get enough data. I unfortunately could not have traps open at four sites, all about 70 miles apart from each other, frequently enough to get good data, or data that would give a reasonably accurate indication of prey availability. Although I was very much interested in prey availability for local coyotes, frankly it was enough work for another thesis project.

For what it's worth, the species I caught most frequently on Padre Island were fulvous harvest mice, keeled earless lizards, ground skinks, and lots of invertebrates (ghost crabs, spiders, beetles, scorpions, and ants). I also caught one pocket gopher, a northern pygmy mouse, a Texas brown snake, and a Great Plains rat snake (these were all caught in the dunes).

The checklists of fauna for Padre Island mention the possibility of the presence of other rodents including the spotted ground squirrel, kangaroo rat, rice rat, white-footed mouse, grasshopper mouse, and the cotton rat. I saw, but did not catch, spotted ground squirrels and kangaroo rats (no mystery that they exist on the island). I did not see or catch cotton rats but am confident of their abundance on Padre based on the contents of coyote scats collected there. I feel much less confident of the presence of rice rats, white-footed mice, and grasshopper mice, but again, I didn't do very much trapping.

Thanks again!

Sincerely,

A handwritten signature in cursive script, reading "Keri Snodgrass".

Keri Snodgrass

FOOD HABITS OF COYOTES (*Canis latrans*) ON BARRIER ISLANDS

By

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May, 1997

A Thesis Submitted
In Partial Fulfillment of the
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IN BIOLOGY

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Abstract: The seasonal and geographical variation in the foraging habits of coyotes (*Canis latrans*) in south Texas was investigated. Approximately 1,600 coyote scats were collected and analyzed from two barrier islands and two mainland sites from June, 1995 to May, 1996. Mammals, primarily rodents, were the dominant prey remains identified in scats collected throughout the year from the four sites. A greater variety of prey including birds, reptiles, fish, and crabs were represented in barrier island scats. Coyote diets changed with the season according to prey availability. The frequency of fruit and insect remains in scats increased during summer and fall whereas the frequency of mammal, bird, and reptile remains generally increased during winter and spring.

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INTRODUCTION

Coyotes (*Canis latrans*) are often described as opportunistic predators (Murie 1940, Fitcher et al. 1955, Ozoga and Harger 1966, Bekoff 1977, Johnson and Hansen 1979, Gese et al. 1988, Toweill and Anthony 1988). Numerous studies report seasonal variations of prey remains in coyote scats or stomachs, such as fruit or ungulate fawns, that correspond to the seasonal abundance of those items (Korschegan 1957, Best et al. 1981, Todd et al. 1981, Bowyer et al. 1983, Andelt 1985, Ortega 1987, Litvaitis and Harrison 1989).

Some biologists disagree with the 'opportunistic predator' description and suggest that coyotes are selective and practice optimal foraging (Clark 1972, Johnson and Hansen 1979a, Todd et al. 1981, MacCracken and Hansen 1987). MacCracken and Hansen (1987) reported that the diet of coyotes in Idaho consisted of the more profitable foods (based on energy and protein content of the food, digestibility, and body size); consumption of less profitable foods depended on the abundance of the most profitable foods. Ozoga and Harger (1966) found that white-tailed deer (*Odocoileus virginianus*) were the preferred prey of coyotes in Michigan even when lagomorphs were abundant.

Literature on coyote foraging also reflects the adaptability of the coyote to various climates and habitats. The frequency of prey remains reported in coyote foraging studies from different locations varies significantly. Notably, the occurrence of white-tailed deer in coyote scats and stomachs ranges from 0% in central Oklahoma (Best et al. 1981) to approximately 90% in northern Michigan (Ozoga and Harger 1966).

The ability to adapt, coupled with the extirpation of larger predators, has contributed to the expansion of the range of the coyote. A plethora of literature on the subject of coyote foraging concerns adaptations to local conditions and the effects of predation on prey populations.

The coyote is the only large predator to successfully occupy the barrier islands of Texas, although there have been no studies documenting the diets of coyotes on these barrier islands. The purpose of this project was to document the seasonal diet of barrier island coyotes and to compare it with the seasonal diet of neighboring mainland coyotes.

STUDY AREA

Coyote scats were collected from four study sites: Padre Island (PI), Matagorda Island National Wildlife Refuge and State Natural Area (MI), the Laureles Division of the King Ranch (KR), and Aransas National Wildlife Refuge (ANWR). Both PI and MI sites are part of a chain of barrier islands adjacent to the Texas coast on the Gulf of Mexico. The KR and ANWR sites were chosen as peninsulas of the mainland adjacent to PI and MI (Fig. 1). The climate at all four sites has been described as semi-arid and sub-tropical with long, hot summers and short, mild winters with average annual temperatures of approximately 22°C (Weise and White 1980, McAlister and McAlister 1995). The annual precipitation at ANWR and MI averaged 94 cm (McAlister and McAlister 1995). At KR and PI the annual precipitation averaged 74 cm (Weise and White 1980). However, 50% of the samples for this project were collected in 1996 which was a drought year. Precipitation in 1996 was 47 cm at KR and PI (B. Lamarre, National

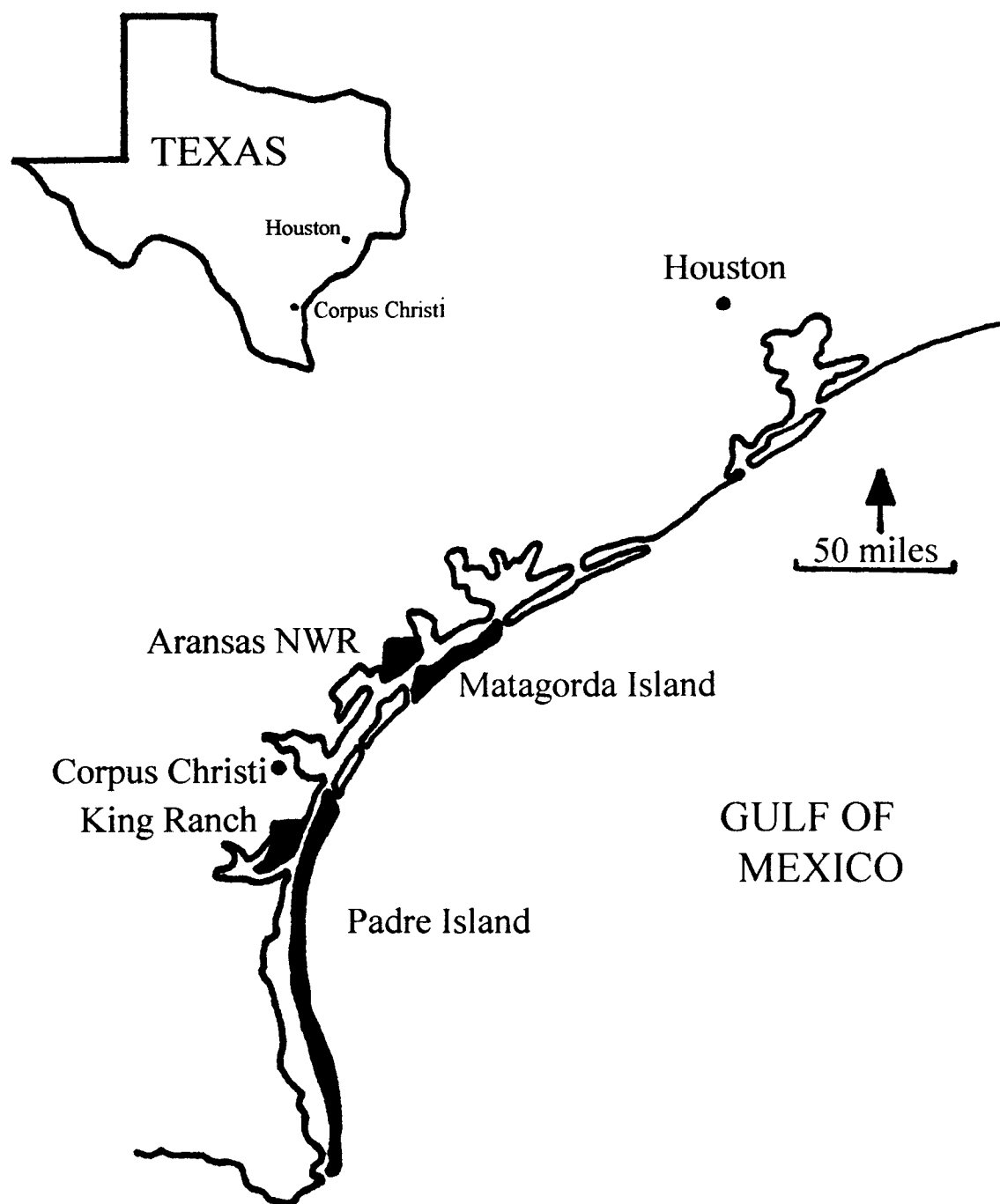


Figure 1. Study sites- Padre Island, Matagorda Island, Aransas National Wildlife Refuge, and King Ranch.

Oceanic and Atmospheric Admin., pers. commun.) and 51 cm at ANWR and MI (K. Schwindt, U.S. Fish and Wildl. Service, pers. commun.).

Padre Island and Matagorda Island

Grasses and other low-growing flora dominated the barrier islands. There were five distinct habitats: beach (Fig. 2), dunes, deflation plain, tidal flats, and freshwater ponds. The back beach and tidal flats were characterized by halophytic flora including glasswort (*Salicornia* sp.), saltwort (*Batis maritima*), beach morning glory (*Ipomoea* sp.), sea ox-eye daisy (*Borrchia frutescens*), and shore grass (*Monanthochloe littoralis*). The deflation plain was dominated by grasses, primarily seacoast bluestem (*Schizachyrium scoparium littoralis*) and gulf dune grass (*Paspalum monostachyum*). Few shrubs or trees grew on these islands, but where conditions were suitable, mesquite (*Prosopis* sp.), huisache (*Acacia smallii*), and occasionally oak (*Quercus* sp.) were present.

King Ranch

The Laureles Division of the King Ranch was characterized by three habitats. Grasslands were vast open areas consisting of grasses such as bluestems (*Andropogon* sp.) The mesquite-prickly pear habitat was dominated by mesquite, prickly pear (*Opuntia* sp.), huisache, and bluestem grasses (Fig. 3). The coastal areas were characterized by halophytes such as glasswort, saltwort, shore grass, and cordgrass (*Spartina* sp.).

Aransas National Wildlife Refuge

Aransas National Wildlife Refuge comprised a wide variety of habitats. However, most prevalent was the ridge and swale community consisting of oak mottes on xeric ridges, and grasses (primarily bluestems) in the more mesic swales (Fig. 4). Other



Figure 2. The primary dune ridge and beach of Padre Island.



Figure 3. Mesquite-prickly pear habitat on King Ranch.



Figure 4. Ridge and swale community on Aransas NWR.

habitats on the refuge included tidal flat, salt marsh, shell ridges, upland grassland, freshwater, and chaparral (McAlister and McAlister 1995).

Human Impact

Cattle have been grazed at all four sites but were removed from Padre Island in 1971 (Weise and White 1980), Matagorda Island in 1991 (McAlister and McAlister 1993), and Aransas National Wildlife Refuge in 1989 (McAlister and McAlister 1995).

Padre Island National Seashore attracts many visitors who often bring companion dogs. This restricted the areas from which coyote scats could be collected on Padre Island without the risk of misidentifying dog scats as coyote scats.

METHODS

Coyote scats were collected in plastic zip-lock bags from hiking trails, roads, and wildlife trails every 2-4 weeks from June 1995 to May 1996. Identification of scats was based on characteristic morphological features such as diameter, segment length, shape, color, and texture, as well as tracks (Murie 1974). A total of 278 scats were collected from PI, 527 from MI, 403 from KR, and 395 from ANWR.

After approximately one month of storage in a freezer, scats were prepared for analysis using a method similar to that employed by Bowyer et al. (1983). Scats were individually packaged with number coded tags in nylon bags and washed in a laundry washing machine. After air drying, the contents of each scat were identified with the use of a reference collection of known hairs, bones, exoskeletons, seeds, and other undigestible food items. Zimmerman et al. (1988), Leary (1961), and Martin and Barkley

(1961) were also used to identify fish otoliths, crab shells, and seeds. Hairs were identified by hair scale and medulla patterns according to Moore et al. (1974).

The contents of each scat were counted and tabulated as percent occurrence (Brillhart and Kaufman 1995). Each prey item was counted once for each scat, whether or not there was evidence of more than one individual of that particular prey item. The only count recorded for plants was fruit which had identifiable seeds. Grass was not recorded since it passes undigested through the gut of coyotes (Fitcher et al. 1955).

Horn's (1966) measure of similarity, which has a value between 0 (totally dissimilar) and 1 (totally similar), was used to compare sites within each season and to compare seasonal occurrence of prey items within each site. Differences in percent occurrence of each prey item found in coyote scats from each site and season were tested for significance with contingency tables using the log-likelihood ratio (G) statistic (Zar 1984). Because calculating the G-statistic requires the use of logarithms, any comparison that included a frequency of 0 could not be tested.

RESULTS

Coyote scats collected from four sites over a one year period contained remains of four classes of vertebrates (including six orders of mammals), two classes of invertebrates (including three species of crabs and three orders of insects), and seeds from ten species of plants (Appendices 1-8).

Remains of mammals were the most common items found (Fig. 5). Of the mammals, remains of rodents occurred with the greatest frequency (Figs. 6 and 7).

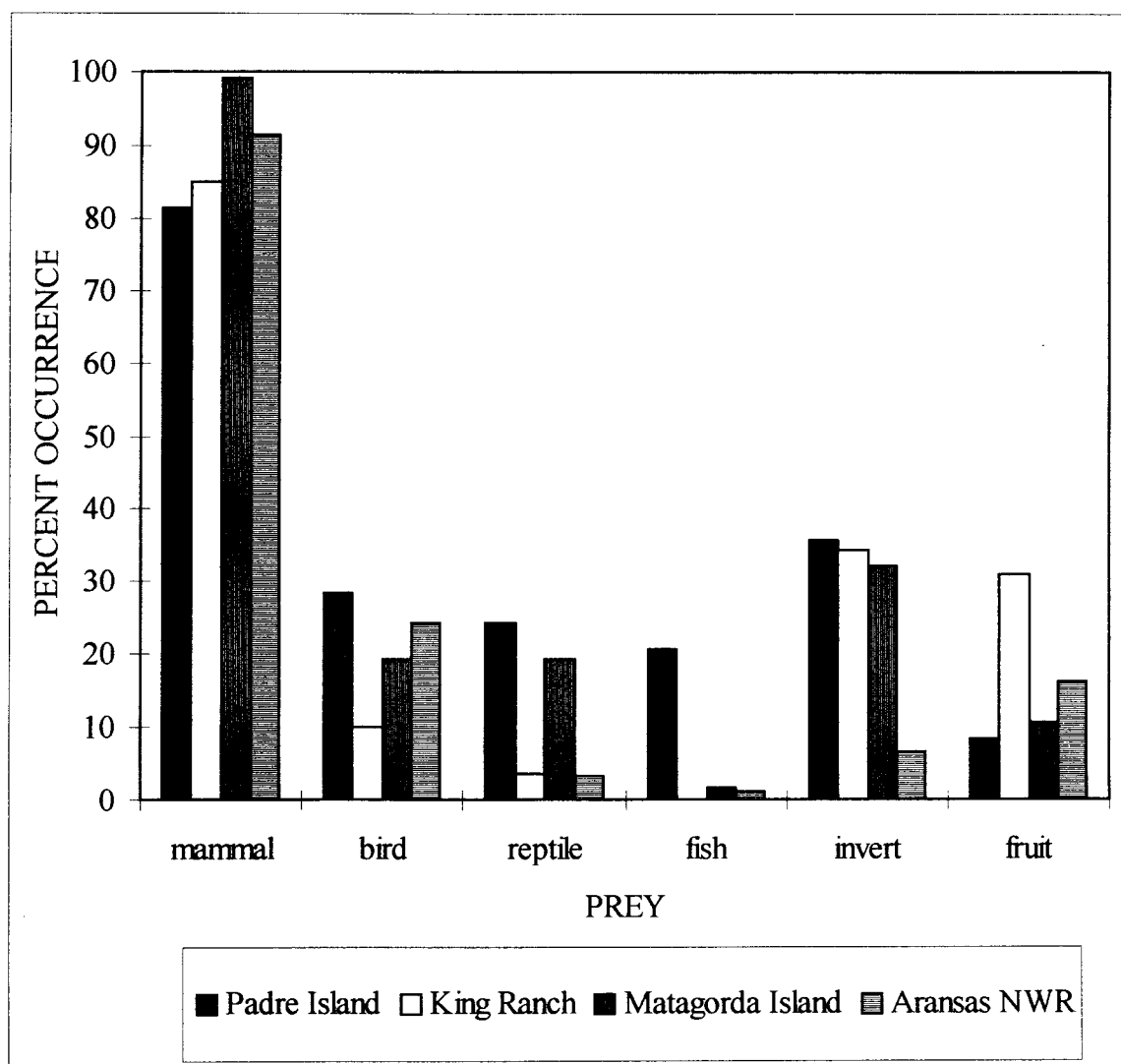


Figure 5. Annual frequency of six major prey groups in coyote scats collected June 1995-May 1996.

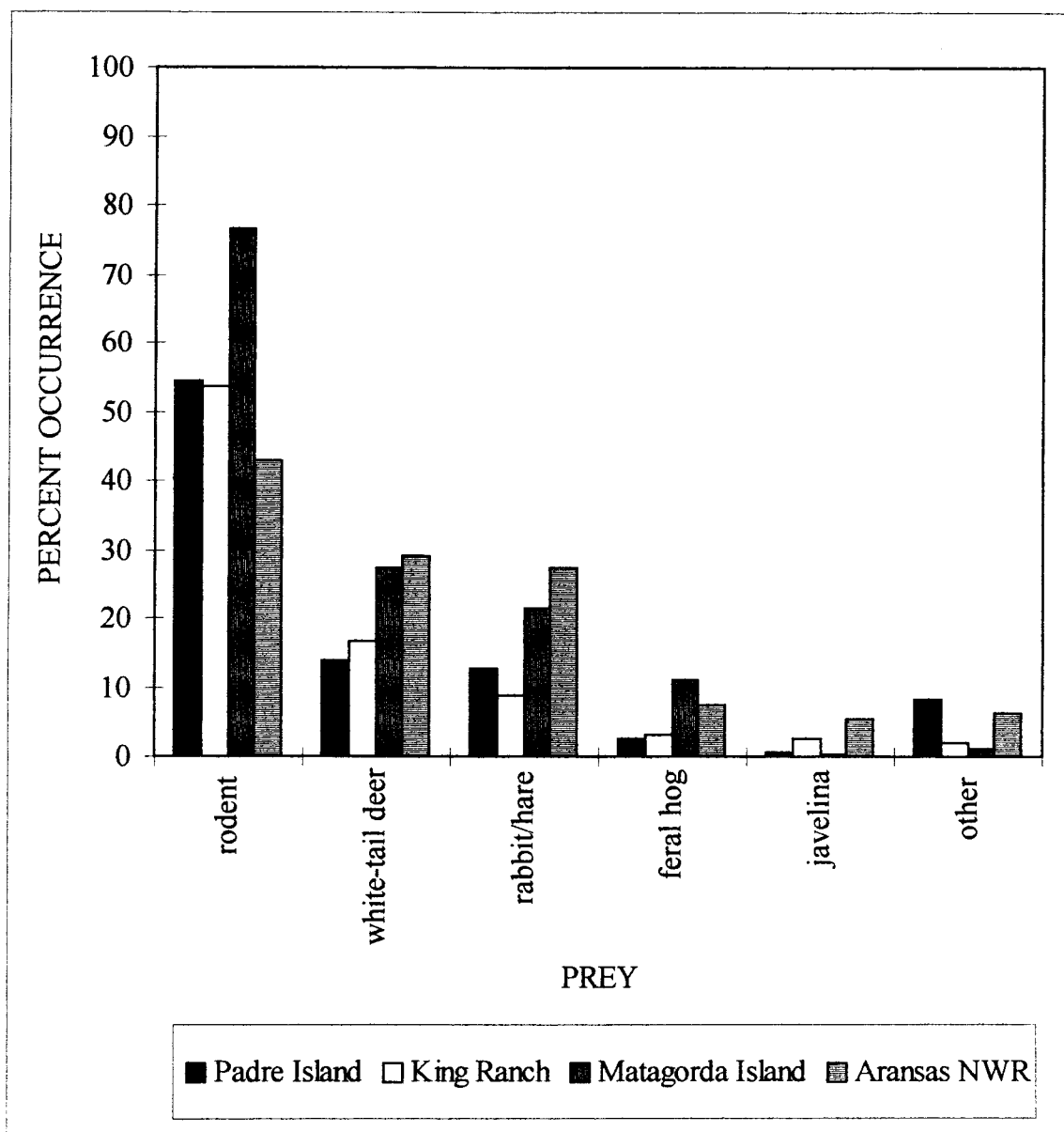


Figure 6. Annual frequency of mammalian prey remains in coyote scats collected June 1995- May 1996.



Figure 7. Coyote scat containing rodent hair, teeth, and bones (magnification=1X).



Figure 8. Coyote scat containing deer hair and fish otolith (magnification=1X).

Remains of deer and lagomorphs were also found in significant proportions. Remains of rodents consisted primarily of hispid cotton rats (*Sigmodon hispidus*) at all sites. In addition, remains of Texas pocket gophers (*Geomys personatus*) were found in scats from PI, and remains of Attwater's pocket gophers (*Geomys attwateri*) were found in scats from ANWR. Other mammalian remains found in coyote scats included feral hog (*Sus scrofa*), javelina (*Tayassu tajacu*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis virginiana*), and eastern mole (*Scalopus aquaticus*).

Although not as prevalent as the remains of mammals, some bird, reptile, fish, and invertebrate remains were found in as much as 20-30% of scats from certain sites.

Bird, reptile, and fish remains were generally not distinct enough to identify the family or species. However, some of the scats with fish scales also contained otoliths which were identified as those of hardhead catfish (*Arius felis*) (Fig. 8).

Invertebrate remains (Fig. 9) consisted of insects, primarily grasshoppers (Fig. 10), and crabs, primarily ghost crabs.

Seeds from the fruit of several different plant species were found (Fig. 11), but the most common were prickly pear (PI and MI scats), mesquite (KR scats), and palmetto seeds (*Sabal* sp.) (ANWR scats).

There were both seasonal and geographical variations in frequency of prey items found in coyote scats.

Seasonal Variation

Similarity indices indicated that there were some significant seasonal variations in the percent occurrence of prey items in coyote scats collected from each site (Table 1).

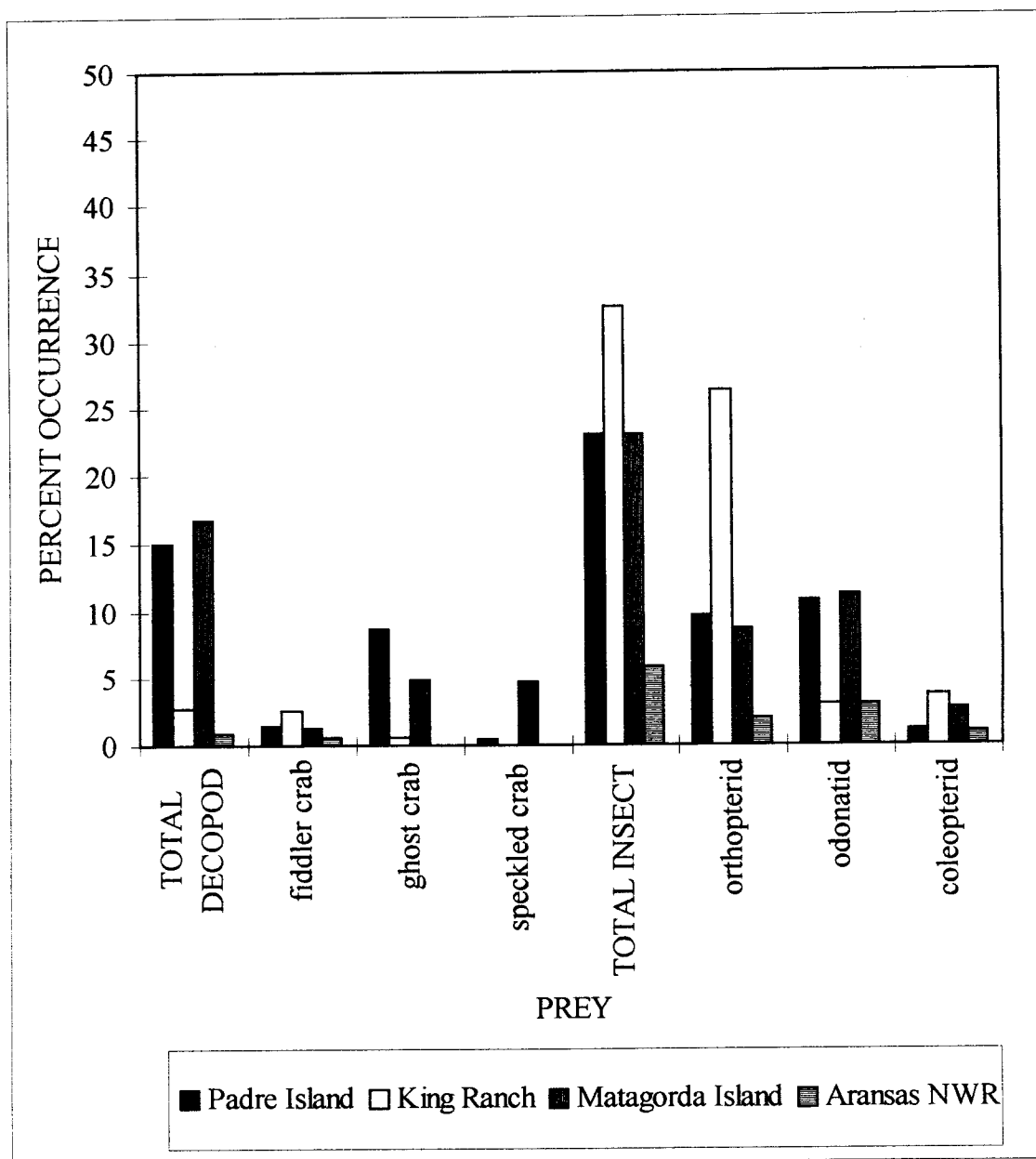


Figure 9. Annual frequency of invertebrate prey remains in coyote scats collected June 1995- May 1996.



Figure 10. Coyote scat containing grasshopper remains (magnification=1X).



Figure 11. Coyote scat containing palmetto palm and American beautyberry seeds and raccoon hair (magnification=1X).

Table 1. Similarity indices (Horn 1966) for seasonal scat content at each study site (1=total similarity, 0=no similarity).

	PADRE ISLAND	KING RANCH	MATAGORDA ISLAND	ARANSAS NWR
SUMMER/ FALL	0.52	0.52	0.6	0.65
SUMMER/ WINTER	0.79	0.55	0.42	0.75
SUMMER/ SPRING	0.89	0.76	0.76	0.67
FALL/ WINTER	0.44	0.45	0.87	0.73
FALL/ SPRING	0.5	0.33	0.66	0.76
WINTER/ SPRING	0.8	0.93	0.99	0.95

Similar seasonal trends were apparent in the occurrence of fruit, insect, crab, and fish remains at all four sites. These items were more prevalent in the summer and fall collected scats and decreased in frequency in the winter and spring scats (Figs. 12-15).

Seasonal changes in the frequency of other prey items varied between sites. In scats from PI, the proportion of mammal and reptile remains was highest during the winter and lowest during the fall ($p < 0.001$). Bird remains in scats from PI ranged from 9.4 (spring) to 48.0% (summer) ($p < 0.001$).

Mammal remains in scats from KR ranged from 72.6 (fall) to 99% (spring) ($p < 0.001$). Bird remains in scats from KR also peaked in the spring (14.0%) and were least frequent (4.1%) in the fall ($p < 0.05$). Reptile remains in scats ranged from 0 (fall) to 6.5% (spring) (not tested).

There was no significant seasonal change in mammal remains in scats from MI. The frequency of bird remains in scats from MI was greater in the spring (28.1%) than in the fall (8.6%) ($p < 0.001$). Reptile remains in scats ranged from 9.9 (summer) to 24.5% (fall) ($p < 0.01$).

The proportion of mammal remains in scats from ANWR ranged from 79.5 (fall) to 100% (summer) ($p < 0.001$). Bird remains in scats from ANWR were lowest in the fall (9.0%) and highest in the winter (38.8%) ($p < 0.001$). Frequency of reptile remains in scats ranged from 1.1 (spring) to 6.7% (winter) ($p < 0.05$).

Geographical Variation

Similarity indices ranged from 0.24 to 0.69 for PI and KR comparisons (Table 2). Barrier island and mainland sites were most similar in the spring and least similar in the

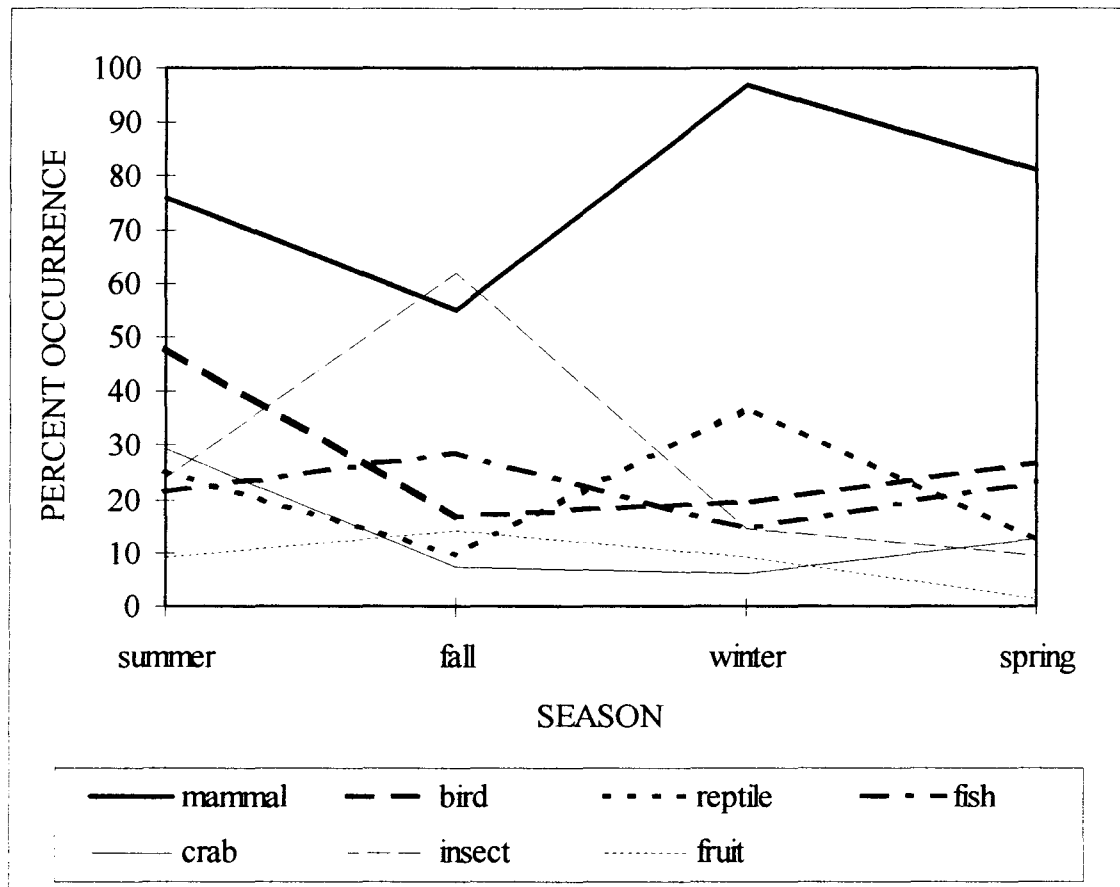


Figure 12. Seasonal variation in the frequency of seven major prey groups in coyote scats collected from Padre Island, June 1995- May 1996.

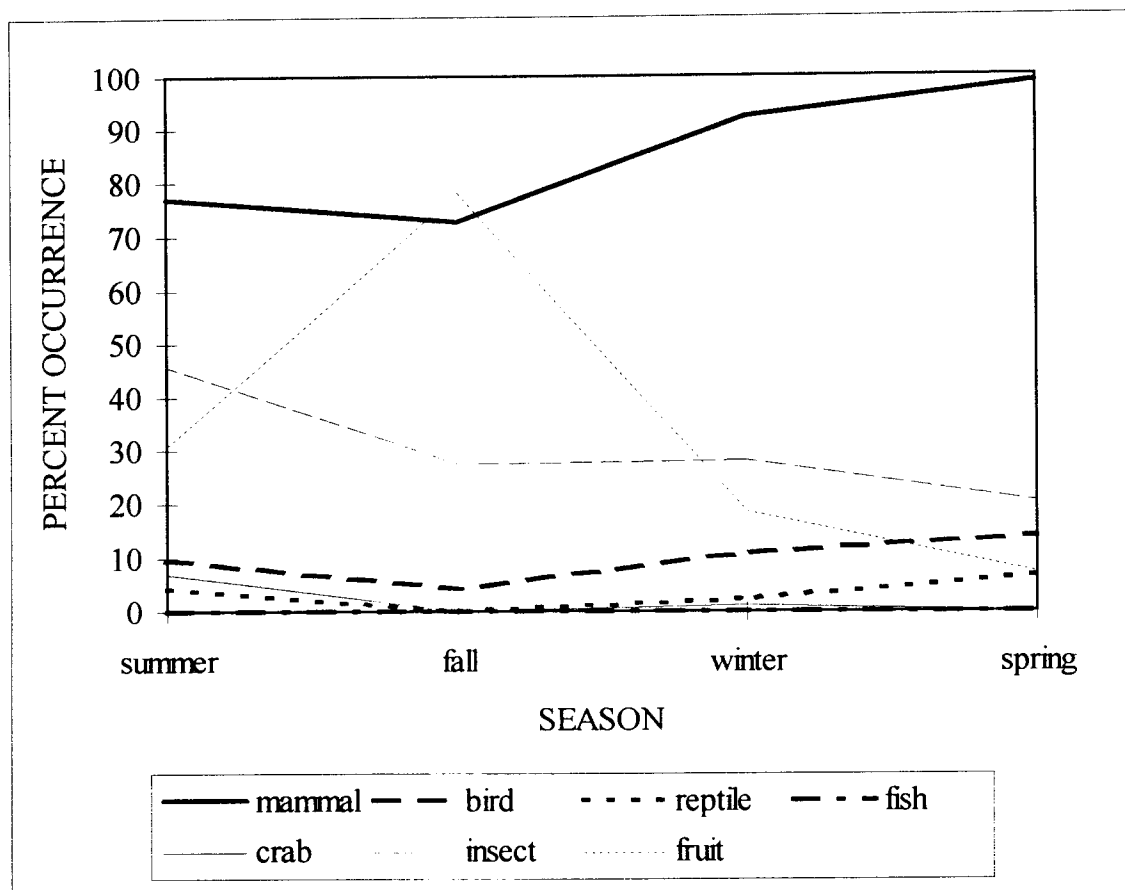


Figure 13. Seasonal variation in the frequency of seven major prey groups in coyote scats collected from King Ranch, June 1995- May 1996.

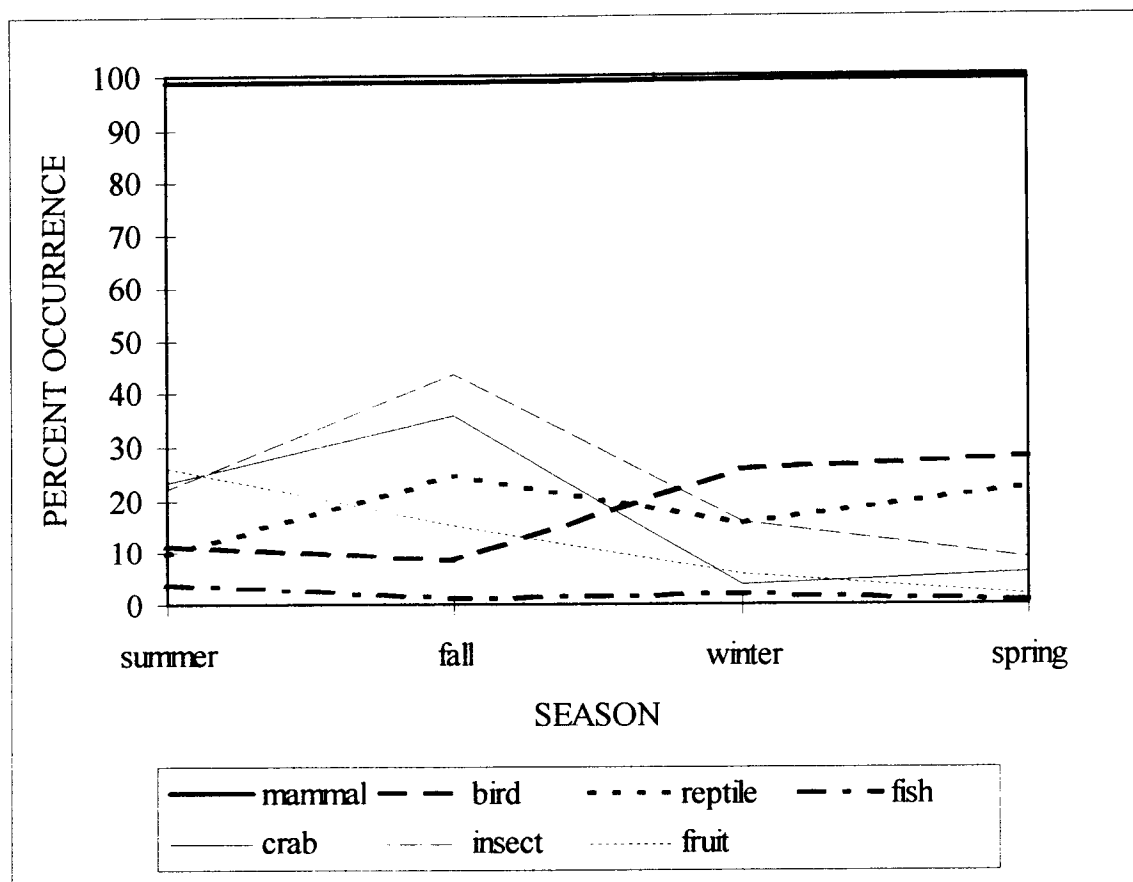


Figure 14. Seasonal variation in the frequency of seven major prey groups in coyote scats collected from Matagorda Island, June 1995- May 1996.

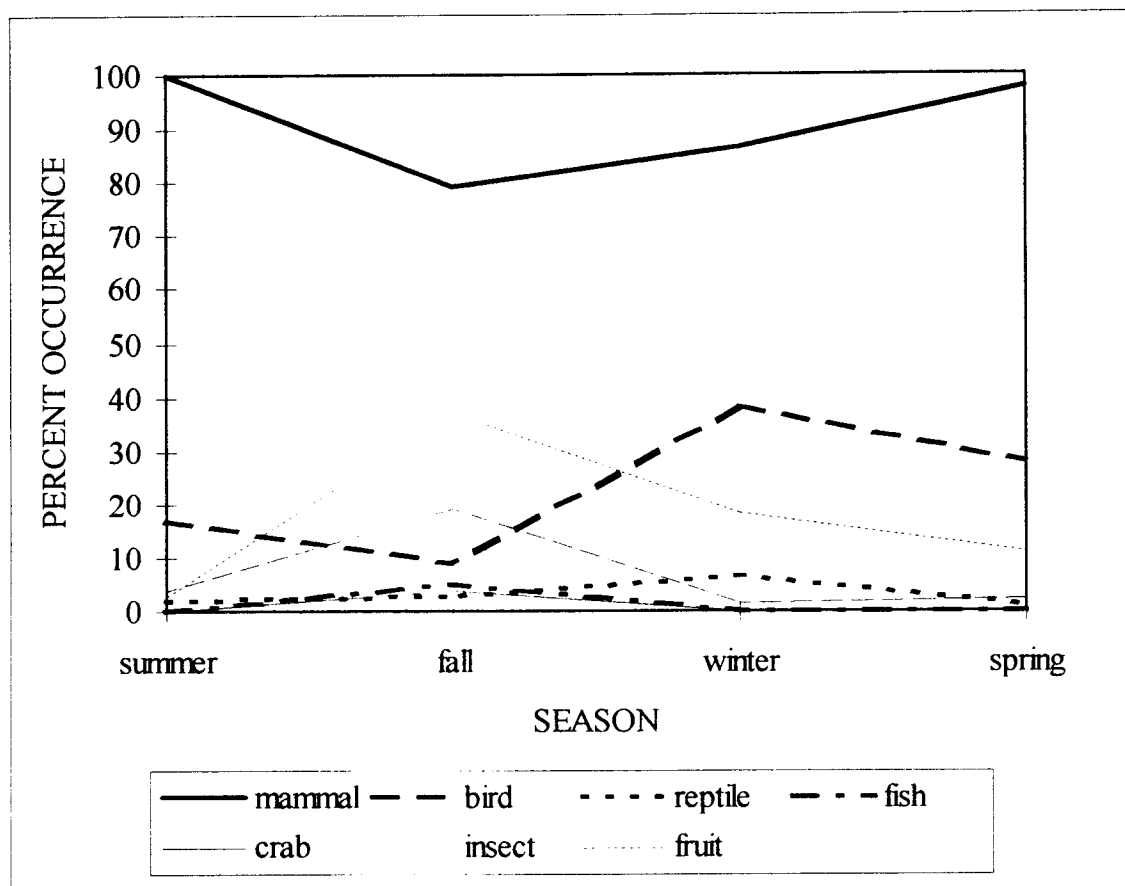


Figure 15. Seasonal variation in the frequency of seven major prey groups in coyote scats collected from Aransas National Wildlife Refuge, June 1995- May 1996.

Table 2. Similarity indices (Horn 1966) for barrier island and mainland comparisons in each season (1=total similarity, 0=no similarity).

	SUMMER	FALL	WINTER	SPRING
PADRE ISLAND/ KING RANCH	0.46	0.24	0.45	0.69
MATAGORDA ISLAND/ ARANSAS NWR	0.76	0.41	0.68	0.82
PADRE ISLAND/ MATAGORDA ISLAND	0.61	0.71	0.25	0.81
KING RANCH/ ARANSAS NWR	0.7	0.1	0.37	0.62
PADRE ISLAND/ ARANSAS NWR	0.54	0.41	0.63	0.78
MATAGORDA ISLAND/ KING RANCH	0.58	0.3	0.69	0.78

fall. Further comparisons between PI and MI, KR and ANWR, PI and ANWR, and MI and KR resulted in similarity indices ranging between 0.10 and 0.81 (Table 2).

Padre Island and King Ranch Comparisons.-- There were distinct differences between PI and KR coyote scats (Table 2).

The similarity index for scats collected during the summer was 0.46. Scats from PI had a significantly higher frequency of bird, reptile, and crab remains ($p < 0.001$). Although not tested statistically, scats from PI also yielded a greater proportion of fish remains (21.3%) than did scats from KR (0%). Fruit and insect remains were more prevalent in scats from KR ($p < 0.005$). The overall frequency of mammal remains in scats from PI and KR were the same (~76%), but different types of mammal remains occurred with different frequencies in scats from each site. Scats from KR contained more deer remains ($p < 0.001$) whereas scats from PI contained more lagomorph ($p < 0.05$), pocket gopher (not tested), and mole (not tested) remains. Remains of rodents as a taxonomic order, however, occurred with the same frequency in scats from both sites (~35%).

The similarity index for scats collected during the fall was 0.24. The occurrence of mammalian remains as a taxonomic class was slightly higher in scats from KR ($p < 0.1$). Deer ($p < 0.1$), mole (not tested), bird ($p < 0.05$), reptile (not tested), fish (not tested), crab (not tested), and insect ($p < 0.001$) remains were more prevalent in scats from PI. There were more fruit remains in scats from KR ($p < 0.001$). Remains of rodents occurred with the same frequency in scats from both sites (~39%).

The similarity index for scats collected from PI and KR during the winter was 0.45. The frequency of deer ($p < 0.1$), mole (not tested), pocket gopher ($p < 0.001$), bird

($p < 0.1$), reptile ($p < 0.005$), fish (not tested), and crab ($p < 0.1$) remains was greater in scats from PI. The proportion of fruit and insect remains was greater in scats from KR ($p < 0.1$). Rodent remains as a taxonomic order occurred with the same frequency in scats from both sites (~72%).

Scat contents from PI and KR were most similar in the spring ($SI = 0.69$). Deer ($p < 0.1$), pocket gopher (not tested), bird ($p < 0.1$), fish (not tested), and crab (not tested) remains were found in greater proportions in scats from PI. Fruit ($p < 0.1$), insect ($p < 0.1$), and rodent remains were found in greater proportions in scats from KR. Reptile remains were found in the same proportions in scats from both sites (~10%).

Matagorda Island and Aransas NWR Comparisons.-- There were distinct differences between the frequencies of prey remains in scats from MI and ANWR, primarily during the fall and winter (Table 2).

The similarity index for scats collected from MI and ANWR during the summer was 0.76. Several prey items were found with the same frequency in scats from both sites. Mammal remains occurred in about 99% of the scats, bird and feral hog remains in about 14%, and rodent remains in about 59%. Scats from ANWR, however had a higher deer content ($p < 0.05$). Scats from MI had a higher frequency of lagomorph ($p < 0.001$), reptile ($p < 0.05$), fish (not tested), insect ($p < 0.001$), crab (not tested), and fruit ($p < 0.001$) remains.

The fall similarity index was 0.41. The frequency of remains of mammals as a taxonomic group was higher ($p < 0.001$) in scats from MI, but deer and lagomorph remains were more prevalent in scats from ANWR ($p < 0.05$). Rodent remains occurred in

a greater percent of scats from MI ($p < 0.001$). A greater frequency of reptile, insect, and crab remains were found in scats from MI ($p < 0.001$). Scats from ANWR contained more seeds ($p < 0.001$). Scats from both sites had a frequency of about 9% bird and feral hog remains and 3% fish remains.

The similarity index for scats collected at MI and ANWR during the winter was 0.68. The frequency of the remains of fruit ($p < 0.005$), birds ($p < 0.05$), and lagomorphs ($p < 0.001$) in scats from ANWR exceeded that of scats from MI. All other prey items occurred in greater proportions in scats from MI, including mammal ($p < 0.001$), deer ($p < 0.005$), feral hog ($p < 0.1$), rodent ($p < 0.001$), reptile ($p < 0.05$), fish (not tested), insect ($p < 0.001$), and crab (not tested) remains.

The spring similarity index for scats collected from MI and ANWR was 0.82. Similar proportions of mammal (~98%), deer (~33%), feral hog (~9%), and bird (28%) remains were found in scats from both MI and ANWR. Lagomorph ($p < 0.1$) and fruit ($p < 0.005$) remains occurred with greater frequency in scats from ANWR.

DISCUSSION

The results of this study demonstrate the flexible nature of the coyote diet. Coyotes foraged for prey in many different habitat types and consumed prey from a wide variety of ecological and taxonomic groups. For example, the habits of prey consumed varied, including nocturnal, diurnal, aquatic, terrestrial, aerial, and fossorial species.

Prey availability seemed to be an important factor in the frequency with which specific prey remains were found in coyote scats. The frequency of fruit and insect

remains in scats increased with increases in their seasonal abundance. Ghost crabs, which spend the winter dormant in their burrows, were found in scats with greater frequency during the summer months. Pocket gopher remains were more prevalent in winter and spring scats during the mating season, when solitary pocket gophers seeking mates may be more vulnerable to predation. Hispid cotton rats breed throughout the year (Davis and Schmidly 1994) and were very common in scat samples; this species appeared to be a staple for coyotes at all of the sites during all four seasons.

In some instances, analysis was hampered by the difficulty of identifying remains. Bird, reptile, and fish remains could not be accurately identified to species or even to ordinal level in most cases. It is not clear, for example, whether coyotes were consuming primarily shore birds or passerines, venomous or non-venomous snakes, or deep or shallow water fish. Furthermore, no identifiable remains of amphibians were found. Amphibians may not be palatable to coyotes. However, it could be that amphibians have a higher digestibility than other prey, leaving very little or no remains to be identified in scats.

Moreover, the presence of prey remains in coyote scats does not indicate hunting and capturing of that prey. Birds, particularly road kills, and fish washed up on the beach or left by fishermen could be scavenged.

The frequency of prey items found in coyote scats from the mainland study sites were very similar to those reported in other coyote foraging studies. The diet of the coyote is generally described in the literature as consisting primarily of mammalian prey (70-100% in scats), supplemented with seasonally abundant fruit and insects (0-90%) and

a few birds (<10%) (Johnson and Hansen 1979, Bowyer et al. 1983, MacCracken and Uresk 1984, Andelt 1985, Brillhart and Kaufman 1995). Reptiles and fish have been reported to occur infrequently (<5%) if at all (Johnson and Hansen 1979, Bowyer et al. 1983, MacCracken and Uresk 1984, Andelt 1985, Litvaitis and Harrison 1989, Brillhart and Kaufman 1995). The diet of coyotes on the King Ranch and Aransas NWR seems to follow this pattern, with the exception of a higher incidence of bird remains in scats from Aransas NWR. Without information on the availability of birds or the species consumed, it is difficult to speculate on why coyotes at Aransas NWR would feed on birds more frequently than coyotes at King Ranch.

There was a significantly greater frequency of bird, reptile, crab, and fish remains in coyote scats from the barrier islands. Coyote scats from the barrier islands were similar to mainland coyote scats in the high frequency of mammalian prey remains. However, bird, reptile, crab, and fish remains each occurred in 20-30% of Padre Island coyote scats. On Matagorda Island, bird, reptile, and crab remains occurred in 20-30% of coyote scats, whereas fish remains were found in <2% of scats. The availability of fish, either live or washed up dead on the shore, is likely the same on Padre Island and Matagorda Island. It may be that fish is not a preferred food and that coyotes on Matagorda Island are able to meet their nutritional requirements without eating fish. However, Padre Island is utilized by a greater number of fishermen leaving behind dead fish, possibly resulting in a higher availability of fish to scavenge on Padre Island than Matagorda Island.

The mainland sites have a greater diversity of potential food items than the barrier island sites (McAlister and McAlister 1993) yet coyote scats collected from King Ranch and Aransas NWR were less diverse in prey remains than those collected from the barrier islands.

One reason for this may be that not only is the diversity of potential prey on the barrier islands lower, but the biomass of potential prey, particularly mammals, is also lower. Barrier island coyotes may be compensating for a lower availability of mammals by preying on birds, reptiles, fish, insects, and crabs more frequently. Furthermore, King Ranch and Aransas NWR coyotes have an abundance of fruit available to them in the summer and fall, but Padre Island and Matagorda Island do not support a large biomass of fruiting plants.

Furthermore, coyotes may be less social on the barrier islands. The small size of the islands, overlapping of coyote ranges, and increased competition for food and mates could result in coyotes behaving more solitary. If barrier island coyotes are, in fact, more solitary, then there would be less cooperative hunting for larger prey such as deer and feral hogs.

The comparison of foraging choices made by coyotes on the mainland and barrier islands indicates that mainland coyotes may not be as opportunistic as suggested in the literature. Coyotes are capable of capturing and digesting a large variety of food items, as demonstrated by analysis of coyote scats collected on barrier islands. Birds, reptiles, fish, and crabs are available to coyotes at mainland and barrier island sites. However, coyotes primarily consume mammalian prey on the mainland. It appears that mammals are the

preferred prey and that coyotes on the mainland are actually being selective. Therefore, barrier island coyotes may be consuming a wide variety of prey species because there is not enough mammalian prey available on the island to meet their daily nutritional needs.

It is beyond the scope of this study, however, to demonstrate on what basis coyotes make foraging choices. Doing so would necessitate, at least, an accurate measure of prey availability. Ideally, a series of controlled feeding trials, coupled with thorough analysis of the nutritional content of each prey item and the energy required to capture and defend each prey item, would provide more accurate information on coyote foraging strategies.

MANAGEMENT IMPLICATIONS

Seasonal shifts in coyote foraging may be significant in relieving predatory pressure from other prey species. Andelt et al. (1987) suggested that strategic planting of fruiting plant species might help buffer other prey species or could be used to attract coyotes to particular areas for capture.

Prior to any action being taken to control local coyote populations, it is important to consider the effect that decreased coyote abundance would have on particular prey species such as cotton rats and pocket gophers, which are generally considered to be pests. Cotton rats are known to destroy crops, and pocket gophers can have a large effect on vegetation and contribute significantly to erosion (Davis and Schmidly 1994). The consumption of fruit by coyotes may also be important in dispersing seeds of local

flowering plants such as wolfberry (*Lycium* sp.), hackberry (*Celtis* sp.), and persimmon (*Diospyrox* sp.).

Because of the limited availability of prey on Padre and Matagorda Islands, coyotes on the barrier islands may be more sensitive to anthropogenic alterations of habitat. If barrier island coyotes are already maximizing their use of available prey, the reduction or elimination of one prey species or group could shift coyote predatory pressure to other prey, such as deer or lagomorphs. On Padre Island, a decrease in available prey might result in coyotes frequenting residential areas in search of food.

The ecological systems of the barrier islands appear to be simple and therefore delicate. Even a generalist species such as the coyote could be greatly affected by small changes in the system. Likewise, changes in prey preference by island coyotes might induce widespread changes in island biotic communities.

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Appendix 1. Percent occurrence of prey items found in coyote scats collected June 1995- August 1995. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Padre Island		King Ranch			
SAMPLE SIZE	75		144			
	#	%	#	%	G	p<
MAMMALIA	57	76.0	111	77.1	0.0	NS
<i>Odocoileus virginianus</i> - white-tailed deer	9	12.0	3	36.8	16.2	0.001
<i>Tayassu tajacu</i> - collared peccary	0	0.0	2	1.4		nt
<i>Sus scrofa</i> - feral hog	1	1.3	6	4.2	1.3	NS
Lagomorpha	17	22.7	17	11.8	4.2	0.05
Rodentia	30	40.0	45	31.1	1.8	NS
<i>Sigmodon hipidus</i> - hispid cotton rat	11	14.7	16	11.1	0.6	NS
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	0	0.0		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	0	0.0		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	3	2.1		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	9	12.0	0	0.0		nt
<i>Scalopus aquaticus</i> - eastern mole	6	8.0	0	0.0		nt
<i>Mephitis mephitis</i> - striped skunk	4	5.3	0	0.0		nt
<i>Procyon lotor</i> - common raccoon	2	2.7	1	0.7	1.2	NS
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	0	0.0		nt
unidentified mammal	3	4.0	7	4.9	0.2	NS
AVES	36	48.0	14	9.7	39.2	0.001
eggshell	1	1.3	0	0.0		nt
REPTILIA	19	25.3	6	4.2	20.4	0.001
Serpentes	2	2.7	1	0.7	0.0	NS
<i>Cnemidophorus</i> sp.- whiptails	7	9.3	1	0.7	9.3	0.005
<i>Terrapene</i> sp.- box turtles	0	0.0	2	1.4		nt
unidentified reptiles	11	14.7	2	1.4	14.4	0.001
OSTEICHTHYES	16	21.3	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	0	0.0	0	0.0		nt
ARTHROPODA	33	44.0	73	50.7	817.8	0.001
INSECTA	18	24.0	66	45.8	10.1	0.005
Orthoptera	8	10.7	55	38.2	20.0	0.001

Appendix 1 (continued).

SITE		Padre Island		King Ranch			
SAMPLE SIZE		75		144			
		#	%	#	%	G	p<
	Odonata	3	4.0	4	2.8	0.2	NS
	Coleoptera	2	2.7	8	5.6	0.8	NS
	unidentified insect	6	8.0	3	2.1	3.6	0.1
	CRUSTACEA	22	29.3	10	6.9	18.4	0.001
	<i>Uca</i> sp. - fiddler crabs	2	2.7	10	6.9	1.7	NS
	<i>Ocypode quadrata</i> - ghost crab	16	21.3	2	1.4	24.7	0.001
	<i>Arenaeus cribrarius</i> - speckled crab	1	1.3	0	0.0		nt
	unidentified crab	4	5.3	0	0.0		nt
FRUIT		7	9.3	44	30.6	13.9	0.001
	<i>Opuntia</i> sp. - prickly pear	6	8.0	5	3.5	1.8	NS
	<i>Prosopis glandulosa</i> - honey mesquite	0	0.0	28	19.4		nt
	<i>Sabal</i> sp. - palmetto palm	0	0.0	0	0.0		nt
	<i>Lycium</i> sp. - wolfberry	0	0.0	1	0.7		nt
	<i>Ilex vomitoria</i> - yaupon	0	0.0	4	2.8		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	5	3.5		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	2	1.4		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	1	0.7		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	0	0.0		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	1	0.7		nt
	unidentified fruit	1	1.3	2	1.4	0.0	NS
HUMAN REFUSE		8	10.7	1	0.7	11.3	0.001

Appendix 2. Percent occurrence of prey items found in coyote scats collected June 1995- August 1995. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Matagorda Island		Aransas NWR		G	p<
SAMPLE SIZE	81		108			
	#	%	#	%		
MAMMALIA	80	98.8	108	100.0	0.9	NS
<i>Odocoileus virginianus</i> - white-tailed deer	25	30.9	49	45.4	4.2	0.05
<i>Tayassu tajacu</i> - collared peccary	0	0.0	1	0.9		nt
<i>Sus scrofa</i> - feral hog	13	16.1	14	13.0	0.4	NS
Lagomorpha	44	54.3	19	17.6	28.1	0.001
Rodentia	52	64.2	57	52.8	2.6	NS
<i>Sigmodon hispidus</i> - hispid cotton rat	16	19.8	19	17.6	0.2	NS
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	0	0.0		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	2	1.9		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	0	0.0	7	6.5		nt
<i>Scalopus aquaticus</i> - eastern mole	0	0.0	1	0.9		nt
<i>Mephitis mephitis</i> - striped skunk	0	0.0	0	0.0		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	0	0.0		nt
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	0	0.0		nt
unidentified mammal	0	0.0	0	0.0		nt
AVES	9	11.1	18	16.7	1.2	NS
eggshell	1	1.2	0	0.0		nt
REPTILIA	8	9.9	2	1.9	5.6	0.05
Serpentes	0	0.0	1	0.9		nt
<i>Cnemidophorus</i> sp.- whiptails	0	0.0	0	0.0		nt
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	8	9.9	1	0.9	8.3	0.005
OSTEICHTHYES	3	3.7	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	0	0.0	0	0.0		nt
ARTHROPODA	25	30.9	4	3.7	27.3	0.001
INSECTA	18	22.2	4	3.7	95.1	0.001
Orthoptera	5	6.2	1	0.9	4.0	0.05

Appendix 2 (continued).

SITE		Matagorda Island		Aransas NWR			
SAMPLE SIZE		81		108			
		#	%	#	%	G	p<
	Odonata	6	7.4	2	1.9	3.3	0.1
	Coleoptera	4	4.9	2	1.9	1.3	NS
	unidentified insect	6	7.4	1	0.9	5.3	0.05
	CRUSTACEA	19	23.5	0	0.0		nt
	<i>Uca</i> sp.- fiddler crabs	2	2.5	0	0.0		nt
	<i>Ocypode quadrata</i> - ghost crab	5	6.2	0	0.0		nt
	<i>Arenaeus cribrarius</i> - speckled crab	3	3.7	0	0.0		nt
	unidentified crab	4	4.9	0	0.0		nt
FRUIT		21	25.9	3	2.8	23.1	0.001
	<i>Opuntia</i> sp.- prickly pear	1	1.2	0	0.0		nt
	<i>Prosopis glandulosa</i> - honey mesquite	0	0.0	1	0.9		nt
	<i>Sabal</i> sp.- palmetto palm	0	0.0	0	0.0		nt
	<i>Lycium</i> sp.- wolfberry	16	19.8	0	0.0		nt
	<i>Ilex vomitoria</i> - yaupon	0	0.0	1	0.9		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	0	0.0		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	0	0.0		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	0	0.0		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	1	0.9		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	4	4.9	0	0.0		nt
HUMAN REFUSE		0	0.0	1	0.9		nt

Appendix 3. Percent occurrence of prey items found in coyote scats collected September 1995- November 1995. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Padre Island		King Ranch		G	p<
SAMPLE SIZE	42		73			
	#	%	#	%		
MAMMALIA	23	54.8	53	72.6	3.7	0.1
<i>Odocoileus virginianus</i> - white-tailed deer	4	9.5	1	1.4	3.8	0.1
<i>Tayassu tajacu</i> - collared peccary	0	0.0	0	0.0		nt
<i>Sus scrofa</i> - feral hog	1	2.4	4	5.5	0.7	NS
Lagomorpha	1	2.4	0	0.0		nt
Rodentia	16	38.1	30	41.1	0.0	NS
<i>Sigmodon hispidus</i> - hispid cotton rat	13	31.0	16	21.9	1.2	NS
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	1	1.4		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	0	0.0		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	0	0.0	0	0.0		nt
<i>Scalopus aquaticus</i> - eastern mole	3	7.1	0	0.0		nt
<i>Mephitis mephitis</i> - striped skunk	0	0.0	0	0.0		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	1	1.4		nt
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	0	0.0		nt
unidentified mammal	1	2.4	23	31.5	17.1	0.001
AVES	7	16.7	3	4.1	4.7	0.05
eggshell	1	2.4	0	0.0		nt
REPTILIA	4	9.5	0	0.0		nt
Serpentes	1	2.4	0	0.0		nt
<i>Cnemidophorus</i> sp.- whiptails	1	2.4	0	0.0		nt
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	2	4.8	0	0.0		nt
OSTEICHTHYES	12	28.61	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	6	14.3	0	0.0		nt
ARTHROPODA	27	64.3	20	27.4	14.9	0.001
INSECTA	26	61.9	20	27.4	12.9	0.001

Appendix 3 (continued).

SITE		Padre Island		King Ranch		G	p<
SAMPLE SIZE		42		73			
		#	%	#	%		
	Orthoptera	3	7.1	17	23.3	5.4	0.05
	Odonata	25	59.5	4	5.5	41.4	0.001
	Coleoptera	0	0.0	0	0.0		nt
	unidentified insect	0	0.0	0	0.0		nt
CRUSTACEA		3	7.1	0	0.0		nt
	<i>Uca</i> sp.- fiddler crabs	0	0.0	0	0.0		nt
	<i>Ocypode quadrata</i> - ghost crab	0	0.0	0	0.0		nt
	<i>Arenaeus cribrarius</i> - speckled crab	0	0.0	0	0.0		nt
	unidentified crab	3	7.1	0	0.0		nt
FRUIT		6	14.3	57	78.1	46.7	0.001
	<i>Opuntia</i> sp.- prickly pear	4	9.5	5	6.8	0.2	NS
	<i>Prosopis glandulosa</i> - honey mesquite	1	2.4	53	72.6	63.2	0.001
	<i>Sabal</i> sp.- palmetto palm	0	0.0	0	0.0		nt
	<i>Lycium</i> sp.- wolfberry	0	0.0	0	0.0		nt
	<i>Ilex vomitoria</i> - yaupon	0	0.0	0	0.0		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	0	0.0		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	0	0.0		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	4	5.5		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	0	0.0		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	2	4.8	0	0.0		nt
HUMAN REFUSE		2	4.8	0	0.0		nt

Appendix 4. Percent occurrence of prey items found in coyote scats collected September 1995- November 1995. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Matagorda Island		Aransas NWR			
SAMPLE SIZE	151		78			
	#	%	#	%	G	p<
MAMMALIA	149	98.7	62	79.5	24.9	0.001
<i>Odocoileus virginianus</i> - white-tailed deer	6	4.0	14	18.0	11.5	0.001
<i>Tayassu tajacu</i> - collared peccary	0	0.0	2	2.6		nt
<i>Sus scrofa</i> - feral hog	20	13.2	5	6.4	2.6	NS
Lagomorpha	26	17.2	25	32.1	6.1	0.05
Rodentia	125	82.8	12	15.4	102.0	0.001
<i>Sigmodon hipidus</i> - hispid cotton rat	82	54.3	4	5.1	62.8	0.001
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	0	0.0		nt
<i>Oryzomys palustris</i> - marsh rice rat	1	0.7	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	0	0.0		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	1	0.7	2	2.6	1.2	NS
<i>Scalopus aquaticus</i> - eastern mole	0	0.0	5	6.4		nt
<i>Mephitis mephitis</i> - striped skunk	0	0.0	4	5.1		nt
<i>Procyon lotor</i> - common raccoon	2	1.3	9	11.5	10.7	0.005
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	0	0.0		nt
unidentified mammal	1	0.7	1	1.3	0.4	NS
AVES	13	8.6	7	9.0	0.0	NS
eggshell	0	0.0	0	0.0		nt
REPTILIA	37	24.5	2	2.6	855.3	0.001
Serpentes	7	4.6	0	0.0		nt
<i>Cnemidophorus</i> sp.- whiptails	8	5.3	0	0.0		nt
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	21	13.9	2	2.6	8.5	0.005
OSTEICHTHYES	2	1.3	4	5.1	2.6	NS
<i>Mylopharodon conocephalus</i> - hardhead catfish	0	0.0	1	1.3		nt
ARTHROPODA	95	63.0	18	23.1	33.7	0.001
INSECTA	66	43.7	15	19.2	14.3	0.001

Appendix 4 (continued).

SITE		Matagorda Island		Aransas NWR			
SAMPLE SIZE		151		78			
		#	%	#	%	G	p<
	Orthoptera	27	17.9	4	5.1	0.0	NS
	Odonata	38	25.2	10	12.8	5.2	0.05
	Coleoptera	5	3.3	1	1.3	0.9	NS
	unidentified insect	12	7.9	0	0.0		nt
	CRUSTACEA	54	35.8	3	3.9	14.5	0.001
	Uca sp.- fiddler crabs	3	2.0	2	2.6	0.0	NS
	Ocypode quadrata- ghost crab	11	7.3	0	0.0		nt
	Arenaeus cribrarius- speckled crab	22	14.6	0	0.0		nt
	unidentified crab	20	13.2	2	2.6	8.0	0.005
FRUIT		23	15.2	29	37.2	13.5	0.001
	Opuntia sp.- prickly pear	20	13.2	1	1.3	11.3	0.001
	Prosopis glandulosa- honey mesquite	0	0.0	0	0.0		nt
	Sabal sp.- palmetto palm	0	0.0	11	14.1		nt
	Lycium sp.- wolfberry	2	1.3	0	0.0		nt
	Ilex vomitoria- yaupon	0	0.0	0	0.0		nt
	Smilax bona-nox- greenbriar	0	0.0	1	1.3		nt
	Callicarpa americana- American beautyberry	0	0.0	12	15.4		nt
	Celtis sp.- hackberry	0	0.0	0	0.0		nt
	Vitis mustangensis- mustang grape	0	0.0	0	0.0		nt
	Diospyrox texana- Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	1	0.7	8	10.3	11.5	0.001
HUMAN REFUSE		0	0.0	0	0.0		nt

Appendix 5. Percent occurrence of prey items found in coyote scats collected December 1995- February 1996. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Padre Island		King Ranch		G	p<
SAMPLE SIZE	97		93			
	#	%	#	%		
MAMMALIA	94	97.0	86	92.5	1.7	NS
<i>Odocoileus virginianus</i> - white-tailed deer	12	12.4	4	4.3	4.1	0.05
<i>Tayassu tajacu</i> - collared peccary	2	2.1	4	4.3	0.6	NS
<i>Sus scrofa</i> - feral hog	5	5.2	1	1.1	2.6	NS
Lagomorpha	10	10.3	4	4.3	2.3	NS
Rodentia	71	73.2	66	71.0	0.0	NS
<i>Sigmodon hispidus</i> - hispid cotton rat	18	18.6	45	48.4	19.2	0.001
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	1	1.1		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	1	1.0	1	1.1	0.0	NS
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	1	1.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	39	40.2	1	1.1	53.1	0.001
<i>Scalopus aquaticus</i> - eastern mole	6	6.2	0	0.0		nt
<i>Mephitis mephitis</i> - striped skunk	0	0.0	1	1.1		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	1	1.1		nt
<i>Didelphis virginiana</i> - Virginia opossum	3	3.1	1	1.1	0.9	NS
unidentified mammal	1	1.0	16	17.2	17.3	0.001
AVES	19	19.6	10	10.8	2.8	0.1
eggshell	0	0.0	0	0.0		nt
REPTILIA	36	37.1	2	2.2	42.2	0.001
Serpentes	11	11.3	1	1.1	9.4	0.005
<i>Cnemidophorus</i> sp.- whiptails	8	8.2	0	0.0		nt
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	21	21.6	1	1.1	23.3	0.001
OSTEICHTHYES	14	14.4	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	4	4.1	0	0.0		nt
ARTHROPODA	20	20.6	26	28.0	1.2	NS
INSECTA	14	14.4	26	28.0	5.0	0.05

Appendix 5 (continued).

SITE		Padre Island		King Ranch			
SAMPLE SIZE		97		93			
		#	%	#	%	G	p<
	Orthoptera	11	11.3	23	24.7	5.7	0.05
	Odonata	2	2.1	1	1.1	0.2	NS
	Coleoptera	0	0.0	0	0.0		nt
	unidentified insect	1	1.0	2	2.2	0.2	NS
CRUSTACEA		6	6.2	1	1.1	3.4	0.1
	<i>Uca</i> sp.- fiddler crabs	2	2.1	0	0.0		nt
	<i>Ocypode quadrata</i> - ghost crab	2	2.1	0	0.0		nt
	<i>Arenaeus cribrarius</i> - speckled crab	0	0.0	0	0.0		nt
	unidentified crab	2	2.1	1	1.1	0.2	NS
FRUIT		9	9.3	17	18.3	3.1	0.1
	<i>Opuntia</i> sp.- prickly pear	7	7.2	14	15.1	2.8	0.1
	<i>Prosopis glandulosa</i> - honey mesquite	0	0.0	1	1.1		nt
	<i>Sabal</i> sp.- palmetto palm	0	0.0	0	0.0		nt
	<i>Lycium</i> sp.- wolfberry	0	0.0	0	0.0		nt
	<i>Ilex vomitoria</i> - yaupon	0	0.0	0	0.0		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	0	0.0		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	0	0.0		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	2	2.2		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	0	0.0		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	2	2.1	0	0.0		nt
HUMAN REFUSE		4	4.1	0	0.0		nt

Appendix 6. Percent occurrence of prey items found in coyote scats collected December 1995- February 1996. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Matagorda Island		Aransas NWR			
SAMPLE SIZE	149		120			
	#	%	#	%	G	p<
MAMMALIA	148	99.3	104	86.7	83.9	0.001
<i>Odocoileus virginianus</i> - white-tailed deer	58	38.9	26	21.7	9.3	0.005
<i>Tayassu tajacu</i> - collared peccary	0	0.0	11	9.2		nt
<i>Sus scrofa</i> - feral hog	11	7.4	3	2.5	3.3	0.1
Lagomorpha	18	12.1	40	33.3	17.8	0.001
Rodentia	117	78.5	48	40.0	42.0	0.001
<i>Sigmodon hipidus</i> - hispid cotton rat	65	43.6	13	10.8	37.2	0.001
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	0	0.0		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	7	4.7	3	2.5	1.0	NS
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	0	0.0	20	16.7		nt
<i>Scalopus aquaticus</i> - eastern mole	0	0.0	3	2.5		nt
<i>Mephitis mephitis</i> - striped skunk	0	0.0	1	0.8		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	0	0.0		nt
<i>Didelphis virginiana</i> - Virginia opossum	1	0.7	0	0.0		nt
unidentified mammal	1	0.7	5	4.2	3.7	0.1
AVES	38	25.5	46	38.3	5.0	0.05
eggshell	5	3.4	0	0.0		nt
REPTILIA	23	15.4	8	6.7	5.1	0.05
Serpentes	13	8.7	2	1.7	6.9	0.01
<i>Cnemidophorus</i> sp.- whiptails	4	2.7	2	1.7	0.4	NS
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	6	4.0	4	3.3	0.2	NS
OSTEICHTHYES	3	2.0	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	0	0.0	0	0.0		nt
ARTHROPODA	28	18.8	2	1.7	23.3	0.001
INSECTA	24	16.1	2	1.7	18.6	0.001

Appendix 6 (continued).

SITE		Matagorda Island		Aransas NWR			
SAMPLE SIZE		149		120			
		#	%	#	%	G	p<
	Orthoptera	6	4.0	1	0.8	3.0	0.1
	Odonata	12	8.1	0	0.0		nt
	Coleoptera	3	2.0	1	0.8	0.0	NS
	unidentified insect	5	3.4	0	0.0		nt
CRUSTACEA		6	4.0	0	0.0		nt
	<i>Uca</i> sp.- fiddler crabs	0	0.0	0	0.0		nt
	<i>Ocypode quadrata</i> - ghost crab	3	2.0	0	0.0		nt
	<i>Arenaeus cribrarius</i> - speckled crab	0	0.0	0	0.0		nt
	unidentified crab	3	2.0	0	0.0		nt
FRUIT		9	6.0	22	18.3	9.6	0.005
	<i>Opuntia</i> sp.- prickly pear	1	0.7	0	0.0		nt
	<i>Prosopis glandulosa</i> - honey mesquite	0	0.0	0	0.0		nt
	<i>Sabal</i> sp.- palmetto palm	0	0.0	19	15.8		nt
	<i>Lycium</i> sp.- wolfberry	5	3.4	1	0.8	2.0	NS
	<i>Ilex vomitoria</i> - yaupon	0	0.0	1	0.8		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	0	0.0		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	0	0.0		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	0	0.0		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	0	0.0		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	3	2.0	1	0.8	0.6	NS
HUMAN REFUSE		3	2.0	0	0.0		nt

Appendix 7. Percent occurrence of prey items found in coyote scats collected March 1996- May 1996. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Padre Island		King Ranch			
SAMPLE SIZE	64		93			
	#	%	#	%	G	p<
MAMMALIA	52	81.3	92	99.0	14.0	0.001
<i>Odocoileus virginianus</i> - white-tailed deer	13	20.3	9	9.7	3.3	0.1
<i>Tayassu tajacu</i> - collared peccary	0	0.0	4	4.3		nt
<i>Sus scrofa</i> - feral hog	0	0.0	1	1.1		nt
Lagomorpha	7	10.9	14	15.1	0.4	NS
Rodentia	34	53.1	75	80.6	13.1	0.001
<i>Sigmodon hipidus</i> - hispid cotton rat	10	15.6	37	39.8	11.0	0.001
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	1	1.1		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	0	0.0		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	1	1.1		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	8	12.5	0	0.0		nt
<i>Scalopus aquaticus</i> - eastern mole	0	0.0	1	1.1		nt
<i>Mephitis mephitis</i> - striped skunk	1	1.6	0	0.0		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	0	0.0		nt
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	2	2.2		nt
unidentified mammal	6	9.4	10	10.8	0.0	NS
AVES	17	26.6	13	14.0	3.7	0.1
eggshell	0	0.0	2	2.2		nt
REPTILIA	8	12.5	6	6.5	1.3	NS
Serpentes	3	4.7	3	3.2	0.0	NS
<i>Cnemidophorus</i> sp.- whiptails	6	9.4	0	0.0		nt
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	1	1.6	3	3.2	0.3	NS
OSTEICHTHYES	15	23.4	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	1	1.6	0	0.0		nt
ARTHROPODA	19	29.7	19	20.4	1.8	NS
INSECTA	6	9.4	19	20.4	3.5	0.1
Orthoptera	5	7.8	11	11.8	0.6	NS

Appendix 7 (continued).

SITE		Padre Island		King Ranch				
SAMPLE SIZE		64		93				
		#	%	#	%	G	p<	
CRUSTACEA	Odonata	0	0.0	3	3.2	2.9	nt	
	Coleoptera	1	1.6	7	7.5		0.1	
	unidentified insect	0	0.0	0	0.0		nt	
		8	12.5	0	0.0		nt	
	Uca sp.- fiddler crabs	0	0.0	0	0.0		nt	
	Ocypode quadrata- ghost crab	6	9.4	0	0.0		nt	
	Arenaeus cribrarius- speckled crab	0	0.0	0	0.0		nt	
	unidentified crab	2	3.1	0	0.0		nt	
	FRUIT		1	1.6	7	7.5	2.9	0.1
		Opuntia sp. - prickly pear	0	0.0	3	3.2		nt
	Prosopis glandulosa- honey mesquite	0	0.0	0	0.0		nt	
	Sabal sp.- palmetto palm	0	0.0	0	0.0		nt	
	Lycium sp.- wolfberry	0	0.0	0	0.0		nt	
	Ilex vomitoria- yaupon	0	0.0	0	0.0		nt	
	Smilax bona-nox- greenbriar	0	0.0	3	3.2		nt	
	Callicarpa americana- American beautyberry	0	0.0	0	0.0		nt	
	Celtis sp.- hackberry	0	0.0	0	0.0		nt	
	Vitis mustangensis- mustang grape	0	0.0	0	0.0		nt	
	Diospyrox texana- Texas persimmon	0	0.0	0	0.0		nt	
	unidentified fruit	1	1.6	1	1.1	0.0	NS	
HUMAN REFUSE		5	7.8	0	0.0		nt	

Appendix 8. Percent occurrence of prey items found in coyote scats collected March 1996- May 1996. G=G statistic. p=p-value. nt=not tested. NS=not significant.

SITE	Matagorda Island		Aransas NWR			
SAMPLE SIZE	146		89			
	#	%	#	%	G	p<
MAMMALIA	145	99.3	87	97.8	0.8	NS
<i>Odocoileus virginianus</i> - white-tailed deer	55	37.7	25	28.1	2.2	NS
<i>Tayassu tajacu</i> - collared peccary	2	1.4	7	7.9	5.9	0.05
<i>Sus scrofa</i> - feral hog	14	9.6	7	7.9	0.2	NS
Lagomorpha	24	16.4	24	27.0	3.8	0.1
Rodentia	110	75.3	52	58.4	7.1	0.01
<i>Sigmodon hipidus</i> - hispid cotton rat	43	29.5	8	9.0	14.9	0.001
<i>Neotoma micropus</i> - southern plains woodrat	0	0.0	1	1.1		nt
<i>Oryzomys palustris</i> - marsh rice rat	0	0.0	0	0.0		nt
<i>Reithrodontomys fulvescens</i> - fulvous harvest mouse	0	0.0	1	1.1		nt
<i>Baiomys taylori</i> - northern pygmy mouse	0	0.0	0	0.0		nt
<i>Dipodomys compactus</i> - Gulf Coast kangaroo rat	0	0.0	0	0.0		nt
<i>Geomys</i> sp.- pocket gophers	0	0.0	10	11.2		nt
<i>Scalopus aquaticus</i> - eastern mole	1	0.7	3	3.4	3.8	0.1
<i>Mephitis mephitis</i> - striped skunk	0	0.0	0	0.0		nt
<i>Procyon lotor</i> - common raccoon	0	0.0	2	2.2		nt
<i>Didelphis virginiana</i> - Virginia opossum	0	0.0	0	0.0		nt
unidentified mammal	5	3.4	4	4.5	0.2	NS
AVES	41	28.1	25	28.1	0.0	NS
eggshell	1	0.7	0	0.0		nt
REPTILIA	33	22.6	1	1.1	26.7	0.001
Serpentes	9	6.2	0	0.0		nt
<i>Cnemidophorus</i> sp.- whiptails	13	8.9	1	1.1	7.3	0.01
<i>Terrapene</i> sp.- box turtles	0	0.0	0	0.0		nt
unidentified reptiles	12	8.2	0	0.0		nt
OSTEICHTHYES	1	0.7	0	0.0		nt
<i>Mylopharodon conocephalus</i> - hardhead catfish	0	0.0	0	0.0		nt
ARTHROPODA	20	13.7	2	2.2	9.9	0.005
INSECTA	13	8.9	2	2.2	4.6	0.05
Orthoptera	8	5.5	2	2.2	1.5	NS

Appendix 8 (continued).

SITE		Matagorda Island		Aransas NWR			
SAMPLE SIZE		146		89			
		#	%	#	%	G	p<
	Odonata	3	2.1	0	0.0		nt
	Coleoptera	2	1.4	0	0.0		nt
	unidentified insect	0	0.0	0	0.0		nt
CRUSTACEA		9	6.2	0	0.0		nt
	<i>Uca</i> sp. - fiddler crabs	2	1.4	0	0.0		nt
	<i>Ocypode quadrata</i> - ghost crab	7	4.8	0	0.0		nt
	<i>Arenaeus cribrarius</i> - speckled crab	0	0.0	0	0.0		nt
	unidentified crab	0	0.0	0	0.0		nt
FRUIT		3	2.1	10	11.2	8.3	0.005
	<i>Opuntia</i> sp.- prickly pear	1	0.7	0	0.0		nt
	<i>Prosopis glandulosa</i> - honey mesquite	0	0.0	0	0.0		nt
	<i>Sabal</i> sp.- palmetto palm	0	0.0	2	2.2		nt
	<i>Lycium</i> sp.- wolfberry	2	1.4	0	0.0		nt
	<i>Ilex vomitoria</i> - yaupon	0	0.0	8	9.0		nt
	<i>Smilax bona-nox</i> - greenbriar	0	0.0	0	0.0		nt
	<i>Callicarpa americana</i> - American beautyberry	0	0.0	0	0.0		nt
	<i>Celtis</i> sp.- hackberry	0	0.0	0	0.0		nt
	<i>Vitis mustangensis</i> - mustang grape	0	0.0	0	0.0		nt
	<i>Diospyrox texana</i> - Texas persimmon	0	0.0	0	0.0		nt
	unidentified fruit	0	0.0	1	1.1		nt
HUMAN REFUSE		1	0.7	0	0.0		nt